

BUSINESS PAPER

ORDINARY MEETING OF COUNCIL

To be held at 6.00 pm on

Monday 21 November 2016

Council Chambers, Level 10, Council Administration Building, 41 Burelli Street, Wollongong

Order of Business

- 1 Acknowledgement of Traditional Owners
- 2 Civic Prayer
- 3 Apologies
- 4 Disclosures of Pecuniary Interest
- 5 Petitions and Presentations
- 6 Confirmation of Minutes Ordinary Meeting of Council 31/10/2016
- 7 Public Access Forum
- 8 Call of the Agenda
- 9 Lord Mayoral Minute
- 10 Urgent Items
- 11 Agenda Items

Members Lord Mayor -Councillor Gordon Bradbery OAM (Chair) Deputy Lord Mayor -Councillor John Dorahy **Councillor Michelle Blicavs** Councillor David Brown **Councillor Leigh Colacino** Councillor Chris Connor **Councillor Bede Crasnich** Councillor Vicki Curran Councillor Janice Kershaw Councillor Ann Martin **Councillor Jill Merrin** Councillor Greg Petty **Councillor George Takacs**

QUORUM - 7 MEMBERS TO BE PRESENT



INDEX

| | PAG | GE NO. |
|---------|---|--------|
| | Minutes of Ordinary Meeting of Council 31/10/2016 | 1 |
| ITEM 1 | Draft Planning Proposal: Wests Illawarra Leagues Club and Surrounding Sites, Unanderra | 9 |
| ITEM 2 | Submission of the Wollongong Draft Coastal Zone Management Plan for Certification | 21 |
| ITEM 3 | Post Exhibition Report - Sustainability Review of Wollongong Development Control Plan 2009 | 36 |
| ITEM 4 | Establishment of Floodplain Risk Management Committees | 42 |
| ITEM 5 | Compulsory Acquisition of Right of Carriageway over Crown Land to provide access to the Waterfall (Garrawarra) Cemetery | 46 |
| ITEM 6 | Acquisition of Easement for Suction Line over Crown Land at Port Kembla | 48 |
| ITEM 7 | Dedication of Lanes at Port Kembla as Drainage Reserve | 50 |
| ITEM 8 | Tender T16/31 Playground - Kanahooka Park, Kanahooka | 52 |
| ITEM 9 | Tender T16/33 Beaton Park Athletics Track Resurfacing | 55 |
| ITEM 10 | Community Transport - Procurement Exemption - Wollongong Radio Cabs | 58 |
| ITEM 11 | Community Transport - Procurement Exemption - Canty's Bus Rentals | 60 |
| ITEM 12 | Draft Quarterly Review Statement September 2016 | 62 |
| ITEM 13 | City of Wollongong Traffic Committee - Minutes of Meeting held 26 October 2016 | 64 |
| ITEM 14 | Bi-Monthly Tabling of Returns of Disclosures of Interest and Other Matters | 67 |





MINUTES

ORDINARY MEETING OF COUNCIL

at 6.00 pm

Monday 31 October 2016

Present

Lord Mayor – Councillor Bradbery OAM (in the Chair), Councillors Kershaw, Brown, Takacs, Martin, Merrin, Blicavs, Dorahy, Colacino, Crasnich, Curran (until 7.37 pm) and Petty

In Attendance

General Manager (Acting) – A Carfield, Director Corporate and Community Services – Creative, Engaged and Innovative City (Acting) – K Hunt, Director Infrastructure and Works – Connectivity, Assets and Liveable City (Acting) – G Doyle, Manager Governance and Information – K Cowgill, Manager Property and Recreation – P Coyte, Manager Environmental Strategy and Planning – R Campbell and Manager Community Cultural and Economic Development (Acting) – S Savage, Manager City Works and Services – M Roebuck, Manager Finance (Acting) – S Packer and Manager Infrastructure Strategy and Planning – M Dowd

Apology

Min No. 124

COUNCIL'S RESOLUTION – RESOLVED UNAMIMOUSLY on the motion of Councillor Brown seconded Councillor Dorahy that the apology tendered on behalf of Councillor Connor be accepted.



INDEX

| | PAGE N | Ю. |
|--------|---|-----|
| | Disclosure of Interests | .1 |
| | Inaugural Call of the Radiance of the Seas | 1 |
| | Confirmation of Minutes of Ordinary Meeting of Council held on Monday, 10 October 2016 | . 1 |
| | Public Access Forum – Current State of Wollongong Harbour | .1 |
| | Public Access Forum - NSW Crown Lands Management Bill 2016 and Lord Mayor's concerns regarding NSW Government's proposed Crown Lands Overhaul | 2 |
| | Call of the Agenda | 2 |
| | Matter of Great Urgency - Crown Land Management Bill 2016 | 2 |
| ITEM A | Notice of Motion - Councillor Petty - Wollongong Mall Markets Agreement | 3 |
| ITEM B | Notice of Motion - Councillor Cr Merrin - Gender Pay Equity in our Workforce | 4 |
| ITEM 1 | Pesticides Notification Plan - Council Policy | 4 |
| ITEM 2 | Annual Financial Statements for the Year Ended 30 June 2016 - Post Advertising | 4 |
| ITEM 3 | Tender T16/24 - Purchase of Electronic Cardio Equipment for Beaton Park Leisure Centre | 5 |
| ITEM 4 | September 2016 Financials | 5 |
| ITEM 5 | Statement of Investments - September 2016 | 5 |
| ITEM 6 | City of Wollongong Traffic Committee - Minutes of Meeting Held 5 October 2016 | 5 |
| ITEM 7 | Tabling of Annual Returns of Disclosures of Interests and Other Matters - 2015-2016 | 6 |



DISCLOSURE OF INTERESTS

Councillor Martin declared a conflict of interest in Item A due to her close relationship with the previous market operators. Councillor Martin advised that she would depart the meeting during debate and voting on the matter.

INAUGURAL CALL OF THE RADIANCE OF THE SEAS

Councillor Colacino tabled a plaque presented to Council commemorating the Inaugural Call of the Radiance of Seas. Councillor Colacino advised that the ship's visit to our region trended nationally in the media from 7 am to midday on 30 October. Also, the 'hits' on Destination Wollongong's website had increased by 700%.

CONFIRMATION OF MINUTES OF ORDINARY MEETING OF COUNCIL HELD ON MONDAY, 10 OCTOBER 2016

125 **COUNCIL'S RESOLUTION** - RESOLVED UNANIMOUSLY on the motion of Councillor Brown seconded Councillor Kershaw that the Minutes of the Ordinary Meeting of Council held on Monday, 10 October 2016 (a copy having been circulated to Councillors) be taken as read and confirmed.

PUBLIC ACCESS FORUM – CURRENT STATE OF WOLLONGONG HARBOUR

On behalf of Wollongong Yacht Club, Mr S Phillips advised of the Club's frustration with the current state of affairs with Wollongong Harbour. The harbour precinct is highly prized by the Wollongong community however it is being allowed to deteriorate. Crown Lands NSW does not have the resources or funds to properly manage the harbour precinct. As an example, Mr Phillips said that no progress had been made on reopening the slipway and boatyard after three years. The slipway and boatyard closed when the previous operator left when unable to meet the requirements of Crown Lands for its operation. Crown Lands have done studies on site contamination and have demolished the old asbestos clad workshop. Wollongong Yacht Club responded to Crown Lands EOI at the end of 2015 to establish a temporary boat repair facility. The Club spent nine months negotiating with Crown Lands and EPA devising how the yard could be operated without harm to the environment. These negotiations collapsed when Crown Lands now suggests it will be the end of 2017 before remediation can commence on the current boatyard site.

Wollongong Harbour does have the potential to be the jewel in the crown of Wollongong, but to achieve that, it needs a dedicated local group to drive its revitalisation. There are limited commercial opportunities available to fund this revitalisation. In conclusion, Mr Phillips advised that these commercial developments, including the slipway and boatyard, should support the boating publics' use of the harbour together with the requirements of the broader community.

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PUBLIC ACCESS FORUM - NSW CROWN LANDS MANAGEMENT BILL 2016 AND LORD MAYOR'S CONCERNS REGARDING NSW GOVERNMENT'S PROPOSED CROWN LANDS OVERHAUL

On behalf of Protect our Parks Inc, Mr J Riggall advised that POPI was a community-based, non-partisan organisation formed by residents of the Wollongong area, with the aim of ensuring that the public interest is always given priority over private profits in public parks. His group has serious concerns about the NSW Government's proposed Crown Land Management Bill which was presented to Parliament on 19 October 2016 and is due to return to Parliament on 8 November.

The Bill will replace the Crown Lands Act 1989 and allied legislation. Mr Riggall said that contrary to the Government's advice, the Bill will have devastating consequences for future generations needing or wanting to use public land for recreation, whereas it will provide a goldmine for vested interests to make private profits. In conclusion, Mr Riggall asked that Council consider taking urgent action to seek deferral of the Bill until early 2017, as well as seek reports on implications for Council and the community due to the Bill and recent changes to the Local Government Act.

126 COUNCIL'S RESOLUTION – RESOLVED UNANIMOUSLY on the motion of Councillor Brown seconded Councillor Blicavs that all speakers be thanked for their presentation and invited to table their notes.

CALL OF THE AGENDA

127 COUNCIL'S RESOLUTION - RESOLVED UNANIMOUSLY on the motion of Councillor Brown seconded Councillor Blicavs that the staff recommendations for Items 1 to 7 inclusive, be adopted as a block.

DEPARTURE OF COUNCILLOR

During debate and prior to voting on the Matter of Great Urgency, Councillor Blicavs departed and returned to the meeting, the time being from 6.29 pm to 6.30 pm.

MATTER OF GREAT URGENCY - CROWN LAND MANAGEMENT BILL 2016

Councillor Curran requested that the Lord Mayor consider a matter which she considered to be urgent and related to the Crown Land Management Bill 2016. Councillor Curran considered this matter to be urgent as the Bill is soon to be debated in the NSW Parliament.

The Lord Mayor ruled Councillor Curran's request to be urgent.

A PROCEDURAL MOTION was MOVED by Councillor Bradbery that Council deal with a Matter of Great Urgency relating to the Crown Land Management Bill 2016. The PROCEDURAL MOTION on being PUT to the VOTE was CARRIED.

The Lord Mayor called upon Councillor Curran to put forward her motion.

A PROCEDURAL MOTION was MOVED by Councillor Merrin seconded Councillor Martin that an additional two minutes be granted to Councillor Curran to address the meeting in relation to her Matter of Great Urgency.

- 128 COUNCIL'S RESOLUTION RESOLVED UNANIMOUSLY on the motion of Councillor Curran seconded Councillor Brown that –
 - 1 Council write to the Minister for Primary Industry and Lands, The Hon. Niall Blair MLC, and all NSW Members of Parliament, raising our concern that no opportunity has been provided for Council to analyse and assess the complex Crown Land Management Bill 2016. This letter also request a delay in the passing of the Crown Land Management Bill 2016 until adequate time is provided for Councils to analyse and make detailed comment prior to this Bill being debated and passed.
 - 2 The letter be emailed and also posted by close of business on 2 November 2016.
- *Variation The variation moved by Councillor Merrin to remove the words 'invite or' (before the word 'opportunity') in Part 1 was accepted by the mover and seconder.*

DEPARTURE OF COUNCILLORS

Due to a prior disclosure of interest, Councillor Martin departed the meeting and was not present for the debate and voting on Item A.

During debate and prior to voting on Item A, Councillor Crasnich departed and returned to the meeting, the time being from 6.58 pm to 6.59 pm.

Councillor Dorahy briefly departed the meeting following a question put by the Lord Mayor to the Manager Property and Recreation in relation to comparisons between this matter and Skydive The Beach. Councillor Dorahy has previously declared a conflict of interest in matters relating to Skydive The Beach.

Following the vote taken on the original motion and during debate on the Foreshadowed Motion, the time being 7.37 pm, Councillor Curran departed the meeting.

ITEM A - NOTICE OF MOTION - COUNCILLOR PETTY - WOLLONGONG MALL MARKETS AGREEMENT

A PROCEDURAL MOTION was MOVED by Councillor Merrin seconded Councillor Blicavs that an additional two minutes be granted for Councillor Petty to address the meeting in relation to Item A.

MOVED by Councillor Petty seconded Councillor Merrin that Council go into open session to debate the recent Mall Market agreement, compliance with the agreement, effect on non-market businesses, long term aspirations for an invigorated Mall, the effect on existing business operators inside and outside the Mall, Mall patronage and parking.

At this stage, Councillor Bradbery FORESHADOWED a MOTION should Councillor Petty's Motion be defeated.

Councillor Petty's MOTION on being PUT to the VOTE was LOST.

In favour Councillor Merrin

Against Councillors Kershaw, Brown, Takacs, Blicavs, Dorahy, Colacino, Crasnich, Curran, Petty and Bradbery

Councillor Bradbery's FORESHADOWED MOTION then BECAME the MOTION.

Councillor Bradbery's MOTION on being PUT to the VOTE was CARRIED UNANIMOUSLY.

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6

- COUNCIL'S RESOLUTION RESOLVED UNANIMOUSLY on 129 the motion _ of Councillor Bradbery seconded Councillor Curran that -
 - 1 Council notes the Professional Conduct Coordinator has reviewed the process of the Mall Market licencing Expression of Interests and outcomes, and advises that the process was fair, appropriate and legal and followed in accordance with Council's Formal Quotation and Tendering Procedures Management Policy and the Local Government Act 1993.
 - 2 A report be submitted to Council in 12 months on the impact of increased activation, inclusive of the Markets, on the CBD business operations, as measured against the aims, desires and outcomes of activating the Mall and the relevant Markets' Development Control Plan.
- Variation The variation moved by Councillor Brown (the addition of the words 'and the relevant Markets' Development Control Plan' at the end of Part 2) was accepted by the mover and seconder.

ITEM B - NOTICE OF MOTION - COUNCILLOR MERRIN - GENDER PAY EQUITY IN OUR WORKFORCE

- COUNCIL'S RESOLUTION 130 RESOLVED UNANIMOUSLY on the motion of Councillor Merrin seconded Councillor Takacs that -
 - Council report annually on pay equity in the Wollongong City Council workforce. 1
 - A report be submitted to Council in three months setting the parameters, indices and 2 benchmarks required to meet Part 1 above.
- Variation The variation moved by Councillor Bradbery (replacement of the words 'report annually on gender pay equity in our workforce' with Parts 1 and 2) was accepted by the mover and seconder.

ITEM 1 - PESTICIDES NOTIFICATION PLAN - COUNCIL POLICY

The following staff recommendation was adopted as part of the Block Adoption of Items (refer Minute Number 127).

COUNCIL'S RESOLUTION - The revised Pesticides Notification Plan - Council Policy be adopted, noting there were only minor administrative changes required to the Policy.

ITEM 2 - ANNUAL FINANCIAL STATEMENTS FOR THE YEAR ENDED 30 JUNE 2016 -POST ADVERTISING

The following staff recommendation was adopted as part of the Block Adoption of Items (refer Minute Number 127).

COUNCIL'S RESOLUTION - The audited Financial Statements for the year ended 30 June 2016, together with the Auditor's report, be presented to the public.



ITEM 3 - TENDER T16/24 - PURCHASE OF ELECTRONIC CARDIO EQUIPMENT FOR BEATON PARK LEISURE CENTRE

The following staff recommendation was adopted as part of the Block Adoption of Items (refer Minute Number 127).

COUNCIL'S RESOLUTION -

- 1 In accordance with clause 178(1)(a) of the Local Government (General) Regulation 2005, Council accept the tender of Technogym Pty Ltd for supply of electronic cardio equipment, in the sum of \$146,120, excluding GST.
- 2 Council delegate to the General Manager the authority to finalise and execute the contract and any other documentation required to give effect to this resolution.
- 3 Council grant authority for the use of the Common Seal of Council on the contract and any other documentation, should it be required, to give effect to this resolution.

ITEM 4 - SEPTEMBER 2016 FINANCIALS

The following staff recommendation was adopted as part of the Block Adoption of Items (refer Minute Number 127).

COUNCIL'S RESOLUTION -

- 1 The financials be received and noted.
- 2 Proposed changes in the Capital Works Program be approved.

ITEM 5 - STATEMENT OF INVESTMENTS - SEPTEMBER 2016

The following staff recommendation was adopted as part of the Block Adoption of Items (refer Minute Number 127).

COUNCIL'S RESOLUTION - Council receive the Statement of Investments for September 2016.

ITEM 6 - CITY OF WOLLONGONG TRAFFIC COMMITTEE - MINUTES OF MEETING HELD 5 OCTOBER 2016

The following staff recommendation was adopted as part of the Block Adoption of Items (refer Minute Number 127).

COUNCIL'S RESOLUTION - In accordance with the powers delegated to Council, the minutes and recommendations of the City of Wollongong Traffic Committee Meeting held on 5 October 2016 in relation to the Regulation of Traffic be adopted.

ITEM 7 - TABLING OF ANNUAL RETURNS OF DISCLOSURES OF INTERESTS AND OTHER MATTERS - 2015-2016

The following staff recommendation was adopted as part of the Block Adoption of Items (refer Minute Number 127).

COUNCIL'S RESOLUTION - Council note the tabling of the Annual Returns of Disclosures of Interests and Other Matters as required by Section 450A of the Local Government Act 1993.

THE MEETING CONCLUDED AT 7.59 PM.

Confirmed as a correct record of proceedings at the Ordinary Meeting of the Council of the City of Wollongong held on 21 November 2016.

Chairperson



File: PP-2014/10 Doc: I16/100064

ITEM 1 DRAFT PLANNING PROPOSAL: WESTS ILLAWARRA LEAGUES CLUB AND SURROUNDING SITES, UNANDERRA

This report considers a draft Planning Proposal request on behalf of Wests Illawarra Leagues Club for 40 allotments located on Central Road, Hargreaves Street, Blackman Parade, Maynes Parade and Cummins Street, Unanderra. Parts of Council's road reserve and laneways are also considered.

The subject land is divided into three sites. Site 1 contains the Wests Illawarra Leagues Club and car park where an increase to the permissible floor space ratio from 0.5:1 to 1.5:1 and maximum building height from 11m to 15m is proposed. The site is zoned SP3 – Tourist. An additional permitted use of Seniors Housing is proposed. It is recommended that this part of the request be progressed to exhibition, excluding the Seniors Housing additional use.

Sites 2 and 3 relate to 21 residential lots to the west and south of the club site and seeks the rezoning from R2 Low Density Residential to R3 Medium Density Residential and allow for 'Tourist and Visitor Accommodation' as an additional permitted use via Schedule 1 of Wollongong LEP 2009. It is recommended that this part of the rezoning request not be supported.

This report presents the preliminary assessment of the draft Planning Proposal request and recommends that Council resolve to submit a draft Planning Proposal to the NSW Department of Planning and Environment seeking a Gateway determination for proposed amendments on the Wests Illawarra Site (Site 1) only.

RECOMMENDATION

- 1 A draft Planning Proposal be submitted to the NSW Department of Planning and Environment for Site 1, 19 lots on Central Road, Maynes Parade and Hargreaves Street, Unanderra seeking a Gateway determination to amend the Wollongong Local Environmental Plan 2009 Height of Buildings and Floor Space Ratio Maps to allow for a maximum building height of 15m and Floor Space Ratio of 1.5:1.
- 2 Following the Gateway determination, the draft Planning Proposal be exhibited for 28 days.
- 3 The Department of Planning and Environment be requested to issue authority to the General Manager to exercise plan making delegations in accordance with Council's resolution of 26 November 2012 noting that the draft Planning Proposal includes roads and lanes under Council control.
- 4 The proposed rezoning of Sites 2 and 3 not be supported and the current Low Density Residential zone, Height of Buildings and Floor Space Ratio development standards be retained.
- 5 The proposed additional permitted uses of Seniors Housing on Site 1 and Tourist and Visitor Accommodation on Sites 2 and 3, in Schedule 1 of Wollongong Local Environmental Plan not be supported.

REPORT AUTHORISATIONS

Report of: Renee Campbell, Environmental Strategy and Planning

Authorised by: Andrew Carfield, Director Planning and Environment - Future City and Neighbourhoods

ATTACHMENTS

- 1 Site Locality Map and Current Zoning
- 2 Affected Properties Table
- 3 Proposed Floor Space Ratio and Height of Buildings Map
- 4 Wests Illawarra Leagues Master Plan



COMPLIANCE WITH OFFICE OF LOCAL GOVERNMENT GUIDELINES ON COUNCIL DECISION MAKING DURING MERGER PROPOSAL PERIODS

The recommendation in this report satisfies the requirements of the OLG Guidelines - *Council Decision Making During Merger Proposal Periods.*

BACKGROUND

In April 2014 a draft Planning Proposal request was submitted by TCW Consulting Pty Ltd on behalf of the Wests Illawarra Leagues Club for 40 allotments and parts of Council's road reserve located on Central Road, Hargreaves Street, Blackman Parade, Maynes Parade and Cummins Street, Unanderra. The site comprises a total area of approximately 4 hectares and is currently zoned SP3 Tourist and R2 Low Density Residential. The site is bounded by RE1 Public Recreation to the east, R3 Medium density residential to the south and R2 Low Density Residential to the north and west (Attachment 1).

The subject allotments have been grouped into three 'sites' for ease of reference. Figure 1 below demonstrates the area of the three sites.



Figure 1:

SITE 1 WESTS ILLAWARRA LEAGUES CLUB

Wests Illawarra Leagues Club (the Club) is located approximately 100m from the defined Unanderra Town Centre. Site 1 (the Club site) is comprised of 19 allotments, three laneways and parts of Council's road reserve.

Site 1 covers an area of approximately 2.4 hectares and is currently zoned SP3 – Tourist. The Club site has a maximum permitted building height of 11m and Floor Space Ratio of 0.5:1.

Site 1 is bounded by Unanderra Park to the East, St. Pius X Catholic School to the west, and R2 Low Density Residential Development to the north and immediate south.



Development on Site 1 is currently comprised of the Wests Illawarra Leagues Club building on the northern part of the site, and the club car park on the southern part of the site, the Unanderra Fire Station and a vacant site to the north east. An unnamed laneway (Lane 97 on the attached maps) connecting Maynes Parade and Central Road separates the vacant site and Fire Station from the Club site proper.

Land ownership within Site 1 is comprised of West Illawarra Leagues Club, the NSW Fire Brigade and three laneways and parts of the road reserve owned by Wollongong City Council. Negotiations between the Club and Council with regard to the closure and sale of these portions of road reserve have been ongoing with Council's Property and Recreation Division. The applicant has advised that negotiations with regard to the possible sale of the Fire Station site to the Club have commenced with the NSW Fire Brigade.

Wests Illawarra Leagues Club has lodged numerous applications that relate to the site as a Registered Club. Most recently, DA-2014/272 was approved on 30 May 2014 for alterations to an outdoor gaming room. Currently the Floor Space Ratio of approved buildings on the site is approximately 0.46:1.

SITE 2

Site 2 is located to the west of the club site, between Tresnan and Hargreaves Streets, Blackman Parade and a multi dwelling housing complex.

Site 2 covers an area of approximately 1.1 hectares and is currently zoned R2 Low Density Residential. The site has a maximum permitted building height of 9m and a maximum floor space ratio of 0.5:1.

Site 2 is bounded by Hargraves Street and the Club site to the east, St. Pius X Catholic School and single residential dwellings to the north, multi dwelling housing to the south west and single dwellings to the immediate south.

The site is comprised of fifteen (15) allotments with mixed ownership. The eastern most three (3) allotments fronting Hargreaves Street are owned by Wests Illawarra Leagues Club. These sites previously contained a restaurant and associated car park which have been demolished. Development consent was granted in 2007 for the demolition of the existing structures and construction of a Fire Station on these sites. It appears that the demolition works associated with this application have been undertaken; however no Construction Certificate has been issued for the construction works.

The NSW Land and Housing Corporation own 4 single residential dwellings within Site 2. The remaining sites are in private ownership and contain single residential dwellings with the exception of a laneway connecting Tresnan Street and Blackman Parade which is owned by Wollongong City Council and identified as Community Land.

Development history of site 2, with the exception of the three eastern most lots, relate to residential building work only.

SITE 3

Site 3 is located to the south of the club site and fronts Blackman Parade. Site 3 has an area of approximately 0.5 hectares and is currently zoned R2 Low Density Residential. The site has a maximum permitted building height of 9m and a maximum floor space ratio of 0.5:1 for Site 3.

Site 3 adjoins R3 Medium Density Residential land to the south west and south east, Site 2 and the Wests Illawarra Leagues Club site (Site 1) to the north.

The site is comprised of six (6) allotments, three (3) of which are owned by the Wests Illawarra Leagues Club, one (1) of which is in private ownership and two of which are owned by Wollongong City Council. The Council owned land within this site are identified as Community Land containing drainage infrastructure (open channel) and part of the Blackman Parade/Hargreaves Street roundabout infrastructure.



Development history within Site 3 generally relates to residential building works including garages, fences and tree removals and pruning. Consent was granted in 1994 for the construction of a dual occupancy at 1 Blackman Parade.

PROPOSAL

The draft Planning Proposal request submitted to Council relates to 40 allotments located on Central Road, Hargreaves Street, Blackman Parade, Maynes Parade and Cummins Street, Unanderra. Parts of Councils road reserve and laneways are also considered. The affected Lot and DP and property addresses are included at Attachment 2 to this report.

As noted, the subject allotments have been separated into three 'sites' as described above.

This draft Planning Proposal request seeks to amend the Wollongong Local Environmental Plan 2009 as follows:

Site 1: - Wests Illawarra Leagues Club

- Amend Wollongong LEP 2009 Height of buildings Map to increase the maximum permitted height from 11m to 15m.
- Amend Wollongong LEP 2009 FSR Map to increase the maximum permitted Floor Space Ratio from 0.5:1 to 1.5:1.
- Amend Schedule 1 of the Wollongong LEP 2009 to include 'Seniors Housing' as an additional permitted use.

Sites 2 and 3:

- Rezone from R2 Low Density Residential to R3 Medium Density Residential, resulting in amendments to the Wollongong LEP 2009 permitted land uses and increases to the Height of buildings Map from 9m to 13m and Floor Space Ratio Map from 0.5:1 to 0.75:1.
- Amend Schedule 1 of Wollongong LEP 2009 to include 'Tourist and Visitor Accommodation' as an additional permitted use.

The key aim of the draft planning proposal request is to facilitate future development by the Wests Illawarra Leagues Club with the intention of improving the connection of the club site to the Unanderra Town Centre, facilitate higher density development in close proximity to the Unanderra Town Centre and provide for opportunities for tourism related development which could assist in supporting activities outside of the Unanderra area, including the Nan Tien Temple and Illawarra Turf Club.

At present, development on Site 1 has almost reached the maximum permitted Floor Space Ratio (FSR of 0.5:1) and therefore further development may not be permitted unless a major renovation is approved, or Council supports a variation to the maximum permitted FSR to the site via a submission addressing clause 4.6 of Wollongong LEP 2009. The maximum height of 11m has been reached by the existing building.

A masterplan for the club site has been prepared and submitted to Council (Attachment 4). The Masterplan indicates a concept built form and architectural design from key viewpoints in the adjoining streets. The masterplan does not consider Sites 2 or 3, and does not include a demonstration of where seniors housing could be located on Site 1, or its relationship with the primary use of the site as a Registered Club.

Indicative shadow diagrams for summer and winter (assumed to be January 21 and June 21) have been submitted demonstrating the expected impact of the increase in building height to 15m in the location of the existing building only. The proponent acknowledges that the increase in height has the potential to deliver visual and overshadowing impacts on surrounding properties, however indicates that these impacts can be assessed with the submission of a future development application.



KEY ISSUES FOR CONSIDERATION

Consistency with Unanderra Town Centre Masterplan

Council adopted the Unanderra Town Centre Masterplan at its meeting on 22 July 2013. The Unanderra Town Centre Master Plan and Implementation Strategy provide a strategic framework for Council, the community and investors, to respond to the opportunities of revitalising the Unanderra Town Centre.

The key strategic outcomes of the Masterplan were the following:

- Strengthen the community 'heart' around the Country Grocer area;
- Establish a central spine;
- Connect the Town Centre to Unanderra Railway Station;
- Reinforce the north-south spine to connect the retail offerings in the north with the community facilities and public recreation areas to the south;
- Extend the spine and connect the Environment Charcoal Creek and the Public Library and Community Centre to the south; and
- Define the Town Centre.



The Unanderra Town Centre is defined by the Masterplan as demonstrated by Figure 4 below.

Figure 4: Unanderra Town Centre Masterplan boundaries

Tallegalla Street and the public car park that connects Tannery Street and Central Road are considered to be the western most boundary of the town centre.

The Wests Illawarra Leagues Club was not involved in the preparation of the Unanderra Town Centre Masterplan and none of the subject sites are located within the town centre area as defined by the plan.



While the positive aspects of future development in the area, particularly higher density residential development and additional seniors housing, are acknowledged there is uncertainty as to the future use and built form of development on the subject sites, and subsequently the impact that this development may have on the operation of the town centre.

The Masterplan submitted does not provide a clear demonstration of the relationship of the redevelopment of the club site with the town centre masterplan. The photomontages provided do however indicate works along the Central Road frontage which could provide for a visual connection with the northern extent of the town centre area. This link and the connection of the site could be considered as part of a future development application process.

The Masterplan also does not provide any indication of where the Seniors Housing could be located on the site, or the relationship between this area and the club proper.

Flooding

Several properties that form part of this draft planning proposal are identified as flood hazard affected. The hazard mapping identifies properties as being located within uncategorised, medium and high flood precinct risk areas.

The Allans Creek Flood Study applicable to the subject sites was completed by Council in September 2008.

At present, Wollongong Development Control Plan (DCP) 2009, Appendix C of Chapter E13 identifies prescriptive standards for floodplains. Controls for the Allans Creek Flood Study are provided at Schedule 4. In this appendix, 'essential community services', within which 'seniors housing' would be defined, is considered to be an unsuitable land use in all flood risk precincts. Residential and tourism related development are identified as potential land uses, subject to satisfying several clauses with regard to floor levels, building components and methods, structural soundness, flood affectation, evacuation and management and design.

The draft Planning Proposal requests amendments to the Wollongong LEP 2009 that would indicate that the land is capable of supporting further permissible development. This is particularly the case for Sites 2 and 3 that are requested to be rezoned from R2 Low Density Residential to R3 Medium Density Residential, with associated increases in FSR and Height.

Following an initial assessment, a report was requested from the applicant to demonstrate that intensification of development within the floodplain was possible. The submitted report essentially suggests that there are perceived flaws within the Allans Creek Catchment Study and therefore the extent of flooding and hazard categories are likely to be different than currently mapped. No further investigation of the extent to which the hazard categories may be incorrect has been provided. The applicant suggests that this can be further investigated as part of a future Development Application process with more detailed modelling.

The information submitted indicates that the areas currently mapped as high flood risk precinct would likely be reclassified to medium flood risk following a local-area 2D study which could be undertaken at DA stage. This area would also be likely to apply to an area of the existing car park (within Site 1), which is indicated to be reconstructed as a multistorey car park as part of the submitted masterplan. This would allow for the reconstruction of the car park at a level which was above the 1% AEP flood levels as part of a future DA.

The report however incorrectly indicates that none of the remaining land within Sites 2 or 3 are within the high flood risk precinct. A review of Council's hazard mapping indicates that this is not the case and no consideration has been given to the impacts of increasing the development potential on these lots.

An additional Flood Study was provided on 27 June 2016 by the proponent. This Study focusses on the Western Suburbs Leagues Club site but does not address the potential development on sites 2 and 3.

Council's Stormwater Engineers have reviewed the draft Planning Proposal request and additional information submitted and have advised that whilst there may be merit in the commentary provided,



should the requested changes be made, there would be an implied right to develop based on the zoning and principle development standards. It is therefore considered that should the hazard category potentially be changed, it is required to be modelled prior to the rezoning being approved so that it can be confirmed. This would then allow the requested amendments to Wollongong LEP 2009 to be properly informed and minimise the risk of the refusal of future development applications based on flood related matters.

On the basis of the current documents supporting the draft Planning Proposal, there is adequate information to support the proposal for Site 1 from a flood perspective. However, there is inadequate information to support the proposal for Sites 2 and 3 in terms of flood hazard considerations. Prior to any changes in land use intensity within Sites 2 and 3, the management of this constraint needs to be better understood.

Traffic

The draft Planning Proposal proposes a significant increase in height and floor space ratio for the Wests Illawarra Leagues Club and the re-zoning of Low Density Residential Land to the south and west to R3 Medium Density Residential. This has the potential to result in increased traffic flows in the area.

A Traffic Impact Assessment (TIA) formed part of the draft Planning Proposal request submission. The report surveyed surrounding intersection performances and considers the expected traffic generation of potential future uses based on the requested changes.

Council's staff have reviewed the submitted documentation and have no objection to the progression of the proposal in principle.

The site is also located in close proximity to the Princes Highway, a classified road. Accordingly, the NSW Roads and Maritime Service (RMS) were notified of the proposal. A response provided to Council on 27 February 2015 states that the RMS did not support the proposal in its current form. Additional information was requested in relation to the submitted Traffic analysis, notations within the submitted TIA regarding signalisation of intersections, trip generation rates, percentage splits and the inclusion of residential accommodation (Seniors Housing) as an option for Site 1. Supplementary traffic advice was provided in response to the RMS comments, and an additional referral undertaken.

RMS provided a further response noting that the traffic analysis indicates that there are already long delays for the right turn out of the Nudjia Road (Level of Service F) and that these delays are predicted to lengthen (should future development facilitated with this planning proposal proceed). RMS undertook a crash analysis of the junction and identified that there is a crash history at the junction.

The Princes Highway at this location is a regional classified road, and it is a matter for Council to monitor and manage the ongoing performance of the Princes Highway and Nudjia Road. The traffic impacts are best assessed when a development application is lodged, when specific design information and potential traffic generation can be assessed. Council's Traffic Section agree any impacts can be managed as part of the development application process.

Satisfactory referrals were received in relation to Contamination, Social Planning, Biodiversity and Riparian Lands.

Visual Assessment

It is acknowledged that due to the relatively flat topography of the site, the proposal may not result in developments that would be visually prominent within the landscape from a distance. No clearing of vegetation/trees is envisaged by the proponent.

The potential future development on the sites may have an impact on the view corridor from the Unanderra Town Centre to the escarpment. However, this is considered unlikely and able to be reasonably managed via design within a future development application.



CONSULTATION AND COMMUNICATION

All affected landowners within the precinct were formally notified. A response was received from NSW Land and Housing Corporation which raised no objection.

Should Council resolve to forward a Planning Proposal to NSW Planning and Environment, a suitable exhibition period will be determined. It would be recommended that Council exhibit for a period of 28 days.

Consultation with Council officers from the Environment, Drainage/Stormwater, Property, Strategic, Social, Traffic and Infrastructure has occurred as part of the assessment of this draft Planning Proposal. Comments received have been satisfactory for the progression of amendments for the Wests Leagues Club site.

The NSW Roads and Maritime Service comments advise that given the Princes Highway at this location is a regional classified road, RMS considers it a matter for Council to monitor and manage the ongoing performance of the Princes Highway and Nudjia Road. Council's Traffic Section agree that the traffic impacts can be managed as part of the development application process.

PLANNING AND POLICY IMPACT

The policies and strategies which are of interest to the draft Planning Proposal are considered below:

Illawarra Shoalhaven Regional Plan (2015)

The Illawarra Shoalhaven Regional Plan (2015) aims to ensure that sufficient housing and employment opportunities are available to cater for this growth and identifies areas where housing and employment areas should be located. Unanderra is identified as a Major Regional Centre which presents significant opportunities for urban renewal. The draft Planning Proposal is considered to be generally consistent with the Illawarra Shoalhaven Plan.

Wollongong City Housing Study 2005

The objective of the Housing Strategy is to provide a mix of housing choice for a broad demographic range, in addition to providing opportunities for housing that are affordable for people living in the city currently and for those choosing to live in the area in the future. The Housing Strategy could be considered relevant to the draft Planning Proposal as the proposed zoning change would enable future higher density development on land that is in close proximity to Unanderra town centre which includes required services and public transport nodes. The proposed rezoning to Sites 2 and 3 is consistent with the aims of the Housing Study which are as follows:

- To promote the provision of high quality medium density housing in the existing urban area with an emphasis on areas with a high level of access to urban goods and services
- To develop sustainable, balanced communities on Greenfield sites that offer a varied housing mix and social diversity, with access to services, employment and transport provision, located in an attractive and safe environment
- To provide housing diversity that caters for all segments of Wollongong society, through the provision of accommodation that is affordable, accessible and suited to the needs of all groups in the community, including those disadvantaged in the housing market
- To regenerate degraded housing areas in Wollongong to provide a safe and attractive environment within which communities can prosper
- To enhance community capacity in Wollongong

The study identified that within the Unanderra areas, there was the infill potential for 83 low density dwellings and no medium density dwellings.

Within this study all land that was identified as flood affected was excluded from the total pool. As such, sites 2 and 3 were not considered as part of the Housing Study. There is still insufficient flood risk information to consider Sites 2 and 3 for rezoning.



Furthermore, the inclusion of 'Tourist and Visitor Accommodation' as an additional permitted use within Schedule 1 of the Wollongong LEP 2009 could result in the use of the subject lands, which, separate to the property affectations, are appropriately located for higher density residential development, for purposes other than for residential accommodation. Tourist and Visitor Accommodation is defined in the LEP as:

Tourist and visitor accommodation means a building or place that provides temporary or short-term accommodation on a commercial basis, and includes any of the following:

- (a) backpackers' accommodation,
- (b) bed and breakfast accommodation,
- (c) farm stay accommodation,
- (d) hotel or motel accommodation,
- (e) serviced apartments,

but does not include:

- (f) camping grounds, or
- (g) caravan parks, or
- (h) eco-tourist facilities.

The Standard Instrument definition identifies backpackers' accommodation, bed and breakfast accommodation and serviced apartments as uses that are permissible with consent in R3 Medium Density Residential zones. As such, the inclusion of 'Tourist and Visitor Accommodation' as an additional permitted use within Schedule 1 of the Wollongong LEP 2009 would essentially allow for 'hotel or motel accommodation' as an additional permitted use only, given the nature of the sites which are unlikely to be capable of meeting the definition of farm stay accommodation.

Hotel or motel accommodation is defined in the LEP as follows:

Hotel or motel accommodation means a building or place (whether or not licensed premises under the Liquor Act 2007) that provides temporary or short-term accommodation on a commercial basis and that:

- (a) comprises rooms or self-contained suites, and
- (b) may provide meals to guests or the general public and facilities for the parking of guests' vehicles,

but does not include backpackers' accommodation, a boarding house, bed and breakfast accommodation or farm stay accommodation.

As no site Masterplan has been provided for Sites 2 and 3, it is unclear as to the intention of the scope of development proposed as a result of this draft Planning Proposal. A copy of the submitted Masterplan is provided at Attachment 4. The development potential of the subject sites as a result of flood affectation is also unclear as discussed above. As such, it is considered that the draft Planning Proposal is not consistent with the Wollongong City Housing Study 2005.

Furthermore, the land use table for the SP3 zone provides that Tourist and visitor accommodation is a permissible use. As such, it is considered that a more appropriate proposal would be for the inclusion of tourist and visitor accommodation on Site 1 as part of any future club redevelopment. This is already a permissible use within the SP3 Tourist zone.

State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004.

The draft Planning Proposal requests that 'Seniors Housing' be included as an additional permitted use on the club site (Site 1). The State Environmental Planning Policy (SEPP) (Housing for Seniors or People with a Disability) 2004 applies to land within New South Wales that is zoned primarily for urban purposes or land that adjoins land zoned primarily for urban purposes. The policy aims to encourage the provision of housing that will increase the supply and diversity of residences that meet the needs of seniors or people with a disability, make efficient use of existing infrastructure and services and be of a good design.



Part 6 of clause 4 states that the policy does not apply to land described in Schedule 1 as environmentally sensitive land. Schedule 1 identifies land with descriptions of flood way and high flooding hazard as environmentally sensitive land. In this case, 15 of the 19 lots within site 1 are identified as flood hazard affected, three of which are identified as being within a high flood risk precinct.

Based on the current flood hazard mapping, the applicant could not rely on the SEPP (Housing for Seniors or People with a Disability) 2004 for permissibility of seniors housing on the subject site.

Whilst the known shortfall in Seniors housing is acknowledged, it is not considered that sufficient information has been submitted to demonstrate that the provision of Seniors housing within site 1 would be appropriate. The submitted Masterplan does not include provision for Seniors Housing nor does it address how Seniors Housing would fit within the club development. A copy of the submitted Masterplan is provided at Attachment 4. Whilst the SEPP could not be considered to directly apply to the subject site, a merit assessment would require that appropriate measures be put in place to separate the club from the residential areas to avoid land use conflicts. How this could be achieved as part of the current proposal has not been demonstrated. Seniors Housing is already permitted with the R2 Low Density Residential zoned land and in the Unanderra Town Centre. As such, the opportunity already exists for Seniors housing developments closer to the town centre.

Wollongong 2022 Community Strategic Plan

This report contributes to the delivery of Wollongong 2022 goals "we value and protect our environment" and "we are a healthy community in a liveable city". It specifically delivers on the following:

| С | community Strategic Plan | Delivery Program 2012-2017 | Annual Plan 2016-17 | |
|-------|--|---|--|--|
| | Strategy | 5 Year Action | Annual Deliverables | |
| 1.6.1 | Our urban environment minimises impacts on habitat and biodiversity and areas of high conservation value are protected | 1.6.1.1 Review planning controls for environmentally sensitive locations | Continue to assess Planning Proposals against environmental strategies, including the Illawarra Biodiversity Strategy and Illawarra Escarpment Strategic Management Plan. | |
| 5.1.5 | The long term needs of the community, including our people and our places are effectively planned for | 5.1.5.1 Continue to undertake social, land use and environmental planning activities that assists in service planning. | Assess rezoning submissions and progress supported Planning Proposals. | |

FINANCIAL IMPLICATIONS

Wollongong City Council is the owner of three allotments which are included within the draft Planning Proposal area. Negotiations have been ongoing with Wests Illawarra Leagues Club on the proposed closure and sale of several portions or road reserve adjoining the club. Discussions regarding the reclassification and sale of land to the club are ongoing. The portions of road reserve of interest are identified by the Figure below. These matters will be subject to a separate process and will require separate reporting to Council.





Figure 5: Portions of road reserve

If the land is rezoned and development proceeds, Council will receive Section 94A development contributions (1% of the development cost) and additional ongoing rate income.

CONCLUSION

A draft Planning Proposal request has been assessed for 40 allotments and parts of Council road reserve on Blackman Parade, Central Avenue, Cummins Street, Hargreaves Street, Maynes Parade and Tresnan Street, Unanderra. The affected Lot and DP and property addresses are included at Attachment 2 to this report. For ease of reference, the subject allotments have been separated into three 'sites' as discussed throughout this report.

For Site 1 – the Wests Illawarra Leagues Club site, the proposed increase in floor space ratio from 0.5:1 to 1.5:1 and increase in maximum building height from 11m to 15m is supported.

The Masterplan indicates that the development on Site 1 is to remain in the same general arrangement as currently, there is considered to be merit in the progression of the requested increase to Height and FSR on this site to allow for the club's continual development. It is noted that the impacts of the redevelopment and the connection of the works with the Unanderra Town Centre would be required to be considered as part of any development application. Further flood analysis including hazard mapping would be required to be provided as part of the submission to Gateway.

For Sites 2 and 3 the adjacent residential areas, while increased housing in close proximity to the Unanderra Town Centre is supported, there is insufficient information, particularly in relation to flood levels, to support the rezoning request.

On this basis, it is recommended that Council support the amendments to the Height of Buildings and Floor Space Ratio Mapping on Site 1 only.

File: ESP-080.03.003 Doc: IC16/100404



ITEM 2

SUBMISSION OF THE WOLLONGONG DRAFT COASTAL ZONE MANAGEMENT PLAN FOR CERTIFICATION

The Draft Wollongong Coastal Zone Management Plan was put on hold in July 2012 because the NSW Government had started a review of the policy framework guiding the preparation of these plans, and coastal management in the State in general. The review process is yet to be completed, but recent announcements by the State Government have implications that require Council's position on the Draft Wollongong Coastal Zone Management Plan to be reconsidered. This report recommends a way forward for Council on this matter.

RECOMMENDATIONS

- 1 The Draft Wollongong Coastal Zone Management Plan be updated to reflect the changes listed in Table 3 of this report.
- 2 The updated Draft Wollongong Coastal Zone Management Plan be submitted to the State Government for certification.
- 3 A further report be provided to Council when the State Government has considered the certification of the Draft Wollongong CZMP.

REPORT AUTHORISATIONS

Report of: Renee Campbell, Manager Environmental Strategy and Planning

Authorised by: Andrew Carfield, Director Planning and Environment - Future City and Neighbourhoods

ATTACHMENTS

- 1 CoastAdapt Sea Level Rise Information for Wollongong
- 2 Final Draft Wollongong Coastal Zone Management Plan Management Study
- 3 Final Draft Wollongong Coastal Zone Management Plan Management Study Appendices
- 4 Final Draft Wollongong Coastal Zone Management Plan Implementation Action Plan

COMPLIANCE WITH OFFICE OF LOCAL GOVERNMENT GUIDELINES ON COUNCIL DECISION MAKING DURING MERGER PROPOSAL PERIODS

The recommendation in this report satisfies the requirements of the OLG Guidelines - *Council Decision Making During Merger Proposal Periods.*

BACKGROUND

The Role of Coastal Zone Management Plans

Councils have a statutory requirement to consider climate change and sea level rise in their planning and development decisions. Meeting this requirement through preparing and implementing a Coastal Zone Management Plan (CZMP), in accordance with the provisions of the Coastal Protection Act (1979), can limit Councils' liabilities for the decisions they make in regard to this matter. These provisions require Councils to submit their draft CZMP to the State Government for certification that it meets the relevant guidelines for its preparation. Once certified, Councils need to adopt their CZMP and publish it in the Gazette. The CZMP can then be implemented, noting that it needs to be reviewed at regular intervals.

While not compulsory, the preparation and implementation of a CZMP allows Councils to adopt a more strategic approach to coastal management in their areas, and this approach is one of the goals of the NSW Coastal Policy (1997). The availability of these plans has also been helpful to Councils for seeking funding support from the State Government for their coastal management projects.



Preparation of the Wollongong Coastal Zone Management Plan

In 2009, the process to prepare a CZMP for Wollongong was started, with funding support and guidance from the State Government. In 2010, the State Government updated its policy framework for these plans and released the Guidelines for Preparing Coastal Zone Management Plans, which required the use of the State-endorsed sea level rise benchmarks for assessing the risks from climate change. These benchmarks were for a rise in sea levels of 40 cm to 2050 and 90 cm to 2100 above the 1990 mean sea level. The Wollongong CZMP was drafted in accordance with these new guidelines, using a two-staged process.

The first stage, the Wollongong Coastal Zone Study, prepared by the consultants, Cardno Lawson Treloar, identified the areas likely to be affected by coastal hazards now and into the future. The study mapped the land extents likely to be affected in the current, 2050 and 2100 timeframes by coastal erosion instability, tidal inundation and geotechnical issues if exposed to a 1 in 100 year storm event. Nearly 3,000 properties were identified to be affected, noting that the majority already had other constraints, such as catchment flooding risk or inherent geotechnical concerns. On 27 July 2010, Council considered the report from the first stage, including the legal advice obtained on Council's obligations towards the findings of this study, and made the following resolutions:

- 1. The Wollongong City Council Coastal Zone Study be endorsed.
- 2. The hazard extents identified in the Wollongong City Council Coastal Zone Study be used for development assessment going forward.
- 3. Section 149 (2) notations be made on properties potentially affected by the coastal hazards identified in the Wollongong City Council Coastal Zone Study.
- 4. The hazard extents identified in the Wollongong City Council Coastal Zone Study form the basis for the preparation of the Wollongong City Council Coastal Zone Management Plan.

These resolutions were implemented, and the hazard maps are now publically available and the information is included on the Section 149 planning certificates of the affected properties, and being used for development assessment purposes. The preparation of the CZMP was initiated, as the second stage of the process, using the consultants BMT WBM Pty Ltd. For this stage, the consultants used a risk-based approach to consider management options to address the risks from the coastal hazards identified in the first stage. An Implementation Action Plan was then developed for assets at greatest risk, which detailed management actions for Council to consider implementing for the next 5 to 10 years until the CZMP was reviewed. Most of these actions related to assets under Council's care and control, such as boat harbours, stormwater assets, surf clubs, ocean pools, cycleways, roadways and parking, and beaches and dunes. The actions that had implications for private property owners included the recommendation to formalise the development assessment process for affected properties by updating the Wollongong Development Control Plan to cover coastal hazards, the proposed voluntary acquisition of two properties in Thirroul, the investigation of a future management strategy for properties identified to be at risk in Woonona, and provisions for a seawall to be constructed around the Thirroul headland.

On 13 February 2012, Council was presented with the Draft Wollongong CZMP with a recommendation to endorse its public exhibition. The resolutions from that meeting were:

- 1. The Draft Wollongong Coastal Zone Management Plan be placed on public exhibition for a period of six weeks.
- 2. Following public exhibition, a further report be provided to Council on the submissions received and the amendments proposed.

The Draft Wollongong CZMP was exhibited from 20 February to 30 March 2012, and 70 submissions were received. There was significant community concern with the Draft Wollongong CZMP, particularly in relation to the sea level rise benchmarks utilised, the methodology used to map the hazard areas, and Council's decision to notate Section 149 planning certificates with this information. Other concerns related to the possibility of new development controls being imposed on the basis of these contentious studies, conflicts between dune restoration and beach amenity, and the suggestion of planned retreat as one of the long-term management options for Beach Drive residents in Woonona. Council also received



a petition with 272 signatures calling for the removal of the suggestion of planned retreat as an option for the Beach Drive area at Woonona, following a meeting on 29 March 2012 between the affected residents and the Lord Mayor.

On 13 April 2012, the Lord Mayor wrote to the then Minister for the Environment, Robyn Parker, about the community's concerns with the Draft Wollongong CZMP, and sought advice on the way forward. On 14 May 2012, the Minister responded indicating that the NSW Government had set up a taskforce to undertake a major review of the policy framework for coastal management in the State, and many of the issues raised by the Lord Mayor in his letter were to be addressed in this review. The Minister advised Council to focus on current hazards in its management approach for the coast.

On 9 July 2012, Council was presented with a post-exhibition report, detailing the response to the submissions received, and options for Council to progress the Draft Wollongong CZMP. Few changes were required to be made to the Draft Wollongong CZMP itself, as the majority of the community's concerns related to the first stage of hazard mapping, and the actions of Council as a result of that study. However, the Draft Wollongong CZMP was amended to include issues surrounding the conflict between dune restoration and beach amenity issues, and the need to prepare a dune management strategy to resolve these conflicts. The concern relating to Beach Drive residents was also addressed with emphasis in the Draft Wollongong CZMP that no firm management option for the area was being recommended, but only that it was an area for future investigation, noting that it was a complex issue with social consequences, and the need for Sydney Water involvement to determine a strategy for their assets, which would be exposed to coastal hazards before the houses would be. At the meeting, Council deferred making a decision on the next steps for the Draft Wollongong CZMP, given the announcement of the coastal reform process by NSW Government, which was intending to focus on many of the areas of concern to the community. Council resolved that:

- 1. The decisions on the next steps with the Draft Wollongong CZMP be deferred until the NSW Government Taskforce has completed its review and provides a direction on the way forward.
- 2. A letter be sent to all property owners within the coastal hazard zones, as well as those who provided a submission, informing them of the decision of Council.
- 3. A further report be provided to Council on the implications for the Draft Wollongong CZMP when the outcome of the NSW Government's review of the State's coastal management framework becomes known.
- 4. Council proceed with preparing a Dune Management Strategy to address the beach amenity, vegetation management and access issues raised by the community in their submissions.
- 5. Council investigate the establishment of a Coastal Community Engagement Program.
- 6. A Councillor briefing be held which looks at the viability of forming a formal partnership with the University of Wollongong PhD scholarship program, or similar, for ongoing Coastal and Dune Management Assessment and Conservation.

These resolutions have been implemented, including the completion of a Dune Management Strategy, which is currently being implemented at several beaches with amenity issues. Council has also been kept updated on the coastal reform developments and their implications for the Draft Wollongong CZMP through further Council reports and Information Folder notes, as detailed below.

NSW Government's Coastal Reform Process and the Response from Council

On 8 September 2012, the State Government announced the coastal management reforms it was introducing as the first stage of this process. The NSW Sea Level Rise Policy Statement, which required councils to use the State endorsed sea level rise benchmarks of 40 cm to 2050 and 90 cm to 2100 above the 1990 mean sea level, was revoked, giving councils the flexibility to select benchmarks appropriate to their own local conditions. The NSW Government also indicated that it would provide advice to councils on sea level rise relevant to their local area, and on coastal hazard notations on Section 149 planning certificates, and make it easier for property owners to install temporary protection works to protect their properties against coastal erosion. The certification of all CZMPs was also stopped until further notice. Council officers conveyed this information to Council through the



Information Folder of September 2012, indicating that the implications of these changes for the Draft Wollongong CZMP would become clearer as further information became available.

On 2 April 2013, Council received a further letter from the then Minister for the Environment, Robyn Parker, in which she responded to a number of councils' concerns about their legal liability from the use of sea level rise projections that varied from the previous state-endorsed benchmarks. Councils were informed that legal advice obtained by the State Government indicated that councils could minimise their potential liability by using sea level rise projections that are widely accepted by competent scientific opinion. The letter again re-iterated the Government's intention to provide expert advice to councils on this matter. This information was conveyed to Council through the Information Folder of April 2013.

A report on the progress of the coastal reforms and its implications for the Draft Wollongong CZMP was presented to the Council meeting of 26 August 2013. Up to this stage, apart from progress with developing provisions for temporary coastal protection works by property owners in erosion hot-spot areas, which did not include Wollongong, no further progress had been announced on providing expert advice on sea level rise or on coastal hazard notations on Section 149 planning certificates. The report to Council indicated that the previous state-wide sea level rise benchmarks could continue be used, given that the NSW Chief Scientist considered that the science behind their derivation was adequate. Council resolved that:

- 1. Council note the information provided in the report.
- 2. Council endorse the continued use of the previous state-wide sea level rise benchmarks for planning and development decisions until a pathway for identifying locally appropriate sea level rise values is identified by the State Government.
- 3. Council retain the current coastal hazard notations on Section 149 Planning Certificates until further direction on this matter is provided by the State Government.
- 4. Council officers continue to monitor the reform process and provide another update to Council after 12 months.

In January 2014, the NSW Government released its draft planning circular on coastal hazard notations on Section 149 planning certificates for public comment. The submission from Wollongong Council on this was considered at the Council meeting of 24 February 2014, and Council resolved that:

- 1. Council endorse the draft submission on coastal hazard notations on Section 149 Planning Certificates for finalisation and submission to the Department of Planning and Infrastructure.
- 2. Council provide a copy of the submission to the Ministerial Taskforce responsible for the NSW coastal reforms.

From July 2014, the NSW Government started to engage Councils for the next phase of the reform process. Council was informed of this development through the Information Folder of September 2014. In November 2014, the NSW Government finalised and released its planning circular on coastal hazard notations on Section 149 planning certificates, which required councils to include the type of coastal hazard, and the timeframe of its affectation, and the source of the information in the notations of affected properties. Council officers updated the planning certificates of the affected properties in the Wollongong LGA, in line with this advice. In November 2014, the new Minister for the Environment, Rob Stokes, also announced that the next stage of the coastal reforms would focus on legislative reforms; new arrangements to better support council decision making, including a decision support framework, a new coastal management manual, and improved technical advice; and more sustainable arrangements for funding and financing coastal management activities.

On 22 February 2015, Council received a letter from Minister Stokes advising that the NSW Government had resumed certifying CZMPs, and that since the Draft Wollongong CZMP had been prepared relatively recently and therefore likely to be consistent with current guidelines and legislation, it could be considered for certification. Council officers conveyed this information to Council through the Information Folder of April 2015, but proposed that certification not be pursued at the time, as the coastal reform process was ongoing and yet to provide advice on some of the more contentious matters in the Draft



Wollongong CZMP, such as those relating to sea level rise and the methodology used to map coastal hazard areas.

In November 2015, as the second stage of the coastal reform process, the NSW Government released major components of its proposed new framework for public feedback. These included the proposal to replace the Coastal Protection Act (1979) with a new act to be called the Coastal Management Act, to integrate several coastal management State Environment Planning Policies (SEPPs) into a single new Coastal Management SEPP, and to develop a Coastal Management Manual to guide Councils in their coastal management planning and implementation activities. The new Act would define the coastal zone as consisting of four coastal management areas to be mapped in the new Coastal Management SEPP, and with management objectives, to be given effect through applying the development controls in the new Coastal Management SEPP and by Councils preparing Coastal Management Programs (CMPs), which would replace the current CZMPs. The documents on exhibition included the draft Coastal Management Bill, and elements of the proposed new Coastal Management SEPP and the Coastal Management Manual. Maps of the proposed coastal management areas were not included. Technical advice on sea level rise and methodology to map coastal hazard areas were not included, but still intended to be provided at a later stage. Councils were advised that if they had completed a substantial amount of work for their CZMPs, they may wish to submit their plans for certification under the existing framework up to such time as the reforms are fully implemented. If certified, these plans could be utilised until December 2021, after which time compliance with the new framework arrangements would be required.

Council's submission on the exhibited coastal reform documents and a recommendation on the next steps for the Draft Wollongong CZMP were considered at its meeting of 22 February 2016. The recommendation for the Draft Wollongong CZMP was that it still be kept on hold, given that advice on its contentious matters relating to sea level rise and methodology for hazard mapping was still outstanding. Council resolved that:

- 1. The draft submission on the NSW Coastal Reform framework be endorsed for finalisation by the General Manager and provided to the State Government
- 2. The submission include a request for commitment from the State Government for ongoing funding support for councils in the preparation and implementation of their coastal management programs.
- 3. The submission include a request to ensure there is no loss of protection provisions in the existing SEPP's 14, 26, and 71, and the Coastal Policy.
- 4. The Draft Wollongong Coastal Zone Management Plan not be submitted to the State Government for certification at this stage.

On 25 February 2016, the NSW Government announced that the full Coastal Management SEPP with the associated mapping of the coastal management areas would be released for further consultation. Some of the mapping was made available for Council officers to preview prior to its exhibition, but it had several drawbacks, and these were brought to the government's attention. In April 2016, the Lord Mayor, in his capacity as the Chair of the Illawarra Pilot Joint Organisation, wrote to Minister Stokes reiterating these concerns. The mapping and the full SEPP are yet to be released, but the Coastal Management Bill has passed both houses of Parliament and expected to be enacted when the mapping and the Coastal Management SEPP are exhibited and finalised.

When the Coastal Management Act comes into force, CZMPs will be replaced by CMPs. However, as previously mentioned, Councils that have CZMPs that are certified will have until December 2021 to conform to the new requirements. CZMPs that are not yet certified can be submitted for certification up until the Coastal Management Act comes into force, and can still be considered for certification under the previous framework for up to six months after that date. Otherwise, CZMPs will need to be transitioned into a CMP, or new CMPs prepared as soon as the new Act comes into force, if Councils choose to have a certified plan guiding their coastal management activities. Recent developments in the coastal reform process have implications that require Council to reconsider its position on the Draft Wollongong CZMP in regard to its certification.



Recent Developments in the Coastal Reform Process and their Implications for Council

On 7 May 2016, the NSW Government announced a substantial increase in funding for coastal management activities in the State over the next five years, including the funding support provided to Councils through its Estuary and Coastal Management Grants Program. However, the grant funding guidelines have been changed to only fund the preparation of CMPs, the transitioning of CZMPs into CMPs, or implementation of projects listed in certified CZMPs or CMPs, or in CZMPs or CMPs submitted for certification. As the Draft Wollongong CZMP is on hold, Wollongong Council is ineligible to apply for funding support on which it has been reliant for many of its coastal and estuary management projects in the past. The priority areas for funding now will be projects which help to reduce the risks from coastal hazards, and have a significant public and environmental benefit.

On 2 August 2016, Council officers met with officers from the OEH Wollongong Office and expressed concern at this development, explaining that Council's decision up to this stage had been to not submit the Draft Wollongong CZMP for certification, as it was still awaiting the coastal reforms to provide advice on the contentious matters of sea level rise and hazard mapping methodology. On 10 August 2016, Council's General Manager sent a letter to Minister Stokes also expressing concern at these developments. A copy of the letter was provided to Councillors through the August 2016 Information Folder.

Council is yet to receive a response from Minister Stokes. However, on 30 August 2016, Council officers received a response from OEH in relation to sea level rise advice and the hazard mapping methodology. For sea level rise advice, Council is now being referred to a new website recently put online by the National Climate Change Adaptation Research Facility (NCCARF), a national consortium of researchers and agencies established by the Australian Government in 2008, which has been working on climate change research for the last five years. The website, called CoastAdapt, has been released as a trial version to support adaptation to coastal climate change and sea level rise. Sea level rise projections at the local government area scale are available on this website. The projections for the Wollongong LGA show that the upper bounds for sea level rise under the RCP8.5 scenario (the highest greenhouse gas emission scenario considered by the International Panel on Climate Change (IPCC)) are about 36 cm for 2050 and about 102 cm at 2100 (Attachment 1). These projections are not significantly different to the previous state-wide benchmarks that were utilised for the Draft Wollongong CZMP at 2050, and slightly higher for 2100. Therefore, under a conservative approach, the sea level rise benchmarks used in the Draft Wollongong CZMP are not unreasonable.

OEH has also advised that the mapping methodology used by Wollongong Council should be considered satisfactory for certification at this stage, and any new methodology, if arising out of the reform process, can be considered when the CZMP is updated into a CMP. Council officers have been further advised that the Coastal Management Act is likely to be enacted by December 2016, and councils have this short window of opportunity to seek certification of their CZMPs, if they wish to be eligible for grant funding. The advice of OEH is that Council should seek to certify their Draft Wollongong CZMP. If Council resolved to follow this advice, it would need to endorse the Draft Wollongong CZMP for submission to the State Government for certification.

Documents Requiring Council Endorsement if Submitting the Draft CZMP for Certification

All documents and studies leading to the preparation of the Draft Wollongong CZMP would need to be endorsed and submitted for certification. These documents must include the coastal hazard study from the first stage, the Wollongong City Council Coastal Zone Study, which has already been endorsed by Council (endorsed on 27 July 2010). Therefore, Council would only need to endorse the documents resulting from the second stage, which are:

- 1) Final Draft Wollongong Coastal Zone Management Plan Management Study (Attachment 2)
- 2) Final Draft Wollongong Coastal Zone Management Plan Management Study Appendices (Attachment 3)
- 3) Final Draft Wollongong Coastal Zone Management Plan Implementation Action Plan (Attachment 4)



The changes made to these documents after the public exhibition are outlined in Table 1, and also shown as track changes in the attached documents. As already noted, the changes required to be made at the time were minimal since many of the community's concerns related to the first stage of the process of preparing a CZMP for Wollongong.

Table 1 List of Changes made to the Final Draft Wollongong CZMP after Public Exhibition

| Document | Page | Changes |
|---|-------|---|
| Final Draft Wollongong City Council Coastal Zone | 19/20 | Section 2.2.11 regarding the role and activities of the Lake Illawarra Authority was added. |
| Management Plan - Management Study | 56 | Changes made to reflect dune management issues and needs identified by the community. |
| | 152 | Changes made to reflect dune management issues and needs identified by the community. |
| Final Draft Wollongong City Council Coastal Zone Management Plan - Management Study Appendices | E15 | For Woonona Beach, <i>Acacia sophorae</i> added as another plant causing dune management issues. |
| Final Draft Wollongong City Council Coastal Zone Management Plan - Implementation Action Plan | 44 | Further information added to indicate the need for all the issues to be considered in determining a future management direction for Woonona and Beach Drive, in particular the social consequences and the need for Sydney Water involvement. |
| | 50 | V.1 – Further information added to reflect the need for a dune management strategy which considers amenity issues. |

The Implementation Action Plan is the document with the management actions that Council would need to consider implementing if it were to seek certification of the Draft Wollongong CZMP. Table 2 gives a summary of these actions, and the locations, timeframes and estimated costs for their implementation. The timeframes are as they appear in the plan when it was completed in 2012, and no attempt has been made to review them for the present time. The summary also indicates the types of projects that Council would be able to submit for State Government funding support in the future, with the change in the funding guidelines.

The majority of the actions in Table 2 concern Council assets, for which the immediate requirement would be the preparation of a strategy to address the risks from coastal hazards, as part of the Asset Management Planning process. Actual works would only be required when assets are under direct threat, which can be tracked through a series of monitoring activities that are recommended. While monitoring projects can be eligible for grant funding, other asset management activities may be considered core activities of Council and not be a high priority for funding support. Other actions that might qualify for funding support are planning activities relating to updating the Wollongong Development Control Plan to address coastal hazards, preparing a decision framework to manage heritage items at risk, or investigations into a future management strategy for public and private assets at risk in Woonona. Options for voluntary acquisition of two properties in Thirroul, that are included, also may not be a high priority for funding support.

There are various beach, dune and vegetation management activities listed in the Implementation Action Plan, but the new funding guidelines preclude projects which seek to remove dunes and vegetation for recreational amenity purposes. Therefore, the types of projects implemented along the Wollongong coastline in recent years as part of the Dune Management Strategy for the Patrolled Swimming Beaches would not be eligible.



Table 2 Summary of Management Actions in the Draft Wollongong CZMP - Implementation Action Plan

| Category | Description of Actions | Location(s) Concerned | Timeframe for Implementation | Estimated Cost |
|---|---|--|--|--|
| Beach Management | Develop policy to reuse sand from dredging exercises, and use beach scraping and vegetation, to replenish | LGA wide | Policy - 2012 or as soon as practical. Works - On an | Policy - staff time Works: \$5 - 10K |
| Cycleways | and stabilise dunes. Audit to identify management options | McCauleys, | opportunistic basis. Audit and Asset | per episode Audit and |
| | for sections at risk; incorporate into Asset Management Plan to determine and implement a forward works program for these sections. | Sandon Point, Bulli, Woonona, Bellambi, Bellambi Point, Towradgi, North Beach, City Beach | Management Plan update - 2012 or as soon as practical. Works - when assets are close to being impacted, as indicated through monitoring. | update of Asset Management Plan- Staff time or consultancy (\$25K) Works: \$100 - 200 K per location |
| Development Controls | Update the Development Control Plan to address constraints from coastal hazards. | LGA wide | 2012 or as soon as practical. | Staff time |
| Heritage | Develop a decision framework for managing heritage items at risk from or impacted by coastal hazards. | LGA wide | 2012 or as soon as practical. | Staff time |
| Infrastructure, Assets and Boat Harbours | For Council-owned assets, include coastal hazards information in Asset Management Plan, and consider in the forward works program. For non Council-owned assets, notify asset owners on the need to consider the risk from coastal hazards in their asset management strategies. | LGA wide, but in particular at Sharkeys and Bellambi Point | Update of Asset Management Plan and notification of other asset owners - 2012 or as soon as practical. Works - when assets are no longer functional. | Update of Asset Management Plan and notification of other asset owners - staff time Works: \$1 - 2 million per location |
| Monitoring | Monitor shoreline profiles to track location of hazard impact zones, and utilise for management decisions and hazard reviews. | LGA wide | Event-based monitoring. | Staff time and about \$20 K per year internal costs |
| Ocean Pools | Audit to identify management options; incorporate into Asset Management Plan to determine and implement a forward works program for these assets. | Coalcliff, Wombarra, Coledale, Austinmer, Thirroul, Bulli, Woonona, Bellambi, Towradgi, Port Kembla | Audit and Asset Management Plan update - 2012 or as soon as practical. Works - when assets begin to get impacted or in accordance with Asset Management Plan. | Audit and update of Asset Management Plan - staff time Works: \$1 - 2 million per location |
| Private Land Acquisition | Voluntary acquisition and management of two properties. | Thirroul | Acquire soon and then recoup costs through rentals, etc OR Wait until the properties begin to be impacted by coastal hazards. | Market value of properties |



| Category | Description of Actions | Location(s) Concerned | Timeframe for Implementation | Estimated Cost |
|---------------------------------------|---|---|---|--|
| Roadways and Parking | Audit to identify management options; incorporate into Asset Management Plan to determine and implement a forward works program for these assets. | Little Austinmer, Austinmer, Sandon Point, Woonona, Bellambi, Towradgi | Audit and Asset Management Plan update - 2012 or as soon as practical. Works - when assets are close to being impacted, as indicated through monitoring. | Audit and update of Asset Management Plan - staff time or minor consultancy (\$25K) Works: \$50 - 500 K per location |
| Recreational Facilities | Repair storm damage to minor recreational facilities, access tracks, etc as required to maintain public safety, or abandon and relocate. | LGA wide | When damage occurs. | Event dependent |
| | Relocate Bulli beach cabins. | Bulli | When assets are close to being impacted, as indicated through monitoring. | about \$100 K |
| | Advise relevant authority of the need to manage the risk to parking and some ancillary buildings at the football grounds at City Beach. | City Beach | When assets are close to being impacted, as indicated through monitoring. | Notification - staff time Works: \$500 K (not a WCC cost) |
| Sea Walls and Training Walls | Audit to determine current condition and capacity to withstand coastal hazards into the future; include information in the Asset Management Plan to direct the management of these structures. | Austinmer, Bellambi headland, North Beach, and Perkins Beach | Audit and update of Asset Management Plan - 2012 or as soon as practical. Works - when assets begin to get impacted. | Audit and update of Asset Management Plan - staff time or minor consultancy (\$20K) Works: \$0.5 - 3.5 million per location |
| | Consolidate Lake Illawarra entrance training walls to withstand storm damage. | Lake Illawarra | When function is being impacted. | \$1 million (not a WCC cost) |
| | Investigate and undertake seawall construction along headland from Thirroul to McCauleys Beach. | Thirroul headland | When private properties begin to get impacted. | Approx. \$1 million (not a WCC cost as beneficiaries are private properties) |
| Surf Clubs and Public Buildings | Audit to determine current condition and capacity to withstand coastal hazards into the future; include information in the Asset Management Plan to direct the future management of these assets. | Stanwell Park, Coalcliff, Coledale, Austinmer, Thirroul, Sandon Point, Bulli, Woonona, Bellambi, Corrimal, Fairy | Audit and update of Asset Management Plan - 2012 or as soon as practical. Works - when assets are close to being impacted, as indicated through monitoring. | Audit and update of Asset Management Plan - staff time or minor consultancy (\$30K) Works: \$0.5 -1 million per location |



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| Category | Description of Actions | Location(s) Concerned | Timeframe for Implementation | Estimated Cost |
|---------------------------------|--|--------------------------|---|---|
| | | Meadow, North Beach | | |
| Further Studies and Plans | Update or completion of flood risk management plans to incorporate all areas identified to be impacted by ocean inundation. | LGA-wide | 2012 or as soon as practical. | \$40 - 80 K per study |
| | Investigations to determine an appropriate response to managing risks to both Council assets and 19 properties at risk by 2100 at Woonona Beach. | Woonona | 2012/ immediately. | Staff time or minor consultancy |
| Stormwater | Audit stormwater assets to determine capacity to withstand coastal hazards and function into the future; include in the Asset Management Plan to direct the future management of these assets. | LGA-wide | Audit and update of Asset Management Plan - 2012 or as soon as practical. Works - when assets are close to being impacted, as indicated through monitoring. | Audit and update of Asset Management Plan - staff time or minor consultancy (\$50K) Works: approx. \$50 K for each structure |
| Vegetation and Habitats | Implement a Dune Management Strategy to address priority issues along the coastline. | LGA-wide | 2012 or as soon as practical. | Staff time |
| | Utilise Norfolk Island pines in new coastal plantings. | LGA-wide | 2012/immediately. | Staff time |
| | Undertake an audit of and prepare a management strategy of all endangered habitats at risk from coastal hazards. | LGA-wide | 2012 or as soon as practical. | Staff time or minor consultancy (\$40 K) |
| Whole of Council Actions | Build awareness within Council and the community on the importance of considering coastal hazards in all relevant council operations. | N/A | 2012 or as soon as practical. | Staff time with minor consultancy assistance (\$20 K) |

Should Council resolve to submit the Draft Wollongong CZMP for certification (as recommended), the currency of the documents would also need to be considered, as nearly five years have passed since they were completed, in which time there have been some changes in the policies, legislation and management agencies referenced in them. The implementation timeframes would also need to be revised for the present time. In the five years since the preparation of the Draft Wollongong CZMP, several dune and asset management projects have been implemented by Council and others, so a change in the condition of Wollongong's coastal landscape can also be expected. Therefore, some of the values and threats that informed the preparation of the Draft Wollongong CZMP may no longer be relevant. While time constraints do not permit a full-scale review of the Draft Wollongong CZMP before the expected submission deadline for certification, some changes may still be possible to improve the currency of these documents. Table 3 gives a list of these changes, which would need to be made by the consultants BMT WBM Pty Ltd who prepared these documents. These changes would not have a material impact on the management issues and needs identified in the documents. Should Council resolve to seek certification of the Draft Wollongong CZMP with these changes (as recommended), it would need to endorse that the changes are reviewed and approved by Council officers, as there would not be adequate time to present them back to a Council meeting.



Table 3 Proposed Changes to the Draft Wollongong CZMP

| Page(s) | Why changes are required? | What changes are recommended |
|------------|---|--|
| Final Drat | t - Wollongong Coastal Zone Management Pla | n – Management Study |
| 1 | Executive Summary – paragraph 2, the last sentence references the use of the now revoked NSW Sea Level Rise Policy Statement in the hazard assessment informing the preparation of the Draft Wollongong CZMP. Current State Government requirements are that councils use their own sea level rise projections; therefore this aituation pando to be raviewed | On 26 August 2013, Council resolved to continue to use the previous SLR benchmarks until a pathway for identifying locally appropriate sea level values is identified by the State Government. Therefore, the following needs to be inserted at the end of this paragraph. "Although the NSW standard sea level |
| | situation needs to be reviewed. | rise benchmarks are now revoked, on 26 August 2013, Wollongong City Council resolved to continue to use the same benchmarks for its planning and development decisions". |
| 9 | Section 2.1, paragraph 2 –the reference to the Guidelines for Preparing Coastal Zone Management Plans has changed from DECCW (2010) to OEH (2013). | Replace DECCW (2010) with OEH (2013) as the reference source for the Guidelines for Preparing Coastal Zone Management Plans. |
| 10 | Section 2.2.1.1 – further amendments have since been made to the Coastal Protection Act in relation to emergency and temporary protection works, and these need to be reflected in the first two paragraphs of this section. | The correct amendments to the Coastal Protection Act need to be cited. Also, wherever there is reference to "emergency works", it needs to be replaced with "temporary works". |
| 16 | Section 2.2.9 outlines the State Government's undertakings under the NSW SLR Policy Statement towards the preparation of CZMPs by councils. As this NSW SLR Statement is no longer applicable, this section needs to be revised. | This section can be retained but the section title needs to be changed to "The Now Revoked Sea Level Rise Policy Statement", and making sure the rest of the text is in the past tense to indicate what the Government's commitments were under the revoked policy. At the end of this section, the following sentence needs to be inserted, "Although the NSW standard sea level rise benchmarks are now revoked, Wollongong City Council resolved to continue to use the same benchmarks for its planning and development decisions." |
| 17 | Section 2.2.10 - the reference to the Guidelines for Preparing Coastal Zone Management Plans has changed from DECCW (2010) to OEH (2013). | Replace DECCW (2010) with OEH (2013) as the reference source for the Guidelines for Preparing Coastal Zone Management Plans. |
| 18 | Table 2-2, In current version of the Guidelines for Preparing CZMPs, Principle 1 has been changed to remove the reference to the NSW Sea Level Rise Policy Statement. Councils need to demonstrate compliance with these principles for certification of their CZMPs, so | Remove the references to the NSW Sea Level Rise Policy Statement from Columns 2 and 3 for Principle 1 in Table 2-2. |



| Page(s) | Why changes are required? | What changes are recommended | |
|------------|--|--|--|
| Final Draf | Final Draft - Wollongong Coastal Zone Management Plan – Management Study | | |
| | this change will need to be addressed. | | |
| 19 | Section 2.2.11 relates to the role and responsibilities of the former Lake Illawarra Authority (LIA) in coastal management. As a separate CZMP is currently being prepared for the Lake, this section is no longer necessary. | Remove Section 2.2.11. | |
| Final Draf | t - Wollongong Coastal Zone Management Pla | n – Management Study Appendices | |
| C-6 | Section on the NSW SLR Policy Statement outlines the State Government's undertakings under the NSW SLR Policy Statement towards the preparation of CZMPs by councils. As this NSW SLR Statement is no longer applicable, this section needs to be revised. | This section can be retained but the section title needs to be changed to "The Now Revoked Sea Level Rise Policy Statement", and making sure the rest of the text is in the past tense to indicate what the Government's commitments were under the revoked policy. At the end of this section, the following sentence needs to be inserted, "Although the NSW standard sea level rise benchmarks are now revoked, Wollongong City Council resolved to continue to use the same benchmarks for its planning and development decisions." | |
| C-8 | Section on Coastal Protection and Other Legislation Amendment Act 2010 - further amendment s have since been made to the Coastal Protection Act in relation to emergency and temporary protection works, and these need to be correctly reflected in this section. | The correct amendments to the Coastal Protection Act need to be cited. Also, wherever there is reference to "emergency works", it needs to be replaced with "temporary works". | |
| Final Draf | t - Wollongong Coastal Zone Management Pla | n – Implementation Action Plan | |
| 1 | Section 1.1, paragraph 4 – reference to the NSW SLR policy statement needs to be removed, as this policy is no longer applicable. | Remove "(as prescribed by the NSW Sea Level Rise Policy Statement, 2009)" from line 9 of this paragraph. | |
| 37 | Action S.10 regarding maintenance of the Lake Illawarra entrance training walls was allocated to the Lake Illawarra Authority as the agency responsible. As this agency is no longer in existence, the current government agency responsible for this, the Dept. of Industry – Lands was contacted for advice. They have recommended that the wording for the action be changed, and they are happy for to retain responsibility for this action. | The Action for this should now state: "Department of Lands maintain the Lake Illawarra training walls to ensure their ongoing stability and function. Note that all river training walls managed by Department of Industry – Lands are included in an asset management plan that includes regular inspections by qualified engineers." LIA be removed as the responsible agency and replaced with Dept. of Industry – Lands. | |
| 43 | SP.2 – Under Action column, reference to the NSW SLR policy statement needs to be removed, as this policy is no longer applicable. | Remove "(refer NSW Sea Level Rise Policy Statement, 2009, DECCW 2009)" from this section. | |

| Page(s) | Why changes are required? | What changes are recommended |
|--|--|--|
| Final Draft - Wollongong Coastal Zone Management Pla | | n – Management Study |
| 65 | References – NSW Sea Level Policy Statement to be removed from list of references, as it is no longer applicable. | Remove DECCW (2009a). NSW Sea Level Rise Policy Statement, October 2009 from reference list. |
| 65 | Acronyms – RTA name has now changed to RMS. | Change RTA to RMS in list of acronyms. |
| Multiple | Action list tables on pages 9, 12, 14, 19, 20, 21, 22, 23, 25, 27, 28, 30, 35, 36, 39, 43, 46, 50, 51, 52, 53, 54 indicate the timeframe for implementation as 2012 or 2013. As these times have passed, these dates need to be changed. | Change the dates to 2016/17. |

Further Matters for Council's Consideration

There are additional matters that Council needs to consider in making a decision to seek certification of the Draft Wollongong CZMP. The Coastal Management SEPP, which is yet to be released, will also map areas subject to coastal hazards, where a specific set of development controls identified in the SEPP will have to be applied by Councils. The type of controls, the way Councils will be expected to exercise them; and the role of CZMPs in this in general, and in particular where CZMPs have areas that are mapped differently, are currently not known. Therefore, having the Draft Wollongong CZMP certified and moving ahead with updating the Development Control Plan without full knowledge of the SEPP implications may result in inconsistencies between state and local policies.

While the advice from OEH is that risk mapping methodology used in the Draft Wollongong CZMP can be considered satisfactory for certification at this stage, there is no guidance on what methodologies would be considered acceptable for this under the new framework. Should a different methodology be recommended for the future, the local community may expect Council to update its CZMP much sooner than December 2021.

PROPOSAL

The two options available for the next steps with the Draft Wollongong CZMP and their implications are considered below.

Option 1 – the Draft Wollongong CZMP is submitted for certification

With this option, Council would become eligible to apply for grant funding for any estuary and coastal management projects listed in the Draft Wollongong CZMP. However, these projects may not be of high priority for funding support. With certification of the Draft Wollongong CZMP, Council would have until December 2021 to comply with the new policy framework, although it can choose to do so sooner if the reforms (and in particular the Coastal Management SEPP) suggest a different approach would be more appropriate or acceptable to the community. The recent advice provided by OEH in relation to sea level rise and hazard mapping methodology means that Council now has some basis to seek to certify the Draft Wollongong CZMP. The certification process would provide the opportunity to get official sanction that the Draft Wollongong CZMP was prepared in accordance with State Government guidelines.

There would also be greater credibility for using the information from it for S149 planning certificate notations and development assessment purposes, and Council can move to formalise the development assessment process for the affected properties. Council would also have the flexibility to implement management actions in line with its other budgetary and other business priorities until at least December 2021, and not be under pressure to make these decisions in the immediate term. However, the currency of the Draft Wollongong CZMP is a matter for consideration, as it was prepared about five years ago, and under normal circumstances, it would be nearing the time for its review. Another major unknown is



what requirements the new Coastal Management SEPP will place on Council, and how these will impact on the requirements resulting from certification of the Draft Wollongong CZMP. The Coastal Management SEPP will also have coastal hazard maps and development controls, and there is potential for landholders to be confused by having to meet two sets of requirements. However, as soon as the implications from the proposed Coastal Management SEPP are known, Council can move to update its plan to resolve any conflicts with the State requirements, and improve its currency. Alternatively, Council can seek to have the Coastal Management SEPP maps amended to reflect its own maps, if the Draft CZMP is certified, and the hazard maps are incorporated into Council's landuse planning instruments and are considered to be more informative than the State maps.

This option is recommended.

Option 2 – the Draft Wollongong CZMP is not submitted for certification

If this option is selected, no further opportunity is likely to be available to seek certification of the Draft Wollongong CZMP in the current form, as the advice from OEH is that the coastal reforms are likely be implemented in full by December 2016. This will mean that Council will be ineligible for any grant funding support from the NSW Government under its Estuary and Coastal Management Grants Program until it can prepare a CMP, or transition its Draft CZMP to a CMP under the new policy framework. Transitioning the Draft Wollongong CZMP into a CMP at an appropriate time could also be a preferable option, as it would mean that the effort that went into its preparation would not be completely lost, but the plan can be properly updated to reflect the current circumstances. This approach would also allow the implications from the completion of the coastal reforms process, and in particular the Coastal Management SEPP, to be fully understood and integrated with the new CMP.

In the interim, Council can continue to use the information from the Draft Wollongong City Council Coastal Zone Study for Section 149 notifications and development assessment purposes, citing the good faith provisions under the Local Government Act (1993), unless advised otherwise by the State Government. However, the opportunity to access grant funding in the immediate term would be lost.

This option is not recommended.

CONSULTATION AND COMMUNICATION

Council's current position on the Draft Wollongong CZMP, as well as the recent developments in the coastal reform process, were discussed at the Estuary and Coastal Zone Management Committee meeting of 28 September 2016. The recommendation from this meeting was that Council be given the opportunity to reconsider its position on the Draft Wollongong CZMP in light of these developments. Some members of the Committee supported the option of Council submitting the Draft Wollongong CZMP for certification.

PLANNING AND POLICY IMPACT

This report contributes to the delivery of Wollongong 2022 goal "We value and protect our environment". It specifically delivers on the following:

| Community Strategic Plan | Delivery Program 2012-2017 | Annual Plan 2016-17 |
|---|---|---|
| Strategy | 5 Year Action | Annual Deliverables |
| 1.2.1 A suite of actions to manage and protect against the future risks of sea level rise is enacted. | 1.2.1.1 Finalise and implement the Coastal Zone Management Plan | Continue to monitor and participate in the NSW Coastal Reforms. |

RISK ASSESSMENT

There are risks from Council seeking certification of the Draft Wollongong CZMP without updating it to reflect current circumstances, and without full knowledge of the implications of the coastal reform process. The Draft Wollongong CZMP and the studies leading up to it have always been contentious issues for the local community, and in particular to those whose properties were identified to be at risk


from coastal hazards, and the move by Council to formalise these documents without further review may not be viewed favourably. However, the implications for property owners from certifying the Draft Wollongong CZMP do not change significantly from the current situation, as these properties already have coastal hazard notations on their S149 planning certificates, which are used for development assessment purposes on a case by case basis. With certification of the Draft Wollongong CZMP, this process would only become more formalized, and would allow Council to apply for funding under the Estuary and Coastal Grants Program.

FINANCIAL IMPLICATIONS

There are no significant costs associated with Council seeking to have the Draft Wollongong CZMP certified. There is a small cost of about \$1,000 to have the documents updated by the consultants to reflect the changes listed in Table 3. If the Draft Wollongong CZMP is certified, Council would have the opportunity to seek grant funding from the State Government to supplement its budgetary resources for coastal management projects listed in the Draft Wollongong CZMP. Council would consider management actions included in the CZMP as part of its annual planning and budgeting processes.

If Council resolved not to seek certification of the Draft Wollongong CZMP, it would not be able to seek funding support from the State Government if some of the actions listed in the Draft Wollongong CZMP were to be implemented in the near future. If Council wished to become eligible for funding support for its coastal management projects in the future, it would have to allocate resources to transition the Draft Wollongong CZMP into a CMP as soon as the implications from the coastal reform process are fully known.

CONCLUSION

Recent announcements by the State Government on its coastal reform agenda require Council to reconsider its decision to put the Draft Wollongong CZMP on hold. The coastal reform process is not yet complete and its full implications for Council seeking certification of the Draft Wollongong CZMP are not known at the current time. The currency of the Draft Wollongong CZMP is also a matter of concern as it was completed about five years ago. However, because of the State Government decision to link funding support to certified plans, it is recommended that Council submit the Draft Wollongong CZMP for certification.



ITEM 3

DEVELOPMENT CONTROL PLAN 2009

File: ESP-100.02.021 Doc: IC16/100248 POST EXHIBITION REPORT SUSTAINABILITY REVIEW OF WOLLONGONG

On 30 May 2016 Council endorsed the Sustainability Review of the Wollongong Development Control Plan 2009, including draft amendments to various DCP chapters and an Appendix for exhibition. The draft chapters were exhibited from 8 June to 8 July 2016 and referred to Council's Design Review Panel on 15 September 2016.

This report summarises submissions received as a result of the exhibition period, comment provided from Council's Design Review Panel, and provides post exhibition DCP amendments recommended for adoption by Council.

RECOMMENDATION

The following revised chapters of the Wollongong Development Control Plan 2009 (Attachments 2-10) be adopted by Council and a notice be placed in the local newspapers to provide effect of such adoption.

- A1 Introduction а
- b A2 Ecologically Sustainable Development
- **B1** Residential Development С
- d **B3 Mixed Use Development**
- е **B5** Industrial Development
- D13 Wollongong City Centre f
- E3 Car Parking, Access, Servicing/Loading Facilities and Traffic Management g
- h E6 Landscaping
- Appendix 4 Definitions i

REPORT AUTHORISATIONS

Renee Campbell, Manager Environmental Strategy and Planning Report of:

Authorised by: Andrew Carfield, Director Planning and Environment - Future City and Neighbourhoods

ATTACHMENTS

- 1 Summary of submissions resulting from public exhibition period July 2016
- 2 A1 Introduction
- 3 A2 Ecologically Sustainable Development
- 4 **B1** Residential Development
- 5 B3 Mixed Use Development
- **B5** Industrial Development 6
- 7 D13 Wollongong City Centre
- 8 E3 Car Parking, Access, Servicing/Loading Facilities and Traffic Management
- 9 E6 Landscaping
- 10 **Appendix 4 Definitions**
- 11 Comments from Design Review Panel

COMPLIANCE WITH OFFICE OF LOCAL GOVERNMENT GUIDELINES ON COUNCIL DECISION MAKING DURING MERGER PROPOSAL PERIODS

The recommendation in this report satisfies the requirements of the OLG Guidelines - Council Decision Making During Merger Proposal Periods.



BACKGROUND

On 30 May 2016 Council resolved to exhibit a Sustainability Review of the Wollongong Development Control Plan 2009 (DCP), as well as the following DCP chapters proposed for amendment:

- A1 Introduction
- A2 Ecologically Sustainable Development (new chapter)
- B1 Residential Development
- B3 Mixed Use Development
- B5 Industrial Development
- D13 Wollongong City Centre
- E3 Car Parking, Access, Servicing, Loading Facilities and Traffic Management
- E6 Landscaping
- Appendix 4 Definitions

Public exhibition occurred for a period of 31 days from 8 June until 8 July 2016. Industry stakeholders were directly informed of the exhibition period and two public notices placed in local newspapers to inform the broader community.

PROPOSAL

Five (5) submissions were received as a result of the exhibition period. One submission provided support for the proposed amendments, subject to minor changes. One submission had no objection to the proposed amendments. All submissions provided further comment regarding the proposed amendments, and/or the broader Wollongong DCP 2009. Submissions received as a result of the exhibition period are summarised in Attachment 1.

In accordance with clause 21A of the Environmental Planning and Assessment Regulation 2000, Council must not approve any amendment to the DCP relating to the design quality of residential apartment development, unless it has referred this to the design review panel and has taken into consideration:

- (i) Any comments made by the design panel, and
- (ii) The matters specified in Parts 1 and 2 of the Apartment Design Guide.

Amendments to the Wollongong DCP 2009, including amended provisions relating to residential apartment buildings as a result of the sustainability review and associated public exhibition period, were reported to Council's Design Review Panel on 15 September 2016. Comments received back from the panel are contained in Attachment 11.

A post exhibition review of the exhibited DCP chapters has occurred taking into account submissions received, comment from Council's Design Review Panel and following internal consultation. Attachments 2-10 detail the post exhibition DCP chapters recommended for adoption by Council.

- Text highlighted yellow throughout each chapter indicates text amendments proposed as a result of the sustainability review.
- Text highlighted green indicates amendments post exhibition.
- Strikethrough indicates text to be deleted from the Wollongong DCP 2009 if adopted by Council.

The following discussion provides a summary of DCP amendments post exhibition resulting from the exhibition period and subsequent internal consultation.



Chapter A2 Ecologically Sustainable Development

Three submissions suggested an incentive be provided for development which embrace sustainable development and extends itself beyond the minimum requirements of the State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004. Suggestions provided included increase in Floor Space ratio, increased height allowances, reduced car parking requirements, or reduced development contribution fees.

Development designed and built that takes into consideration the principles of ecologically sustainable development, such as being designed to achieve optimum passive solar access, and responding to relevant site conditions and constraints, will exceed the minimum BASIX requirements. Such development will have lower energy/gas/water costs when compared to similar development that are not designed and built in such a manner. Reduced utility costs for such developments provide a longer term payback and incentive for owners/ occupiers.

Floor Space Ratio and Maximum Building Height

Floor Space Ratio and Maximum Building Height are regulated through the Wollongong Local Environment Plan 2009. These are consistently applied throughout the local government area and as such, variation to such provisions is not recommended.

Variations to car parking provisions

Car parking rates are primarily regulated through the Wollongong Development Control Plan 2009. For development subject to SEPP 65 and the Apartment Design Guide 2015, Council's car parking rates or the requirements as set out in the RMS Guide to Traffic Generating Developments may apply.

Car parking, particularly within the Wollongong City Centre, remains a contentious issue and is subject to periodic review. No widespread variation to car parking provisions is recommended in this report.

Reduced development contributions or development application fees

A reduction in development contributions or development application fees could be considered. Council would need to consider and implement thresholds at which such reductions were to be awarded and a rigorous system auditing compliance against such features. Further investigation would be required before considering a reduction in these fees.

Sustainable Building Advisory Service

Lane Cove Council offers a Sustainable Building Advisory Service free of charge to residents looking to build/renovate their home. The process includes one on one onsite consultation with an external architect or building designer (engaged by Council), and preparation of a follow up report for the landowner outlining onsite discussion and sustainable development initiatives that may be incorporated. Providing such a service informs and educates residents, and encourages an extension of sustainable design and building beyond the minimum SEPP BASIX requirements. Such a service would sit outside of the Wollongong DCP 2009 and could cost in order of \$150,000 per annum to run.

If Council was interested in considering this type of service a Business Proposal could be prepared.

<u>Amendment</u>

As a consequence of submissions and following discussion with internal staff, amendment to the Wollongong DCP 2009 to further incentivise development that achieves excellence in environmental sustainability is being investigated. A future report to Council will detail any additional amendments which may further incentivise such development. Public exhibition of any such amendment would be recommended.

Chapter B1 Residential Development

Following comment from Council's Design Review Panel (DRP), a small number of amendments are proposed as follows:

• Inclusion of an additional landscaping objective for residential flat building development (section 6.11). The additional objective is included in the NSW Department of Planning and Environment's



Apartment Design Guide (ADG), and states to ensure landscape design responds to the existing site conditions including changes in levels, views, and significant landscape features including trees and rock outcrops.

- An increase in the minimum number of trees to be planted onsite for residential flat building development dependent on lot size and deep soil zone provisions.
- Retention of current 10% provision relating to adaptable housing for residential flat building development and multi dwelling housing. The DRP recommended that Council not increase the adaptable housing rate to 20% unless it completed feasibility testing prior to the introduction of such a provision.
- Retention of exhibited draft requirement for residential flat building development (with six more dwellings) to include 10% (or a minimum of one) dwellings that achieve silver livable housing design standard. The ADG includes provision for livable dwellings and the silver standard for SEPP 65 affected development. The exhibited draft requirement for multi-dwelling housing to achieve this silver standard has been removed based on the need for feasibility testing prior to introduction of such a provision.

A number of additional minor wording amendments are recommended as a result of submissions received. Such amendments are considered minor in nature and:

- Further clarify a development objective and control, or
- Update references to and application of State Environmental Planning Policy 65 Design Quality of Residential Apartment Development and related Apartment Design Guide 2015.

Refer to Attachment 4, which specifies post exhibition amendments recommended for adoption.

B3 Mixed Use Development

Following comment from Council's Design Review Panel (DRP), a small number of amendments are proposed similar to those outlined for chapter B1. These include:

- Retention of current 10% provision relating to adaptable housing for residential flat building development and multi dwelling housing. No increase recommended.
- Retention of exhibited draft requirement for residential flat building development (with six or more dwellings) to include 10% (or a minimum of one) dwellings that achieve silver liveable housing design standard. The ADG includes provision for liveable dwellings and the silver standard for SEPP 65 affected development.

The exhibited draft requirement for multi-dwelling housing to achieve this silver standard has been removed based on the need for feasibility testing prior to introduction of such a provision.

Refer to Attachment 5 which specifies post exhibition amendment recommended for adoption.

B5 Industrial Development

Amendment of one development control occurred post exhibition to provide examples of reducing reliance on artificial lighting. Amendment states 'reduce reliance on artificial lighting by incorporating natural light. This may include designing the development to provide direct daylight access to office spaces, providing skylights whenever possible and/ or sectioning lighting throughout to cater for current and future business needs'.

Refer to Attachment 6 which specifies post exhibition amendments recommended for adoption.

D13 Wollongong City Centre

Following comment from Council's Design Review Panel (DRP), a small number of amendments are proposed similar to those outlined for chapter B1. These include:



- Retention of current provision relating to adaptable housing (10%) for residential flat building development and multi dwelling housing and not increase it to 20%.
- Retention of requirement for residential flat building development (with six or more dwellings) to include 10% (or a minimum of one) dwellings that achieve silver liveable housing design standard. The ADG includes provision for liveable dwellings and the silver standard for SEPP 65 affected development.

This report does not recommend multi-dwelling housing be required to achieve this silver standard.

A number of minor wording amendments are recommended as a result of submissions received. Such amendments are considered minor in nature and:

- Further clarify a development objective and control, or
- Update references to and application of State Environmental Planning Policy 65 Design Quality of Residential Apartment Development and related Apartment Design Guide 2015.

Refer to Attachment 7 which specifies post exhibition amendments recommended for adoption.

E3 Car parking, Access, Servicing/Loading Facilities and Traffic Management

One submission provided suggested changes in relation to Green Travel Plans recommending requirement if development is for commercial, institutional or industrial purposes over 2000m2 or 50 workers. As this is a new inclusion in the Wollongong DCP, this report recommends retaining the approach which encourages, rather than mandates, use. No post exhibition amendment recommended.

E6 Landscaping

Internal advice received proposed minor word updates to the landscaping chapter. Examples of such amendments include amended definition of a green wall to include reference to a suitable growing medium, and landscape maintenance schedule provisions be required to state such schedule *should cover a period of 12 months...* The existing development control states such schedules *should cover a period of 6 months...*

The internal advice also proposed amendment of the minimum qualifications required for a Landscape Designer preparing Landscape Plans or Site and Context Analysis Plans for dual occupancy developments. Current provisions allow such plans to be prepared by a Landscape Designer with either of the following qualifications:

- Category 1 No formal qualification, or
- Category 2 Landscape Architect or Landscape Designer with Landscape Associated Diploma or similar and at least 3 years post graduate experience in landscape design.

Dual occupancy development is becoming increasingly prevalent throughout the Wollongong local government area and the need to ensure satisfactory landscaping outcomes is becoming more prominent. It is recommended this control be revised and include category 2 as a minimum qualification.

Amendment:

As a consequence of internal discussion, minor amendments are proposed consistent with the above. These are detailed in Attachment 9.

Appendix 4 Definitions

Minor amendment is proposed to the definition of a green wall, to include reference to a suitable growing medium and a hydroponic system.

Refer to Attachment 10 which specifies post exhibition amendment recommended for adoption.



CONSULTATION AND COMMUNICATION

The Sustainability Review of the Wollongong DCP 2009, and draft DCP chapters were exhibited from 8 June until 8 July 2016. Industry stakeholders were informed of the exhibition period and provided opportunity to be briefed regarding the proposed amendments.

In accordance with clause 21A of the Environmental Planning and Assessment Regulation 2000, Council must not approve any amendment to the DCP relating to the design quality of residential apartment development, unless it has referred this to the design review panel and has taken into consideration:

- (iii) Any comments made by the design panel, and
- (iv) The matters specified in Parts 1 and 2 of the Apartment Design Guide.

Council's Design Review Panel considered the proposed amendments to the DCP relating to residential apartment development on 15 September 2015, and provided comment as per Attachment 11. The matters specified in Parts 1 and 2 of the Apartment Design Guide have also been considered.

Environment and Sustainability Reference Group

Council's Environment and Sustainability Reference Group (ESRG) were briefed in relation to the proposed changes to the Wollongong DCP on 27 April 2016. The ESRG was informed of the exhibition period and invited to provide further comment. An overview of submissions received was provided to the ESRG at its meeting of 17 August 2016.

Adoption of the revised DCP chapters

In accordance with clause 21 of the Environmental Planning and Assessment Regulations 2000, a development control plan, if adopted by Council, comes into effect the date that a public notice is given in a local newspaper. This public notice is required to occur within 28 days after a decision is made by Council.

PLANNING AND POLICY IMPACT

This report contributes to the delivery of Wollongong 2022 goal "We value and protect our environment". It specifically delivers on the following:

| Community Strategic Plan | Delivery Program 2012-2017 | Annual Plan 2016-17 |
|--|---|--|
| Strategy | 5 Year Action | Annual Deliverables |
| 1.6.3 Development is functional, attractive and sympathetic with the environment and avoids unnecessary use of energy, water and other resources | 1.6.3.2 Maximise sustainability principles in the design and construction of Wollongong's built form. | Prepare a Sustainability Chapter for incorporation in Wollongong Development Control Planning. |

CONCLUSION

The Sustainability Review of the Wollongong DCP 2009 has been completed with the aim of enhancing the sustainability of development occurring throughout Wollongong. Proposed amendments have been publicly exhibited and submissions received have been used to refine post exhibition DCP amendments (Attachments 2-10).

This report recommends Council adopt the post exhibition amendments as detailed in Attachments 2-10.



File: IW-090.001 Doc: IC16/100432 ITEM 4 ESTABLISHMENT OF FLOODPLAIN RISK MANAGEMENT COMMITTEES

Reviews of Council's existing Flood Studies or Floodplain Risk Management Studies and Plans are about to commence in a variety of drainage catchments within the Wollongong LGA. The reviews of these studies will be undertaken with support of Floodplain Risk Management Committees in accordance with Council's revised Charter for Floodplain Risk Management Committees.

This report seeks to establish Floodplain Risk Management Committees including Councillor representation.

RECOMMENDATION

- 1 Two Councillors (one as chairperson) from Wards covered by the respective catchment areas (one from each Ward where catchments cross Wards) be nominated to each of the following identified Floodplain Risk Management Committees –
 - a Hewitts Creek (Ward 1)
 - b Collins Creek (Ward 1)
 - c Towradgi Creek (Ward 1)
 - d Fairy and Cabbage Tree Creeks (Wards 1 and 2)
 - e Wollongong City (Ward 2)
 - f Mullet and Brooks Creeks (Ward 2 and 3)
 - g Lake Illawarra (Ward 3)
 - h Minnegang Creek (Ward 3)
- 2 Council seek other appropriate representation (including Council staff, State Government agencies, and local community members) on each of the identified Floodplain Risk Management Committees.
- 3 The revised Charter for Floodplain Risk Management Committees be adopted.
- 4 The establishment of these Floodplain Risk Management Committees dissolves any existing Committees that have overseen already completed studies in these catchments.

REPORT AUTHORISATIONS

Report of: Mike Dowd, Manager Infrastructure Strategy and Planning Authorised by: Greg Doyle, Director Infrastructure and Works - Connectivity Assets and Liveable City (Acting)

ATTACHMENTS

- 1 Charter Floodplain Risk Management Committee (Revised)
- 2 Catchments Map

COMPLIANCE WITH OFFICE OF LOCAL GOVERNMENT GUIDELINES ON COUNCIL DECISION MAKING DURING MERGER PROPOSAL PERIODS

The recommendation in this report satisfies the requirements of the OLG Guidelines - *Council Decision Making During Merger Proposal Periods*.



BACKGROUND

Floodplain Risk Management Planning

Under the NSW Government's Floodplain Development Manual (2005), a Floodplain Risk Management Committee is required to assist Councils in the preparation of a Flood Study, Floodplain Risk Management Study, and a Floodplain Risk Management Plan for drainage catchments within their LGA. The Committee provides advice to Council in the process of developing these studies.

Council has completed a Flood Study, Floodplain Risk Management Study, and a Floodplain Risk Management Plan for each of the nine catchments across the City, with priority actions identified in the Plans, being progressively implemented.

Table 1 below, lists the nine catchment areas covered by existing studies as well as the currency of the plans and the relevant Councillor Wards. Boundaries of the catchments are shown on the attached map:

| | CATCHMENT AREA | WARD | Flood Study Adopted | FRMP&S Adopted |
|---|--------------------------------|------|---|-------------------|
| 1 | HEWITTS CREEK | 1 | 2002*, 2015 | 2002 |
| 2 | COLLINS CREEK | 1 | 2011 | 2014 |
| 3 | TOWRADGI CREEK | 1 | 2003*, 2015 | 2003 |
| 4 | FAIRY & CABBAGE TREE CREEKS | 1, 2 | 2009 | 2010 |
| 5 | WOLLONGONG CITY | 2 | 2013 | 2015 |
| 6 | ALLANS CREEK | 2, 3 | 2006*, 2009 • Review underway | 2008 |
| 7 | MULLET & BROOKS CREEKS | 2, 3 | 2010 • Mullet Creek Review 2012 • Brooks Creek Review underway | 2010 |
| 8 | LAKE ILLAWARRA | 3 | 2001 | 2012 |
| 9 | MINNEGANG CREEK | 3 | 2002 | 2004 |

TABLE 1

* Superseded plans

Review of Council's Studies and Plans

All Flood Studies and Plans are prepared using the most current information, modelling and policies at the time of their preparation. In the last year, two significant policy changes have occurred necessitating the holistic review of all existing studies and plans. These are:

- The release of the new Australian Rainfall & Runoff guidelines (Released by Federal Government in 2016), which document the latest rainfall data used in flood modelling.
- Council's adoption of the revised Conduit Blockage Policy (adopted in 2016), which sets revised parameters and methods for taking blockage into account in determining flood risk.



In addition, studies need to be periodically reviewed and updated to reflect -

- Advances in catchment modelling techniques to improve accuracy.
- The availability of improved survey data and further detailed ground survey.
- Consideration of climate change impacts on the catchment.
- Development which may have occurred within each of the respective catchments.
- The implementation of recommended flood mitigation measures from each of the respective Floodplain Risk Management Plans.
- Information available from subsequent flood events since the initial studies were completed.

The Allans Creek Floodplain Risk Management Committee was formed within the last 12 months, to support review and development of the Allans Creek Flood Study, so it is not subject to this report.

PROPOSAL

It is proposed to establish Floodplain Risk Management Committees, in accordance with Council's revised Floodplain Risk Management Committee Charter, to support the review of Council's existing studies for each of the identified catchment areas within the Wollongong Local Government Area. The Charter was previously adopted by Council on 27 January 2015 and has been edited to update references to Council Divisions and State agency names.

It is proposed that the composition of the Committee will be in accordance with Section 5 of the Charter, and will also consider any specific local requirements of a particular catchment. Each Committee would meet on an as needed basis, with meetings arranged to review studies at key milestones in the projects.

Membership on each Committee will include representation from Ward Councillors, Council staff, state government agencies, and local community members. It is proposed that Council nominates a maximum of two Councillors (one as chairperson) from appropriate Wards to each of the identified Floodplain Risk Management Committees. Where catchments cross over two Wards, one Councillor from each Ward is proposed to be nominated. Council staff will provide executive and administrative support to the Committees.

The establishment of these Floodplain Risk Management Committees will replace any existing Committees that have overseen completed studies in these catchments.

CONSULTATION AND COMMUNICATION

Invitations will be sent to all relevant state government agencies seeking representation by suitable staff as members of the respective Floodplain Risk Management Committees.

Representation from the local community will be sought by placing advertisements in Council's Newspaper Notices and via electronic media requesting interested owners and occupiers of residential and business properties within each of the catchments to apply for membership of the Committees. Appointment of these members will be in accordance with Council's "Recruitment of External Members to Committees Policy".

PLANNING AND POLICY IMPACT

This proposal specifically delivers on core business activities as detailed in the Stormwater Service Plan 2016-17 as it continues to implement a coordinated approach to floodplain and stormwater management.

The review and update of all current Flood Studies and Floodplain Risk Management Studies and Plans will put into effect recent planning and policy changes in the industry (Australian Rainfall and Runoff) and within Council (Revised Conduit Blockage Policy).



RISK ASSESSMENT

Council's existing studies and assessment of flood risk needs to be updated to account for changes which have occurred since the completion of these studies. Failure to undertake periodic and timely reviews of the catchment Flood Studies and subsequent Floodplain Risk Management Studies and Plans may lead to –

- Inaccurate flood risk information being used by the community, external bodies, developers and in Council's infrastructure planning.
- Inconsistent or out-of-date application of industry standards and government policies relating to flood planning.
- Reduced success in applications for assistance from funding bodies, which require applications to be based on current and contemporary plans and policies.

FINANCIAL IMPLICATIONS

In addition to its \$350,000 annual allocation, Council has allocated a further \$1 million over the next 2 years to undertake a program to review all of its flood studies. These reviews will be staged such that priority is generally placed on reviewing the oldest completed studies first. The allocated budget includes allowance for the formation of and support to the proposed Floodplain Risk Management Committees.

A resource strategy has been established to support the delivery of the review program. Progress will be reviewed regularly to ensure the program is appropriately resourced.

CONCLUSION

Council is committed to the review of all its Flood Studies and Floodplain Risk Management Studies and Plans. This will ensure we use the best available and most current information, policies and standards in assessing, reporting and managing flood risk to the community.

The review of the flood studies and plans requires Floodplain Risk Management Committees to be established for each of the identified catchments, to operate under a revised Charter for the Committees. This report seeks the adoption of the revised Charter, the nomination of two Councillors from appropriate Wards (one as chairperson) to be appointed as members of the respective Committees and endorsement to seek representation to the Committees from state government agencies and local community.





File: PP-2015/2 Doc: IC16/100407

COMPULSORY ACQUISITION OF RIGHT OF CARRIAGEWAY OVER CROWN LAND TO **ITEM 5** PROVIDE ACCESS TO THE WATERFALL (GARRAWARRA) CEMETERY

On 1 September 1967, the Waterfall General (Garrawarra) Cemetery, Lot 4 DP840501, was placed under the custodianship of Wollongong City Council and Council became responsible for its care and management. The cemetery is surrounded by Crown Land and no legal access currently exists for Council to access the cemetery and undertake its maintenance responsibilities.

RECOMMENDATION

- Council compulsorily acquire a Right of Carriageway over Lot 3 DP840501 which is 1 Crown Land adjoining the Waterfall General (Garrawarra) Cemetery.
- 2 Council seek approval from the Minister for Local Government in accordance with section 187 of the Local Government Act 1993 to give all necessary Proposed Acquisition Notices in accordance with the Land Acquisition (Just Terms Compensation) Act 1991.
- Council take each further step as is necessary to obtain approval from the Minister, the Governor or 3 any public authority as may be necessary, and take all actions as may be necessary, to give notices and other wise carry out the acquisitions by means of compulsory acquisition.
- Council pay compensation, as determined by the Valuer General, to the Crown Lands Division for 4 the acquisition of the Right of Carriageway over Lot 3 DP840501.
- The General Manager be authorised to sign any documentation necessary to finalise the acquisition 5 and the Common Seal of Council be applied where necessary.

REPORT AUTHORISATIONS

Report of: Peter Coyte, Manager Property and Recreation

Authorised by: Kerry Hunt, Director Corporate and Community Services - Creative, Engaged and Innovative City (Acting)

ATTACHMENTS

1 Plan of proposed easement over Lot 3 DP840501

COMPLIANCE WITH OFFICE OF LOCAL GOVERNMENT GUIDELINES ON COUNCIL DECISION MAKING DURING MERGER PROPOSAL PERIODS

The recommendation in this report satisfies the requirements of the OLG Guidelines - Council Decision Making During Merger Proposal Periods.

BACKGROUND

Between 1909 and 1949, the Waterfall General (Garrawarra) Cemetery received over 2,000 burials, almost all of whom died of tuberculosis within the Waterfall Sanatorium. On 1 September 1967, 18 years after the last burial at the site, and following a significant period of minimal maintenance, the cemetery was placed under the custodianship of Wollongong City Council. The transfer of management responsibility occurred under the Local Government (Control of Cemeteries) Amendment Act 1966. This Act transferred responsibility for most general cemeteries across the state to local government. For Wollongong City Council, the handover came at the same time as the transfer of four other active general cemeteries being Helensburgh, Scarborough, Bulli and Wollongong.

It appears from the evidence that, whilst Council's cemetery staff in the late 1960s and early 1970s were aware of Council's management responsibility, the handover of the abandoned Waterfall site appears to have been a legal transfer only. There is no evidence that Council ever took up an active role in maintaining the site and it appears that the burial records were never handed to Council by the Department of Health, as was required under the 1966 legislation.



Council's responsibility for the site was effectively not attended to up until 2011 when, during the consideration of the Helensburgh 7D Lands Review, the matter was brought to Council's attention.

Since 2011, Council resolved to take up the management of the cemetery, however, the site is surrounded by Crown land and legal access to the site has never been formalised.

As the cemetery was transferred to Council in 1967 from the Crown Lands Division (Crown Lands), with no legal access provided, Council originally sought to compulsorily acquire the Right of Carriageway (over Lot 3 DP840501) from Crown Lands for nil or \$1 compensation. Whilst Crown Lands gave its approval to the compulsory acquisition, it advised that it could not waive its right to compensation, that this was a decision for the Treasurer of NSW to make and that its preference was for the Valuer General to determine the compensation.

Council then obtained a valuation report from the registered property valuers, Walsh and Monaghan, who valued the Right of Carriageway at \$1,000 (exc GST).

PROPOSAL

Given the likely low rate of compensation as determined by the valuation report, it is recommended that Council pay compensation to Crown Lands for the Right of Carriageway as determined by the Valuer General. An application to waive the compensation to the NSW Treasurer would need to come from the General Manager and it is likely that considerable time would elapse before a response would be received.

CONSULTATION AND COMMUNICATION

The Crown Lands Division has been consulted and approval has been received from it to the compulsory acquisition of the Right of Carriageway over Lot 3 DP840501.

Consultation with the Local Aboriginal Council and the Native Title Corporation will be undertaken before submitting an application to The Office of Local Government to compulsorily acquire.

PLANNING AND POLICY IMPACT

This report contributes to the delivery of Wollongong 2022 goal under the objective "Develop a sustainable financial model and strategy for the maintenance and management in perpetuity for Council cemeteries, in response to the Cemeteries Act and establishment of 'Cemeteries NSW'.

It specifically delivers on core business activities as detailed in the Property Services Service Plan 2016-17.

FINANCIAL IMPLICATIONS

Council will be responsible for all costs associated with the compulsory acquisition which includes survey, NSW Land and Property Information fees and compensation.

CONCLUSION

Council should acquire the Right of Carriageway over Lot 3 DP840501 to ensure legal access to the adjoining Garrawarra Cemetery, ie Lot 4 DP840501. Once the Right of Carriageway is in place, Council can commence works to restore the cemetery back to Bush Cemetery status which would allow Council to run open days for families to visit the cemetery. Council currently does not allow visitors to the cemetery as it is unsafe.



File: CF-05.01666 Doc: IC16/100406



ITEM 6

ACQUISITION OF EASEMENT FOR SUCTION LINE OVER CROWN LAND AT PORT KEMBLA

Council requires an extension of an easement for a suction line over Crown Land at Port Kembla, to allow for an extension of the northern inlet pipe which will improve the flows and capacity for water recirculation at the Port Kembla swimming pool. It will also provide consistent access to water to allow compliance with health standards and the pool will be able to remain operational when extreme low tides are experienced.

RECOMMENDATION

- 1 Council compulsorily acquire an extension of an easement for a suction line over Crown Land at Port Kembla which was previously acquired from the Crown in DP1047304. The easement extension is shown on the attached easement acquisition plan.
- 2 Council seek approval from the Minister for Local Government in accordance with section 187 of the Local Government Act 1993 to give all necessary Proposed Acquisition Notices in accordance with the Land Acquisition (Just Terms Compensation) Act 1991.
- 3 Council take each further step as is necessary to obtain approval from the Minister, the Governor or any public authority as may be necessary, and take all actions as may be necessary, to give notices and otherwise carry out the acquisitions by means of compulsory acquisition.
- 4 Council be responsible for all costs associated with the compulsory acquisition of the easement extension.
- 5 The Valuer General determine the compensation to be paid to the Crown Lands Division for the compulsory acquisition.
- 6 The General Manager be authorised to sign any documentation necessary to complete the compulsory acquisition and the Common Seal of Council be applied where/if necessary.

REPORT AUTHORISATIONS

Report of: Peter Coyte, Manager Property and Recreation

Authorised by: Kerry Hunt, Director Corporate and Community Services - Creative, Engaged and Innovative City (Acting)

ATTACHMENTS

1 Easement extension acquisition survey over Crown Land at Port Kembla

COMPLIANCE WITH OFFICE OF LOCAL GOVERNMENT GUIDELINES ON COUNCIL DECISION MAKING DURING MERGER PROPOSAL PERIODS

The recommendation in this report satisfies the requirements of the OLG Guidelines - *Council Decision Making During Merger Proposal Periods.*

BACKGROUND

In August 2014, the Property Section wrote to the Crown Lands Division (Crown Lands) to request an extension of the easement acquired from the Crown in DP 1047304 to cover the extension of the northern inlet pipeline proposed to be constructed.

Council received approval from Crown Lands to compulsorily acquire the easement extension in October 2014.

Council has until 2 May 2017 to complete the compulsory acquisition as per the most recent extension of the timeframe allowed by Crown Lands.



Crown Lands authorised a Permit to Enter for Council to undertake the pipeline extension works in November 2014.

These works have recently been completed and a registered surveyor has prepared a plan of acquisition of the easement extension. The plan has been sent to Crown Lands for approval and, once authorised and returned, the plan will be lodged at NSW Land and Property Information for registration.

PROPOSAL

Once successfully resolved by Council, an application will be lodged with the Office of Local Government for authorisation to compulsorily acquire the easement extension with the compensation to be determined by the Valuer General (as requested by Crown Lands).

CONSULTATION AND COMMUNICATION

Crown Lands

Office of Local Government

The Valuer General

PLANNING AND POLICY IMPACT

This report contributes to the delivery of Wollongong 2022 Goal under the objective "Investigate the future provision of Aquatic Services across the local government area and implement improvements".

It specifically delivers on core business activities as detailed in the Property Services Service Plan 2016-17.

FINANCIAL IMPLICATIONS

Council is responsible for all costs associated with the acquisition of the easement extension including survey, legal and compensation.

CONCLUSION

The acquisition of the extension of the easement for the suction line over Crown Land will improve the flows and capacity for water recirculation at the Port Kembla swimming pool. The extended pipeline will provide consistent access to water to allow compliance with health standards and the pool will be able to remain operational when extreme low tides are experienced.



File: PR-175.01.011 Doc: IC16/100413 ITEM 7 DEDICATION OF LANES AT PORT KEMBLA AS DRAINAGE RESERVE

DP14939 which is a Plan of Subdivision of Port Kembla dated 1927, reserved Lots 516 to 520 as "For Foot Traffic and Drainage". However, it appears that the lots were never gazetted and remain in the subdivider's name ie in the name of Charles William Wentworth. As Council is responsible for the lots, it intends to dedicate the lots as drainage reserve under Section 50 of the Local Government Act 1993 which affords Council the right to dedicate as drainage reserve by gazettal notice in the NSW Government Gazette ".... drainage reserves provided for in subdivisions approved before 15 June 1964".

RECOMMENDATION

- 1 Council dedicate Lots 516 to 520 DP14939 as drainage reserve under Section 50 of the Local Government Act 1993.
- 2 Upon dedication all of the abovementioned land becomes operational land.
- 3 The General Manager be authorised to sign any documentation necessary to complete the dedication.

REPORT AUTHORISATIONS

Report of: Peter Coyte, Manager Property and Recreation

Authorised by: Kerry Hunt, Director Corporate and Community Services - Creative, Engaged and Innovative City (Acting)

ATTACHMENTS

1 Lots 516 to 520 DP14939, Port Kembla to be dedicated as Drainage Reserve

COMPLIANCE WITH OFFICE OF LOCAL GOVERNMENT GUIDELINES ON COUNCIL DECISION MAKING DURING MERGER PROPOSAL PERIODS

The recommendation in this report satisfies the requirements of the OLG Guidelines - *Council Decision Making During Merger Proposal Periods.*

BACKGROUND

DP14939 being a Plan of Subdivision of Port Kembla dated 1927 reserved Lots 516 to 520 as "For Foot Traffic and Drainage". However, despite the subdivision registration and completion the lots were never gazetted and remain in the sub-divider's name i.e. in the name of Charles William Wentworth.

These lots have been used for this purpose since the subdivision was completed and Council has spent funds constructing and maintaining infrastructure on them.

PROPOSAL

As Council is responsible for the lots, it intends to dedicate Lots 516 to 520 as Drainage Reserve under Section 50 of the Local Government Act 1993, which affords Council the right to dedicate as drainage reserve by gazettal notice in the NSW Government Gazette ".... drainage reserves provided for in subdivisions approved before 15.6.1964".

CONSULTATION AND COMMUNICATION

Not required.



PLANNING AND POLICY IMPACT

This report contributes to the delivery of Wollongong 2022 goal under the objective *Carry out commercial business management of Council's Operational lands* (Community Goal: *We are a healthy community in a liveable city).*

It specifically delivers on core business activities as detailed in the Property Services Service Plan 2015-16.

FINANCIAL IMPLICATIONS

Council will be responsible for all costs associated with the dedication of Lots 516 -520 DP14939 as drainage reserve.

CONCLUSION

Lots 516-520 are required to be dedicated as drainage reserve as this was the intention of the original subdivider and has not occurred to date.



File: FI-230.01.257 Doc: IC16/100419

52

ITEM 8 TENDER T16/31 PLAYGROUND - KANAHOOKA PARK, KANAHOOKA

This report recommends acceptance of a tender for installation of soft fall, landscaping and other works associated with the replacement of the playground at Kanahooka Park, Kanahooka in accordance with the requirements of the Local Government Act 1993 and the Local Government (General) Regulation 2005.

An audit of playground facilities has indicated that this playground had reached its end of life and required replacement due to its age and poor condition. The Kanahooka Park Playground is listed for replacement in the Play Wollongong Strategy 2014-2024 and the adopted Capital Works Program.

RECOMMENDATION

- 1 In accordance with clause 178(1)(a) of the Local Government (General) Regulation 2005, Council accept the tender of Glenn Simpson Landscapes Pty Ltd for installation of soft fall, landscaping and other works associated with the replacement of the playground at Kanahooka Park, Kanahooka in the sum of \$170,381.00, excluding GST.
- 2 Council delegate to the General Manager the authority to finalise and execute the contract and any other documentation required to give effect to this resolution.
- 3 Council grant authority for the use of the Common Seal of Council on the contract and any other documentation, should it be required, to give effect to this resolution.

REPORT AUTHORISATIONS

Report of: Glenn Whittaker, Manager Project Delivery

Authorised by: Greg Doyle, Director Infrastructure and Works - Connectivity Assets and Liveable City (Acting)

ATTACHMENTS

1 Location Plan

COMPLIANCE WITH OFFICE OF LOCAL GOVERNMENT GUIDELINES ON COUNCIL DECISION MAKING DURING MERGER PROPOSAL PERIODS

The recommendation in this report satisfies the requirements of the OLG Guidelines - *Council Decision Making During Merger Proposal Periods.*

BACKGROUND

During an audit of Council's playgrounds undertaken by Property and Recreation Division, it was revealed that the playground located at Kanahooka Park, Kanahooka was in extremely poor condition, due to its age and close proximity to the lake. A review of the Play Wollongong Strategy 2014-2024 and the adopted Capital Works Program both indicated that Kanahooka Park Playground was due for replacement in 2016/17.

Tenders were invited for installation of soft fall, landscaping and other works associated with the replacement of the playground at Kanahooka Park. The outcome of the project is to to renew a well used facility for the community.

Tenders were invited by the open tender method with a close of tenders of 10.00 am on 11 October 2016. Five tenders were received by the close of tenders and all tenders have been scrutinised and assessed by a Tender Assessment Panel constituted in accordance with Council's Procurement Policies and Procedures and comprising representatives of the Property and Recreation, Infrastructure, Strategy and Planning, Governance and Information, Human Resources and Finance Divisions.



The Tender Assessment Panel assessed all tenders in accordance with the following assessment criteria and weightings as set out in the formal tender documents:

- 1 Cost to Council 40%
- 2 Appreciation of scope of works and construction methodology 20%
- 3 Experience and satisfactory performance in undertaking projects of similar size, scope and risk profile 10%
- 4 Staff qualifications and experience 10%
- 5 Demonstrated strengthening of local economic capacity 5%
- 6 Project Schedule 5%
- 7 Workplace Health and Safety management systems 5%
- 8 Environmental management policies and procedures 5%

The mandatory assessment criteria have been met by the recommended tenderer.

The Tender Assessment Panel utilised a weighted scoring method for the assessment of tenders which allocates a numerical score out of 5 in relation to the level of compliance offered by the tenders to each of the assessment criteria as specified in the tender documentation. The method then takes into account pre-determined weightings for each of the assessment criteria which provides for a total score out of 5 to be calculated for each tender. The tender with the highest total score is considered to be the tender that best meets the requirements of the tender documentation in providing best value to Council. Table 1 below summarises the results of the tender assessment and the ranking of tenders.

TABLE 1 – SUMMARY OF TENDER ASSESSMENT

| Name of Tenderer | Ranking |
|-----------------------------------|---------|
| Glenn Simpson Landscapes Pty Ltd | 1 |
| CRS Creative Recreation Solutions | 2 |
| Escaping Pty Ltd | 3 |
| Moduplay Group Pty Ltd | 4 |
| O Landscapes | 5 |

PROPOSAL

Council should authorise the engagement of Glenn Simpson Landscapes Pty Ltd to carry out the installation of soft fall, landscaping and other works associated with the replacement of the playground at Kanahooka Park, Kanahooka, in accordance with the scope of works and technical specifications developed for the project.

The recommended tenderer has satisfied the Tender Assessment Panel that it is capable of undertaking the works to Council's standards and in accordance with the technical specification.

Referees nominated by the recommended tenderer have been contacted by the Tender Assessment Panel and expressed satisfaction with the standard of work and methods of operation undertaken on their behalf.

CONSULTATION AND COMMUNICATION

- 1 Members of the Tender Assessment Panel
- 2 Nominated Referees



PLANNING AND POLICY IMPACT

This report contributes to the delivery of Wollongong 2022 goal "We are a healthy community in a liveable city". It specifically delivers on the following:

| Community Strategic Plan | Delivery Program 2012-2017 | Annual Plan 2016-17 |
|--|---|---|
| Strategy | 5 Year Action | Annual Deliverables |
| 5.1.6 Urban areas are created to provide a healthy living environment for our community. | 5.1.6.2 Provide an appropriate and sustainable range of quality passive and active open spaces and facilities | Pursue playground renewals in accordance with the Play Wollongong Strategy 2014 – 2024 and adopted Capital Works Program. |

RISK ASSESSMENT

The risk in accepting the recommendation of this report is considered low on the basis that the tender process has fully complied with Council's Procurement Policies and Procedures and the Local Government Act 1993.

The risk of the project works or services is considered low based upon Council's risk assessment matrix and appropriate risk management strategies will be implemented.

FINANCIAL IMPLICATIONS

It is proposed that the total project be funded from the following source/s as identified in the Annual Plan –

Capital Budget 2016/2017

CONCLUSION

Glenn Simpson Landscapes Pty Ltd has submitted an acceptable tender for this project. Council should endorse the recommendations of this report.



File: FI-230.01.259 Doc: IC16/100418

ITEM 9 TENDER T16/33 BEATON PARK ATHLETICS TRACK RESURFACING

This report recommends acceptance of a tender for resurfacing of the Kerryn McCann (Beaton Park) Athletics Track at Beaton Park Leisure Centre in accordance with the requirements of the Local Government Act 1993 and the Local Government (General) Regulation 2005.

The surface of the athletics track has deteriorated with use since the last resurfacing works in 2004. Resurfacing in its current state is essential to prevent rapid deterioration, which will result in slip and trip hazards, creating risks for all users.

RECOMMENDATION

- 1 In accordance with clause 178(1)(a) of the Local Government (General) Regulation 2005, Council accept the tender of Polytan Asia Pacific Pty Ltd for resurfacing and line marking of the Beaton Park athletics track, in the sum of \$458,350.00, excluding GST.
- 2 Council delegate to the General Manager the authority to finalise and execute the contract and any other documentation required to give effect to this resolution.
- 3 Council grant authority for the use of the Common Seal of Council on the contract and any other documentation, should it be required, to give effect to this resolution.

REPORT AUTHORISATIONS

Report of: Glenn Whittaker, Manager Project Delivery

Authorised by: Greg Doyle, Director Infrastructure and Works - Connectivity Assets and Liveable City (Acting)

ATTACHMENTS

1 Location Plan

COMPLIANCE WITH OFFICE OF LOCAL GOVERNMENT GUIDELINES ON COUNCIL DECISION MAKING DURING MERGER PROPOSAL PERIODS

The recommendation in this report satisfies the requirements of the OLG Guidelines - *Council Decision Making During Merger Proposal Periods.*

BACKGROUND

Tenders were required to be invited for the resurfacing and line marking of the Kerryn McCann Athletics Track at Beaton Park. Since the last resurfacing in 2004, the track has worn well, but the need for works has been identified in a condition inspection report and is aligned with comments from users regarding the condition of the track. Rapid deterioration of the track can be expected if the works are not carried out, resulting in a higher degree of risk of injuries to users of the facility.

The project has been allocated funding in the Capital Program for 2016/17, and a track shutdown planned from March to May 2017 to undertake these works. It is critical to meet this deadline, as late completion of works will impact on a congested school athletics winter carnival program commencing 1 June 2017. A critical activity necessary to meet this shutdown timeline is the award of the contract to the successful tenderer to enable the ordering and delivery of long lead-time materials from overseas. Council's endorsement of this project is therefore critical to make allowance for material ordering before the closure of suppliers due to the Christmas – New Year holiday period.

A successful completion of resurfacing and line marking will enable the track to comply with the current International Amateur Athletics Federation (IAAF) requirements for synthetic surfaced athletics facilities, notably Class 2 certification.



Tenders were invited by the open tender method with a close of tenders of 10.00 am on Tuesday, 1 November 2016. Prior to the commencement of the tender, a desktop search revealed that three vendors had athletics track resurfacing experience. Each of these vendors was notified of the tender being available on the tenderlink site. One tenderer (Polytan Asia Pacific Pty Ltd) was present at the optional tender site inspection. The other two vendors were each again contacted informing them of the tender and that the site inspection had been held.

One (1) tender was received by the close of tenders and the tender has been scrutinised and assessed by a Tender Assessment Panel constituted in accordance with Council's Procurement Policies and Procedures and comprising representatives of the Property and Recreation, Project Delivery, Human Resources, Finance, Governance and Information, and City Works and Services Divisions.

The Tender Assessment Panel assessed all tenders in accordance with the following assessment criteria and weightings as set out in the formal tender documents:

- 1 Cost to Council 35%
- 2 Appreciation of scope of works and construction methodology 10%
- 3 Experience and satisfactory performance in undertaking projects of similar size, scope and risk profile 20%
- 4 Staff qualifications and experience 5%
- 5 Proposed sub-contractors 5%
- 6 Demonstrated strengthening of local economic capacity 5%
- 7 Project Schedule 10%
- 8 Workplace Health and Safety management system 5%
- 9 Environmental management policies and procedures 5%

The Tender Assessment Panel utilised a weighted scoring method for the assessment of tenders which allocates a numerical score out of 5 in relation to the level of compliance offered by the tenders to each of the assessment criteria as specified in the tender documentation. The method then takes into account pre-determined weightings for each of the assessment criteria which provides for a total score out of 5 to be calculated for each tender. The tender with the highest total score is considered to be the tender that best meets the requirements of the tender documentation in providing best value to Council. Table 1 below summarises the results of the tender assessment and the ranking of tenders.

| Name of Tenderer | Ranking |
|------------------------------|---------|
| Polytan Asia Pacific Pty Ltd | 1 |

PROPOSAL

Council should authorise the engagement of Polytan Asia Pacific Pty Ltd to carry out the Beaton Park Athletics Track Resurfacing in accordance with the scope of works and technical specifications developed for the project. Council is advised that Polytan Asia Pacific Pty Ltd, (at the time trading as STI Pty Ltd) installed the original athletics track in 1993, and also performed the track resurfacing in 2004. Hence, the proposed contractor is familiar with the Beaton Park Athletics Track facility.

The recommended tenderer has satisfied the Tender Assessment Panel that it is capable of undertaking the works to Council's standards and in accordance with the technical specification.

An acceptable financial capability assessment has been received in relation to the recommended tenderer.



Referees nominated by the recommended tenderer have been contacted by the Tender Assessment Panel and expressed satisfaction with the standard of work and methods of operation undertaken on their behalf.

CONSULTATION AND COMMUNICATION

- 1 Members of the Tender Assessment Panel
- 2 Nominated Referees

PLANNING AND POLICY IMPACT

This report contributes to the delivery of Wollongong 2022 goal 5 "We are a healthy community in a liveable city". It specifically delivers on the following:

| | Community Strategic Plan | Delivery Program 2012-2017 | Annual Plan 2016-17 |
|-------|--|--|---|
| | Strategy | 5 Year Action | Annual Deliverables |
| 5.1.5 | The long term needs of the community, including our people and our places, are effectively planned for | 5.1.5.2 Carry out commercial business management of Council operational lands | Manage Council's commercial businesses to maximum returns |

RISK ASSESSMENT

The risk in accepting the recommendation of this report is considered low on the basis that the tender process has fully complied with Council's Procurement Policies and Procedures and the Local Government Act 1993.

The risk of the project works or services is considered low based upon Council's risk assessment matrix and appropriate risk management strategies will be implemented. However, late delivery of the works will create disruption to the winter school athletics carnival program, causing reputational damage to Council.

FINANCIAL IMPLICATIONS

It is proposed that the total project be funded from the following source/s as identified in the Annual Plan –

Capital Budget 2016/17

CONCLUSION

Polytan Asia Pacific Pty Ltd has submitted an acceptable tender for this project. Council should endorse the recommendations of this report.





ITEM 10 CABS

File: LCS-160.35.039 Doc: IC16/100433 COMMUNITY TRANSPORT - PROCUREMENT EXEMPTION - WOLLONGONG RADIO

This report seeks Council approval for exemption from the Procurement Procedures Management Policy in relation to contracting Wollongong Radio Cabs to deliver taxi voucher services for Council's Community Transport Program. The request for exemption affords compliance with Section 55(3)(i) of the Local Government Act 1993.

RECOMMENDATION

Council, under Section 55(3)(i) of the Local Government Act 1993, enter into an agreement with Wollongong Radio Cabs without inviting tenders, due to extenuating circumstances, unavailability of competitive and reliable tenderers and otherwise for the reasons set out in this report.

REPORT AUTHORISATIONS

Report of: Jenny Thompson, Manager Library and Community Services Authorised by: Kerry Hunt, Director Corporate and Community Services - Creative, Engaged and Innovative City (Acting)

ATTACHMENTS

There are no attachments for this report.

COMPLIANCE WITH OFFICE OF LOCAL GOVERNMENT GUIDELINES ON COUNCIL DECISION MAKING DURING MERGER PROPOSAL PERIODS

The recommendation in this report satisfies the requirements of the OLG Guidelines - Council Decision Making During Merger Proposal Periods.

BACKGROUND

Wollongong City Council delivers community transport services across the Wollongong and Shellharbour local government areas under a funding program administered by Transport for NSW. On 10 October 2016 Council accepted a new funding contract for the delivery of these services until 30 June 2018. A previous exemption for contracting of Wollongong Radio Cabs was approved by Council on 26 August 2013. This exemption expired on 30 June 2015 and an extension to the contract has been in place since that date.

This report seeks approval for a procurement exemption as per Section 55(3)(i) of the Local Government Act 1993. This Section of the Act refers to extenuating circumstances under which a council is not required to tender for services because a satisfactory result will not be achieved by the tender process. Details of these specific circumstances are outlined below.

The request for exemption to deviate from Council's Procurement Procedures Management Policy is based on the following criteria:

- Wollongong Radio Cabs is the sole provider of taxi services in the Wollongong and Shellharbour . local government areas, from the southern end of Helensburgh, south to the Minnamurra Bridge.
- Wollongong Radio Cabs is based in Wollongong and operates as a co-operative with 114 taxi driver members. Some of the members are multiple taxi plate licensees.
- Wollongong Radio Cabs is capable of undertaking the service to Council's standards and in accordance with service specifications.

Approval for a new exemption is required in order for the service to continue its operations.



PROPOSAL

Council endorse an exemption to deviate from the Procurement Procedures Management Policy for contracting of Wollongong Radio Cabs based on the fact that there are no other taxi providers in the local government area. This will enable Council's community transport service to continue to utilise Wollongong Radio Cabs.

CONSULTATION AND COMMUNICATION

Finance Division – Supply Chain and Logistics

Corporate Support Services – Governance and Information

PLANNING AND POLICY IMPACT

This report contributes to the delivery of Wollongong 2022 goals - Goal 5 – We are a healthy community in a liveable city and Goal 6 – We have sustainable, affordable and accessible transport. It specifically delivers on the following:

| | Community Strategic Plan | Delivery Program 2012-2017 | Annual Plan 2016-17 |
|-------|---|---|---|
| | Strategy | 5 Year Action | Annual Deliverables |
| 5.5.3 | Healthy, active ageing programs are promoted in partnership with government agencies and community organisations | 5.5.3.1 Deliver a range of programs for older people. | Support the provision of Community Transport Services across Wollongong and Shellharbour LGA. |
| 6.3.1 | Community Transport options for frail older people, people with disabilities and the transport disadvantaged are actively promoted and available. | 6.3.1.1 Promote access to Community Transport | Promote access to Community Transport |

FINANCIAL IMPLICATIONS

The value of the contract with Wollongong Radio Cabs is to the value of up to \$450,000.

The endorsement of an exemption from tender for the provision of taxi voucher services has no financial implications for Council.

Community transport services are fully funded by federal and state government. The provision of a Taxi Voucher Scheme is a component of Council's Service Agreement with Transport for NSW and has been provided for within the current and forward budget, until June 2018.

CONCLUSION

This report seeks an exemption from Council's Procurement Policy to enable the continued brokerage of Wollongong Radio Cabs to deliver the Community Transport Taxi Voucher Scheme, while complying with Section 55(3)(i) of the Local Government Act 1993.



File: LCS-160.35.053 Doc: IC16/100434

60

ITEM 11 COMMUNITY TRANSPORT - PROCUREMENT EXEMPTION - CANTY'S BUS RENTALS

This report seeks Council approval for exemption from the Procurement Procedures Management Policy in relation to contracting Canty's Bus Rentals to deliver bus hire services for Council's Community Transport Program. The request for exemption affords compliance with Section 55(3)(i) of the Local Government Act 1993.

RECOMMENDATION

Council, under Section 55(3)(i) of the Local Government Act 1993, enter into an agreement with Canty's Bus Rentals without inviting tenders, due to extenuating circumstances, unavailability of competitive and reliable tenderers and otherwise for the reasons set out in this report.

REPORT AUTHORISATIONS

Report of: Jenny Thompson, Manager Library and Community Services Authorised by: Kerry Hunt, Director Corporate and Community Services - Creative, Engaged and Innovative City (Acting)

ATTACHMENTS

There are no attachments for this report.

COMPLIANCE WITH OFFICE OF LOCAL GOVERNMENT GUIDELINES ON COUNCIL DECISION MAKING DURING MERGER PROPOSAL PERIODS

The recommendation in this report satisfies the requirements of the OLG Guidelines - *Council Decision Making During Merger Proposal Periods.*

BACKGROUND

Wollongong City Council delivers community transport services across the Wollongong and Shellharbour local government areas under a funding program administered by Transport for NSW. On 10 October 2016 Council accepted a new funding contract for the delivery of these services until 30 June 2018.

This report seeks approval for a procurement exemption as per Section 55(3)(i) of the Local Government Act 1993. This Section of the Act refers to extenuating circumstances under which a council is not required to tender for services because a satisfactory result will not be achieved by the tender process. Details of these specific circumstances are outlined below.

The request for exemption to deviate from Council's Procurement Procedures Management Policy is based on the following criteria:

- Canty's Bus Rentals is the sole provider that has a fleet of suitable buses available to hire in the Wollongong and Shellharbour local government areas.
- Canty's Bus Rentals is a local firm that is able to undertake the service to Council's standards and in accordance with service specifications. Canty's is also able to supply more than one bus per day to meet service demand and will make those buses available for volunteers to pick up at the Shell Garage, Corrimal Street, Wollongong, for easy access.

Approval for a procurement exemption is required in order for the service to continue its operations.



PROPOSAL

Council endorse an exemption to deviate from the Procurement Procedures Management Policy for contracting of Canty's Bus Rentals, based on the fact that there are no other suitable providers in the local government area. This will enable Council's community transport service to continue to utilise the services of Canty's Bus Rentals.

CONSULTATION AND COMMUNICATION

Finance Division – Supply Chain and Logistics

Corporate Support Services – Governance and Information

PLANNING AND POLICY IMPACT

This report contributes to the delivery of Wollongong 2022 goals - Goal 5 – We are a healthy community in a liveable city and Goal 6 – We have sustainable, affordable and accessible transport. It specifically delivers on the following:

| | Community Strategic Plan | Delivery Program 2012-2017 | Annual Plan 2016-17 |
|-------|--|---|---|
| | Strategy | 5 Year Action | Annual Deliverables |
| 5.5.3 | Healthy, active ageing programs are promoted in partnership with government agencies and community organisations | 5.5.3.1 Deliver a range of programs for older people. | Support the provision of Community Transport services across Wollongong and Shellharbour LGA. |
| 6.3.1 | Community Transport options for fail older people, people with disabilities and the transport disadvantaged are actively promoted and available. | 6.3.1.1 Promote access to Community Transport | Promote access to Community Transport. |

FINANCIAL IMPLICATIONS

The value of the contract with Canty's Bus Rentals is to the value of up to \$160,000.

The endorsement of an exemption from tender for the provision of bus hire services has no financial implications for Council.

Community transport services are fully funded by federal and state government. The provision of a Bus Hire Service is a component of Council's Service Agreement with Transport for NSW and has been provided for within the current and forward budget until June 2018.

CONCLUSION

This report seeks an exemption from Council's Procurement Policy to enable the continued brokerage of Canty's Bus Rentals to deliver Community Transport Bus Hire Services, while complying with Section 55(3)(i) of the Local Government Act 1993.



File: EM-030.55.008 Doc: IC16/100437

62

ITEM 12 DRAFT QUARTERLY REVIEW STATEMENT SEPTEMBER 2016

An The draft Quarterly Review Statement September 2016 outlines progress made to achieve Council's Wollongong 2022 Strategic management Plans, in particular the Delivery Program 2012-17 and Annual Plan 2016-17. It addresses the financial and operational performance of Council for the first quarter of 2016-17. The draft Quarterly Review also includes the Quarterly Review Budget Report.

RECOMMENDATION

- 1 The draft Quarterly Review Statement September 2016 be adopted.
- 2 The Budget Review Statement as at September 2016 be adopted and revised totals of income and expenditure be approved and voted.

REPORT AUTHORISATIONS

Report of:Clare Phelan, Executive Strategy ManagerAuthorised by:David Farmer, General Manager

ATTACHMENTS

1 Draft Quarterly Review Statement September 2016

COMPLIANCE WITH OFFICE OF LOCAL GOVERNMENT GUIDELINES ON COUNCIL DECISION MAKING DURING MERGER PROPOSAL PERIODS

The recommendation in this report satisfies the requirements of the OLG Guidelines - *Council Decision Making During Merger Proposal Periods.*

BACKGROUND

Council's draft Quarterly Review Statement September 2016 outlines the operational and financial performance of Council's Wollongong 2022 Strategic Management Plans, in particular the Delivery Program 2012-17 and Annual Plan 2016-17.

This report also provides an overview of the significant achievements against priority areas and demonstrates organisational performance through the inclusion of performance indicators.

During the Quarter there were a number of significant highlights:

- 1 Council received the 50:50 Vision for Gender Equity Award.
- 2 The Figtree Oval Masterplan was endorsed.
- 3 The Disability Inclusion Action Plan was endorsed.
- 4 Council hosted its first ever Trainee Expo.

CONSULTATION AND COMMUNICATION

Executive Management Committee

Senior Management Group

PLANNING AND POLICY IMPACT

This report contributes to the delivery of Wollongong 2022 goal 4 "We are a connected and engaged community".

It specifically delivers on core business activities as detailed in the Corporate Strategy Service Plan 2016-17.



FINANCIAL IMPLICATIONS

Full financial performance details and implications on Council's financial position are contained within the attached Budget Review Statement.

The revised Operating Result [pre capital] indicates deterioration in forecast result of \$1.8M which is largely due to the introduction of funded projects that is partially offset by a range of operational improvements. The introduction of funded projects, including some of which were in progress at the end of last financial year, does not impact on the Fund Result as the proposed expenditure is offset by transfer of funds from restricted cash. General improvement in expenditure patterns, improved income (both recurrent and non-recurrent) and an increase in internal services applied to capital have contributed to an underlying improvement in the operating result of \$1.2M for 2016-17.

The achievement of an improved result provides an opportunity to eliminate the remnant low impact efficiency targets that are held at service level and to effectively remove the need to pursue high impact service adjustments that were developed through the Securing Our Future Program. The revised financial forecasts that are contained in the September Quarterly Review are premised on the elimination of the low impact efficiency targets and high impact service adjustments of \$0.4M and \$0.3M respectively with the remaining improvement of \$0.5M for 2016-17 to be transferred to restricted cash for Strategic Projects.

The recurrent aspects of the improvements identified at September, have allowed the proposed elimination of low impact efficiency targets in all future years, and the reduction of the legacy high impact service adjustments to a relative low value, in the vicinity of \$0.2M in most years. It is expected that these can be addressed through the remaining quarterly reviews.

CONCLUSION

This draft Quarterly Review Statement September 2016 has been prepared following input and assistance from all Divisions within the organisation. It is submitted for consideration by Council.





File: IW-911.01.155 Doc: IC16/100427 ITEM 13 CITY OF WOLLONGONG TRAFFIC COMMITTEE - MINUTES OF MEETING HELD 26 OCTOBER 2016

A meeting of the City of Wollongong Traffic Committee was held on 26 October 2016.

Items 1 and 5 have been adopted by Council through delegated authority.

Items 2, 3, 4 and 6 of the meeting must be determined by Council and are recommended to Council for approval for the temporary regulation of traffic on public roads for works or events by independent parties.

RECOMMENDATION

In accordance with the powers delegated to Council, the Minutes and recommendations of the City of Wollongong Traffic Committee meeting held on 26 October 2016 in relation to the Regulation of Traffic be adopted.

REPORT AUTHORISATIONS

Report of: Mike Dowd, Manager Infrastructure Strategy and Planning Authorised by: Greg Doyle, Director Infrastructure and Works - Connectivity Assets and Liveable City (Acting)

ATTACHMENTS

- 1 Standard Conditions for Road Closures
- 2 Standard Conditions for Street Parties
- 3 Thirroul Seaside and Arts Festival 2017
- 4 Building Works Church Street, Wollongong

COMPLIANCE WITH OFFICE OF LOCAL GOVERNMENT GUIDELINES ON COUNCIL DECISION MAKING DURING MERGER PROPOSAL PERIODS

The recommendation in this report satisfies the requirements of the OLG Guidelines - *Council Decision Making During Merger Proposal Periods.*

BACKGROUND

REGULATION OF TRAFFIC

2 THIRROUL – WARD 1 King and McCauley Streets – Thirroul Seaside & Arts Festival – 1 to 2 April, 2017

Background:

The Thirroul Seaside & Arts Festival is to be run on the weekend of 1 to 2 April, 2017 in a similar way to previous years. The event involves a closure of McCauley Street between Bath Street and Lawrence Hargrave Drive and of King Street between the shopping centre car park and Lawrence Hargrave Drive. The road closures are to take effect from 6am to 6pm Saturday 1 April. It should be noted that the Sunday events will take place in the reserve off Cliff Parade and do not involve any road closures.

In previous years the taxi operators have attempted to use the indented bus zone (northbound carriageway) on Lawrence Hargrave Drive. The bus operators have requested that formal arrangements be made to allow taxis to use two car spaces at the southern end of this bus zone.

PROPOSAL SUPPORTED UNANIMOUSLY

The submitted traffic management plans be approved (Attachment 3) subject to Council's Standard Conditions for Road Closures (Attachment 1), and that the traffic management plans be altered to show provisions for taxis to operate from the northbound bus zone on Lawrence Hargrave Drive.



3 KEIRAVILLE – WARD 2

Shoobert Crescent – Annual Street Party – 2 or 4 December 2016

Background:

Council has received a request from residents in Shoobert Crescent for a full road closure to hold their annual community street party on Friday 2 December from 6pm to 9pm. A second option of Sunday 4 December from 3pm to 6pm was also presented. As in previous years, the section of Shoobert Crescent proposed to be closed extends from the corner of Murphy's Avenue to the corner of Harkness Avenue. Signatures have been obtained from all residents in Shoobert Crescent supporting the temporary closure. Diversion of traffic around the closure is expected to have minimal inconvenience on drivers.

PROPOSAL SUPPORTED UNANIMOUSLY

The proposed road closure on one of the dates 2 December 2016 or 4 December 2016 be approved subject to Council's Standard Conditions for Street Parties (Attachment 2).

4 WOLLONGONG – WARD 2

Church Street – between Gipps and Edward Streets for building work

Background:

A contractor has requested that Council agree to a full road closure of Church Street between Gipps and Edward Streets, to allow a major concrete pour to be completed at a new development; 28 – 30 Church Street, Wollongong. The contractor has nominated three dates however only requires one day for the work, the nominated dates being 23, 25 or 29 November 2016. The road closure will take effect from 7am to 5pm and arrangements have been made to permit access for residents.

The closure will involve a relocation of bus route 65 for the duration, via Edward Street, Keira Street and Campbell Street. The bus operators have requested that the bus zone for school students in Keira Street be extended by 30 metres to permit school bus services to drop off and pick up passengers instead of using the usual school bus zone in Church Street. In addition, the applicant will be required to notify the bus companies of the date to be selected for the work and also to ensure a traffic controller is located at the extended school bus zones from 7am to 9am and 2pm to 3:30pm.

There is a simple diversion in place for all other through traffic via Edward Street, View Street and Gipps Street (Gipps Street between Church and View Streets is two way.)

PROPOSAL SUPPORTED UNANIMOUSLY

The submitted traffic management plans (Attachment 4) be approved subject to:

- Council's Standard Conditions for Road Closures (Attachment 1)
- The school bus zones in Keira Street being extended by 30 Metres (outside Smith's Hill High School)
- The supply of a traffic controller by the Applicant, to be located at the school bus zones in Keira Street from 7am to 9am and 2pm to 3:30pm
- Notification to the bus companies by Applicant to confirm the date of works.

LATE ITEM

6 CORRIMAL – WARD 1

Station Street – Street Party – 10 December 2016

Background:

Subsequent to the Traffic Committee Meeting on 26 October 2016, an application was received to close Station Street, Corrimal for a Street Party on Saturday, 10 December 2016 from 6 pm to



10.30 pm. The organiser has provided evidence that the residents affected by the closure from Numbers 5 to 15 Station Street (and the homes opposite from Numbers 10 to 16) have consented to the closure. Arrangements have been made to allow residents access if required, under supervision during the event.

There is little through traffic, however the detour via Murray Road and Gregory Street to the north or south and Duff Parade to the west is straight forward. There are no bus routes in Station Street and a similar event was held in December 2015 without incident. It should be noted that Station Street is wide at 12.5 metres between kerbs and drivers can make a U turn safely should a vehicle enter the street during the closure.

PROPOSAL SUPPORTED UNANIMOUSLY

The proposed road closure be approved subject to Council's Standard Conditions for Street Parties (Attachment 2).

PLANNING AND POLICY IMPACT

This report contributes to the delivery of Wollongong 2022 goal under the objective Community Goal 6 – *We have sustainable, affordable and accessible transport.*

It specifically delivers on core business activities as detailed in the Transport Services Plan 2016-17.



File: GI-80.12.020 Doc: IC16/100285

67

ITEM 14 BI-MONTHLY TABLING OF RETURNS OF DISCLOSURES OF INTEREST AND OTHER MATTERS

The Local Government Act 1993 requires the General Manager to table all Returns of Disclosures of Interest lodged by persons nominated as designated persons. Returns are submitted to Council on a bi-monthly basis.

RECOMMENDATION

Council note the tabling of the Returns of Disclosures of Interest as required by Section 450A of the Local Government Act 1993.

REPORT AUTHORISATIONS

Report of: Kylee Cowgill, Manager Governance and Information Authorised by: Kerry Hunt, Director Corporate and Community Services - Creative, Engaged and Innovative City (Acting)

ATTACHMENTS

1 Returns of Disclosures of Interests and Other Matters (to be tabled).

COMPLIANCE WITH OFFICE OF LOCAL GOVERNMENT GUIDELINES ON COUNCIL DECISION MAKING DURING MERGER PROPOSAL PERIODS

The recommendation in this report satisfies the requirements of the OLG Guidelines - Council Decision Making During Merger Proposal Periods.

PLANNING AND POLICY IMPACT

This report contributes to the delivery of Wollongong 2022 goal "We are a connected and engaged community". It specifically delivers on core business activities as detailed in the Governance and Administration Service Plan 2016-17.



Attachment 2 – Affected Properties Table

| Lot & DP | Address | | | |
|-------------------|--|-----------------------------------|--|--|
| Site 1 | | | | |
| Lot 494 DP 31905 | Unanderra Fire Station, 80 Central Road, UNANDERRA NSW 2526 | NSW Fire Brigades | | |
| Lot 493 DP 31905 | 78 Central Road UNANDERRA NSW 2526 | Western Suburbs Leagues Club | | |
| Lot 206 DP 521643 | Lot 206 Central Road, UNANDERRA NSW 2526 | | | |
| Lot 2 DP 203572 | Lot 2 Central Road, UNANDERRA NSW 2526 | | | |
| Lot 3 DP 203572 | Lot 3 Central Road, UNANDERRA NSW 2526 | | | |
| Lot 4 DP 203572 | Lot 4 Central Road, UNANDERRA NSW 2526 | | | |
| Lot 5 DP 203572 | Lot 5 Central Road, UNANDERRA NSW 2526 | 9, | | |
| Lot 6 DP 203572 | Lot 6 Central Road, UNANDERRA NSW 2526 | | | |
| Lot 7 DP 203572 | Lot 7 Central Road, UNANDERRA NSW 2526 | 0 | | |
| Lot 8 DP 203572 | Lot 8 Central Road, UNANDERRA NSW 2526 | | | |
| Lot 9 DP 203572 | Lot 9 Central Road, UNANDERRA NSW 2526 | | | |
| Lot 1 DP 720905 | Lot 1 Central Road, UNANDERRA NSW 2526 | | | |
| Lot 1 DP 720922 | Lot 1 Central Road, UNANDERRA NSW 2526 | | | |
| Lot 1 DP 241842 | Lot 1 Central Road, UNANDERRA NSW 2526 | | | |
| Lot 1 DP 729171 | Lot 1 Central Road UNANDERRA NSW 2526 | | | |
| Lot 2 DP 203572 | Lot 2 Central Road, UNANDERRA NSW 2526 | | | |
| Lot 1 DP 657222 | Lot 1 Maynes Parade, UNANDERRA NSW 2526 | | | |
| Lot 1 DP 205003 | Lot 1 Maynes Parade, UNANDERRA NSW 2526 | | | |
| Lot 1 DP 244201 | Lot 1 Hargreaves Street, UNANDERRA NSW 2526 | | | |
| Site 2 | | | | |
| Lot 61 DP 32220 | 24 Blackman Parade, UNANDERRA NSW 2526 | NSW Land & Housing Corporation | | |
| Lot 64 DP 32220 | 18 Blackman Parade, UNANDERRA NSW 2526 | | | |
| Lot 27 DP 32220 | 1 Cummins Street, UNANDERRA NSW 2526 | | | |
| Lot 28 DP 32220 | 3 Cummins Street, UNANDERRA NSW 2526 | | | |
| Lot 304 DP 32220 | Lot 304 Blackman Parade, UNANDERRA NSW 2526 | Wollongong City Council | | |
| Lot 65 DP 32220 | 16 Blackman Parade, UNANDERRA NSW 2526 | Western Suburbs Leagues Club | | |
| Lot 66 DP 32220 | Lot 26 Hargreaves Street, UNANDERRA NSW 2526 | | | |

| Lot 26 DP 32220 | Lot 26 Hargreaves Street, UNANDERRA NSW 2526 | |
|------------------|---|---|
| Lot 62 DP 32220 | 22 Blackman Parade UNANDERRA NSW 2526 | Private |
| Lot 63 DP 32220 | 20 Blackman Parade, UNANDERRA NSW 2526 | |
| Lot 29 DP 32220 | 5 Cummins Street, UNANDERRA NSW 2526 | |
| Lot 30 DP 32220 | 7 Cummins Street, UNANDERRA NSW 2526 | |
| Lot 31 DP 32220 | 1 Tresnan Street, UNANDERRA NSW 2526 | |
| Lot 32 DP 32220 | 3 Tresnan Street, UNANDERRA NSW 2526 | |
| Lot 33 DP 32220 | 5 Tresnan Street, UNANDERRA NSW 2526 | |
| | Site 3 | |
| Lot 68 DP 32220 | 3 Blackman Parade, UNANDERRA NSW 2526 | Western Suburbs Leagues Club Illawarra Limited |
| Lot 69 DP 32220 | 5 Blackman Parade, UNANDERRA NSW 2526 | |
| Lot 70 DP 32220 | 9-11 Blackman Parade, UNANDERRA NSW 2526 | C · |
| Lot 302 DP 32220 | Lot 302 Blackman Parade, UNANDERRA NSW 2526 | Wollongong City Council |
| Lot 305 DP 32220 | Lot 305 Blackman Parade, UNANDERRA NSW 2526 | |
| Lot 2 DP 535173 | 1 Blackman Parade, UNANDERRA NSW 2526 | Private |
| | A. Alt | |
| | | |








WEST ILLAWARRA LEAGUES CLUB



DESIGN PRESENTATION October 2015.



Context

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Masterplan Ground Floor







Masterplan First Floor







Masterplan Staging Diagram







Masterplan Ground Floor – Stage 1







Masterplan Ground Floor – Stage 2







Masterplan Stage 3 – Carpark Phase A







Masterplan Stage 3 - Carpark Phase A















Masterplan Stage 4 – Functions + Sports







Masterplan Stage 4 – Functions + Sports

















Masterplan Stage 4 - Sports and Beer Garden







Masterplan Stage 5 – Food Precinct







Masterplan Stage 5 – Food Precinct















Masterplan Stage 6 – Carpark Phase B







Masterplan Ground Floor







Masterplan First Floor













Home > Resource centre > Tools > Sea-level rise information for all Australian coastal councils

Sea-level rise information for all Australian coastal councils

Select your Local Government Area in the dropdown box on the right to view sea-level rise information.

15 June 2016



Sea-level rise

(relative to an average calculated between 1986 and 2005)

| Date (unit) | RCP2.6 | RCP4.5 | RCP6.0 | RCP8.5 | |
|-----------------------------------|------------------|------------------|------------------|------------------|--|
| 2030 (m) | 0.13 (0.09-0.18) | 0.14 (0.09-0.18) | 0.13 (0.08-0.17) | 0.14 (0.10-0.19) | |
| 2050 (m) | 0.22 (0.14-0.29) | 0.24 (0.16-0.32) | 0.22 (0.15-0.30) | 0.27 (0.19-0.36) | |
| 2070 (m) | 0.30 (0.19-0.42) | 0.35 (0.24-0.48) | 0.34 (0.23-0.46) | 0.45 (0.31-0.59) | |
| 2090 (m) | 0.38 (0.22-0.54) | 0.47 (0.30-0.65) | 0.48 (0.32-0.66) | 0.66 (0.45-0.88) | |
| Rate of change at 2100 (mm/yr) | 3.8 (1.3-6.2) | 5.7 (3.0-8.5) | 7.3 (4.5-10.3) | 11.4 (7.3-16.1) | |

Allowances

(relative to an average calculated between 1986 and 2005)

| Date (unit) | RCP2.6 | RCP4.5 | RCP6.0 | RCP8.5 |
|-------------|--------|--------|--------|--------|
| 2030 (m) | 0.14 | 0.14 | 0.13 | 0.15 |
| 2050 (m) | 0.24 | 0.26 | 0.25 | 0.30 |
| 2070 (m) | 0.36 | 0.41 | 0.40 | 0.52 |
| 2090 (m) | 0.48 | 0.59 | 0.60 | 0.85 |

Inundation maps



| 2100 RCP8.5 | PDF 8MB |
|-------------|---------|
| 2100 RCP4.5 | PDF 8MB |
| 2050 RCP8.5 | PDF 7MB |

View guidance information on maps

15 June 2016





Australian Government

Department of the Environment and Energy

CoastAdapt was developed by NCCARF with funding from the Australian government through the Department of the Environment and Energy

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Wollongong Coastal Zone Management Plan: Management Study Final Draft Report

Offices

Brisbane Denver Mackay Melbourne Newcastle Perth Sydney Vancouver

Prepared For:

Wollongong City Council

Prepared By:

BMT WBM Pty Ltd (Member of the BMT group of companies)

C:USERSILWATKINSIAPPDATAILOCALWEWLETT-PACKARDWP TRIMITEMPWPTRIM.7124IZ16 242661 ESP - PROJECT MANAGEMEN COASTAL ZONE MANAGEMENT PLAN - MANAGEMENT STUDY - FINAL DRAFT ~ WITH TRACK CHANGES.DOCX



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| www.wbmpl.com.au | Client Contact: | Philomena Gangaiya | |
| | Client Reference | | |

| Title : | Wollongong Coastal Zone Management Plan: Management Study Final Draft Report | | | |
|------------|---|--|--|--|
| Author : | Verity Rollason | | | |
| Synopsis : | This Report presents management options for treating risks to assets and land within Wollongong's coastline from erosion and recession, coastal inundation and geotechnical hazards. The report presents a risk assessment and risk treatment options to manage coastal hazards at each beach in the LGA. | | | |

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EXECUTIVE SUMMARY

The Wollongong Coastline is characterised by a series of mostly small pocket beaches north of Port Kembla, and the larger sweeping sandy Perkins Beach extending south from Port Kembla to the Lake Illawarra entrance. The northern section of the LGA coastline comprises long sections of headlands and cliffs, with occasional pocket beaches. Wollongong has a long history of development, and as such, there is already significant development and infrastructure sited along the coastline, some of which is heritage-listed (including beach pavilions, Norfolk Island pines etc).

The interaction of natural coastal processes and the built environment results in hazards and associated risks along the Wollongong coastline. The Wollongong Coastal Zone Study (Cardno, 2010) identified the coastal hazards and the areas potentially impacted by 2100. Coastal hazards include storm-based beach erosion, longer-term shoreline recession, backwater inundation and overtopping due to elevated sea levels and waves during storms, and instability of cliffs and coastal headlands. Overprinted on these hazards are the potential impacts of future climate change, particularly sea level rise. Cardno (2010) produced coastal hazard lines (representing the combined effects of erosion, recession and sea level rise) for the years 2010, 2050 and 2100. The hazard assessment adopted the NSW Government's standard sea level rise projections of 0.06m by 2010, 0.4m by 2050 and 0.9m by 2100 above 1990 mean sea level.

The Wollongong Coastal Zone Management Plan has used the hazards assessment to identify and evaluate the risks to the Wollongong community associated with on-going coastal processes, and has developed a series of management strategies to manage and treat these risks to an acceptable level. The Australian Standard (ISO 31000:2009) Risk Management Principles and Guidelines were adopted as the framework for identifying and assessing coastal risks. Risks are considered to be the combination of the 'likelihood' of an event occurring, and the 'consequence' if that event actually occurs. Within the context of coastal risks for Wollongong, the 'likelihood' was determined from the Cardno (2010) hazard study, which identified vulnerable lands and the timeframe for impact. The 'consequence' was then determined by considering the land use and community values for that land being impacted. This step involved eliciting community and stakeholder input and perspectives, which helped prioritise the land and assets potentially at risk.

Giving consideration to both likelihood and consequence, coastal risks along the Wollongong Coastline were defined as 'Low', 'Medium', 'High' or 'Extreme'. Risks were established for 2010, 2050 and 2100 timeframes, highlighting a shift in risk profile with time, as sea levels rise and other climate change impacts begin to manifest. 'Extreme' and 'High' risks were considered to be intolerable. That is, these risks cannot be accepted by the community, and as such, require mitigation or treatment through specific risk management actions. The land and assets determined to have the highest levels of risk along the coastline include:

- Beaches themselves (in terms of amenity and social value) and associated coastal dunes.
- Wollongong's impressive list of ocean (rock) pools;
- Various Surf Club buildings, amenities and pavilions (some of which are heritage-listed);
- Existing seawalls and promenades;
- Stormwater infrastructure;
- Beach access and carparks, local roads servicing residential properties, and a couple of arterial roads (including Lawrence Hargrave Drive);
- The coastal cycleway that extends from Thirroul to City Beach;

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- Infrastructure, such as Bellambi and Austinmer Boat Harbours, Bellambi STP and WIN stadium;
- Important habitat areas (such as EECs) and coastal vegetation; and
- Residential properties (some potentially affected by coastal erosion and recession, while many more are potentially affected by coastal inundation).

The Wollongong Coastal Zone Management Plan consists of two parts - a Coastal Zone Management Study and an Implementation Action Plan. The Coastal Zone Management Study evaluates all potential options and provides a list of recommended risk management options for managing the highest coastal risks to the lands and assets along the Wollongong Coastline. The Implementation Action Plan details the preferred actions for treatment of the highest priority risk areas, and lists timeframes or triggers, responsibilities, estimated costs and prior actions, to facilitate implementation of the Plan.

The recommended management actions incorporate a mix of treatment alternatives. Risks to future development and re-development can be managed through the application of development controls. Development controls are already in-place for managing other types of risk, including risks associated with flooding and geotechnical instability. Recommendations made in the Plan to address future development and re-development include:

- Preparation of a new Coastal DCP relating to areas at risk from coastal erosion and recession;
- Inclusion of coastal inundation areas into Council's existing Flood DCP Chapter E13; and
- Updating Council's existing Geotechnical DCP Chapter E12 to incorporate any additional risks associated with sea level rise and actions of the sea (i.e. wave impacts).

Managing the impact of coastal risks on existing development is considerably harder. Options available to address existing development generally fall into three categories.

- <u>Protect</u>: whereby engineered structural works are used to protect existing development and assets from erosion and recession and/or wave overtopping and inundation (e.g. seawalls and beach nourishment).
 Pro-active management of beaches and coastal dunes to maximise the volume of sand in front of existing development is also a protection option.
- <u>Accommodate</u>: whereby existing development is redesigned or retrofitted to withstand potentially different design conditions in the future, or is designed to be "relocatable" in the future once damage becomes imminent. Examples include raising houses to above inundation levels, installation of flaps on stormwater to prevent backflow inundation, or relocatable structures for lifeguard services.
- <u>Retreat</u>: whereby existing development along the coast is progressively abandoned and rebuilt further landward outside the hazard area (if rebuilt at all). Retreat from private property may involve voluntary acquisition, unless the retreat can be accommodated through future development controls.

'High' and 'extreme' risks at the current timeframe have been given priority for immediate attention, while for risks to lands and assets that are not expected to eventuate until sea level rise impacts start to occur, the most appropriate course of action <u>at present</u> is 'do-nothing'. A future intended action is signalled in the Plan, with a 'trigger' for implementation identified. This trigger-based approach limits the investment required until there is certainty of impact. Notwithstanding, any trigger for action needs to have sufficient lead-time to allow for potentially lengthy design and environmental impact assessments, and securing of funding required for some of the more major options recommended. Therefore, the Plan also details a suite of preliminary actions that provide for the completion of relevant assessments, approvals and forward planning (such as through Council's



Asset Management Plan) to enable the required action to be implemented smoothly at the time that a trigger is reached.

Furthermore, the plan takes advantage of asset management cycles, stating that when assets require maintenance or minor refurbishment, Council (or the asset owner) should start to 'accommodate' potential future risks. When assets reach the end of their functional design life and require replacement, options for retreating (i.e. relocating the asset to an alternative site) should be canvassed, if a replacement structure is deemed necessary.

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CONTENTS

| Executive Summary | i |
|-------------------|------|
| Contents | iv |
| List of Figures | viii |
| List of Tables | xi |

| 1 | Intro | DUCTION | 1 |
|---|-------|--|----|
| | 1.1 | Purpose of the Wollongong Coastal Zone Management Plan | 1 |
| | 1.2 | Study Area | 2 |
| | 1.3 | Wollongong's Coastal Management Objectives | 4 |
| | 1.4 | Community Involvement in Developing the Plan | 4 |
| | 1.5 | Plan Structure | 5 |
| 2 | LEGIS | LATIVE CONTEXT FOR COASTAL MANAGEMENT | 10 |
| | 2.1 | NSW Coastal Management Framework | 10 |
| | 2.2 | Key Legislation, Policies and Guidelines | 11 |
| | 2.2 | .1 Coastal Protection Act 1979 | 11 |
| | | 2.2.1.1 Recent Amendments to the Coastal Protection Act and other Acts | 11 |
| | 2.2 | .2 Environmental Planning and Assessment Act 1979 | 12 |
| | 2.2 | .3 Wollongong Local Environment Plan (2009) | 13 |
| | 2.2 | .4 Wollongong Development Control Plan 2009 | 14 |
| | 2.2 | .5 State Environmental Planning Policy No. 71 – Coastal Protection | 15 |
| | 2.2 | .6 Crown Lands Act 1989 | 15 |
| | 2.2 | .7 Local Government Act 1993 | 15 |
| | | 2.2.7.1 Plans of Management for Community, Crown and Recreational Land | 16 |
| | 2.2 | .8 The NSW Coastal Policy 1997 | 17 |
| | 2.2 | .9 The NSW Sea Level Rise Policy Statement (2009) | 17 |
| | 2.2 | .10 Guidelines for Preparing Coastal Zone Management Plans (2010) | 18 |
| | 2.2 | .11 Lake Illawarra Authority Act 1987 | 20 |
| | 2.2 | .12 Other Policies and Guidelines | 21 |
| 3 | COAS | TAL HAZARDS ALONG THE WOLLONGONG LGA COASTLINE | 23 |
| | 3.1 | Introduction | 23 |
| | 3.2 | Coastal Processes and Hazards | 23 |
| | 3.2 | .1 Erosion and Recession | 24 |

C:USERSILWATKINSIAPPDATALOCALHEWLETT-PACKARDHP TRIMTEMPHPTRIM.7124/216 242661 ESP - PROJECT MANAGEMENT COASTAL ZONE MANAGEMENT PLAN - MANAGEMENT STUDY - FINAL DRAFT ~ WITH TRACK CHANGES.DOCX

| | 3.2.2 | Coastal Inundation | 26 |
|---|---------|--|----------|
| | 3.2.3 | Geotechnical Hazards | 27 |
| | 3.2.4 | Coastal Entrances and Stormwater Erosion Hazards | 28 |
| | 3.2.5 | Sand Drift | 28 |
| 4 | COAST | AL RISK ASSESSMENT | 29 |
| | 4.1 | Application of a Risk Framework to Coastal Management | 29 |
| | 4.2 | Analysis of Risk Likelihood | 31 |
| | 4.2.1 | Likelihood of Erosion and Inundation Hazards | 31 |
| | 4.2.1 | Likelihood of Geotechnical Hazards | 34 |
| | 4.3 | Analysis of Risk Consequence | 34 |
| | 4.3.1 | Coastal Assets and Values | 34 |
| | 4.3.2 | Consequence from Coastal Hazards | 36 |
| | 4.4 I | ncorporating Existing Controls | 42 |
| | 4.5 | Analysis of the Level of Risk | 42 |
| | 4.6 I | Risk Evaluation: Priorities for Treatment | 43 |
| | 4.6.1 | Timeframe and Triggers for Action | 44 |
| 5 | Μανιας | | 16 |
| J | | ntroduction | 40 |
| | 5.1 I | Albele of Council Anarcash to Coastal Bisk Management | 40 |
| | 5.2 | Euture Development and Be Development | 40 |
| | 5.5 | -uture Development and Re-Development | 40 51 |
| | 5.4 I | "No Pograto" Optiona | 51 |
| | 5.4.1 | Protection Options | 52 |
| | 5.4.2 | Planned Retract Options | 57 |
| | 5.4.5 | | 02 |
| | 5.4.4 | "Do Nothing" (Accort Rick) Option | 69 |
| | 5.5 | Rapid Analysis for Costs and Benefits of Options | 69 |
| | 0.0 | | |
| 6 | RISK LE | VELS AND TREATMENT OPTIONS | 71 |
| | 6.1 | Stanwell Park Beach | 72 |
| | 6.1.1 | Erosion and Recession Risk Level and Treatment Options | 72 |
| | 6.1.2 | Coastal Inundation Risk Level and Treatment Options | 74 |
| | 6.1.3 | Assessment of Treatment Options | 77 |
| | 6.2 | Coalcliff Beach | 79 |
| | 6.2.1 | Erosion and Recession Risk Level and Treatment Options | 79 |
| | 6.2.2 | Coastal Inundation Risk Level and Treatment Options | 81 |

V

| | | | ~~~ |
|-----|-----------------|--|------------------|
| | 6.2.3 | Assessment of Treatment Options | 83 |
| 6.3 | Sc | carborough and Wombarra Beaches | 85 |
| | 6.3.1 | Erosion and Recession Risk Level and Treatment Options | 85 |
| | 6.3.2 | Coastal Inundation Risk Level and Treatment Options | 87 |
| | 6.3.3 | Assessment of Treatment Options | 89 |
| 6.4 | Co | bledale Beach | 91 |
| | 6.4.1 | Erosion and Recession Risk Level and Treatment Options | 91 |
| | 6.4.2 | Coastal Inundation Risk Level and Treatment Options | 93 |
| | 6.4.3 | Assessment of Treatment Options | 95 |
| 6.5 | Sł | narkys Beach | 97 |
| | 6.5.1 | Erosion and Recession Risk Level and Treatment Options | 97 |
| | 6.5.2 | Coastal Inundation Risk Level and Treatment Options | 99 |
| | 6.5.3 | Assessment of Treatment Options | 101 |
| 6.6 | Lit | ttle Austinmer and Austinmer Beaches | 103 |
| | 6.6.1 Austin | Erosion and Recession Risk Level and Treatment Options – Little mer | 103 |
| | 6.6.2 | Erosion and Recession Risk Level and Treatment Options – Austinmer | 104 |
| | 6.6.3 | Coastal Inundation Risk Level and Treatment Options - Little Austinmer | [.] 107 |
| | 6.6.4 | Coastal Inundation Risk Level and Treatment Options – Austinmer | 108 |
| | 6.6.5 | Assessment of Treatment Options – Little Austinmer | 110 |
| | 6.6.6 | Assessment of Treatment Options – Austinmer | 114 |
| 6.7 | Th | hirroul Beach 🧳 | 118 |
| | 6.7.1 | Erosion and Recession Risk Level and Treatment Options | 118 |
| | 6.7.2 | Coastal Inundation Risk Level and Treatment Options | 122 |
| | 6.7.3 | Assessment of Treatment Options | 124 |
| 6.8 | M | cCauleys Beach | 129 |
| | 6.8.1 | Erosion and Recession Risk Level and Treatment Options | 129 |
| | 6.8.2 | Coastal Inundation Risk Level and Treatment Options | 132 |
| | 6.8.3 | Assessment of Treatment Options | 134 |
| 6.9 | Sa | andon Point Beach | 137 |
| | 6.9.1 | Erosion and Recession Risk Level and Treatment Options | 137 |
| | 6.9.2 | Coastal Inundation Risk Level and Treatment Options | 140 |
| | 6.9.3 | Assessment of Treatment Options | 142 |
| 6.1 | 0 Βι | ılli Beach | 145 |
| | 6.10.1 | Erosion and Recession Risk Level and Treatment Options | 145 |
| | 6.10.2 | Coastal Inundation Risk Level and Treatment Options | 147 |
| | 6.10.3 | Assessment of Treatment Options | 150 |
| 6.1 | 1 W | oonona Beach | 152 |

C:USERSILWATKINSIAPPDATALOCALWEWLETT-PACKARDWP TRIMTEMPHPTRIM.7124/Z16 242661 ESP - PROJECT MANAGEMENT (COASTAL ZONE MANAGEMENT PLAN - MANAGEMENT STUDY - FINAL DRAFT ~ WITH TRACK CHANGES.DOCX



| | 6.11.1 | Erosion and Recession Risk Level and Treatment Options | 152 |
|--------------|-------------------|---|-------------|
| | 6.11.2 | Coastal Inundation Risk Level and Treatment Options | 155 |
| | 6.11.3 | Assessment of Treatment Options | 157 |
| 6.1 2 | 2 Bel | lambi Beach, Boat Harbour, Bellambi Point Beach | 162 |
| | 6.12.1 Beach a | Erosion and Recession Risk Level and Treatment Options – Bellambi & Bellambi Boat Harbour | 162 |
| | 6.12.1 Point B | Erosion and Recession Risk Level and Treatment Options – Bellambi each | 163 |
| | 6.12.2 Bellam | Coastal Inundation Risk Level and Treatment Options – Bellambi Bead bi Boat Harbour | ch & 167 |
| | 6.12.3 Beach | Coastal Inundation Risk Level and Treatment Options – Bellambi Poin 168 | ıt |
| | 6.12.4 Harbou | Assessment of Treatment Options – Bellambi Beach & Bellambi Boat r 172 | |
| | 6.12.5 | Assessment of Treatment Options – Bellambi Point Beach | 175 |
| 6.1 | 3 Co | rrimal Beach | 177 |
| | 6.13.1 | Erosion and Recession Risk Level and Treatment Options | 177 |
| | 6.13.2 | Coastal Inundation Risk Level and Treatment Options | 179 |
| | 6.13.3 | Assessment of Treatment Options | 181 |
| 6.1 | 4 To\ | wradgi Beach | 183 |
| | 6.14.1 | Erosion and Recession Risk Level and Treatment Options | 183 |
| | 6.14.2 | Coastal Inundation Risk Level and Treatment Options | 185 |
| | 6.14.3 | Assessment of Treatment Options | 187 |
| 6.1 | 5 Fai | ry Meadow Beach | 190 |
| | 6.15.1 | Erosion and Recession Risk Level and Treatment Options | 190 |
| | 6.15.1 | Coastal Inundation Risk Level and Treatment Options | 190 |
| | 6.15.2 | Assessment of Treatment Options | 195 |
| 6.1 | 6 No | rth Beach | 196 |
| | 6.16.1 | Erosion and Recession Risk Level and Treatment Options | 196 |
| | 6.16.2 | Coastal Inundation Risk Level and Treatment Options | 199 |
| | 6.16.3 | Assessment of Treatment Options | 201 |
| 6.1 | 7 Wo | llongong Harbour Belmore Basin | 204 |
| | 6.17.1 | Erosion and Recession Risk Level and Treatment Options | 204 |
| | 6.17.2 | Coastal Inundation Risk Level and Treatment Options | 204 |
| 6.1 | 8 City | y Beach | 207 |
| | 6.18.1 | Erosion and Recession Risk Level and Treatment Options | 207 |
| | 6.18.2 | Coastal Inundation Risk Level and Treatment Options | 209 |
| | 6.18.3 | Assessment of Treatment Options | 211 |
| 6.1 | 9 Co | niston Beach | 213 |





7

8

| REFERENCES | | 246 |
|---------------------|--|-----|
| | | 243 |
| 6.22 Ge | otechnical Risk Levels and Treatment Options | 241 |
| 6.21.2 | Assessment of Treatment Options | 240 |
| 6.21.1 | Coastal Inundation Risk Level and Treatment Options | 238 |
| 6.21 Lake Illawarra | | 238 |
| 6.20.3 | Assessment of Treatment Options | 224 |
| 6.20.2 | Coastal Inundation Risk Level and Treatment Options | 222 |
| 6.20.1 | Erosion and Recession Risk Level and Treatment Options | 219 |
| 6.20 Pe | rkins Beach | 219 |
| 6.19.2 | Assessment of Treatment Options | 218 |
| 6.19.1 | Coastal Inundation Risk Level and Treatment Options | 213 |
| 6.19.1 | Erosion and Recession Risk Level and Treatment Options | 213 |
| | | |

APPENDIX A: Risk Levels Maps for 2050 and 2100 Error! BOOKMARK NOT DEFINED.

APPENDIX B: ESTUARY PLANS AND BEACH ACCESS ARRANGEMENTSERROR! BOOKMARK

APPENDIX C: LEGISLATION SUMMARY ERROR! BOOKMARK NOT DEFINED.

APPENDIX D: SUMMARY OF APPROACH TO ASSESSING BEACH EROSIONERROR! BOOKMA

APPENDIX E: BEACH ASSET CONSEQUENCE TABLESERROR! BOOKMARK NOT DEFINED.

APPENDIX F: THIRROUL CASE STUDY ECONOMIC ANALYSIS OF MANAGEMENT OPTIONS: GILLESPIE ECONOMICS ERROR! BOOKMARK NOT DEFINED.

APPENDIX G: Wollongong Coastal Erosion Emergency Action Subplan Error! Bookmark not defined.

LIST OF FIGURES

| Figure 1-1 | Study Area – Wollongong LGA Coastline | 3 |
|------------|---|------------|
| Figure 1-2 | Plan Hierarchy / Framework for Management Options | 8 |
| Figure 4-1 | Risk Management Framework (ISO 31000:2009) adapted to Coastal Management | Zone 30 |
| Figure 4-2 | Increasing Likelihood of Hazards Over Time with Sea Level Rise | 33 |

C:IUSERSILWATKINSIAPPDATAILOCALWEWLETT-PACKARDWP TRIMITEMPWPTRIM.7124/Z16 242661 ESP - PROJECT MANAGEMENT COASTAL ZONE MANAGEMENT PLAN - MANAGEMENT STUDY - FINAL DRAFT ~ WITH TRACK CHANGES.DOCX


| Figure 4-3 | Adaptation Action Continuum Model (Fisk and Kay, 2010) | 44 |
|-------------|--|-----------------|
| Figure 6-1 | Immediate Erosion Risk Levels and Treatment Options Stanwell Park | Beach 73 |
| Figure 6-2 | Immediate Inundation Risk Levels and Treatment Options Stanwell Pa | rk Beach 76 |
| Figure 6-3 | Immediate Erosion Risk Levels and Treatment Options Coalcliff Beach | ו 80 |
| Figure 6-4 | Immediate Inundation Risk Levels and Treatment Options Coalcliff Be | ach 82 |
| Figure 6-5 | Immediate Erosion Risk Levels and Treatment Options Scarborough & Wombarra Beaches | 86 |
| Figure 6-6 | Immediate Inundation Risk Levels and Treatment Options Scarboroug Wombarra Beaches | h & 88 |
| Figure 6-7 | Immediate Erosion Risk Levels and Treatment Options Coledale Beac | h92 |
| Figure 6-8 | Immediate Inundation Risk Levels and Treatment Options Coledale Be | each 94 |
| Figure 6-9 | Immediate Erosion Risk Levels and Treatment Options Sharkys Beach | n 98 |
| Figure 6-10 | Immediate Inundation Risk Levels and Treatment Options Sharkys Be | ach 100 |
| Figure 6-11 | Immediate Erosion Risk Levels and Treatment Option Austinmer Beac Seawall S1 Option | :h 105 |
| Figure 6-12 | Immediate Erosion Risk Levels and Treatment Options Austinmer and Austinmer Beaches | l Little 106 |
| Figure 6-13 | Immediate Inundation Risk Levels and Treatment Options Little Austin Austinmer Beaches | nmer and 109 |
| Figure 6-14 | Immediate Erosion Risk Levels and Treatment Options Thirroul Beach S1 Option | Seawall 119 |
| Figure 6-15 | Immediate Erosion Risk Levels and Treatment Options Thirroul Beach S2 Option | Seawall 120 |
| Figure 6-16 | Immediate Erosion Risk Levels and Treatment Options Thirroul Beach Retreat Option | Planned 121 |
| Figure 6-17 | Immediate Inundation Risk Levels and Treatment Options Thirroul Bea | ach123 |
| Figure 6-18 | Immediate Erosion Risk Levels and Treatment Options McCauleys Beawall S2 Option | ach 130 |
| Figure 6-19 | Immediate Erosion Risk Levels and Treatment Options McCauleys Bear Planned Retreat Option | ach 131 |
| Figure 6-20 | Immediate Inundation Risk Levels and Treatment Options McCauleys | Beach 133 |
| Figure 6-21 | Immediate Erosion Risk Levels and Treatment Options Sandon Point I Seawall S1 Option | Beach 138 |
| Figure 6-22 | Immediate Erosion Risk Levels and Treatment Options Sandon Point I Planned Retreat Option | Beach 139 |
| Figure 6-23 | Immediate Inundation Risk Levels and Treatment Options Sandon Poi | nt Beach 141 |
| Figure 6-24 | Immediate Erosion Risk Levels and Treatment Options Bulli Beach | 146 |
| Figure 6-25 | Immediate Inundation Risk Levels and Treatment Options Bulli Bea | ach 149 |
| Figure 6-26 | Immediate Erosion Risk Levels and Treatment Options Woonona Bead | ch 153 |
| Figure 6-27 | Immediate Erosion Risk Levels and Treatment Options Woonona Beau Planned Retreat Option | ch 154 |

C:USERSILWATKINSIAPPDATALOCALWEWLETT-PACKARDWP TRIMTEMPWPTRIM.7124IZ16 242661 ESP - PROJECT MANAGEMEN (COASTAL ZONE MANAGEMENT PLAN - MANAGEMENT STUDY - FINAL DRAFT ~ WITH TRACK CHANGES.DOCX



| Figure 6-28 | Immediate Inundation Risk Levels and Treatment Options Woonona Beach 156 | |
|-------------|---|-----------|
| Figure 6-29 | Immediate Erosion Risk Levels and Treatment Options Bellambi Beach164 | |
| Figure 6-30 | Immediate Erosion Risk Levels and Treatment Options Bellambi Boat Harbo 165 | ur |
| Figure 6-31 | Immediate Erosion Risk Levels and Treatment Options Bellambi Point Beach 166 | า |
| Figure 6-32 | Immediate Inundation Risk Levels and Treatment Options Bellambi Beach 16 | 39 |
| Figure 6-33 | Immediate Inundation Risk Levels and Treatment Options Bellambi Boat Harbour 170 | |
| Figure 6-34 | Immediate Inundation Risk Levels and Treatment Options Bellambi Point Beach 171 | |
| Figure 6-35 | Immediate Erosion Risk Levels and Treatment Options Corrimal Beach178 | |
| Figure 6-36 | Immediate Inundation Risk Levels and Treatment Options Corrimal Beach 18 | 30 |
| Figure 6-37 | Immediate Erosion Risk Levels and Treatment Options Towradgi Beach184 | |
| Figure 6-38 | Immediate Inundation Risk Levels and Treatment Options Towradgi Beach 186 | |
| Figure 6-39 | Immediate Erosion Risk Levels and Treatment Options Fairy Meadow Beach (north) 191 | l |
| Figure 6-40 | Immediate Inundation Risk Levels and Treatment Options Fairy Meadow Bea (north) 192 | ach |
| Figure 6-41 | Immediate Erosion Risk Levels and Treatment Options Fairy Meadow Beach (south) 193 | I |
| Figure 6-42 | Immediate Inundation Risk Levels and Treatment Options Fairy Meadow Bea (south) 194 | ìch |
| Figure 6-43 | Immediate Erosion Risk Levels and Treatment Options North Beach Seawall S2 Option 197 | |
| Figure 6-44 | Immediate Erosion Risk Levels and Treatment Options North Beach Planned Retreat Option 198 | ł |
| Figure 6-45 | Immediate Inundation Risk Levels and Treatment Options North Beach200 | |
| Figure 6-46 | Immediate Erosion Risk Levels and Treatment Options Wollongong Harbour 205 | • |
| Figure 6-47 | Immediate Erosion Risk Levels and Treatment Options Wollongong Harbour 206 | • |
| Figure 6-48 | Immediate Erosion Risk Levels and Treatment Options Wollongong City Bea 208 | ich |
| Figure 6-49 | Immediate Inundation Risk Levels and Treatment Options Wollongong City Beach 210 | |
| Figure 6-50 | Immediate Erosion Risk Levels and Treatment Options Coniston Beach (nor 214 | th) |
| Figure 6-51 | Immediate Erosion Risk Levels and Treatment Options Coniston Beach (sou 215 | ıth) |
| Figure 6-52 | Immediate Inundation Risk Levels and Treatment Options Coniston Beach (north) 216 | |
| Figure 6-53 | Immediate Inundation Risk Levels and Treatment Options Coniston Beach (south) 217 | |

C:USERSILWATKINSIAPPDATALOCALWEWLETT-PACKARDWP TRIMTEMPHPTRIM.7124/Z16 242661 ESP - PROJECT MANAGEMENT (COASTAL ZONE MANAGEMENT PLAN - MANAGEMENT STUDY - FINAL DRAFT ~ WITH TRACK CHANGES.DOCX



| Figure 6-54 | Immediate Erosion Risk Levels and Treatment Options Port Kembla Beach - Seawall S2 Option 220 |
|-------------|---|
| Figure 6-55 | Immediate Erosion Risk Levels and Treatment Options Port Kembla Beach - Planned Retreat Option 221 |
| Figure 6-56 | Immediate Inundation Risk Levels and Treatment Options Port Kembla Beach 223 |
| Figure 6-57 | Immediate Erosion Risk Levels and Treatment Options Perkins Beach (1)226 |
| Figure 6-58 | Immediate Inundation Risk Levels and Treatment Options Perkins Beach (1) 227 |
| Figure 6-59 | Immediate Erosion Risk Levels and Treatment Options Perkins Beach (2)228 |
| Figure 6-60 | Immediate Inundation Risk Levels and Treatment Options Perkins Beach (2) 229 |
| Figure 6-61 | Immediate Erosion Risk Levels and Treatment Options Perkins Beach (3)230 |
| Figure 6-62 | Immediate Inundation Risk Levels and Treatment Options Perkins Beach (3) 231 |
| Figure 6-63 | Immediate Erosion Risk Levels and Treatment Options Perkins Beach (4)232 |
| Figure 6-64 | Immediate Inundation Risk Levels and Treatment Options Perkins Beach (4) 233 |
| Figure 6-65 | Immediate Erosion Risk Levels and Treatment Options Perkins Beach (5)234 |
| Figure 6-66 | Immediate Inundation Risk Levels and Treatment Options Perkins Beach (5) 235 |
| Figure 6-67 | Immediate Erosion Risk Levels and Treatment Options Windang Beach236 |
| Figure 6-68 | Immediate Inundation Risk Levels and Treatment Options Windang Beach 237 |
| Figure 6-69 | Immediate Inundation Risk Levels and Treatment Options Lake Illawarra239 |
| Figure 6-70 | Geotechnical Risk Evaluation and Treatment Option: Thirroul to McCauley's Headland 242 |
| F TABLES | |

LIST OF TABLES

| Table 2-1 | Land Zones in the Wollongong LEP | 13 |
|-----------|---|---------------|
| Table 2-2 | Coastal Management Principles addressed by the Wollongong CZMP | 19 |
| Table 4-1 | Risk Likelihood / Probability, Coastal Hazards | 33 |
| Table 4-2 | Likelihoods Ascribed to Erosion and Coastal Inundation Hazards at Ea Timeframe | ach 33 |
| Table 4-3 | Likelihood Ascribed to Coastal Induced Geotechnical Hazard at Each Timeframe | 34 |
| Table 4-4 | Risk Consequence Scale for Coastal Hazards | 35 |
| Table 4-5 | Coastal Asset Categories and Items | 36 |
| Table 4-6 | Consequence Ascribed to Assets and Land in the Wollongong Coasta | al Zone 38 |
| Table 4-7 | Risk Score Matrix | 43 |
| Table 4-8 | Risk Tolerance Scale | 43 |
| Table 5-1 | Suggested Timeframe and Risk Level for Development Types | 50 |
| Table 5-2 | Rapid Cost Benefit (Traffic Light) Assessment Criteria | 70 |
| | | |

C:USERSILWATKINSIAPPDATAILOCALHEWLETT-PACKARDHP TRIMTEMPHPTRIM.7124IZ16 242661 ESP - PROJECT MANAGEMENT COASTAL ZONE MANAGEMENT PLAN - MANAGEMENT STUDY - FINAL DRAFT ~ WITH TRACK CHANGES.DOCX

- Table 7-1
 Recommended Management Options to Address Intolerable Risks to 2100 (Stanwell Park to Bulli)

 244
 244
- Table 7-2Recommended Management Options to Address Intolerable Risks to 2100
(Woonona to Lake Illawarra)245

tem?



1 INTRODUCTION

1.1 Purpose of the Wollongong Coastal Zone Management Plan

The purpose and context for preparing the Wollongong Coastal Zone Management Plan (CZMP) is to manage the risks from coastal hazards along the Wollongong LGA coastline. The plan shall provide practical actions to address the risks from coastal hazards, including sea level rise, upon existing and future development and community assets and values in Wollongong. The CZMP shall provide guidance and strategies for effective consideration of coastal hazards within Council (and state) statutory and operational plans.

CZMPs are intended to focus upon coastal hazard risk management because this is not specifically addressed in other statutory planning processes (DECCW, 2010). This CZMP will provide direction to managing recreational and community access where these aspects are affected by or affect the extent of coastal hazards. Recreational and community access and amenity is already managed across the Wollongong coastal zone through such strategic planning documents as *Planning People Places* (WCC, 2005) and various Plans of Management for community and crown land. Beach access arrangements are detailed in Appendix B.

Risks to estuary health are managed through the implementation of Council's Estuary Management Plans. More information on these existing policies and programs are given in Appendix B.

The Wollongong CZMP has been prepared in accordance with the *Coastal Protection Act 1979*, the NSW Coastal Policy, and the *Guidelines for Preparing Coastal Zone Management Plans*, as well as other legislation applicable to managing the coastal zone (refer Chapter 2). The plan shall meet the key objective of ecologically sustainable development which allows for equitable, balanced and coordinated use of the coastal zone and its unique physical, ecological, cultural and economic attributes.

The scope of the planning area is the Wollongong Coastal Zone, as described in Section 1.2. The plan will largely target the land based area of the Wollongong coastal zone, which is the area of key impact from coastal hazards and which is also the key area that may be influenced by Council and other stakeholders through management actions. Strategies implemented will also be considerate of any impacts upon the portion of the coastal zone below sea level.

In order to develop management strategies, a Risk Management Framework has been used to identify the risks from coastal hazards to the community and analyse the risk level based upon the likelihood and consequence of coastal hazards. The risk evaluation process was used to identify the priority coastal risks to be managed within the Wollongong CZMP.

Management strategies were derived in the context of managing coastal risks over the present to the 2100 timeframe. Triggers for implementing the strategies have been set with respect to this timeframe for coastal hazard impacts.

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1.2 Study Area

The study area comprises the coastal zone of the Wollongong Local Government Area (LGA), extending from the shores of Lake Illawarra and Windang Peninsula in the south to Garie Beach in the north, excluding the following regions:

- Port Kembla port area, as this is managed under a separate policy and legislative framework; and
- Areas managed by NSW Office of Environment & Heritage (OEH) (formerly DECCW) National Parks and Wildlife Service (NPWS) including the Royal National Park and the Five Islands Nature Reserve.

The coastal zone of Wollongong's LGA is identified on NSW Government gazetted maps delineating the zone covered by *State Environmental Planning Policy No.* 71 – *Coastal Protection* (SEPP71). The coastal zone is broadly defined in the NSW Coastal Policy 1997 to extend one kilometre inland measured from the shoreline, including along coastal rivers, lakes, lagoons, estuaries and islands, and three nautical miles seaward. The land area of the gazetted coastal zone for Wollongong is narrower than one kilometre in some areas, likely aligning with high topographic regions on the slope of the Illawarra Escarpment, which is situated very close to the shoreline in the northern part of the LGA. The Coastal Zone of Wollongong LGA given in the gazetted SEPP71 maps is illustrated in Figure 1-1.

The study area covers the immediate coastal environments such as beaches, dunes, headlands, bluffs, coastal entrances and waters to the extent that their management is affected by coastal processes and hazards and human activities. The lands within the Wollongong Coastal Zone include both public and private lands. The public lands include Crown lands which are either managed by Council (as Community Land, with associated Plans of Management defining permissible uses of these lands) or the Department of Primary Industries (DPI) (formerly part of LPMA). Private lands of the coastal zone are predominantly residential, with some commercial and industrial uses also.

Wollongong's beaches are typically high energy sandy beaches with occasional rocky shorelines. Wollongong has in places steep and rugged cliffs and bluffs, creating small pocket beaches. In the far northern part of the LGA, cliffs and bluffs dominate the coastline, as the Illawarra escarpment trends eastwards to meet the coast.

The Wollongong coastline was largely developed (particularly for residential and community purposes) prior to widespread understanding of local coastal processes. Interactions between natural coastal processes and development on the shoreline are the principle source of hazard within the coastal zone.





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1.3 Wollongong's Coastal Management Objectives

The NSW Coastal Policy 1997 sets nine goals for coastal management. These goals, along with site specific objectives for the Wollongong coastal zone are the basis for the plan's objectives. The objectives of the Wollongong Coastal Zone Management Plan are to:

- Recognise and accommodate natural coastal processes and hazards, including sea level rise and climate change, in the management of the coastal zone;
- Protect beaches, dunes and undeveloped headlands, permitting only minor development for essential public purposes;
- Manage and reduce the risks to existing and future development such that the value of assets at risk from coastal hazards is not increased over time; and
- Accord with the nine goals of the NSW Coastal Policy 1997.

The actions developed to treat coastal risks shall also meet the following objectives, in addition to treating coastal risks:

- The height, setback and scale of development shall enhance and protect the public's right to access the foreshore and ensure beaches and foreshores are not overshadowed, including acquisition of significant sites adjacent to the coastline to increase opportunities for access;
- The scale and setback specified for future and re-development shall not compromise the aesthetic and ecological values of the coastal zone;
- Cultural heritage, both indigenous and non-indigenous shall be protected and preserved;
- Lands identified to be of high conservation value shall be conserved, including through acquisition, dedication or reservation of such lands; and
- Actions that additionally provide opportunities to restore and enhance the amenity, recreational, ecological and cultural values of the coast shall be identified and given preference in treating coastal risks.

1.4 Community Involvement in Developing the Plan

The development of a Coastal Zone Management Plan requires the involvement of the community, including state agencies, stakeholders groups and directly and indirectly affected residents across the Wollongong LGA and greater region, who utilise the coastline in many different ways. Community involvement is crucial to the preparation of a plan that is considered acceptable, within financial and technical constraints. A careful and comprehensive consultation process has been conducted to ensure community values and priorities have been incorporated into preparing and selecting the management strategies and actions that will form the Wollongong CZMP. The following consultation activities have been, and will be, conducted.

- Following preparation of the Wollongong Coastal Zone Study (Cardno, 2010) Council undertook comprehensive presentation of the findings of this report to community, to assist in their understanding of the technical assessment of likely coastal risks to Wollongong's public and private land and assets.
- The first stage of the preparation of the CZMP was a series of informal workshops with the community and the Wollongong Estuary and Coastal Zone Management Committee ('the

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Committee'), to gauge community values and priorities for assets and land along Wollongong's coastline. During the workshops, attendees were asked to indicate what they believed the consequence to specific assets would be, should hazards impacts occur. The outcomes from community were used directly to determine potential "consequences" of coastal hazards as part of the risk assessment (refer Section 4.3.2). These "consequence" values have played a key role in determining the priority assets and land requiring treatment to mitigate coastal risks.

- The next stage of consultation involved more formal Presentations to the community and the Committee, outlining those options considered viable for treating coastal risks (erosion and recession, coastal inundation, geotechnical failure). The draft Management Study report was made available to the community at this stage. The presentations and report aimed to provide better understanding by the community as to potential costs and benefits from the options (financial, social and environmental). Another key outcome from the presentations was to gather feedback from the community as to preferred options. The outcomes from the community workshops were used to determine the "community acceptability" of the various options (refer Section 5.5 and Chapter 6), which formed part of determining recommended options for implementation.
- The final stage of consultation shall be to present to community the recommended management actions that shall form the Wollongong CZMP. The selection of options will in part be based upon community's preference for options, within financial, technical and other constraints for implementing options. Any final concerns or input regarding the recommended actions will be gauged from community prior to finalising the Plan.
- Through ongoing consultation with the community, it is anticipated that the recommended actions for managing coastal risks will be fully understood and accepted by community, particularly where difficult decisions or trade offs are necessary. Conversely, there will be areas for which little to no action may be needed at the present time, and again, community have and will be involved in determining the level and type of action required to manage the coastal risks to their coastline.

1.5 Plan Structure

The structure and development of the Wollongong CZMP, as illustrated in Figure 1-2, utilised the Risk Assessment framework to determine high priority areas and assets for management across the coastal zone. The strategic framework for the management options is based upon a hierarchy starting from the whole of Wollongong Local Government Area perspective, determining management options for existing development, re-development and asset replacement and future development. The management options are then applied as appropriate to the different coastal risks, being:

- short-term storm erosion and longer-term recession;
- coastal inundation, including wave overtopping and backwater inundation through coastal creeks; and
- geotechnical failure relating to wave action.

The information provided in this report to support the risk assessment and development of management options is as follows.

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- The legislative context for preparation of a CZMP and managing the coastal zone is outlined in Chapter 2.
- The coastal hazard extents, as taken directly from the previous stage study, being the Wollongong Coastal Zone Study, 2010 (Cardno, 2010), is given in Chapter 3;
- The risk assessment framework and its implementation for this CZMP is described in detail in Chapter 4.
- The management options that are available to treat erosion and recession, coastal inundation and geotechnical risks to existing and future development are presented in Chapter 5;
- The Risk Levels and Treatment Options for each risk at each beach are detailed in Chapter 6.
- Recommended options and implementation details are given in Chapter 7, which will be completed after stakeholders and community have reviewed and given input to preferred management options).
- Details for emergency action to provide safe beach access following storms, including activities such as re-contouring of eroded profiles is detailed in the Wollongong Emergency Action Sub Plan in Appendix G.

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Figure 1-2 Plan Hierarchy / Framework for Management Options

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2 LEGISLATIVE CONTEXT FOR COASTAL MANAGEMENT

2.1 NSW Coastal Management Framework

Coastal management in New South Wales is guided by the *NSW Coastal Protection Act 1979*, NSW Coastal Policy (1997), *State Environment Planning Policy No. 71 – Coastal Protection*, the *NSW Sea Level Rise Policy Statement (2009)* (which supersedes the NSW Coastline Hazard Policy 1988 with respect to sea level rise) and amendments to the *Coastal Protection Act, Local Government Act 1993 and Environmental Planning and Assessment Act 1979* relating to coastal protection (refer Chapter 2). Other guidance for land use planning in the coastal zone is given by the *NSW Coastal Planning Guideline: Adapting to Sea Level Rise* (DP, 2010) and the *Coastal Design Guidelines for NSW* (DP, 2003).

The requirements for the preparation of coastal zone management plans is outlined in the *Coastal Protection Act 1979* and recently adopted *Guidelines for Preparing Coastal Zone Management Plans* (DECCW, 2010) (the CZMP Guidelines). The CZMP Guidelines replace the Coastline Management Manual (NSW Government, 1990). A key change in the CZMP Guidelines (and supported by other recent NSW documents, as listed above) is the direction to adopt a risk-based approach to coastal management, which incorporates the uncertainty in hazards definition, and provides for prioritisation of management resources towards the greatest risks in the coastal zone.

The process to be followed in preparing Coastal Zone Management Plans is given below. <u>This study</u> forms Steps 3, 4 and 5 in the process, being the preparation of a Coastal Zone Management Study and Plan for the Wollongong LGA coastline.

- 1. Establish a Coastal Zone Management Committee;
- 2. Conduct a **Coastal Zone Study** to specifically identify and quantify hazards affecting the coastal area and investigate specific aspects of the coastal zone environment;
- 3. Prepare a **Coastal Zone Management Study** to consider all feasible management options whilst also assessing the social, economic, aesthetic, recreational and ecological issues associated with land uses of the coastal zone;
- 4. Prepare a draft **Coastal Zone Management Plan** consisting of the best combination of options for reducing the risks from coastal hazards and achieve the plan objectives, including the preparation of a strategy to implement the Plan;
- 5. Review the draft Plan through public exhibition and consultation,
- 6. Council to **adopt the Plan** and submit the Plan to Minister for the Environment for **certification** in accordance with Part 4A of the *Coastal Protection Act* 1979
- 7. Implement the certified Coastal Zone Management Plan; and
- 8. **Review** the Coastal Zone Management Plan on a regular basis (5-10 years), to enable continued update and review of coastal risks and management measures.



2.2 Key Legislation, Policies and Guidelines

A short summary of the key legislation, policies and guidelines for this CZMP is given below, with more detailed summary provided in Appendix C.

While a detailed review is not applicable here, it is noted that in managing the coastal zone, other legislation needs also be taken into consideration, which may include: the *Environment Protection* and *Biodiversity Conservation Act 1999*; the *Threatened Species Conservation Act 1995*; the *Fisheries Management Act 1994*; the *National Parks and Wildlife Act 1974*; the *Water Management Act 2000*; and others.

2.2.1 Coastal Protection Act 1979

The NSW *Coastal Protection Act 1979* (the CP Act) provides guidance on the use, occupation and development of the coastal zone in NSW. The CP Act was amended in 2002 to better reflect the purpose of the NSW Coastal Policy (1997) and to incorporate the principles of ecologically sustainable development.

The Act allows the Minister for the Environment to direct a council with land within the coastal zone to prepare a Coastal Zone Management Plan, and gives directions as to how such Plans shall be prepared, approved, gazetted and amended where necessary.

This Coastal Zone Management Plan is being prepared in accordance with the *Coastal Protection Act 1979*, including the objectives of the Act as outlined in Appendix C.

Amendments to the CP Act were also implemented as part of the Coastal Protection and Other Legislation Amendment Act 2010, as outlined below

2.2.1.1 Recent Amendments to the Coastal Protection Act and other Acts

The Coastal Protection and Other Legislation Amendment Act 2010 provided for reforms to coastal erosion management in NSW through amendments to *the Coastal Protection Act 1979*, the *Local Government Act 1993* and the *Environmental Planning and Assessment Act 1979*. The amendments relate to both emergency and permanent coastal protection works. The bill was passed in October 2010, and amendments came into effect in January 2011.

Amendments were made under Part 4C of the Coastal Protection Act outlining emergency coastal protection works that landholders or public authorities are permitted to carry out. The emergency coastal protection works must be consistent with a Code of Practise associated with this Part, which includes the Schedule of Authorised Locations for these works. There are no authorised locations in the Wollongong LGA for emergency coastal protection works. If there are found to be locations within the Wollongong LGA that Council considers would be suitable for emergency coastal protection works at some time in the future, Council may request the NSW Government to add these locations to the Schedule.

Amendments were made to the *Local Government Act 1993* (Section 553B) to allow local councils to levy a coastal protection service charge to landholders where they have contributed to the construction of new or expansion of existing coastal protection works. This charge covers council

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Of key note, residents must agree to pay the coastal protection service charge prior to the works being constructed. This annual charge is then attached to the land and becomes the responsibility of all future land owners for the life of the protection works. The amount of the charge is regularly reviewed depending on the cost of maintaining the works and in ameliorating any adverse impacts. Where works are implemented by Council and Council chooses to contribute to the cost of the works then Council also must accept liability for a portion of the future coastal protection service charge.

Legislative amendments were made that permit landholders to submit applications to erect long term coastal protection works, with approval contingent on the landholders demonstrating that potential offsite impacts can be managed (for example, with beach nourishment), refer Section 55M of *the Coastal Protection Act 1979*. The works can be fully funded by the landholders who submit the application. Ongoing maintenance can be facilitated through an annual coastal protection service charge (as above).

Effectively, a mechanism is now available to Councils whereby residents may promote and undertake coastal protection works (with approval) at their own expense to protect private property and land. Council in approving the works can establish a levy on the benefitting landowners for the costs of the works, their future maintenance and for the amelioration of any adverse impacts from the works that may occur into the future. There is no need for any cost for the works to be borne by local government and no contribution or responsibility emanating from the State as a result of the works or the coastal hazards.

Amendments were also made under Part 2A of the *Coastal Protection Act 1979* to establish a joint state-local body called the NSW Coastal Panel. The Coastal Panel is to act as a consent authority for long term protection works development applications where a council does not have a certified CZMP and / or requires further technical assistance in assessing such development applications. The Coastal Panel shall also assist the Minister when requested, such as for reviewing CZMPs.

2.2.2 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EPA Act) is the key NSW legislation for planning and land use. The Act provides a system of environmental planning and assessment for NSW, and involves developing plans to regulate competing land uses, through 'environmental planning instruments'. The objectives of the EPA Act are listed in Appendix C. The EPA Act establishes three types of environment planning instruments (EPI):

- Local Environmental Plans;
- Regional Environmental Plans; and
- State Environmental Planning Policies.

Approval processes for "development" and "works" in NSW are provided for in Part 3A (now repealed), Part 4, Part 5 and Part 5A of the EPA Act. Detail for these parts is given in Appendix C.

The Wollongong LEP, recently gazetted under the EPA Act, provides guidance as to land use in the Wollongong LGA, including the coastal zone.

2.2.3 Wollongong Local Environment Plan (2009)

The Wollongong Local Environment Plan 2009 (LEP) was adopted by the Minister for Planning in 2010, and provides local environmental planning provisions for land in Wollongong in accordance with the relevant standard environmental planning instrument under Section 33A of the EPA Act. The LEP also sets specific aims for the use and development of land in Wollongong, including "to ensure that significant landscapes are conserved, including...the coastline".

The LEP sets out the zonings for all land in the LGA, and the objectives and permitted development (with or without consent) given for each land zone. The LEP also guides the assessment and approval for Development Applications for lands within Wollongong. Land use zones specified in the LEP are given in Table 2-1. For each of these zones, the LEP specifies:

- Objectives for development within the zone
- Development that may be carried out without consent
- Development that may be carried out only with consent
- Development that is prohibited.

Most land in the Wollongong coastal zone is zoned for recreation (mostly public and some private), environmental conservation or management, or for residential uses. There is no rural land and very little industrial land within the coastal zone. There are small areas of commercial land, typically for restaurants, kiosks and cafes in the coastal zone.

| Rural Zones | Residential Zones | Business Zones | Industrial Zones |
|-----------------------------|----------------------------------|--|------------------------------|
| RU1 Primary Production | R1 General Residential | B1 Neighbourhood Centre | IN1 General Industrial |
| RU2 Rural Landscape | R2 Low Density Residential | B2 Local Centre | IN2 Light Industrial |
| RU4 Rural Small Holdings | R3 Medium Density Residential | B3 Commercial Core | IN3 Heavy Industrial |
| | R4 High Density Residential | B4 Mixed Use | IN4 Working Waterfront |
| | R5 Large Lot Residential | B6 Enterprise Corridor | |
| | | B7 Business Park | |
| Special Purpose Zones | Recreation Zones | Environment Protection Zones | Waterway Zones |
| SP1 Special Activities | RE1 Public Recreation | E1 National Parks and Nature Reserves | W1 Natural Waterways |
| SP2 Infrastructure | RE2 Private Recreation | E2 Environment Conservation | W2 Recreational Waterways |
| SP3 Tourist | | E3 Environmental Management | W3 Working Waterways |
| | | E4 Environmental Living | |

Table 2-1 Land Zones in the Wollongong LEP

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The LEP contains Miscellaneous Provisions for Development within the Coastal Zone (Section 5.5. of the LEP), which set objectives and matters for consideration by the consent authority prior to granting consent to development on land wholly or partly within the coastal zone. The objectives include implementing the principles of the NSW Coastal Policy, and which form the objectives for the CZMP (refer Section 1.3).

The LEP overrides (in that, the following plans do not apply to land within the LGA) SEPP No 1 – Development Standards, SEPP No 4 – Development Without Consent and Miscellaneous Exempt and Complying Development (Clause 6 and Parts 3 and 4), SEPP No 60 – Exempt and Complying Development and the Illawarra Regional Environmental Plan No 1. SEPP 71 does not apply to land within the Wollongong city centre. The provisions of any other SEPP and REP that apply to the Wollongong LGA prevail over the LEP (as provided by Section 36 of the EPA Act).

2.2.4 Wollongong Development Control Plan 2009

The Wollongong Development Control Plan 2009 (DCP) establishes objectives and planning controls for development on any land within the LGA, to supplement the provisions given in the LEP. The DCP provides specific controls for development relating to particular areas (e.g. Thirroul Village), development types (e.g. Residential Development) and / or particularly issues (e.g. flood planning controls), which governs the way that permitted development is conducted in the LGA. The 2009 DCP combined 89 separate plans into one document.

The DCP was prepared in accordance with Section 74C of the EPA Act and clause 16 of the Environmental Planning and Assessment Regulation 2000. Under Section 79C of the EPA Act, the consent authority is required to take into consideration the provisions of the DCP when determining a Development Application for land in Wollongong. The LEP and any relevant SEPPs that apply to lands in the LGA prevail over the DCP, in the event of any inconsistency.

Key chapters and sections of relevance to managing the coastal zone include the following.

- Chapter E12 Geotechnical Assessment, which sets specific requirements for geotechnical investigations for lands within the LGA known or suspected to be subject to slope instability and geotechnical hazards. At present, coastal processes (waves, sea level rise) are not specifically stated to be included in the geotechnical hazard investigation.
- Chapter E13 Floodplain Management, which sets development controls for low, medium and high risk floodplain areas, with prescriptive standards for development applying to those floodplains where flood studies have been completed to specify the low, medium and high risk flood areas, i.e. Towradgi / Hewitts / Slacky / Woodlands / Tramway/ Thomas Gibson Creeks, Minnegang Creek, Allans Creek, with Lake Illawarra and Mullet Creek due to be added shortly. At present, the flood planning area controls cover the coastal inundation extents in the majority of land affected by these hazards.

While recreational land is managed through Community and Crown Lands POMs, works on such lands need to also comply with the DCP.

There is no specific DCP chapter providing guidance and development controls for coastal hazards such as erosion and recession or coastal inundation, over any timeframe (e.g. 2010, 2050, 2100).

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2.2.5 State Environmental Planning Policy No. 71 – Coastal Protection

State Environmental Planning Policy No. 71 – Coastal Protection (SEPP71) aims to protect and manage the natural, cultural, recreational and economic attributes of the New South Wales coast, through appropriate and suitably located development in accordance with ESD principles. SEPP 71 applies to all lands within the coastal zone of NSW, defined on gazetted maps under the SEPP.

SEPP 71 outlines the conditions for which the Minister for Planning becomes the consent authority for 'significant coastal development'. SEPP 71 defines this as development in 'sensitive coastal locations' namely land within 100 metres of and below mean high water mark of the sea, a bay or an estuary.

SEPP 71 does not apply to land within the Wollongong city centre, however does apply to the remaining coastal zone land in Wollongong (as in Figure 1-1).

2.2.6 Crown Lands Act 1989

The *Crown Lands Act 1989* (the CL Act) provides for the administration and management of Crown land for the benefit of the people of NSW. Waterbodies such as beaches and foreshores and estuaries / creeks / lagoons below the mean high water mark are designated as Crown Land and managed by the Department of Primary Industries (DPI). In addition to this, there are many other parcels of land within the Wollongong coastal zone that are Crown reserves that are controlled and managed by Council. That is, Council is the reserve trust manager or trustee appointed by the Minister for Lands to care, control and manage the land in accordance with its public purpose and the principles of Crown Lands management, Section 11 of the CL Act as given in Appendix C.

In addition to these principles, the objectives of the Coastal Crown Lands Policy 1991 apply to Crown lands within the coastal zone of Wollongong (the policies objectives are given in Appendix C).

For all Crown land reserves, a Plan of Management (POM) is required to be prepared and adopted (in accordance with Division 6 of the CL Act). The POM shall identify the key attributes and values of the area, general physical improvements to enhance the values and to specify the permissible uses for the land.

Plans of Management relating to Council managed Crown lands in Wollongong are discussed below in relation to the *Local Government Act 1993*.

2.2.7 Local Government Act 1993

The *Local Government Act 1993* (the LG Act) creates local governments and grants them the power to perform their functions, which involve management, development, protection, restoration, enhancement and conservation of the environment for the local government area. The functions of

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The service functions of local councils (defined in Chapter 6 of the LG Act) includes the classification, use and management of public land, including the objectives for management of the community land owned by Council (i.e. that is not Crown Land).

Plans of Management for Community Land need also to be prepared under Section 35 of the LG Act. Other aspects of categorisation, core objectives and use of Community Land are designated under Section 36 of the Act (refer Appendix C for more detail). Discussion of existing POMs for Community and Crown Lands is given below.

2.2.7.1 Plans of Management for Community, Crown and Recreational Land

Council has a generic plan of management (POM) and a range of site specific POMs that govern the permissible uses for Community Land (both Council owned land and Council managed Crown Lands). The relevant POMs for coastal Community Lands include:

- Stanwell Park Reserve and Bald Hill Plan of Management August 2009
- Wollongong City Foreshore Plan of Management, January 2008 (which incorporates former POMs for Andrew Lysaght Park (December, 2002), City Beach (July, 2001 and December 1995) and North Beach and Stuart Park (August, 2000))
- Coledale Beach Plan of Management, June 2004)
- Judbooley Parade, Windang Plan of Management, June 2008
- The Community Land of Wollongong Generic Plan of Management 2010

The *Blue Mile MasterPlan* provides more detail regarding the improvements proposed within the Wollongong City Foreshore POM, outlining the series of improvements and actions proposed in the Wollongong City Foreshore POM area.

Planning People Places (WCC, 2005) provides the strategic framework to guide provision, development and management of open space and key recreation and community facilities in Wollongong over the next 20 years. The document also provides guidance to developers and State agencies considering developments that provide open space, recreation and community facilities. Planning Areas 1 to 5 and 7 in this document cover the Wollongong coastal zone. The objectives for these areas focus on enhancing existing important coastline recreational nodes, and improving connection between these nodes.

A review of *People Planning Places*, Wollongong's POMs and the *Blue Mile Master Plan* indicated that all documents except one do not outline the relationship between recreational land use and development, and the need to plan for or manage coastal hazards impacts when planning uses and facilities.

The plans provide for a range of improvements to community facilities, but do not indicate whether planning for coastal erosion or other hazards had been incorporated into decision making regarding improvement works. Coastal hazards and engineering assessments are being undertaken for the proposed Blue Mile Masterplan works, however decisions regarding location, type and improvement

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to facilities was made prior to determining the feasibility of these decisions with respect to coastal hazards impacts.

Only the Coledale Beach Reserve POM provided a strategy directly relating to the incorporation of coastal hazards in future planning. The strategy requires new development and activities to be located behind the 50 year hazard line and structural protection to protect existing assets seaward of the 50 year hazard line (although, the type of structural protection, or any costs or benefits associated with structural protection was not indicated).

The POMs and strategic plans for recreational land have not explicitly included coastal hazards as part of decision making as there has not previously been hazards definition available to guide such decisions.

2.2.8 The NSW Coastal Policy 1997

The NSW Coastal Policy 1997 (the Policy) sets the strategic framework for coordinated, integrated and ecologically sustainable development of the coast. The Policy details nine goals and associated objectives and strategic actions for achieving ecologically sustainable development in NSW. Preparation of coastal zone management plans is one of the strategic actions given by the Policy, with the plans to be consistent with the Policy's goals and objectives.

The nine goals of the NSW Coastal Policy (refer to policy for objectives associated with these goals) are:

- to protect, rehabilitate and improve the natural environment;
- to recognise and accommodate natural processes and climate change;
- to protect and enhance the aesthetic qualities of the coastal zone;
- to protect and conserve cultural heritage;
- to promote ecologically sustainable development and use of resources;
- to provide for ecologically sustainable human settlement;
- to provide for appropriate public access and use;
- to provide information to enable effective management; and
- to provide for integrated planning and management.

2.2.9 The NSW Sea Level Rise Policy Statement (2009)

The NSW (2009) Sea Level Rise Policy Statement (the Policy Statement) sets the planning standards for projected sea level rise to 2100 that must be adopted in all forms of coastal assessment, from development applications to coastal hazards definitions studies and coastal zone management plans. The adopted benchmarks are 0.4 m rise in sea level by 2050 and 0.9 m by 2100. These benchmarks were used to prepare the Wollongong Coastal Zone Study and hazard lines.

The Policy Statement outlines the recommended risk based management approach and the commitments of the NSW government to assist planning and managing sea level rise, including:

• promoting risk-based assessment approaches to sea level rise and coastal planning;

- providing guidance to councils to support adaptation planning initiatives;
- encouraging appropriate development on land at risk from sea level rise;
- providing continued emergency management support for damaging storms and floods; and
- providing ongoing updated information to the public about sea level rise and projected impacts.

This Wollongong CZMP is consistent with the commitments outlined above.

The Sea Level Rise Policy Statement (2009) supersedes the 1988 Coastline Hazards Policy. Most of the objectives from that policy were included in the NSW Coastal Policy 1997, which remains current. With respect to managing sea level rise, NSW Coastline Hazard Policy was updated by the Sea Level Rise Policy Statement.

The Policy Statement also outlines the NSW Government's continued commitment to provide funding assistance to local councils for coastal hazard studies and management planning. Similarly, they shall continue to provide guidance and assistance to local councils on reducing the risk to private and public property from coastal hazards. However, when allocating funding assistance to local councils for coastal protection works, the Government will now give priority to public safety and protecting valuable publicly-owned assets, and then to private land. The criteria now to be applied to councils to voluntarily protect private property will include the:

- magnitude of current and future hazards
- cost-effectiveness of management actions
- contribution to the project's costs from the local council and benefiting landowners, taking into consideration genuine hardship for affected coastal residents
- effectiveness of the proposed arrangements for maintaining any proposed works
- ability of the project to accommodate sea level rise.

Where assistance is provided to reduce the impacts of coastal hazards, the Government does not assume any responsibility for these hazards.

2.2.10 Guidelines for Preparing Coastal Zone Management Plans (2010)

Guidelines for preparing Coastal Zone Management Plans (CZMP Guidelines) were finalised by OEH (formerly DECCW) in December 2010, and adopted in early 2011. The CZMP Guidelines specify the requirements for preparing a coastal zone management plan (CZMP) in accordance with the *Coastal Protection Act 1979*, including requirements additional to those specified in the Act. The guidelines specify the use of a risk based approach to preparation of a CZMP and actions for managing coastal hazards. The CZMP Guidelines documents the ISO 31000:2009 risk process which requires the likelihood and consequence of coastal risks to be analysed and combined to determine the level of risk. The highest risks are then treated as a priority over lower risks.

The CZMP Guidelines outline the steps for preparing CZMPs for the open coast in Part B, with further technical notes to be released by the NSW Government in coming months.

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Under Section 733 of the *Local Government Act 1993*, councils are taken to have acted in 'good faith' and receive an exemption from liability where their actions were done substantially in accordance with the coastal management principles given the CZMP Guidelines, as summarised below. Intended changes to the section 117 of the *Environmental Planning and Assessment Act 1979* will require the CZMP Guidelines be taken into consideration when councils prepare their local environment plans (LEPs).

The coastal management principles and how these principles have been addressed or achieved within this Wollongong CZMP are given in Table 2-2.

| | Coastal Management Principles | Addressed by Wollongong CZMP | Report Section |
|-------------|--|---|------------------------|
| Principle 1 | Consider the objectives of the Coastal Protection Act 1979 and the goals, objectives and principles of the NSW Coastal Policy 1997 and the NSW Sea Level Rise Policy Statement (2009) | Wollongong's coastal management objectives are aligned with the NSW Coastal Policy, and NSW Sea Level Rise Policy Statement 2009. The sea level rise benchmarks were also used in deriving future hazard extents (2050, 2100) | 2.2.8, 2.2.9 |
| Principle 2 | Optimise links between plans relating to the management of the coastal zone | By using a risk-based approach, existing controls within existing plans are reviewed and incorporated into the analysis of risk, and also used as starting point for developing risk treatments. Existing POMs address most beach amenity and access issues. This CZMP focuses on hazards issues that may not be addressed by such existing plans, as well as providing guidance for future and revised POMs. | 4.4 |
| Principle 3 | Involve the community in decision- making and make coastal information publicly available | Comprehensive community consultation has been undertaken in developing this plan, including workshops, mailouts, website, and interviews with stakeholders and community | 1.4 |
| Principle 4 | Base decisions on the best available information and reasonable practise; acknowledge the interrelationship between catchment, estuarine and coastal processes; adopt a continuous improvement management approach | The risk based approach is an internationally recognised framework for management because it incorporates the best available information and its uncertainty. Management options recognise the overlap between flooding and oceanic processes through estuaries, streamlining management into one approach. The adopted Risk Management Framework intrinsically requires ongoing monitoring of risks and review and tailoring of risk treatments (management options). | 3.1, 1.5, 5 and 5.5 |
| Principle 5 | The priority for public expenditure is public benefit; public expenditure should cost effectively achieve the best practical long-term outcomes | Cost benefit analysis for management options has recognised the public benefit as priority for management options | 5.4 and 5.5 |

 Table 2-2
 Coastal Management Principles addressed by the Wollongong CZMP

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| | Coastal Management Principles | Addressed by Wollongong CZMP | Report Section |
|--------------|--|--|-------------------------------|
| Principle 6 | Adopt a risk management approach to managing risks to public safety and assets; adopt a risk management hierarchy involving avoiding risk where feasible and mitigation where risks cannot be reasonably avoided; adopt interim actions to manage high risks while long-term options are implemented | This plan has been prepared using the ISO 31000:2009 International Standard Risk Management Principles and Guidelines. Risks to public safety and assets have been analysed and mapped. Evaluation of the tolerability of risks has been evaluated. In certain cases risks that cannot be reasonably treated must be accepted. A triggered based approach to implementation has been applied, with "no regrets" options to build resilience implemented now, as well as signal intent and a plan for allow appropriate approvals and funding for more difficult options in the future. | Entire Plan: 4, 5, 5.5. |
| Principle 7 | Adopt an adaptive risk management approach if risks are expected to increase over time, or to accommodate uncertainty in risk predictions | The adaptability of management options to future circumstances was a consideration in selection of preferred options. A triggered based approach has been applied | 5.5 |
| Principle 8 | Maintain the condition of high value coastal ecosystems; rehabilitate priority degraded coastal ecosystems | Ability of a management option to provide environmental protection or benefit has formed part of cost benefit analysis of options. Specific options for prioritising rehabilitation for at risk coastal ecosystems have also been developed. | 5.5 and 5.4.1 |
| Principle 9 | Maintain and improve safe public access to beaches and headlands consistent with the goals of the NSW Coastal Policy | This plan interlinks with existing community access plans (i.e. POMs) by recommending coastal hazards considerations be incorporated into existing community access planning. | 5.4 |
| Principle 10 | Support recreational activities consistent with the goals of the NSW Coastal Policy | This plan interlinks with existing community recreation plans (i.e. POMs) by recommending coastal hazards considerations be incorporated into existing recreation planning. | 5.4, 1.3 |

2.2.11 Lake Illawarra Authority Act 1987

The Lake Illawarra Authority Act 1987 (the LIA Act) constitutes the Lake Illawarra Authority (LIA) for the purpose of improving the environment of Lake Illawarra and its foreshores, and other related purposes. The LIA Act stipulates the functions of the LIA, makes the LIA a statutory body representing the Crown, and states LIA is subject to the control and direction of the Minister in the exercise of its functions.

The LIA Act outlines membership of the LIA, which is appointed by the Minister but shall include: members nominated by Wollongong City Council and Shellharbour City Council; and one member each to represent NSW Fisheries, the relevant Catchment Management Authority and the Department administering the LIA Act.

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- the authority to carry out the development works (or cause them to be carried out), with the development works being:
 - o the removal of ooze, silt, sand, sediment, algae and weed growth,
 - o the deepening of channels and bays and disposal of spoil,
 - o the construction of silt traps and nutrient filters at entry points of streams and drains,
 - the landscaping of foreshores, including the planting and removal of trees and other vegetation,
 - the provision of recreational facilities and amenities, including beaches, boat ramps, boatsheds, jetties, wharves, moorings and appropriately screened car parks, and
 - o the carrying out of land reclamation and works for the protection of the environment; and
- the authority to do any things, such as entering into contracts, necessary to carry out the development works;
- the development works are deemed an authorised work within the meaning of the Public Works Act 1912, with the Minister is the Constructing Authority within the meaning of that act, except for certain sections of that Act (as listed in the LIA Act);
- entering into and giving effect to agreements for the extraction of sand or other material from the development area;
- granting of leases or licences to any part of the development area for commerical activities such as kiosks, boatsheds or restaurants, or any other prescribed purpose;
- works or structures within the development area by parties other than the LIA require the written consent of the Authority (and which also requires consents and approvals required from other acts prior to the LIA's consent); and
- for unauthorised works or structures or alterations to works or structures (including noncompliance with any conditions of consent from the LIA), the LIA has the authority to demolish or otherwise alter the works as it directs.

The development area referred to by the LIA Act (and vested in the LIA by the act) largely comprises the bed of Lake Illawarra up to the mean high water mark (and some adjacent public lands, as described in the LIA Act). In legislating the Act, then, some public land and foreshore land of Wollongong's LGA was vested in the LIA.

The LIA Act, and the functions of the LIA in managing the Lake Illawarra development area, are necessarily relevant to this Coastal Zone Management Plan. Actions relating to the Lake's foreshores fall to the LIA, and must be consistent with the LIA's functions in protecting the environment of Lake Illawarra.

2.2.112_Other Policies and Guidelines

The remaining policies relating to the coastal zone of Wollongong LGA, as reviewed in Appendix C, include:

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- The NSW Coastal Planning Guideline: Adapting to Sea Level Rise, which provides guidance by the Department of Planning and Infrastructure for risk based planning for sea level rise;
- The Coastal Risk Management Guide Incorporating sea level rise benchmarks in coastal hazards assessments, which provides technical guidance for assessing sea level rise impacts using the NSW Sea Level Rise Policy Statement benchmarks, such as used for the Wollongong Coastal Zone Study (Cardno, 2010);
- SEPP (Infrastructure) 2007, which outlines works permitted without consent by public authorities particularly for environmental management purposes, including beach nourishment and erosion control;
- The Coastline Management Manual (1990) which guided the commencement of the Wollongong CZMP, most notably the completion of the Wollongong Coastal Zone Study, but which has since been superseded by the CZMP Guidelines

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3 COASTAL HAZARDS ALONG THE WOLLONGONG LGA COASTLINE

3.1 Introduction

The coastal hazards extents as defined and mapped within the 2010 Wollongong City Council Coastal Zone Study (Cardno, 2010) have been adopted in preparing this Coastal Zone Management Plan. The 2010 Wollongong City Council Coastal Zone Study was adopted by Council and therefore provides an appropriate basis for this Plan.

The Wollongong City Council Coastal Zone Study provided definition and mapping of the Erosion and Recession Hazard extent for the immediate (2010), 2050 and 2100 timeframes, the Coastal Inundation Extent for 2010, 2050 and 2100 and the Coastal-Influenced Geotechnical Hazard Zone for the present to 2100 timeframe. This mapping of hazard extents has been utilised to undertake the Risk Assessment in Chapter 4 that was subsequently used to prepare management options to treat the risks.

A Coastal Zone Management Plan is required to begin the process of long term strategic planning and future works to manage coastal hazards. The hazards definition should be updated as methodologies and scientific information (particularly relating to climate change) continues to improve into the future. It is intended that this Plan shall also be updated in conjunction with new hazards assessments, however, the approach to managing the risk from coastal hazards is aimed to be of a form that can be expanded, reversed or adapted as new hazards information becomes available.

3.2 Coastal Processes and Hazards

Coastal processes (natural and human influenced) are the principle source of risk in the coastal zone, as such processes can generate significant hazards to coastal land and assets.

Coastal processes include and are affected by:

- Regional geology (which sets the structure of the coastal zone) and geomorphology (which is both a product of coastal processes as well as affecting processes);
- Waves (particularly during storms);
- Water levels (from tides and during storms);
- Coastal entrances (for creeks, lagoons, lakes and estuaries);
- Sediment transport;
- Windborne sediment transport;
- Stormwater runoff; and
- Climate change, particularly sea level rise, which will affect all of the above coastal processes.

A summary of coastal processes acting along Wollongong's coastline is provided in Section 1.6 of the Wollongong CZMP: Implementation Action Plan.

Each of these processes interact to generate hazards, which include:

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- Beach erosion (during short term storm event or events in close succession) and dune slope instability;
- Shoreline recession (particularly relating to sea level rise);
- Coastal inundation (during high tides combined with storms and sea level rise), which can manifest as both wave overtopping of the open coastline, or inundation of land behind the open coastline via coastal creeks and estuaries and stormwater systems connecting to the ocean;
- Cliff instability and geotechnical hazards;
- Coastal entrance instability;
- Erosion at stormwater outlets / drainage lines; and
- Sand drift.

All of the above hazards were assessed in the Wollongong City Council Coastal Zone Study (Cardno, 2010) for the current year (2010), 2050 and 2100 timeframes taking into account climate change, specifically sea level rise. The hazards as derived in the Cardno (2010) report have been adopted for use in developing this Coastal Zone Management Plan, without amendment.

3.2.1 Erosion and Recession

Beach (Storm) Erosion

In order to investigate the extent of erosion occurring under high waves and water levels (i.e. storms), the following process was undertaken by Cardno (2010):

- The Simulating WAves Nearshore (SWAN) numerical model was used to transpose waves from offshore into the surfzone of Wollongong's beaches, using measured peak offshore wave data statistics of 100 year ARI from Botany Bay (for wave height);
- The SBEACH modelling system was used to investigate storm erosion potential at individual beaches during a single 'design' storm, equivalent to the 1 in 100 year wave height and water levels in the ocean (between 2 4 cross-sectional profiles were modelled for each beach);
- Historical beach volume losses between closely spaced dates of photogrammetry were calculated and averaged within each beach (10 beaches have photogrammetric data), for comparison with the SBEACH model outputs (at some beaches the photogrammetric data was dated too far apart to represent a 'design' storm for comparison with SBEACH model output).
- SBEACH model outputs were scaled up according to the high and low storm demand values (250 m³/m and 160 m³/m respectively) given in NSW Government manuals (e.g. DECCW, 2010).

A short summary of the approach to storm erosion, including limitations is given in Appendix D. A detailed explanation of the process used to calculate the beach erosion hazard can be found within the Wollongong Coastal Zone Study (Cardno, 2010).

Historical Shoreline Recession

The analysis of photogrammetric data by Cardno (2010) indicated there to be no signature of long term recession at any of the Wollongong beaches. In fact, there had been a noticeable increase in



dune volumes at most locations between 1974 and 2010. The most eroded beach state at almost all beach locations was recorded in 1974, and this is consistent with the historical storm records (Cardno, 2010).

Regional Longshore Sediment Transport

Cardno (2010) assumed there to be no longshore sediment transport between embayments. That is, each beach was assumed to be a closed system, with no significant transfer of sediment between embayments.

Future Recession Due to Sea Level Rise

Shoreline recession is generally expected to occur as a result of the projected rise in sea level to 2100 and beyond. Cardno (2010) utilised the Bruun Rule (1962) for estimating shoreline recession due to sea level rise. There are a number of widely documented limitations to the Bruun Rule, as given by Ranasinghe *et al.* (2007).

The closure depth is a parameter within the Bruun Rule, from which the nearshore slope and recession extents are measured. For use in the Bruun Rule, it was noted that the open NSW coast is generally considered to have a closure depth of 9 - 12 m below sea level, and this is the value utilised by Cardno (2010).

The recession analyses at each beach were included in the hazard lines for 2050 and 2100.

Erosion and Recession Hazard Mapping

The following Erosion and Recession hazards were mapped at the following timeframes:

- 2010 landward extent of the eroded scarp following the design storm event;
- 2050 shoreline recession due to 0.4 m SLR + landward extent of the eroded scarp following the design storm event; and
- 2100 shoreline recession due to 0.9 m SLR + landward extent of the eroded scarp following the design storm event.

For each time period, the zone of reduced foundation capacity (ZRFC) was mapped as a separate hazard, beyond the erosion and recession hazard line. The zone of reduced foundation capacity is defined as follows. The near vertical erosion scarp left following a storm erosion event will over time slump through a zone of slope adjustment to the natural angle of repose of the sand (approx. 1.5 Horizontal to 1.0 Vertical). Immediately adjacent to and landward of the dune scarp exists a zone of reduced foundation capacity, which is unstable due to the potential for soil slip or undermining of the dune scarp, and is therefore unsuitable for building foundations.

Mapping of the erosion hazard and ZRFC at each time period was based upon either ALS data or the average photogrammetric profile condition. At the ends of beaches, the hazard extent was reduced to consider the presence of rock and cliffs, generally reduced wave exposure, and generally steeper slopes (Cardno, 2010).

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Erosion of entrance berms was not included in the defined hazard. Instead, the erosion hazard through the entrance berm area was defined at the design water levels (Cardno, 2010). No erosion or recession hazard was defined for the Lake Illawarra foreshores.

The erosion hazard definition at all sites except the North Beach Bathers Pavillion seawall and Continental Pool wall, did not account for shoreline protection features. Shoreline protection features (e.g. Thirroul seawall) were not included as there was no definitive information available on the foundations of the works from which to judge the effectiveness during the design wave and water level conditions. Where site specific investigations for the existing protection structures indicated that the structure was suitably founded on rock or deep foundations and built to withstand wave attack, the erosion hazard line could be redefined at the line of the structure.

3.2.2 Coastal Inundation

Wave run up during storms may be of sufficient height to overtop the back beach area. The height of the overtopping wave depends not only on the wave conditions, but on the slope of the back beach area. Coastal inundation also relates to the ingress of water through coastal entrances to flood low lying land behind the coastline. The duration of inundation is much shorter than catchment flooding, usually lasting 1 - 3 hours over the peak of high tide. Likewise for wave overtopping, during the storm the irregular height and period storm waves would result in only the larger waves overtopping, and this would occur only during the peak of the storm water levels (including tide).

Wave inundation was modelled for 2010, 2050 and 2100 timeframes to identify the area subject to wave inundation (including wave run-up) during a 100 year ARI wave height and water level. Cardno (2010) used:

- nearshore wave modelling to determine the wave set up component of still water levels at each beach profile location in the study area;
- the Delft3D Flow model to investigate wave overtopping and coastal inundation in the study area;
- Overtopping rates were calculated using the computational methods of PIANC (1992), and to calculate overtopping rates, the back beach area was assumed to be eroded, as would be expected during the storm conditions (Cardno, 2010);
- Wave overtopping simulations were then modelled including the 2050 and 2100 sea level rise scenarios.

A Coastal Inundation Hazard zone for 2010, 2050 and 2100 was mapped based upon the wave inundation model results at each of these time periods. The mapping has been utilised in the risk assessment and options development for this Plan.

The Delft 3D FLOW model was used to investigate the propagation of the overtopped wave in the back beach area. Cardno (2010) found that waves attenuated within 50 m of the top of the back beach area, depending on the back beach level. In only a few cases, a landward flow was identified beyond that distance in model results. The model results were said to be consistent with observations of wave overtopping, for example at Austinmer Beach (Cardno, 2010).

For Lake Illawarra, inundation levels inside the lake due to the ocean water level condition was also modelled (in Delft 3D FLOW). The model results showed inundation levels relating to ocean water

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levels to be consistently lower than water levels from 100 yr ARI catchment rainfall flooding event (not including ocean water levels), at all planning horizons (Cardno, 2010). The additional wave overtopping component was not investigated for Lake Illawarra, as waves were said to be typically small wind waves. Instead, Cardno (2010) assumed wave run-up was attenuated within 10 m landward of the shoreline around the lake foreshores.

Flows from the catchment due to rainfall were not included in the modelling of coastal inundation (as is typical for coastal hazards studies), which may combine with high ocean water levels during a storm to influence inundation of lagoon, creek and lake waterways. Such investigations would typically be conducted as part of catchment flood studies. Likewise the effect of high water levels (without wave overtopping or run-up) into the stormwater system were also not assessed by the Wollongong Coastal Zone Study (Cardno, 2010), and again, this would typically be assessed during a flood modelling study.

The wave inundation modelling does not account for structures such as buildings and stormwater outlets that may modify the dissipation and flow of waves. Overtopping at seawall and coastal protection structures was not specifically calculated. However, the overtopping modelling is still considered suitable for use in preparing management actions to treat areas at high risk.

A detailed description of the Coastal Inundation assessment can be found within the Wollongong Coastal Zone Study (Cardno, 2010).

3.2.3 Geotechnical Hazards

Wollongong LGA has a long history of geotechnical landslip hazards, and long experience in assessing and managing such hazards. The investigations for the Wollongong Coastal Zone Study focussed upon the influence of coastal processes, including wave breaking, run-up and overtopping, sea level rise, and climate change induced shifts in rainfall intensity, upon the area affected by geotechnical hazards.

A Coastal-Influenced Geotechnical Hazard Zone representing the "areas where coastal processes (including climate change) will directly influence geotechnical hazards to 2100" was defined. Geotechnical assessments for proposed or future development should include specific assessment of coastal processes if located within this zone (GHD, 2010).

The geotechnical hazard considered the following coastal processes:

- Wave run-up on representative cliffs in the study region was calculated using empirical formulae for wave run up on rough impermeable slopes (wave run up implicitly includes wave set up), for up to the 100 yr ARI offshore wave height. Sea level rise was included at 2050 and 2100, to feed into the geotechnical investigations of the change in run-up affected areas over the next 100 yrs (Cardno, 2010);
- Wave inundation extents and storm erosion hazard extents were also considered in concert with the geotechnical hazard extent (Cardno, 2010); and
- Rainfall data was used in the geotechnical and slope stability assessments. The 90-days rainfall intensities were calculated using a frequency analysis for rainfall gauge sites in the study area (Bureau of Meteorology gauges at Woonona – Popes Rd, Wombarra – Reef Avenue and Port Kembla – BHP Central Lab), for use in land slip analysis. Climate change parameters

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incorporating an increase in rainfall intensities of 10% by 2050 and 20% by 2100 were then adopted and stabilities re-assessed (Cardno, 2010).

3.2.4 Coastal Entrances and Stormwater Erosion Hazards

While there are numerous entrances to small coastal creeks and lagoons along the Wollongong coastline, the erosion of coastal entrance berms was not defined separately or included in the assessment of beach erosion hazard lines for the study area. It was assumed that entrance breakout processes are being addressed within local catchment flood studies, because entrance breakout is driven by rainfall patterns in the catchment (Cardno, 2010).

For stormwater erosion surrounding outlets, following rainfall events, there is expected to be some scouring of the surrounding beach around the outlets. Cardno (2010) noted, however, that the impact of stormwater drains on the morphology of the whole beach is localised near each individual outlet, and as such did not consider this to influence the definition of the erosion hazard. Thus, stormwater erosion at outlets has not been included in the erosion hazard lines defined.

3.2.5 Sand Drift

The Wollongong Coastal Zone Study (Cardno, 2010) found that, while areas at Windang and Port Kembla had been subject to sand drift as a hazard in the past, extensive dune rehabilitation works at these beaches and elsewhere in the Wollongong coastal zone have effectively mitigated this hazard. Therefore, Cardno (2010) did not investigate sand drift further.

Dune rehabilitation works at City Beach, Bulli Beach and elsewhere have been observed by community to have mitigated the occurrence of windblown sand drifts across adjacent roadways, for example, at Flagstaff Hill. Changes in sediment supply between beaches that may have occurred in relation to dune rehabilitation (for example, between City Beach and Brighton Beach) were not investigated by Cardno (2010). However, dune rehabilitation to capture windblown losses of sediment from the beach system has improved protection for the beaches from storm erosion.



4 COASTAL RISK ASSESSMENT

4.1 Application of a Risk Framework to Coastal Management

A risk-based framework is a robust methodology for dealing with outcomes that are uncertain or have limited data, or for impacts with uncertain timeframes. This approach is therefore particularly applicable to coastal hazards impacts and the impacts of predicted sea level rise, where there is considerable uncertainty regarding when and if impacts will manifest. Uncertainties associated with future climate change presents huge challenges to local government and the wider community, who need to consider and manage future risks. Decisions made today are likely to have ramifications for up to 100 years or more (depending on the development), so consideration of an extended timeframe is essential, even though risks may not manifest for several decades.

The Risk Assessment process utilised for the Wollongong CZMP is adapted from the Australian Standard Risk Management Principles and Guidelines ISO 31000:2009, as described below and presented schematically in Figure 4-1. The use of a risk-based approach for managing coastal hazards is a requirement of the new CZMP guidelines, and accords with current international best practice for natural resource management.

- Establish the Context the requirements of a coastal zone management plan set by NSW Legislation and Guideline documents provides the context for the risk assessment and intended outcomes. The purpose and context for the Wollongong CZMP, including the management objectives derived from the NSW Coastal Policy, are outlined in Chapter 1.
- Identify the Risks the risks arise from the coastal hazards, as defined in the CZMP Guidelines and the Coastline Management Manual (1990), which will impact upon coastal values. Values and hazards assessments were combined with community and stakeholder consultation to identify the risks from coastal hazards, refer Chapter 3.
- Analyse the Risks this involves considering the likelihood and consequence of the identified risks, to determine the overall level of risk (high, medium, low).

The *likelihood* of risks is largely related to the extent of coastal hazards, now and in the future. Analysis of the likelihood of erosion and recession, coastal inundation at 2010, 2050, 2100 and for geotechnical hazards between 2010 – 2100 is described in Section 4.2.

The *consequence* of the risks will largely relate to the extent of existing or future development and the values (e.g. aesthetic, recreational, ecological) associated with land and assets within the coastal zone. The coastal assets mapping and incorporation of community consultation outcomes was used to determine consequence of coastal risks in Section 4.3.

The consequence and likelihood were combined (using GIS processing) to determine and map the *level of risk* for assets and land in the coastal zone. The level of risk was revised to include existing controls that may reduce the level of risk. Risk analysis and mapping is illustrated in Appendix A.

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Figure 4-1 Risk Management Framework (ISO 31000:2009) adapted to Coastal Zone Management

30



- Evaluate the Risks in consultation with Council and other stakeholders, the level of risk that is deemed acceptable, tolerable and intolerable was determined. The evaluation criteria determine the intolerable risks that must be treated as a priority, to which management effort shall be directed, refer Section 4.6.
- Treat the Risks the process of developing coastal management options is directly related to
 reducing or eliminating intolerable risks where possible. Tolerable (low) risks can be flagged for
 monitoring, with no further resources necessary. Management options can be designed to
 reduce the likelihood of the risks (e.g. planning setbacks to reduce the likelihood of shoreline
 recession impacts), or reduce the consequence of the risk (e.g. emergency management to
 reduce the consequence of shoreline recession) or both. A cost benefit analysis is then used to
 determine the pros, cons and trade-offs for the options, based on economic, social and
 environmental goals. A strategic framework and management options is detailed in Chapter 5.

For existing development given the uncertainty and timeframes over which hazards may manifest, a trigger for implementing the options has been flagged. Setting triggers ensures the management option and associated resources are not utilised until it is absolutely necessary to do so, which is particularly important for difficult and costly, but necessary, options. This is described further in Section 4.6.1.

 Implement Management Strategies (Risk Treatments) – The coastal zone management plan provides the forum to detail how the recommended management options (risk treatments) shall be implemented (costs, timeframes etc) and funded. Ongoing monitoring and review of both the risks and management options is also detailed. Plan implementation is detailed in Chapter 7.

4.2 Analysis of Risk Likelihood

The likelihood scale used for the risk assessment was developed specifically for this project, to account for both the timeframes over which coastal processes occur and present a hazard to property and coastal values, as well as the planning timeframes over which risk must be assessed and accounted for. The description of timeframes from Council's Enterprise-wide Risk Management Likelihood Table was too short to apply to landuse planning or the timeframes over which coastal hazards pose a significant risk. However, aspects relevant to the description of coastal hazard likelihood from Council's Likelihood Table have been incorporated into a customised scale given in Table 4-1.

4.2.1 Likelihood of Erosion and Inundation Hazards

The likelihood ascribed to the erosion / recession and coastal inundation hazard lines aims to incorporate the key concept associated with sea level rise, whereby the likelihood of an erosion or inundation impact increases over time and with proximity to the ocean. The concept of increasing likelihood overtime is demonstrated in Figure 4-2. The likelihood values ascribed to the hazard lines are given in Table 4-1. The likelihood values were assigned spatially (within GIS) to each of relevant hazard zones mapped in the Wollongong coastal zone.

At the present time (without sea level rise), the defined coastal erosion hazard is considered "possible". The erosion event described by the mapping is recorded in the photogrammetric survey record for the beaches. The hazard estimates for storm erosion at 2010 were determined based upon design storm criteria (a 100 year average recurrence interval wave height and water level), which

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For the present timeframe, a likelihood has also been ascribed to the 2050 and 2100 hazard lines. This aims to incorporate historical erosion events that have been recorded further landward than the 2010 hazard lines, for example, in the photogrammetric data at Coledale, Corrimal, City and Port Kembla / Perkins beaches. Ascribing an "unlikely" possibility to the 2050 hazard line is appropriate, as there has indeed been a history of isolated and infrequent occurrence.

As noted above, the 2010 hazard estimates are based upon design storm criteria. However, design storm criteria do not necessarily produce a design or maximum storm erosion extent. For example, the design erosion may be due to a series of closely spaced storms. Wave direction may also be important in the potential extent of erosion, which drives longshore sediment transport and will result greater or lesser erosion at different sections of the beach. The SBEACH model used to derive the 2010 estimates does not account for longshore sediment transport. Lastly, there is potential for storm events larger than historically recorded. For this reason, a "rare" likelihood was ascribed to the 2100 hazard estimates for the current time period, to account for potentially greater storm impacts than historically recorded or estimated, but clarifying that such events would indeed be highly unlikely(similar to the probable maximum flood used in flood mapping).

By the 2050 timeframe when the effects of sea level rise has begun to manifest as recession of the sandy shoreline and inundation into estuaries, it has become more likely that erosion to defined hazard lines at 2010, 2050 and 2100 will be experienced. Indeed, erosion to the 2010 line is expected to be occurring frequently, but erosion beyond the 2050 line would still be relatively infrequent and isolated.

Likewise as sea level rise progresses to 2100 projections, further recession of the sandy shoreline and inundation into estuaries is expected to have occurred. Once again, the probability of experiencing erosion to the defined 2010, 2050 and 2100 lines will have increased. Indeed, the 2010 erosion hazard line is likely to be occurring with every regular storm, or more often.

The possibility that sea level rise will not manifest is also catered for within this approach: at each timeframe, it is not assumed that the relevant hazard line for that timeframe is absolutely certain or even 'almost certain'. The possibility that sea level rise will not occur needs also be considered when developing future management options. This is done through prescribing likelihood to hazard extents, as well as setting triggers for implementation of management actions (refer Section 4.6.1) that are event based rather than time based.


| Probability | Description | | | |
|----------------|--|--|--|--|
| Almost Certain | There is a high possibility the event will occur as there is a history of frequent occurrence. | | | |
| | The event is expected to occur in most circumstances. | | | |
| Likely | It is likely the event will occur as there is a history of casual occurrence. | | | |
| | The event has occurred several times or more in the past. | | | |
| Possible | The event has occurred at least once in the past and may occur again. | | | |
| Unlikely | There is a low possibility that the event will occur, however, there is a history of infrequent and isolated occurrence. | | | |
| Rare | It is highly unlikely that the event will occur, except in extreme / exceptional circumstances, which have not been recorded historically. | | | |
| | | | | |

Table 4-1 Risk Likelihood / Probability, Coastal Hazards

| Probability | | C C | At 2100 |
|----------------|---------------------------|---------------------------|---------------------------|
| Almost Certain | | At 2050 | 2010 erosion / inundation |
| Likely | At 2010 | 2010 erosion / inundation | 2050 erosion / inundation |
| Possible | 2010 erosion / inundation | 2050 erosion / inundation | 2100 erosion / inundation |
| Unlikely | 2050 erosion / inundation | 2100 erosion / inundation | |
| Rare | 2100 erosion / inundation | | - |

Figure 4-2 Increasing Likelihood of Hazards Over Time with Sea Level Rise

Table 4-2 Likelihoods Ascribed to Erosion and Coastal Inundation Hazards at Each Timeframe

| | XO | Timorramo | |
|-----------|-------------------------------|------------------------------|----------------|
| Timeframe | Erosion / Recession Hazard | Coastal Inundation Hazard | Likelihood |
| | 2010 ZRFC line | 2010 OI line | Possible |
| 2010 | 2050 ZRFC line | 2050 OI line | Unlikely |
| | 2100 ZRFC line | 2100 OI line | Rare |
| 2050 | 2010 ZRFC line | 2010 OI line | Likely |
| | 2050 ZRFC line | 2050 OI line | Possible |
| | 2100 ZRFC line | 2100 OI line | Unlikely |
| 2100 | 2010 ZRFC line | 2010 OI line | Almost Certain |
| | 2050 ZRFC line | 2050 OI line | Likely |
| | 2100 ZRFC line | 2100 OI line | Possible |

* Where ZRFC is the Zone of Reduced Foundation Capacity associated with an erosion escarpment; and OI refers to Oceanic Inundation, which is also referred to as Coastal Inundation

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4.2.1 Likelihood of Geotechnical Hazards

At all timeframes, the Geotechnical hazard line remains 'rare'. The methodology used to develop the coastal hazard area is considered conservative, and typically falls within areas of existing landslip hazard. Further, the zone was developed for the 2010 to 2100 timeframe (specific 2010 and 2050 hazards were not defined).

The likelihood values were assigned spatially (within GIS) to each of relevant hazard zones mapped in the Wollongong coastal zone.

| Timeframe | Geotech Hazard Line | Likelihood |
|-----------|---------------------|------------|
| 2010 | Geotech Hazard Line | Rare |
| 2050 | Geotech Hazard Line | Rare |
| 2100 | Geotech Hazard Line | Rare |
| of Risk C | Consequence | amen |

Table 4-3 Likelihood Ascribed to Coastal Induced Geotechnical Hazard at Each Timeframe

4.3 Analysis of Risk Consequence

A consequence scale was developed for this project to capture the community, cultural and essential services aspects that may be impacted by coastal hazards over the relevant planning timeframes, as given in Table 4-4. Council's existing Enterprise-wide Risk Management Risk Ranking Tool Severity Table was also utilised with respect to Property (economic) and Environment consequences, as given in Table 4-4. The scale was utilised in deriving a consequence value for the various assets and land in the coastal zone that is affected by the different coastal hazards.

4.3.1 Coastal Assets and Values

A variety of coastal "assets" representing various land uses, facilities and features, including environmental features, of the Wollongong Coastal Zone were delineated based upon Geographical Information Systems (GIS) processing of:

- spatial mapping of land zoning, land tenure, cadastre and aerial photography;
- mapping of stormwater assets, heritage items, parks, public buildings, cycleways, roads, vegetation condition, endangered ecological communities;
- information regarding assets (social, cultural, recreational, economic) from various reports, such as noted below; and
- details from community consultation, including meetings within Council's departments, Committee, Community Workshops including one-on-one conversations, which assisted in determining specific information about individual assets.

The assets delineated across the Wollongong coastal zone are listed in Table 4-5.



| Consequence | Community | WCC Property (Economic) | WCC Environment |
|---------------|---|--|--|
| Catastrophic | Widespread permanent impact to community's services, wellbeing, finances, <u>or</u> culture (eg, > 75 % of community affected), or international loss, or no suitable alternative sites exist | Damage to property, plant and equipment, finances > \$5 million | Catastrophic event (e.g. habitat destruction) with national impact (e.g. endangered species) for more than one year |
| Major | Major permanent or widespread medium term (somewhat reversible) disruption to community's services, wellbeing, finances, <u>or</u> culture (eg <50 % of community affected), or national loss, or Only a few suitable alternative sites exist | Damage to property, plant and equipment, finances >\$2 million - \$5 million | Major event (e.g. creek contamination) with regional impact (e.g. lake, escarpment) for more than one year |
| Moderate | Minor long term or major short term (mostly reversible) disruption to services, wellbeing, finances, <u>or</u> culture of the community (eg, <25 % of community affected), or regional loss, or Some suitable alternative sites exist | Damage to property, plant and equipment, finances >\$100,000 - \$2 million | Major event (e.g. creek contamination) with regional impact (e.g. lake, escarpment) for between one month and one year |
| Minor | Small medium – short term (reversible) disruption to services, wellbeing, finances, <u>or</u> culture of the community (eg, <10 % of community affected), or local loss, or many alternative sites exist | Damage to property, plant and equipment, finances >\$10,000 -\$100,000 | Minor event (e.g. 20 It oil spill) with localised impact (e.g. street, precinct) for less than one month |
| Insignificant | Very small short term disruption to services, wellbeing, finances, <u>or</u> culture of the community (eg, <5 % of community affected), or neighbourhood loss, or numerous alternative sites exist | Damage to property, plant and equipment, finances <\$10,000 | Negligible event (e.g. noise pollution) with localised impact (e.g. street, precinct) for less than one month |

| Table 4-4 | Risk Conseq | uence Scale | for Coastal | Hazards |
|-----------|--------------------|-------------|-------------|---------|
|-----------|--------------------|-------------|-------------|---------|

A series of maps of coastal assets in Wollongong were generated. The asset maps provided the blueprint for determining the values associated with coastal land and assets.

Information regarding the coastal assets was gathered to help value the assets. Detailed information for each asset at each beach (where available) was tabulated into a series of Beach Asset and Consequence Tables, as provided in Appendix E.

The detailed information drew upon the following information sources:

• Review of relevant reports, plans and documents for the Wollongong Coastal Zone, including available estuary management plans, Plans of Management for community and crown lands, masterplans and recreational strategic plans, floodplain management plans, regional biodiversity strategies, and the Wollongong Coastal Zone Study (Cardno, 2010), which is summarised in Section 1.7 of the Wollongong CZMP: Implementation Action Plan. The reference list to this document includes the reports utilised;

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- Detailed meetings with individual departments within Council;
- Outcomes from four community workshops, utilising both a generic worksheet task plus one-onone conversations; and
- Workshop with the Committee.

The values information and outcomes of community consultation formed the basis of determining the consequence of impact from the coastal hazards.

| Coastal Assets Categories and Asset item | IS |
|---|---|
| Parks, Beaches and open space | Transport Infrastructure |
| Beaches | Major (arterial) roads, bridges |
| Parks, Public open space / reserves | Local Roads, (including car parks) |
| Private recreational land (e.g. golf courses, football grounds, bowls clubs, tennis courts) | Railway systems |
| Wetlands / Forests / Other Habitats (including estuary entrances) | Jetties, wharves, boat ramps |
| Coastal Dune Systems | Harbours |
| Community Infrastructure | Water and sewage infrastructure |
| Surf Clubs | Stormwater outlets and pipes |
| Caravan Parks | Sewage Treatment Plants, sewage pumping stations, water supply networks |
| Heritage / Historic Sites and Significant Aboriginal Sites | Residential Development |
| Heritage Norfolk Island Pines | Existing Residences |
| Cycleway / Shared Pathway | Vacant Land (Future Development) |
| Ocean Pools | Commercial and Industrial Development |
| Community halls, libraries, other public buildings | Institutional Infrastructure |
| Amenities blocks, sheds, etc (Council facilities / assets) | Hospitals, Hospices |
| Lifeguard towers | Schools, child care facilities |
| | Aged care facilities |

 Table 4-5
 Coastal Asset Categories and Items

4.3.2 Consequence from Coastal Hazards

The coastal assets and values information for the different asset categories was used to determine:

- a generic consequence value for each asset type and each hazard, as given in Table 4-6; and
- a separate consequence value for specific assets where it was apparent from the values assessments that a higher or lower consequence should be applied (i.e. because the specific asset or value was determined to be exceptional from other similar assets in the LGA), as given in the Beach Asset and Consequence Tables, Appendix E.

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The consequence values were assigned spatially (within GIS) to each of the generic and specific assets mapped across the LGA.

A separate consequence value was ascribed for the erosion and geotechnical hazards compared with the coastal inundation hazard, as the types of impacts are different, even though the value of the land may be the same. The impacts from both erosion and recession and geotechnical land failure are permanent and irreversible. That is, once recession has undermined a house on a sandy dune or landslip has undermined a house on a cliff, the loss of the land is permanent. In contrast, coastal inundation resulting in flooding of property is a short term reversible phenomenon, as the water recedes after the storm surge and tide ebbs.

It is worth emphasising that the coastal inundation hazard is different from permanent inundation due to sea level rise. The coastal inundation hazard refers to elevated water levels during a coastal storm that may overtop dunes, or penetrate into estuaries, causing flooding of adjacent property. Coastal inundation will be exacerbated over time by sea level rise, causing an increase in the frequency and water depth during such events.

This plan has attempted to consider permanent inundation due to sea level rise where feasible in developing management options. That is, many of the treatment options for inundation or recession would additionally manage permanent inundation. However, specific focus to address permanent inundation due to sea level rise is not within the context of this CZMP.

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| Table 4-6 | Consequence Ascribed | to Assets and Land in the | Wollongong Coastal Zone |
|-----------|-----------------------------|---------------------------|--------------------------------|
| | | | |

| Coastal Assets | Consequence | Reason: Erosion & Geotechnical Hazards (i.e. permanent loss of land) | Consequence | Reason: Coastal Inundation Hazard (i.e. periodic inundation during storms) |
|--|-------------|---|---------------|--|
| Parks, Beaches and open space | e | | | |
| Beaches | Major | From all sectors of community, the beach amenity itself is rated extremely highly. Regardless of peoples interest point, whether this be for scenic amenity, recreation, tourism or environmental reasons, virtually every respondent noted the beauty and importance of Wollongong's beaches both to them and to the region's visitors. At the current time period, the beach will generally recover from storm erosion events, although following large storm events this can take a number of years, during which time the beach may be less usable by community. Sea level rise has already commenced at measured rates, therefore we may expect recovery following storms to become increasingly subdued until such point as the loss of sand is irreversible. | Insignificant | The impact of inundation (<u>as separate from erosion</u>) would occur over a short period (a few hours), resulting in a minor nuisance to the community, and causing little to no damage to the value of this asset. |
| Parks | Moderate | These areas will still remain functional even if reduced in size by erosion. They also serve as a buffer to allow roll back and therefore retention of the beach amenity. There may be some financial and social costs associated with specific facilities within parks (e.g. sports grounds, shelters, sports pitches etc), that make impacts of greater consequence to community. | Minor | The impact of inundation (as separate from erosion) would occur over a short period (a few hours), resulting in a minor nuisance to the community, and causing little to no damage to the value of this asset. |
| Public open space / reserves | Minor | These areas will still remain functional even if reduced in size by erosion. They also serve as a buffer to allow roll back and therefore retention of the beach amenity. | Insignificant | The impact of inundation (as separate from erosion) would occur over a short period (a few hours), resulting in a minor nuisance to the community, and causing little to no damage to the value of this asset. |
| Private recreational land (e.g. golf courses, football grounds, bowls clubs, tennis courts) | Minor | As per the Committee's response, private recreational land may have some economic value but to limited users, thus should therefore be ranked below Community's land. | Minor | The impact of inundation (as separate from erosion) would occur over a short period (a few hours), resulting in a minor nuisance to the community, and causing limited damage to the value of this asset. |
| Wetlands / Forests / Other Habitats | Moderate | Where beach recession occurs slowly enough, habitats will have the ability to migrate. However, areas that are backed by development will not be able to migrate. Areas of high habitat value (where identified through EEC or vegetation mapping) have been highlighted where possible. It is noted that The Illawarra Regional Biodiversity Strategy in determining priorities and habitat value did not account for the impacts of existing coastal processes, sea level rise or periodic inundation that may affect habitat value and areas for priority rehabilitation. | Minor | Given that inundation during storms may last for only a short period, most habitats should withstand such impacts. There are some wetland habitats that may be improved by inundation due to sea level rise, particularly where they are afforded area for migration. However, areas that are backed by development will not be able to migrate. Areas of high habitat value (where identified through EEC or vegetation mapping) have been highlighted where possible. It is noted that The Illawarra Regional Biodiversity Strategy in determining priorities and habitat value did not account for the impacts of existing coastal processes, sea level rise or periodic inundation that may affect habitat value and areas for priority rehabilitation. |



COASTAL RISK ASSESSMENT

| COASTAL RISK ASSESSMENT | | | 39 | |
|---|-------------|--|---------------|---|
| Coastal Assets | Consequence | Reason: Erosion & Geotechnical Hazards (i.e. permanent loss of land) | Consequence | Reason: Coastal Inundation Hazard (i.e. periodic inundation during storms) |
| Coastal Dune Systems | Major | It is recognised across the broader community that dunes are vitally important, providing sand reserves to buffer land and property from the impacts of erosion. Many of the dunes were established since the 1970s. In many places the dunes have limited ecological value, and / or said to be infested by weeds and pests. However, they have significant value as an erosion buffer requiring maintenance into the future. | Insignificant | The impact of inundation (<u>as separate from erosion</u>) would occur over a short period (a few hours), resulting in a minor nuisance to the community, and causing little to no damage to the value of this asset. |
| Community Infrastructure | | | | |
| Surf Clubs | Major | Many community members noted the importance of the surf clubs both as assets to bring a sense of community, as well as tourism assets based upon the provision of patrolled beaches for visitors. There may be commercial value through the use of clubs to provide restaurants / kiosks/ bars for community and visitors also, in sought after beach setting. Loss of this asset through erosion or geotechnical landslip would be irreversible. | Moderate | The impact of inundation (<u>as separate from erosion</u>) may cause damage to this asset and its interiors, however the damages are repairable. |
| Caravan Parks | Minor | These facilities, while often being commercially / financially important to Council, may be important to visitors, but less so to the resident community. They are also easily relocated or adapted. | Minor | The impact of inundation (<u>as separate from erosion</u>) may cause damage to this asset and its interiors, however the damages are repairable. |
| Heritage / Historic Sites and Significant Aboriginal Sites | Major | There are many different public buildings, other built structures and sites/areas of local to state significance. In general, the sites have a range of community values, such as cultural, aesthetic and even commercial /tourism value. Further, damages and losses from erosion or geotechnical landslip are irreversible. | Moderate | The impacts of periodic inundation during storms (including sea level rise) may cause damage to interior and items within the buildings, however is largely reversible and repairable. There are many different public buildings, other built structures and sites/areas of local to state significance. In general, the sites have a range of community values, such as cultural, aesthetic and even commercial /tourism value. |
| Heritage Norfolk Island Pines | Minor | Norfolk Island Pines are a marker of settlement in the coastal zone and the foreshore and there are currently restrictions on development near the pines or their removal. However, the pines have a limited lifespan and many of the pines are aging and likely to perish over the next 100 years. The trees can and will be replanted over the future, in which case they could be relocated. In a relative sense then, the pines would be considered lower importance / value than other assets, particularly as only a few specific trees may be affected and which shall need to be replaced over time regardless. | Insignificant | Inundation of Norfolk Island Pines over a short period during a storm would cause little if any long term impact. Norfolk Island Pines are a marker of settlement in the coastal zone and the foreshore and there are currently restrictions on development near the pines or their removal. However, the pines have a limited lifespan and many of the pines are aging and likely to perish over the next 100 years. The trees can and will be replanted over the future, in which case they could be relocated. |
| Cycleway / Shared Pathway | Moderate | The cycleway / shared pathway is an important, highly utilised community asset. It also offers an effective use of high risk coastal land that can be relocated in the future (e.g as part of maintenance scheduling). Sections of cycleway have been relocated or maintained for coastal erosion in the past (e.g. Waniora Point) | Minor | The cycleway / shared pathway is an important, highly utilised community asset. It also offers an effective use of high risk coastal land that can be periodically inundated during high water levels during storms. Permanent inundation due to sea level rise however would have a permanent impact upon the value of this asset, however this would be accompanied by erosion impacts (thus can be managed through this process). |



COASTAL RISK ASSESSMENT

| COASTAL RISK ASSESSMENT | | 40 | | |
|---|-------------|---|---------------|---|
| Coastal Assets | Consequence | Reason: Erosion & Geotechnical Hazards (i.e. permanent loss of land) | Consequence | Reason: Coastal Inundation Hazard (i.e. periodic inundation during storms) |
| Ocean Pools | Major | Various pools have been rated more or less highly, relating to their patronage and potential to withstand future impacts. Permanent inundation due to sea level rise would have a permanent impact upon the value and effectiveness of this as a public asset. Impacts from storm waves may also cause damage to these assets (albeit reversible). | Minor | Various pools have been rated more or less highly, relating to their patronage and potential to withstand future impacts. Periodic inundation during storm events is unlikely to affect the value and effectiveness of this as a public asset in the long term. |
| Community halls, libraries, other public buildings | Moderate | These facilities are considered in a similar manner to commercial and industrial development with respect to consequence of impact for the community. | Moderate | The impact of inundation (as separate from erosion) may cause damage to this asset and its interiors, however the damages are repairable. |
| Amenities blocks & sheds (Council facilities / assets) | Minor | It is important for such facilities to be provided to the community, however the buildings themselves are not of high value, and can be relocated or replaced. | Insignificant | The impact of inundation (<u>as separate from erosion</u>) may cause minor damage to this asset and its interiors, however the damages are repairable. It has been assumed that the level of inundation to amenities blocks would not affect the workings of the sewerage system at these sites. |
| Lifeguard towers | Minor | These assets can be replaced easily, the structure itself is of low value (the lifeguard services is the item of value) | Insignificant | Lifeguard towers are typically located high above ground, therefore the interior of the asset is protected from damage from periodic inundation. |
| Transport Infrastructure | | | | |
| Major (arterial) roads, bridges | Major | Arterial roads are the key conduits for traffic flow within the regional community. Damage or loss that blocks or impedes these routes would indeed cause major disruption to the community. | Major | Inundation across major traffic routes may have impacts upon the safety and access for community particularly during storms where access is important |
| Local Roads, (including car parks) | Minor | So long as access to the beach, to private property or effective transport routes to major roads for residents can be maintained, the permanent loss of local roads is of lesser importance to the functioning of the greater community. | Moderate | Inundation across minor traffic routes may have impacts upon the safety and access for community particularly during storms where access is important |
| Railway systems | Major | Railway assets are of regional economic and social importance | Moderate | Inundation across railway systems may have greater regional economic and community impacts while such systems are affected, however the impacts are reversible and not permanent. |
| Jetties, wharves, boat ramps | Minor | These features typically service few community members, compared with other transport infrastructure (and they can be raised or relocated easily) | Minor | These features typically service few community members, compared with other transport infrastructure (and they can be raised or relocated easily) |
| Harbours | Major | There are very few such features on the open coast, therefore they are of high community and economic value. The majority of harbours are also heritage listed. Permanent inundation due to sea level rise would have a permanent impact upon the functionality of the harbours as a community asset. Impacts from storm waves may also cause damage to these assets (albeit reversible). | Minor | There are very few such features on the open coast, therefore they are of high community and economic value. The majority of harbours are also heritage listed. Periodic inundation during storms would typically be expected over the life of the harbour, and unlikely to permanently affect the functionality of the harbours as a community asset. |



COASTAL RISK ASSESSMENT

| Coastal Assets | Consequence | Reason: Erosion & Geotechnical Hazards (i.e. permanent loss of land) | Consequence | Reason: Coastal Inundation Hazard (i.e. periodic inundation during storms) |
|---|-------------|---|---------------|--|
| Water and sewage infrastructur | e | | | |
| Stormwater outlets and pipes | Major | These assets provide an important service to the community, and are often very expensive infrastructure with long expected design life (75 -100 yrs). Replacement can be difficult and costly. Careful design to maintain future functioning of this service will be required | Major | These assets provide an important service to the community, and are often very expensive infrastructure with long expected design life (75 -100 yrs). Replacement can be difficult and costly. Careful design to maintain future functioning of this service will be required |
| Sewage Treatment Plants, sewage pumping stations, water supply networks | Major | Provide a vital service to social health and functioning. | Major | Provide a vital service to social health and functioning. The impacts from inundation may potentially have significant environmental and community impacts, even where this is reversible. |
| Residential Development | | | | |
| Existing Residences | Moderate | For the general public, other community assets would be rated more highly. For the individual owner, this asset is of very high importance. Losses in relation to erosion or geotechnical landslip are irreversible. | Moderate | For the general public, other community assets would be rated more highly. For the individual owner, this asset is of very high importance. The economic impact from inundation of private residential property could potentially be substantial. However, damages are repairable. |
| Vacant Land (Future Development) | Minor | There may be financial implications for the owners of such land, however impacts to vacant land have minimal effect upon the broader community. | Insignificant | Periodic inundation of vacant land may have minimal effect upon the broader community and cause little if any damage. |
| Commercial and Industrial Development | Moderate | Commercial and Industrial development is largely relocatable, and while it contributes to the greater economic good, many businesses would expect to move or relocate over the typical life of a business | Moderate | Commercial and Industrial development is largely relocatable, and while it contributes to the greater economic good, many businesses would expect to move or relocate over the typical life of a business. The economic impact from inundation of businesses could potentially be substantial. However, damages are repairable. |
| Institutional Infrastructure | | | | |
| Hospitals, Hospices | Major | Such facilities are socially vital, while the building is typically highly financially costly to build and fit out, making relocation of the physical asset difficult. | Major | Such facilities are socially vital, while the building is typically highly financially costly to build and fit out, making relocation of the physical asset difficult. During periodic inundation events, damages or loss of services from this asset is of significant impact to community. |
| Schools, child care facilities | Moderate | Such facilities are highly important to the community, however the grounds and buildings can be relocated / replaced | Moderate | Such facilities are highly important to the community, however the grounds and buildings can be relocated / replaced |
| Aged care facilities | Moderate | Such facilities are highly important to the community, however the grounds and buildings can be relocated / replaced | Moderate | Such facilities are highly important to the community, however the grounds and buildings can be relocated / replaced |



41

4.4 Incorporating Existing Controls

Existing controls such as provisions in the LEP or DCPs, POMs, or other strategic plans, including estuary and floodplain management plans need to be incorporated into the assessment of risk, as such controls may reduce the level of existing risk (likelihood and / or consequence).

The review of the legislative context for the CZMP given in Chapter 2 has provided details regarding the key legislative and policy controls applicable to the coastal zone, including the LEP, DCP and POMs for Wollongong. The range of existing management strategies has been reviewed and incorporated where possible within the assessment of risk to specific and generic assets, such as detailed within the Beach Asset and Consequence Tables, in Appendix E. This includes those aspects of the existing estuary management plans, floodplain management plans, biodiversity strategy, masterplans and POMs for the coastal zone.

In most cases, however, the existing controls require some modification or update to adequately modify the level of risk from coastal hazards. In their present form, the existing LEP, DCP and POM provisions are inadequate to manage the risk from erosion and recession. With minor modification, DCP Chapter E12 – Geotechnical Assessment would adequately manage the coastal influenced geotechnical hazard area. Existing provisions in DCP E13 – Floodplain Management provide controls for those areas affected by backwater inundation from the sea where such areas are coincidentally at risk from catchment flooding. The provisions could be expanded to apply to those areas affected by backwater inundation from have any flood planning controls, to manage future development and re-development.

The preparation of management options has included both recommended changes to existing controls that may better address coastal risks and made note of synergies between management options and existing strategic plans where relevant.

4.5 Analysis of the Level of Risk

The Risk Score Matrix from Council's Enterprise-wide Risk Management Risk Ranking Tool was utilised to determine the level of risk as a result of *likelihood* x *consequence*, given in Table 4-7.

Risk maps for the Wollongong coastal zone demonstrating the level of risk to assets from coastal hazards have been prepared. As noted above, the likelihood and consequence values were assigned spatially (in GIS) to the hazard zones and assets respectively. Through GIS processing, the two spatial values (consequence and likelihood) were combined to produce an overall level of risk, using the risk matrix scores in Table 4-7. Separate Risk Maps for Erosion and Recession, Coastal Inundation and Geotechnical hazards for the immediate, 2050 and 2100 timeframes are provided in Series A to C, Series D to F and G respectively in Appendix A.

A risk register for each beach listing the assets predicted to be affected by hazards, and the level of risk associated with each hazard has been derived from the risk maps across the coastal zone. The risk register and risk maps form the basis for prioritising and specifying management options for the various assets at each beach, in the following chapter. The risk register, immediate risk map and management options are presented for each beach in Chapter 6.

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| | | | (| CONSEQUENCE | E | |
|------------|-------------------|---------------|--------|-------------|---------|--------------|
| | | Insignificant | Minor | Moderate | Major | Catastrophic |
| | Almost Certain | Medium | High | Extreme | Extreme | Extreme |
| LIKELIHOOD | Likely | Low | Medium | High | Extreme | Extreme |
| | Possible | Low | Medium | Medium | High | Extreme |
| | Unlikely | Low | Low | Medium | Medium | High |
| | Rare | Low | Low | Low | Low | Medium |

Table 4-7 Risk Score Matrix

4.6 Risk Evaluation: Priorities for Treatment

Determining which risks to treat as part of the CZMP is based upon Council (and the community's) tolerance to risk. In most cases it would be expected that low risks can simply be monitored, rather than demand valuable management resources, while extreme or high risks require more immediate management attention. A risk tolerance scale is used to determine which risks/locations/assets must be addressed as a priority.

The risk tolerance scale utilised in this project is taken from Council's Enterprise-wide Risk Management Risk Ranking Tool, which in discussion with Council was determined to be appropriate for this project. The risk tolerance scale outlines the action required for different levels of risk, as given in Table 4-8.

| Risk Level | Action required | Tolerance |
|----------------|---|-------------|
| Extreme / High | Immediate action required; Eliminate or Reduce the risk or Accept the risk provided residual risk level is understood | Intolerable |
| Medium | Reduce the risk or Accept the risk provided residual risk level is understood | Tolerable |
| Low | Accept the risk; Manage by routine procedure | Acceptable |

| Table 4-8 Risk Tolerance Sca |
|------------------------------|
|------------------------------|

43

4.6.1 Timeframe and Triggers for Action

The timeframe over which risks may manifest offers an additional consideration in the prioritisation (and implementation) of management action. For example, the risk level may be tolerable (medium) at the current time (2010), however, it may be predicted to increase to intolerable (high) by the 2050 timeframe. In this case, a management action introduced now may be premature, particularly as there is uncertainty as to the exact timing of the hazard impact.

Particularly where the most suitable management options are costly, difficult to implement or unpalatable for community to accept, determining when to act will be important to ensure that such actions are only implemented when it becomes necessary. The trigger approach is most applicable to existing development, while future developments can be managed through development controls.



Figure 4-3 Adaptation Action Continuum Model (Fisk and Kay, 2010)

Fisk and Kay (2010) developed the Adaptation Action Continuum Model (see Figure 4-3) as part of climate change adaptation planning, however, this method is also equally applicable to coastal hazards management. The method was developed in recognition that at some point in the future, difficult decisions with more significant trade-offs will need to be made.

For risks identified as intolerable in the future, the method involves identifying one or more trigger points that are a flag to managers for when more aggressive or decisive actions must be

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The risk register and risk mapping for assets at each beach demonstrates the risk level over the immediate (2010) and future (2050 and 2100) timeframes. Management options have been flagged for those existing assets / development types deemed to be at an intolerable level of risk from coastal hazards. The timeframes over which intolerable risks are expected to manifest can be used to determine triggers for existing development. If the expected timeframe is sufficiently long (or risk is low at the present time), the asset replacement or redevelopment cycle may be used as a trigger to implement controls. Where the timeframes for impact are shorter, triggers relating to the hazard itself will be more appropriate. Management options and relevant triggers are presented in Chapter 5.

enevant triggers are present.



5.1 Introduction

This Chapter describes the available options to treat coastal risks for future and existing development. The options are separated according to the type of option, and may treat more than one risk, that is, erosion and recession as well as coastal inundation. The options as they apply to individual assets at each beach, according to the risk level, are presented in Chapter 6.

The management options were developed from various sources including the NSW Coastline Management Manual (1990), NSW Guidelines for Preparing Coastal Zone Management Plans (DECCW, 2010), the First Pass National Assessment of Climate Change Risks to Australia's Coast (2009), the NSW Coastal Planning Guideline: Adapting to Sea Level Rise (2009) and other coastal management plans and studies. Following on from this, discussions with the Committee and Council enabled further refinement, as well as more local and site specific options to be developed.

5.2 Whole of Council Approach to Coastal Risk Management

In the past, without a whole of LGA coastal hazards assessment or management plan, consideration of coastal hazards in Council decision making has been undertaken on an as needs basis. In some cases this has meant decisions are made prior to assessing risk from coastal hazards, then retrospectively designing the asset or infrastructure to cater for a hazards impact. For example, only one of the existing Community and Crown Lands Plans of Management (POMs) for coastal areas specifically note coastal hazards as an issue requiring consideration in planning new facilities, structures or uses of the land.

With a CZMP in place, including hazard lines, coastal risks can now be considered at the outset in Council decision making. From a whole of Council / LGA perspective, this is a crucial milestone, particularly as Council is the owner of key assets affected by coastal hazards, and can set the benchmark for private landholders and community in the coastal zone.

While specific public assets at risk are discussed in Chapter 6, listed below are over-arching actions that should be undertaken by Council to better incorporate coastal risk management into Council decision making processes.

1 Consideration of coastal hazards in all levels of Council decision making.

Key areas where better consideration of coastal hazards is needed include:

• Preparation of Community & Crown Land Plans of Management and Masterplans. In the past, decisions regarding facilities and works as described in such plans considered hazards once the decision to refurbish or construct a facility had been made from the Masterplan perspective. Now that hazard lines are available, the development of such plans should consider the hazard extents and timeframes prior to specifying actions within such plans. That is, depending on the expected life of a facility it may or may not be appropriate to construct within a 2050 hazard area. Once again, guidance as to appropriate timeframes for development is given in the Future Development section.

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- Consideration of hazards and development controls for Council works not requiring development consent. Where development consent is required for a Council action, then the DCP controls apply. However, there are many works undertaken by Council where development consent is not required (for example, environmental management works under SEPP Infrastructure (2007)). In this case, there needs to be an internal process for taking consideration of coastal hazards constraints when undertaking exempt development by Council. Part of this will be through internal Council education (see below), however, a checklist or guideline should be prepared for internal Council use for exempt developments.
- Asset Management: At the present time, the management of assets does not take into consideration the risk to an asset from coastal hazards when prioritising asset replacement or maintenance, nor are replacement assets flagged as requiring redesign to accommodate coastal hazards. This applies to all types of council assets (public buildings, stormwater, roads, footpaths, etc). This is considered further as a separate "No regrets" action (refer NR1 in Section 5.4.1), to ensure that the timeframe for and type of hazard impact is factored into Council's prioritisation of asset replacement and maintenance schedules, particularly for larger, more costly assets such as stormwater infrastructure or public buildings.
- 2 Conduct internal Council training to educate the different departments about coastal hazards and the coastal hazard lines, to support greater consideration of hazards in Council planning.

The aim of internal education is two-fold. First, this allows better use of the existing hazard mapping in preparing decisions internally by Council, for example, in prioritising asset replacement or designing assets for hazard impacts. Second, it will facilitate explanation of the hazards to community by Councillors, particularly as planning and other actions may affect the general community.

There is a need for better education within Council (and the general community, see below) regarding what the hazard lines mean and how they should be utilised and applied.

3 Prepare a foreshore building line for entire LGA based upon the existing hazard lines

The foreshore building line would present the starting point from which setbacks for development can be drawn. This would be a key tool for use in managing future development and redevelopment in conjunction with a Coastal Management DCP (refer Section 5.3). The foreshore building line may be modified in the future in concert with implementation of specific management actions, such as construction of a seawall for a specific beach.

For those beaches where seawall protection is being considered as an option, a recommended seawall alignment has been mapped. At all other locations, the immediate (2010) ZRFC line is recommended as an appropriate foreshore building line to be adopted by Council. The foreshore building line should be updated as and when coastal hazard zones are redefined as part of the revision of the CZMP (e.g. every 5 to 10 yrs). This will ensure that the foreshore building line progressively retreats in line with the impacts of sea level rise over time.

4 Community Education – Resilience Building

To support the implementation of this Plan, there will need to be ongoing community education about coastal risks. The risk approach is a valid way of expressing to community both likelihood and consequence from coastal hazards. This will assist community to make their own judgements

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regarding how they perceive the risk from coastal hazards, and make decisions regarding this risk over likely timeframes of impact. It is important that community begin to understand now the types of impacts relating to storms and how Council proposes to manage this, as well as how such risks may change with sea level rise. This supports the overarching approach to implement resilience building actions now, and delay more difficult or costly options for when impacts occur. There may be many years before impacts eventuate, however, at that time, the community will be better prepared to accept and implement the actions required.

5 Monitoring - Long term baseline monitoring and event based monitoring following storm erosion events

This option enables Council to assess the frequency and severity of events, the impact and consequences on various land uses, to revise risk levels and determine the effectiveness or appropriateness of management actions/options over time. Regular monitoring shall also support the identification of triggers for management actions to be implemented.

For the whole of the coastline, a baseline monitoring program should be set up to chart long term trend and condition following major events.

- For coastal erosion risks, monitoring should consider the zone of reduced foundation capacity behind the erosion escarpment following storm events in relation to at risk land / infrastructure. The monitoring should be conducted every three years, or following major storm events.
- At estuary entrances, the breakout level, frequency and berm height should be monitored over time, as sea level rise (including recession) impacts upon the entrance configuration.
- For coastal inundation risks, monitoring should consider the depth and frequency of events over time. This should include data on inundation levels and extents following major events, and should be mapped against continued monitoring for mean sea level.

The results of monitoring should be analysed and published, this could be included in State of the Environment reports, or could be completed at the Plan review stage. The monitoring at specific assets should be reviewed more regularly to provide warning for when a trigger will or has been reached.

At Plan review stage, the monitoring shall provide key data to re-run the risk assessment and revise management response if risk level changes (for either an increase or decrease in level of risk).

This action has been repeated as NR14 (see "No regrets" options Section 5.4.1), to more specifically identify assets that should be monitored prior to the next plan revision.

5.3 Future Development and Re-Development

Wollongong's coastal zone is largely developed, with very few land parcels as yet undeveloped (including "greenfields" sites). In this case, most development applications will consist of either complete redevelopment of a site, including subdivision, or major alterations or refurbishments to existing structures. The re-development of land within Wollongong offers an opportunity to apply development controls that mitigate or accommodate coastal risks to an extent that is consistent with the expected lifetime of the development.

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Applying development controls as properties are redeveloped improves the compatibility and therefore the longevity of the developments. Applying development controls does not affect future ability to protect or retreat from the properties. The development controls can be revised in the future in line with improved estimation of hazards and future changes.

Development controls apply equally to future development and redevelopment of existing structures. For this reason, a Coastal Management DCP is also included as an option to manage existing development, particularly where such development is currently at low risk.

The following recommendations are made for preparing a Coastal Management chapter within the Wollongong DCP, to manage future and re-developments:

Determine Development Controls applicable to the Level of Risk and Type of Development.

In a similar format to Council's DCP Chapter E13, the development controls should relate to the level of risk (high, medium, low) and the type of development (including whether a development type is permissible, and including alterations and additions).

For coastal hazards, the level of risk increases over time, in relation to sea level rise. Therefore, the expected life of the development can be used to determine at what timeframe (ie, 2010, 2050 and 2100) the level of risk should be applicable to the proposed development. The expected life of the development should be determined by Council, and should relate to the type of development. For example, a residential development may be expected to last up to 100 years. Therefore, the risk level determined for 2100 would apply, and subsequent development controls dependent upon this level of risk. Likewise, where a surf club is intended to be refurbished with an expected design life of 25 years, then the 2010 risk level would apply, and subsequent development controls dependent upon this level of time frame and risk is given in Table 5-1.

 Specify Assessment or Performance Criteria for the Development (based on Risk Level and Development Type)

Similarly to the Chapter E13 where prescriptive controls are specified for building components, etc, assessment or performance criteria and prescriptive controls should be specified within the DCP, as applicable to a development type and level of risk. Example considerations include:

- Setbacks for development landward of specified hazard zone, proposed seawall alignment or, Foreshore Building Line;
- o Minimum floor levels and acceptable size for alterations and additions;
- Foundation capacity requirements within hazard zones, triggering a geotechnical assessment for depth to bedrock;
- Where foundation capacity cannot be provided (based on geotechnical assessment), a set of alternative criteria could apply, for example:
 - Alternative designs for temporary or sacrificial structures or relocatable structures, as considered suitable for the type of development (e.g. SLSCs, caravan park cabins etc);
 - For public assets, an assessment of alternative locations for the structure;

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The format and content of a Coastal Management DCP will be determined by Council at the time of its preparation. However, as the above examples demonstrate, the Coastal DCP can be tailored to the level of risk and type of development. The Coastal DCP can then be used to manage future development and existing developments when they are redeveloped or assets replaced.

| Land Use Categories** | Design Life (yrs) | Risk Level* | Coastal zone land uses / assets in this Development Type |
|--|-------------------------|---|--|
| Essential Community Facilities | 75 -100 | Refer 2100 Risk Levels - Map Series C | Hospitals, Hospices, Nursing Homes |
| Critical Utilities | 75 -100 | Refer 2100 Risk Levels - Map Series C | Major (arterial) roads, bridges, stormwater infrastructure, water supply networks, wastewater infrastructure |
| Subdivision | 100 | Refer 2100 Risk Levels - Map Series C | Existing and vacant residential land |
| Residential | 75 - 100 | Refer 2100 Risk Levels - Map Series C | Residential properties (including existing residences, vacant residential land), schools, childcare facilities, aged care facilities, university campus, caravan parks (long-term sites only), additions or alterations to existing dwellings > 40m2 |
| Commercial & Industrial | 50 | Refer 2050 Risk Levels - Map Series B | Commercial buildings (e.g. WIN Entertainment Centre, WIN stadium), Industrial sites, public libraries, other public buildings, University campus, private recreational premises / buildings (e.g. RSL, Bowling, Golf club houses) |
| Tourist Related Development | 10 - 25 | Refer 2010 Risk Levels - Map Series A | Caravan parks (short term sites only) |
| Recreation & Non- Urban | 25 | Refer 2010 Risk Levels – Map Series A | Parks, Public open space / recreation, private recreational land, Cycleway / shared pathway, recreation facilities (e.g picnic shelters, minor storage sheds), jetties, wharves, boat ramps |
| New Landuse Category | | | |
| Public recreational facilities / buildings | 25 | Refer 2010 Risk Levels - Map Series A | SLSC buildings, lifeguard towers, beach kiosks / pavilions, ocean pools, amenities blocks / buildings, storage buildings |

 Table 5-1
 Suggested Timeframe and Risk Level for Development Types

** the Land Use Categories are taken from Councils existing DCP Chapter E13. Map Series A, B and C are provided in Appendix A.



5.4 Existing Development

A range of management options to treat existing development (assets and land) at risk are detailed below. The options have been separated into the traditional 'protect', 'retreat' and 'accommodate' categories for coastal management options. However, unlike the traditional approach, these options are specified as applicable to the level of risk to an asset, and a trigger at which the option should be implemented is also specified (refer Chapter 6).

A range of "no regrets" options that provide for further investigations to both improve understanding of the best management option applicable and the extent of risk are also provided, which enables Council to build resilience and be adequately prepared for when impacts eventuate at some point in the future.

Current actions listed for the "no regrets" and other options are intended to be implemented within the timeframe prior to the review of this CZMP. There are a number of actions that Council and others can undertake now that either improve resilience or assist in being prepared to implement more substantial actions as and when needed. Prioritisation for implementing the current actions will be determined as part of selecting recommended options at the next stage of preparing the CZMP.

While the management options presented below are targeted at existing development, in some cases the most appropriate way to manage existing development is through controls on future redevelopment, that is, as assets are being replaced, houses redeveloped, council buildings refurbished etc. As explained in Section 4.6.1, where expected timeframes for impacts are long, this is a cost effective and sensible approach to implementing management action, and the "trigger" is then asset replacement or redevelopment.

Description of aspects of the costs and benefits of the various options is given with the management options below. This aims to provide more detail regarding the option to support the cost benefit assessment given for each beach in Chapter 6.

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5.4.1 "No Regrets" Options

The "No regrets" options provide for a range of assessments and works that shall provide further information (including approvals) required prior to implementing larger scale options at specific assets, particularly where a more costly or difficult option may be needed, or better understanding regarding the level of risk to an asset. The "no regrets" options also provide for activities that will improve resilience and preparedness for coastal hazards.

| Option Symbol | Option Name | Option Type | Description | Cost-benefit considerations | Potential Locations / Assets (refer to Beach Maps & Tables for further detail) |
|------------------|---|----------------|---|--|---|
| NR1 | Include notation of coastal hazard type and timeframe on Asset Management Plan | No Regrets | Council's Asset Management Plan shall be updated to make note of which assets lie within a coastal hazard area: detailing the type of hazard i.e. erosion, recession, inundation, or geotechnical hazard; and the estimated timeframe for impact (i.e. 2010, 2050, 2100), bearing in mind that impacts may occur prior to this. This information shall then be included within prioritisation for asset replacement and maintenance schedules. The assets shall include public buildings, heritage items, stormwater infrastructure, roads etc as managed variously by Council. | This option enables coastal hazards to be flagged in Council decision making processes. At the present time, the management of assets does not take into consideration the risk to an asset from coastal hazards when prioritising asset replacement or maintenance. The option is easy to implement as the information is already available to Council. This option is a "no regrets" action that provides a preliminary step prior to undertaking more detailed assessment of assets to determine which can be relocated or require redesign to accommodate coastal hazards, and which may be managed as planned retreat. | All types of council assets (public buildings, stormwater, roads, footpaths, parks/beaches etc) within a coastal risk area. |
| NR2 | Conduct audit of existing seawall structures, to determine their current condition, effectiveness and future protection potential | No Regrets | A seawall audit shall determine the condition of existing seawalls and their effectiveness to mitigate storm erosion, and recession and wave overtopping with sea level rise, depending upon accessibility (e.g. where the toe of the structure is buried etc). The estimated remaining life of the walls shall also be specified, and recommendations as to revision of hazard estimates for 2010, 2050 or 2100 provided where practical. The assessment should be used to guide subsequent decisions at the relevant beaches, including future replacement with seawall protection or "manage to fail" (planned retreat) options. | There are some existing seawalls that may already provide protection to coastal assets. Depending upon the expected life and future protection from existing walls, there may be updates to the hazard estimates (2010, 2050) which assumed no protection provided. This will flow on to affect other coastal management options, including implementation of the Coastal DCP and decisions regarding seawalls at those beaches. The audit therefore offers a "no regrets" option by providing more information on which to base decisions regarding other coastal management options. | Austinmer, Thirroul, Bellambi Beaches |
| NR3 | Conduct audit of substantial public buildings to determine site constraints, including foundation capacity, and land availability to relocate the structures. | No Regrets | This option shall investigate the foundation capacity of existing buildings to withstand erosion and wave overtopping and determine if and where land is available to relocate the structure. Where both aspects are constrained, the audit shall identify the possibility of replacement with a relocatable structure. The outcomes of the audit shall specify for each asset the future action being "relocate", "redesign", "retrofit" or "relocatable". The audit shall also make note of suitable triggers for implementation of future action. The outcomes of the audit shall guide implementation of A2 or A3, and prioritisation for asset maintenance and replacement schedules | Relocation and redesign options (A2, A3) for existing public buildings (i.e. surf clubs, kiosks, pavilions) are contingent upon the capacity of existing foundations to support a structure during a storm event; and the availability of land to relocate the structure. This option is a "no regrets" option as it facilitates better planning for asset replacement and maintenance that additionally considers coastal hazards impacts while potentially allowing continued use of at risk structures. The investigations can flag suitable options now, but which do not need to be implemented until the hazard impacts occurs (refer to triggers for specific assets at specific beaches). | Key locations include Thirroul SLSC, Thirroul Pavilion, Bulli SLSC, Bulli Kiosk, Coalcliff SLSC, Stanwell Park SLSC, refer individual beach maps / tables for all locations. |

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Proposed Actions or Trigger for Future Actions

Current Action

- 1. For all Council assets, add a notation to all assets within the hazard zones as to coastal hazard type (erosion, recession, inundation, geotechnical) and estimated timeframe for impacts (immediate/2010, 2050, 2100).
- 2. Utilise this information within prioritisation for asset maintenance & replacement

This action is required prior to other "no regrets" options.

Current Action

- 1. Conduct audit of seawalls
- 2. Update hazard lines where relevant to account for existing seawall protection
- 3. Update CZMP proposed actions to account for condition (life) of existing seawalls
- 4. Seawalls added to Council's Asset Management Plan, and outcomes of audit used to determine asset replacement and maintenance schedules for the structures.

This action is required prior to implementing S1, S2 and or DCP.

Current Action

- 1. Determine priority for this action from Council's Asset Management Plan.
- 2. If supported by the Asset Management Plan, undertake audit of all public buildings affected by erosion / recession
- 3. Update Asset Management Plan to specify future action being "relocate", "redesign", "retrofit" or "relocatable" and identify the trigger for implementation of future action.
- 4. Utilise findings for prioritisation of asset maintenance and replacement schedules.

This action is required prior to implementing PR2, A2 or A3.

| Option Symbol | Option Name | Option Type | Description | Cost-benefit considerations | Potential Locations / Assets (refer to Beach Maps & Tables for further detail) |
|------------------|---|----------------|--|--|---|
| NR4 | Undertake audit of all Ocean Pools in LGA | No Regrets | The audit shall investigate the relative sensitivity of the pools to wave impacts and sea level rise, in addition to their current condition, maintenance regime, and community usage. Where necessary, future adaptation/modification should be identified e.g. raise seaward parapet wall, modify inlet/outlet system etc.)This audit shall build upon the review of tidal pools recommended in <i>Planning People Places</i> (WCC, 2005). The audit shall prioritise pools based on their ability to withstand hazard impacts versus maintenance regimes and other community needs. The audit shall also ensure that the pools are added to Council's Asset Management Plan, with the outcomes of the assessment also noted to guide future maintenance plans and priorities. | This option is a "no regrets" option as it facilitates the formal inclusion of the ocean pools within Council's Asset Management Plan, and their prioritisation for maintenance based upon community usage and likelihood of hazard impacts. Further, it will recognise the future usability based on sea level rise scenarios. | All tidal and other ocean pools along the coastline |
| NR5 | Undertake traffic assessments to determine the feasibility and costs associated with redirection compared with redesign/protection of roadways at risk of recession. | No Regrets | Traffic assessment is required for those local roads and major roads (Lawrence Hargrave Drive) that may be affected by recession in the future. The focus of this option is to determine the technical feasibility of redirecting traffic from a local road that will be at risk, which will govern subsequent actions. The assessment needs to consider the impact of redirection of traffic onto other roads and feasibility of maintaining access to residences. Redirection options may also include purchase of land to construct a new roadway connection. Where redirection is unlikely to be possible due to road/traffic constraints, protection and /or accommodation options for the roadway shall be considered. | This is a "no regrets" option as it provides the technical feasibility for redirection from which further management options can be determined (i.e. implementing retreat (PR2), protection (S1, S2) or redesign (A2) options). The costs/practicality associated with either redirection onto existing roads, redirection onto a newly planned road section (including property purchase) and protection or accommodation options will need to be compared. The decisions regarding existing roadways will then need to take into consideration the effect upon adjacent land uses, for example where utilities or residential property is located next to the roadway. The advantages/disadvantages, costs-benefits identified in this plan for the viable coastal management alternatives (PR2, A2, S1/S2) will also need to be taken into consideration when determining the appropriate final action. | Key locations: Lawrence Hargrave Drive at Austinmer & Little Austinmer, local roads at Bulli, Woonona, Towradgi. Refer individual beach maps / tables for all locations. |
| NR6 | Undertake audit of cycleway to guide future maintenance options. | No Regrets | The audit shall determine which sections of cycleway identified at risk can be relocated, and planning commenced to secure land to relocate the path. Where relocation is not possible due to constraints from other land uses, the feasibility (technical and financial) for rock protection and / or raising the cycleway should be determined. Outcomes of the audit should be noted on Council's Asset Management Plan, to guide future maintenance plans and priorities (e.g. notation where relocation or retrofit is required, with set triggers for implementation). | Where parts of the cycleway route become disconnected following erosion, the value of the cycleway becomes compromised. The whole route needs to be maintained as a continuous path to remain functional. This "no regrets" option allows for specific investigation of the cycleway capability for either relocation or retrofit, should impacts occur in the future. The investigations can flag suitable options now, but that do not need to be implemented until the hazard impacts occur. | Key locations include Sandon Point Beach (Waniora Point), Bulli Beach North Beach, Woonona, refer individual beach maps / tables for all locations. |

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Proposed Actions or Trigger for Future Actions

Current Action

- 1. Determine priority for this action from Council's Asset Management Plan.
- 2. If supported by the Asset Management Plan, review audit of all tidal pools affected by erosion / recession and sea level rise.
- 3. Update Asset Management Plan to include future action ("managed to fail" or "retrofit") and identify the trigger for implementation of future action.
- 4. Utilise findings for prioritisation of asset maintenance and replacement schedules.

This action is required prior to implementing PR2 or A2.

Current Action

- For all roads identified as likely to be at risk of recession, if supported by the Asset Management Plan, determine the feasibility of options (redirecting, protecting or redesigning) to retain residential access.
- 2. Update relevant strategic plans to include future action determined, including triggers for implementation.

This action is required prior to implementing PR2, A2 or S1 / S2.

Current Action

- 1. Determine priority for this action from Council's Asset Management Plan.
- 2. If supported by the Asset Management Plan, undertake audit of cycleway sections within the erosion / recession and inundation hazard areas, to determine suitable area for relocation or retrofit design alternatives as required.
- 3. Update Asset Management Plan to note future action ("relocate" or "retrofit") and identify the trigger for future action.
- 4. Utilise findings within prioritisation of asset maintenance and replacement schedules.

This action is required prior to implementing PR2, A2 or S1 / S2.

| Option Symbol | Option Name | Option Type | Description | Cost-benefit considerations | Potential Locations / Assets (refer to Beach Maps & Tables for further detail) |
|------------------|---|----------------|---|--|---|
| NR7 | Investigate appropriate design elements for stormwater, infrastructure for periodic inundation with seawater and / or wave action and utilise as assets are replaced. | No Regrets | This option involves noting where and when stormwater assets will be affected by permanent inundation with sea level rise, to determine if certain systems may become unviable. The option also involves investigating the capacity for stormwater infrastructure to withstand periodic inundation by seawater and / or periodic wave attack during ocean storm events. Asset replacement and maintenance schedules shall be updated to reflect the expected timeframe for inundation when substantial upgrade is required, noting that seawater is expected to yield shorter design life. For assets affected by erosion, the recommended upgrades to withstand wave impacts / erosion will need to consider the design life for the stormwater asset compared with the expected timeframe for the erosion hazard to occur. Loss to erosion of land around the stormwater asset may make it unviable irrespective of the robustness of design. | This option targets assessment towards critical infrastructure for which the risk of inundation with seawater may not be adequately managed or identified at present. The option also recognises the cost savings for such design elements to be implemented based upon the programmed asset maintenance / replacement timeframe. NB - Erosion impacts to stormwater outlets shall be noted in NR1, with expected action through PR2. | All stormwater infrastructure affected by coastal inundation (ie, within the coastal inundation hazard area) or by erosion and recession. |
| NR8 | Investigate design elements for water supply and wastewater infrastructure and electricity infrastructure to withstand inundation with seawater and / or wave action, and implement action as required. | No Regrets | This is similar to option NR7 but applies to wastewater, water supply and electricity infrastructure which are managed separately by Sydney Water Corporation and the local power supply owners for Wollongong. This option is proposed separately from Council's assets, due to the different asset types and Sydney Water Corporation's existing climate change assessments. | Initially the existing risk and subsequently the potential impact of Council management strategies should be brought to the attention of the relevant authority. Prior to finalising the management strategy, future performance (protection, relocation, adaptation) of affected infrastructure must be considered. | Key Locations include Trinity Row (Sandon Pt Beach), Woonona Beach (Beach Drive, Kurraba Road), STP at Bellambi, Marine Parade (Towradgi Beach), and other locations where erosion may affect roadways and properties |
| NR9 | Develop evacuation plans for local roads and property affected by coastal inundation outside of existing flood planning areas. | No Regrets | Where extensive area of roads and property may be affected by coastal inundation, and are not identified within existing flood planning areas, or Local Emergency Management Plans, evacuation plans will be important for managing traffic flows around roads affected by future inundation, and for ensuring the safety of residents. | This option addresses the changing consequence of coastal inundation to people's safety, as climate change impacts occur. | Priority Locations: Thirroul (Lawrence Hargrave Drive, local roads, affected properties especially in Flanagans Ck catchment), Sandon Point to Bulli Beach (Whartons Ck), Woonona (Beach Dr, ppty), Bellambi Lagoon, (local roads & property). |

See BMT WBM

Proposed Actions or Trigger for Future Actions

Current Action

- 1. Determine priority for this action from Council's Asset Management Plan.
- 2. If supported by the Asset Management Plan, conduct mapping to determine changes in frequency of inundation within stormwater systems with sea level rise (separate from coastal inundation).
- 3. Investigate design elements to enable functioning of stormwater assets inundated by seawater, and wave attack (over short term), and utilise when replacing assets (see A2).
- 4. Update Asset Management Plan to reflect changes in frequency of inundation over time due to sea level rise (i.e. storm surge), and use as part of prioritisation for asset maintenance and replacement.
- 5. Develop long term strategy for replacement and upgrade to systems that will become unviable with sea level rise. Relevant triggers for future action will depend on the nature of the impact and future maintenance requirements.

This action is required prior to implementing PR2 or A2.

Current Action

- 1. Council shall advise relevant authorities of the extent of current and future hazards.
- 2. Management as in NR7 above, with responsibility of implementation falling to SWC and electricity utilities.
- 3. Opportunity for clear strategies to be developed should be provided and where practical, feed into determining future management elements by Council.

This action is required prior to implementing PR2 or A2, and in some locations may govern implementation of S1 / S2.

Current Action

- 1. Develop evacuation plans for catchments without existing flood mapping as a priority.
- 2. Update evacuation plans with existing flood mapping or Local Emergency Management Plans to include coastal inundation area
- 3. Collate evacuation plans on an LGA-wide scale, to ensure consistency and safety across LGA

Trigger

Implement evacuation plans as needed.

| Option Symbol | Option Name | Option Type | Description | Cost-benefit considerations | Potential Locations / Assets (refer to Beach Maps & Tables for further detail) |
|------------------|--|----------------|--|--|--|
| NR10 | Update or commence flood studies at all catchments that are impacted by elevated ocean water levels in flood mapping and management. | No Regrets | This option involves conducting a combined assessment for catchment flooding with oceanic water level events, including the latest sea level rise predictions (refer NSW Sea Level Rise Policy Statement 2009) and ocean water level scenarios (refer DECCW 2009, Cardno 2010) as per guidance given by NSW Government . The combined flood modelling shall then by used to determine the level of risk from such hazards (i.e. clarify Flood Risk Precincts) and therefore the appropriate planning controls that should apply (i.e. based on DCP Chapter E13). | This option provides for a more detailed assessment for properties that are currently at risk of coastal inundation, to determine any increased future risk as sea level rises. This will better constrain the types of planning and other controls most appropriate to identified coastal inundation risk areas. It will offer residents affected by coastal inundation better clarity of the likelihood and consequence of future impacts. This option is a "no regrets" option, as catchment flood modelling is required at a number of catchments without flood mapping at present, while existing flood mapping needs to be updated to better consider ocean water levels based upon current best practice, and NSW Government requirements. | Priority locations include: Hargraves & Stanwell Creeks Flanagans Creek; Thomas Gibson Creek (requires update), Whartons Ck, Collins Ck. Woonona, Bellambi Gully and Lagoon, Fairy Lagoon. Existing flood planning areas also require update for sea level rise and oceanic elevated water levels. |
| NR11 | Undertake an audit of all EECs and important habitat areas within the hazard zones and implement buffers and rehabilitation as appropriate. | No Regrets | This option would involve: - Identifying important flora/fauna species that, due to their limited distribution, will need to be translocated; - Prioritising rehabilitation requirements based upon the relative threat to distributions from coastal hazard impacts, to ensure lower risk distributions are protected and enhanced; and - identifying areas that can be designated buffers around important habitats, to enable migration in response to hazard impacts, i.e. erosion and recession, as well as migration in response to sea level rise. The outcomes of the audit should feed into existing biodiversity strategies (e.g. <i>Illawarra Regional Biodiversity</i> <i>Strategy, 2010</i>). Hazards impacts investigated should include both permanent inundation as well as recession due to sea level rise. | The option will improve resilience of important habitats to withstand future impacts from recession and inundation due to sea level rise, particularly if the recommendations for biodiversity are implemented as soon as possible. The implementation of buffers must consider cost or land use conflicts, although there will be areas where buffers can be readily established with little cost or conflict. | All habitats affected by coastal hazards (refer Management options Maps), particularly estuary entrance areas |
| NR12 | Utilise Norfolk Island Pines in new coastal plantings. | No Regrets | Norfolk Island Pines continue to be used in coastal plantings by Council. This would ensure continued use of this plant as a marker of coastal settlement. Where possible, new plantings to replicate or replace perished or eroded trees should be sought, outside of hazard zones. | This option recognises the cultural importance of Norfolk Island Pines in coastal development. Continual replacement of existing plantings would become Council practice. | Key locations include Thirroul Beach, North Beach, Bulli, Stanwell Park. Refer individual beach maps / tables for all locations. |
| NR13 | Develop a decision framework for managing Aboriginal and Non-Indigenous Heritage Items affected by hazards | No Regrets | In cooperation with local Aboriginal Groups and NPWS, prepare a Decision Framework for managing heritage sites and items that are uncovered by erosion or affected by inundation where such sites are previously unrecorded. The plan should provide clear direction as to the actions required as relevant to the type of item. This may include relocating the item (for example, as is conducted for burial sites), burying the item (for example as is done for midden sites), sacrificing the item or protection the item (as is done for midden sites also). | This option aims to provide a clear decision framework for actions and approvals required to manage important heritage assets, as they are affected by erosion or inundation over time, in consultation with local Aboriginal groups. It is noted that where non-indigenous heritage sites are already known to exist, the sites have been included in the asset registers for each beach. Aboriginal heritage items are confidential, therefore general areas only have been discussed (and management options also provided) at each beach. | Specific sites have not been identified for privacy reasons. Further, this option aims to manage assets that are currently unidentified. |

Proposed Actions or Trigger for Future Actions

Current Action

- 1. Utilise design ocean water levels specified by NSW Government and within the Cardno (2010) study within appropriate catchment flood modelling scenarios.
- 2. Update Flood Planning Areas (for catchment and coastal inundation effects), flood risk precincts and development controls for affected areas, such as through the Floodplain Risk Management Plan process.

Trigger: Conduct studies at the earliest opportunity.

Current Action

- 1. Identify important flora/fauna species that require relocation
- 2. Prioritise rehabilitation requirements based upon the relative threat to distributions from coastal hazard impacts, to ensure lower risk distributions are protected and enhanced
- 3. Identify and implement buffers for migration, in consultation with community.
- 4. Update existing biodiversity strategies to reflect findings within prioritisation for rehabilitation.

Current Action Implement now and into the future.

Current Action:

- 1. Consult with Local Aboriginal Groups as to the preferred methods for managing different types of heritage assets
- 2. Develop a decision framework to enable a clear pathway of action and approvals, to manage sites as they are discovered

Trigger:

Implement as heritage items are uncovered by coastal hazards

| Option Symbol | Option Name | Option Type | Description | Cost-benefit considerations | Potential Locations / Assets (refer to Beach Maps & Tables for further detail) |
|------------------|--|----------------|--|--|---|
| NR14 | Long term baseline monitoring and event based monitoring following storm erosion events | No Regrets | For coastal erosion risks, monitoring should consider the zone of reduced foundation capacity behind the erosion escarpment following storm events in relation to at risk land / infrastructure. At estuary entrances, the breakout level, frequency and berm height should be monitored over time, as sea level rise (including recession) impacts upon the entrance configuration. For coastal inundation risks, monitoring should consider the depth and frequency of events over time. | This option enables Council to assess the frequency and severity of events, the impact and consequences on various land uses, to revise risk levels and determine the effectiveness or appropriateness of management actions/options over time. Regular monitoring will support the identification of triggers for adaptation measures to be implemented. | Whole coastline, Thirroul Pool and Pavilion, Beach Dr at centre of Woonona, Trinity Row southern end of Sandon Pt Beach |
| | | | tern | | |

Proposed Actions or Trigger for Future Actions

Current Action

- 1. Set up a baseline monitoring programme for long term trend and condition following major events.
- 2. Review results for particular asset triggers regularly, eg within SoE reporting.
- 3. Re-run risk assessment based on monitoring results and revise management response if risk level changes (i.e. increase or decrease in level of risk).

Trigger

- Erosion Beach surveys and distance from scap to structures every three years or following major events
- 2. Inundation Monitor inundation levels and extents following major events, and compare with continued mean sea level monitoring.

5.4.2 Protection Options

Protection options are aimed at protecting coastal development (private or public) from damaging erosion and recession and / or wave overtopping. The options should also enhance or preserve beach amenity. Protection may be of the form of hard structures (seawalls of various kinds, groynes, offshore breakwaters or reefs, artificial headlands) or soft measures (beach nourishment), as is compatible with both the coastal processes and amenity of the proposed site. Protection works can cause impacts to adjacent areas ('offsite impacts'), for example erosion at the edge or base of seawalls. Therefore, the decision to implement a 'protect' option must consider potential offsite impacts and include measures to manage such impacts, in accordance with NSW legislation.

| Option Symbol | Option Name | Option Type | Description | Cost-benefit considerations | Potential Locations / Assets (refer to Beach Maps & Tables for further detail) | Proposed Actions or Trigger for Future Actions |
|------------------|---|----------------|--|---|---|--|
| DV | Revitalise and continue Dune Care Programs | Protect | Enhancement and continuation of existingRevitalisation of dune care programs would allow for ongoing capture of sand to provide sediments stores for protection during storm events, and as a barrier to wave overtopping at key locations. Where existing dune vegetation is sufficient or substantial, the Dune Management Strategy shall focus on weeds and vermin removal, plant species diversity and vegetation height management, to ensure beach amenity values are not substantially degraded. For example, where monocultures of <i>Acacia sophorae</i> (or other species) are found, the Dune Management Strategy provides a mechanism for Council to introduce greater species diversity to reduce the proliferation of the species. Dune vegetation programs must be considerate of sightline requirements of all Surf Clubs in the LGA, such as detailed in Council's Draft Beach Sightline Strategy (2007). Liaison with SLSC and use of appropriate low-growing species). This option could investigate programs to involve SLSC members in dune care work (e.g. during winter months, as an activity for nippers etc). The Coastal Dune Management Manual (2001) shall also be a reference document for Council in developing and implementing a dune vegetation strategy. | Dune rehabilitation is suitable for buffering short term erosion and has other environmental benefits without irreversible long terms impacts. Over the short term, dune vegetation captures sediments that may otherwise be blown out of the beach system, ensuring beach volumes are retained to buffer against storm erosion. However, enhanced dune vegetation will not manage long term recession. It is noted that species such as spinifex and <i>Acacia sophorae</i> have been of concern to community when growing across the beach berm, causing a perceived narrowing of beach width. The plants form part of the cyclic growth of incipient dunes, which is a sign of accreted beach volumes. Similar to the occurrence of storm erosion, this should be considered relatively short term and periodic. There is a need to improve community education regarding the growth of dune volumes and value as beach protection. <i>Acacia sophorae</i> is a commonly found dune species that can occassionally form monocultures, such as currently found at Woonona and other beaches. A dune vegetation strategy would enable Council to manage such outbreaks and reduce the occurrence of monocultures, which damage beach amenity. The increase of dune height which occurs as dune species capture sediments within the beach system additionally provides a higher barrier to mitigate wave overtopping effects. Reducing dune heights (for example, through re-profiling of dune sands) reduces the protection from wave overtopping. | All beaches | Current Action: <u>Prepare and limplement an LGA-wide Dune Management Strategy, including:</u> review and enhancement of current dune care program, Involving local volunteers, particularly SLSC members in dune care works, to additionally provide an opportunity for education regarding coastal processes and environments, and Prioritising locations to ensure beaches with limited vegetation or weed species are rehabilitated as a priority. Implement improved program. |
| ВМ | Beach Sand Management (beach scraping or nature assisted beach management) | Protect | Management of beach sands through re-contouring and scraping sands into the upper beach (beach scraping or nature assisted beach enhancement). The objective is to redistribute sand from areas of accretion to depleted or at risk areas. Beach scraping is carried out when the beach begins to recover following beach erosion events, as sand is won in thin layers from the intertidal zone and moved above the area of fair weather wave action. It can be used to build a buffer against storm erosion and dune overtopping. Beach scraping does not add to overall beach volumes. This option can also incorporate Council policies to ensure that all sand is retained in the active beach systems. Sand removed from estuary/lagoon entrances can be returned to the adjacent beaches. Construction excavation of suitable beach size sand can be disposed to the adjacent beaches. | Beach scraping can be undertaken on an opportunity basis by Council when beaches are accreted and appropriate equipment and resources are available. Undertaken properly it is unobtrusive and cost effective. It is used to maximize the benefit of existing beach sand reserves. The activity should be undertaken in combination with revegetation, to reduced the risk of loss of sand to windborne transport. Cost for small exercises completed elsewhere in Wollongong LGA were up to \$7,000 for a single event. Sand retention policies ensure that available and suitable sand is used for beach building (for example, after small scale dredging exercises) This can be a win-win exercise, providing cheap and environmentally friendly opportunities for disposal of small quantities of suitable beach sand within the littoral system, near the extraction location. | Beaches with limited sand reserves and or to assist protection of assets identified at risk. | Current Action: The feasibility of sand retention policies can be investigated by Council. If adopted they become an ongoing part of Council operations as excavation or dredging activities are undertaken that win suitable beach sands. These actions will need to be incorporated into Council's Asset Management Plan Trigger: Beach scraping is undertaken on an opportunity basis during periods of beach accretion. Monitoring (NR14) using beach survey is required to identify periods of beach accretion, suitable for BM. Accretion typically follows calm weather periods when the intertidal zone is full and beach width has increased. This commonly occurs at the end of Summer following build up from north east winds. |

| Option Symbol | Option Name | Option Type | Description | Cost-benefit considerations | Potential Locations Assets (refer Beach Maps & Table for further detail) | |
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| Ν | Beach nourishment | Protect | Beach nourishment shall involve placement of beach sands on the upper beach face and dunes, to re-establish a sandy beach after a storm event and to provide a sediment supply for subsequent storm events. Nourishment programs should address wave overtopping in the design profile adopted for placement of nourishment sands. Along the Illawarra coast, the placement of sand is recommended to be along the upper beach profile and dunes, to maximise sand retention within each compartment Where the objective is to increase the overall beach width, the whole profile must be nourished (from the offshore base of the profile to the dune). | Suitable sand sources are not likely to be available for large scale beach nourishment in the local area. This significantly increases the cost of this option and may therefore constrict the use of this option to localised spots across the LGA, to protect assets on as needs basis. Nourishment costs have been estimated at \$25/m ³ , with typical volumes of up to 200 m ³ /m length of beach required to widen the beach by 20 m. For a single nourishment event across half of Thirroul Beach this would equate to roughly 100,000 m ³ , costing \$2.5 million. Nourishment is a necessity to retain a sandy beach in combination with Seawall S1 (in keeping with new NSW legislation, see below). Refer to S1 for economic analysis for a combined S1 and N event at Thirroul. Under NSW legislation, Council can apply a rate payers levy to landholders who directly benefit from this action where private property (e.g. residences) or state-owned assets (e.g. RTA road, sewage infrastructure) is being protected by nourishment or where the nourishment is addressing the impacts of a protective structure on beach amenity or adjacent property. The percentage of the levy individuals can be required to pay for this option relates to the extent of property protected. Council may also contribute where the community is considered to benefit from retaining the sandy beach. The first nourishment equired of protection/amenity). Initially, nourishment may only be required infrequently (e.g. following major events, refer triggers). However, as sea level rises, if the beach alignment and width is to be maintained in its current form, nourishment requirements may substantially increase in the future. Costs to community and private landholders would likewise increase substantially. This reduces the economic viability of this option further, particularly if a local and inexpensive sand source is not available. | Wollongong City Bead (adjacent to WI Stadium extending City Beach SLSC Thirroul, Austinme Little Austinmer, refindividual beach maps tables for all locations. | |
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| chNto);,,ers./ | Current Actions: 1. Undertake investigation of sand sources for detailed costing, detailed design of nourishment profiles, planning approvals and to determine funding mechanisms. 2. Implement DCP (prior to implementing N) 3. Continued monitoring (NR14) for trigger point Trigger Renourishment will be site specific and dependent on the beach width/sand volume required and the objective (protection/ amenity). Could be expressed as a beach distance from the most recent beach erosion escarpment to development or as an average beach sand volume providing protection to assets at risk or a recreational beach width available. |

| Option Symbol | Option Name | Option Type | Description | Cost-benefit considerations | Potential Locations Assets (refer t Beach Maps & Table for further detail) |
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| S1 | Construct seawall (revetment) along specified alignment covering majority to all of beach length | Protect | This option involves the construction of a seawall along an entire section of shoreline, e.g. a whole beach embayment. If a sandy beach is to be retained, this seawall option must be accompanied by ongoing beach nourishment. The proposed alignments where seawall protection is technically viable are illustrated on maps for individual beaches. The design profile and height of the seawall shall additionally include consideration of wave overtopping and inundation, to ensure such impacts are also mitigated at present and into the future as sea level rises. For example, the slope of the wall can be added at the top of the wall, without impacting negatively upon use added at the top of the wall, without impacting negatively upon use added at the top of the wall, without impacting negatively upon use added at the top of the wall, without impacting negatively upon use added at the top of the wall, without impacting negatively upon use added at the top of the wall, without impacting negatively upon use added at the top of the wall, without impacting negatively upon use added at the top of the wall, without impacting negatively upon use added at the top of the wall, without impacting negatively upon use added at the top of the wall, without impacting negatively upon use added at the top of the wall, without impacting negatively upon use inforced concrete, sheet piling, contiguous bored piles. Armour units, sand filled geotextile bags, reinforced concrete, sheet piling, contiguous bored piles. Armour units can be randomly placed, pattern placed or in blockwork. They can incorporate graded filters or geotextile filters and various toe designs. They can include walkways, cycleways and parapet walls. The appropriate design and materials are site specific and selected during the design process. | While seawalls are expensive to build, this needs to be weighed against the value of assets being protected. Seawalls extending the majority of beach length require ongoing beach nourishment if a sandy beach amenity is to be maintained over time. In this case, issues associated with beach nourishment noted above are also applicable here. Seawall costs are of the order of \$5,000 - \$10,000 per m length of wall. For a 500 m wall along half of Thirroul Beach, this would equate to \$2.5 - 5 million, and doesn't include the costs of nourishment (see above), ongoing maintenance and future upgrading. If the seawall is to be abandoned at some time in the future, the costs for removal and repair of the beach must also be included. At Thirroul Beach, assuming unlimited funds for all options, Gillespie Economics (Appendix F) found the S1 + N option to be economic as nourishment ensures the beach amenity is retained and Thirroul Beach Reserve is retained. Beach use values were estimated at \$142 million (see PR1 below). However, funding is limited, and Gillespie Economics found that compared with both S1 & N and S2 options, planned retreat (including relocating assets and loss of park land) has a substantially higher net present value [s1 retains the use of Thirroul Beach Reserve, avoided loss of the reserve would need to be worth 520% higher before the net present value per dollar invested is greater than other beaches, this economic analysis is likely to be valid at other locations where extensive seawalls are proposed. Following recent changes to the NSW Coastal Legislation, the NSW Government places a low priority on allocating funding to protection options for private property. The Government also requires that any adverse impacts from protection works (such as beach sand loss or erosion of adjacent properties) must be addressed and remedied by the applicants for the protection works. In approving these works Council must ensure that a funding instrument (including future main | Thirroul (S end beach); Austinm (length of beach Sandon Point Beac (southern half beach). Refer to beac maps for propose seawall alignments. |

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| of mer ch), ach of ach sed | Current Actions: 1. Undertake NR2, to investigate viability of existing walls on beaches. 2. Consider outcomes of NR3, NR5, NR6, NR7 & NR8 to determine protection needs for assets (refer beach tables for more specific locations), which shall be consistent with Council's Asset Management Plan. 3. Undertake investigation of rock and sand sources for detailed costings, detailed design of seawall & nourishment requirements, planning approvals and to determine funding mechanisms. 4. Implement DCP (prior to implementing S1) 5. Continued monitoring (NR14) for trigger point Trigger 1. For private development and significant public development where the present day impact line (including foundation stability allowance) encroaches on the existing development most recent erosion escarpment crest encroaches the seaward property boundary. 3. For undeveloped reserve or public land, where the most recent erosion escarpment encroaches the predetermined protection line along the beach. |

| Option Symbol | Option Name | Option Type | Description | Cost-benefit considerations | Potential Locations / Assets (refer to Beach Maps & Tables for further detail) | Proposed Actions or Trigger for Future Actions |
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| S 2 | Construct seawall (revetment) along specified alignment to protect specific asset(s) | Protect | The objective for this option is to protect specific assets along the beach when or prior to their being considered at risk. This strategy accepts that there will be recession of the beach between the protected areas which may or may not be nourished. Provided any enhance recession effects relating to the seawalls can be managed, this would be permissible under current legislation. Examples where selective protection options are technically viable are illustrated on maps for individual beaches. All or some of the assets identified may be protected. In one particular case (North Beach), the seawall section would essentially form an "artificial headland", to retain the current shoreline position. This may also be considered in certain locations to treat the geotechnical risk (cliff retreat). Generic comments relating to seawall types and construction for S1 are also applicable. | Seawall costs are of the order of \$5,000 - \$10,000 per m length of wall. For sections of wall along Thirroul Beach, this would equate to \$2.25 - 4.5 million, and doesn't include the costs of ongoing management of offsite impacts (small scale nourishment) and future upgrading. If the seawall is to be abandoned at some time in the future, the costs for removal and repair of the beach must also be included. Even if the \$ value of the beach (estimated at \$142 million, refer PR1) is reduced by 80 %, planned retreat remains the more economically viable option at Thirroul (Gillespie Economics, Appendix F). At Thirroul Beach, compared with both S1 & N and S2 options, planned retreat was found to have a substantially higher net present value (i.e. value of benefits less value of costs) per dollar invested, particularly as funds for action are constrained. S2 may be economic on a small scale, and where minimal offsite impacts requiring nourishment are expected (e.g. McCauleys Beach). Another potential benefit is that only the high value assets are protected while natural beach embayments are permitted to develop between wall sections. However, under NSW legislation offsite impacts (edge effects) caused by seawalls must be mitigated, and this may negate this action. If feasible or required at some future time revetment sections could be joined to increase the overall security of assets further behind the beach (i.e. implement option S1). Comments in S1 above relating to funding (who pays) for specific protection structures are equally applicable. Where they are only designed to protect private property, individual owners will need to meet all associated costs, including future maintenance, remediation and removal. Restrictions on re-development (i.e. DCP option) should be used until protection works are in place. | Thirroul Beach, McCauleys Beach (northern end if headland also completed) Woonona Beach (along Beach Drive to Dorrigo Ave), North Beach (inc. as an "artificial headland"), Bellambi Point Beach & Harbour, | Current Actions Undertake NR2, to investigate viability of existing walls on beaches. Consider outcomes of NR3, NR5, NR6, NR7 & NR8 to determine protection needs for assets (refer beach tables for more specific locations), which shall be consistent with Council's Asset Management Plan Undertake investigation of rock and sand sources for detailed costings detailed design of seawall & nourishment, planning approvals and determine funding mechanisms. Implement DCP (prior to implementing S2). Continued monitoring (NR14) for trigger. Where walls are to be developed in sections a common alignment and design needs to be agreed. For development, triggers outlined in S1 are applicable for seawall implementation. |
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| Option Symbol | Option Name | Option Type | Description | Cost-benefit considerations | Potential Locations Assets (refer Beach Maps & Tabl for further detail) |
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| R | Construct a nearshore artificial reef or breakwater in surfzone to reduce shoreline wave impacts | Protect | Artificial reefs are constructed to be submerged (such as multi- function reefs) or emergent (such as detached breakwaters or islands). They can be constructed from a range of materials and in a range of shapes, sizes and locations depending on the outcome required. Emergent reefs effectively block wave energy, with wave impact being absorbed on their seaward side. They create a lower wave energy section on the beach immediately in the lee of the reef which is characterised by a salient (or bump in the beach) where sand accretes in the low energy environment. They are rarely favoured in Australia due to their obtrusive appearance and interference with beach surf conditions. Submerged reefs act to refract waves causing them to break on the reef and reducing wave energy on the leeward side, similar to the emergent reef. They are less effective than an emergent reef as they do not block the waves and during storm events water depths over the reef may be sufficient to allow waves up to several metres in height to pass over the reef without breaking, reducing their effectiveness in protecting the beach from erosion. They offer the opportunity for other objectives such as creating marine habitat and improving surfing conditions. Both types of structures are more suited to embayed coastlines (such as the Illawarra) where low or negligible net alongshore sediment transport reduces the impacts of the structure down drift on the beach, away from the reef location. The location of bedrock close to the surface provides an opportunity to reduce scour and slumping of the reef once constructed, reducing maintenance costs. | Constructed reefs are typically very expensive and on a low littoral drift coastline will provide protection to a relatively short section of the coast, possibly increasing erosion at immediately adjacent areas of the beach. They are difficult to design to operate effectively across a range of wave directions and conditions and varying water levels. They generally have high maintenance costs. Importantly, they may not provide the level of protection sought during design erosion conditions. In particular for a submerged reef, the ability of the reef to dissipate wave energy will progressively reduce as sea levels rise. The reef would require upgrading to raise the crest level in the future with sea level rise. Costs (capital and maintenance) are well beyond the resources of an individual or group of individuals and such structures elsewhere in Australia and around the world are constructed as a part of a regional strategy with Local, State or National funding. Reefs built for a multi-purpose (i.e. creating marine habitat, provide surfing break) have to date had limited success in meeting all such objectives. Therefore, while there may be some locations identified within the Illawarra that are suitable for reefs, the technical difficulties and associated high costs of achieving a structure which meets its intended function are prohibitive. | No locations we identified where offshore reef would a financially a technically viat protection option. |
| G | Construct a groyne(s) shore normal to capture sediment to protect the shoreline | Protect | Groynes are shore normal structures constructed from the beach through the surf zone to a sufficient depth to stop or restrict the movement of sand around the end of the structure. They can be constructed from a range of materials and in a range of shapes, sizes and locations depending on the outcome required. They are usually employed on high littoral drift coastlines to trap sand on the updrift side, providing a sand buffer to protect property and assets behind the beach. On a low or zero drift coastline, the groynes need to be closely spaced and (usually) nourished to provide the required sand buffer between the groynes. As such they are intrusive and expensive by comparison with revetments or nourishment options. The Wollongong Coastal Zone Study (Cardno, 2010) has stated there to be no net longshore sediment transport within the Wollongong coastal zone. As a primary protection option, therefore groynes are not technically viable options for the beaches considered. That is, it is assumed that cross-shore (i.e., shore normal) sediment transport predominates on the Wollongong beaches. Without a longshore sand supply, the groynes merely act as retention structures containing the nourishment sand. | The groynes are an additional cost on top of the massive sand nourishment option (N). They are expensive and obtrusive, effectively changing the nature and appearance of the beach. Costs (capital and maintenance) are well beyond the resources of an individual or group of individuals and such structures elsewhere in Australia and around the world are constructed as a part of a regional strategy with Local, State or National funding. | No locations we identified where single groyne or groy field would considered technically viable a economically effecti protection option. |

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5.4.3 Planned Retreat Options

'Planned Retreat' options are aimed at preserving beach amenity by allowing natural retreat in response to coastal processes, particularly sea level rise. The options for existing development involve relocating or sacrificing infrastructure, public assets or private property, if and when erosion and recession impacts occur (in combination with wave overtopping). The planned retreat options offered include methods to compensate private property owners where feasible.

| Option Symbol | Option Name | Option Type | Description | Cost-benefit considerations | Suitable Locations / Applicable Assets (refer to Beach Maps & Tables for further detail) | Proposed Actions or Trigger for Future Actions |
|------------------|--|--------------------|---|--|---|---|
| PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Planned Retreat | Planned retreat to allow the natural recession of the shoreline over the long term, is particularly considered for the following land uses: - Parks, public open space, private recreation (e.g. golf courses) and coastal dunes, as the remaining land is still able to be used even where reduced in size through erosion. Existing recreational infrastructure such as picnic shelters, footpaths, BBQs and amenities buildings would be relocated as impacts occur. - Norfolk Island Pines, as the trees have a finite lifespan (~ 100 yrs). - For certain heritage items (e.g. ocean pools) where inundation by seawater enables "burial" as a viable long term option to preserve the heritage asset. - For creek / lagoon entrances, to allow the natural process response to recession. | Gillespie Economics (refer Appendix F) found that the asset with the highest economic value is the beach itself. Based on both local resident and visitor use (domestic day visitors, overnight visitors and international visitors whose main activity is spending time at the beach (TRA, 2007)). Thiroul Beach alone was valued at over \$142 million over the next 100 years. Therefore, any option which retains this asset shall be preferred for economic reasons. This is in addition to the community and environmental values associated with the beach. Planned retreat is a particularly viable option where adjacent back beach land uses (such as public open space, parks and coastal dunes) offer the opportunity to permit the beach to retreat over time, retaining the sandy beach amenity. The cost of loss of this land is far outweighed by the gains from retaining the economic values associated with the beach, as shown at Thirroul Beach by Gillespie Economics. This is in addition to the community and environmental benefit of relaining the beach. At Thirroul Beach, compared with both S1 & N and S2 options, planned retreat (including relocating assets and loss of park land) was found to have a substantially highen net present value (ie value of benefits less value of costs) per dollar invested. Particularly as funds are constrained, the option of planned retreat is far more viable than both "do nothing" and protect options such as S1 & N or S2. Even if the \$ value of the beach is reduced by 80%, the S2 option, planned retreat remains the more economically viable option at Thirroul is greater than other beaches, this economic analysis is likely to be valid at other locations where extensive seawalls are proposed. S2 may be economic on a small scale, and where minimal offsite impacts requiring nourishment are required (e.g. McCauleys Beach). | Key locations include: Stanwell Park, Coalcliff, Scarborough, Wombarra, Coledale, Sharkies, Macauleys, Secondary: Austinmer, Little Austinmer, Thirroul, Sandon Point Beach, refer individual beach maps / tables. | Current Action: 1. Undertake NR3 – NR7 to determine specific and assets that deemed are sacrificial (compared with those that will be relocated, refer action below) and consult with the community. 2. Monitoring (NR14) to identify when trigger is reached. Trigger 1. Low key structures can be repaired, maintained, upgraded until such time as they are "at risk". 2. This could be determined by the movement of the immediate impact line over time (including reduced foundation capacity for larger structures) which should then be demolished / removed. 3. Indicative removal timelines should be continually updated in Councils Asset Register (i.e. following NR1, NR3 – 7). |

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| Option Symbol | Option Name | Option Type | Description | Cost-benefit considerations | Suitable Locations / Applicable Assets (refer to Beach Maps & Tables for further detail) | Proposed Actions or Trigger for Future Actions |
|------------------|--|--------------------|--|--|---|---|
| PR2 | Relocate structure / service outside of hazard zone | Planned Retreat | This option applies to structures which are either: easily relocatable (e.g. cabins in caravan park, lifeguard towers); have an asset value that is far lower than the value of beach amenity (e.g. a public amenities building); or for assets where it is technically and financially impractical to design the structure to withstand erosion/inundation within the hazard area, instead of relocating the structure. This option is also applicable to infrastructure such as stormwater outlets where the outlet may need to be relocated further landward to avoid ongoing damage from erosion of surrounding land and / or wave action. For local roads, this option refers to re-routing traffic off the affected road where alternate routes and access to residential property is available. Applicable assets/ locations are identified upon beach maps, however this will need to be confirmed by investigations NR2, NR3, NR4 and NR5. | This option allows for the beach amenity to be retained, which has community and financial benefits, as assets and lower value land uses are relocated. See PR1 above for details regarding the financial values associated with retaining the beach. In many cases this option can be implemented when public asset replacement is required, which would additionally enable a rejuvenation of a failing asset in combination with the reduction of risk from coastal hazards (e.g. a SLSC, new stormwater treatment outlet onto beach). This is a "win- win" solution where the erosion risk is reduced in conjunction with replacing a failing asset. Further, the cost of mitigating erosion impacts through relocation is shared with the cost of asset replacement. This reduces the overall cost now, and in the future, as relocating an existing asset with remaining life is far more costly than implementing the risk treatment as it is being built. However, there are some locations where erosion or inundation impacts may occur prior to the asset replacement cycle. | Bulli Tourist Park cabins, Lifeguard Towers, Caravan Parks, Cycleways, Stormwater Outlets, Local Roads (where it is identified that access to property can be maintained), Bulli SLSC, Thirroul SLSC. | Current Action Undertake NR3 – NR7 to determine specific assets that can be relocated, and update Asset Register to reflect likely timeframe for impact, to assist in prioritising asset relocation. Prepare planning approvals for new locations, design of new structures and generate funding to rebuild, in priority order based upon existing asset replacement requirements and expected timeframes for impact. Monitoring (NR14) to identify when trigger is reached. Trigger for Implementation: When asset replacement is required OR When immediate impact zone encroaches the asset location (e.g. erosion escarpment < 10 m from asset) (as identified through NR14) OR When frequency / extent of storm inundation becomes unacceptable (e.g. frequency of inundation > 6 times /year). whichever occurs sooner. |
| PR3 | Prohibit expansion of existing use rights | Planned Retreat | This option would enable an existing landholder to remain on land until such time as an impact occurs. Up until that time, further expansion of the development footprint (e.g. extensions or renovations, subdivision, change of use) would not be permitted, as specified in a Coastal Management DCP. | Application of this option is not viable for all locations. It is being considered at the few sites where private property(s) are located within a land use that would otherwise be permitted to retreat to retain beach amenity; and where seawall protection is not viable for the property and adjacent land. Limiting use to existing rights would ensure there is minimal increase in asset value at risk from hazards, while still enabling use of the development during the time before an impact is imminent. The actual cost of this option to property value relates to the length of time before an expected impact (e.g. immediate, 2050 or 2100). However, the cost of this option would be borne by the property owner, with land remaining in private ownership despite limitations on future development. | Thirroul existing residences (1 ppty centre of beach) | Current Action Implement Now, through Coastal DCP |
| PR4 | Voluntary acquisition | Planned Retreat | This option would involve Council applying for funding (from the NSW Government's Coastal Lands Protection Scheme or Coastal Management Program) to acquire affected properties, on a voluntary basis. However, the rate shall be based on market value, which means that purchase price would be lower should the owners wait until erosion impacts manifest before accepting the offer. | Application of this option is being considered at only the few sites where private property(s) are located within a land use that would otherwise be permitted to retreat to retain beach amenity (see PR1 above); and where alternative options (i.e. protect, accommodate) are not viable for the property and adjacent land (see S1 and S2). This option has been offered in other location along the NSW coastline with limited success. For example, at Collaroy, Council had limited funds and there was little available assistance from NSW Government. Typically, coastal land is viewed as too valuable and the risks too remote. The Coastal Lands Protection Scheme has been used to purchase isolated residential blocks but is predominantly used for rural land repurchase and addition to national park estate. NSW Government annual funding for the Coastal Lands Protection Scheme and Coastal Management Program is very limited, constraining implementation of this option. That is, the option may only be possible at a limited / isolated number of locations. | Thirroul existing residences (1 ppty centre of beach, 3 ppties at southern end, refer maps); Woonona existing residences (4 at centre of beach, refer Maps) | Current Actions Apply for funding through Coastal Lands Protection Scheme and Coastal management Program for acquisition of priority properties Offer voluntary acquisition at current market rates. This rate shall progressively discount as impacts manifest, to accurately reflect the reduction in asset value. |

| Option Symbol | Option Name | Option Type | Description | Cost-benefit considerations | Suitable Locations / Applicable Assets (refer to Beach Maps & Tables for further detail) | Proposed Actions or Trigger for Future Actions |
|------------------|--------------------------|--------------------|--|--|--|--|
| PR5 | Buy back – lease back | Planned Retreat | This option would involve Council applying for funding through typical mortgage arrangements to acquire affected property(s) at market rates, on a voluntary or compulsory basis. The property would then be leased out at market rates until such time as the hazard impact is imminent. The offer shall be discounted in accordance with the length of time remaining before the property becomes uninhabitable due to erosion. At that time the development shall be demolished, and land returned to Community Land, to enable continued retreat of shoreline and for use by the community. Council would absorb any profit/loss over that period. | The offer shall be discounted in accordance with the length of time remaining before the property becomes uninhabitable due to erosion because this option is dependent upon Council leasing the property at market rates to assist loan repayments prior to erosion impacts. This option is likely to only be applied at the few sites where private property(s) are located within a land use that would otherwise be permitted to retreat to retain beach amenity (see PR1 above); or where alternative options (i.e. protect or accommodate) are not viable (see S1 and S2). Further, the option may only be financially possible at a limited number of locations. This option allows existing property owners to be compensated at market rates. The existing owners could also have the option of leasing back the property from Council until the hazard is imminent. The option also ensures that natural retreat of the shoreline can be facilitated, by demolishing the development and returning the land to the general public once the property can no longer be inhabited. This option is as yet untested. | Thirroul existing residences (1 ppty centre of beach, 3 ppties at southern end, refer maps); Woonona existing residences (4 at centre of beach, refer Maps) | Current Action Apply for loan Offer voluntary acquisition at current market rates. This rate shall progressively discount as impacts manifest, to accurately reflect the reduction in asset value. Rent property at market rates Monitoring (NR14) to identify when trigger is reached. Trigger Demolish the property when the immediate impact zone (including allowance for reduced foundation capacity) encroaches the building foundations. |

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5.4.4 Accommodate Options

'Accommodate' options are aimed at methods to re-develop existing infrastructure, public assets and private property in a manner that mitigates potential impacts (e.g. foundation piles) or allows for impacts to occur (relocatable structures) through structure design, and which can then lead into 'protect' (e.g. future seawall) or 'planned retreat' alternatives (temporary or sacrificial structures, distance based development approvals) at a later time.

| Option Symbol | Option Name | Option Type | Description | Cost-benefit considerations | Suitable Locations Applicable Asset (refer to Beach Maps & Tables for furthe detail) | | | |
|------------------|---|-------------|--|--|---|--|--|--|
| DCP | Prepare a Coastal Management Development Control Plan (DCP) Chapter to implement controls upon future development and re-development (including minor and major alterations) in erosion / recession risk areas. | Accommodate | This option involves applying development controls through a Coastal Management DCP Chapter to existing developments at risk. The controls will be applied at the time of property and asset redevelopment or replacement, including alterations and extensions. The development controls will reflect the level of risk to an individual property. That is, less stringent controls are applied to land at lower risk and / or land uses considered to have a shorter timeframe (design life), and vice versa. The types of controls may relate to foundation capacity (bedrock), structure design (relocatable or permanent), floor levels, distance to hazard zones or distance based approvals, as in Section 5.3. The controls shall manage wave overtopping as well as erosion, as existing Flood DCP controls may not be applicable to the overtopping risk. The controls apply to all land uses including roads and stormwater infrastructure, and both private and public landholders. The DCP shall also apply to properties where a protection option is proposed (e.g. seawall) until such time as the protection option is implemented and risk level for properties revised. | The costs to develop a DCP are minimal, however the costs to implement the development controls are borne by the property owners – this includes Council who owns many assets and land in the coastal zone. Applying development controls does not affect future ability to protect or retreat from the properties, and management options can be revised in the future, as the estimates for hazard impact change or impacts become imminent. Development controls facilitate the replacement of existing assets and properties with more resilient structures to accommodate risks over time. Particularly where assets are currently at low risk, there is no immediate need for action. When asset replacement or redevelopment is required, the DCP will trigger investigations and controls that will govern whether the asset needs to be relocated (e.g. PR2), or redesigned to withstand impacts (A2 or A3). This allows Council to prioritise efforts towards other locations presently at high risk. This is also more cost effective as actions are done in conjunction with the expected cost for asset maintenance and replacement. The cost of the alternative over the designated planning period (i.e. "do nothing") may be substantially greater than the current cost of implementing planning controls, as development is intensified (i.e. property continues to be developed, land subdivided and development density increased). This strategy places the cost upon the current generation to enable a reduction in the likelihood, consequence and therefore cost of coastal risks for future generations in accordance with the principles of Ecologically Sustainable Development. | All land identified "at risk from erosion / recessio in the coastal zone ove the designated plannin period. | | | |
| | | | | | | | | |

| / S & r | Proposed Actions or Trigger for Future Actions |
|------------------|---|
| c"nerg | Current Action Following completion and endorsement of CZMP by Council, prepare a Coastal Management DCP, including: 1. Determining level of risk to apply to development types 2. Determining appropriate controls for erosion and wave overtopping to be specified in the DCP, or Foreshore Building Line 3. Approval of the DCP chapter by Council, ready for implementation 4. Apply DCP to all properties within all hazard risk zones in the LGA Trigger: Implement DCP as properties are redeveloped and assets are replaced OR As existing assets are affected by hazards, requiring repair. |

66

| Option Symbol | Option Name | Option Type | Description | Cost-benefit considerations | Suitable Locations / Applicable Assets (refer to Beach Maps & Tables for further detail) | Proposed Actions or Trigger for Future Actions |
|------------------|---|-------------|---|--|---|---|
| Α2 | Redesign structures in current location to withstand impacts. | Accommodate | Where relocation of a structure is not possible due to other site constraints, further redesign options may need to be considered. This may be applicable to the coastal harbours where the structures/assets are necessarily at the waters edge; stormwater infrastructure, for some surf club locations where suitable foundations exist and there are relocation constraints; or for major road redesign, where there are no alternatives for redirection of the road. Redesign of existing structures shall necessarily include provisions for managing wave overtopping and inundation, as well as erosion and recession impacts. Typical measures could include deep seated pile foundations, elevated floor levels, clear air space below the floors to limit risk of wave inundation, bunding to reduce wave run-up, use of appropriate materials, elevation of occupied areas within the development etc. | This option aims to retain existing community services in needed locations but reduce the risk (consequence) of coastal hazards. In some cases this option can be implemented when asset replacement is required, enabling a rejuvenation of a failing asset in combination with the reduction of risk from coastal hazards (e.g. a new SLSC, improved roadway). The cost of mitigating erosion impacts through redesign may be shared with the cost of asset replacement. This reduces the overall cost now, and in the future, as retrofitting an existing asset is far more costly than implementing the risk treatment as it is being built. In some locations this option shall involve a retrofit of an existing structure (e.g. coastal harbours, selected ocean pools). It is not applicable to design residential dwellings seaward of the Immediate Impact zone to withstand ocean wave attack. | Bellambi Boat Harbour, Sharkies (Austinmer) Boat Harbour, Lawrence Hargrave Drive at Austinmer & Little Austinmer, Sandon Point SLSC, North Beach SLSC. This option is not applicable to residential dwellings seaward of the immediate impact zone. | Current Action 1. Undertake NR1 – NR7 to determine specific assets that must be redesigned / retrofitted, and update Asset Register to reflect likely timeframe for impact, to assist in prioritising asset maintenance/replacement. 2. Prepare planning approvals and design for replacement structures and generate funding to rebuild /retrofit, in priority order based upon existing asset replacement requirements and expected timeframes for impact. 3. Monitoring (NR14) to identify when trigger is reached. Trigger for Implementation: When asset replacement is required OR When immediate impact zone encroaches the asset location (e.g. erosion escarpment < 10 m from asset when identified through NR14) OR When frequency / extent of storm inundation becomes unacceptable (e.g. frequency of inundation > 6 times /year). |
| Α3 | Replace existing structure with relocatable structure. | Accommodate | Where relocation or redesign of a permanent structure "at risk" is not possible due to other site constraints, investigate option of constructing a relocatable structure. | In some cases, designing a structure to withstand erosion and wave impacts may be prohibitively expensive or not technically possible. However the asset cannot be relocated permanently, in which case building a relocatable structure may be a viable option. Relocatable structures are typically relatively inexpensive, compared with hard structures (e.g. foundation piles to bedrock). The relocatable structure also enables natural retreat of the shoreline, offering a community and environmental benefit also. For example, at Coledale Beach, the relocatable SLSC structure is inexpensive (~ \$30,000) and can be moved prior to a storm (where there is sufficient warning). The structure provides power, water and sewer services, in addition to storage and viewing platforms. However, the relocatable structure may not provide for additional commercial enterprise (e.g. function centres, restaurants) that can be associated with surf club developments. Ongoing monitoring is essential to ensure that later changes (renovations, supply of services, ancillary structures/landscaping etc.) do not compromise the speedy and efficient removal/return of the structure during and following storm events. | Coledale, Stanwell Park, Bulli SLSCs. | Current Action Undertake NR1 and NR3 to determine specific assets that could be replaced with relocatable structures, and update Asset Register to reflect likely timeframe for impact, to assist in prioritising asset redesign. Prepare planning approvals and design for relocatable structures and generate funding to build, in priority order based upon existing asset replacement requirements and expected timeframes for impact. Monitoring (NR14) to identify when trigger is reached. Trigger for Implementation: When asset replacement is required OR When immediate impact zone encroaches the asset location (e.g. erosion escarpment < 10 m from asset, when identified from NR14) OR When frequency / extent of storm inundation becomes unacceptable (e.g. frequency of inundation > 6 times /year). |

67

| Option Symbol | Option Name | Option Type | Description | Cost-benefit considerations | Suitable Locations / Applicable Assets (refer to Beach Maps & Tables for further detail) |
|------------------|---|-------------|---|---|--|
| FDCP | Update DCP Chapter E13 – Floodplain Management to include areas affected by Coastal Inundation as Low Risk Flood Precincts, and implement DCP to manage inundation impacts as properties are redeveloped and assets replaced. | Accommodate | This option involves assigning areas within the Coastal Inundation Area but outside of the existing Flood Planning Area into the Low Flood Risk Precinct of the Flood Planning area, then managing this area according to the provisions in DCP Chapter E13 – Floodplain Management. This will include flood proofing or relocatable structures etc as required on a site by site basis as assets are redeveloped or replaced. Controls for flood inundation, as specified in DCP E13, would adequately manage coastal inundation backwater impacts, but not wave overtopping impacts. Properties affected by wave overtopping will need to be managed through erosion / recession controls, as per the Coastal Management DCP chapter (see DCP above). | This option facilitates the redesign of existing public assets (e.g. public buildings), infrastructure (e.g. stormwater) and development (e.g. existing residences, commercial / industrial property) to accommodate coastal inundation through coastal entrances and creeks (ie backwater inundation). Existing flood DCP controls may not be applicable to wave overtopping. The development controls are applied to existing development and implemented as assets and properties are replaced and upgraded, spreading the burden of managing the risk across the community. This option provides for coastal inundation impacts to be managed under an existing, tested program. The option accepts the consequence of impacts that occur prior to redevelopment / retrofit of existing assets, however this is already accepted largely by community in accepting the risk of catchment flooding. Where an existing Flood Planning Area exists, the majority of areas identified as likely to experience coastal inundation at the immediate, 2050 and 2100 timeframes lie within the Flood Planning Area (this may change as Flood Studies are reworked to include climate change, refer NR10), therefore only a small area is being added to those existing FPAs For areas without existing flood mapping, the coastal inundation area provides a "first pass" assessment of low-lying areas likely to also be affected by catchment flooding, until such time as flood studies are completed. Areas affected by coastal inundation outside of any existing Flood Planning Areas are considered to have a risk equivalent to the Low Flood Risk Precinct as defined in DCP Chapter E13 – Floodplain Management because raised water levels via an oceanic entrance will not have high current velocities, and so the inundation event is relatively passive. | All public assets (e.g. public buildings, recreational assets such as caravan parks), infrastructure (e.g. local roads, major roads, stormwater infrastructure) and private property (residential, industrial, renovations and extensions). |
| GDCP | Update DCP Chapter E12 – Geotechnical Assessment (GDCP) to ensure actions of the sea (overtopping, sea level rise) are included in the assessment of geotechnical stability and apply GDCP to areas identified within the geotechnical hazard area | Accommodate | This option would update the existing GDCP to additionally include actions of the sea (overtopping, sea level rise) in geotechnical assessments, and then apply development controls according to the risk of geotechnical failure under existing risk assessment mechanisms. The DCP is applied on a case by case basis as property (private or public) is developed or re-developed. | The majority of properties identified as at risk from coastal influenced geotechnical hazards already exist in an area identified to be at risk from geotechnical failure. Properties within the coastal-influenced geotechnical hazard area have already been informed of their risk through notation of this hazard on their Section 149 certificates. | |

| / s x r | Proposed Actions or Trigger for Future Actions |
|--------------------------|--|
| 1. s, h), al s, d y l, d | Current Actions 1. Designate all relevant areas within the Coastal Inundation Area but not within an existing Flood Planning area as a Low Flood Risk Precinct Flood Planning Area (see Chapter 6) 2. Implement the planning controls given for Low Flood Risk Precincts in DCP Chapter E13 – Floodplain Management, for future development or re-development. |
| | Current Action Update existing provisions within the DCP Chapter E12 - Geotechnical Assessment to: Identify wave action, wave overtopping, sea level rise and increased rainfall intensities due to climate change as possible causes of geotechnical failure that should be assessed; and; State the NSW Government's Sea Level Rise planning benchmarks (i.e. 0.4 m above AHD by 2050 and 0.9 m above AHD by 2100) for use in geotechnical assessments. |

5.4.5 "Do Nothing" (Accept Risk) Option

| Option Symbol | Option Name | Option Type | Description | Cost-benefit considerations | Suitable Locations / Applicable Assets (refer to Beach Maps & Tables for further detail) | Proposed Actions or Trigger for Future Actions |
|------------------|--|--------------|--|--|---|---|
| DN | No limitations upon existing development or future development / re- development over planning timeframe | "Do nothing" | The "do nothing" option assumes all levels of risk are accepted. The "do nothing" scenario assumes that there is no change in existing planning controls, and no actions are implemented (i.e. no controls are implemented to treat known coastal risks). Private and public landholders are free to maximise their development rights as per current controls. This would allow further subdivision, increased development density and built area on land identified to be at risk now and to 2100. The "do nothing" scenario provides the basis for comparison of all other options. | The "do nothing" or accept option does not involve any new action. Where existing levels of risk are low, accepting the risk may be appropriate. However, the "do nothing" scenario may not be appropriate for high risk locations / assets. Under the "do nothing" scenario, the value of property at risk continues to increase over time as development is intensified (i.e. property continues to be developed, land subdivided and development density increased). The cost of "do nothing" may be substantially greater in the future than the current cost of implementing planning controls. This is because the value of land at risk continues to increase, as does the cost of mitigating recession impacts over time (such as retrofit, or even abandoning lost lands). Further, as the value of land at risk continues to increase over time, implementation of retreat options in the future, which provide for a sandy beach amenity for the broader community, become increasingly desirable while more difficult to implement. This approach is at odds with the NSW Coastal Policy and the stated objectives of the NSW Coastal Protection Act to manage the future development of coastal areas and minimise the risk from coastal hazards at present and into the future. This strategy also places the cost upon future generations to manage the impacts and damage from coastal risks and does not accord with the principles of ecologically sustainable development. | This option is assessed at all locations. | Implement Now |

minimise . also places the cost . from coastal risks and does not ac development.

TAL ZONE MANAGEMENT PLAN - MANAGEMENT STUDY - FINAL DRAFT ~ WITH TRACK CHANGES.DOCX
5.5 Rapid Analysis for Costs and Benefits of Options

A simple tool has been developed to assess the positive and negative costs and benefits of the various options, as given in Table 5-2. The criteria are based on a "traffic light" colour system to clearly display if an aspect of an option should be cause to "stop" and reconsider, "slow" to proceed with caution or "go" with few trade-offs expected.

The assessment has been conducted for each option specified at each beach, to account for the local variants between beaches that may make an option more or less beneficial. This aims to build upon the cost-benefit considerations given for the management options above.

The aim of the assessment is to provide a straightforward overview of the options at a particular beach. It is aimed at presenting quickly and clearly to community the benefits and trade-offs of a particular option, to assist in the selection of a preferred option

For the assessment tables for each beach, details regarding who may fund the option have also been indicated. For community to make an informed decision regarding a particular option, it will be important to understand not only the cost of the option, but who may need to fund the option, whether this be by current programs, new levies or increased rates through Council, State Government Grants, or private investment by affected landholders (as directed by Council or otherwise).

The capital cost and recurrent cost limit values are based upon an order of magnitude difference from "high" to "low". Typically, this order of magnitude expenditure would require investigations and approvals by Council before proceeding.

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MANAGEMENT OPTIONS

 Table 5-2
 Rapid Cost Benefit (Traffic Light) Assessment Criteria

| | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk |
|--------------------|---|---|---|---|---|--|--|
| STOP & reassess | Very Expensive (\$300K to millions) | Very Expensive (\$300K to millions) | Will impact negatively on environment, community or beach amenity | Unlikely to be acceptable to community and politically unpalatable. Extensive community education, endorsement by Minister(s) and Council required. | Option is irreversible once implemented; option limits alternative options in future. | Option does not provide a long term solution, only effective over short term | Will require an EIS and/or Government approval to implement. There is a residual risk that approval will not be able to be obtained for the proposed works/strategy |
| SLOW | Moderately expensive (e.g. \$30,000 - \$300,000) | Moderately expensive (e.g. \$30,000 - \$300,000) | No net impact | Would be palatable to some, not to others (50/50 response). Briefing by Councillors, GM and community education required | Option is reversible or adaptable but at considerable cost / effort | Option is only a short term solution but has other benefits; or option requires further resources / changes to be effective over long term | Will require Government approvals to be implemented. Generally these approvals would likely to be granted assuming requirements are met |
| GO | Little to no cost (< \$30,000) | Little to no cost (< \$30,000) | Will benefit environment, community or beach amenity (e.g. improve beach access, recreation, habitats etc) | ls very politically palatable, acceptable to community. Minimal education required | Option can be easily adapted for future circumstances or should impacts not occur, option would not negatively impact future generations. | Option provides a long term solution | No or minimal government approvals required to implement |

Note that the technical viability of the options has been assessed for specific assets / locations on a beach by beach basis. Refer to individual beach tables and maps (Chapter 6) for the technical assessment of options.

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This chapter provides a risk register for each beach detailing assets affected by erosion and recession or coastal inundation, with a risk level for the immediate (2010), 2050 and 2100 time periods. Presented with the risk register are treatment options considered technically viable for each asset affected. Following on from the risk register, for each beach a map is presented that provides the immediate risk level for erosion and recession or coastal inundation, then a spatial representation of the management options. Linear assets such as stormwater pipelines and cycleways are also risk colour coded on these maps. It is also noted that the flood planning area is displayed upon the coastal inundation maps where one exists for each beach, presenting the existing controls for the backwater inundation hazard.

The risk level mapping for immediate (2010), 2050 and 2100 for erosion and recession, coastal inundation and geotechnical hazards are presented in Appendix A.

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6.1 Stanwell Park Beach

6.1.1 Erosion and Recession Risk Level and Treatment Options

| | | | | | | | | | | - | | | | | | | | | DV | Revitalise Dune Care Programs |
|--|---------|-----------|---------|----|----|--------|------------------------|----|------------|-------|--------|-----------------|--------|------------------------|---------|-------|--------------|---|-------|--|
| | | | | | | | | | | | | | | | | | | г – – – – – – – – – – – – – – – – – – – | BM | Manage beach sands |
| | Erosio | n and Red | ession | | | | | Fr | osion | / Rec | ession | Risk | Treatr | nents | | | | | PR1 | Accept loss as sacrificial |
| Stanwell Park Beach | | Risk Leve | | | | | | | | | | | | | | | | | PR2 | Relocate out of hazard zone |
| Claiment and Doubh | Erosion | Erosion | Erosion | | r | Drotoc | .+ | | | Dionr | | troot | | A | 00000 | adata | No Dograto | "Do Nothing" | PR3 | Prohibit development expansion |
| | by 2010 | by 2050 | by 2100 | | ſ | TOLEC | <i>,</i> L | | | FIALI | | enear | | AUU | OFIITIC | Juale | NO Regrets | (Accept Risk) | PR4 | Voluntary Acquisition |
| Parks, Beaches and open space | | | | Ν | S1 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCP | A2 | A3 | Investigate* | DN | PR5 | Buy back then lease back |
| Stanwell Park Beach | High | Extreme | Extreme | | | | √ √ | | √ √ | | | | | X | | | NR14 | | DCP | devit and re-devit) |
| Stanwell Park Recreation Area Park, and Natural Area | Medium | Medium | High | | | | | | ~~ | | | | | | | | | | A2 | Redesign / retrofit in current location |
| Coastal Dune Systems | High | Extreme | Extreme | | | | $\checkmark\checkmark$ | | V V | | | | | | | | | | A3 | Replace with relocatable structure |
| Hargraves Creek | Medium | Medium | High | | | | | | V V | | | $\mathbf{\cap}$ | | | | | NR11 | | FDCP | controls (future dev/t and re-dev/t) |
| Stanwell Creek | Medium | High | High | | | | | | V V | | | | | | | | NR11 | | NR1 | Update Asset Register for Hazards |
| | | g | | | | | | | | | N | | | | | | | | NR2 | Audit existing seawalls |
| Helensburgh / Stanwell Park SLSC | Medium | High | Extreme | | | | | ✓ | | ~~ | | • | | √√ | ✓ | ✓ | NR3, NR14 | • | NR3 | Assess Public Buildings for "accommodate" or "relocate" |
| Transport Infrastructure | | | | | | | | | | | | | | | | | | | NR4 | Audit Ocean Pool condition |
| Beach Access Car Park | Low | Low | Medium | | | | | | k 7 | | | | | $\checkmark\checkmark$ | | | NR5 | ✓ | NR5 | Assess Roads for "accommodate" |
| Residential Development | | | | | | | | X | | | | | | | | | | | | or "relocate" |
| Existing Residences (1 centre of beach) | Low | Medium | Medium | | | | | | | | | | | $\checkmark\checkmark$ | | | | | NR6 | "accommodate" or "relocate" |
| Existing Residences (4 ppty S end) | Medium | Medium | High | | | | | | | | | | | $\checkmark\checkmark$ | | | NR14 | • | NR7 | Design criteria for Stormwater |
| Vacant Land (Future Development) (1 block | Low | Low | Medium | | | | | | | | | | | 11 | | | | | | Assets |
| at S end) | LOW | LOW | Medium | | | | | | | | | | | ••• | | | | | NR8 | water supply and electricity assets |
| | | | | | | | | | | | | | | | | | | | NR9 | Develop evacuation plans |
| | | | | | | | | | | | | | | | | | | | NR10 | Conduct Flood Study including |
| | | | | | | | | | | | | | | | | | | | NICIO | ocean water levels |
| | | | | .A | | | | | | | | | | | | | | | NR11 | Audit EECs and habitats for priority |
| | | | | | | | | | | | | | | | | | | | | Conservation |
| | | | | | | | | | | | | | | | | | | | NR12 | Use Norrolk Island Pines in new |
| | | • | XX | | | | | | | | | | | | | | | | NR13 | Manage Aboriginal Heritage Items |
| | | | | | | | | | | | | | | | | | | | NR14 | Monitor erosion & inundation events |
| | | | | | | | | | | | | | | | | | | | DN | "Do Nothing" (Accept Risk) |
| | | | | | | | | | | | | | | | | | | | ~~ | Substantial risk reduction and / or |
| | | | | | | | | | | | | | | | | | | | | highly effective in managing risk |
| | | | | | | | | | | | | | | | | | | | ~ | Good risk reduction and / or |
| | | | | | | | | | | | | | | | | | | | | effective in managing risk |
| | | | | | | | | | | | | | | | | | | | ? | rechnical reasibility of applying the |
| | | | | | | | | | | | | | | | | | | | | "Do Nothing" option is likely to have |
| | | | | | | | | | | | | | | | | | | | • | detrimental effect OR result in |
| | | | | | | | | | | | | | | | | | | | | increased risk over time |

Sym-

bol

N Nourishment

S1 Seawall - long or majority of beach

S2 Seawall - short sections

72



| BMT WBM map is cor guarantee accuracy o | Title: Imm Stan | KEY |
|---|------------------------|--|
| Mendeavours to er rrect at the time of or make represen of information cont : K:\N1965 Wo | ediate I well Pa | PLAN |
| nsure that the informa publication. BMT WE tations regarding the tained in this map. | Erosion F Irk Beach | CLEDALE CLEAR CARACTERISTICS C |
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| WBM bmpl.com.au | Rev: | |

6.1.2 Coastal Inundation Risk Level and Treatment Options

| bol | |
|-------|--|
| N | Nourishment |
| S1 | Seawall - long or majority of beach |
| S2 | Seawall - short sections |
| DV | Revitalise Dune Care Programs |
| BM | Manage beach sands |
| PR1 | Accept loss as sacrificial |
| PR2 | Relocate out of bazard zone |
| DP3 | Prohibit dovelopment expansion |
| | |
| | Voluntary Acquisition |
| PR5 | Buy back then lease back |
| DCP | Apply development controls (future dev/t and re-dev/t) |
| A2 | Redesign / retrofit in current |
| A3 | Replace with relocatable structure |
| , | Apply existing flood development |
| FDCP | controls (future dev/t and re-dev/t) |
| NP1 | Lindate Asset Register for Hazards |
| NID2 | Audit existing seawalls |
| INF | Audit existing seawalls |
| NR3 | Assess Fublic Buildings IOI |
| | |
| INF(4 | Audit Ocean Pool condition |
| NR5 | Assess Roads for "accommodate" |
| | |
| NR6 | Assess Cycleways for |
| | "accommodate" or "relocate" |
| NR7 | Design criteria for Stormwater |
| | Assets |
| NR8 | Design criteria for Waste water, |
| | water supply and electricity assets |
| INR9 | Develop evacuation plans |
| NR10 | Conduct Flood Study Including |
| | Audit EECo and habitate for arianity |
| NR11 | Adult EECS and habitats for phonty |
| | Lice Norfelk Jeland Dines in now |
| NR12 | De NUTUK Islanu Pines in new |
| ND12 | Managa Abariginal Haritaga Itama |
| ND14 | Monitor procion & inundation superto |
| DN | "Do Nothing" (Accept Risk) |
| | g (, coopt asit) |
| ~~ | Substantial risk reduction and / or |
| | highly effective in managing risk |
| ~ | Good risk reduction and / or |
| | effective in managing risk |
| 2 | Technical feasibility of applying the |
| • | option is questionable |
| | "Do Nothing" option is likely to have |
| • | detrimental effect OR result in |
| | increased risk over time |

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75

| | Inun | dation Risk | Level | Inu | undatior | n Risk T | reatme | nts | |
|--|-----------------------|-----------------------|-----------------------|---|--------------------|------------------------|--------------|--------------------|-------------------------------|
| Stanwell Park Beach | Inundation by 2010 | Inundation by 2050 | Inundation by 2100 | Overtopping risk treated by erosion option | Planned Retreat | Acco oda | mm- ate | No Regrets | "Do Nothing" (Accept Risk) |
| Parks, Beaches and open space | | | | | PR2 | FDCP | A2 | Investigate* | DN |
| Stanwell Park Beach | Low | Low | Medium | | | | | | ✓ |
| Stanwell Park Recreation Area Park, and Natural Area | Low | Medium | Medium | | | | × | V | ~ |
| Coastal Dune Systems | Low | Low | Medium | | | | | | ✓ |
| Hargraves Creek | Medium | Medium | High | | | | | NR10, NR11 | |
| Stanwell Creek | Medium | Medium | High | | | O | | NR10, NR11 | |
| Baird Park | Low | Low | Medium | | | | | | ✓ |
| Community Infrastructure | | | | | | | | | |
| Helensburgh / Stanwell Park SLSC | Low | Medium | Medium | ✓ | | ~ | ✓ | NR10 | |
| Stanwell Park Beach Toilets (South) | Low | Low | Medium | | | ~ ~ | ✓ | NR10 | ✓ |
| Kiosk (in Stanwell Park Recreation Area) | Medium | High | Extreme | | | $\checkmark\checkmark$ | ✓ | NR10, NR9 | • |
| Stanwell Park Reserve Dwelling | Medium | High | Extreme | | | ~ ~ | ✓ | NR10, NR9 | • |
| Stanwell Park Reserve Toilets | Medium | Medium | High | | | ~ | ✓ | NR10 | |
| Transport Infrastructure | | | | | | | | | |
| Local Roads, (including car parks) | Medium | High | Extreme | | | ~ | ✓ | NR10 | |
| Water and sewage infrastructure | | | | | | | | | |
| Stormwater outlets and pipes (servicing upper reaches surrounding Stanwell Ck) | High | Extreme | Extreme | | | ~ | ~ ~ | NR7, NR10, NR14 | • |
| Stormwater outlets and pipes (servicing across Stanwell Park adjacent to Kiosk and from N carpark to Hargraves Ck) | High | Extreme | Extreme | | | ~ | ~ ~ | NR7, NR10, NR14 | ٠ |
| Residential Development | XV | | | | | | | | |
| Existing Residences (edge of 6 ppties at S end of beach next to Stanwell Ck) | Medium | High | Extreme | ~ | | ~~ | ~ | NR10, NR9 | • |
| Existing Residences (Edge of 13 ppties at upper reach of Stanwell Ck) | Medium | High | Extreme | | | ~ ~ | \checkmark | NR10, NR9 | • |
| Vacant Land (Future Development) (edge of 4 ppties at S end of beach next to Stanwell Ck) | Low | Medium | High | | | ~~ | ~ | NR10, NR9 | |





125

Approx. Scale

250m

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6.1.3 Assessment of Treatment Options

| Star | well Park Beach | | | | | | | | | | | | | | |
|-------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|---------------------------------|-----------------------|---|---|-------------|
| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over long term | Legal / Approval Risk | Specific Cost Benefit Considerations for Stanwell Park Beach | Potential Funding Sources (Who may pay) | Conclusion |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ~ | × | | | | | | | | Dune care programs must be considerate of sightline requirements for SLSC activities. Refer to Protect Options Table for further cost benefit details of DV. | ? State Government (Grant Programs) ☑ Council (Current Programs) <i>N/A</i> Private landholders who directly benefit from option | Recommended |
| ВМ | Beach Sand Management (beach scraping or nature assisted beach management) | Now and continuing | ~ | ~ | x | | | | | | | | This option involves scraping and contouring beach sands to accumulate in dunes in front of the surfclub structure. This aims to increase sand volumes in front of the structure to prolong its current location. Refer to Protect Options Table for further cost benefit details for BM. | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | x | | | | | 2 | Ň, | Ç | This is an excellent option for retaining the beach at Stanwell Park where there are wide dunes and reserve lands to enable natural retreat of the beach, and hence continued provision of a beach over the long term. <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR1.</i> | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| PR2 | Relocate SLSC outside of hazard zone | Current Action: NR3 Trigger: When SLSC needs to be refurbished <u>OR</u> erosion escarpment threatens building foundations. | ~ | ~ | x | | | l | • | | | | There are likely to be site contstraints (Norfolk Is Pine) that limit relocating the surfclub. If this option is feasible (based on NR3) relocation of the surf club would provide a new club facility for community and the SLSC. Refer to Planned Retreat Options Table for further cost benefit details for PR2. | ? State Government (Grant Programs) ☑ Council (Current programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Recommended |
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | ~ | ~ | × | 2 | | | | | | | Erosion and inundation impacts are likely to affect land within property boundaries, however the buildings are not likely to be affected for some time. Applying development controls when these residences are redeveloped would improve their structural stability and therefore the longevity of the developments. Management options to either retreat from or protect the residences can be revised in the future, as the estimates for hazard impact change or impacts become imminent. Development controls may include foundations piles down to bedrock, minimum floor levels, distance from boundary for structures etc. Refer to Accommodate Options Table for further cost benefit details for DCP. | ? State Government (Grant programs) ☑ Council (Current Programs, increased rates and levies?) - cost to prepare DCP and implement at public assets ☑ Private landholders - cost to implement DCP | Recommended |



| 7 | 0 |
|---|---|
| 1 | 0 |

| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability*** | Reversible / Adaptable in Future | Effectiveness over long term | Legal / Approval Risk | Potential Funding Sources (Who may pay) | |
|-------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|-------------------------------|-------------------------------------|------------------------------|-----------------------|---|-----------------|
| A2 | Redesign or retrofit stormwater structures in current location to withstand impacts. | Current Action: NR7 Trigger: When inundation frequency impedes effective conveyance of stormwater <u>OR</u> when asset replacement is required, whichever is sooner. | × | × | ~ | | | | | | | | Stormwater assets are shown to be affected by coastal inundation through Hargraves and Stanwell Creeks. The outcomes of NR7 shall guide suitable designs for ensuring conveyance of stormwater with more frequent inundation with sea level rise. Refer to Accommodate Options Table for further cost benefit details for A2.? State Government (Grant Programs) | Recommended |
| A2 | Redesign or retrofit SLSC in current location to withstand impacts. | Current Action: NR3 Trigger: When SLSC needs to be refurbished <u>OR</u> erosion escarpment threatens building foundations. | ~ | ~ | ~ | | | | | | | | Would require re-development of SLSC in current location, but with design to withstand erosion and wave overtopping. The viability of this option will depend on outcomes of NR3. <i>Refer to Accommodate Options Table for further cost benefit details for A2.</i> ? State Government (Grant Programs) © Council (Current programs, new levies or increased rates?) <i>N/A</i> Private landholders who directly benefit from option | Marginal |
| A3 | Replace existing SLSC with relocatable structure. | Current Action: NR3 Trigger: When SLSC needs to be refurbished <u>OR</u> erosion escarpment threatens building foundations. | ~ | ~ | ~ | | | | | 7 | X | 0 | Depending upon site contraints, this option may be only viable way to retain structure in current location to withstand impacts. The viability of this option will depend on outcomes of NR3. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for A3.</i> | Marginal |
| FDCP | Update DCP Chapter E13 – Floodplain Management to include areas affected by Coastal Inundation as Low Risk Flood Precincts, and implement DCP to manage inundation impacts as properties are redeveloped and assets replaced. | As residences redeveloped, new developments built | × | × | ~ | | | 2 | 1 | Y | | | This option involves applying the existing Flood DCP chapter to properties at risk of coastal inundation at the "low flood risk" level, until Flood Studies are conducted for the creeks (for combined catchment and ocean water level events, see NR10). <i>Refer to Accommodate Options Table for further cost benefit details for FDCP. N/A</i> State Government (external funding unlikely to be needed) ☑ Council (Current Programs) ☑ Private landholders - cost to implement FDCP | Recommended |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | N/A | N/A | 2 | | | | | | | In general, Stanwell Park has relatively few assets at risk, so "do nothing" may not be as detrimental as elsewhere in Wollongong. However there would be a small number of private residences and public assets affected, making this an unacceptable option. Further, this option limits future management options, both where land value at risk is increased, or permanent loss of land/assets from erosion occurs prior to management action. <i>Refer to "Do Nothing" Option Table for further cost benefit details.</i> ? State Government ? State Government ② Council (new levies and increased rates) ② Private landholders in Future Generations | Not Recommended |
| NR | NR1, NR3, NR5, NR7, NR9, NR10, NR11, NR13, NR14 | Now | ~ | ~ | ~ | | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. ? State Government (Grant Programs) Ø Council (Current Programs) Ø Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |



6.2 Coalcliff Beach

6.2.1 Erosion and Recession Risk Level and Treatment Options

| Coalcliff Beach Erosion and Recession Erosion / Recession Erosion / Recession Risk Level Parks, Beaches and open space Icosion Icosion Protect Planned Reireat Accommodale No Regress 'Do Nothing' (Accept Risk) Calcliff Beach Hgh Icosion Ic | | | | | | | | | | | | | | | | | | |
|--|---|---------|-----------|---------|------------------------|----|--------|------------------------|------------------------|------------------------|--------|--------|--------|--------|------------------------|----------|--------------|---------------|
| Coalcliff Beach Insist Level Protect Planed Retreat Accommodate No Regrete "Do Nothing" (Accept Risk) Parks, Beaches and open space N N S1 S2 DV BM PRI PR2 PR3 PR4 PR5 DCP A2 A3 Investigate* DN Coalcliff Beach Reserve Nature Area Medium High Investigate* DN Investigate* DN Coalcliff Beach Reserve Nature Area Medium High Investigate* DN Coalcliff Beach Reserve Netium Medium High Investigate* DN Coalcliff Beach Reserve Medium High Investigate* NR1 Investigate* DN Coalcliff Beach Reserve Medium High Investigate* NR1 Investigate* DN Coalcliff Beach Low Medium High Investigate* NR3 Investigate* Area Investigate* Area Investigate* Area Investigate* Area Investigate* Area | | Erosio | n and Red | cession | | | | | Erc | osion | / Rece | ession | Risk | Treatn | nents | | | |
| Erosion Erosion Protect Planned Retreat Accompodate No Regres "Do Nothing" (Accept Risk) Parks, Beaches and open space High N S1 S2 DV BM PR1 PR2 PR3 PR4 PR5 DCP A2 A3 Investigate* DN Coalciff Beach High Extreme I I I I/I I/ | Coalcliff Beach | | Risk Leve | | | | | | | | | | | | | | | |
| by 2010 Duration Duration <thd< td=""><td></td><td>Erosion</td><td>Erosion</td><td>Erosion</td><td></td><td></td><td>Protec</td><td>t</td><td></td><td></td><td>Planr</td><td>ned Re</td><td>etreat</td><td></td><td>Acc</td><td>ommodate</td><td>No Regrets</td><td>"Do Nothing"</td></thd<> | | Erosion | Erosion | Erosion | | | Protec | t | | | Planr | ned Re | etreat | | Acc | ommodate | No Regrets | "Do Nothing" |
| Parks, Beaches and open space Image: Space stress of the space stress tress of the space stress of t | | by 2010 | by 2050 | by 2100 | | | | ~ | | | | | | r | | | No Region | (Accept Risk) |
| Cadeliff Beach High Extreme VV VV <t< td=""><td>Parks, Beaches and open space</td><td></td><td></td><td></td><td>Ν</td><td>S1</td><td>S2</td><td>DV</td><td>BM</td><td>PR1</td><td>PR2</td><td>PR3</td><td>PR4</td><td>PR5</td><td>DCP</td><td>A2 A3</td><td>Investigate*</td><td>DN</td></t<> | Parks, Beaches and open space | | | | Ν | S1 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCP | A2 A3 | Investigate* | DN |
| Coalciff Beach Reserve Nedium Hegin Image: Coalciff Beach Reserve Nedium Hegin Image: Coalciff Beach Reserve NR11 Convertige Medium Hegin Image: Coalciff Beach Reserve NR11 Image: Coalciff Beach Reserve NR11 Community Infrastructure Image: Coalciff Beach Reserve Image: Coalciff Beach Reserve NR1 Image: Coalciff Beach Reserve NR3 Image: Coalciff Beach Reserve Coalciff Beach Reserve Image: Coalciff Beach Reserve Medium Image: Coalciff Beach Reserve | Coalcliff Beach | High | Extreme | Extreme | | | | $\checkmark\checkmark$ | $\checkmark\checkmark$ | $\checkmark\checkmark$ | | | | | | | NR14 | |
| Occurrent Medium High Image: Construction of the second of the sec | Coalcliff Beach Reserve Nature Area, | Medium | Medium | High | | | | | | ~ ~ | | | | | | | | |
| Community Infrastructure Low Medium Columnation Columnation <thcolumnation< th=""> Columnation</thcolumnation<> | Stoney Creek | Medium | Medium | High | | | | | | ~ | | | | 6 | | | NR11 | |
| Coalcliff Sutr Club Low Medium Image: Coalcliff Statshed Image: Coalcliff Statshed <thimage: coalcliff="" statshed<="" th=""> Image: Coalcl</thimage:> | Community Infrastructure | | | 5 | | | | | | | | | | | | | | |
| Coaciff Boatshed Low Medium High High Coaciff Tidal Rock Pool (S end) Medium High High Coaciff Tidal Rock Pool (S end) Medium High High Coaciff Tidal Rock Pool (S end) Medium High High Coaciff Tidal Rock Pool (S end) Medium Medium Medium Medium Coaciff Tidal Sevage infrastructure Coaciff Boatshed Coaciff Boatsh | Coalcliff Surf Club | Low | Medium | Medium | | | | | | | ✓ | | | • | $\checkmark\checkmark$ | | NR3 | ✓ |
| Occount Duction Durb | Coalcliff Boatshed | Low | Low | Medium | | | | | | | | | | | √ √ | | 1110 | ✓ |
| Transport Infrastructure Index Org Org Infrastructure Infrastructure <thinfrastructure< th=""> <thinfrastructure< th=""> <t< td=""><td>Coalcliff Tidal Rock Pool (S end)</td><td>Medium</td><td>High</td><td>High</td><td></td><td></td><td></td><td></td><td></td><td>✓</td><td>C</td><td></td><td></td><td></td><td></td><td>✓</td><td>NR4. NR14</td><td>-</td></t<></thinfrastructure<></thinfrastructure<> | Coalcliff Tidal Rock Pool (S end) | Medium | High | High | | | | | | ✓ | C | | | | | ✓ | NR4. NR14 | - |
| Beach access road and car park Low Medium | Transport Infrastructure | | | | | | | | | | | | | | | | | |
| Water and sewage infrastructure Image: Construction of beach) Low Medium High Image: Construction of beach) Image: Construction of beach Im | Beach access road and car park | Low | Medium | Medium | | | | | | k 7 | 7 | | | | $\checkmark\checkmark$ | | | ✓ |
| Stormwater outlet and pipe (S end of beach) Low Medium High Image: Constraint of beach (S end of beach) Image: Constraint of beach (S end of beach (| Water and sewage infrastructure | | | | | | | | X | | | | | | | | | |
| Residential Development Existing Residences (10 ppties N end, but edge of ppty below cliff) Medium Medium High | Stormwater outlet and pipe (S end of beach) | Low | Medium | High | | | | | | 2 | ~~ | | | | ~ | | NR7, NR14 | |
| Existing Residences (10 ppties N end, but Medium High High Y | Residential Development | | | | | | | | | | | | | | | | | |
| edge of ppty below clift) | Existing Residences (10 ppties N end, but | Medium | Medium | High | | 6 | | | | | | | | | ~ ~ | | | |
| Hen k | edge of ppty below cliff) | | | Ŭ | | | | | | | | | | | | | | |
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Ν Nourishment S1 Seawall - long or majority of beach S2 Seawall - short sections DV Revitalise Dune Care Programs Manage beach sands Accept loss as sacrificial Relocate out of hazard zone Prohibit development expansion Voluntary Acquisition Buy back then lease back Apply development controls (future dev't and re-dev't) Redesign / retrofit in current ocation Replace with relocatable structure Apply existing flood development controls (future dev't and re-dev't) Update Asset Register for Hazards Audit existing seawalls Assess Public Buildings for "accommodate" or "relocate" Audit Ocean Pool condition Assess Roads for "accommodate" or "relocate" Assess Cycleways for "accommodate" or "relocate" Design criteria for Stormwater Assets Design criteria for Waste water, water supply and electricity assets Develop evacuation plans Conduct Flood Study including ocean water levels Audit EECs and habitats for priority conservation Use Norfolk Island Pines in new plantings Manage Aboriginal Heritage Items Monitor erosion & inundation events "Do Nothing" (Accept Risk) Substantial risk reduction and / or highly effective in managing risk Good risk reduction and / or effective in managing risk Technical feasibility of applying the option is questionable "Do Nothing" option is likely to have detrimental effect OR result in increased risk over time

Symbol





Coalcliff Beach

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6.2.2 Coastal Inundation Risk Level and Treatment Options

| | | | | | | | | | | S2 | Seawall - short sections |
|--|------------|-------------|--------------|------------------------|------------|-----------|--------|--------------|------------------------|-------|--|
| | Г | | | 1 | | | | | 1 | DV | Revitalise Dune Care Programs |
| | | | | | | | | | | BM | Manage beach sands |
| | Inun | dation Risk | Level | In | undatio | n Risk Ti | reatme | nts | | PR1 | Accept loss as sacrificial |
| | | | | | | | | | | PR2 | Relocate out of hazard zone |
| Cooleliff Booch | | 1 | 1 | | | | | | | PR3 | Prohibit development expansion |
| | | | | Overtopping | at g | | | | "Do | PR4 | Voluntary Acquisition |
| | Inundation | Inundation | Inundation | risk treated | Le: | Acco | omm- | No Dograto | Nothing" | PRO | Apply development controls (future |
| | by 2010 | by 2050 | by 2100 | by erosion | lar čet | oda | ate | NO Regress | (Accept | DCP | dev't and re-dev't) |
| | | | 5 | option | ᆸᄮ | | | | Risk) | A2 | Redesign / retrofit in current |
| Parks Beaches and onen snace | | | | • | PR2 | EDCP | Δ2 | Investigate* | | 43 | location Replace with relevatable structure |
| i arks, beaches and open space | | | | | 1112 | 1.001 | 712 | Investigate | | 7.5 | Apply existing flood development |
| Coalcliff Beach | Low | Low | Medium | | | | | | $\checkmark\checkmark$ | FDCF | controls (future dev't and re-dev't) |
| Coalcliff Beach Reserve Nature Area, Coalcliff Beach | | | | | | | | | | NR1 | Update Asset Register for Hazards |
| Reserve | Low | Low | Medium | | | | | | $\checkmark\checkmark$ | NR2 | Audit existing seawalls |
| | 1 | 1 | N.A. allower | | | | | | | NR3 | Assess Public Buildings for |
| Stoney Creek | LOW | LOW | Iviedium | | | | | | ~ ~ | | "accommodate" or "relocate" |
| Community Infrastructure | | | | | | | | | | INIX4 | Addit Ocean Pool condition Assess Roads for "accommodate" |
| Coalcliff Tidal Rock Pool (S end) | Low | Medium | Medium | | | | | | $\checkmark\checkmark$ | NR5 | or "relocate" |
| Transport Infrastructure | | | | | | | | | | NR6 | Assess Cycleways for |
| Beach access road and car park | Low | Low | Low | | | | | | √ √ | NR7 | Design criteria for Stormwater |
| Residential Development | | | | | | | | | | | Assets |
| Existing Residences (10 poties N and but adde of | | | | | | | | | | NR8 | water supply and electricity assets |
| note below oliff) | Medium | High | Extreme | $\checkmark\checkmark$ | | | | | \checkmark | NR9 | Develop evacuation plans |
| ppty below citri) | | | | | | | | | | NR10 | Conduct Flood Study including |
| | | | | | | | | | | | ocean water levels |
| | | | | | | | | | | NR11 | Audit EECs and nabitats for priority |
| | | • | | | | | | | | | Use Norfolk Island Pines in new |
| | | | | | | | | | | NR12 | plantings |
| | | | | | | | | | | NR13 | Manage Aboriginal Heritage Items |
| | | | | | | | | | | NR14 | Monitor erosion & inundation events |
| | | | | | | | | | | DN | "Do Nothing" (Accept Risk) |
| | | | | | | | | | | | Substantial risk reduction and / or |
| | | | | | | | | | | •• | highly effective in managing risk |
| | | | | | | | | | | ~ | Good risk reduction and / or |
| | | | | | | | | | | | Technical feasibility of applying the |
| | | | | | | | | | | ? | option is questionable |
| | | | | | | | | | | | "Do Nothing" option is likely to have |
| | | | | | | | | | | • | detrimental effect OR result in |
| | | | | | | | | | | | increased risk over time |

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Sym-

bol N

Nourishment

S1 Seawall - long or majority of beach



Immediate Inundation Risk Levels and Treatment Options Coalcliff Beach

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0 125 250m Approx. Scale



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6.2.3 Assessment of Treatment Options

| Co | alcliff | | | | | | | | | | | | |
|------------|---|--|----------------|--|--------------|-----------------|-----------------------------------|-------------------------------|-------------------------------------|-------------------------|-----------------------|--|---------------|
| Sym bol | - Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option Backwater Inundation | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability*** | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Sbecitic Cost Benetit Cousiderations to coarclift Beach Bources (Who may Day) | (provisional) |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ✓ N/A | | | | | | | | Dune care programs must be considerate of sightline requirements for SLSC activities. ? State Government (Grant Programs) Refer to Protect Options Table for further cost benefit details for DV. ☑ Council (Current Programs) | Recommended |
| BM | Beach Sand Management (beach scraping or nature assisted beach management) | Now and continuing | ~ | ✓ N/A | | | | | | | 0 | This option involves scraping and contouring beach sands to increase sand volumes held in dune storage for storm protection. ? State Government (Grant Programs) Refer to Protect Options Table for further cost benefit details for BM. ? Ouncil (Current Programs) | Recommended |
| PR | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ✓ N/A | | | | | 2 | | C | This is an excellent option for retaining Coledale beach, by utilising public open space to enable natural retreat and thus continued provision of a beach over the long term. ? State Government (Grant Programs) Refer to Planned Retreat Options Table for further cost benefit details for PR1. ? Ouncil (Current Programs) | Recommended |
| PR | Relocate stormwater assets landward of hazard zone | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe. | ~ | ✓ N/A | | | 2 | | | | | Given the small piece of stormwater outlet and pipe shown to be at risk, it is likely that the outlet and pipe can be progressively removed landward as impacts occur The best option for these assets should be confirmed through NR7. ? State Government (Grant Programs) Refer to Planned Retreat Options Table for further cost benefit details for PR2. N/A Private landholders who directly benefit from option | Recommended |
| PR | Relocate Coacliff SLSC landward of hazard zone | Current Action: NR3 Trigger: When asset requires major refurbishment or replacement | ~ | ✓ N/A | 2 | | | | | | | Coalcliff is highly constrained by bedrock, making the need for the SLSC to remain in current location unlikely, because of retreat of the shoreline. Relocation of the SLSC would require reconfiguring of the access road and carpark – this would be required with a retreated shoreline in any case. The best option for the SLSC should be confirmed through NR3. ? State Government (Grant Programs) Image: Reference of the standard stream of the stream of the stream of the | Recommended |



| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability*** | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for PR2 Beach (Apple Decomposition of Control of Co | Conclusion |
|-------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|-------------------------------|-------------------------------------|-------------------------|-----------------------|--|-------------|
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | ~ | × | N⁄A | | | | | ۷, | X, | 2 | Private Properties Erosion and overtopping impacts are shown to affect land within the property boundary, however the residences are situated far landward and higher than area identified at risk. Applying development controls to redevelopment ensures coastal erosion and overtopping are considered, but given the distance and building footprint, controls are unlikely to be extensive. ? State Government (Grant programs) Public Assets: SLSC, Boatshed, carpark ? Ouncil (Current Programs, increased rates and levies?) - until asset replacement is required. At that time, the DCP will trager investigations that will govern whether the asset needs to be relocated (e.g. PR2), or redesigned to withstand impacts (A2 or A3). In the meantime, Council can prioritise efforts towards other locations presently at high risk. This is also more cost effective as actions are done in conjunction with the expected cost for asset maintenance & replacement. Ø Private landholders - cost to implement DCP Inundation at Coalcliff is related to wave overtopping, rather than backwater inundation. This should be managed through Coastal DCP controls, as existing Flood DCP controls may not be Ø Private landholders - cost to implement development and programs) | Recommended |
| A2 | Retrofit Coalcliff Pool in current location to withstand impacts. | Current Action: NR4 Trigger: When damage to pool shell occurs <u>OR</u> the pool is being inundated at water levels lower than MSL. | ~ | ~ | N/A | 4 | | 2 | | | | | ? State Government (Grant The decision to progressively retrofit Coalcliff Pool over time to withstand wave and sea level rise impacts shall depend upon the suitability of pool condition for this purpose, based upon NR4. <i>Refer to Accommodate Options Table for further cost benefit</i> details for A2. | Recommended |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | ~ | | N/A | 2 | | | | | | | There is generally a low risk or limited area at risk from erosion, recession and overtopping. This includes private property where the developments themselves are well outside of the hazard area. "Do nothing" is therefore largely an acceptable option as it enables Council to focus resources on other higher risk locations. <i>Refer to "Do Nothing" Option Table for further cost benefit details.</i> ? State Government ? State Government ? Council (new levies and increased rates) ? Private landholders in Future Generations | Marginal |
| NR | NR1, NR3, NR4, NR7, NR11, NR13, NR14 | Now | ~ | ~ | ~ | | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. ? State Government (Grant Programs) Ø Council (Current Programs) Ø Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |



6.3 Scarborough and Wombarra Beaches

6.3.1 Erosion and Recession Risk Level and Treatment Options

| | | | | | | | | | | | | | | | | | | | DV | Revitalise Dune Care Programs |
|---|---------|-----------|---------|---|----|--------|------------------------|------------------------|------------------------|-------|--------|--------|--------|------------------------|-----------|-------|--------------|---------------|------------------------|--|
| | Frosio | n and Red | ression | | | | | | | | | | | | | | | | BM | Manage beach sands |
| Scarborough / Wombarra | L10310 | Rick Love | | | | | | Er | osion | / Rec | essior | n Risk | Treatr | nents | | | | | PR1 | Accept loss as sacrificial |
| Deesk | | | , | | | | | | - | | | | | | | | | | PR2 | Relocate out of hazard zone |
| Beach | Erosion | Erosion | Erosion | | | Protec | t | | | Plan | ned R | etreat | | Acc | ommo | odate | No Regrets | "Do Nothing" | PR3 | Prohibit development expansion |
| | by 2010 | by 2050 | by 2100 | | | | | | | | | | - | | \square | | | (Accept Risk) | PR4 | Voluntary Acquisition |
| Parks, Beaches and open space | | | | Ν | S1 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCP | A2 | A3 | Investigate* | DN | PR5 | Buy back then lease back |
| Scarborough Wombarra Beaches | High | Extreme | Extreme | | | | $\checkmark\checkmark$ | $\checkmark\checkmark$ | $\checkmark\checkmark$ | | | | | X | | | NR2, NR14 | | DCP | devt and re-devt) |
| Scarborough Recreation Reserve, Jim Allen Oval Natural Area | Low | Medium | Medium | | | | ~ ~ | | ~~ | | | | | | | | | ~ | A2 | Redesign / retrofit in current location |
| Small creek / drainage lines (S end and centre of Scarborough beach) | Low | Medium | Medium | | | | | | ~~ | | | | S | | | | NR11 | ~ | A3 FDCP | Replace with relocatable structure Apply existing flood development controls (future dayt and re-dayt) |
| Community Infrastructure | | | | | | | | | | | | | | | | | | | NR1 | Lodate Asset Register for Hazards |
| Wombarra Rock Pool | Medium | Medium | High | | | | | | ✓ | | | | | | ✓ | | NR4, NR14 | | NR2 | Audit existing seawalls |
| Wombarra Rock Pool Amenities | Low | Low | Medium | | | | | | | | | | | $\checkmark\checkmark$ | | | | ✓ | NR3 | Assess Public Buildings for |
| Local roads (inc road access within William Sweeney Park area at Wombarra) | Low | Low | Medium | | | | | | | | | | | ~ ~ | | | | ~ | NR4 | "accommodate" or "relocate" Audit Ocean Pool condition |
| Water and sewage infrastructure | | | | | | | | | k (| | | | | | | | | | NR5 | Assess Roads for "accommodate" or "relocate" |
| Stormwater outlets and pipes (3 at S end | High | Extreme | Extreme | | | | 2 | | | ~~ | | | | ~ ~ | ? | | NR7, NR14 | | NR6 | Assess Cycleways for "accommodate" or "relocate" |
| | | | | | 1 | | | | r | 1 | | 1 | J | | <u> </u> | | | LJ | NR7 | Design criteria for Stormwater Assets |
| | | | | | | | | | | | | | | | | | | | NR8 | water supply and electricity assets |
| | | | | | | | | | | | | | | | | | | | NR9 | Develop evacuation plans |
| | | | | | | | | | | | | | | | | | | | NR10 | Conduct Flood Study including |
| | | | | | | | | | | | | | | | | | | | NICIO | ocean water levels |
| | | | | | | | | | | | | | | | | | | | NR11 | Audit EECs and habitats for priority |
| | | | | | | | | | | | | | | | | | | | | Conservation |
| | | | | | | | | | | | | | | | | | | | NR12 | plantings |
| | | | XC | | | | | | | | | | | | | | | | NR13 | Manage Aboriginal Heritage Items |
| | | | | | | | | | | | | | | | | | | | NR14 | Monitor erosion & inundation events |
| | | | | | | | | | | | | | | | | | | | DN | "Do Nothing" (Accept Risk) |
| | | | | | | | | | | | | | | | | | | | $\checkmark\checkmark$ | Substantial risk reduction and / or |
| | | | | | | | | | | | | | | | | | | | | highly effective in managing risk |
| | | | | | | | | | | | | | | | | | | | ✓ | Good risk reduction and / or |
| | | | | | | | | | | | | | | | | | | | | Technical feasibility of applying the |
| | | | | | | | | | | | | | | | | | | | ? | option is questionable |
| | | | | | | | | | | | | | | | | | | | | "Do Nothing" option is likely to have |
| | | | | | | | | | | | | | | | | | | | • | detrimental effect OR result in |
| | | | | | | | | | | | | | | | | | | | | increased risk over time |

Sym-

bol

S1

S2

N Nourishment

Seawall - long or majority of beach

Seawall - short sections

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6.3.2 Coastal Inundation Risk Level and Treatment Options

| | | | | | | | | | | | ~ ~ / / |
|---|--------------|-------------|------------|-------------------|------------|----------|--------|----------------|------------------------|--------|---------------------------------------|
| | | | | | | | | | | S2 | Seawall - short sections |
| | | | | | | | | | | DV | Revitalise Dune Care Programs |
| | | | | | | | | | | BM | Manage beach sands |
| | Inun | dation Risk | Level | In | undatio | n Risk T | reatme | nts | | PR1 | Accept loss as sacrificial |
| | | | | | | | | | | PR2 | Relocate out of hazard zone |
| Coorborough /Wamborro Doooh | | 1 | 1 | | | | | 1 | | PR3 | Prohibit development expansion |
| Scarborougn/ wombarra beach | | | | Overtopping | ਜ਼ ਕ | | | | "Do | PR4 | Voluntary Acquisition |
| | Inundation | Inundation | Inundation | risk treated | re | Acco | omm- | No Dograto | Nothing" | PRO | Apply development controls (future |
| | bv 2010 | by 2050 | by 2100 | by erosion | lar čet | od | ate | NO Regreis | (Accept | DCP | dev't and re-dev't) |
| | ., | ., | - , | ontion | L | | | | Rick) | 4.0 | Redesign / retrofit in current |
| | | | | opion | | | _ | | TABK) | AZ | location |
| Parks, Beaches and open space | | | | | PR2 | FDCP | A2 | Investigate* | DN | A3 | Replace with relocatable structure |
| Scarborough Wombarra Beaches | Low | Low | Medium | | | | | | $\checkmark\checkmark$ | FDCP | Apply existing flood development |
| Quarkaneusk Basestian Baserra Line Allen Ord | LOW | LOW | Wearan | | | | | | | | controls (future devt and re-devt) |
| Scarborough Recreation Reserve, Jim Allen Oval | Low | Low | Medium | $\langle \rangle$ | | | | | $\checkmark\checkmark$ | NR1 | Opdate Asset Register for Hazards |
| Natural Area | 2011 | 2011 | mourant | | | | | | | TNI V2 | Assess Public Buildings for |
| Small creek / drainage lines (S end and centre of | | | | | | | | | | NR3 | "accommodate" or "relocate" |
| Scarborough beach) | Low | Low | Medium | | | | | | ~~ | NR4 | Audit Ocean Pool condition |
| | | | | | | | | | | NR5 | Assess Roads for "accommodate" |
| | | | | | | - | | | | 141.00 | or "relocate" |
| Wombarra Rock Pool | Low | Low | Medium | | | | | | $\checkmark\checkmark$ | NR6 | Assess Cycleways for |
| Wombarra Rock Pool Amenities | Low | Low | Low | | | | | | $\checkmark\checkmark$ | | Design criteria for Stormwater |
| Water and sowage infractructure | | | | | | | | | | NR7 | Assets |
| | | | | | | | | | | | Design criteria for Waste water, |
| Stormwater outlets and pipes (3 at S end Wombarra | High | Extreme | Extreme | 11 | | | | NR7 NR1/ | | INIXO | water supply and electricity assets |
| Beach) | riigii | | LATETIC | | | | | 111117, 111114 | | NR9 | Develop evacuation plans |
| | | | • | | | | | | | NR10 | conduct Flood Study Including |
| | | | | | | | | | | | Audit EECs and babitats for priority |
| | | | | | | | | | | NR11 | conservation |
| | \mathbf{O} | | | | | | | | | NID12 | Use Norfolk Island Pines in new |
| | | | | | | | | | | INIX12 | plantings |
| | | | | | | | | | | NR13 | Manage Aboriginal Heritage Items |
| | | | | | | | | | | NR14 | |
| | | | | | | | | | | DN | "Do Nothing" (Accept Risk) |
| | | | | | | | | | | | Substantial risk reduction and / or |
| | | | | | | | | | | ~ ~ | highly effective in managing risk |
| | | | | | | | | | | ~ | Good risk reduction and / or |
| | | | | | | | | | | | effective in managing risk |
| | | | | | | | | | | ? | rechnical feasibility of applying the |
| | | | | | | | | | | | "Do Nothing" option is likely to have |
| | | | | | | | | | | • | detrimental effect OR result in |
| | | | | | | | | | | | increased risk over time |



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Nourishment

S1 Seawall - long or majority of beach



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6.3.3 Assessment of Treatment Options

| Sca | borough and Wombarra B | Beaches | | | | | | | | | | | | | | |
|-------------|---|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|-----------------------|---|--|-------------|
| Sym- bol | . Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Legai / Approval Kisk | Specific Cost Benefit Considerations for Scaborough and Wombarra Beaches | Potential Funding Sources (Who may pay) | Conclusion |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ~ | N/A | | | | | | | | | Dune care programs must be considerate of sightline requirements for SLSC activities. Refer to Protect Options Table for further cost benefit details for DV. | ? State Government (Grant Programs) ☑ Council (Current Programs) <i>N/A</i> Private landholders who directly benefit from option | Recommended |
| ВМ | Beach Sand Management (beach scraping or nature assisted beach management) | Now and continuing | ~ | ~ | N/A | | | | | | | | | This option involves scraping and contouring beach sands to accumulate in dunes along the beach. This aims to increase sand volumes held in dune storage for storm protection. Refer to Protect Options Table for further cost benefit details for BM. | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | N/A | | | | | 2, | ×V. | | | This is an excellent option by utilising public open space to enable natural retreat to retain the beach. At Scarborough and Wombarra, erosion risk extents are limited suggesting there may not be extensive impacts to parkland, increasing the viability of this option. <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR1.</i> | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| PR2 | Relocate stormwater assets landward of hazard zone | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe OR the pipe requires replacement, whichever is sooner. | ~ | ~ | N/A | Ś | | 2 | | | | | | Erosion risk appears to affect the ends of a small number of stormwater assets. It is likely that the outlets and pipes can be progressively removed as erosion occurs. However, the outlets will also need to withstand inundation with sea level rise and wave overtopping. The best option for these assets should be confirmed through NR7. <i>Refer to Planned Retreat Options Table for further cost benefit details for PR2.</i> | ? State Government (Grant Programs) ☑ Council (new levies or increased rates) N/A Private landholders who directly benefit from option | Recommended |
| | | | | | | | | | | | | | | | | |



| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Both and the second sec | Conclusion |
|-------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|--|--------------------|
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | ~ | ~ | N/A | | | | | | | | The Amenities building and local access road are currently at low risk, so there is no immediate need for action. Investigations and action can be delayed until asset replacement is required. This is also more cost effective as actions are done in conjunction with the expected cost for asset maintenance & replacement. At that time, the DCP will trigger investigations that will govern whether the assets need to be relocated (e.g. PR2), or redesigned to withstand impacts (A2, A3). This allows Council to prioritise efforts towards other locations presently at high risk. Inundation at Scarborough and Wombarra is related to wave overtopping, rather than backwater inundation. This should be managed through Coastal DCP controls rather than existing Flood DCP controls that may not be applicable to the overtopping risk. <i>Refer to Accommodate Options Table for further cost benefit details for DCP</i> . | (s) Recommended |
| A2 | Redesign or retrofit stormwater structures and Wombarra Pool in current location to withstand impacts. | Current Action: NR7; NR4 Trigger: When erosion or wave overtopping destabilises outlet or pipe <u>OR</u> when asset replacement is required, whichever is sooner; When damage to pool shell occurs <u>OR</u> the pool is being inundated at water levels lower than MSL. | ~ | ~ | N/A | | | 2 | | ×~ | X. | 2 | Based on outcomes of NR7, if it is not possible to relocate the stormwater assets (i.e. PR2), then they will need to be redesigned and replaced in the current location to withstand impacts. The decision to progressively retrofit Wombarra Rock Pool over time to withstand wave and sea level rise impacts shall depend upon the suitability of pool condition, based upon NR4. <i>Refer to Accommodate Options Table for further cost benefit details for A2.</i> ? State Government (Grant Programs) | Marginal |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | N/A | N/A | 5 | | | | | | | There is generally a low risk or limited area at risk from erosion, recession and overtopping. "Do nothing" is therefore largely an acceptable option as it enables Council to focus resources on other higher risk locations. <i>Refer to "Do Nothing" Option Table for further cost benefit details.</i> ? State Government I Council (new levies and increased rates) I Private landholders in Fu Generations | Marginal |
| NR | NR1, NR2, NR4, NR7, NR11, NR13, NR14 | Now | ~ | ~ | ~ | | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. ? State Government (Grant Programs) Image: Council Current Program N/A Private landholders wh directly benefit from option | s) (s |



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6.4 Coledale Beach

6.4.1 Erosion and Recession Risk Level and Treatment Options

| | 1 | | | 1 | | | | | | | | | | | | | | | ٦L |
|--|---------|------------------------|---------|---------------------------------------|----|--------|------------|------------------------|------------------------|-------------------|--------|--------|-----|------------------------|------|------------------------|--------------|-------------------------------|------|
| | Erosio | n and Red Risk Leve | cession | n Erosion / Recession Risk Treatments | | | | | | | | | | | | | | | |
| Coledale Beach | Erosion | Erosion | Erosion | | | Protec | ct | | | Plan | ned Re | etreat | | Acc | ommo | odate | No Regrets | "Do Nothing" (Accept Risk) | |
| Parks, Beaches and open space | by 2010 | by 2000 | by 2100 | Ν | S1 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCP | A2 | A3 | Investigate* | DN | 1 - |
| Coledale Beach | High | Extreme | Extreme | | | | √ √ | $\checkmark\checkmark$ | √ √ | | | | | X | | | NR14 | | 1 L |
| Coledale Beach Reserve | Medium | Medium | High | | | | | | $\checkmark\checkmark$ | | | | | | | | | | 11 |
| Carricks Creek | Medium | High | Extreme | | | | | | $\checkmark\checkmark$ | | | | 2 | | | | NR11 | | 1 – |
| Stockyard Creek | Medium | High | Extreme | | | | | | $\checkmark\checkmark$ | | | | 0 | | | | NR11 | | 11. |
| Dalys Creek | Medium | Medium | High | | | | | | $\checkmark\checkmark$ | | | | | | | | NR11 | | |
| EEC - Coastal Headland Banksia Scrub | Medium | Medium | High | | | | | | √ √ | | | | | | | | NR11 | | 1 – |
| Community Infrastructure | | | | | | | | | | N | | | | | | | | | 1 - |
| Coledale Surf Club | Low | Medium | Medium | | | | | | | | | | | $\checkmark\checkmark$ | | $\checkmark\checkmark$ | | ✓ | |
| Coledale Beach Camping and Caravan Park | Medium | Medium | High | | | | | | $\checkmark\checkmark$ | $\mathbf{\nabla}$ | | | | ✓ | | | | | 1 |
| Coledale Beach Camping Reserve - Amenities Building | Low | Medium | Medium | | | | | | 7 | | | | | ~ ~ | | | NR3 | ✓ | |
| Heritage Site: Norfolk Island Pines | Medium | Medium | High | | | | | | 11 | | | | | | | | NR12 | ✓ | 1 |
| Coledale Rock Pool | High | Extreme | Extreme | | | | | | ✓ | | | | | | ✓ | | NR4, NR14 | | 1 - |
| Transport Infrastructure | | | | | | | | | | | | | | | | | | | 1 L |
| Local Beach Access Road and car parking | Low | Low | Medium | | | | | | | | | | | $\checkmark\checkmark$ | | | | ✓ | |
| Water and sewage infrastructure | | | | | | | | | | | | | | | | | | | |
| Stormwater outlet and pipe (1 at S end = Carricks CK) | Medium | High | Extreme | | | | | | | ~~ | | | | ~ | | | NR7, NR14 | | |
| Institutional Infrastructure | | | | K | | | | | | | | | | | | | | | 1 |
| Coledale Public School - Grounds only | Low | Low | Medium | | • | | | | | | | | | ✓ | | | | ✓ |] - |
| | | l | | | | | | | | | | | | | | | | | - L' |
| | | | \sim | | | | | | | | | | | | | | | | Ľ |
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| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |

Symbol N Nourishment Seawall - long or majority of beach S1 S2 Seawall - short sections DV Revitalise Dune Care Programs Manage beach sands Accept loss as sacrificial Relocate out of hazard zone Prohibit development expansion /oluntary Acquisition Buy back then lease back Apply development controls (future lev't and re-dev't) Redesign / retrofit in current ocation Replace with relocatable structure Apply existing flood development controls (future dev't and re-dev't) Jpdate Asset Register for Hazards Audit existing seawalls Assess Public Buildings for accommodate" or "relocate" Audit Ocean Pool condition Assess Roads for "accommodate" r "relocate" Assess Cycleways for accommodate" or "relocate" Design criteria for Stormwater ssets Design criteria for Waste water, vater supply and electricity assets Develop evacuation plans Conduct Flood Study including cean water levels Audit EECs and habitats for priority onservation Jse Norfolk Island Pines in new lantings Anage Aboriginal Heritage Items Nonitor erosion & inundation events Do Nothing" (Accept Risk) Substantial risk reduction and / or ighly effective in managing risk Good risk reduction and / or effective in managing risk Technical feasibility of applying the ? option is questionable

 "Do Nothing" option is likely to have detrimental effect OR result in increased risk over time

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| 6.4.2 Coastal Inundation Risk Leve | and Tre | atment | Ontions | | | | | | | Sym- | |
|---|------------|--------------|------------|------------------------|--------------|------------------------|------------------------|--------------------------|--------------|--------------|---|
| | | atment | options | | | | | | | N | Nourishment |
| | | | | | | | | | | S1 | Seawall - long or majority of beach |
| | | detien Diele | | | | | | | | S2 | Seawall - short sections |
| | Inun | dation Risk | Level | In | undation | RISK I | eatme | nts | | DV | Revitalise Dune Care Programs |
| | | | | | | | | | | BM DD1 | Manage beach sands |
| Coledale Beach | | | | Overtopping | d t | | | | "Do | PR2 | Relocate out of hazard zone |
| | Inundation | Inundation | Inundation | risk treated | nec ea | Acco | mm- | | Nothina" | PR3 | Prohibit development expansion |
| | by 2010 | by 2050 | by 2100 | by erosion | lan | oda | ate | No Regrets | (Accept | PR4 | Voluntary Acquisition |
| | 5, 2010 | 5, 2000 | 5, 2100 | ontion | 르뽀 | | | | (Pick) | PR5 | Buy back then lease back |
| | | | | option | DD 0 | FROR | 10 | | | DCP | Apply development controls (future |
| Parks, Beaches and open space | | | | | PR2 | FDCP | A2 | Investigate [*] | DN | 4.2 | Redesign / retrofit in current |
| Coledale Beach | Low | Low | Medium | \checkmark | | | | | \checkmark | AZ | location |
| Coledale Beach Reserve | Low | Low | Medium | 1 | N | | | | ✓ | A3 | Replace with relocatable structure |
| | | | | ~ | | | | NR10. | | FDCP | controls (future dev/t and re-dev/t) |
| Carricks Creek | Medium | Medium | High | | | | | NR14 | \checkmark | NR1 | Update Asset Register for Hazards |
| | | | | | | | | | | NR2 | Audit existing seawalls |
| Stockyard Creek | Medium | Medium | High | CN | | | | INR IU, | ✓ | NR3 | Assess Public Buildings for |
| | | | - | | | | | INR14 | | NR4 | Audit Ocean Pool condition |
| Dalvs Creek | Medium | Medium | High | \mathbf{r} | | | | NR10, | ✓ | NR5 | Assess Roads for "accommodate" |
| | | | | | | | | NR14 | | | or "relocate" |
| EEC - Coastal Headland Banksia Scrub | Medium | Medium | High | | | | | NR11 | \checkmark | NR6 | "accommodate" or "relocate" |
| Community Infrastructure | | | | | | | | | | NR7 | Design criteria for Stormwater |
| Caladala Surf Club | Modium | Lligh 🥒 | Extromo | 1 | | 11 | | NR10, | | | Design criteria for Waste water. |
| | Medium | Flight | Extreme | · | | •• | | NR14 | | NR8 | water supply and electricity assets |
| Coledale Beach Camping and Caravan Park | Medium | Medium | High | | | $\checkmark\checkmark$ | \checkmark | NR10 | | NR9 | Develop evacuation plans |
| Coledale Beach Camping Reserve - Amenities | | | | | | | | | | NR10 | ocean water levels |
| Building | Low | Medium | Medium | ~ | | $\checkmark\checkmark$ | | NR10 | ~ | NR11 | Audit EECs and habitats for priority |
| Heritage Site: Norfolk Island Pines | Low | Low | Medium | | | | | | ✓ | | Conservation Use Norfolk Island Pines in new |
| Coledale Rock Pool | Medium | Medium | Hiah | ✓ | | | | | | | plantings |
| Transport Infrastructure | | | | | | | | | | NR13 NR14 | Manage Aboriginal Heritage Items |
| Local Beach Access Road and car parking | Low | Low | Medium | | | | | | ✓ | DN | "Do Nothing" (Accept Risk) |
| Water and sewage infrastructure | | | | | | | | | | | Substantial risk reduction and / or |
| Stormwater outlets and pipes (1 at S end at Carrick | | | | | | | | | | ~~ | highly effective in managing risk |
| Ck 2 baseb parallel at Dalva Ck) | High | Extreme | Extreme | | \checkmark | \checkmark | $\checkmark\checkmark$ | NR7, NR14 | • | ~ | Good risk reduction and / or |
| Un 2 Deach parallel at Daiys UN | | | | | | | | | | | Technical feasibility of applying the |
| | | | | | | | | | | Ŷ | option is questionable |
| Coledale Public School - Grounds only | Low | Low | Medium | $\checkmark\checkmark$ | | \checkmark | | | \checkmark | | "Do Nothing" option is likely to have |
| | | | | | | | | | | - | increased risk over time |



| KEY PLAN OCCUPATE USERNAL Destal Inundation Risk Evaluation Master Boundaries Hazard Definition Lines Overtopping Risk Treated By Erosion Option Risk Level Kigh Extreme | | | | Concentrate or one of the second seco | | | |
|---|--|---------|--------|--|-------------|----------|---------|
| Title: | Dick Low | ole and | Troatn | ont On | tions | Drawing: | Rev: |
| Coledale Beach | VISK LEV | eis anu | meath | ient Op | lions | 6-8 | A |
| BMT WBM endeavours to ensure that the information pro map is correct at the time of publication. BMT WBM does guarantee or make representations regarding the current accuracy of information contained in this map. | ovided in this s not warrant, cy and | Å | 0A | 125 pprox. Sca | 250m ale | СВ | WEW WBM |

6.4.3 Assessment of Treatment Options

| Сс | ledale | | | | | | | | | | | | | |
|-----------|---|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|--|---|
| Syr bo | n- Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Ontion | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for Coledale Beach | Conclusion |
| D١ | / Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ~ | × | | | | | | | | Dune care programs must be considerate of sightline requirements for SLSC activities. There are limited dunes here at present. <i>Refer to Protect Options Table for further cost benefit details for</i> <i>DV.</i> ? State Government (G Programs) Solution Council (Current Pro- N/A Private landholders directly benefit from option | ant pepuang rams) who on a |
| в | Beach Sand Management (beach scraping or nature assisted beach management) | Now and continuing | ~ | ~ | × | | | | | | | | This option involves scraping and contouring beach sands to accumulate in and increase sand volumes held in dune storage for storm protection. <i>Refer to Protect Options Table for further cost benefit details for BM.</i> 2 State Government (G Programs) ☑ Council (Current Programs) ☑ Council (Current Programs) ☑ Council (Current Programs) | ant (rams) who on on |
| PR | Accept loss following hazard event. 1 Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | × | | | | | | 8 | 1Xx | This option enables the beach to be retained over time by allowing natural retreat through reserve and campground lands. These areas will still be usable even with erosion. Over time, existing Norfolk Pines can be replaced with new pines further landward, as the trees naturally perish. Based on NR4, if it is found that Coledale Pool cannot be progressively repaired to withstand wave and sea level rise impacts that M/A Private landholders directly benefit from optifails over time. Refer to Planned Retreat Options Table for further cost benefit details for PR1. | ant papuage (rams) who on age of the second |
| PR | 2 Relocate stormwater structures outside of hazard zone | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe <u>OR</u> when asset replacement is required, whichever is sooner. | V | ~ | × | | Ś | | 1 | | | | Stormwater assets at Carricks Creek could be progressively removed and relocated landward. At Dalys Creek, parallel stormwater assets affected by inundation may not be able to be relocated, this would need to be confirmed through NR7. ? State Government (G Programs) Refer to Planned Retreat Options Table for further cost benefit details for PR2. ? NA Private landholders directly benefit from options | ant who on |
| PR | Relocate camp ground amenities 2 and beach access road outside of hazard zone | When amenities needs to be replaced; when erosion impacts occur to roadway. | √ | ✓ ✓ | × | | 5 | | | | | | The Camp ground amenities is currently at low risk, so relocation needs only be timed to occur at the next refurbishment cycle. This makes relocation more cost effective as it is done in conjunction with the expected cost for asset maintenance & replacement. The local road access would not need to be relocated until impacts manifest, as it is currently at low risk. Refer to Planned Retreat Options Table for further cost benefit details for PR2. | ant rams, who on |
| A | Replace SLSC with relocatable structure. | Already in progress | ~ | ~ | ~ | | | | | | | | A proposal is already in progress to replace the Coledale SLSC with a relocatable structure, which is relatively inexpensive,will have power, water and wastewater and can be moved prior to a storm. Refer to Accommodate Options Table for further cost benefit details for A3. | ant ,ram) who on B |

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| Sum Distribution Triggers for form one of the property intervention of the | | | | | | | | | | | | | | | | |
|--|-------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|---|-------------|--|
| A2 Redesign or mindle stormwater inductions and Coldade Pool in pace 02 when assets inductions and Coldade Pool in pace 02 when assets indicates in pace 02 when asset indicates in pace 02 when asset indicates in pace 02 when assets indicates in pace 02 when assets indicates in pace 02 when assets indicates in pace 02 when asset indicates in pace 02 when assets indicates i | Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Sbecitic Cost Benefit Considerations for DCb Beach Sources (Who may pay) | Conclusion | |
| Prepare a Coastal Management Deel operant Control Plan (DCP) charter, to implement to include areas dentified at risk trans constal immation, as an interim measure unit such time as Fload Studies for DLP, those areas dentified at risk trans constal immation, as an interim measure unit such time as Fload Studies for DLP, those areas dentified at risk trans constal immation, as an interim measure unit such time as Fload Studies for DLP, those areas dentified at risk trans constal immation, as an interim measure unit such time as Fload Studies for DLP, those areas dentified at risk trans constal immation, as an interim measure unit such time as Fload Studies for DLP, those areas dentified at risk trans constal immation, as an interim measure to fluid despondent as the fload Acc | A2 | Redesign or retrofit stormwater structures and Coledale Pool in current location to withstand impacts. | Current Action: NR7; NR4 Trigger: When erosion or wave overtopping destabilises outlet or pipe <u>OR</u> when asset replacement is required, whichever is sooner; When damage to pool shell occurs <u>OR</u> the pool is being inundated at water levels lower than MSL. | ~ | ~ | N/A | | | | | | | | Based on outcomes of NR7, if it is not possible to relocate the stormwater assets (i.e. PR2), then they may need to be redesigned and replaced in the current location to withstand impacts. The decision to progressively retrofit Coledale Pool over time to withstand wave impacts and sea level rise shall depend upon the suitability of pool condition for this purpose, based upon NR4. <i>Refer to Accommodate Options Table for further cost benefit details for A2.</i> State Government (Grant Programs) | Recommended | |
| Update DCP Chapter E13 - Floodplain Maragement to include areas affected by Coastal inundation, as an interim measure until such time as Flood Studies for Dalys, Stockyard and Precincts, and implement DCP to manage inundation implement DCP to manage inundation implement DCP to manage inundation implement DCP. N/A State Government (external funding unlikely to be needed) W A State Government (external funding unlikely to be needed) W A State Government (external funding unlikely to be needed) W A State Government (external funding unlikely to be needed) W A State Government (external funding unlikely to be needed) W A State Government (external funding unlikely to be needed) W A State Government (external funding unlikely to be needed) W A State Government (external funding unlikely to be needed) W A State Government (external funding unlikely to be needed) W A State Government (external funding unlikely to be needed) W A State Government (external funding unlikely to be needed) W A State Government (external funding unlikely to be needed) W A State Government (external funding unlikely to be needed) W A State Government (external funding unlikely to be needed) W O neute Internal funding unlikely to be needed) W O neute Internal funding unlikely to be needed) W Private Indudiders - cost to implement FDCP W NA NA No No limitations upon existing development / redevelopment / redevelopment over planning timeframe N/A N/A N/A N/A N/A N/A N/A N/A Private Indudiders in Future Generations ? State Government (Grant Programs) W Private Indudiders in Future Ge | DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | ~ | ~ | × | | | | | | , P | ×, | The amenities and roadway are currently at low risk, so there is no immediate need for action. At the time for asset replacement, the DCP will trigger investigations to govern whether the asset needs to be relocated (e.g. PR2), redesigned to withstand impacts (A2, A3). This allows Council to prioritise efforts towards other locations presently at high risk. This is also more cost effective as actions are dope in conjunction with the expected cost for asset maintenance & replacement. The DCP controls will also manage wave overtopping. The risk to the school applies to the grounds only. Applying the DCP will flag investigations to ensure future re-developments/developments consider and mitigate erosion and overtopping risks if required for DCP. Refer to Accommodate Options Table for further cost benefit details. | Recommended | |
| No limitations upon existing development or future development / re-development or future development over planning timeframe N/A | FDCP | Update DCP Chapter E13 – Floodplain Management to include areas affected by Coastal Inundation as Low Risk Flood Precincts, and implement DCP to manage inundation impacts as properties are redeveloped and assets replaced. | As property / assets redeveloped, new developments built | × | × | ~ | R | Ś | | L | | | | This option involves applying the existing Flood DCP chapter to those areas identified at risk from coastal inundation, as an interim measure until such time as Flood Studies for Dalys, Stockyard and Carricks Creek are completed (refer NR10). The controls are applied at the "low risk" level. Refer to Accommodate Options Table for further cost benefit details for FDCP. | Recommended | |
| NR NR1, NR3, NR4, NR7, NR10, NR11, NR12, NR13, NR14 Now Image: A mark of the second sec | DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | N/A | . N/A | | | | | | | | There is generally a low risk or limited assets at risk from erosion, recession and overtopping. "Do nothing" is a partly acceptable option as it enables Council to focus resources on other higher risk locations. The key assets that may be affected are stormwater assets, and impacts may be costly if not managed. Refer to "Do Nothing" Option Table for further cost benefit details. State Government I increased rates) Private landholders in Future Generations | Marginal | |
| | NR | NR1, NR3, NR4, NR7, NR10, NR11, NR12, NR13, NR14 | Now | ~ | ~ | ~ | | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. ? State Government (Grant Programs) Image: Council (Current Programs) Image: Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended | |

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6.5 Sharkys Beach

6.5.1 Erosion and Recession Risk Level and Treatment Options

| | | | | | | | | | | | | | | | | | | | DV | Revita |
|--|--------------------|------------------------|--------------------|---|----|--------|------------------------|------------|------------------------|-------|-------|--------|-------|------------------------|-----|-------|--------------|-------------------------------|-------------------|----------------------------|
| | Erosio | n and Reo Risk Leve | cession | | | | | Er | rosion | / Rec | essio | n Risk | Treat | ments | | | | | BM PR1 | Manag Accep |
| Sharkys Beach | Erosion by 2010 | Erosion | Erosion by 2100 | | | Protec | ct | | | Plan | ned R | etreat | | Acc | omm | odate | No Regrets | "Do Nothing" (Accept Risk) | PR2 PR3 PR4 | Reloca Prohib Volunt |
| Parks, Beaches and open space | | | | Ν | S1 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCP | A2 | A3 | Investigate* | DN | PR5 | Buy ba |
| Sharkys Beach | High | Extreme | Extreme | | | | $\checkmark\checkmark$ | √ √ | $\checkmark\checkmark$ | | | | | X | | | NR14 | | DCP | dev't a |
| Sharkys Beach Reserve | Medium | Medium | High | | | | | | $\checkmark\checkmark$ | | | | | | | | | | A2 | Redes |
| Community Infrastructure | | | | | | | | | | | | | | | | | | | 1.2 | locatio |
| Heritage Site: Norfolk Island Pines (backing entire beach) | Medium | Medium | High | | | | | | ~~ | | | | Ø | | | | NR12 | | FDCP | Apply contro |
| Heritage Site: Site of Austinmer Jetty | High | Extreme | Extreme | | | | | | $\checkmark\checkmark$ | ? | | | • | | | | NR14 | | NR1 | Update |
| Austinmer Boat Harbour toilets | Low | Low | Medium | | | | | | | | | | | $\checkmark\checkmark$ | | | NR3 | ✓ | NR2 | Audit e |
| Transport Infrastructure | | | | | | | | 1 | | C | N | | | | | | | | NR3 | Asses: |
| Car park (behind Sharkys beach) | Low | Medium | Medium | | | | | 1 | | | | | | ✓ | | | | ✓ | NR4 | Audit (|
| Car park (At boat harbour) | Medium | Medium | High | | | | | | | 11 | | | | ✓ | | | | | NR5 | Asses |
| Sharkys / Austinmer Boat Harbour (Heritage listed) | High | Extreme | Extreme | | | | 6 | X | × | | | | | | ~~ | | NR14 | • | NR6 | or "rel Asses |
| Water and sewage infrastructure | | | | | | | | | | | | | | | | | | | | Design |
| Stormwater outlets and pipes | High | Extreme | Extreme | | | | | T | | ✓ | | | | ✓ | √√ | | NR7, NR14 | • | NR7 | Assets |
| Residential Development | | | | | | | | Ĩ | | | | | | | | | | | NR8 | Desigr |
| Vacant Land (Shark Park, currently zoned | Madium | Madium | Lliab | | | | | 1 | | | | | | | | | | | NR9 | Develo |
| residential) | Medium | Medium | Figh | | • | | | | | | | | | Ľ | | | INK 14 | | NP10 | Condu |
| | | | | | | | | | | | | | | | | | | | INKIU | ocean |
| | | | | | | | | | | | | | | | | | | | NR11 | Audit E |
| | | | | | | | | | | | | | | | | | | | | Use N |
| | | | | | | | | | | | | | | | | | | | NR12 | plantin |
| | | • | | | | | | | | | | | | | | | | | NR13 | Manag |
| | | | | | | | | | | | | | | | | | | | NR14 | Monito |
| | | | • | | | | | | | | | | | | | | | | DN | "Do No |
| | | | | | | | | | | | | | | | | | | | ~~ | Substa |
| | | | | | | | | | | | | | | | | | | | | Good |
| | | | | | | | | | | | | | | | | | | | ~ | effecti |
| | | | | | | | | | | | | | | | | | | | 2 | Techn |
| | | | | | | | | | | | | | | | | | | | | option |

Sym-

bol

S1

N Nourishment

Seawall - long or majority of beach





Immediate Erosion Risk Levels and Treatment Options Sharkies Beach

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

0 75 150m Approx. Scale



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| 6.5.2 Coastal Inundation Risk Leve | el and Tre | atment | Options | | | | | | | Sym- bol |
|--|-----------------------|-----------------------|-----------------------|---|--------------------|-------------|--------------|--------------|-------------------------------------|--|
| | Inun | dation Risk | Level | Int | undatior | n Risk Tr | reatme | nts | | N Nourishment S1 Seawall - long or majority of beach S2 Seawall - short sections DV Revitalise Dune Care Programs BM Manage beach sands |
| Sharkies Beach | Inundation by 2010 | Inundation by 2050 | Inundation by 2100 | Overtopping risk treated by erosion option | Planned Retreat | Acco oda | mm- ate | No Regrets | "Do Nothing" (Accept Risk) | PR1 Accept loss as sacrificial PR2 Relocate out of hazard zone PR3 Prohibit development expansion PR4 Voluntary Acquisition PR5 Buy back then lease back |
| Parks, Beaches and open space | | | | | PR2 | FDCP | A2 | Investigate* | DN | DCP dev/t and re-dev/t) |
| Sharkys Beach | Low | Low | Medium | | | | | | $\checkmark\checkmark$ | A2 Redesign / retrofit in current location |
| Sharkys Beach Reserve | Low | Low | Medium | | S | | | | $\checkmark\checkmark$ | A3 Replace with relocatable structure |
| Community Infrastructure | | | | | | | | | | FDCP Apply existing flood development controls (future dev/t and re-dev/t) |
| Heritage Site: Norfolk Island Pines (backing entire beach) | Low | Low | Medium | | | | | | √√ | NR1 Update Asset Register for Hazards NR2 Audit existing seawalls |
| Heritage Site: Site of Austinmer Jetty | Medium | High | Extreme | 47 | | | | | $\checkmark\checkmark$ | NR3 "accommodate" or "relocate" |
| Austinmer Boat Harbour toilets | Low | Medium | Medium | 11 | | | | | ✓ | NR4 Audit Ocean Pool condition |
| Transport Infrastructure | | | | | | | | | | NR5 Assess Roads for accommodate or "relocate" |
| Lawrence Hargrave Drive (Major Coastal Road) | Low | Medium | High | | | ✓ | \checkmark | | | NR6 Assess Cycleways for |
| Car park (behind Sharkys beach) | Medium | Medium | High | √ √ | | | | | | NB7 Design criteria for Stormwater |
| Car park (At boat harbour) | Medium | Medium | High | <i>√√</i> | | | | | | Assets |
| Sharkys / Austinmer Boat Harbour (Heritage listed) | High | Extreme | Extreme | <i>√√</i> | | | | | • | NR8 water supply and electricity assets |
| Water and sewage infrastructure | | | | | | | | | | NR9 Develop evacuation plans Conduct Flood Study including |
| Stormwater outlets and pipes | High_ | Extreme | Extreme | √ √ | | | \checkmark | NR7, NR14 | • | ocean water levels |
| Residential Development | | | | | | | | | | NR11 Addit EECs and habitats for phonty conservation |
| Vacant Land (Shark Park) | Low | Low | Medium | √ √ | | | | | | NR12 Use Norfolk Island Pines in new |
| | | | | | | | | | | NR13 Manage Aboriginal Heritage Items NR14 Monitor erosion & inundation events DN "Do Nothing" (Accept Risk) ✓ Substantial risk reduction and / or highly effective in managing risk ✓ Good risk reduction and / or effective in managing risk ? Technical feasibility of applying the option is questionable "Do Nothing" option is likely to have |



increased risk over time



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|-----------|----------|---------------------------------------|-----|--------|-----------|----------|---|
| | | | | | | | - |

6.5.3 Assessment of Treatment Options

| Sha | rkys | | | | | | | | | | | | | |
|-------------|---|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|---|-------------|
| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for Sharkys Beach Guing Funding Considerations for Sharkys Beach Sources (Neu and Sources) | Conclusion |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ~ | × | | | | | | | | Dune care programs must be considerate of sightline requirements for SLSC activities. There are currently limited dunes, this action would be supported by BM. Refer to Protect Options Table for further cost benefit details for DV. | Recommended |
| ВМ | Beach Sand Management (beach scraping or nature assisted beach management) | Now and continuing | ~ | ~ | × | | | | | | | | This option involves scraping and contouring beach sands to accumulate in dunes along the beach, to increase sand volumes held in dune storage for storm protection. <i>Refer to Protect Options Table for further cost benefit details for BM.</i> 2 State Government (Grant Programs) ✓ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | × | | | | | | | | Similarly to Coalcliff, the extent of erosion is limited at Sharkys Beach, making this an excellent option for retaining the beach, by utilising public open space to enable natural retreat of the beach, and hence continued provision of a beach over the long term. Refer to Planned Retreat Options Table for further cost benefit details for PR1. | Recommended |
| PR2 | Relocate stormwater structures outside of hazard zone | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe <u>OR</u> when asset replacement is required, whichever is sooner. | * | ~ | × | 0 | 2 | | 2 | 1 | | | Erosion and overtopping risks affect the ends of two stormwater assets at the northern end of the beach. It is likely that the outlets and pipes can be progressively removed as erosion occurs. Overtopping risk appears more extensive for the stormwater pipeline at Austinmer Boat Harbour, and it may not be possible to relocate this structure further landward. The ability to relocate or redesign these pipes & outlets would need to be confirmed through NR7. <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR2.</i> | Marginal |
| PR2 | Relocate Boat Harbour carpark landward of hazard zone | Trigger: When erosion or wave overtopping damages carpark such that it is not functional <u>OR</u> when Harbour is being redesigned | ~ | ~ | x | | | | | | | | As part of retaining a functioning boat harbour for the community, car parking facilities for boat users needs to be retained. There is public open space landward of the current car park, relocation to this site would need to be determined in conjuction with remodelling the harbour to remain functional with sea level rise inundation impacts. <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR2.</i> | Recommended |
| A2 | Redesign or retrofit stormwater structures in current location to withstand impacts. | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe <u>OR</u> when asset replacement is required, whichever is sooner. | ~ | ~ | ~ | | | | | | | | Particularly for the stormwater outlet at Austinmer Boat Harbour, the extent of inundation as well as erosion may not enable the structure to be located landward, and instead require redesign at the current location. This shall need to be confirmed based on outcomes of NR7. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for A2.</i> <i>Particularly for the stormwater outlet at Austinmer Boat Harbour, Programs)</i> <i>Council (Current programs, new levies or increased rates?)</i> <i>N/A Private</i> landholders who directly benefit from option | Recommended |

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102

| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation | Uption Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Active Specific Cost Benefit Considerations for PR2 Beach (Neuros (Neuros Concess (Meuros (Meuros Concess (Meuros (Meu | Conclusion | |
|-------------|--|---|----------------|--------------------|----------------------|------------------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|--|-----------------|--|
| A2 | Redesign or retrofit Austinmer Boat Harbour to withstand wave forces and inundation due to sea level rise. | Current Action: Investigate options, prepare approvals (as required) now Trigger: When wave overtopping and mean sea level inundation cause harbour to not be functional for the majority of sea conditions <u>OR</u> at major asset maintenance cycles, as required. | ~ | ~ | × | | | | | | | | Austinmer Boat Harbour could feasibly be redesigned, such as boat ramp and breakwalls raised, to remain a functional regional recreational boat access point. Given there is a small patch of sandy beach below the ramp at present, the redesign will need to consider retaining the sandy strip with nourishment following storm events. The volumes are likely to be small. Alternative designs without sand that retain or improve current functioning may also be acceptable. Refer to Accommodate Options Table for further cost benefit details for A2. | Recommended | |
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments | ~ | ~ | × | | | | | | ~ | XX, | Vacant Land at Shark Park, Sharkys carpark and Austimmer Boat Harbour amenities building are currently at low risk, so there is no immediate need to action. Investigations and action can be delayed until asset replacement is required. At that time, the DCP will trigger investigations that will govern whether the asset needs to be relocated (e.g. PR2) or redesigned to withstand impacts (A2, A3) (which may be prohibitively expensive). Council can prioritise efforts towards other locations presently at high risk. The Coastal DCP shall manage both inundation related to wave overtopping as well as erosion and recession. Refer to Accommodate Options Table for further cost benefit details for DCP. | Recommended | |
| FDCP | Update DCP Chapter E13 – Floodplain Management to include areas affected by Coastal Inundation as Low Risk Flood Precincts, and implement DCP to manage inundation impacts as properties are redeveloped and assets replaced. | As property / assets redeveloped, new developments built | × | × | ~ | | ~ | (| N | | | | This option involves applying the existing Flood DCP chapter to the small area of Lawrence Hargrave Drive affected by coastal inundation. The controls are applied at the "low risk" level, until more detailed studies as to flood levels are undertaken at this location. Refer to Accommodate Options Table for further cost benefit details for FDCP. ? State Government (Grant programs), cost to implement at RTA road [] Council (Current Programs, increased rates and levies?) - cost to prepare DCP N/A Private landholders - cost to implement FDCP | Recommended | |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/# | N/A | N/# | 4 | ر | | | | | | There is generally a low risk or limited assets at risk from erosion, recession and overtopping. "Do nothing" is a somewhat acceptable option as it enables Council to focus resources on other higher risk locations. However, the key assets that may be affected are stormwater assets and the Austinmer Boat Harbour. Impacts are likely to be costly if not managed. Further, the harbour is one of few regional recreational boat access points for the community. <i>Refer to "Do Nothing" Option Table for further cost benefit details.</i> | Not Recommended | |
| NR | NR1, NR3, NR7, NR11, NR12, NR13, NR14 | Now | ~ | ~ | ~ | | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. ? State Government (Grant Programs) Ø Council (Current Programs) Ø Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended | |

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6.6 Little Austinmer and Austinmer Beaches

6.6.1 Erosion and Recession Risk Level and Treatment Options – Little Austinmer

| | | | | | | | | | | | | | | PR2 | Reloc | | | | | |
|--|---------|--------------|---------|----------|----|--------|------------------------|------------|------------------------|------------------------|-------|--------|-------|------------------------|----------|-------|--------------|---------------|----------|----------------|
| | Frosio | n and Red | cession | | | | | | | | | | | | | | | | PR3 | Prohil |
| | | Risk Leve | | | | | | Er | osion | / Rec | essio | n Risk | Treat | ments | \frown | | | | PR4 | Volun |
| Little Austinmer Beach | Erosion | Erosion | Erosion | | | | | | r | | | | | | | | | "Do Nothing" | PR5 | Buy b |
| | by 2010 | 2010 by 2050 | | | | Protec | ct | | | Plan | ned R | etreat | | Acc | ommo | odate | No Regrets | (Accept Risk) | DCP | dev't a |
| Parks, Beaches and open space | | | | Ν | S1 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCP | A2 | A3 | Investigate* | DN | A2 | Redes |
| Little Austinmer Beach | High | Extreme | Extreme | | | | $\checkmark\checkmark$ | √ √ | √√ | | | | | | | | NR14 | | A3 | Repla |
| Little Austinmer Beach Reserve | Medium | Medium | High | | | | | | √ √ | | | | V | | | | | | FDCP | Apply |
| Coastal Dune Systems | High | Extreme | Extreme | | | | ✓ | | $\checkmark\checkmark$ | | | | | | | | | | ND1 | Contro |
| Community Infrastructure | | | | | | | | | | | | | | | | | | | NR2 | Audit |
| Heritage Site: Norfolk Island Pines (backing | Medium | Medium | High | | | | | | v | | | | | | | | NR12 | | NR3 | Asses |
| entire beach) | Weardin | Weardin | riigii | | | | | | Ľ | C | | | | | | | | | ND4 | "acco |
| Tuckerman Park Toilet/Shed | Low | Medium | Medium | | | | | | | | | | | $\checkmark\checkmark$ | | | | | NR4 | Audit |
| Transport Infrastructure | | | | | | | | | k *(| | | | | | | | | | NR5 | or "re |
| Lawrence Hargrave Drive (Major Coastal Road) | Medium | High | Extreme | ? | | ? | 2 | × | | | | | | ~~ | ~ | | NR5, NR14 | • | NR6 | Asses "acco |
| Local roads and car park | Medium | Medium | High | | | | | | | $\checkmark\checkmark$ | | | | ✓ | | | | | NR7 | Desig |
| Water and sewage infrastructure | | | | | | | | | | | | | | | | | | | | Desig |
| Stormwater outlets and pipes | High | Extreme | Extreme | | | | | | | $\checkmark\checkmark$ | | | | ✓ | | | NR7, NR14 | | NR8 | water |
| Residential Development | | | | | | | | | | | | | | | | | | | NR9 | Devel |
| Existing Residences (1 at N end) | Low | Medium | Medium | | | | | | | | | | | $\checkmark\checkmark$ | | | | | NR10 | Cond |
| | | | | | | | | | | | | | | | | | | | | Audit |
| | | | | | | | | | | | | | | | | | | | NR11 | conse |
| | | | 0 | | • | | | | | | | | | | | | | | NR12 | Use N |
| | | | |) | | | | | | | | | | | | | | | ND42 | planti |
| | | | | | | | | | | | | | | | | | | | NR13 | Monit |
| | | | | | | | | | | | | | | | | | | | DN | "Do N |
| | | | | | | | | | | | | | | | | | | | | Subst |
| | | | | | | | | | | | | | | | | | | | ~~ | highly |
| | | | | | | | | | | | | | | | | | | | ~ | Good effect |
| | | | | | | | | | | | | | | | | | | | ? | Techr |
| | | | | | | | | | | | | | | | | | | | <u> </u> | option |
| | | | | | | | | | | | | | | | | | | | 1 | T DO N |

increased risk over time



| 6.6.2 Erosion and Reces | 6.2 Erosion and Recession Risk Level and Treatment Options – Austinmer | | | | | | | | | | | | | | Sym- bol | | | | | |
|--|---|---------|---------|--------------|---------|----|----|----|-----------------------|-------|--------|-----|-----|------|-------------|--|-------------------|----------------|---|--|
| | Erosion and Recession Rick Lovel Erosion / Recession Risk Treatments | | | | | | | | | | | | | | N S1 | Nourishment Seawall - long or majority of beach | | | | |
| Austinmer Beach | Erosion | Erosion | Erosion | | Protect | | | | | Planr | etreat | | Acc | ommo | date | No Regrets | "Do Nothing" | S2 DV BM | Seawall - short sections Revitalise Dune Care Programs Manage beach sands | |
| Parks, Beaches and open space | by 2010 | by 2000 | by 2100 | Ν | S1 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCP | A2 | A3 | Investigate* | DN | PR1 | Accept loss as sacrificial |
| Austinmer Beach | High | Extreme | Extreme | | _ | - | ~ | ~ | ✓ | | | | _ | - | | - | NR2 NR14 | | PR2 | Relocate out of hazard zone |
| Austinmer Beach Reserve and Tuckermans Park | Medium | Medium | High | | ~ | | | - | <i>√</i> | | | | | | n | | NR2 | | PR3 PR4 PR5 | Prohibit development expansion Voluntary Acquisition |
| | | | | | | | | | | | | | | | | | | | 110 | Apply development controls (future |
| Austinmer Surf Club | Medium | High | Extreme | | ~ | | | | | ? | | | | | • | | NR2, NR3, NR14 | • | DCP A2 | devt and re-devt) Redesign / retrofit in current |
| Heritage Site: Norfolk Island Pines (backing entire beach) | Medium | Medium | High | | ~ | | | | ~ | | | | 0 | | | | NR2 | | A3 | location Replace with relocatable structure |
| Austinmer Rock Pool | Hiah | Extreme | Extreme | | | | | | √ | | | | | | ✓ | | NR4, NR14 | | FDCP | controls (future devt and re-devt) |
| Austinmer changeroom & toilets | Low | Medium | Medium | | ✓ | | | | | | | | - | ✓ | | | , | | NR1 | Update Asset Register for Hazards |
| Austinmer Boatshed | Low | Low | Low | | ✓ | | | | | | | | | ~ | | | | | NR2 | Audit existing seawalls |
| War Memorial (Heritage Site) | High | Extreme | Extreme | | ✓ | | | | | 5 | | | | | | | NR2 NR14 | | NR3 | Assess Public Buildings for |
| Transport Infrastructure | riigit | Extreme | Extreme | | - | | | | | |) · | | | | | | 1112, 11117 | | NR4 | Audit Ocean Pool condition |
| Lawrence Hargrave Drive (Major Coastal Road) | Medium | High | Extreme | | ~ | | | | K |) | | | | ~ | ~ | | NR2, NR5, | • | NR5 | Assess Roads for "accommodate" or "relocate" |
| Beach access and car park | Medium | Medium | High | | ~ | | | | | | | | | | | | NR14 | | NR6 | Assess Cycleways for |
| Water and sowage infrastructure | Wearun | Wearan | Tilgit | | - | | | | | | | | | | | | | | | Design criteria for Stormwater |
| Stormwater outlets and pipes | High | Extreme | Extreme | | ~ | | | | | ~ | | | | ~ | ~ | | NR7, NR2, | • | | Assets Design criteria for Waste water, |
| | | | | | C | | | | 1 | | | | | | | | INR 14 | J | NR9 | water supply and electricity assets Develop evacuation plans |
| | | | | C | | V | | | | | | | | | | | | | NR10 | Conduct Flood Study including ocean water levels |
| | | | | \mathbf{C} | | | | | | | | | | | | | | | NR11 | conservation |
| | | | | | | | | | | | | | | | | | | | NR12 | plantings |
| | | • | | | | | | | | | | | | | | | | | NR13 | Manage Aboriginal Heritage Items |
| | | | | | | | | | | | | | | | | | | | NR14 | Monitor erosion & inundation event |
| | | | | | | | | | | | | | | | | | | | DN | "Do Nothing" (Accept Risk) |
| | | | | | | | | | | | | | | | | | | | ~~ | Substantial risk reduction and / c highly effective in managing risk |
| | | | | | | | | | | | | | | | | | | | ~ | Good risk reduction and / or effective in managing risk |
| | | | | | | | | | | | | | | | | | | | ? | Technical feasibility of applying the option is questionable |
| | | | | | | | | | | | | | | | | | | | • | "Do Nothing" option is likely to have detrimental effect OR result in increased risk over time |

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| Asset Boundaries | x · | | | 1- | 6°°° | 10 |
| Hazard Definition Lines | XXX | C | | .1 | Bellina | |
| Risk Level at 2010 | | 17 S | | A S | 2 | |
| Medium | IP | | | Con. | | |
| High Extreme | | TENT | | 12 | | |
| | A2 or PR1 | a boo | | | | |
| Title: | ovols an | d Treatm | ent Ontior | ne | Drawing: | Rev: |
| Austinmer Beach - Seawa | all S1 Opt | tion | one option | 10 | 0-11 | A |
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| 6.6.3 Coastal Inundation Risk Leve | l and Tre | atment | Ontions | _ l ittle A | ustin | mer | | | | Sym- bol | |
|---|------------|--------------|------------|------------------------|----------|-----------|-------|--------------|------------------------|-------------|--|
| | | | options | Little A | astin | | | | | N | Nourishment |
| | | | | | | | | | | S1 | Seawall - long or majority of beach |
| | lun um | dation Diale | ا من بما | l.e. | | | | | | S2 | Seawall - short sections |
| | Inun | uation Risk | Levei | inu | undation | I RISK II | eatme | nis | | BM | Revitalise Dune Care Programs |
| | | | | | - | - | | | | PR1 | Accept loss as sacrificial |
| Little Austinmer Beach | | | | Overtopping | t o | | | | "Do | PR2 | Relocate out of hazard zone |
| | Inundation | Inundation | Inundation | risk treated | ea | Acco | mm- | | Nothina" | PR3 | Prohibit development expansion |
| | by 2010 | by 2050 | by 2100 | by erosion | etr | oda | ate | No Regrets | (Accept | PR4 | Voluntary Acquisition |
| | by 2010 | by 2000 | by 2100 | ontion | 르 쏘 | | | | (7.000pt Bick) | PR5 | Buy back then lease back |
| | | | | option | 1 | | | | risk) | DCP | Apply development controls (future |
| Parks, Beaches and open space | | | | | PR2 | FDCP | A2 | Investigate* | DN | | Redesign / retrofit in current |
| Little Austinmer Beach | Low | Low | Medium | | | | | | $\checkmark\checkmark$ | A2 | location |
| Little Austinmer Beach Reserve | Low | Low | Medium | | | | | | $\checkmark\checkmark$ | A3 | Replace with relocatable structure |
| Coastal Dune Systems | Low | | Medium | | | | | | 11 | FDCP | controls (future dev/t and re-dev/t) |
| | LOW | LOW | Weardin | | | | | | | NR1 | Update Asset Register for Hazards |
| | | | | | | | | | | NR2 | Audit existing seawalls |
| Heritage Site: Norfolk Island Pines (backing entire | Low | Low | Medium | CN | | | | | $\checkmark\checkmark$ | NR3 | accommodate" or "relocate" |
| beach) | 2011 | Low | Weddiam | | | | | | | NR4 | Audit Ocean Pool condition |
| Tuckerman Park Toilet/Shed | Low | Low | Low | | | | | | $\checkmark\checkmark$ | NR5 | Assess Roads for "accommodate" |
| Transport Infrastructure | | | | | | | | | | | or "relocate" |
| Lawrence Hargrave Drive (Major Coastal Road) | Medium | High | Extreme | $\checkmark\checkmark$ | | | | | | NR6 | "accommodate" or "relocate" |
| Local roads and car park | Medium | Medium | High | $\checkmark\checkmark$ | | | | | | NR7 | Design criteria for Stormwater Assets |
| Water and sewage infrastructure | | | | | | | | | | NR8 | Design criteria for Waste water, |
| Stormwater outlets and pipes | High | Extreme | Extreme | √√ | | | | | | NR9 | Develop evacuation plans |
| | . J | | | | | | | 1 | | | Conduct Flood Study including |
| | C | | | | | | | | | INICIO | ocean water levels |
| | A | | | | | | | | | NR11 | Audit EECs and habitats for priority |
| | | | | | | | | | | | Use Norfolk Island Pines in new |
| | | | | | | | | | | NR12 | plantings |
| | | | | | | | | | | NR13 | Manage Aboriginal Heritage Items |
| | | | | | | | | | | | "IVIONITOR PROSION & INUNDATION EVENTS |
| | | | | | | | | | | DN | Do Nothing (Accept Risk) |
| | | | | | | | | | | ~~ | Substantial risk reduction and / or highly effective in managing risk |
| | | | | | | | | | | | Good risk reduction and / or |
| | | | | | | | | | | × | effective in managing risk |
| | | | | | | | | | | ? | Technical feasibility of applying the |
| | | | | | | | | | | | "Do Nothing" option is likely to have |
| | | | | | | | | | | • | detrimental effect OR result in |
| | | | | | | | | | | | increased risk over time |



| 6.6.4 Coastal Inundation Risk Leve | el and Tre | atment | Options | – Austinr | ner | | | | | Sym- | |
|---|------------|-------------|------------|--------------|------------|-----------|--------------|--------------|--------------|----------|--|
| | | | - [| | | | | | | N | Nourishment |
| | | | | | | | | | | S1 | Seawall - long or majority of beach |
| | Inun | dation Risk | | In | undation | n Risk Ti | reatme | nts | | S2 | Seawall - short sections |
| | indi | | | | | | Caunc | 110 | | DV BM | Revitalise Dune Care Programs |
| Austinner Deesh | | ſ | | | 1 | | | | | PR1 | Accept loss as sacrificial |
| Austinmer Beach | | | | Overtopping | ਡ ਕ | | | | "Do | PR2 | Relocate out of hazard zone |
| | Inundation | Inundation | Inundation | risk treated | er es | Acco | omm- | No Pograte | Nothing" | PR3 | Prohibit development expansion |
| | by 2010 | by 2050 | by 2100 | by erosion | lar Ret | oda | ate | NO Negreis | (Accept | PR4 | Voluntary Acquisition |
| | - | - | - | option | <u>а</u> ч | | | | Risk) | PR5 | Buy back then lease back |
| Parka Pasahas and anan anasa | | | | | 002 | FDCD | 42 | Investigate* | | DCP | Apply development controls (future |
| Parks, beaches and open space | | | | | PRZ | FDCP | AZ | Investigate | DN | | Redesign / retrofit in current |
| Austinmer Beach | Low | Low | Medium | | | | | | ✓ | A2 | location |
| Austinmer Beach Reserve and Tuckermans Park | Low | Low | Medium | | | ľ | | | \checkmark | A3 | Replace with relocatable structure |
| Community Infrastructure | | | | | | | | | | FDCP | controls (future dev't and re-dev't) |
| Austinmer Surf Club | Medium | High | Extreme | × | | | | | | NR1 | Update Asset Register for Hazards |
| Heritage Site: Norfolk Island Pines (backing entire | | | | | | | | | , | NR2 | Audit existing seawalls Assess Public Buildings for |
| beach) | Low | Low | Medium | \mathbf{C} | | | | | ~ | NR3 | "accommodate" or "relocate" |
| Geologic Site: Rock headland / platform | Low | Low | Medium | | | | | | ✓ | NR4 | Audit Ocean Pool condition |
| Austinmer Rock Pool | Medium | Medium | High | ~ | | | | | ✓ | NR5 | or "relocate" |
| Austinmer changeroom & toilets | Low | Low | Low | | | | | | √ | NR6 | Assess Cycleways for |
| Austinmer Boatshed | Medium | Medium | High | ✓ | | | | | | NR7 | Design criteria for Stormwater |
| War Memorial (Heritage Site) | Medium | High 🥒 | Extreme | ✓ | | | | | | | Assets Design criteria for Waste water |
| Transport Infrastructure | | | | | | | | | | NR8 | water supply and electricity assets |
| | | | | | | | | NR10 | | NR9 | Develop evacuation plans Conduct Flood Study including |
| Lawrence Hargrave Drive (Major Coastal Road) | Medium | High | Extreme | \checkmark | | ✓ | \checkmark | NR14 | | NR10 | ocean water levels |
| Beach access and car park | Low | Low | Medium | √ | | | | | √ | NR11 | Audit EECs and habitats for priority |
| Water and sewage infrastructure | | | | | | | | | | NR12 | Use Norfolk Island Pines in new |
| | XO | | | | | | | NR10 | | NR13 | plantings Manage Aboriginal Heritage Items |
| Stormwater outlets and pipes | High | Extreme | Extreme | ✓ | | | | NR14 | | NR14 | Monitor erosion & inundation events |
| Commercial and Industrial Development | | | | | | | | | | DN | "Do Nothing" (Accept Risk) |
| Neighbourbood Business Centre (legal shaps) | Modium | Modium | High | | | 1 | 1 | NR10, | | ~~ | Substantial risk reduction and / o |
| neignbournoou dusiness Centre (local Shops) | Medium | Medium | High | | | | • | NR14 | | | Good risk reduction and / or |
| | | | | | | | | | | × | effective in managing risk |
| | | | | | | | | | | ? | Technical feasibility of applying the option is questionable |
| | | | | | | | | | | • | "Do Nothing" option is likely to have detrimental effect OR result in |



increased risk over time



6.6.5 Assessment of Treatment Options – Little Austinmer

| Little | Austinmer | | | | | | | | | | | | | | |
|-------------|--|---|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|---|----------------------------|-------------|
| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for Little Austinmer Beach Beach Beach | | Conclusion |
| N | Beach nourishment | Current Action: NR5 Trigger: Implement when ZRFC measured from the erosion escarpment reaches the roadway. | ~ | ~ | × | | | | | | | | Beach nourishment is not proposed for the entire beach. This option is suggested for protection of Lawrence Hargrave Drive only, at some point in future when roadway is impacted. Nourishment of relatively small volumes would be performed to protect this major local and regional traffic route. Typical costs for nourishment are \$25/m3, with 200 m3/ m required to widen the beach by 20m. <i>Refer to Protect Options Table for further cost benefit details for N.</i> | rough Grant vho n | Marginal |
| S2 | Construct seawall (revetment) along specified alignment to protect specific asset(s) | Current Action: NR5 Trigger: Implement when ZRFC measured from the erosion escarpment reaches the roadway. | ~ | ~ | × | X | | | 7 | YX. | S, | U A | Lawrence Hargrave Drive is the major traffic pathway for the northern Wollongong LGA, and will need to be retaned in some form. The decision to protect the roadway using a section of seawall or accommodate impacts in some other form will need to be determined through NR5. This option suggests a short section of wall to protect the roadway (approx 200m). At a typical cost of \$5,000 - \$10,000 /m length of wall, this equates to between \$1 -2 million, without ongoing maintenance or nourishment costs. Long sections of seawall will typically not be economically viable, however the needs to retain this traffic route will govern outcomes. The option has the additional benefit of protecting properties landward of the roadway, although the primary purpose remains for public benefit. <i>Refer to Protect Options Table for further cost benefit details for</i> <i>S2</i> . | rough Grant vho n | Marginal |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | • | v | × | | | | | | | | Dune coverage is limited at this location at present. ? State Government (Gra Refer to Protect Options Table for further cost benefit details for DV. DV. Question of the state of the st | nt ams) vho n | Recommended |



| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Comm unity Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for BM Beach | Potential Funding Sources (Who may pay) | Conclusion |
|-------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|-----------------------------|-------------------------------------|-------------------------|-----------------------|---|--|-------------|
| вм | Beach Sand Management (beach scraping or nature assisted beach management) | Now and continuing | ~ | ~ | x | | | | | | | | This option involves scraping and contouring beach sands to accumulate in dunes along the beach, to increase sand volumes held in dune storage for storm protection.? State 0 Program ☑ Cound N/A Prive directly butRefer to Protect Options Table for further cost benefit details for BM | Government (Grant s) iil (Current Programs) ate landholders who benefit from option | Recommended |
| PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | x | | | | | | | | This is typically an excellent option for retaining the beach, by utilising public open space to enable natural retreat of the beach, however assets at risk such as Lawrence Hargrave Drive may be affected (refer S2, A2). <i>Refer to Planned Retreat Options Table for further cost benefit details for PR1.</i> ? State 0 | Sovernment (Grant s) iil (Current Programs) ate landholders who benefit from option | Marginal |
| PR2 | Relocate stormwater structures outside of hazard zone | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe <u>OR</u> when asset replacement is required, whichever is sooner. | ~ | ~ | x | | | | 7 | Yx. | | | Erosion and overtopping risks affects the stormwater asset at the northern end of the beach, and it is possible that the outlets and pipes can be progressively removed as erosion occurs. The ability to relocate or redesign the pipes & outlets would need to be confirmed through NR7. <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR2.</i> | Bovernment (Grant s) sil (Current programs, ss or increased ate landholders who benefit from option | Recommended |
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | ~ | ~ | x | | | | | | | | There is one private property proposed to have the Coastal DCP applied. The buildings on the property are at the edge of the risk zones and may not be affected for some time. Applying the DCP allows redesign of buildings upon the land when the building is redeveloped, improving longevity of the developments. Additional controls can be considered as needed in the future, should risk levels be revised or hazard impacts advance more quickly (see NR14). The DCP shall also be applied to public assets such as Lawrence Hargrave Drive, as well as the local carpark and amenities. Again, this will ensure that investigations that will govern the redesign or location of these assets are prepared, when the asset needs to be replaced (either through wear and tear or coastal damage). For Lawrence Hargrave Drive, this may trigger the need for seawall protection or other accomodating design. <i>Refer to Accommodate Options Table for further cost benefit</i> details for <i>DCP</i> . | Government (Grant s) il (Current Programs) prepare DCP and nt at public assets ate landholders | Recommended |



| Syn bol | I- Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for PR2 Beach | Potential Funding Sources (Who may pay) | Conclusion |
|------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|------------------------|-------------------------|-----------------------|--|---|-----------------|
| A2 | Redesign or retrofit stormwater structures in current location to withstand impacts. | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe <u>OR</u> when asset replacement is required, whichever is sooner. | ~ | ~ | x | | | | | | | | The extent of inundation as well as erosion may not enable the stormwater structure to be located landward, and instead require redesign at the current location. This shall need to be confirmed based on outcomes of NR7. <i>Refer to Accommodate Options Table for further cost benefit details for A2.</i> | ? State Government (Grant Programs) ☑ Council (Current programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Marginal |
| A2 | Redesign Lawrence Hargrave Drive in current location to withstand impacts. | Current Action: NR5 Trigger: When erosion or wave overtopping destabilises roadway | ~ | ~ | x | | | | 7 | Yx. | | N N | Based upon the outcomes of NR5, there will need to be clear decision regarding the approach to accommodating impacts to Lawrence Hargrave Drive, and which may include protection (see S2 and N above). Alternative measures to protect the roadway, such as raising the roadway as a bridge will need to be investigated. This decision can be delayed until impacts become imminent <i>Refer to Accommodate Options Table for further cost benefit details for A2</i> . | ? State Government (Grant Programs) ☑ Council (Current programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Marginal |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | N/A | N/A | Ś | | | • | | | | For coastal inundation at Little Austinmer, the majority of assets are at low risk, and hence the risk can be accepted. However, there are significant assets at risk from erosion. "Do nothing" may result in unacceptable impacts, such as the destabilisation of the major roadway at Lawrence Hargrave Drive. Further, "Do nothing" may limit management options considered in the future, as either land and assets at risk have increased making more costly options inevitable, or irreversible erosion impacts impacts have already occurred. <i>Refer to "Do Nothing" Option Table for further cost benefit details.</i> | ? State Government ☑ Council (new levies and increased rates) ☑ Private landholders in Future Generations | Not Recommended |
| NR | NR1, NR5, NR7, NR11, NR12, NR13, NR14 | Now | ~ | ~ | ~ | | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |



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6.6.6 Assessment of Treatment Options – Austinmer

| Aust | inmer | | | | | | | | | | | | | | |
|-------------|---|---|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|--|---|-------------|
| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for Austinmer Beach | Potential Funding Sources (Who may pay) | Conclusion |
| S1 | Replacce or repair seawall (revetment) along existing alignment covering entire beach length | Current Action: NR2, then detailed design and approvals to replace or repair existing wall as required Trigger: When upgrade / replacement required (based on Current Action) <u>OR</u> structure is damaged by storm event, whichever is sooner | ~ | ~ | × | | C | | - | Yx. | S. | | There is an existing wall extending 350 m in length across the entire Austinmer Beach. The wall should be assessed (NR2) as it may already offer adequate protection. Further if this wall requires upgrade rather than construction of an entire new wall, this option may be more inancially viable. The S1 option may require limited nourishment (N) in the future to retain a sandy beach with sea level rise (refer Protect Options Table for cost benefit details for N). S1 is aimed at protecting Lawrence Hargrave Drive. However, rather than allowing the other significant assets seaward of the roadway to be lost to erosion, it is sensible to retain these assets and keep a seawall along the current alignment. As this beach already has a seawall and promenade, this option is in keeping with the current character of the beach. Costs for a new wall at Austinmer based on \$5,000 - \$10,000 /m are \$1.75 - 3.5 million, not including ongoing maintenance and nourishment costs. The seawall design will need to include measures to reduce the wave overtopping risk. The S1 option would not provide for reduced inundation at the stormwater outlet and pipeline, and consideration of wave overtopping risk to the SLSC that cannot be cost effectively managed within the seawall design. The costs of these factors will | ? State Government - through RTA as major road asset protected by this option; Grant Programs ☑ Council (new levies or increased rates) N/A Private landholders who directly benefit from option | Recommended |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ~ | × | くい | | | | | | | In this location, dune care programs would be associated with beach management activities, to stabilise re-contoured sands. The vegetation types should be low-lying and unobtrusive, in keeping with the character of this beach. <i>Refer to Protect Options Table for further cost benefit details for</i> <i>DV.</i> | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| BM | Beach Sand Management (beach scraping or nature assisted beach management) | Now and continuing | ~ | ~ | × | | | | | | | | Scraping and contouring beach sands to accumulate in the back beach area in front of the existing wall is proposed, to assist retaining sand volumes for storm protection. For either a "planned retreat" or "seawall" option, beach management should be undertaken to assist protection of the existing wall (i.e., until wall is replaced or removed, depending on decision to "retreat" or "repair the seawall") <i>Refer to Protect Options Table for further cost benefit details for</i> <i>BM.</i> | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |



| | P | Ρ | Sy b |
|----------|--|---|--|
| | R2 | R1 | /m- iol |
| | Relocate structure / service outside of hazard zone: Stormwater assets; war memorial | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Option |
| L | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe <u>OR</u> when asset replacement is required, whichever is sooner; Relocate War Memorial when ZRFC measured from erosion escarpment encroaches foundations | Repair damages to maintain public safety as impacts occur | Trigger for implementation (following relevant planning, approvals, etc) |
| | ~ | ~ | Erosion Option |
| | ~ | ~ | Overtopping Option |
| r | × | x | Backwater Inundation Option |
| | 6 | | Capital Cost |
| | C / | | Recurrent Costs |
| | | | Environmental or Social Impact |
| | 7 | | Community Acceptability |
| | XX | | Reversible / Adaptable in Future |
| | 2 | .9 | Effectiveness over time |
| | | | Legal / Approval Risk |
| | This option is an alternative to S1. The stormwater assets at Austinmer Beach run parallel to the current seawall, and are at risk from erosion and inundation at present. It is likely to be a very costly exercise to relocate this extent of pipe. This would need to be compared with the cost of upgrading the existing seawall, or redesign of these assets to withstand impacts, based on NR7 and A2. Relocation of the War Memorial could be undertaken in the future. Relocation of the surf club structure or Lawrence Hargrave Drive are unlikely to be possible due to land constraints (this would need to be confirmed through NR3 and NR5). <i>Refer to Planned Retreat Options Table for further cost benefit</i> | This option is an alternative to S1. This is typically an excellent option for retaining the beach, by utilising public open space to enable natural retreat of the beach and hence continued provision of a beach in the long term. However, at Austinmer, there is an existing seawall, and allowing degradation and removal of this wall is not in keeping with the current promenade character of this beach. There are also extensive stormwater assets and the main traffic pathway of Lawrence Hargrave Drive located landward of public open space. These assets would need to be moved (see PR2) or redesigned (see A2). Given these factors, economic analysis of seawall options from Thirrout may not be relevant to this location. Based on NR4, if it is found that Austinmer Pool cannot be progressively repaired to withstand wave and sea level rise impacts into the future, the pool will need to be slowly removed as it fails over time. <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR1.</i> | Potential Funding Sources (Who may year) |
| | t no | t ms) no | |
| _ | Marginal | Marginal | Conclusion |



| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Ontion | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for PR2 Beach | Potential Funding Sources (Who may pay) | Conclusion |
|-------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|--|--|-------------|
| A2 | Redesign or retrofit stormwater structures in current location to withstand impacts | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe OR when inundation frequency impedes effective conveyance of stormwater OR when asset replacement is required, whichever is sooner. | ~ | ~ | ~ | | | | | | | | This option is an alternative to S1 for erosion only. Regardless of whether S1 is implemented, the outlet will still need to be redesigned to withstand inundation, and there may be impacts from I inundation along the pipeline also. This will need to be considered in I selecting an appropriate option for the entire beach (e.g. S1 or PR1 and 2). Refer to Accommodate Options Table for further cost benefit details for A2. | ? State Government (Grant Programs) ☑ Council (new levies or increased rates) <i>N</i> /A Private landholders who directly benefit from option | Recommended |
| A2 | Redesign or retrofit SLSC in current location to withstand impacts | Current Action: NR3 Trigger: When ZRFC measured from erosion escarpment threatens building foundations <u>OR</u> building requires major refurbishment. | ~ | ~ | ~ | | | | 5 | Yx. | 3 | | This option is an alternative to S1 for erosion only. Wave overtopping may still require redesign of the SLSC, regardless of S1. Additionally designing for erosion impacts (e.g suitable foundation capacity) will be dependent upon the decision to implement S1. Given land constraints, it is unlikely to be possible to relocate the SLSC, and therefore the structure will need to be redesigned or retrofit in current location to withstand impacts. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for A2.</i> | ? State Government (Grant Programs) ☑ Council (new levies or increased rates) N/A Private landholders who directly benefit from option | Recommended |
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | ~ | ~ | × | Ś | | | | | | | Planning controls shall apply to development in areas at risk regardless of which option is selected (i.e. S1 or PR1 & 2 and A2) to improve resilience of the structures. Public assets including Lawrence Hargrave Drive, SLSC, carpark, boatshed and amenities are at risk. The DCP will trigger investigations that will govern whether the asset needs to be relocated (e.g. PR2) or redesigned to withstand impacts (A2 or A3) either alone or prior to a seawall being implemented. Given risk is currently high at assets affected, the DCP controls may be done in conjunction with the expected cost and timeframe for asset maintenance & replacement or sooner should erosion and wave overtopping impacts threaten the development. <i>Refer to Accommodate Options Table for further cost benefit</i> details for DCP. | ? State Government (Grant programs), cost to implement at RTA road ☑ Council (Current Programs, increased rates and levies?) - cost to prepare and implement DCP N/A Private landholders - cost to implement DCP | Recommended |



| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option Backwater Inundation | Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable | in Future | Effectiveness over time | Legal / Approval Risk | Potential Funding Sources (Who may Say) | | Conclusion |
|-------------|--|--|----------------|--|--------|--------------|-----------------|-----------------------------------|----------------------------|------------------------|-----------|-------------------------|-----------------------|--|-------------------------|-----------------|
| FDCP | Update DCP Chapter E13 – Floodplain Management to include areas affected by Coastal Inundation as Low Risk Flood Precincts, and implement DCP to manage inundation impacts as properties are redeveloped and assets replaced. | As property / assets redeveloped, new developments built | × | x | * | | | | | | | | | While the majority of inundation at Austinmer appears related to wave overtopping and will be managed in combination with erosion controls, the backwater inundation risk to Lawrence Hargrave Drive and to stormwater assets should consider the combined catchment flood and ocean water level event (ie, NR10). In the interim, the existing Flood DCP chapter controls are applied at the "low risk" level, until such studies are conducted. ? State Government (Grant programs), cost to implement at RTA road While the majority of inundation risk to Lawrence Hargrave Drive and to stormwater assets should consider the combined catchment flood and ocean water level event (ie, NR10). In the interim, the existing Flood DCP chapter controls are applied at the "low risk" level, until such studies are conducted. ? Council (Current Program increased rates and levies? cost to prepare and implement DCP Refer to Accommodate Options Table for further cost benefit details for FDCP. Private landholders - cost to implement FDCP | nt is, i - ent | Recommended |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | N/A N | I/A | | | | | ۲. | × | 2 | č | There is currently a large extent of assets that are both expensive and vital to community function at risk at Austinmer, so "Do nothing" is unlikely to be acceptable. Land and assets lost to erosion cannot be replaced, and particularly for Lawrence Hargrave Drive (and stormwater assets to a lesser degree) are likely to cause unacceptable disruption to the regional and local community should impacts occur. <i>Refer to "Do Nothing" Option Table for further cost benefit details.</i> ? State Government © Council (new levies and increased rates) © Private landholders in Fu Generations | ure | Not Recommended |
| NR | NR1, NR2, NR3, NR4, NR5, NR7, NR10, NR13, NR14 | Now | ~ | ¥ . | ~ | | C | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. ? State Government (Grant Programs) N/A Private landholders who directly benefit from option | s) | Recommended |
| | | | | ~ | 2 | Ś | | V | | | | | | | | |



118

6.7 Thirroul Beach

6.7.1 Erosion and Recession Risk Level and Treatment Options

| | | | | | | | | | | | | | | | | | | | DV | Revitalise Dune Care Programs |
|---|------------------|-----------|-----------|----------|---------------------|------------------------|----|----|------------|-----------------------|--------------|--------------|-------|-----------------------|-------|-------|--------------|----------------|------------------------|---------------------------------------|
| | Erosio | n and Rec | cession | | | | | Er | ocion | | occior | Dick | Troat | monte | | | | | BM | Manage beach sands |
| Thirroul Boach | | Risk Leve | | | | | | L1 | 051011 | / 1.60 | 622101 | 11/13/ | neai | | | | | | PR1 | Accept loss as sacrificial |
| Thirtour beach | Erosion | Erosion | Erosion | | | - . | | | | | | | | | | | | "Do Nothina" | PR2 | Relocate out of hazard zone |
| | by 2010 | by 2050 | by 2100 | | | Protec | t | | | Planr | ned Re | etreat | | ACC | commo | odate | No Regrets | (Accept Risk) | PR3 | Prohibit development expansion |
| Parks Beaches and open space | · · | | | N | S1 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCP | A2 | A3 | Investigate* | DN | PR4 | Voluntary Acquisition |
| Thirrow Booch | Lliab | Extrama | Extreme | | | | | | | | | | | | | 7.0 | MD14 | | PR5 | Buy back then lease back |
| | nign Marilian | Extreme | Extreme | v | | | •• | | •• | | | | | | | K | NR 14 | | DCP | Apply development controls (future |
| lingara Park | Medium | Medium | High | | | | ~ | - | * * | | | | | | | | | | 501 | dev't and re-dev't) |
| Flanagans Creek | Medium | Medium | High | | | | | | ✓ | | | | | | | | NR11 | | A2 | Redesign / retrofit in current |
| Coastal Dune System (small area adjacent | Hiah | Extreme | Extreme | | | | ~ | | 11 | | | | | | | | | • | 4.0 | location |
| to creek entrance) | | | | | | | | | | | | | | | | | | | A3 | Replace with relocatable structure |
| Community Infrastructure | | | | | | | | | | | | | | | | | | | FDCP | Apply existing nood development |
| Thirroul Surf Club | High | Extreme | Extreme | | √ | ✓ | | | | √ | | | | | | ~ | NR2, NR3, | • | NR1 | Lindate Asset Register for Hazards |
| | , ngn | Exaronno | Extrontio | | | | | | | - | • | | | | | | NR14 | | NR2 | Audit existing seawalls |
| Thirroul Pool (also beritage site) | High | Extreme | Extreme | | √ | ✓ | | | | 2 | | | | ~ | | | NR2, NR4, | • | TNI V2 | Assess Public Buildings for |
| | . iigii | | | | | | | | | <u> </u> | | | | | | | NR14 | | NR3 | "accommodate" or "relocate" |
| Thirroul Pool office and amenities | High | Extreme | Extreme | | ✓ | ✓ | | | | ? | | | | ✓ | | | NR2, NR4 | • | NR4 | Audit Ocean Pool condition |
| Thirroul Pool toilet | Medium | High | Extreme | | ✓ | ✓ | | | | ? | | | | \checkmark | | | NR2, NR4 | • | NDC | Assess Roads for "accommodate" |
| Thirroul Pool storage shed (large) | Medium | High | Extreme | | ✓ | ✓ | | | | ? | | | | ✓ | | | NR2, NR4 | • | NR5 | or "relocate" |
| Thirroul Pool intake | High | Extreme | Extreme | | | | | 5 | | \checkmark | | | | ✓ | ✓ | | NR14 | • | NR6 | Assess Cycleways for |
| Heritage site: Thirroul Pavillion (being used | | _ | _ | | | | | | | | | | | | | | NR2. NR3. | _ | ININO | "accommodate" or "relocate" |
| as kiosk / restaurant) and residence | High | Extreme | Extreme | | ✓ | ✓ | | | | ? | | | | | | | NR14 | • | NR7 | Design criteria for Stormwater |
| Heritage Site: Thirroul Beach Reserve (S of | | | | | , | | | | . | | | | | | | | | | | Assets |
| looq | Medium | High | Extreme | | ✓ | | | | √ | | | | | | | | NR2, NR3 | | NR8 | Design criteria for Waste water, |
| Heritage Site: Norfolk Island Pines | Low | Low | Medium | | | | | | ✓ | | | | | | | | NR2. NR12 | ✓ | NR9 | Develop evacuation plans |
| Transport Infrastructure | | | | | | | | | | | | | | | | | , | | TNI CO | Conduct Flood Study including |
| Local Roads (Bath St) | Low | Medium | Medium | | | 1 | | | | ✓ | | | | ✓ | | | NR2 NR5 | | NR10 | ocean water levels |
| Boach access and car park (S and of | LOW | Wearan | Wearan | | A | | | | | - | | | | | | | 11102, 1110 | | | Audit EECs and habitats for priority |
| Boach) | Low | Low | Medium | | \checkmark | √ | | | | ✓ | | | | ✓ | | | NR2, NR5 | ✓ | NR11 | conservation |
| Beach access and car park (N end of | | | | 2 | | | | | | | | | | | | | | | NP12 | Use Norfolk Island Pines in new |
| beach): Local Roads Henley St. Jones St. | Low | Low | Modium | C | | | | | | _ | | | | 1 | | | | <u> </u> | INIX12 | plantings |
| Mony St | LOW | LOW | Medicini | | | | | | | · | | | | | | | 111/2, 111/0 | • | NR13 | Manage Aboriginal Heritage Items |
| Water and sewage infrastructure | | | | | | | | | | | | | | | | | | | NR14 | Monitor erosion & inundation events |
| Starmuster autlet to Flanggang Crook | Madium | Lligh | Lligh | | | | | | | | | | | ./ | | | | | DN | "Do Nothing" (Accept Risk) |
| Stormwater outer to Flanagaris Creek | Nearum | nign | nign | | ⊢• | | | | | · | | | | , v | • | | NK7, NK14 | | | Substantial risk reduction and / or |
| Thomas Gibson Creek - Major stormwater | High | Extreme | Extreme | | ✓ | ✓ | | | | ✓ | | | | ✓ | ✓ | | NR7, NR14 | • | $\checkmark\checkmark$ | highly effective in managing risk |
| | | | | | | | | | | | | | | | | | | | | Good risk reduction and / or |
| Residential Development | | | | | | | | | | | | | | | | | | | ~ | effective in managing risk |
| Existing Residences: 1 ppty at centre of | Medium | High | Extreme | | | ? | | | ✓ | | \checkmark | \checkmark | ? | ✓ | | | NR14 | • | _ | Technical feasibility of applying the |
| | | Ŭ | | | | | | | | | | | | - | | | | ├ ────┤ | | option is questionable |
| Existing Residences (8 ppty at S end of | Medium | High | Extreme | | ✓ | $\checkmark\checkmark$ | | | ✓ | | | ? | ? | ✓ | | | NR14 | • | | "Do Nothing" option is likely to have |
| Deacn) | | Ŭ | | | | | | | L | | | | | | | | I | | • | detrimental effect OR result in |
| | | | | | | | | | | | | | | | | | | | 1 | increased rick over time |

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Sym-

bol N

S1

Nourishment

S2 Seawall - short sections

Seawall - long or majority of beach







122

| 672 Coastal Inundation Ris | k l evel | and T | reatme | nt Onti | ons | | | | | Sym- | |
|--|------------|-------------|------------|-----------------------|-------------|--------------|--------------|--------------|---------------|--------|---|
| | | | canne | in opti | 0113 | | | | | N N | Nourishment |
| | | | | 1 | | | | | | S1 | Seawall - long or majority of beach |
| | Inun | dation Rick | امريما | Ini | Indation | Dick Tr | ootmo | nte | | S2 | Seawall - short sections |
| | inun | ualion RISK | Level | | Indation | I RISK II | eaune | nis | | DV | Revitalise Dune Care Programs |
| Thirroyd Booch | | | <u> </u> | | r – | 1 | | 1 | | BM | Manage beach sands |
| Thirtour Deach | 1 1 | 1 | | Overtopping | ed ät | | | | | PR1 | Accept loss as sacrificial |
| | Inundation | Inundation | Inundation | risk treated | ann etre | ACCO | mm- | No Regrets | "Do Notning" | PR2 | Relocate out of hazard zone |
| | by 2010 | by 2050 | by 2100 | by erosion | E S | oda | ite | 0 | (Accept Risk) | PR3 | Prohibit development expansion |
| | | | | option | | | | | | PR4 | Voluntary Acquisition |
| Parks, Beaches and open space | | | | | PR2 | FDCP | A2 | Investigate* | DN | PR5 | Buy back then lease back |
| Thirroul Beach | Low | Low | Medium | | | | | | \checkmark | DCP | dev't and re-dev't) |
| Tingara Park | Low | Low | Medium | | | | | | ~ | Δ2 | Redesign / retrofit in current |
| Flanagans Creek | Low | Low | Medium | | | | | NR10, | ~ | A2 | location |
| | | | | | | | | NR14 | | A3 | Apply existing flood development |
| Coastal Dune System (small area adjacent to creek | Low | Low | Medium | | | | | | ~ | FDCP | controls (future dev't and re-dev't) |
| outlet) | | | | | | | | | | NR1 | Update Asset Register for Hazards |
| Community Infrastructure | | | | | | | | | | NR2 | Audit existing seawalls |
| Thirroul Surf Club | Medium | High | Extreme | ✓ | | | Ť | | • | NR3 | Assess Public Buildings for |
| Thirroul Pool (also heritage site) | Medium | High | Extreme | ✓ | | \checkmark | | | • | ND4 | "accommodate" or "relocate" |
| Thirroul Pool office and amenities | Medium | High | Extreme | ~ | | \checkmark | | | • | NR4 | Audit Ocean Pool condition |
| Thirroul Pool toilet | Medium | High | Extreme | ✓ | | ~ | | | • | NR5 | or "relocate" |
| Thirroul Pool storage shed (large) | Medium | High | Extreme | | | ✓ | | | • | NIDE | Assess Cycleways for |
| Thirroul Pool intake | Medium | High | Extreme | | • | ✓ | | | • | INRO | "accommodate" or "relocate" |
| Heritage site: Thirroul Pavillion (being used as kiosk / | Maaliuma | 1 Back | Estrano | | | | | | | NR7 | Design criteria for Stormwater |
| restaurant) and residence | weatum | ⊓ign | Extreme | v | | v | | | • | | Assets Design criteria for Waste water |
| Heritage Site: Thirroul Beach Reserve | Low | Medium | Medium | • | | | | | ✓ | NR8 | water supply and electricity assets |
| Heritage Site: Norfolk Island Pines | Low | Medium | Medium | | | | | | ✓ | NR9 | Develop evacuation plans |
| Heritage site: Former Quest House | Medium | High | Extreme | | | ✓ | √ | | | NR10 | Conduct Flood Study including |
| Transport Infrastructure | | | | | | | | | | | Ocean water levels |
| | | | | | | | | NR10, NR9, | | NR11 | conservation |
| Major Roads (Lawrence Hargrave Drive) | High | Extreme | Extreme | | | ~ | | NR14 | • | ND40 | Use Norfolk Island Pines in new |
| Local Roads (Bath St linking to the Esplanade, Henley | | XV | = . | | | , | | NR10, NR9, | - | INR 12 | plantings |
| St, Road reserve for Harbord & Ocean Sts) | Medium | High | Extreme | | | ~ | | NR14 | • | NR13 | Manage Aboriginal Heritage Items |
| Beach access and car park (N end of beach) | Low | Low | Low | | | | | | ✓ | NR14 | Monitor erosion & inundation events |
| Beach access and car park (S end of beach) | Low | Low | Low | | | | | | ✓ | DN | "Do Nothing" (Accept Risk) |
| Water and sewage infrastructure | | | | | | | | | | ~~ | Substantial risk reduction and / or |
| Stormwater outlets and pipes (upper Flanagans Ck | 1 Back | Estasas | Estrance | | | | | NR10, NR7, | | | highly effective in managing risk |
| catchment) | Figh | Extreme | Extreme | | | × · | v | NR14 | • | ✓ | effective in managing risk |
| Thomas Gibson Creek - Stormwater outlet | High | Extromo | Extromo | | | ./ | ./ | NR10, NR7, | • | _ | Technical feasibility of applying the |
| | nigh | Extreme | Extreme | | | · | × | NR14 | • | ? | option is questionable |
| Residential Development | | | | | | | | | | | "Do Nothing" option is likely to have |
| Existing Residences (151 cadastral parcels) | Medium | High | Extreme | | | ✓ | \checkmark | NR10, NR9 | • | • | detrimental effect OR result in |

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| Coastal Inundation Risk Evaluation | h les | |
| Asset Boundaries | S A S | |
| Hazard Definition Lines | CROWNRID | |
| Flood Planning Area | | 51 |
| Overtopping Risk Treated By Erosion Option The Eispitamade | | |
| Risk Level at 2010 | | |
| Medium High | oose, | 1 |
| Extreme | rour e | l . |
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| Thirroul Beach | 6-17 | A |
| BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and N 0 125 250 | m A | |
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6.7.3 Assessment of Treatment Options

| Thir | roul Beach | | | | | Rapid | Cost E | enefit A | Analysi | s (Traf | ic Ligh | t) | | |
|----------------------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|--|---|
| Opt- ion Sym- bol | _ Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for Thirroul Beach | Conclusion |
| Ν | Beach nourishment | Immediately and whenever sand reserve is below the identified storm demand seaward of development being protected (following storms) | ~ | × | × | | | | 1 | X | 3 | | Suitable sand sources are not likely to be available for large scale beach nourishment in the local area. This significantly increases the cost of this option, or constrict the use of this option. However, nourishment is a necessity to retain a sandy beach in combination with Seawall S1 (see below). Thirroul Beach alone was valued at over \$142 million over the next 100 years (see PR1 below, Gillespie Economics Appendix D). Nourishment costs have been estimated at \$25/m3, with typical volumes of up to 200 m3/m length of beach required to widen the beach by 20 m. For a single nourishment event across half of Thirroul Beach this would equate to roughly 100,000 m3, costing \$2.5 million. As sea level rises, the frequencey of nourishment events shall increase, resulting in increasing costs over time. <i>Refer to Protect Options Table for further cost benefit details for N.</i> | nt (Grant ly to fund otection vies or lers who n option ant or il) |
| S1 | Construct seawall (revetment) along specified alignment covering majority to all of beach length | Prior to redevelopment /upgrading of any development identified as "at risk" (otherwise DCP shall apply). | | × | × | ģ | | | | | | | This seawall option would need to be accompanied by ongoing beach nourishment if a sandy beach amenity is to be maintained over time as sea level rises. Issues associated with beach nourishment noted above are also applicable here. Seawall costs are of the order of \$5,000 - \$10,000 per m length of wall. For a 500 m wall along half of Thirroul Beach, this would equate to between \$2.5 - \$5 million, and doesn't include the costs of nourishment (see above), ongoing maintenance and future upgrading. If the seawall is to be abandoned at some time in the future, the costs for removal and repair of the beach must also be included. At Thirroul Beach, assuming unlimited funds for all options, Gillespie Economics (Appendix D) found the S1 + N option to be economic as nourishment ensures the beach amenity and Thirroul Beach Reserve is retained. Beach use values were estimated at \$142 million (see PR1 below). However, as funding is limited, Gillespie Economics found that compared with both S1 & N and S2 options, planned retreat (including relocating assets (PR2) and loss of park land (PR1)) has a substantially higher net present value (i.e. value of benefits less value of costs) per dollar invested. While S1 retains the use of | nt (Grant ly to fund otection vies or lers who n option ant or il) |



tem2. Attachment?

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126

| Optio n Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable | in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for S2 | Conclusion |
|---------------------------|---|---|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|------------------------|-----------|-------------------------|-----------------------|--|---------------------------------------|
| S2 | Construct seawall (revetment) along specified alignment to protect specific asset(s) | Prior to redevelopment /upgrading of any development identified as "at risk" or when the Immediate Impact Zone (including foundation stability allowance) intersects the development. | ~ | ~ | x | | | | 0 | V v | X | S. | X U X | Seawall S2 option assumes shorter sections of seawall are installed without large scale nourishment (except to manage offsite impacts) and assuming it is accepted that sections between shall erode naturally to retain a limited sandy beach amenity (see map). Seawall costs are of the order of \$5,000 - \$10,000 per m length of wall. For sections of wall wall along Thirroul Beach, this would equate to between \$2.25 - \$4.5 million, and doesn't include the costs of ongoing management of offsite impacts (e.g.small scale nourishment) and future upgrading. Even if the \$ value of the beach (estimated at \$142 million, refer PR1) is reduced by 80 %, planned retreat remains the more economically viable option at Thirroul (Gillespie Economics, Appendix D), see PR1 below. It may be viable to allow a section of wall connecting with the geotechnical seawall option for properties affected at the southern end of the beach, but not other areas along the beach. In this case, such walls protecting private properties should be built on private land, and State Government legislation permits Council to require sections of wall protecting private property and ongoing maintenance to be funded by the private property owners. <i>Refer to Protect Options Table for further cost benefit details for</i> | Marginal (Southern end of beach only) |
| PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | ¢ | ç, | 6 | | | | | | | This is an excellent option for retaining the beach, by utilising public open space to enable natural retreat of the beach, and hence continued provision of a beach over the long term Gillespie Economics found that the asset with the highest economic value is Thirroul Beach itself. Based on both resident and visitor use (domestic day visitors, overnight visitors and international visitors whose main activity is spending time at the beach, (TRA, 2007)), Thirroul Beach alone was valued at over \$142 million over the next 100 years. Therefore, any option which retains this asset shall be preferred for economic reasons. This is in addition to the community and environmental values associated with the beach. At Thirroul Beach, compared with both S1 & N and S2 options, planned retreat (including relocating assets (PR2), loss of Thirroul Beach Reserve area (PR1) and planning controls on residences (DCP)) was found to have a substantially higher net present value (ie value of benefits less value of costs) per dollar invested. Particularly as funds are constrained, the option of planned retreat is far more viable than both "do nothing" and protect options such as S1 & N or S2, even if the \$ value of the beach is reduced by 80% | ز: Recommended |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ~ | x | | | | | | | | | The continuation of dune care programs must be considerate of sightline requirements for SLSC activities. <i>Refer to Protect Options Table for further cost benefit details for DV.</i> Programs) ✓ Council (Current Program <i>N/A</i> Private landholders who directly benefit from option | ») kecommended |

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127

| Opt n Syr bc | io n- Option I | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for PR4 | Conclusion |
|-----------------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|----------------------------|-----------------------|--|-----------------|
| PF | 2 Relocate structure / service outside of hazard zone | Prior to redevelopment /upgrade OR when the Immediate Impact Zone (including foundation stability allowance) intersects the development, whichever is sooner | ~ | ~ | × | | | | | | | | Further investigations are required to confirm that it is technically and financially viable to relocate Thirroul Pool or Thirroul Pavilion in a manner which retains their heritage character and value. Preliminary investigations suggest it is technically viable and may cost less (financially and environmentally) than implementation of a seawall to protect the structures (refer S1 and S2 above). The pool intake would have to be relocated to continue to service the pool well before impacts occur to the pool itself. Relocation of the surf club structure could provide a new club facility for community and the SLSC. <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR2.</i> | Recommended |
| PR | 3 Prohibit expansion of existing use rights | Now | ~ | ~ | × | | | | 2 | Yx. | 2 | | This option is proposed for a single residential property that is located within adjacent park lands that are suitable for planned retreat to retain the sandy beach into the future. This option may limit the property value. Without repurchase of this land by the government (State, Federal, Local?), the land remains in private ownership. This may become a problem should planning controls change in the future. <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR3.</i> | Not Recommended |
| PR | 4 Voluntary acquisition | Current Action: Apply for government funding. Trigger: Offer once funding becomes available. | ~ | ~ | ~ | ~ | C / | Ľ | | | | | This option may be financially viable for a single property, but would not be financially possible for multiple properties without substantial government assistance, which is not currently available. Current funding mechanisms from State Government and Council are not sufficient to acquire multiple properties. <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR4.</i> ? State Government (Grant Programs) © Council (new levies or increased rates) © Private landholders who directly benefit from option | Recommended |
| PR | 5 Buy back – lease back | Current Action: Apply for mortgage now Trigger: Offer acquisition once funding becomes available. Demolish property when erosion impacts destabilise building foundations. | ~ | × | ¢ | | | | | | | | This option involves Council applying for funding through typical mortgage arrangements to acquire affected property(s), on a voluntary basis. As the finanical viability of this option depends on leasing the property once purchased at market rates to assist mortgage repayments until the hazard impact is imminent, the repurchase offer to landholders will be discounted in accordance with likely time remaining before erosion impacts . The option then enables natural retreat of the beach and land available for use by the community as the development shall be demolished once impacts occur. This option ensures the land returns to public ownership once impacts are imminent (unlike PR3 above). Funding and financial risk for this option would fall solely with Council. This option is as yet untested. <i>Refer to Planned Retreat Options Table for further cost benefit</i> | Recommended |

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128

| Optio n Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for FDCP | Funding Sources / Who pays | Conclusion | |
|---------------------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|---|---|-----------------|--|
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property/ assets redeveloped, new developments built | ~ | ~ | × | | | | | | | | This option shall apply planning controls to development that reflect the level of risk at the propertye and expected life of the development. DCP controls will apply to land prior to implementation of seawalls also, should this be selected. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for DCP.</i> | ? State Government (Grant programs) ☑ Council (Current Programs) - cost to prepare DCP and implement for public assets ☑ Private landholders - cost to implement DCP | Recommended | |
| A2 | Redesign or retrofit stormwater structures and Thirroul Pool intake in current location to withstand impacts | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe OR when inundation frequency impedes effective conveyance of stormwater OR when asset replacement is required, whichever is sooner. | ~ | ~ | ~ | | | | | | | 2 | Thomas Gibson Creek forms a significant section of stormwater infrastructure and will be affected by inundation due to sea level rise. Seawall (S1, S2) options, if implemented, will not reduce inundation impacts, and other mechanisms to accommodate this risk shall need to be considered. Thirroul Pool intake will similarly be affected by inundation with sea level rise, and this impact will need to be accommdated (for example, raising the pipe line) if the structure cannot be relocated and the Pool is to be protected or retained in a similar form to present. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for A2.</i> | ? State Government (Grant Programs) ☑ Council (new levies or increased rates) N/A Private landholders who directly benefit from option | Recommended | |
| A3 | Replace existing SLSC with relocatable structure. | Current Action: NR3 Trigger: When SLSC needs to be replaced <u>OR</u> erosion escarpment threatens building foundations. | ~ | ~ | ~ | | | | | R | | | This would provide an alternative to relocating or protecting the surf club. The viability of this option will depend on outcomes of NR3. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for A3.</i> | ? State Government (Grant Programs) ☑ Council (Current programs, new levies or increased rates ?) N/X Private landholders who directly benefit from option | Marginal | |
| FDCP | Update DCP Chapter E13 – Floodplain Management to include areas affected by Coastal lnundation as Low Risk Flood Precincts, and implement DCP to manage inundation impacts as properties are redeveloped and | As property/ assets redeveloped, new developments | × | × | ~ | | 2 | | | | | | This option involves applying the existing Flood DCP chapter to those areas identified at risk from coastal inundation at the "low risk" level, until a Flood Study is completed and updated for Flanagans Creek and Thomas Gibson Creek respectively (refer NR10). The majority of properties affected by coastal inundation in the Thomas Gibson catchment are also within the existing Flood Planning Area, therefore this option would have no additional effect | <i>N/A</i> State Government (external funding unlikely to be needed) ☑ Council (Current Programs) ☑ Private landholders - cost to implement FDCP | Recommended | |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | . N/A | . N/A | | | | | | | | Given the extent, type and value of assets at risk from erosion and recession and inundation at Thirroul, the "do nothing" option is unacceptable. There would be damaging and irreversible impacts, and this may limit management options in the future as land is irreversibly lost or development has intensified, requiring more costly options to mitigate future risk. This option is not reversible in the future for development or land that is lost to erosion. | State Government | Not Recommended | |
| NR | NR1, NR2, NR3, NR4, NR5, NR7, NR9, NR10, NR11, NR12, NR13, NR14 | Now | ~ | ~ | ~ | | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended | |

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McCauleys Beach 6.8

6.8.1 Erosion and Recession Risk Level and Treatment Options

| | | | | | | | | • | | | | | | | | | | | DV | Revitalise Dune Care Programs |
|--|--|-----------|---------|---|---------|--------|------------|----|------------------------|----------|----------|--------|----------|----------|-------------------------|-----------------------------|-----------------------------|---------------|--------|--|
| | Frosio | n and Rec | ression | | | | | | | | | | | | | | | | BM | Manage beach sands |
| McCauleys Beach | L10310 | Rick Lovo | 1 | | | | | Er | osion | / Rec | essior | n Risk | Treat | ments | | | | | PR1 | Accept loss as sacrificial |
| WicCauleys Deach | Freedore | | 1 | | | | | | 1 | | | | | 1 | | | | "De Nethine" | PR2 | Relocate out of hazard zone |
| (not inc Sandon Pt) | Erosion | Erosion | Erosion | | F | Protec | t | | | Plan | ned R | etreat | | Acc | ommo | odate | No Regrets | Do Nothing | PR3 | Prohibit development expansion |
| | by 2010 | by 2050 | by 2100 | | | | r – | | | <u> </u> | <u> </u> | 1 | | | \frown | 1 | | (Accept Risk) | PR4 | Voluntary Acquisition |
| Parks, Beaches and open space | | | | Ν | S1 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCP | A2 | A3 | Investigate* | DN | PR5 | Buy back then lease back |
| McCauleys Beach | High | Extreme | Extreme | | | | √ √ | | $\checkmark\checkmark$ | | | | | X | V | | NR14 | | DCP | Apply development controls (futu dev't and re-dev't) |
| Woodland Avenue Reserve, Corbett Ave Reserve, Sandon Point Reserve | Medium | Medium | High | | | | | | ~~ | | | | | | | | | | A2 | Redesign / retrofit in current location |
| McCauleys Beach Reserve | High | Extreme | Extreme | | | | | | $\checkmark\checkmark$ | | | | 7 | | | | | | A3 | Replace with relocatable structu |
| Hewitts Creek | Medium | Medium | High | | | | | | $\checkmark\checkmark$ | | | | | | | | NR11 | | FDCP | Apply existing flood developmen controls (future dev't and re-dev |
| Tramway Creek | Low | Medium | Medium | | | | | | $\checkmark\checkmark$ | | | | | | | | NR11 | | NR1 | Update Asset Register for Hazar |
| Dastal Dune Systems (S end) High Extreme VV VV | | | | | | | | | | | | | | NR2 | Audit existing seawalls | | | | | |
| Community Infrastructure | Initial Durie Systems (Sterio) Initial Exitence Initial Exitence munity Infrastructure Initial Exitence Initial Exitence | | | | | | | | | | | | | | NR3 | Assess Public Buildings for | | | | |
| Significant Aboriginal Site (Tent Embassy). | unity Infrastructure Medium High High NR14 cant Aboriginal Site (Tent Embassy). Medium High Image: Control of the second secon | | | | | | | | | | | | | | | | "accommodate" or "relocate" | | | |
| Cycleway / Shared Pathway (Northern | ficant Aboriginal Site (Tent Embassy). Medium High High embedded way / Shared Pathway (Northern Machine Machine Little Context of the Context | | | | | | | | | | | | | | | NR4 | Audit Ocean Pool condition | | | |
| Coastal Cycleway) | way / Shared Pathway (Northern Medium Medium High High NR6, NR14 | | | | | | | | | | | | | | NR5 | or "relocate" | | | | |
| Transport Infrastructure | | | | | | | | | | | | | | | | | | | | Assess Cycleways for |
| Local Roads (inc Woodlands Ave, Corbett | Low | Madium | Madium | | | | | X | | | | | | | | | | | INIXO | "accommodate" or "relocate" |
| Ave) | LOW | Medium | weaturn | | | • | | | • | | | | | | | | | | NR7 | Assets |
| Water and sewage infrastructure | | | | | | | | | | | | | | | | | | | NIDO | Design criteria for Waste water, |
| Stormwater outlets and pipes (N end of | Low | Modium | High | | | | r | | | 1 | | | | | 1 | | NID7 | | NR8 | water supply and electricity asse |
| beach) | LOW | Medium | riigii | | | | | | | • | | | | ľ | • | | INFX7 | | NR9 | Develop evacuation plans |
| Residential Development | | | | | | | | | | | | | | | | | | | NR10 | Conduct Flood Study including |
| Existing Residences (1 ppty at N end of | Medium | Medium | High | | | ~ | | | | | 2 | ~ | √ | √ | | | NR14 | | | Audit EECs and habitats for price |
| beach) | mourum | mouran | i "gii | | | | | | | | • | | | | | | | | NR I I | conservation |
| | | | .0 | | | | | | | | | | | | | | | | NR12 | Use Norfolk Island Pines in new plantings |
| | | | XC | | | | | | | | | | | | | | | | NR13 | Manage Aboriginal Heritage Iten |
| | | | | | | | | | | | | | | | | | | | NR14 | Monitor erosion & inundation ev |
| | | | | | | | | | | | | | | | | | | | DN | "Do Nothing" (Accept Risk) |
| | | | | | | | | | | | | | | | | | | | | |

| BM | Manage beach sands |
|---------|---------------------------------------|
| PR1 | Accept loss as sacrificial |
| PR2 | Relocate out of hazard zone |
| PR3 | Prohibit development expansion |
| PR4 | Voluntary Acquisition |
| PR5 | Buy back then lease back |
| DOD | Apply development controls (future |
| DCP | dev't and re-dev't) |
| 10 | Redesign / retrofit in current |
| AZ | location |
| A3 | Replace with relocatable structure |
| EDCD | Apply existing flood development |
| FDCF | controls (future dev't and re-dev't) |
| NR1 | Update Asset Register for Hazards |
| NR2 | Audit existing seawalls |
| | Assess Public Buildings for |
| NR3 | "accommodate" or "relocate" |
| NR4 | Audit Ocean Pool condition |
| | Assess Roads for "accommodate" |
| INKO | or "relocate" |
| NDG | Assess Cycleways for |
| NINO | "accommodate" or "relocate" |
| NR7 | Design criteria for Stormwater |
| | Assets |
| | Design criteria for Waste water, |
| | water supply and electricity assets |
| NR9 | Develop evacuation plans |
| NR10 | Conduct Flood Study including |
| | ocean water levels |
| NR11 | Audit EECs and habitats for priority |
| | Conservation |
| NR12 | Use Norrolk Island Pines in new |
| ND12 | Managa Abariginal Haritaga Itama |
| ND14 | Monitor procion & inundation procto |
| 1117(14 | |
| DN | "Do Nothing" (Accept Risk) |
| 11 | Substantial risk reduction and / or |
| * * | highly effective in managing risk |
| 1 | Good risk reduction and / or |
| • | effective in managing risk |
| 2 | Technical feasibility of applying the |
| 1 | option is questionable |
| | "Do Nothing" option is likely to have |

detrimental effect OR result in

increased risk over time

Sym-

bol Ν

S1

S2

Nourishment

Seawall - long or majority of beach

Seawall - short sections

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| 6.8.2 Coastal Inundation Risk | Level a | nd Treat | ment Op | otions | | | | | | Sym- bol | |
|--|---------------------------------------|-------------|------------|--------------|----------|------------------------|------------------------|--------------|--------------|-------------|---|
| | | | - | | | | | | | N | Nourishment |
| | | | | | | | | | | S1 | Seawall - long or majority of beach |
| | Inun | dation Risk | level | In | undatio | n Risk T | reatme | nts | | S2 | Seawall - short sections |
| | i i i i i i i i i i i i i i i i i i i | | 20101 | | andadoi | | roaano | | | DV | Revitalise Dune Care Programs |
| McCaulevs Beach | | | 1 | | | 1 | | 1 | | BM | Manage beach sands |
| (not ine Senden Dt) | | | | Overtopping | ਤ ਦ | | | | "Do | PRI PP2 | Accept loss as sacrificial |
| (not inc Sandon Pt) | Inundation | Inundation | Inundation | risk treated | Leg | Acco | omm- | | Nothing" | PR3 | Prohibit development expansion |
| | by 2010 | by 2050 | by 2100 | by erosion | et an | od | ate 🦷 | No Regrets | (Accept | PR4 | Voluntary Acquisition |
| | | | | ontion | 귵╙ | | | | (Pick) | PR5 | Buy back then lease back |
| | | | | opiion | | | | | T (SK) | DCP | Apply development controls (future |
| Parks, Beaches and open space | | | | | PR2 | FDCP | A2 | Investigate* | DN | DOI | dev't and re-dev't) |
| McCauleys Beach | Low | Low | Medium | | | | | | ✓ | A2 | Redesign / retrofit in current location |
| Woodland Avenue Recorve Carbett Ave | | | | | | | | | | A3 | Replace with relocatable structure |
| | | | | | | | | | 1 | FDCF | Apply existing flood development |
| Reserve, Sandon Point Reserve (public open | LOW | LOW | Medium | ~ | | | | | ~ | ND1 | controls (future devt and re-devt) |
| space) | | | | | | • | | | | NR2 | Audit existing seawalls |
| McCauleys Beach Reserve (park & open | Ma aliuwa | Liberte | Estrano | | | 11 | | | | NIDO | Assess Public Buildings for |
| space) | weatum | High | Extreme | | | ~ ~ | | NR10 | | NR3 | "accommodate" or "relocate" |
| | | | | | | | | NR10 | | NR4 | Audit Ocean Pool condition |
| Hewitts Creek | Medium | Medium | High | XO | | | | NR14 | | NR5 | Assess Roads for "accommodate" |
| | | | | | | | | | | NIDO | Assess Cycleways for |
| Tramway Creek | Medium | Medium | High | | | | | INICIU, | | NR6 | "accommodate" or "relocate" |
| | | | - | | | | | NR14 | | NR7 | Design criteria for Stormwater |
| Coastal Dune Systems (S end) | Low | Low | Medium | | | | | | \checkmark | | Assets |
| Community Infrastructure | | | | | | | | | | NR8 | water supply and electricity assets |
| Significant Aboriginal Site (Tent Embassy) | High | Extreme | Extromo | | | √ √ | 1 | | | NR9 | Develop evacuation plans |
| Significant Aboriginal Site (Terit Embassy). | riigit | LAUGING | LAUGING | - | | | - | | | NR10 | Conduct Flood Study including |
| Cycleway / Shared Pathway (Northern | Medium | Medium | High | | ✓ | $\checkmark\checkmark$ | ✓ | | | - | Ocean water levels |
| Coastal Cycleway) | | | | | | | | | | NR11 | conservation |
| Transport Infrastructure | | | | | | | | | | ND12 | Use Norfolk Island Pines in new |
| Local Roads (inc Corbett Ave, Hamilton Rd) | Medium | High | Extreme | | | ~~ | ✓ | NR14 | | NP13 | plantings |
| Water and sewage infrastructure | | | | | | | | | | NR14 | Monitor erosion & inundation events |
| Stormwater outlets and pipes (N end of | | | | | | | | | | DN | "Do Nothing" (Accept Risk) |
| baseb) | High | Extreme | Extreme | | | ✓ | $\checkmark\checkmark$ | NR7, NR14 | | DIT | |
| | | | | | | | | | I | √√ | Substantial risk reduction and / or bighty effective in managing risk |
| Residential Development | | | | | <u> </u> | | | ļ | | | Good risk reduction and / or |
| Existing Residences (1 ppty at N end of | Modium | Llich | Extreme | | | | | | | ~ | effective in managing risk |
| beach | Nedium | nign | Exiteme | Ý | | ľ | | INFCIU | | ? | Technical feasibility of applying the |
| Existing Residences (7 pptv at N end of | | | | | | | | | | | "Do Nothing" option is likely to have |
| beach not inc poty above) | Medium | High | Extreme | | | $\checkmark\checkmark$ | | NR10 | | • | detrimental effect OR result in |
| poulder, not into ppty above) | | | | | I | ļ | I | 1 | | 1 | increased risk over time |

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6.8.3 Assessment of Treatment Options

| Ν | /lcC | auleys | | | | | | | | | | | | | | | |
|---|-------------|---|---|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|---|-----------------------|---|--|-------------|
| s | iym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | | Legal / Approval Risk | Specific Cost Benefit Considerations for McCauleys Beach | Potential Funding Sources (Who may pay) | Conclusion |
| | S2 | Construct seawall (revetment) along specified alignment to protect specific asset(s) | Prior to redevelopment /upgrading of any development identified as "at risk" or when the Immediate Impact Zone (including foundation stability allowance) intersects the development. | ~ | ~ | × | | | | 6 | Y X. | | 0 | | This option proposes a small section of seawall connecting with Council and other landholder seawalls (see Thirroul geotechnical hazard) along the very northem end of the beach. This section of wall would extend for 70 m in length costing an estimated \$350,000 \$700, 000 (based upon \$5,000 - \$10,000 m per length of seawall) not including ongoing maintenance costs. The wall would not significantly constrict natural retreat of the beach (PR1) as it is located along the northem headland of the beach. However, the wall would not be in keeping with the natural character of the beach, unless tied to adjacent walls along the headland. The majority of this land is publicly owned except for 1 residential property. The wall should be extended to protect the stormwater outlet at the N end of the beach from erosion also. <i>Refer to Protect Options Table for further cost benefit details fo</i> S2. | ? State Government (Grant Programs) - unlikely to fund private property protection ☑ Council (new levies or increased rates) ☑ Private landholders who directly benefit from option (personal investment or directed by Council) | Marginal |
| | DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ~ | × | | C | | | | | | | Dune care programs would be suitable to enhance the existing dune vegetation on this largely natural beach. Refer to Protect Options Table for further cost benefit details for DV. | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| ļ | PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | | × | × | | | | | | | | | This is an excellent option for retaining the beach at this location where natural retreat through reserve lands enables continued provision of a beach over the long term. The land at risk has heritage values. However protection options (e.g. seawall) are in no way financially or environmentally viable and would destroy the current natural amenity of this location. <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR1.</i> | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| | PR2 | Relocate stormwater structures outside of hazard zone | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe <u>OR</u> when asset replacement is required, whichever is sooner. | ~ | ~ | x | | | | | | | | | The stormwater outlet at the N end of the beach could be progressively moved landward as impacts eventuate. This should be confirmed through NR7, as there are likely to also be inundation impacts to be managed. The Aboriginal Tent Embassy could viably be relocated landward, to avoid erosion impacts. Landward area is community land also. <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR2.</i> | ? State Government (Grant Programs) ☑ Council (Current Programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Recommended |



135

| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Potential Funding Sbecitic Cost Benefit Considerations for but Beach Sources (Who may pay) | Conclusion |
|-------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|--|-----------------|
| PR3 | Prohibit expansion of existing use rights | Now and continuing | ~ | ~ | × | | | | | | | | This option is proposed for the single residential property located at the northern end of the beach adjacent to Woodland Ave reserve. This option limits the property value. The option offers no compensation (repurchase) of the property to the current landholder when impacts occur. Without repurchase of this land by the government (State, Federal, Local?), the land remains in private ownership. This may become a problem should planning controls change in the future. <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR3.</i> | Not Recommended |
| PR4 | Voluntary acquisition | Current Action: Apply for government funding. Trigger: Offer once funding becomes available. | ~ | ~ | × | | | | | | | 2 | This option may be financially viable for the single property at risk at the N end of the beach. Voluntary acquisition would be offered at market rates, although the rate shall be discounted substantially should the owners wait until erosion impacts occur before accepting the offer. This option enables the land to return to community ownership, ensuring a suitable use for the land in keeping with the erosion risk in the future, and allowing natural retreat of the beach. <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR4.</i> | Recommended |
| PR5 | Buy back – lease back | Current Action: Apply for mortgage now Trigger: Offer acquisition once funding becomes available. Demolish property when erosion impacts destabilise building foundations. | ~ | ~ | ~ | 1 0, | 2 | <u>ุ</u> า | | V | | | This option involves Council applying for funding through typical mortgage arrangements to acquire 1 property at the N end of the beach. The repurchase the property is offered voluntarily at market rates, however, the offer shall be discounted in accordance with the length of time remaining before the property becomes uninhabitable due to erosion. This is because this option is dependent upon Council leasing the property at market rates to assist mortgage repayments prior to erosion impacts to building foundations. At that time the development shall be demolished and returned to Community Land. This option, as above, provides fair compensation to landowners and return of at risk land to public ownership to permit natural retreat of the beach. This option is as yet untested. <i>Refer to Planned Retreat Options Table for further cost benefit details for PR5.</i> | Recommended |
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | ~ | ~ | × | | | | | | | | This option applies proposed Coastal DCP controls to any redevelopments in areas at risk. This includes the Aboriginal Tent Embassy and the property at the northem end of the beach. The DCP controls will reflect the level of risk and development lifespan. The DCP will trigger investigations as to foundation capacity (bedrock), alternative locations, distance to erosion escparments, permissible fixed structures etc that will govern the relocation (e.g. PR2) or suitable design for developments (e.g.A2, A3). Refer to Accommodate Options Table for further cost benefit details for DCP. | Recommended |

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| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for PR5 Beach | Potential Funding Sources (Who may pay) | Conclusion |
|-------------|--|---|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|---|---|-----------------|
| A2 | Redesign or retrofit stormwater structures in current location to withstand impacts. | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe OR when inundation no longer allows conveyance of stormwater <u>OR</u> when asset replacement is required, whichever is sooner. | ~ | ~ | ~ | | | | | | | | The stormwater assets affected by backwater inundation may require redesign and re-siting to enable conveyance of stormwater as sea levels rise. The stormwater asset at the N end of the beach may require design to withstand erosion, if it cannot be progressively relocated landward (i.e. PR2). Suitable design for replacement structures shall depend upon the outcomes of NR7. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for A2</i> . | ? State Government (Grant Programs) ☑ Council (Current programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Recommended |
| FDCP | Update DCP Chapter E13 – Floodplain Management to include areas affected by Coastal Inundation as Low Risk Flood Precincts, and implement DCP to manage inundation impacts as properties are redeveloped and assets replaced. | As property / assets redeveloped, new developments built | × | x | ~ | | | | | ٧. | X | 2 | This option involves applying the existing Flood DCP chapter to those areas identified at risk from coastal inundation outside of the existing flood planning area at the "low flood risk" level prior to updated Flood Studies for Hewitts and Tramway Creeks (refer NR10). There are limited additional properties outside the flood planning area. The majority of properties affected by coastal inundation are also within the existing Flood Planning Area, therefore this option would have no additional effect on existing property value or development restrictions. Refer to Accommodate Options Table for further cost benefit details for FDCP. | N/A State Government (external funding unlikely to be needed) ☑ Council (Current Programs) ☑ Private landholders - cost to implement FDCP | Recommended |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | . N/A | N/A | Č | | 2 | 1 | | | | Assets at McCauleys are at risk from both erosion, overtopping and backwater inundation. The "do nothing" option would be acceptable within natural areas without development, however there are a number of private, community and cultural assets within this location, for which the outcomes of "do nothing" would have an unacceptable impact. Refer to "Do Nothing" Option Table for further cost benefit details. | ? State Government ☑ Council (new levies and increased rates) ☑ Private landholders in Future Generations | Not Recommended |
| NR | NR1, NR6, NR7, NR10, NR11, NR13, NR14 | Now | ~ | | | 2 | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |



6.9 Sandon Point Beach

6.9.1 Erosion and Recession Risk Level and Treatment Options

| | | | | | | | | | | | | | | | | | | | BM | Manage beach sands |
|--|---------|-----------|------------|----|-----------|----------|----|------|--------|---------|----------|--------------|--------------|---------------------|------|-------|--------------|---------------|----------|---------------------------------------|
| | Erosio | n and Rec | ession | | | | | En | nsion | / Rec | nizza | n Risk | Treat | ments | | | | | PR1 | Accept loss as sacrificial |
| Sandon Point Beach | | Risk Leve | I | | | | | L., | 001011 | / 11000 | 000101 | | mout | | , | | | | PR2 | Relocate out of hazard zone |
| Sandon i Olin Deach | Erosion | Erosion | Erosion | | | . | | | | C . | | | | | | | | "Do Nothing" | PR3 | Prohibit development expansion |
| | bv 2010 | by 2050 | bv 2100 | | ŀ | rotec | t | | | Planr | ned R | etreat | | Acc | comm | odate | No Regrets | (Accept Risk) | PR4 | Voluntary Acquisition |
| Parks Boachos and open space | | ., | ., | N | S1 | \$2 | עס | BM | DD1 | DP2 | DD3 | | DP5 | | Δ2 | 43 | Investigate* | | PR5 | Buy back then lease back |
| | L P als | E da cara | E. transie | IN | 51 | 52 | 00 | DIVI | | 1112 | 1103 | 1 1/4 | 110 | | 74 | 7.5 | Investigate | DN | DCP | Apply development controls (future |
| Sandon Point Beach | High | Extreme | Extreme | | | | ~ | | ~ | | | | | | | | NR14 | | | Redesign / retrofit in current |
| Sandon Point Beach Reserve (not including | Medium | Medium | High | | | | | | ~ | | | | | | • | | | | A2 | location |
| Sandon Point Heritage area) | | | ·g | | | - | | | | | | | \mathbf{O} | | | | | | A3 | Replace with relocatable structure |
| Slacky Creek | Medium | Medium | High | | | | | | ✓ | | | | | | | | NR11 | | FDOD | Apply existing flood development |
| Coastal Dune Systems (N end of beach) | High | Extreme | Extreme | | | | ✓ | | ✓ | | | | | | | | | | FDCP | controls (future dev't and re-dev't) |
| Community Infrastructure | | | | | | | | | | | | | • | | | | | | NR1 | Update Asset Register for Hazards |
| Sandon Point Surf Club | Hiah | Extreme | Extreme | | | | | | | | \frown | | | ✓ | ✓ | | NR14 | | NR2 | Audit existing seawalls |
| Heritate Site: Sandon Point (also under | g | | 2741 01110 | | | | | | | C | | ľ – | | | | | | | NR3 | Assess Public Buildings for |
| | High | Extreme | Extreme | | | | | | ✓ | |) | | | | | | | | | Audit Occor Deal condition |
| Haritaga Sita: Sandan Baint Baat Shada | Modium | High | High | | | | | | | | | | | | | | | | IND4 | Assess Roads for "accommodate" |
| Heritage Site. Saluon Foint Boat Sheds | Medium | підп | підп | | | | | | v | | | | | | | | | | NR5 | or "relocate" |
| Northern Cycleway / Shared Pathway (at S | Medium | Medium | High | | ✓ | | | | | ~ | | | | | | | NR6, NR14 | | NDO | Assess Cycleways for |
| end of beach) | | | | | | | | | | | | | | | | | | | INR6 | "accommodate" or "relocate" |
| Heritage Site: Norfolk Island Pines (S end | Medium | Medium | High | | | | | | ✓ | | | | | | | | NR12 | | NR7 | Design criteria for Stormwater |
| of beach) | | | 3 | | | | | | | | | | | | | | | | | Assets |
| Transport Infrastructure | | | | | | | | | | | | | | | | | | | NR8 | Design criteria for Waste water, |
| Local Roads: Blackall St, Ursula St, Alroy | Modium | Modium | High | | | | 1 | 1 | | 1 | | | | 1 | | | NR5, NR8, | | | Water supply and electricity assets |
| St) | Medium | weaturn | Flight | | | | • | v | | v | | | | ľ | | | NR14 | | ININ9 | Conduct Flood Study including |
| Beach car parks (S end of Beach) | Low | Low | Medium | | ~ | V | | | ~ | | | | | | | | | ✓ | NR10 | ocean water levels |
| Water and sewage infrastructure | | | | | | | | | | | | | | | | | | | ND11 | Audit EECs and habitats for priority |
| Stormwater outlets and pipes (S end of | | _ | | | , i | | | | | | | | | | | | NR7, NR8, | | INIX I I | conservation |
| beach) | High | Extreme | Extreme | | ✓ | | | | | ~ | | | | √ | | | NR14 | | NR12 | Use Norfolk Island Pines in new |
| Residential Development | | | XX |) | | | | | | | | | | | | | | | ND12 | plantings |
| Existing Residences (edge of 5 poties at S | | | | | | | | | | | | | | | | | | | NR13 | Monitor erosion & inundation events |
| end of booch) | Low | Medium | Medium | | ✓ | | | | | | | \checkmark | ✓ | ✓ | | | NR8 | | | |
| | | | | | | | | | | | | | | | | | | | DN | "Do Nothing" (Accept Risk) |
| | | | | | | | | | | | | | | | | | | | 11 | Substantial risk reduction and / or |
| | | | | | | | | | | | | | | | | | | | | highly effective in managing risk |
| | | | | | | | | | | | | | | | | | | | ~ | Good risk reduction and / or |
| | | | | | | | | | | | | | | | | | | | | effective in managing risk |
| | | | | | | | | | | | | | | | | | | | ? | ontion is questionable |
| | | | | | | | | | | | | | | | | | | | | "Do Nothing" option is likely to have |
| | | | | | | | | | | | | | | | | | | | • | detrimental effect OR result in |

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Sym-

bol N

S1

S2

DV

Nourishment

Seawall - long or majority of beach

Revitalise Dune Care Programs

Seawall - short sections

increased risk over time



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0 75 150m Approx. Scale



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140

| 6.9.2 Coastal Inundation Risk Level and Treatment Options | | | | | | | | | | Sym- | |
|---|--|------------|------------|--------------|-------------|--------------|-----|---------------------------------------|-------------------------------|------------------------|---|
| • | | | | | | | | | | N | Nourishment |
| | | | | | | | | | | S1 | Seawall - long or majority of beach |
| Sandon Point Beach | Inundation Risk Level Inundation Risk Treatments | | | | | | | S2 | Seawall - short sections | | |
| | man | | | | | | | DV | Revitalise Dune Care Programs | | |
| | | | | | | | | BM | Manage beach sands | | |
| | | | 1 | Overtopping | ਸ਼ ਹ | | | | "Do | PR1 | Accept loss as sacrificial |
| | Inundation | Inundation | Inundation | risk treated | rea | Acco | mm- | No Dograto | Nothing" | PR2 | Relocate out of hazard zone |
| | by 2010 | by 2050 | by 2100 | by erosion | Plar Ret | odate | | NO REGIELS | (Accept | PR3 | Prohibit development expansion |
| | ., | | | | | | | | Risk) | PR4 DP5 | Pure back then lease back |
| | | | | option | | | | | | FNJ | Apply development controls (future |
| Parks, Beaches and open space | | | | | PR2 | FDCP | A2 | Investigate* | DN | DCP | devt and re-devt) |
| Sandon Point Beach | Low | Low | Medium | | | | | | \checkmark | A2 | Redesign / retrofit in current |
| Sandon Point Beach Reserve (not including Sandon | Low | Low | Medium | | | | | | 1 | A3 | Replace with relocatable structure |
| Point Heritage area) | LOW | LOW | Wearan | | | | | | ÷ | EDCB | Apply existing flood development |
| | | | | S. | | | | | | FDCF | controls (future dev't and re-dev't) |
| Slacky Creek | Medium | Medium | High | | | | | NR10, NR14 | \checkmark | NR1 | Update Asset Register for Hazards |
| Coastal Dune Systems (N end of beach) | Low | Low | Medium | | | | | | \checkmark | | Assess Public Buildings for |
| | | | | | | | | | | INR3 | "accommodate" or "relocate" |
| | | | | | | | | | | NR4 | Audit Ocean Pool condition |
| Sandon Point Surf Club | Medium | High | Extreme | \sim | | ✓ | | | | NR5 | Assess Roads for "accommodate" |
| Heritate Site: Sandon Point (also under NPW Act) | Medium | Medium | High | ~ | | | | | \checkmark | NIDO | Assess Cycleways for |
| Heritage Site: Sandon Point Boat Sheds | Medium | High | High | \checkmark | | | | | \checkmark | INRO | "accommodate" or "relocate" |
| Northern Cycleway / Shared Pathway (Centre of Beach) | Medium | Medium | High | | | ~ | ✓ | NR10 | | NR7 | Design criteria for Stormwater Assets |
| Northern Cycleway / Shared Pathway (at S end of | | | | | | | | | | NR8 | water supply and electricity assets |
| hoach) | Medium | Medium | High | \checkmark | | \checkmark | | | | NR9 | Develop evacuation plans |
| Heritage Site: Norfolk Island Pines (S and of beach) | Low | Low | Medium | | | | | | 1 | NR10 | Conduct Flood Study including |
| | LOW | LOW | Weardin | | | | | | - | | Audit EECs and habitats for priority |
| Transport Infrastructure | | · | | | | | | | | NR11 | conservation |
| Local Roads: Blackall St adjacent to Slacky Creek) | Medium | High | Extreme | | | ~ | ~ | NR10, NR14 | | NR12 | Use Norfolk Island Pines in new plantings |
| Local Roads: Blackall St, Ursula St, Alroy St) | Medium | Medium | High | \checkmark | | | | NR10, NR14 | | NR13 NR14 | Manage Aboriginal Heritage Items |
| | | | | | | ~ | ~ | | | DN | "Do Nothing" (Accept Risk) |
| Water and sewage infrastructure | | | | | | | | | | | Substantial risk reduction and / or |
| Stormwater outlets and pipes (Centre of beach) | High | Extreme | Extreme | | | ✓ | ✓ | NR7, NR14 | | $\checkmark\checkmark$ | highly effective in managing risk |
| Stormwater outlets and pipes (S end of beach) | High | Extreme | Extreme | | ✓ | ✓ | | NR7, NR14 | | ~ | Good risk reduction and / or effective in managing risk |
| Residential Development | - U | | | | | | | · · · · · · · · · · · · · · · · · · · | | | Technical feasibility of applying the |
| Existing Residences (adjacent to Slacky Creek) | Medium | High | Extreme | | | ✓ | √ | NR10 | | 7 | option is questionable |
| Existing Residences (S and off Plackall St) | Modium | Medium | High | | | | | | | • | "Do Nothing" option is likely to have detrimental effect OR result in |
| LAISUNY RESIDENCES (S END UN DIACKAIL SU) | Medium | Medium | Tign | | | * | | INITIO, INITS | | | increased risk over time |

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Immediate Inundation Risk Levels and Treatment Options Sandon Point Beach

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6.9.3 Assessment of Treatment Options

| San | don Point | | | | | | | | | | | | | | | |
|-------------|---|---|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|------------------------|-----------------------|--|---|-----------------|
| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | l egal / Approval Risk | Legal / Approval KISK | Specific Cost Benefit Considerations for Sandon Point Beach | Potential Funding Sources (Who may pay) | Conclusion |
| S1 | Construct seawall (revetment) along specified alignment covering half of beach length | Current Action: Undertake concept design for entire length, plus approvals Trigger: implement progressively as erosion threatens cycleway | ~ | ~ | × | | | | | Yx. | 3 | | | At this location, the erosion risk is higher at the south, progressively increasing towards the north over time. In this case, the proposed seavall could be built slowy in sections from south to north as the erosion impact occurs, managing the offsite impacts at the end of the wall progressively northwards also, ending at the creek mouth. The offsite impacts from the wall would require this full length to be implemented. This 600 m length of seavall would cost \$ 3 - 6 million (based on estimate of \$5,000 - \$10,000 per m length of wall), not including management of offsite impacts and ongoing maintenance. Without nourishment the seawall would result in loss of the sandy beach amenity. The wall shall be designed to mitigate overtopping impacts also, and the wall can be progressively heightened over time as overtopping increases with sea level rise. However, this adds to costs of this option. Redesign of stormwater assets to accommodate inundation will be required even with a seawall, which must be included in costs. The wall would also protect residences that are currently at low risk behind the roadway and associated wastewater and water supply assets and which may add to the economic viability of this option. | ? State Government (Grant Programs, Sydney water if assets are protected) ☑ Council (new levies or increased rates) ☑ Private landholders who directly benefit from option (personal investment or directed by Council) | Not Recommended |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ~ | × | | | | | | | | | Dune care programs must be considerate of sightline requirements for SLSC activities. <i>Refer to Protect Options Table for further cost benefit details for</i> <i>DV.</i> | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | x | | | | | | | | | This is an excellent option for retaining the beach, particularly along the northern half of the beach where public open space can be used to allow natural retreat of the beach, and hence continued provision of a beach over the long term (compared with seawall protection that would substantially reduce beach amenity in this location at a prohibitive financial cost to community). Retreat is also possible at the southern end of the beach provided assets are relocated or redesigned, and traffic redirected (refer PR2, A2). <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details</i> . | ? State Government (Grant Programs) ☑ Council (Current Programs) <i>N/A</i> Private landholders who directly benefit from option | Recommended |



143

| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Ontion | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for PR2 Beach | Potential Funding Sources (Who may pay) | Conclusion |
|-------------|---|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|---|---|-------------|
| PR2 | Relocate cycleway and roadway outside of hazard zone | Current Action: NR6; NR5 Trigger: When erosion escarpment encroaches cycleway foundations OR when ZRFC from erosion escarpment encroaches upon Trinity Row. | ~ | ~ | × | | | | | | | | The cycleway can be progressively relocated landward as erosion impacts occur, as an alternative to seawall protection. The ability to redirect traffic off Trinity Row will need to be confirmed through NR5. This option proposes allowing residential access only, and redirecting traffic along an alternate route. The current roadway would then be sacrificed to erosion, allowing the beach to naturally retreat, retaining the beach. Refer to Planned Retreat Options Table for further cost benefit details for PR2. | ? State Government (Grant Programs) ☑ Council (Current Programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Recommended |
| PR2 | Relocate stormwater structures outside of hazard zone | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe <u>OR</u> when asset replacement is required, whichever is sooner. | ~ | ~ | x | | | | | | | | For stormwater assets, the outcomes of NR7 shall determine where assets may be progressively relocated landward as impacts occur. This is most likely possible for the assets perpendicular to the beach, providing inundation aspects are also managed. <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR2.</i> | ? State Government (Grant Programs) ☑ Council (Current Programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Recommended |
| PR4 | Voluntary acquisition | Current Action: Apply for government funding. Trigger: Offer once funding becomes available. | ~ | ~ | * | | C | | 7 | XX | 3 | | This option is suggested for the four properties at the S end of the beach. The option is unlikely to be viable as there are typically insufficient government funds to apply this option to multiple properties. Voluntary acquisition would be offered at market rates. This includes discounting the rate substantially should the owners wait until erosion impacts occur before accepting the offer. This option enables the land to return to community ownership, ensuring a suitable use for the land in keeping with the erosion risk in the future, and allowing natural retreat of the beach. <i>Refer to Planned Retreat Options Table for further cost benefit details for PR4</i> . | ? State Government (Grant Programs) ☑ Council (new levies or increased rates) ☑ Private landholders who directly benefit from option | Marginal |
| PR5 | Buy back – lease back | Current Action: Apply for mortgage now Trigger: Offer acquisition once funding becomes available. Demolish property when erosion impacts destabilise building foundations. | ~ | | 8. | Ś | | | | | | | This option involves Council applying for funding through typical mortgage arrangements to acquire the four properties at the N end of the beach. The repurchase the property is offered voluntarily at market rates, then progressively discounted in accordance with the length of time remaining before the property becomes uninhabitable due to erosion, which Council will use to lease the property to assist mortgage repayments. This option, provides fair compensation to landowners and return of at risk land to public ownership to enable natural retreat of the beach. This option is as yet untested. Refer to Planned Retreat Options Table for further cost benefit details for PR5. | ? State Government (Grant Programs) ☑ Council (new levies or increased rates) ☑ Private landholders who directly benefit from option | Marginal |



144

| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Accentability | Reversible / Adaptable | in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for PR5 Beach | | Conclusion |
|-------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|------------------------|-----------|-------------------------|-----------------------|---|--|-----------------|
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | ~ | ~ | × | | | | | | | | | This option shall apply planning controls to 4 private propertys and some public assets currently in areas at risk, with less stringent controls applied to land at lower risk and / or land uses considered to have a shorter timeframe (design life), and vice versa. For the Sandon Point SLSC, a new development at the current site is already underway. Applying the DCP controls will ensure any future re-developments adequately consider alternative locations outside of the hazard zone. <i>Refer to Accommodate Options Table for further cost benefit</i> details for <i>DCP</i> . | nt (Grant : Programs, d levies?) - :P and c assets ers - cost | Recommended |
| A2 | Redesign or retrofit stormwater structures in current location to withstand impacts. | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe OR when asset replacement is required, whichever is sooner | ~ | < | * | | | | | | | 0 | | Stormwater assets running parallel with Trinity Row may need to be redesigned in their current location particularly to enable conveyance of water with inundation. This option would be required in conjunction with S1 or PR options. ? State Governme Programs) Refer to Accommodate Options Table for further cost benefit details for A2. N/A Private landho directly benefit for | nt (Grant <i>i</i> es or Iders who n option | Recommended |
| FDCP | Update DCP Chapter E13 – Floodplain Management to include areas affected by Coastal Inundation as Low Risk Flood Precincts, and implement DCP to manage inundation impacts as properties are redeveloped and assets replaced. | As property / assets redeveloped, new developments built | × | × | * | | C | | | ~~~ | | | > | This option involves applying the existing Flood DCP chapter to those areas identified at risk from coastal inundation outside of the existing flood planning area. This area is limited around Slacky Creek, with most properties already within the catchment flooding area. However, properties along Trinity Row are not currently within a flood planning area. The controls are applied at the "low flood risk" level, until A Flood Study at Whartons Creek is completed to provide better advice for flood planning (see NR10). <i>Refer to Accommodate Options Table for further cost benefit</i> | nent nlikely to be : Programs) ers - cost o | Recommended |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | N/A | N/A | Ś | | | | | | | | Particulalry at the S end of the beach, there are a number of private and public assets at risk. "Do nothing" is unacceptable, as there would be unacceptable disruption to the local community from the loss of those assets currently at risk. "Do Nothing" may limit management options considered in the future, as either land and assets at risk have increased making more costly options inevitable, or damaging impacts have already occurred, for example, irreversible erosion impacts. <i>Refer to "Do Nothing" Option Table for further cost benefit details.</i> State Governmer | it ies and ers in Future | Not Recommended |
| NR | NR1, NR5, NR6, NR7, NR8, NR9, NR10, NR11, NR12, NR13, NR14 | Now | ~ | ~ | ~ | | | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. Ø Council (Current N/A Private landho directly benefit for | t (Grant Programs) Iders who option | Recommended |

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6.10 Bulli Beach

6.10.1 Erosion and Recession Risk Level and Treatment Options

| | | | | | | | | | | | | | | | | | | | DV | Revitalise Dune Care Programs |
|--|-----------|------------|---------------|---|----|--------|----|----|------------------------|------------------------|--------|--------|-------|--------------|--------------|-------|--------------|---------------|------|--|
| | Fracia | n and Da | ion | | | | | | | | | | | | | | | | BM | Manage beach sands |
| Bulli Beach | Erosio | Diale Lave | Jession | | | | | Er | rosion | / Rec | essior | n Risk | Treat | ments | 6 | | | | PR1 | Accept loss as sacrificial |
| Dam Deach | | RISK Leve | 1 | | | | | | | | | | | 1 | | | 1 | | PR2 | Relocate out of hazard zone |
| | Erosion | Erosion | Erosion | | | Protec | t | | | Plan | ned Re | etreat | | Acc | anmo | odate | No Regrets | "Do Nothing" | PR3 | Prohibit development expansion |
| | by 2010 | by 2050 | by 2100 | | | | | | | | | | r | | | Judio | The Regrete | (Accept Risk) | PR4 | Voluntary Acquisition |
| Parks, Beaches and open space | | | | Ν | S1 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCP | A2 | A3 | Investigate* | DN | PR5 | Buy back then lease back |
| Bulli Beach | High | Extreme | Extreme | | 1 | | √√ | | √√ | | | | | K | | | NR14 | | DCP | Apply development controls (future dev/t and re-dev/t) |
| Bulli Beach Reserve | Medium | Medium | High | | | | | | $\checkmark\checkmark$ | | | | | | | | | | A2 | Redesign / retrofit in current |
| Ocean Park | Medium | Medium | High | | | | | | $\checkmark\checkmark$ | | | | | | | | | | 1.2 | |
| Collins Park | Low | Medium | Medium | | | | | | $\checkmark\checkmark$ | | | | | | | | | | AS | Apply existing flood development |
| Whartons Creek | Medium | Medium | High | | | | | | $\checkmark\checkmark$ | | | | | | | | | | FDCP | controls (future devt and re-devt) |
| Collins Creek | Medium | Hiah | Extreme | | | | | | $\checkmark\checkmark$ | | | | | | | | | | NR1 | Update Asset Register for Hazards |
| Coastal Dune Systems | High | Extreme | Extreme | | | | ✓ | | √ √ | | | | | | | | | | NR2 | Audit existing seawalls |
| Waniora Point (Heritage site) | High | Extreme | Extreme | | | | | | | | | | | | 11 | | NR13 | | NR3 | Assess Public Buildings for |
| | riigii | LATOTIC | LATOTIC | | | | | | · | | | | | | | | NICIO | | | Audit Occan Real condition |
| Pulli Surf Club | Lliab | Extromo | Extromo | | | | | | | | | | | | | | | | | Addit Ocean Pool condition |
| Bulli Kingk and regidence | Madium | Madium | Lich | | | | | | Ť | | | | | V V | • | | NR3, NR14 | | NR5 | or "relocate" |
| Bulli Klosk and residence | Medium | Madium | High | | - | | | | | •• | | | | v | ~ | | NR3, NR14 | | NR6 | Assess Cycleways for |
| Buill Tourist Park (caravan park) | weatum | iviedium | High | | | | | | - | ~ ~ | | | | v | | | | | | "accommodate" or "relocate" |
| Cycleway / Shared Pathway (extent | Medium | High | Extreme | | | | | | | $\checkmark\checkmark$ | | | | ✓ | | | NR6, NR14 | | NR7 | Assets |
| Detween beach and tourist park) | N.A. Para | L PL | E. da a ser a | | | | | | | | | | | | | | | | NIDO | Design criteria for Waste water, |
| | Iviedium | High | Extreme | | | - | | | ~ | | | | | | ~ | | NR4, NR14 | | INR8 | water supply and electricity assets |
| Transport Infrastructure | | | | | | | | | | | | | | | | | | | NR9 | Develop evacuation plans |
| Car parks (Bulli SLSC, Collins Pt reserve) | Low | Low | Medium | | | | | | | $\checkmark\checkmark$ | | | | ✓ | | | | \checkmark | NR10 | Conduct Flood Study including |
| Water and sewage infrastructure | | | | | | | | | | | | | | | | | | | | Audit EECs and habitats for priority |
| Stormwater outlets and pipes | Low | Medium | High | | | | | | | ✓ | | | | \checkmark | \checkmark | | NR7 | | NR11 | conservation |
| | | | \mathbf{O} | | | | | | | | | | | | | | | | NR12 | Use Norfolk Island Pines in new |
| | | | XV |) | | | | | | | | | | | | | | | ND12 | plantings Manage Aberiginal Heritage Itoms |
| | | | | | | | | | | | | | | | | | | | NR14 | Monitor erosion & inundation events |
| | | | | | | | | | | | | | | | | | | | DN | "Do Nothing" (Accept Risk) |
| | | | | | | | | | | | | | | | | | | | ~~ | Substantial risk reduction and / or highly effective in managing risk |
| | | | | | | | | | | | | | | | | | | | ~ | Good risk reduction and / or effective in managing risk |
| | | | | | | | | | | | | | | | | | | | ? | Technical feasibility of applying the option is questionable |
| | | | | | | | | | | | | | | | | | | | | "Do Nothing" option is likely to have |

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Sym-

bol N

S1

Nourishment

S2 Seawall - short sections

Seawall - long or majority of beach

detrimental effect OR result in

increased risk over time



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0 75 150m Approx. Scale

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6.10.2 Coastal Inundation Risk Level and Treatment Options

Sym-

| | Ν |
|--------------|------|
| | S1 |
| | S2 |
| | DV |
| | BM |
| | PR1 |
| | PR2 |
| \mathbf{O} | PR3 |
| | PR4 |
| | PRD |
| | DCP |
| | A2 |
| | A3 |
| | FDCP |
| | NR1 |
| | NR2 |
| - CN | NR3 |
| | NR4 |
| | NR5 |
| | NR6 |
| | NR7 |
| 0 1 | NR8 |
| | NR9 |
| | NR10 |
| | NR11 |
| | NR12 |
| | NR13 |
| | NR14 |
| | DN |
| | ~~ |
| | ~ |
| | ? |
| | - |

| bol | |
|--------------|--|
| Ν | Nourishment |
| S1 | Seawall - long or majority of beach |
| S2 | Seawall - short sections |
| DV | Revitalise Dune Care Programs |
| BM | Manage beach sands |
| PR1 | Accent loss as sacrificial |
| PR2 | Relocate out of bazard zone |
| DP3 | Prohibit development evention |
| F NJ | Vehicle and Association |
| PR4 | Voluntary Acquisition |
| PR5 | Buy back then lease back |
| DCP | Apply development controls (future dev/t and re-dev/t) |
| A2 | Redesign / retrofit in current location |
| A3 | Replace with relocatable structure |
| FDOF | Apply existing flood development |
| FDCP | controls (future dev/t and re-dev/t) |
| NR1 | Update Asset Register for Hazards |
| NR2 | Audit existing seawalls |
| | Assess Public Buildings for |
| NR3 | "accommodate" or "relocate" |
| NR4 | Audit Ocean Pool condition |
| | Assess Roads for "accommodate" |
| NR5 | or "relocate" |
| | Assess Cycleways for |
| NR6 | "accommodate" or "relocate" |
| | Design criteria for Stormwater |
| NR/ | Assets |
| | Design criteria for Waste water, |
| INRO | water supply and electricity assets |
| NR9 | Develop evacuation plans |
| | Conduct Flood Study including |
| INR IU | ocean water levels |
| | Audit EECs and habitats for priority |
| | conservation |
| | Use Norfolk Island Pines in new |
| INFX 1Z | plantings |
| NR13 | Manage Aboriginal Heritage Items |
| NR14 | Monitor erosion & inundation events |
| DN | "Do Nothing" (Accept Risk) |
| ~ ~ | Substantial risk reduction and / or highly effective in managing risk |
| | Good risk reduction and / or |
| \checkmark | effective in managing risk |
| | Technical feasibility of applying the |
| ? | option is questionable |
| | "Do Nothing" option is likely to have |
| • | detrimental effect OR result in |
| | in a second view of the second size |

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148

| Bulli Boach | Inun | dation Risk | Level | In | undation | n Risk T | reatme | nts | |
|--|-----------------------|-----------------------|-----------------------|---|--------------------|--------------|-------------|--------------------|-------------------------------------|
| Duili Deach | Inundation by 2010 | Inundation by 2050 | Inundation by 2100 | Overtopping risk treated by erosion option | Planned Retreat | Acco od: | omm- ate | No Regrets | "Do Nothing" (Accept Risk) |
| Parks, Beaches and open space | | | | | PR2 | FDCP | A2 | Investigate* | DN |
| Bulli Beach | Low | Low | Medium | | | | | | ✓ |
| Bulli Beach Reserve | Low | Low | Medium | | | | | | ✓ |
| Ocean Park | Low | Medium | Medium | | | | | | ✓ |
| Collins Park | Low | Low | Medium | | | | | | ✓ |
| Whartons Creek | Low | Medium | Medium | | | | 0 | NR10, NR14 | |
| Collins Creek | Medium | Medium | High | | | 2 | 0 | NR10, NR14 | |
| Coastal Dune Systems | Low | Low | Medium | | | | ŀ | | ~ |
| Waniora Point (Heritage site) | Medium | High | High | ✓ | | | | | |
| Community Infrastructure | | | | | | | | | |
| Bulli Surf Club | Medium | High | Extreme | × (| | | | | |
| Bulli Kiosk and residence | Low | Medium | Medium | ~ | 5 | | | | |
| Bulli Tourist Park (caravan park) | Medium | Medium | High | | | \checkmark | ✓ | | |
| Cycleway / Shared Pathway | Low | Medium | Medium | | | | | | |
| Bulli Pool | Medium | Medium | High | ~ | | | | | |
| Heritage Site: Bulli Cemetary | Low | Medium | Medium | | | | | | ✓ |
| Transport Infrastructure | | | | | | | | | |
| Car parks (Bulli SLSC, Collins Pt reserve) | Low | Low | Medium | | | | | | ✓ |
| Local Roads (Farrell Rd, Trinity Row, Jardine St, Godolphin St affected by Whartons Ck) | Medium | High | Extreme | | | ~ | ~ | NR10, NR9, NR14 | |
| Local Roads (Carrington St, Campbells St, affected by Collins Ck) | Medium | Medium | High | | | ~ | ~ | NR10, NR14 | |
| Water and sewage infrastructure | | | | | | | | | |
| Stormwater outlets and pipes | High | Extreme | Extreme | | | ✓ | ✓ | NR7, NR10 | |
| Residential Development | • | | | | | | | | |
| Existing Residences (adjacent to Whartons creek & Stormwater System) | Medium | High | Extreme | | | ~ | ~ | NR10, NR9 | |
| Institutional Infrastructure | | | | | | | | | |
| Bulli High School | Low | Medium | Medium | | | ✓ | | NR10 | |





Immediate Inundation Risk Levels and Treatment Options Bulli Beach

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6.10.3 Assessment of Treatment Options

| Bulli | | | | | | | | | | | | | | |
|-------------|--|---|----------------|--------------------|----------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|--|-------------|
| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for Bulli Beach | Conclusion |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ~ | × | | | | | | | | Dune care programs must be considerate of sightline requirements for SLSC activities. This is particularly important at Bulli as existing dune vegetation in front of surf club already impedes sight to patrol area. Refer to Protect Options Table for further cost benefit details for DV. 2 State Government (Grant Programs) ☑ Council (Current Programs N/A Private landholders who directly benefit from option | Recommended |
| PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | × | | | | | | | × | This is an excellent option for retaining Bulli Beach, by utilising public open space and dunes to enable natural retreat of the beach, and hence continued provision of a beach over the long term. Based on NR4, if it is found that Bulli Pool cannot be progressively repaired to withstand wave and sea level rise impacts into the future, the pool will need to be slowly removed as it fails over time. Refer to Planned Retreat Options Table for further cost benefit details for PR1. | Recommended |
| PR2 | Relocate structures outside of hazard zone: Surf club and kiosk; tourist park cabins; cycleway | Current Action: NR3, NR6 Trigger: At scheduled time for asset maintenance OR when ZRFC measured from erosion escarpment encroaches onto building foundations, cabins or cycleway, whichever is sooner | ~ | ~ | × | | ć | | 2 | 1 | P | 2 | Relocation of the surf club and kiosk structures would provide a new club facility for community and the SLSC. There is likely to be sufficient space nearby to relocate these structures, however this shall be based on NR3. If timed with asset maintenance this may reduce costs as they are combined with expected major maintenance costs. Tourist cabins are typically low key structures that will be easily relocatable. There is likely to be an alternative location to relocate the cycleway landward of the hazard zone. <i>Refer to Planned Retreat Options Table for further cost benefit details for PR2.</i> | Recommended |
| PR2 | Relocate stormwater assets landward of hazard zone | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe OR the pipe requires replacement, whichever is sooner. | ~ | • • | × | | 5 | | | | | | The stormwater asset is likely to be able to be relocated, but this should depend on outcomes of NR7 and in combination with outcomes for the extended network affected by inundation (see also A2). Refer to Planned Retreat Options Table for further cost benefit details for PR2. ? State Government (Grant Programs) ☑ Council (Current Programs new levies or increased rates?) N/A Private landholders who directly benefit from option | Recommended |
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | ~ | ~ | × | | | | | | | | Public assets at risk including the SLSC, kiosk, caravan park, cycleway and stormwater assets shall be subject to Coastal DCP Controls. The DCP will ensure that future upgrades/redevelopment involve assessments to determine whether the asset shall to be relocated (e.g. PR2) or redesigned to withstand impacts at the current location (A2 or A3). Refer to Accommodate Options Table for further cost benefit details for DCP. | Recommended |

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151

| Sym- bol | - Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for DCP Beach (Who may Builtial Builtial Cost Benefit Considerations for DCP Beach (Ned Builtial Cost Benefit Considerations for DCP Beach | Conclusion | |
|-------------|--|--|----------------|--------------------|----------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|---|-----------------|--|
| A2 | Redesign or retrofit surf club and kiosk structures in current location to withstand impacts. | Current Action: NR3 Trigger: At scheduled time for asset maintenance OR when ZRFC measured from erosion escarpment encroaches onto building foundations, whichever is sooner | ~ | v | N/A | | | | | | | | Based on the outcomes of NR3, if alternative locations are not available for replacement structures, and there is foundation capacity and other controls for erosion and wave impacts can be affordably built, then the structures could be redeveloped or retrofit at the current location. <i>Refer to Accommodate Options Table for further cost benefit details for A2.</i> ? State Government (Grant Programs) | Marginal | |
| A2 | Redesign or retrofit stormwater structures and cycleway in current location to withstand impacts. | Current Action: NR7 Trigger: When inundation regularly impedes conveyance of stormwater <u>OR</u> when asset replacement is required, whichever is sooner | ~ | ~ | V | | | | | | | | There is a significant extent of stormwater pipes and structures that may be affected by coastal inundation that will require redesign to convey stormwater as effectively as possible with sea level rise. Designs shall be based on outcomes of NR7. Refer to Accommodate Options Table for further cost benefit details for A2 | Recommended | |
| A2 | Retrofit Bulli Pool in current location to withstand impacts. | Current Action: NR4 Trigger: When damage to pool shell occurs <u>OR</u> the pool is being inundated at water levels lower than MSL. | · √ | ~ | N/A | | | | | | 6 | X | The decision to progressively retrofit Bulli Pool over time to withstand wave impacts and remain a viable pool with sea level rise shall depend upon the suitability of pool condition for this purpose, based upon NR4. Refer to Accommodate Options Table for further cost benefit details for A2. | Recommended | |
| FDCP | Update DCP Chapter E13 – Floodplain Management to include areas affected by Coastal Inundation as Low Risk Flood Precincts, and implement DCP to manage inundation impacts as properties are redeveloped and assets replaced. | As property / assets redeveloped, new developments built | × | × | v | | | | R | - | X | | This option involves applying the existing Flood DCP chapter to those areas identified at risk from coastal inundation outside of an existing flood planning area at the "low flood risk" level, until a proper flood modelling study is conducted (refer NR10 for Whartons and Collins Ck). A flood study should be completed at Whartons Creek as a priority (see NR10), as many houses may be affected. Refer to Accommodate Options Table for further cost benefit details for FDCP. | Recommended | |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | N/A | A N/A | | 3 | | | | | | There are a number of private and public properties at high risk from erosion, overtopping and or backwater inundation at Bulli. "Do Nothing" is likely to be unacceptable due to damage causing increased social, environmental and financial costs over time, borne by future generations. "Do Nothing" may limit management options considered in the future, as either land and assets at risk have increased making more costly options inevitable, or irreversible erosion impacts have already occurred. <i>Refer to "Do Nothing" Option Table for further cost benefit details.</i> ? State Government ⊘ Council (new levies and increased rates) ⊘ Private landholders in Future Generations | Not Recommended | |
| NR | NR1, NR3, NR4, NR6, NR7, NR9, NR10, NR13, NR14 | Now | ~ | ~ | ~ | | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. ? State Government (Grant Programs) Image: Council Current Programs) Image: Council Current Programs) Image: Councurrent Programs | Recommended | |

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6.11 Woonona Beach

6.11.1 Erosion and Recession Risk Level and Treatment Options

| | | | | | | | | | | | | | | | | | | | DV | Revitalise Dune Care Programs |
|--|---------|-----------|----------|---|----|--------|--------------|----|------------------------|-------|--------|----------|-------|--------|------|-------|------------------|-----------------|------|--|
| | Erosio | n and Re | cession | | | | | _ | | | | 6 | - | | | | | | BM | Manage beach sands |
| Woonona Beach | | Risk Leve | e | | | | | Er | osion | / Rec | essioi | n Risk | Ireat | tments | 5 | | | | PR1 | Accept loss as sacrificial |
| (beach extends to creek at centre of | Erosion | Erosion | Frosion | | | | | | I | | | | | 1 | | | | "Do Nothing" | PR2 | Relocate out of hazard zone |
| beach) | L103011 | L1031011 | L1031011 | | | Protec | ct | | | Plan | ned R | etreat | | Acc | comm | odate | No Regret | S (Accort Bick) | PR3 | Prohibit development expansion |
| | by 2010 | by 2050 | by 2100 | | | | | | | | | | | | | | | | PR4 | Voluntary Acquisition |
| Parks, Beaches and open space | | | | N | S1 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCF | 7 A2 | A: | 3 Investigate | * DN | FRO | Apply development controls (future |
| Woonona Beach | High | Extreme | Extreme | | | | \checkmark | ✓ | $\checkmark\checkmark$ | | | | | X | | | NR14 | | DCP | dev't and re-dev't) |
| Collins Point Reserve, Woonona Beach Reserve, Beach Drive Park | Medium | Medium | High | | | | | | ~~ | | | | | | | | | | A2 | Redesign / retrofit in current location |
| Creek at Lighthorse Drive and adjacent | | | | | | | | | | | | | | | | | | | A3 | Replace with relocatable structure |
| habitat | Medium | Medium | High | | | | | | \checkmark | | | | | | | | NR11 | | FDCP | Apply existing flood development |
| Coastal Dune Systems | High | Extreme | Extreme | | | | ✓ | | $\checkmark\checkmark$ | | | \frown | | | | | | | | controls (future devt and re-devt) |
| Community Infrastructure | | | | | | | | | | | | | | | | | | | NR1 | Update Asset Register for Hazards |
| Woonona Surf Club | Low | Medium | High | | | | | | | 11 | | | | ✓ | | | NR3 | | | Assess Public Buildings for |
| | Low | Low | Medium | - | | | | | | 1 | | | | | | | - NIXO | | NR3 | "accommodate" or "relocate" |
| Woonona Ocean Bool (Collins Bt) | Modium | High | Extromo | | | | | | | | | | | | 1 | | | 1 | NR4 | Audit Ocean Pool condition |
| Cucleway (Shared Bathway | Medium | Modium | Lich | - | | ./ | | | | | | | | | • | - | | 4 | NR5 | Assess Roads for "accommodate" |
| | Medium | Medium | Fign | | - | • | ~ | | | • • | | | | • | | _ | | + | | Assess Cycleways for |
| | | | | | - | | | | | | | | | | | _ | | | NR6 | "accommodate" or "relocate" |
| Beach access and car parks | Low | Low | Medium | _ | _ | | ` | | | | | | | | | _ | | ~ | | Design criteria for Stormwater |
| Local Roads (Kurraba Rd) | Medium | Medium | High | | | | | | | ~ | | | | ~ | ~ | | NR5, NR8 NR14 | 2 | | Assets Design criteria for Waste water, |
| Local Roads (Beach Drive, Liamina Ave, | Modium | Modium | Lliab | | | | | | | | | | | | | | NR5, NR8 | , | NIXO | water supply and electricity assets |
| Robertson Rd, Dorrigo Ave) | weatum | weatum | Fign | | | ľ, | | | | v | | | | v | | | NR14 | | NR9 | Develop evacuation plans |
| Water and sewage infrastructure | | | | | | | | | | | | | | | | | | | NR10 | ocean water levels |
| Stormwater outlets and pipes (N end at Kurraba Rd) | High | Extreme | Extreme | 5 | | | | | | ~ | | | | ~ | ~ | | NR7, NR1 | 4 | NR11 | Audit EECs and habitats for priority conservation |
| Stormwater outlets and pipes (connecting line from Kurraba Rd to Beach Drive along | High | Extreme | Extreme | 5 | | | | | | ~ | | | | ~ | | | NR7, NR1 | 4 | NR12 | Use Norfolk Island Pines in new plantings |
| beachfront) | Ŭ | | | | | | | | | | | | | | | | | | NR13 | Manage Aboriginal Heritage Items |
| Stormwater outlets and pipes (along seaward edge of Beach Drive) | High | Extreme | Extreme | | | ~ | | | | ~ | | | | ~ | | | NR7, NR1 | 4 | DN | "Do Nothing" (Accept Risk) |
| Residential Development | | | | | | | | | | | | | | | | | | | ~~ | Substantial risk reduction and / o |
| Existing Residences (19 at centre of beach) | Medium | Medium | High | | | ~ | | | ~ | | | ? | ? | ~ | | | NR8, NR1 | 4 | ~ | Good risk reduction and / or |
| | | | | • | | | • | | • | | | | | | | | • | I | ? | Technical feasibility of applying the option is questionable |
| | | | | | | | | | | | | | | | | | | | • | "Do Nothing" option is likely to have detrimental effect OR result in |



increased risk over time

Sym-

bol

N Nourishment

S1 Seawall - long or majority of beach

S2 Seawall - short sections



Woonona Beach - Seawall S2 Option

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.





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Woonona Beach - Planned Retreat Option

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155

| 6.11.2 Coastal Inundation Risk Leve | and Tr | eatment | Options | | | | | | | Sym- bol | |
|--|------------|-------------|--------------|--------------------|------------|-----------------------|--------------|---------------|--------------|--------------|---|
| | | | | | | | | | | N | Nourishment |
| | | | | | | | | | | S1 | Seawall - long or majority of beach |
| | Inun | dation Risk | level | Ini | Indation | n Risk Tr | eatme | nts | | S2 | Seawall - short sections |
| | | | 2010. | | anadadoi | | oaano | | | BM | Manage beach sands |
| Woonona Beach | | | | O se referencia se | | | | | "D - | PR1 | Accept loss as sacrificial |
| (beach extends to creek at centre of beach) | | | | Overtopping | atad | | | | "Do | PR2 | Relocate out of hazard zone |
| | Inundation | Inundation | Inundation | risk treated | nn. tre | Acco | mm- | No Regrets | Nothing" | PR3 | Prohibit development expansion |
| | by 2010 | by 2050 | by 2100 | by erosion | Re | oda | ite | i to riogroto | (Accept | PR4 | Voluntary Acquisition |
| | | | | option | ш. | | | | Risk) | PRO | Apply development controls (future |
| Parks, Beaches and open space | | | | | PR2 | FDCP | A2 | Investigate* | DN | DCP | devit and re-devit) |
| Woonona Beach | Low | Low | Medium | | | | | | \checkmark | A2 | location |
| Collins Point Reserve, Woonona Beach Reserve, | 1 | Laur | N An allower | | | | | | | A3 | Replace with relocatable structure |
| Beach Drive Park | LOW | LOW | weatum | | | | | | v | FDCP | Apply existing flood development |
| | | _ | | | | | | NR10. | | NR1 | Controls (future devt and re-devt) |
| Creek at Lighthorse Drive and adjacent habitat | Low | Low | Medium | | | | | NR14 | \checkmark | NR2 | Audit existing seawalls |
| Coastal Duno Systems | Low | Low | Modium | | | | | | 1 | NR3 | Assess Public Buildings for |
| | LOW | LOW | weulum | | | | | | • | NP/ | "accommodate" or "relocate" |
| Community Infrastructure | | | | \mathbf{O} | | | | | | | Addit Ocean Foor Condition |
| Woonona Surf Club | Medium | High | Extreme | ~ | | \checkmark | | | | NR5 | or "relocate" |
| Lifeguard Tower | Low | Low | Medium | | | ✓ | | | \checkmark | NR6 | Assess Cycleways for "accommodate" or "relocate" |
| Woonona Ocean Pool (Collins Pt) | Low | Low | Medium | ✓ | | | | | | NR7 | Design criteria for Stormwater |
| Cycleway / Shared Pathway | Low | Medium | Medium | ✓ | | ✓ | | | ✓ | | Assets Design criteria for Waste water, |
| Transport Infrastructure | | | | | | | | | | INR8 | water supply and electricity assets |
| Local Roads (Kurraba Rd) | Low | Medium | Medium | ✓ | | | | | | NR9 | Develop evacuation plans Conduct Flood Study including |
| Local Roads (Beach Drive, Robertson Rd, Dorrigo | (| | | | | | | | | NR10 | ocean water levels |
| Ave. Lighthorse Drive. Lassifer Ave. Pendlebury | Medium | High | Extreme | \checkmark | | ✓ | | NR10, | \checkmark | NR11 | Audit EECs and habitats for priority |
| | | • · ··g·· | Lina offici | | | | | NR14 | | | Conservation |
| Water and sewage infrastructure | XO | | | | | | | | | NR12 | plantings |
| Stormwater outlets and pipes | High | Extreme | Extreme | ✓ | | ✓ | ✓ | NR7. NR14 | | NR13 NR14 | Monitor erosion & inundation events |
| Residential Development | • • | | | | | | | , | | DN | "Do Nothing" (Accept Risk) |
| Existing Residences (19 at centre of beach) | Low | Medium | Medium | ✓ | | ✓ | | | | ~~ | Substantial risk reduction and / or |
| Existing Residences (80 along creek & stormwater | | | - | | | | , | | | | nignly effective in managing risk |
| alignments, centre of beach) | Medium | High | Extreme | | | ✓ | \checkmark | NR10, NR9 | | ~ | effective in managing risk |
| | | | | l | 1 | 1 1 | | 1 | | ? | Technical feasibility of applying the |
| | | | | | | | | | | | "Do Nothing" option is likely to have |
| | | | | | | | | | | • | detrimental effect OR result in |



increased risk over time



157

6.11.3 Assessment of Treatment Options

ten? Attachment?

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158

| Woo | onona | | | | | | | | | | | | | |
|-------------|--|---|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|-------------------------------|-------------------------------------|-------------------------|-----------------------|--|---------------|
| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability*** | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Sbecitic Cost Benefit Cousiderations to conclusion Potential Funding Sources (Who may pay) | (provisional) |
| S2 | Construct seawall (revetment) along specified alignment to protect specific asset(s) | Current Action: Detailed design and approvals Trigger: When ZRFC measured from erosion escarpment encroaches onto Beach Drive | ~ | ~ | × | | | | | | | | A section of seawall is essentially proposed to protect the 18 residences along Beach Drive. If this is to be conducted, the roadway, underlying stormwater assets and potentially water supply and waste water assets are also needed to service the properties, and so must be protected by the seawall also, with the seawall installed on public land. Where seawalls shall protect private property, Council and State Government can require sections of wall protecting private property (and ongoing maintenance) to be funded by the private property (and ongoing maintenance) to be funded by the private property owners. Given the natural beach shall be retained either side, the seawall could be constructed without large scale nourishment (except to manage offsite impacts). The erosion and recession risk is current, requiring a decision regarding S2 to be made presently. Based upon \$5,000 - \$10,000 per m length of wall, the proposed section of wall at Woonona Beach is estimated to cost \$3 - \$6 million, not including the costs of ongoing management of offsite impacts (e.g.small scale nourishment) and future upgrading. <i>Refer to Protect Options Table for further cost benefit details for</i> \$2 | Marginal |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | × | × | | 5 | | n | | V | X | Pune care programs must be considerate of sightline requirements for SLSC activities, and beach amenity issues relating to prolific vegetation growth. Implementation of a dune care strategy enables Council to also manage prolific growth of plant species, and would not involve adding more vegetation to already well vegetated beaches but instead, ensuring weeds and vermin are not an issue on such beaches. Issues relating to growth of <u>Acacia sophorae</u> spinifex across incipient dunes are reported at Woonona, which limits beach usage at high tide. This is a short term (<u>5 - 10 year</u>) issue, as this area of the beach is the first to be impacted during storms. While there are community issues associated with this and height of dunes, the dunes are required as relatively cheap means of retaining beach sand to buffer from storm erosion. Over the long term, the incipient dunes and <u>Acacia sophorae</u> will become less common as the beach is <u>impacted by storms and the dune</u> is eroded periodically. Refer to Protect Options Table for further cost benefit details for DV. | Recommended |
| BM | Beach Sand Management (beach scraping or nature assisted beach management) | Now and continuing | ~ | ~ | × | | | | | | | | This option involves scraping and contouring beach sands to accumulate in dunes along the beach. This aims to increase sand volumes held in dune storage for storm protection. ? State Government (Grant Programs) Wolumes held in dune storage for storm protection. @ Council (Current Programs) Refer to Protect Options Table for further cost benefit details for BM. N/A Private landholders who directly benefit from option | Recommendea |



159

| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | - Ford Amount Diel- | Legal / Approval Risk | Specific Cost Benefit Considerations for BM Beach | Potential Funding Sources (Who may pay) | Conclusion |
|-------------|--|---|----------------|---------------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|---------------------|-----------------------|---|--|-------------|
| PR1 | Accept loss of land following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | × | | | | | | | | | This is an excellent option for retaining the beach by allowing natural retreat of dunes and reserve lands enabling continued provision of a beach over the long term. <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR1.</i> | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| PR1 | Accept loss of Pool following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | × | | | | | | | | , | Woonona Pool is said to have higher walls and so is likely to withstand sea level rise impacts for longer. It is unlikely that the Pool will be managed to fail at this time, however this will depend upon assessment of its condition through NR4. Refer to Planned Retreat Options Table for further cost benefit details for PR1. | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Marginal |
| PR2 | Relocate structures outside of hazard zone: Surf club (and minor carparks) | Current Action: NR3 Trigger: At scheduled time for asset maintenance OR when ZRFC measured from erosion escarpment encroaches onto building foundations or cabins, whichever is sooner | ~ | ~ | × | | | | | | X) | 3 | 0 | Relocation of the surf club would provide a new club facility for community and the SLSC. There is likely to be sufficient space nearby to relocate these structures, however this shall be based on NR3. If timed with scheduled major asset refurbishment, this may reduce costs as they are combined with expected major maintenance costs. Refer to Planned Retreat Options Table for further cost benefit details for PR2. | ? State Government (Grant Programs) ☑ Council (new levies or increased rates) N/A Private landholders who directly benefit from option | Recommended |
| PR2 | Relocate stormwater assets landward of hazard zone | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe OR the pipe requires replacement, whichever is sooner. | ~ | ~ ~ | × | S | | 2 | 1 | X | | | | For stormwater assets, the outcomes of NR7 shall determine where assets may be progressively relocated landward as impacts occur. This is most likely possible for the assets perpendicular to the beach, providing inundation aspects are also managed. There is a significant extent of stormwater assets running parallel to the beach. This may make it a very costly exercise to relocate these assets, however this may be less than the cost of a seawall. Further, regardless of implementing S2, the assets must be redesign to accommodate inundation with sea level rise. This would need to be included in analysis of the benefit of a seawall (S2) or redesign of these assets to withstand impacts (see A2 and NR7). <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR2</i> . | ? State Government (Grant Programs) ☑ Council (new levies or increased rates) N/A Private landholders who directly benefit from option | Recommended |
| PR2 | Relocate Beach Drive, Kurraba Rd and cycleway landward of hazard zone | Current Action: NR5, NR6 Trigger: When ZRFC measured from erosion escarpment encroaches onto the cycleway and roadway. | ~ | ~ | × | | | | | | | | | This option shall relocate Beach Drive, the cycleway and Kurraba Rd further landward when erosion impacts become imminent. At Kurraba Rd. This option is an alternative to S2 for the cycleway and Beach Drive. For Kurraba Road and Beach Drive, access to residential properties must be retained. The ability to redirect traffic on these roads will depend upon NR5. Relocating the cycleway is likely to be suitable and affordable, and could be conducted in sections as impacts manifest. Refer to Planned Retreat Options Table for further cost benefit details for PR2. | ? State Government (Grant Programs) ☑ Council (new levies or increased rates) N/A Private landholders who directly benefit from option | Recommended |

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160

| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community | Acceptability Reversible / Adaptable | in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for PR2 Beach | Potential Funding Sources (Who may pay) | Conclusion |
|-------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|-----------|---|-----------|-------------------------|-----------------------|---|---|-------------|
| PR4 | Voluntary acquisition | Current Action: Apply for government funding. Trigger: Offer once funding becomes available. | ~ | ~ | ~ | | | | | | | | | This option is not financially possible for multiple properties without substantial government assistance, which is not currently available. Given that impacts are not expected until 2050, it may be possible to flag this option now, with an assumption that government funding may change in the future. DCP controls until that time would limit intensification of risk until that time. Current funding mechanisms from State Government and Council are not sufficient to acquire multiple properties. Refer to Planned Retreat Options Table for further cost benefit details for PR4. | ? State Government (Grant Programs) ☑ Council (new levies or increased rates) ☑ Private landholders who directly benefit from option | Marginal |
| PR5 | Buy back – lease back | Current Action: Apply for mortgage now Trigger: Offer acquisition once funding becomes available. Demolish property when erosion impacts destabilise building foundations. | ~ | ✓ | V | | C | | | , | X) | S. | | This option involves Council applying for funding through typical mongage arrangements to acquire 18 properties at the centre of the beach. The repurchase the property is offered voluntarily at market rates, but the rate is progressively discounted in accordance with the length of time remaining before the property becomes uninhabitable due to erosion. This is because this option is dependent upon Council leasing the property at market rates to assist mortgage repayments until the time the building is uninhabitable. At that time the property is demolished and land returned to community for natural beach retreat. The option provides fair compensation to landowners and ensures natural retreat to retain beach use values. This option is a yet untested. Refer to Planned Retreat Options Table for further cost benefit details for PR5. | ? State Government (Grant Programs) ☑ Council (new levies or increased rates) ☑ Private landholders who directly benefit from option | Marginal |
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | | × | × | Ś | | | | | | | | This option applies controls to redevelopment of existing 18 properties and public assets currently in areas at risk. Controls are applied such that less stringent controls apply to land at lower risk and / or land uses considered to have a shorter timeframe (design life), and vice versa. The DCP may require assessment of foundation capacity (bedrock), alternative locations, distance to erosion escparments, etc as relevant to the level of risk, to determine design controls for assets to remain in their current location (e.g. A2, A3) or require relocation of developments landward of hazard zones (e.g. PR2). Wave overtopping is also managed by the Coastal DCP, as existing Flood DCP controls may not be applicable to the overtopping risk. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for DCP</i> . | ? State Government (Grant programs) ☑ Council (Current Programs) - cost to prepare DCP and implement at public assets ☑ Private landholders - cost to implement DCP | Recommended |



161

| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation | Uption Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Potential Funding Specific Cost Benefit Considerations for DCP Beach Sources (Who may Pay) | Conclusion |
|-------------|--|--|----------------|--------------------|----------------------|------------------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|--|-----------------|
| A2 | Redesign Kurraba Rd in current location to withstand impacts. | Current Action: NR5 Trigger: When ZRFC measured from erosion escarpment encroaches onto the roadway. | ~ | ~ | x | | | | | | | | Based on the outcomes of NR5, if access to residential properties cannot be maintained on Kurraba Rd, methods to accommodate impacts at the current roadway may need to be investigated. ? State Government (Grant Programs) Refer to Accommodate Options Table for further cost benefit details for A2. ? Ouncil (Current programs, new levies or increased rates?) | Marginal |
| A2 | Redesign or retrofit stormwater structures in current location to withstand impacts. | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe <u>OR</u> when asset replacement is required, whichever is sooner; | ~ | ~ | ~ | | | | | | | | Ensuring function of stormwater assets with inundation due to sea level rise will be required regardless of whether S2 is or is not implemented. Particularly for stormwater assets surrouding Lighthorse Drive Creek, these services cannot be relocated and will require redesign at the current location to withstand inundation impacts. This shall need to be confirmed based on outcomes of NR7.? State Government (Grant Programs) © Council (Current programs, new levies or increased rates?)NR7.NR7.Refer to Accommodate Options Table for further cost benefit details for A2.With a state in the current in the | Recommended |
| A2 | Retrofit Woonona Pool in current location to withstand impacts. | Current Action: NR4 Trigger: When damage to pool shell occurs <u>OR</u> the pool is being inundated at water levels lower than MSL. | ~ | ~ | × | | | | | V×. | S. | 0 | The decision to progressively retrofit Woonona Pool over time to withstand wave impacts and remain a viable pool with sea level rise shall depend upon the suitability of pool condition for this purpose, based upon NR4. It is likely Woonona Pool is more suitable to being maintained as the pool walls are already higher, buffering from sea level rise. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for A2.</i> | Recommended |
| FDCP | Update DCP Chapter E13 – Floodplain Management to include areas affected by Coastal Inundation as Low Risk Flood Precincts, and implement DCP to manage inundation impacts as properties are redeveloped and assets replaced. | As property / assets redeveloped, new developments built | × | × | ~ | | 7 | 2 | | | | | This option involves applying the existing Flood DCP chapter to all properties identified at risk from coastal inundation that are outside of an existing flood planning area applied at the "low flood risk". A Flood Study should be completed for the Creek at Lighthorse Driveas a priority, as many houses may be affected (refer NR10). Refer to Accommodate Options Table for further cost benefit details for FDCP. | Recommended |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | . N/# | A N// | 4 | | | | | | | The "do nothing" scenario is not acceptable at this location as there are a large number of assets at risk currently. Failure to take action will either result in irreversible or very costly erosion impacts. Where development is intensified in the high risk zones this increases the cost to manage risks in the future also. <i>Refer to "Do Nothing" Option Table for further cost benefit details.</i> ? State Government ? Council (new levies and increased rates) ? Private landholders in Future Generations | Not Recommended |
| NR | NR1, NR3, NR4, NR5, NR6, NR7, NR8, NR9, NR10, NR13, NR14 | Now | ~ | ~ | ~ | | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. ? State Government (Grant Programs) Image: Council (Current Programs) Image: Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |

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6.12 Bellambi Beach, Boat Harbour, Bellambi Point Beach

6.12.1 Erosion and Recession Risk Level and Treatment Options – Bellambi Beach & Bellambi Boat Harbour

| | | | | | | | | | | | | | | | | | | | | 0 |
|---|---------|-----------|-------------|----------|----|---------------------|------------------------|----------|------------------------|-----------------------------|--------|--------|-------|-------|--------------|-------|--------------|---------------|--------|---|
| | | | | | | | | | | | | | | | | | | | PR1 | Accept loss as sacrificial |
| | Erosio | n and Red | cession | | | | | - | | | | 6 | - | | | | | | PR2 | Relocate out of hazard zone |
| Bellambi Beach | | Risk Leve | | | | | | Er | osion | / Rec | essior | n Risk | Ireat | ments | | | | | PR3 | Prohibit development expansion |
| (Bollambi Bt in port table) | Eropion | Eropion | Eropion | | | | | | 1 | | | | | r – | A | | | "Do Nothing" | PR4 | Voluntary Acquisition |
| | ETOSION | ETOSION | ETOSION | | | Protec | ct | | | Planr | ned R | etreat | | Acc | ommo | odate | No Regrets | Do Nothing | PR5 | Buy back then lease back |
| | by 2010 | by 2050 | by 2100 | | | | | | | | | | | | | | | (Accept Risk) | DCP | Apply development controls (future |
| Parks, Beaches and open space | | | | N | S1 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCP | A2 | A3 | Investigate* | DN | - | devt and re-devt) |
| Bellambi Beach | High | Extreme | Extreme | | | | $\checkmark\checkmark$ | | $\checkmark\checkmark$ | | | | | | | | NR14 | | A2 | location |
| Beach Drive Park, Bellambi Natural Area, | | | | | | | | | | | | | | | | | | | A3 | Replace with relocatable structure |
| Bellambi Point Reserve, Bellambi Pool | Medium | Medium | High | | | | | | $\checkmark\checkmark$ | | | | | | | | | | FDCP | Apply existing flood development |
| Reserve | | | | | | | | | | | | A | | | | | | | 1 DOI | controls (future dev't and re-dev't) |
| Coastal Dune Systems | High | Extreme | Extreme | | | | $\checkmark\checkmark$ | | $\checkmark\checkmark$ | | | | • | | | | NR11 | | NR1 | Update Asset Register for Hazards |
| Bellambi Gully and adjacent habitat | Medium | High | Extreme | | | | | | ✓ | | | | | | | | NR11 | | INRZ | Audit existing seawais |
| Bellambi Gully training walls | Low | Medium | High | | | | | | | C | | | | ✓ | ✓ | | NR2 | | NR3 | "accommodate" or "relocate" |
| Community Infrastructure | | | | | | | | | | | | | | | | | | | NR4 | Audit Ocean Pool condition |
| Cycleway / Shared Pathway (N of Bellambi | Low | Medium | Medium | | | | | | K (| $\mathcal{I}_{\mathcal{I}}$ | | | | ~ | | | | | NR5 | Assess Roads for "accommodate" or "relocate" |
| Gully entrance) | | | | | | | | | | | | | | | | | | | NR6 | Assess Cycleways for |
| Cycleway / Shared Pathway (S of Beliambi | Medium | Medium | High | | | ✓ | | | | | | | | ✓ | | | INKZ, INKO, | | 1110 | "accommodate" or "relocate" |
| Guily entrance) | | | - | | | | | K | | | | | | | | | NR14 | | NR7 | Design criteria for Stormwater |
| Bellambi Pool | High | Extreme | Extreme | | | | | | \checkmark | | | | | | \checkmark | | NR2, NR4, | | | Design criteria for Waste water |
| Delle sel: De el Telle (Die els | 1 | Marilian | Mar Private | | | | | | | | | | | | | | NR14 | | NR8 | water supply and electricity assets |
| Beliambi Pool Tollet Block | LOW | Iviedium | Iviedium | | | V | | | | ~ | | | - | ~ | | | NR2 | ~ | NR9 | Develop evacuation plans |
| Transport Infrastructure | | | | | | | | | | | | | | | | | | | NR10 | Conduct Flood Study including |
| Bellambi Pool car park | Low | Medium | Medium | | | ▼√ | | | ✓ | | | | | √ | | | NR2 | ~ | | ocean water levels |
| Bellambi Boat Harbour | High | Extreme | Extreme | | | | | | | | | | | | ✓ | | NR2, NR14 | | NR11 | conservation |
| Local access road along coastline to | Medium | High | Extromo | | | | | | | 1 | | | | 1 | | | | | | Use Norfolk Island Pines in new |
| harbour (does not service houses) | Medium | riigii | LAUGINE |) | | | | | | • | | | | Ľ | | | | | INR 12 | plantings |
| Water and sewage infrastructure | | | | | | | | | | | | | | | | | | | NR13 | Manage Aboriginal Heritage Items |
| Stormwater outlets and pipes (adjacent to | L PL | Estavas | - | | | | | | | | | | | | | | NR2, NR7, | | NR14 | Monitor erosion & inundation events |
| Bellambi Pool carpark) | High | Extreme | Extreme | | | | | | | v | | | | Ŷ | | | NR14 | | DN | "Do Nothing" (Accept Risk) |
| Sewage Treatment Plant | High | Extreme | Extreme | | | | | | | ✓ | | | | ✓ | | | NR2, NR8 | | | Substantial risk reduction and / or |
| | | | | | | | | | | | | | | | | | | | •• | highly effective in managing risk |
| | | | | | | | | | | | | | | | | | | | ~ | Good risk reduction and / or |
| | | | | | | | | | | | | | | | | | | | | effective in managing risk |
| | | | | | | | | | | | | | | | | | | | ? | rechnical teasibility of applying the |
| | | | | | | | | | | | | | | | | | | | | "Do Nothing" option is likely to have |
| | | | | | | | | | | | | | | | | | | | 1 | I DO NOUTING OPTION IS INCLY TO HAVE |



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Sym-

bol N

S1

S2

DV

ΒM

Nourishment

Seawall - long or majority of beach

Revitalise Dune Care Programs

detrimental effect OR result in

increased risk over time

Seawall - short sections

Manage beach sands

| 6.12.1 Erosion and Rece | ssion | Risk I | Level | and | l Tre | eatr | mer | nt O | ptic | ons | – B | ella | amb | i Po | oint | Bea | ach | | Sym- | |
|---|---------|-----------|-----------|-----|-------|--------|------------------------|------|------------------------|------------------------|--------|----------|------------|--------------|------|-------|--------------------------|---------------|-------|--|
| | | | | | | | | | | | | | | | | | | | N | Nourishment |
| | Erosio | n and Red | cession | | | | | - | | / D | | <u> </u> | - . | | | | | | S1 | Seawall - long or majority of beach |
| Bellambi Point Beach | | Risk Leve | el | | | | | Er | osion | / Rec | essior | n Risk | Ireatr | ments | | | | | S2 | Seawall - short sections |
| (Bellambi Point to Bellambi Lagoon) | Frosion | Frosion | Frosion | | | | | | | | | | | | | | | "Do Nothina" | DV | Revitalise Dune Care Programs |
| (Benambi Font to Benambi Eugeon) | by 2010 | by 2050 | by 2100 | | I | Protec | ct | | | Plan | ned R | etreat | | Acc | ommo | odate | No Regrets | (Accept Risk) | BM | Manage beach sands |
| | by 2010 | by 2030 | by 2100 | | | 00 | | | | | | | 005 | D O D | 4.0 | | | | PR1 | Accept loss as sacrificial |
| Parks, Beaches and open space | | | | N | 51 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCP | A2 | A3 | Investigate [*] | DN | PR2 | Relocate out of hazard zone |
| Bellambi Point Beach | High | Extreme | Extreme | | | | $\checkmark\checkmark$ | | $\checkmark\checkmark$ | | | | | | | | NR14 | | PR3 | Prohibit development expansion |
| Coastal Dune Systems | High | Extreme | Extreme | | | | $\checkmark\checkmark$ | | $\checkmark\checkmark$ | | | | | | | | | | PR4 | Voluntary Acquisition |
| Heritage Site: Bellambi Lagoon and associated habitat | High | Extreme | Extreme | | | | | | ~~ | | | | | × | ļ | | NR11 | | DCP | Buy back then lease back Apply development controls (future |
| | | | | | | | | | | | | | | | | | 1 | | | devt and re-devt) |
| Leritage Sites: Bellembi (Sendnit) Deint | Llinda | Extrama | Extromo | | | - | 1.1 | | .1.1 | | | | | | | | NDO | | A2 | |
| Heritage Sites. Bellaribi (Sanopit) Point | nign | Exiteme | Extreme | | | · / | ~ ~ | | ~ ~ | | | (| | | | | INRZ | | A3 | Replace with relocatable structure |
| Water and sewage infrastructure | | | | | | | | | | | | | | | | | | | FROR | Apply existing flood development |
| Stormwater outlets and pipes (adjacent to | High | Extreme | Extreme | | | ✓ | | | | $\checkmark\checkmark$ | | | | ✓ | | | NR2, NR7, | | FDCP | controls (future dev't and re-dev't) |
| STP) | | | | | | | | | | | | | | | | | NR14 | | NR1 | Update Asset Register for Hazards |
| Sewage Treatment Plant | High | Extreme | Extreme | | | ✓ | | | | \checkmark | | • | | ~ | | | NR2, NR8, | | NR2 | Audit existing seawalls |
| conage froathold half | . "gri | Extronito | Livaronno | | | | | | | | | | | | | | NR14 | | NR3 | Assess Public Buildings for |
| | | | | | | | | | | | | | | | | | | | | Audit Occor Real condition |
| | | | | | | | | | | | | | | | | | | | INFX4 | Audit Ocean Fool condition Assess Roads for "accommodate" |
| | | | | | | | | | | | | | | | | | | | NR5 | or "relocate" |
| | | | | | | | | | | | | | | | | | | | NIDO | Assess Cycleways for |
| | | | | | | | | | • | | | | | | | | | | NRb | "accommodate" or "relocate" |
| | | | | | | | | X. | | | | | | | | | | | NR7 | Design criteria for Stormwater Assets |
| | | | | | | | | | | | | | | | | | | | NR8 | Design criteria for Waste water, |
| | | | | | | | | | | | | | | | | | | | INIXO | water supply and electricity assets |
| | | | | | | | | | | | | | | | | | | | NR9 | Develop evacuation plans |
| | | | | | | | | | | | | | | | | | | | NR10 | Conduct Flood Study including |
| | | | | | | | | | | | | | | | | | | | | Audit EECs and babitats for priority |
| | | | • | | ۱. | | | | | | | | | | | | | | NR11 | conservation |
| | | | 0 | | | | | | | | | | | | | | | | | Use Norfolk Island Pines in new |
| | | | XX | | | | | | | | | | | | | | | | NR12 | plantings |
| | | | | | | | | | | | | | | | | | | | NR13 | Manage Aboriginal Heritage Items |
| | | | | | | | | | | | | | | | | | | | NR14 | Monitor erosion & inundation events |
| | | | | | | | | | | | | | | | | | | | DN | "Do Nothing" (Accept Risk) |
| | | | | | | | | | | | | | | | | | | | ~~ | Substantial risk reduction and / or |
| | | | | | | | | | | | | | | | | | | | | Good risk reduction and / or |
| | | | | | | | | | | | | | | | | | | | ~ | effective in managing risk |
| | | | | | | | | | | | | | | | | | | | - | Technical feasibility of applying the |
| | | | | | | | | | | | | | | | | | | | ? | option is questionable |
| | | | | | | | | | | | | | | | | | | | | "Do Nothing" option is likely to have |
| | | | | | | | | | | | | | | | | | | | • | detrimental effect OR result in |
| | | | | | | | | | | | | | | | | | | | 1 | increased rick over time |

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6.12.2 Coastal Inundation Risk Level and Treatment Options - Bellambi Beach & Bellambi Boat Harbour

| | | | | | | | | | | S2 | 2 3 | Seawall - short sections |
|--|------------|-------------|---------------|----------------|--------------|--------------|------------------------|--------------|--------------|-----|-----------------|---------------------------------------|
| | | | | | | | | | | D\ | / F | Revitalise Dune Care Programs |
| | Inun | dation Risk | Level | In | undatio | n Risk T | reatme | nts | | BN | N N | Vanage beach sands |
| | | | | | | | | | | PR | 1 | Accept loss as sacrificial |
| Bellambi Beach | | | | O ventere in e | | | | | "De | PR | 2 F | Relocate out of hazard zone |
| (Bellambi Pt in next table) | | | | Overtopping | atg | | | | Do | PR | 3 F | Prohibit development expansion |
| | Inundation | Inundation | Inundation | risk treated | tre | Acco | omm- | No Regrets | Nothing" | PR | 4 ۱ | Interview Acquisition |
| | by 2010 | by 2050 | by 2100 | by erosion | laı Ref | od | ate | No Regrets | (Accept | PR | 15 E | 3uy back then lease back |
| | - | _ | - | option | <u> </u> | | K \ | | Risk) | DC | P / | Apply development controls (future |
| Barks, Boachos and open space | | | | | DP2 | EDCP | 12 | Investigate* | | i | | Jevt and re-devt) |
| Palambi Basah | Low | Low | Madium | | 1112 | T DOI | 72 | Investigate | | A2 | 2 | ocation |
| | LOW | LOW | weatum | | | | | | • | A3 | 3 F | Replace with relocatable structure |
| Beach Drive Park, Bellambi natural Area, Bellambi | Low | Low | Medium | | | | | | 1 | FDC | ~ P | Apply existing flood development |
| Point Reserve, Bellambi Pool Reserve | LOW | LOW | Medium | | | | | | • | FDC | ٦P (| controls (future dev't and re-dev't) |
| | | | _ | | | | | NR10. | | NR | 1 I | Jpdate Asset Register for Hazards |
| Bellambi Gully and adjacent habitat | Medium | High | Extreme | | | | | NR14 | \checkmark | NR | 2 / | Audit existing seawalls |
| On antal Duran Quatana | 1 | 1 | N de alla una | | | | | 111114 | | NR | 3 | Assess Public Buildings for |
| Coastal Dune Systems | LOW | Low | Ivledium | | ľ | | | | ~ | | | accommodate" or "relocate" |
| Community Infrastructure | | | | | | | | | | INR | 4 / | Audit Ocean Pool condition |
| Bellambi SLSC | Medium | High | Extreme | | | ✓ | $\checkmark\checkmark$ | NR14 | | NR | ¹⁵ (| or "relocate" |
| Cycleway / Shared Pathway (N of Bellambi Gully | | | | | | | | | | NP | 4 | Assess Cycleways for |
| entrance) | Medium | Medium | High | \checkmark | | | | | | | .0 " | accommodate" or "relocate" |
| Civelence/ | | | | | | | | | | NR | 7 | Jesign criteria for Stormwater |
| Cycleway / Shared Pathway (S of Bellambi Gully | Medium | Medium | High | ✓ | | | | | | | - / | Assets |
| entrance) | | | | | | | | | | NR | 8 | vater supply and electricity assets |
| Bellambi Pool | Medium | Medium | High | \checkmark | | | | | | NR | 9 [| Develop evacuation plans |
| Bellambi Pool Toilet Block | Low | Low | Medium | | | | | | ✓ | NR1 | 10 | Conduct Flood Study including |
| Transport Infrastructure | | | | | | | | | | | | Audit EECs and habitats for priority |
| Bellambi SLSC car park | Low | Medium | Medium | | | ✓ | $\checkmark\checkmark$ | | | NR1 | 11 ₍ | conservation |
| Bellambi Pool car park | Low | Low | Medium | ✓ | | | | | ✓ | NR1 | 12 | Jse Norfolk Island Pines in new |
| Bellambi Boat Harbour | Medium | Medium | Hiah | ✓ | | | | | | NR1 | 13 I | Manage Aboriginal Heritage Items |
| Local access road along coastline to harbour (does | | | Ŭ | | | | | | | NR1 | 14 I | Monitor erosion & inundation events |
| not service houses) | Medium | Medium | High | ✓ | | | | | | DN | N " | Do Nothing" (Accept Risk) |
| Water and sewage infrastructure | | | | | | | | | | × • | | Substantial risk reduction and / or |
| Stormwater outlets and pipes under Bellambi SI SC | | | | | | | | | | | r | iighly effective in managing risk |
| corpork | High | Extreme | Extreme | | \checkmark | \checkmark | $\checkmark\checkmark$ | NR7, NR14 | | ✓ | . (| 500d FISK reduction and / or |
| | | | | | | | | | | . – | - | Technical feasibility of applying the |
| Stormwater outlets and pipes (adjacent to Bellambi | High | Extreme | Extreme | ✓ | | | | NR14 | | ? | c | option is questionable |
| Pool carpark) | , "gri | | | | | | | | | | " | "Do Nothing" option is likely to have |
| Sewage Treatment Plant | High | Extreme | Extreme | ✓ | | | | NR8 | | • | c | Jetrimental effect OR result in |
| | | | | | I | 1 | | | 1 | 1 | i | ncreased risk over time |

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bol

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S1

Nourishment

Seawall - long or majority of beach

| 6.12.3 Coastal Inundation Risk Lev | vel and T | reatmer | nt Option | s – Bellar | nbi P | oint B | each | | | Sym- | |
|--|------------|--------------|------------|--------------|----------------|------------------------|------------------------|--------------|--------------|-----------|--|
| | | | | | | | | | | N | Nourishment |
| | | | | | | | | | | S1 | Seawall - long or majority of beach |
| | line i un | dation Diale | امرما | | un el esti e u | | | in fa | | S2 | Seawall - short sections |
| | Inun | dation RISK | Levei | In | undation | I RISK II | eatme | nts | | DV | Revitalise Dune Care Programs |
| Bellambi Point Beach | | | | | | | | | | BM DD1 | Manage beach sands |
| | | | | Overtopping | 4 t | | | | "Do | PR2 | Relocate out of bazard zone |
| (Bellambi Point to Bellambi Lagoon) | Inundation | Inundation | Inundation | risk treated | ea | Acco | mm- | | Nothina" | PR3 | Prohibit development expansion |
| | by 2010 | by 2050 | by 2100 | by orosion | etr | oda | ato | No Regrets | (Accept | PR4 | Voluntary Acquisition |
| | by 2010 | by 2030 | by 2100 | | Ē | | aic | | | PR5 | Buy back then lease back |
| | | | | option | | | | | RISK) | DCP | Apply development controls (future |
| Parks, Beaches and open space | | | | | PR2 | FDCP | A2 | Investigate* | DN | | devt and re-devt) Redesign / retrofit in current |
| Bellambi Point Beach | Low | Low | Medium | | | | | | ✓ | A2 | location |
| Coastal Dune Systems | Low | Low | Medium | | | | | | ✓ | A3 | Replace with relocatable structure |
| Heritage Site: Bellambi Lagoon (Lake) and | | | - | | | | | NR10, | , | FDCP | controls (future dev/t and re-dev/t) |
| associated habitat | Medium | High | Extreme | | | | | NR14 | ~ | NR1 | Update Asset Register for Hazards |
| Bollambi Doint Posoryo Happy Valley Posoryo | | | | | | | | | | NR2 | Audit existing seawalls |
| Dellambi Lagaan Destaction Area | Low | Low | Medium | c | | | | | \checkmark | NR3 | Assess Public Buildings for |
| Beliamol Lagoon Recreation Area | | | | | | | | | | NR4 | Audit Ocean Pool condition |
| Community Infrastructure | | | | | | | | | | NP5 | Assess Roads for "accommodate" |
| Heritage Sites: Bellambi (Sandpit) Point | Medium | High | Extreme | ~ | | | | | \checkmark | NING | or "relocate" |
| Cycleway / Shared Pathway (W of Bellambi | NAL PLAN | NAL PLAN | | | | | | | | NR6 | "accommodate" or "relocate" |
| Lagoon, along Dobbie & Murray Ave) | Medium | Iviedium | High | | | ~~ | ✓ | NR14 | | NR7 | Design criteria for Stormwater |
| Transport Infrastructure | | | | | | | | | | | Assets Design criteria for Waste water, |
| Local roads (Dobbie Ave) | Medium | High | Extreme | | | $\checkmark\checkmark$ | | NR14 | ✓ | NR8 | water supply and electricity assets |
| Local car park at Lagoon entrance (off Murray | | | _ | | | | | | , | | Conduct Flood Study including |
| Rd) | Medium | High | Extreme | | | $\checkmark\checkmark$ | | NR14 | ~ | NR10 | ocean water levels |
| Water and sewage infrastructure | 5 | | | | | | | | | NR11 | Audit EECs and habitats for priority conservation |
| Stormwater outlets and pipes (adjacent to STP) | High | Extreme | Extreme | | | | | | | NR12 | Use Norfolk Island Pines in new |
| Stormwater outlets and pipes (dujacent to OTT) | 1 light | Extreme | Exitence | • | | | | | | NP13 | plantings Manage Aboriginal Heritage Items |
| | High | Extreme | Extreme | | | ✓ | $\checkmark\checkmark$ | NR7, NR14 | | NR14 | Monitor erosion & inundation events |
| Lagoon) | | | | | | | | , | | DN | "Do Nothing" (Accept Risk) |
| Sewage Treatment Plant | High | Extreme | Extreme | ✓ | | | | | | DIN | Substantial risk reduction and / or |
| Residential Development | | | | | | | | | | ~~ | highly effective in managing risk |
| Existing Residences (10 adjacent to Bellambi | | | | | | | , | | | ~ | Good risk reduction and / or |
| | Medium | Medium | High | | | | \checkmark | NR10 | | - | effective in managing risk |
| 2490011 | | | | I | | | | 1 | | ? | option is questionable |
| | | | | | | | | | | | "Do Nothing" option is likely to have |

keiy ng up detrimental effect OR result in ٠ increased risk over time

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6.12.4 Assessment of Treatment Options – Bellambi Beach & Bellambi Boat Harbour

| Bell | ambi | | | | | | | | | | | | | | | |
|-------------|---|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|------------------------|-------------------------|---|-----------------------|--|---|-------------|
| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable | Effectiveness over time | | Legal / Approval Risk | Specific Cost Benefit Considerations for Bellambi Beach | Potential Funding Sources (Who may pay) | Conclusion |
| S2 | Maintain existing seawall along existing alignment | On as needs basis for asset maintenance or to repair storm damage. | ~ | ~ | × | | | | | | | | | This option involves maintaining the existing seawall / training wall from Bellambi Gully entrance to Bellambi Pool. The ability of the wall to provide protection or be upgraded will depend upon outcomes of NR2. The wall is likely to already provide some protection to land and pool assets, and could be progressively upgraded on an as needs basis overtime to continue to protect from erosion and wave overtopping (e.g. deflection or other barriers, changes to slope and armour stones). Refer to Protect Options Table for further cost benefit details for \$2. | ? State Government (Grant Programs) ☑ Council (Current Programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Recommended |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ~ | x | | | | 7 | Yx. | | Ś | | Dune care programs must be considerate of sightline requirements for SLSC activities. The existing vegetation coverage should be maintained, particularly managing weed species (e.g. bitou). Refer to Protect Options Table for further cost benefit details for DV. | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | × | 6 | () | L | • | | | | | This is an excellent option at Bellambi Beach as there are extensive dunes and reserve lands to enable natural retreat of the beach, and hence continued provision of a beach over the long term. The outcomes of NR4 will determine the long term viability of Bellambi Pool. If pool condition is inadequate, the pool may have to be abandoned (progressively removed over time). <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR1</i> . | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| PR2 | Relocate roadway, car park and adjacent sewage treatment plant assets landward of hazard zone | Current Action: NR5, NR8 Trigger: When ZRFC measured from erosion escarpment encroaches roadway | ~ | ~ | × | | | | | | | | | The roadway would need to be relocated onto land currently within the Sewage Treatment Plant boundary. This would require agreement and purchase of the land from Sydney Water. The Pool carpark could be relocated in conjunction with relocating the roaway. There appears to be sufficient vacant land within the Plant to relocate activities within the site to allow retreat or relocation of the roadway. The extent of rocky shore at this location suggests recession may be constrained by bedrock. Further investigations could better define the potential extent of recession, and relocation (or other) option requirements <i>Refer to Planned Retreat Options Table for further cost benefit</i> details for PR2. | ? State Government (Grant Programs), Sydney Water (at site) ☑ Council (new levies or increased rates) N/A Private landholders who directly benefit from option | Marginal |

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173

| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for PR2 Beach | Potential Funding Sources (Who may pay) | Conclusion |
|-------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|--|--|-------------|
| PR2 | Relocate cycleway outside of hazard zone | Current Action: NR6 Trigger: When ZRFC measured from erosion escarpment encroaches cycleway | ~ | ~ | x | | | | | | | | There is a low to medium risk at present, thus there is no immediate need for action. There appears to be sufficient land to relocate all of the at risk cycleway sections in the future when erosion impacts manifest. The cycleway section between Bellambi Gully and the pool may be protected by the existing seawall (see S2) if this structure is maintained. <i>Refer to Planned Retreat Options Table for further cost benefit details for PR2</i> . | ? State Government (Grant Programs) ☑ Council (Current Programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Recommended |
| PR2 | Relocate stormwater assets landward of hazard zone | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe | ~ | ~ | x | | | | | | | | Should the existing seawall not be maintained, the stormwater outlet adjacent to Bellambi Pool will need to be progressively moved landward and pipe shortened as erosion impacts manifest. Refer to Planned Retreat Options Table for further cost benefit details for PR2. | ? State Government (Grant Programs) ☑ Council (Current Programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Marginal |
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | ~ | ~ | × | | | | 7 | Yx, | | した | This option applies proposed Coastal DCP controls to any redevelopments on the Sewage Treatment Works site. Refer to Accommodate Options Table for further cost benefit details for DCP. | ? State Government (Grant programs) ☑ Council (Current Programs) - cost to prepare DCP ☑ Sydney Water - cost to implement DCP | Recommended |
| A2 | Redesign roadway in current location to withstand impacts. | Current Action: NR3 Trigger: At scheduled time for asset maintenance OR when ZRFC measured from erosion escarpment encroaches onto building foundations, whichever is sooner | ~ | ~ | × | \$ | () | | | | | | The roadway could be raised as a method of accommodating the erosion and wave overtopping threat. As noted for PR2 above, there is potentially bedrock below the site that could form suitable foundations to accommodate risks at the roadway. Actions to accommodate risks along the roadway would likewise offer protection to the Sewage Treatment Plant land behind. <i>Refer to Accommodate Options Table for further cost benefit details for A2</i> . | ? State Government (Grant Programs), Sydney Water (at site, may be benefit from action?) ☑ Council (Current Programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Marginal |
| A2 | Upgrade Bellambi Boat Harbour in current location to withstand impacts. | Trigger: As asset maintenance to revetment and boat ramp is required over time, or following storm damage | ~ | ~ | × | | | | | | | | The boatramp and associated carpark and revetment could be raised and upgraded over time, to ensure the structure remains viable for boat use with sea level rise and to continue to withstand wave overtopping and impacts during storms. Actions to preserve the Harbour additionally offer protection to the Sewage Treatment Plant behind Refer to Accommodate Options Table for further cost benefit details for A2. | ? State Government (Grant Programs) ☑ Council (Current Programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Recommended |



174

| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Accentability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for A2 Beach Sources (Who may Pad) | Conclusion |
|-------------|--|--|----------------|--------------------|----------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|--|-------------|
| A2 | Retrofit Bellambi Pool in current location to withstand impacts. | Current Action: NR4 Trigger: When damage to pool shell occurs <u>OR</u> the pool is being inundated at water levels lower than MSL. | ~ | ~ | N/A | | | | | | | | The decision to progressively retrofit Bellambi Pool over time to withstand wave impacts and remain a viable pool with sea level rise shall depend upon the suitability of pool condition for this purpose, based upon NR4. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for A2.</i> ? State Government (Grant Programs) © Council (Current Programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Recommended |
| A2 | Redesign or retrofit stormwater structures adjacent to surf club in current location to withstand impacts. | Current Action: NR7 Trigger: When inundation frequency impedes effective conveyance of stormwater OR as asset replacement is required, whichever is sooner; | × | × | ~ | | | | | | | | Stormwater assets may be increasingly impacted by inundation with sea level rise (this includes increased frequency of inundation events from storms). This option involves redesigning and / or re- siting the stormwater structures at their current location to withstand impacts. Designs will depend on outcomes of NR7. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for A2.</i> State Government (Grant Programs) Council (Current Programs, new levies or increased rates?) <i>N/A</i> Private landholders who directly benefit from option | Recommended |
| A2 | Redesign or retrofit Surf Club in current location to withstand impacts. | Current Action: NR3 Trigger: When structure is refurbished or re-built. | × | × | ~ | | | | | ζ, | | 0 | Development controls (see FDCP) would be utilised to redesign the Surf Club structure to accommodate inundation. This would be more affordably done at the next asset replacement cycle, particularly as the risk is medium at the present time. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for A2.</i> ? State Government (Grant Programs) Council (Current Programs, me levies or increased rates?) N/A Private landholders who directly benefit from option | Recommended |
| FDCP | Update DCP Chapter E13 – Floodplain Management to include areas affected by Coastal Inundation as Low Risk Flood Precincts, and implement DCP to manage inundation impacts as properties are redeveloped and assets replaced. | As property / assets redeveloped, new developments built | × | × | v | ~ | | 2 | | | | | This option involves applying the existing Flood DCP chapter to the surf club at the "low flood risk" level, until a Flood Study for Bellambi Gully is conducted (refer NR10). <i>Refer to Accommodate Options Table for further cost benefit details for FDCP.</i> | Recommended |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | N/A | A N/A | 5 | | | | | | | There are many areas at low risk from inundation, to which 'do nothing' is an acceptable option, and allows Council to focus efforts on high risk areas. For areas at high risk, such as the Sewage Treatment Plant or Harbour, 'do nothing' may be acceptable now, but at some time in the future, impacts on these assets would not be tolerated by community and action will be required. <i>Refer to "Do Nothing" Option Table for further cost benefit details.</i> ? State Government ? Council (new levies and increased rates) ? Private landholders in Future Generations | Marginal |
| NR | NR1, NR2, NR4, NR5, NR6, NR7, NR8, NR10, NR11, NR13, NR14 | Now | ~ | ~ | ~ | | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. ? State Government (Grant Programs) Ø Council (Current Programs) Ø Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |

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ASTAL ZONE MANAGEMENT PLAN - MANAGEMENT STUDY - FINAL DRAFT ~

6.12.5 Assessment of Treatment Options – Bellambi Point Beach

| Bell | ambi Point | | | | | | | | | | | | | | | |
|-------------|---|---|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|-----------------------|---|---|-------------|
| Sym- bol | . Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | regai / Approvar Nisk | Specific Cost Benefit Considerations for Bellambi Point Beach | Potential Funding Sources (Who may pay) | Conclusion |
| S2 | Maintain seawall along existing alignment | On as needs basis for asset maintenance or to repair storm damage. | ~ | ~ | × | | | | | | | | | There is an existing seawall along the boundary of the Sewage Treatment Plant between Bellambi Lagoon and Bellambi Point. This option proposes ongoing maintenance of this wall to provide protection to the Sewage Treatment Plant. The wall should additionally be designed to ensure protection for the stormwater outlet at this location. Audit of the current wall (NR2) will need to investigate the combined impact from this existing seawall and Bellambi Boat Harbour on erosion rates on Bellambi Point. Given there may be heritage values at Bellambi Point, the need to and impacts of extending the wall around Bellambi Point should be considered. <i>Refer to Protect Options Table for further cost benefit details for</i> S2. | ? State Government (Grant Programs) ? Sydney Water - their site ? Council (Current Programs, new levies or increased rates) N/A Private landholders who directly benefit from option | Recommended |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ~ | × | | | | | 7 | YX. | | Ç | The existing vegetation coverage should be maintained, particularly managing weed species (e.g. bitou). Refer to Protect Options Table for further cost benefit details for DV. | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | × | | C | 1 | | | | | | This option allows reserve or public open space to naturally recede, for continued provision of a beach over the long term. Refer to Planned Retreat Options Table for further cost benefit details for PR1. | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| PR2 | Relocate activities on Sewage Treatment Plant compound landward of hazard zone | Trigger: Move activities as erosion impacts manifest | ~ | | x | 2, | | | | | | | | There appears to be sufficient vacant land within the Plant to relocate activities within the site to allow retreat. Refer to Planned Retreat Options Table for further cost benefit details for PR2. | ? State Government (Grant Programs) ☑ Sydney Water N/A Council (new levies or increased rates) N/A Private landholders who directly benefit from option | Recommended |
| PR2 | Relocate stormwater assets landward of hazard zone | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe | ~ | ~ | × | | | | | | | | | Should the existing seawall not be maintained, the stormwater outlet through the wall will need to be progressively moved landward and pipe shortened as erosion impacts manifest. Refer to Planned Retreat Options Table for further cost benefit details for PR2. | ? State Government (Grant Programs) ? Sydney Water ☑ Council (Current Programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Marginal |

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176

| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for PR2 Beach | Potential Funding Sources (Who may pay) | Conclusion |
|-------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|--|--|-----------------|
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | ~ | ~ | × | | | | | | | | This option applies proposed Coastal DCP controls to any redevelopments on the Sewage Treatment Works site. Refer to Accommodate Options Table for further cost benefit details for DCP. | ? State Government (Grant programs) ☑ Council (Current Programs) - cost to prepare DCP ☑ Sydney Water - cost to implement DCP | Recommended |
| A2 | Redesign or retrofit stormwater structures W of Bellambi Lagoon in current location to withstand impacts. | Current Action: NR7 Trigger: When inundation frequency impedes effective conveyance of stormwater OR as asset replacement is required, whichever is sooner; | × | × | ✓ | | | | | | | ĉ | Stormwater assets may be increasingly impacted by inundation with sea level rise (this includes increased frequency of inundation events from storms). This option involves redesigning and / or re- siting the stormwater structures at their current location to withstand impacts. Designs will depend on outcomes of NR7. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for A2</i> . | ? State Government (Grant Programs) ☑ Council (Current Programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Recommended |
| FDCP | Update DCP Chapter E13 – Floodplain Management to include areas affected by Coastal Inundation as Low Risk Flood Precincts, and implement DCP to manage inundation impacts as properties are redeveloped and assets replaced. | As property / assets redeveloped, new developments built | x | × | > | | | | 7 | Yx. | | | This option involves applying the existing Flood DCP chapter to those areas identified at risk from coastal inundation at the "low risk" level, until a Flood Study for Bellambi Lagoon is conducted (refer NR10). Refer to Accommodate Options Table for further cost benefit details for FDCP. | N/A State Government (external funding unlikely to be needed) ☑ Council (Current Programs) ☑ Private landholders - cost to implement FDCP | Recommended |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | N/A | N/A | Ś | | | | | | | There are many assets at low or medium risk from inundation, which may be acceptable at the current time. For assets at high risk particularly from erosion, there will be unacceptable impacts should 'do nothing' be selected, particulary where community services are impacted. <i>Refer to "Do Nothing" Option Table for further cost benefit details</i> . | ? State Government ☑ Council (new levies and increased rates) ☑ Private landholders in Future Generations | Not Recommended |
| NR | NR1, NR2, NR7, NR8, NR10, NR11, NR13, NR14 | Now | ~ | ~ | ~ | | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |


6.13.1 Erosion and Recession Risk Level and Treatment Options

| | | | | | | | | | | | | | | | | | | | DV | Revitalise Dune Care Programs |
|--|---|------------|---------|-------------------|----|--------|------------------------|----|------------------------|-------------------|----------|--------|------------|------------------------|------------------|------|--------------|---------------|--------|--|
| | Erosio | n and Rec | ession | | | | | _ | | | | | _ | | | | | | BM | Manage beach sands |
| Corrimal Beach | | Risk I eve | | | | | | Er | osion | / Rec | ession | Risk | Treatr | nents | | | | | PR1 | Accept loss as sacrificial |
| (from south of Bellambi Lagoon | Fracian | | Fracian | | | | | | I | | | | | | | | | "Do Nothing" | PR2 | Relocate out of hazard zone |
| entrance) | EIOSION | EIOSION | ETOSION | | | Protec | t | | | Planı | ned Re | etreat | | Acco | ommo | date | No Regrets | Do Nothing | PR3 | Prohibit development expansion |
| | by 2010 | by 2050 | by 2100 | | 1 | | | 1 | | 1 | | | | | $\left(\right)$ | | - | (Accept Risk) | PR4 | Voluntary Acquisition |
| Parks, Beaches and open space | | | | Ν | S1 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCP | A2 | A3 | Investigate* | DN | PR5 | Buy back then lease back |
| Corrimal Beach | High | Extreme | Extreme | | | | $\checkmark\checkmark$ | | $\checkmark\checkmark$ | | | | | X | | | NR14 | | DCP | Apply development controls (future dev/t and re-dev/t) |
| Coastal Dune Systems (Corrimal Beach Natural Area, Towradgi Park) | High | Extreme | Extreme | | | | ~ ~ | | ~~ | | | | | | | | | | A2 | Redesign / retrofit in current location |
| Towradgi Lagoon and adjacent EEC Habitat | Low | Medium | Medium | | | | | | ~~ | | | | \bigcirc | | | | NR11 | ✓ | A3 | Replace with relocatable structure |
| | | | | | | | | | | | | | | | | | | | FDCP | controls (future dev/t and re-dev/t) |
| Towradgi Park | Low | Medium | Medium | | | | | | $\checkmark\checkmark$ | | | | · | | | | | \checkmark | NR1 | Update Asset Register for Hazards |
| Community Infrastructure | | | | | | | | | | | \frown | | | | | | | | NR2 | Audit existing seawalls |
| Towradgi Rock Pool amenities mens | Low | Low | Medium | | | | | | | | | | | $\checkmark\checkmark$ | | | | ✓ | NR3 | Assess Public Buildings for |
| Towradgi Rock Pool amenities womens | Low | Low | Medium | | | | | | | |) | | | $\checkmark\checkmark$ | | | | ✓ | 1110 | "accommodate" or "relocate" |
| | | | | | | | | | | $\mathbf{\nabla}$ | | | | | | | | | NR4 | Audit Ocean Pool condition |
| | | | | | | | | | X (| | | | | | | | | | NR5 | or "relocate" |
| | | | | | | | | | | | | | | | | | | | NIDO | Assess Cycleways for |
| | | | | | | | | | | | | | | | | | | | INRO | "accommodate" or "relocate" |
| | | | | | | | | X | Ĩ | | | | | | | | | | NR7 | Design criteria for Stormwater Assets |
| | | | | | | | | | | | | | | | | | | | NR8 | Design criteria for Waste water, |
| | | | | | | | | | | | | | | | | | | | NIDO | Water supply and electricity assets |
| | | | | | | | | | | | | | | | | | | | INIXO | Conduct Flood Study including |
| | rrimal Beach th of Bellambi Lagoon entrance) Erosion and Re Risk Leve Erosion s and open space Image: Corrimal Beach owradgi Park) High an and adjacent EEC Habitat Low Medium Image: Corrimal Beach owradgi Park) High Extreme an and adjacent EEC Habitat Low Medium Image: Corrimal Beach owradgi Park) Low Low Pool amenities mens Low Low Pool amenities womens Low Low Image: Corrimal Beach owradgi Park Image: Corrimal Beach Dow Image: Corrimal Beach Dow Image: Corrimal Beach owradgi Park Image: Corrimal Beach Dow Image: Corrimal Beach D | | | | | | | | | | | | | | | | | | NR10 | ocean water levels |
| | imal Beach of Bellambi Lagoon entrance) Erosion and Rec Risk Leve Erosion by 2010 Erosion by 2010 and open space High ystems (Corrimal Beach radgi Park) High and adjacent EEC Habitat Low Medium structure Image: Comparison of the comparison of th | | | | | | | | | | | | | | | | | | | Audit EECs and habitats for priority |
| | | | | $\langle \rangle$ | | | | | | | | | | | | | | | NR11 | conservation |
| | | | | | | | | | | | | | | | | | | | NR12 | Use Norfolk Island Pines in new |
| | | | XX |) | | | | | | | | | | | | | | | | plantings |
| | | | | | | | | | | | | | | | | | | | NR13 | Manage Aboriginal Heritage Items |
| | | | | | | | | | | | | | | | | | | | INR 14 | Monitor erosion & mundation events |
| | | | | | | | | | | | | | | | | | | | DN | "Do Nothing" (Accept Risk) |
| | | | | | | | | | | | | | | | | | | | ~~ | Substantial risk reduction and / or |
| | | | | | | | | | | | | | | | | | | | | highly effective in managing risk |
| | | | | | | | | | | | | | | | | | | | ~ | Good risk reduction and / or |
| | | | | | | | | | | | | | | | | | | | | Technical feasibility of applying the |
| | | | | | | | | | | | | | | | | | | | ? | option is questionable |
| | | | | | | | | | | | | | | | | | | | | "Do Nothing" option is likely to have |
| | | | | | | | | | | | | | | | | | | | • | detrimental effect OR result in |
| | | | | | | | | | | | | | | | | | | | | increased risk over time |



Sym-

bol Ν

S1

S2

Nourishment

Seawall - short sections

Seawall - long or majority of beach

| KEY PLAN VOLGOUGH Asset Boundaries Hazard Definition Lines Risk Righ Externe | Bellambl Leon | |
|---|---------------------------------|------------------------------|
| Immediate Erosion Risk Level Corrimal Beach | s and Treatment Options | Drawing: Rev: 6-35 A |
| BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map. | N 0 75 150m Approx. Scale | WBMT WBM |
| Filepath : K:\N1965_WollongongCZMP\MapInfo\Workspaces\ | DRG_115_110428 Drawing 6-35.WOR | |

179

| Corrimal Beach Inundational display by 2010 (from south of Bellambi Lagoon entrance) Inundational display by 2010 Parks, Beaches and open space Inundational display by 2010 Corrimal Beach Low Coastal Dune Systems (Corrimal Beach Natural Area, Towradgi Park) Low Towradgi Lagoon and adjacent EEC Habitat Medium | Inundation Risk Inundation by 2050 | Level Inundation by 2100 Medium | In Overtopping risk treated by erosion option | Planned Retreat | Accc | reatme | nts No Regrets | "Do Nothing" | N Nourishment S1 Seawall - long or majority of beach S2 Seawall - short sections DV Revitalise Dune Care Programs BM Manage beach sands PR1 Accept loss as sacrificial PR2 Relocate out of hazard zone |
|---|--|--|---|--------------------|-------------|--------|-------------------|------------------|--|
| Corrimal Beach Inundation (from south of Bellambi Lagoon entrance) Inundation Parks, Beaches and open space Inundation Corrimal Beach Low Coastal Dune Systems (Corrimal Beach Natural Area, Towradgi Park) Low Towradgi Lagoon and adjacent EEC Habitat Medium | Inundation by 2050 | Inundation by 2100 Medium | Overtopping risk treated by erosion option | Planned Retreat | Acco | mm- | No Regrets | "Do Nothing" | BM Manage beach sands PR1 Accept loss as sacrificial PR2 Relocate out of hazard zone |
| (from south of Bellambi Lagoon entrance)Inundational display to the parks, Beaches and open spaceParks, Beaches and open spaceInundational display to the parks, Beaches and open spaceCorrimal BeachLowCoastal Dune Systems (Corrimal Beach Natural Area, Towradgi Park)LowTowradgi Lagoon and adjacent EEC HabitatMedium | n Inundation by 2050 Low | Inundation by 2100 Medium | risk treated by erosion option | Planned Retreat | Acco oda | mm- | No Regrets | Nothing" | PR2 Relocate out of hazard zone |
| Parks, Beaches and open space Image: Constant open space Corrimal Beach Low Coastal Dune Systems (Corrimal Beach Natural Area, Towradgi Park) Low Towradgi Lagoon and adjacent EEC Habitat Medium | Low | Medium | | | | | | (Accept Risk) | PR3 Prohibit development expansion PR4 Voluntary Acquisition PR5 Buy back then lease back |
| Corrimal Beach Low Coastal Dune Systems (Corrimal Beach Natural Area, Towradgi Park) Low Towradgi Lagoon and adjacent EEC Habitat Medium | Low Low | Medium | | PR2 | FDCP | A2 | Investigate* | DN | DCP Apply development controls (future dev/t and re-dev/t) |
| Coastal Dune Systems (Corrimal Beach Natural Area, Towradgi Park) Low Towradgi Lagoon and adjacent EEC Habitat Medium | Low | | | Y | | | | ✓ | A2 Redesign / retrofit in current |
| Towradgi Lagoon and adjacent EEC Habitat Mediun | | Medium | | Ø | | | | ~ | A3 Replace with relocatable structure Apply existing flood development |
| | High | Extreme | 5 | | | | NR10, NR14 | ~ | PDCP controls (future devt and re-devt) NR1 Update Asset Register for Hazards NR2 Audit evicting seguralis |
| Corrimal Beach Reserve. Towradgi Creek Reserve | Low | Medium | | | | | | ✓ | NR3 Assess Public Buildings for |
| Towradai Park | Low | Medium | | | | | | ✓ | NPA Audit Occar Real condition |
| Community Infrastructure | | | 0 | | | | | | Addit Ocean Pool condition |
| Corrimal Surf Club Medium | Medium | High | | | ~ ~ | ~ | NR10, NR14 | | NR6 Assess Cycleways for "accommodate" or "relocate" |
| Towradgi Rock Pool amenities mens | Low | Low | | | ✓ | | | ✓ | NR7 Design criteria for Stormwater |
| Cycleway (across & next to Towradgi Lagoon) Mediun | Medium | High | | | ~ | ✓ | NR14 | | NR8 Design criteria for Waste water, |
| Transport Infrastructure | 0. | 5 | | | | | | | NR9 Develop evacuation plans |
| Local roads (Lake Pde) Medium | High | Extreme | | | √ √ | | NR14 | ✓ | NR10 Conduct Flood Study including |
| Water and sewage infrastructure | | | | | | | | | Audit EECs and habitats for priority |
| Stormwater outlets and pipes | Extreme | Extreme | | | ~ | √√ | NR7, NR14 | | NR11 conservation |
| Residential Development | | | | | | | | | NR12 Use Norfolk Island Pines in new plantings |
| Existing Residences (37 adjacent to Towradgi Lagoon Mediun | High | High | | | ~ ~ | ✓ | NR10 | | NR13 Manage Aboriginal Heritage Items NR14 Monitor erosion & inundation events |





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6.13.3 Assessment of Treatment Options

| Cor | rimal | | | | | | | | | | | | | | | |
|-------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|---|-----------------------|--|---|-------------|
| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | | Legal / Approval Risk | Specific Cost Benefit Considerations for Corrimal Beach | Potential Funding Sources (Who may pay) | Conclusion |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ~ | × | | | | | | | | | The existing vegetation coverage should be maintained, particularly managing weed species (e.g. bitou). Dune care programs must be considerate of sightline requirements for SLSC activities. Refer to Protect Options Table for further cost benefit details for DV. | ? State Government (Grant Programs) ☑ Council (Current Programs) <i>N/A</i> Private landholders who directly benefit from option | Recommended |
| PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | × | | | | | | . (| 2 | NC X | This is an excellent option at Corrimal Beach as there are extensive dunes and reserve lands to enable natural retreat of the beach, and hence continued provision of a beach over the long term. <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR1.</i> | ? State Government (Grant Programs) ☑ Council (Current Programs) <i>N/A</i> Private landholders who directly benefit from option | Recommended |
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | ~ | ~ | x | | C | | 7 | × | 25 | | | Application of the Coastal DCP to minor public buildings, to ensure erosion and overtopping risks are adequately managed (including relocating the structures) in the future when the assets require redevelopment. Refer to Accommodate Options Table for further cost benefit details for DCP. | ? State Government (Grant programs) ☑ Council (Current Programs) - cost to prepare DCP ☑ Private landholders - cost to implement DCP | Recommended |
| A2 | Redesign or retrofit stormwater structures in current location to withstand impacts. | Current Action: NR7 Trigger: When inundation frequency impedes effective conveyance of stormwater OR as asset replacement is required, whichever is sooner; | × | × | Ĩ. | | | | | | | | | Stormwater assets may be increasingly impacted by inundation with sea level rise (this includes increased frequency of inundation events from storms). This option involves redesigning and / or re- siting the stormwater structures at their current location to withstand impacts. Designs will depend on outcomes of NR7. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for A2</i> . | ? State Government (Grant Programs) ☑ Council (Current Programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Recommended |



182

| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for A2 Beach | Potential Funding Sources (Who may pay) | Conclusion |
|-------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|---|--|-----------------|
| A2 | Redesign or retrofit Surf Club in current location to withstand impacts. | Current Action: NR3 Trigger: When structure is refurbished or re-built. | × | x | * | | | | | | | | Development controls (see FDCP) would be utilised to redesign the Surf Club structure to accommodate inundation. This would be more affordably done at the next asset replacement cycle, particularly as the risk is medium at the present time. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for A2.</i> | State Government (Grant Programs) Z Council (Current Programs, new levies or increased ates?) V/A Private landholders who directly benefit from option | Recommended |
| FDCP | Update DCP Chapter E13 – Floodplain Management to include areas affected by Coastal Inundation as Low Risk Flood Precincts, and implement DCP to manage inundation impacts as properties are redeveloped and assets replaced. | As property / assets redeveloped, new developments built | x | x | ~ | | | | | | | ~ | The majority of land and assets within the coastal inundation area are within the Flood Planning Area for Towradgi Lagoon. These properties will aready have flood planning controls (FDCP), which should be applied also to managing the backwater inundation risk from coastal inundation. NR10 should be completed for Towradgi Lagoon to improve flood planning levels. N Refer to Accommodate Options Table for further cost benefit details for FDCP. to | V/A State Government external funding unlikely to be needed) ☑ Council (Current Programs) ☑ Private landholders - cost o implement FDCP | Recommended |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | N/A | N/A | | | | 7 | XX | <i>Z</i> , | | There is high risk from erosion and recession, but at little impact to developed assets. The "do nothing" option is acceptable to some degree where this allows for natural retreat of the shoreline. The majority of area affected by coastal inundation is already at risk from catchment flooding. Controls on catchment flooding will mitigate the coastal inundation risk under a "do nothing" scenario which is acceptable. <i>Refer to "Do Nothing" Option Table for further cost benefit details.</i> | State Government 2 Council (new levies and hcreased rates) 3 Private landholders in Future benerations | Not Recommended |
| NR | NR1, NR3, NR5, NR7, NR9, NR10, NR11, NR13, NR14 | Now | ~ | ~ | ~ | K | | | | | | | ? Pr Refer to "No Regrets" Options Table for cost benefit details. ☑ N/ dif | State Government (Grant Programs) @ Council (Current Programs) I/A Private landholders who irectly benefit from option | Recommended |
| | | | | | Ś | | | _ | _ | | | _ | | | _ |

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6.14 Towradgi Beach

6.14.1 Erosion and Recession Risk Level and Treatment Options

| | | | | | | | | | | | | | | | | | | | DV | Revitalise Dune Care Programs |
|--|---------|-----------|---------|---|----|--------|------------------------|----|------------------------|------------------------|--------|---------|-------|------------------------|------|------|--------------|---------------|-------|--|
| | Fracia | n and Day | | [| | | | | | | | | | | | | | 1 | BM | Manage beach sands |
| Towradgi Beach | Erosio | n and Red | cession | | | | | Er | osion | / Rec | ession | Risk | Treat | ments | | | | | PR1 | Accept loss as sacrificial |
| (extending to just north of Fairy Meadow | - | RISK Leve | 1 | | | | | | | | | | | | | | | | PR2 | Relocate out of hazard zone |
| SLSC, at cadastral boundary of tourist | Erosion | Erosion | Erosion | | | Protec | t | | | Planr | ned Re | etreat | | Acc | ommo | date | No Regrets | "Do Nothing" | PR3 | Prohibit development expansion |
| park) | by 2010 | by 2050 | by 2100 | | | | | | | i iain | | , a cat | | /.00 | | auto | No Regieta | (Accept Risk) | PR4 | Voluntary Acquisition |
| Parks, Beaches and open space | | | | Ν | S1 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCP | A2 | A3 | Investigate* | DN | PR5 | Buy back then lease back |
| Towradgi Beach | High | Extreme | Extreme | | | | $\checkmark\checkmark$ | | $\checkmark\checkmark$ | | | | | X | | | NR14 | | DCP | dev/t and re-dev/t) |
| Coastal Dune Systems | High | Extreme | Extreme | | | | $\checkmark\checkmark$ | | $\checkmark\checkmark$ | | | | | | | | | | A2 | Redesign / retrofit in current |
| Towradgi Beach Reserve | Low | Low | Medium | | | | $\checkmark\checkmark$ | | $\checkmark\checkmark$ | | | | | | | | | | 4.2 | location |
| Community Infrastructure | | | | | | | | | | | | | | | | | | | A3 | Apply existing flood development |
| Cycleway / Shared Pathway | Medium | High | High | | | | | | | ✓ | | - | | ✓ | | | NR6, NR14 | | FDCP | controls (future dev/t and re-dev/t) |
| Towradqi Pool | High | Extreme | Extreme | | | | | | ✓ | | | | | | ✓ | | NR4, NR14 | | NR1 | Update Asset Register for Hazards |
| Towraddi Beach Lifeguard Tower | Low | Low | Medium | | | | | | | | \sim | | | √ | | | , | ✓ | NR2 | Audit existing seawalls |
| Transport Infrastructure | 2011 | 2011 | | | | | | | | C | | | | | | | | | NR3 | Assess Public Buildings for "accommodate" or "relocate" |
| Local Roads: Marine Parade (N end of | | | | | | | | | | | | | | | | | | | NR4 | Audit Ocean Pool condition |
| beach) | Low | Medium | Medium | | | | | | | | | | | ~~ | | | NR5 | | NR5 | Assess Roads for "accommodate" |
| Water and sewage infrastructure | | | | | | | | | | | | | | | | | | | | or "relocate" |
| Stormwater outlet / pipe (N end) | Medium | High | High | | | | 2 | | | $\checkmark\checkmark$ | | | | ✓ | | | NR7, NR14 | | NR6 | "accommodate" or "relocate" |
| Residential Development | | | | | | | | | | | | | | | | | | | NR7 | Design criteria for Stormwater |
| Existing Residences (3 at N end) | Low | Medium | Medium | | | | | | | | | ✓ | ✓ | 11 | | | NR14 | | | Assets |
| Existing Residences (1 at N end) | Medium | Medium | High | | | | | | | | | ✓ | ✓ | $\checkmark\checkmark$ | | | NR14 | | NR8 | water supply and electricity assets |
| | | | | | | | | | | | | | | | | | | | NR9 | Develop evacuation plans |
| | | | | | | | | | | | | | | | | | | | | Conduct Flood Study including |
| | | | | | | | | | | | | | | | | | | | NICIO | ocean water levels |
| | | | | ~ | | | | | | | | | | | | | | | NR11 | Audit EECs and habitats for priority |
| | | | | | | | | | | | | | | | | | | | | Use Norfolk Island Pines in new |
| | | | | | | | | | | | | | | | | | | | NR12 | plantings |
| | | • | | | | | | | | | | | | | | | | | NR13 | Manage Aboriginal Heritage Items |
| | | | | | | | | | | | | | | | | | | | NR14 | Monitor erosion & inundation events |
| | | | | | | | | | | | | | | | | | | | DN | "Do Nothing" (Accept Risk) |
| | | | | | | | | | | | | | | | | | | | ~~ | Substantial risk reduction and / or |
| | | | | | | | | | | | | | | | | | | | | highly effective in managing risk |
| | | | | | | | | | | | | | | | | | | | ~ | effective in managing risk |
| | | | | | | | | | | | | | | | | | | | | Technical feasibility of applying the |
| | | | | | | | | | | | | | | | | | | | ? | option is questionable |
| | | | | | | | | | | | | | | | | | | | | "Do Nothing" option is likely to have |
| | | | | | | | | | | | | | | | | | | | • | detrimental effect OR result in |

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Sym-

bol N

S2

Nourishment

S1 Seawall - long or majority of beach

Seawall - short sections

increased risk over time



| 6 14 2 Coastal Inundation Risk Level and Treatment Ontions | |
|--|---|
| | Nourishment |
| S1 | Seawall - long or majority of beach |
| S2 | Seawall - short sections |
| | Revitalise Dune Care Programs |
| I owradgi Beach | Accept loss as sacrificial |
| (extending to just north of Fairy Meadow SLSC, Overtopping Determined and PR2 | Relocate out of hazard zone |
| at cadastral boundary of tourist park) Inundation Inundation Inundation risk treated 2 0 Accomm- | Prohibit development expansion |
| by 2010 by 2050 by 2100 by erosion to be a second by PR4 | Voluntary Acquisition |
| $\frac{1}{PR5}$ | Buy back then lease back |
| Parka Basehea and energinates DN | Apply development controls (tuture dev/t and re-dev/t) |
| Farks, Beaches and open space DN | Redesign / retrofit in current |
| Towradgi Beach | location |
| Coastal Dune Systems Low Low Medium | Replace with relocatable structure |
| Community Infrastructure | controls (future dev/t and re-dev/t) |
| Cycleway / Shared Pathway Medium Medium High | Update Asset Register for Hazards |
| Towradgi Pool Medium High | Assess Public Buildings for |
| Transport Infrastructure | "accommodate" or "relocate" |
| Local Roads: Towradgi Road, Marine Parade (N end | Audit Ocean Pool condition |
| of beach) | or "relocate" |
| Water and sewage infrastructure | Assess Cycleways for "accommodate" or "relocate" |
| Stormwater outlet / pipe (N end) | Design criteria for Stormwater |
| Residential Development | Assets Design criteria for Waste water. |
| Existing Residences (3 at N end) | water supply and electricity assets |
| Existing Residences (1 at N end) Low Medium Medium V | Develop evacuation plans Conduct Flood Study including |
| NR10 | ocean water levels |
| NR11 | Audit EECs and habitats for priority |
| | Use Norfolk Island Pines in new |
| INR12 | plantings |
| NR13 | Manage Aboriginal Heritage Items |
| | "Do Nothing" (Accept Risk) |
| | Substantial risk reduction and / or |
| \checkmark | highly effective in managing risk |
| \checkmark | Good risk reduction and / or |
| | effective in managing risk Technical feasibility of applying the |
| ? | option is questionable |
| | "Do Nothing" option is likely to have |
| • | detrimental effect OR result in increased risk over time |





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6.14.3 Assessment of Treatment Options

tem? Attachment?

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ASTAL ZONE MANAGEMENT PLAN - MANAGEMENT STUDY - FINAL DRAFT ~

188

| Tow | radgi | | | | | | | | | | | | | | |
|-------------|---|---|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|--|--|-----------------------------|
| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for Towradgi Beach | Potential Funding Sources (Who may pay) | Conclusion (provisional) |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ~ | × | | | | | | | | Dune care programs must be considerate of sightline requirements for SLSC activities. There is generally good dune vegetation coverage, this needs to be maitained including to manage weeds (e.g. bitou). <i>Refer to Protect Options Table for further cost benefit details for</i> <i>DV</i> . | ? State Government (Grant Programs) ☑ Council (Current Programs) <i>N</i>/A Private landholders who directly benefit from option | Recommended |
| PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | x | | | | | | | | This is an excellent option for retaining Towradgi Beach as there are generally wide dunes for the majority of beach length and reserve lands to enable natural retreat of the beach, and hence continued provision of a beach over the long term. Any decision to remove Towradgi Pool would be based on pool condition to withstand future impacts (see NR4). Refer to Planned Retreat Options Table for further cost benefit details for PR1. | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| PR2 | Redirect traffic from roadway outside of hazard zone, allowing retreat of road | Current Action: NR3 Trigger: At scheduled time for asset maintenance OR when ZRFC measured from erosion escarpment encroaches onto building foundations or cabins, whichever is sconer | ~ | ~ | × | | | | | | 5 | YX. | Marine Drive is currently at low risk, with impacts not expected for many years. Initiating plans to redirect the roadway at the present time assists future traffic planning. Access to residential properties will need to be maintained if this option is selected. Refer to Planned Retreat Options Table for further cost benefit details for PR2. | ? State Government (Grant Programs) ☑ Council (Current Programs, new levies or increased rates?) <i>IVA</i> Private landholders who directly benefit from option | Recommended |
| PR2 | Relocate stormwater assets landward of hazard zone | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe OR the pipe requires replacement, whichever is sooner. | ~ | ~ | × | | | | N | | | | Assets adjacent to the roadway would need to be relocated to permit retreat at the northern end of the beach. The assets are at medium risk at the present, suggesting it is likely to be some time before impacts manifest <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR2.</i> | ? State Government (Grant Programs) ☑ Council (Current Programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Recommended |
| PR2 | Relocate cycleway outside of hazard zone | Current Action: NR6 Trigger: When ZRFC measured from erosion escarpment encroaches cycleway | V | √ , | x | | 5 | | | | | | A long section of cycleway is at risk over time. To maintain the integrity of the cycleway, the path would need to be relocated at the same time. There are alternate routes to relocate the at risk sections of cycleway, at the time impacts become imminent. Refer to Planned Retreat Options Table for further cost benefit details for PR2. | ? State Government (Grant Programs) ☑ Council (Current Programs, new levies or increased rates ?) N/A Private landholders who directly benefit from option | Recommended |
| A2 | Retrofit Towradgi Pool in current location to withstand impacts. | Current Action: NR4 Trigger: When damage to pool shell occurs <u>OR</u> the pool is being inundated at water levels lower than MSL. | ✓ | ~ | N/A | | | | | | | | The decision to retrofit Towradgi Pool over time to withstand wave and sea level rise impacts will depend on assessment of pool condition for this purpose (i.e. NR4). <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for A2.</i> | ? State Government (Grant Programs) ☑ Council (Current Programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Recommended |



189

| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation | Capital Cost | Recurrent Costs | Environmental or | Social Impact Community | Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for PR2 Beach Sources (Who may pay) | Conclusion | |
|-------------|--|--|----------------|--------------------|----------------------|--------------|-----------------|------------------|----------------------------|---------------|-------------------------------------|-------------------------|-----------------------|---|-----------------|--|
| PR4 | Voluntary acquisition | Current Action: Apply for government funding. Trigger: Offer once funding becomes available. | ~ | ~ | × | | | | | | | | | This option may be financially viable for a single property, but would not be financially possible for multiple properties without substantial government assistance, which is not currently available. As noted for DCP option, the location of the properties suggest there may be stable foundation zone (bedrock) at close depth. In this case, private landowners may be able to accommodate the risk to their buildings and / or the hazard estimate for recession could be revised. This may negate the need for voluntary acquisition to retreat from these properties. <i>Refer to Planned Retreat Options Table for further cost benefit</i> details for <i>PR4</i> . | Marginal | |
| PR5 | Buy back – lease back | Buy and lease out property now. Demolish property when the Immediate Impact Zone (including foundation stability allowance) intersects the development. | ~ | ~ | · • | | | | | | 2 | X | | This option involves voluntary acquisition of at risk private property by Council funded by typical mortgage arrangements, with the properties leased at market rates until impacts become imminent. As noted for DCP option, the location of the properties suggest there may be stable foundation zone (bedrock) at close depth. In this case, private landowners may be able to accommodate the risk to their buildings and / or the hazard estimate for recession could be revised. This may negate the need to acquire and retreat from these properties. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for DCP.</i> | Marginal | |
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | ~ | ~ | × | 0 | | | 7 | | | | | This option shall apply Coastal DCP controls to redevelopments of at risk private property and public assets. The development controls will reflect the level of risk and lifespan of the (re-)development. The location of the private properties at the northern end of the beach suggests there may be stable foundation zone (bedrock) at close depth. In this case, private landowners may be able to accommodate the risk to their buildings and / or the hazard estimate for recession could be revised. The geotechnical investigation would be initiated through the Coastal DCP for any proposed re-developments. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for DCP.</i> | Recommended | |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | N// | A N/A | | | | | | | | | The risk can be accepted at areas at low risk from inundation or erosion at the current time. However, impacts to community services (the roadway) or private property in the long term will not be acceptable, with impacts of 'do nothing' likely to be costly and possibly irreversible. <i>Refer to "Do Nothing" Option Table for further cost benefit details.</i> | Not Recommended | |
| NR | NR1, NR4, NR5, NR6, NR7, NR13, NR14 | Now | ~ | ~ | ✓ | | | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. ? State Government (Grant Programs) Ø Council (Current Programs) Ø Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended | |

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6.15 Fairy Meadow Beach

6.15.1 Erosion and Recession Risk Level and Treatment Options

| | | | | | | | | | | | | | | | | | | | BM | Manage beach sands |
|---|---------|------------|---------|-------|------|---------|--------------|---------|------------------------|------------------------|-----------------------|-------|---------|--------------|-------|-------|--------------|------------------|------|--|
| Fairy Meadow Beach | Erosio | n and Rec | ession | | | | | Er | osion | / Rec | ession | Risk | Treatr | nents | ; | | | | PR1 | Accept loss as sacrificial |
| (ovtonds to immediately porth of Eairy | | Risk Level | | | | | | | | | | | | | | | | | PR2 | Relocate out of hazard zone |
| (extends to inimediately north of Fairy | Erosion | Erosion | Erosion | | | Drotoot | | | | Dloor | and Do | troot | | A a a | | data | No Dograto | "Do Nothing" | PR3 | Prohibit development expansion |
| Lagoon at boundary to Puckeys Estate) | by 2010 | by 2050 | by 2100 | | | FIOLECI | | | | FIAIII | ieu re | lleal | | ACC | Ommo | Juale | No Regrets | (Accept Risk) | PR4 | Voluntary Acquisition |
| Parks, Beaches and open space | | | | Ν | S1 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCP | A2 | A3 | Investigate* | DN | PR5 | Buy back then lease back |
| Fairy Meadow Beach | High | Extreme | Extreme | | - | , | ~~ | | √√ | | _ | | _ | X | | - | NR14 | | DCP | Apply development controls (future dev't and re-dev't) |
| Fairy Lagoon Habitat (part of Puckeys Estate lands) | Medium | High | High | | | | ~~ | | ~~ | | | | | | | | NR11 | | A2 | Redesign / retrofit in current location |
| Coastal Dune Systems | High | Extreme | Extreme | | | | \checkmark | | $\checkmark\checkmark$ | | | (| | | | | | | A3 | Replace with relocatable structure |
| Community Infrastructure | | | | | | | | | | | | 5 | | | | | | | FDCP | controls (future dev/t and re-dev/t) |
| Fairy Meadow SI SC Lifeguard Tower | Low | Medium | Medium | | | | | | | $\checkmark\checkmark$ | | | | ✓ | | | | | NR1 | Update Asset Register for Hazards |
| | | | | | | II. | | I | | | | | | | - | I | | | NR2 | Audit existing seawalls |
| | | | | | | | | | | C | $\mathbf{\mathbf{N}}$ | | | | | | | | NR3 | Assess Public Buildings for "accommodate" or "relocate" |
| | | | | | | | | | | |) | | | | | | | | NR4 | Audit Ocean Pool condition |
| 6.15.1 Coastal Inundation | on Ris | k Leve | and | Tre | eatr | ment | t O | oti | ons | 5 | | | | | | | | | NR5 | Assess Roads for "accommodate" or "relocate" |
| | | | | | | | | | | | | | | | | | | | NR6 | Assess Cycleways for "accommodate" or "relocate" |
| | | | | | | | | | | | | Inun | datio | n Ris | sk Tr | eatm | ents | | NR7 | Design criteria for Stormwater Assets |
| Fairy Meadow Bea | ach | | | | | | | | | | | | 0.0.1.0 | | | | | | NR8 | Design criteria for Waste water, water supply and electricity assets |
| (extends to immediately north of F | airv La | doon at | | | | | | | | Over | toppir | ng - | - + | | | | | "Do | NR9 | Develop evacuation plans |
| boundary to Puckeys Es | state) | J | Inunda | ation | Inur | ndation | In | unda | ation | risk | treate | d | trea | A | Accor | nm- | No Rearet | Nothing" | NR10 | Conduct Flood Study including ocean water levels |
| | | | by 20 | 010 | by | 2050 | t | oy 21 | 00 | by e | erosio otion | | Re | | oda | te | No regret | (Accept Risk) | NR11 | Audit EECs and habitats for priority conservation |
| Parks, Beaches and open space | | | .0 | 1 | | | | | | - | | | PR2 | FD | CP | A2 | Investigate | e* DN | NR12 | plantings |
| Fairy Meadow Beach | | | 1.01 | N | 1 | 0W | Ν | Mediu | ım | | | | | | | | | ✓ | NR13 | Manage Aboriginal Heritage Items |
| Fairy Logoon and Habitat (part of | Duckov | o Estato | Loi | | - | | | violare | | | | | | | - | | | | NR14 | Monitor erosion & inundation events |
| lands) | Рискеу | 'S Estate | Medi | um | H | ligh | E | Extre | me | | √ | | | | | | NR11 | ✓ | DN | "Do Nothing" (Accept Risk) |
| Coastal Dune Systems | | | Lov | N | L | _OW | Ν | Nediu | um | | | | | | | | | ✓ | ~~ | highly effective in managing risk |
| Community Infrastructure | | | | | | | | | | | | | | | | | | | ~ | Good risk reduction and / or effective in managing risk |
| Fairy Meadow SLSC Lifeguard Towe | r | | Lov | N | L | _OW | | Lov | V | | | | | | | | | ✓ | ? | Technical feasibility of applying the option is questionable |
| | | | | | | | | | | | | | | | | | | | • | "Do Nothing" option is likely to have detrimental effect OR result in increased risk over time |



Sym-

bol N

S1

S2

DV

Nourishment

Seawall - long or majority of beach

Revitalise Dune Care Programs

Seawall - short sections

| KEY PLAN (COLEDALE (| Thomas Da Park | | | aliry Meadow Beach | | | |
|--|--|--------------------------|-----------------|--------------------|------|-----|-------------------|
| Immediate Erosion Risk Fairy Meadow Beach (n | k Levels | and Trea | atment O | ptions | 6-39 |) | Α |
| BMT WBM endeavours to ensure that the information pro map is correct at the time of publication. BMT WBM does guarantee or make representations regarding the currence accuracy of information contained in this map. Filepath : K:\N1965_WollongongCZMP\MapInfo | ovided in this s not warrant, cy and | N 0 A RG_117_110429 D | 75 Approx. s | 150r Scale | n | BMT | WBM npl.com.au |





Immediate Erosion Risk Levels and Treatment Fairy Meadow Beach (south)

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map. 0 75 150m Approx. Scale



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6.15.2 Assessment of Treatment Options

| Fair | y | | | | | | | | | | | | | | |
|-------------|--|---|----------------|--------------------|--------------------------------|--------------|--------------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|--|---|-------------|
| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for Fairy Beach | Potential Funding Sources (Who may pay) | Conclusion |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ~ | × | | | | | | | | Dune care programs must be considerate of sightline requirements for SLSC activities. Existing vegetation coverage is good and should be maitained and managed for weeds (e.g. bitou bush). <i>Refer to Protect Options Table for further cost benefit details for</i> <i>DV</i> . | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | × | | | | | | | | This is an excellent option for retaining Fairy Meadow Beach as there are generally wide dunes and reserve lands to enable natural retreat of the beach, and hence continued provision of a beach over the long term. <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR1.</i> | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| PR2 | Relocate lifeguard tower structure outside of hazard zone | Trigger: when ZRFC measured from erosion escarpment encroaches onto building foundations | ~ | ~ | × | | | | | 2 | 1/~ | | The lifeguard tower is at low risk, there is no immediate need for action. When impacts become imminent, the tower is a low key structure that will be easily relocatable. Refer to Planned Retreat Options Table for further cost benefit details for PR2. | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | ~ | ~ | x | | | J. | | | | | Coastal DCP controls should apply to any future re-development of the lifeguard tower or other recreational facility. Refer to Accommodate Options Table for further cost benefit details for DCP. | ? State Government (Grant programs) ☑ Council (Current Programs) - cost to prepare DCP and implement for public assets N/A Private landholders | Recommended |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | . N/A | A N/A | U, | | | | | | | Risk from inundation is low due to extensive dune protection and limited development and can be accepted. Likewise, while there are high erosion risks, 'do nothing' may be acceptable as there is limited development and the recession of dunes would enable the beach to be retained. Refer to "Do Nothing" Option Table for further cost benefit details. | ? State Government ☑ Council (new levies and increased rates) <i>N/A</i> Private landholders in Future Generations | Recommended |
| NR | NR1, NR11, NR13, NR14 | Now | ~ | ~ | ~ | | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |

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6.16 North Beach

6.16.1 Erosion and Recession Risk Level and Treatment Options

| | Erosio | n and Ree Risk Leve | cession | | | | | Er | osion | / Rec | essior | n Risk | Treat | ments | | | | |
|---|--------------------|------------------------|--------------------|---|----|--------|----|----|-------|--------------|--------|--------|-------|-------|------|-------|-------------------|-------------------------------|
| North Beach | Erosion by 2010 | Erosion by 2050 | Erosion by 2100 | | | Protec | ct | | | Plan | ned R | etreat | | Acc | ommo | odate | No Regrets | "Do Nothing" (Accept Risk) |
| Parks, Beaches and open space | | | | Ν | S1 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCP | A2 | A3 | Investigate* | DN |
| North Beach | High | Extreme | Extreme | | | | ✓ | ✓ | ✓ | | | | | X | | 1 | NR14 | |
| Fairy Lagoon | Medium | High | Extreme | | | | | | ✓ | | | | | / | | | NR11 | |
| Stuart Park (on heritage list, local significance) | Medium | High | Extreme | ~ | | ~ | ~ | ~ | ~ | | | | | | | | | |
| Public open space adjacent to Pavillion, Kiosk | Low | Medium | Medium | ~ | | ~ | | | ~ | | | | | | | | NR2 | |
| Community Infrastructure | | | | | | | | | | | | | | | | | | |
| Puckeys Estate including Seafield House, Saltworks and gardens ruins | High | Extreme | Extreme | | | | | | ~ | ? | | | | | | | NR14 | |
| North Beach Surf Club | High | Extreme | Extreme | ✓ | | ✓ | | | | \checkmark | | | | ✓ | | | NR2, NR14 | |
| Heritage Site: North Beach Kiosk | Low | Medium | High | ~ | | ~ | | X | K | ? | | | | ~ | ~ | | NR3, NR2, NR14 | |
| Heritage Site: North Beach Pavillion | Low | Medium | Medium | | | | 7 | | | | | | | ✓ | | | NR14 | ✓ |
| Heritage Site: Norfolk Island Pines | Medium | Medium | High | | | | | | ✓ | | | | | | | | NR12 | |
| Cycleway / Shared Pathway (includes heritate railway cuttings and embankments) | Medium | High | Extreme | ~ | C | v | | | | ~ | | | | ~ | ~ | | NR6, NR14 | |
| Water and sewage infrastructure | | | | | | V | | | | | | | | | | | | |
| Stormwater outlets / pipes (at Lagoon entrance) | High | Extreme | Extreme | 3 | | • | | | | ~ | | | | ~ | ~ | | NR7, NR14 | |
| Stormwater outlets / pipes (adjacent to Pavilion) | High | Extreme | Extreme | v | | ~ | | | | ~ | | | | ~ | ~ | | NR7, NR14 | |
| | | | 6 | | | | | • | • | | | | | • | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

Ν Nourishment S1 Seawall - long or majority of beach S2 Seawall - short sections Revitalise Dune Care Programs Manage beach sands Accept loss as sacrificial Relocate out of hazard zone Prohibit development expansion Voluntary Acquisition Buy back then lease back Apply development controls (future dev't and re-dev't) Redesign / retrofit in current location Replace with relocatable structure Apply existing flood development controls (future dev't and re-dev't) Update Asset Register for Hazards Audit existing seawalls Assess Public Buildings for "accommodate" or "relocate" Audit Ocean Pool condition Assess Roads for "accommodate" or "relocate" Assess Cycleways for "accommodate" or "relocate" Design criteria for Stormwater Assets Design criteria for Waste water, water supply and electricity assets Develop evacuation plans Conduct Flood Study including ocean water levels Audit EECs and habitats for priority conservation Use Norfolk Island Pines in new plantings Manage Aboriginal Heritage Items Monitor erosion & inundation events "Do Nothing" (Accept Risk) Substantial risk reduction and / or highly effective in managing risk Good risk reduction and / or ~ effective in managing risk Technical feasibility of applying the ? option is questionable "Do Nothing" option is likely to have detrimental effect OR result in ٠

ncreased risk over time

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199

| 6.16.2 Coastal Inundation Risk Level | and Tre | eatment | Options | i | | | | | | Sym- | |
|--|------------|---------------|------------|--------------|---------|---|--------------|--------------|--------------|--------------|---|
| | 1 | | | r. | | | | | | N | Nourishment |
| | | | | | | | | | | S1 | Seawall - long or majority of beach |
| | Inun | dation Risk I | Level | Inu | undatio | n Risk T | reatme | nts | | S2 | Seawall - short sections |
| | | | | | | | | | | DV | Revitalise Dune Care Programs |
| North Beach | | | | Overtopping | | | | | "Do | DR1 | Manage beach sands |
| | Inundation | Inundation | Inundation | risk treated | ed | Acco | mm- | | Nothing" | PR2 | Relocate out of hazard zone |
| | hy 2010 | hy 2050 | hy 2100 | hy orogion | anr | 71000 | ato | No Regrets | (Accept | PR3 | Prohibit development expansion |
| | by 2010 | by 2050 | by 2100 | by erosion | ਜ਼ ਨੂ | - Ou | ale | | (Accept | PR4 | Voluntary Acquisition |
| | | | | option | | | | | RISK) | PR5 | Buy back then lease back |
| Parks, Beaches and open space | | | | | PR2 | FDCP | • A2 | Investigate* | DN | DCP | Apply development controls (future |
| North Beach | Low | Low | Medium | | | | | | ✓ | Δ2 | Redesign / retrofit in current |
| Fairy Lagoon | Medium | High | Extreme | | 0 | | | NR10, | | A3 | location Replace with relocatable structure |
| | | | | | | , i i i i i i i i i i i i i i i i i i i | | NR14 | | EDCP | Apply existing flood development |
| Stuart Park (Heritage listed of local significance) | Medium | Medium | High | | | ✓ | | | ✓ | FDCP | controls (future dev't and re-dev't) |
| Public open space adjacent to Pavillion, Kiosk | Low | Low | Low | | * | | | | ✓ | NR1 | Update Asset Register for Hazards |
| Live Steamers Site, Public open space | Low | Low | Medium | | | | | | \checkmark | INRZ | Audit existing seawaits |
| Community Infrastructure | | | | U. | | | | | | NR3 | "accommodate" or "relocate" |
| Puckeys Estate including Seafield House, Saltworks | _ | | | | | | | | | NR4 | Audit Ocean Pool condition |
| and gardens ruins | Low | Medium | High | ~ | | | | | | NR5 | or "relocate" |
| Lagoon Kiosk/Restaurant | Low | Medium | Medium | | | ✓ | ✓ | | ✓ | NR6 | Assess Cycleways for "accommodate" or "relocate" |
| Stuart Park toilet block | Low | Low | Low | | | \checkmark | | | \checkmark | NR7 | Design criteria for Stormwater |
| North Beach Surf Club | Medium | High 🥒 | Extreme | ✓ | | | | | | | Assets Design criteria for Waste water. |
| Heritage Site: North Beach Pavillion | Medium | High | Extreme | ✓ | | | | | | NR8 | water supply and electricity assets |
| Heritage Site: Norfolk Island Pines | Low | Low | Medium | | | | | | ✓ | NR9 | Develop evacuation plans Conduct Flood Study including |
| Cycleway / Shared Pathway (includes heritate railway | Low | Low | Medium | ✓ | | | | | √ | NR10 | ocean water levels |
| cuttings and embankments) | | LOW | Modian | | | | | | | NR11 | conservation |
| Cycleway / Shared Pathway (adjacent to Squires | Modium | Modium | High | | | 1 | | | 1 | NP12 | Use Norfolk Island Pines in new |
| Way) | Nieurum | Medium | riigii | | | • | | 111/14 | v | NIX12 | plantings |
| Water and sewage infrastructure | | | | | | | | | | NR13 NR14 | Manage Aboriginal Heritage Items Monitor erosion & inundation events |
| Stormwater outlets / pipes (at Lagoon Restuarant) | High | Extreme | Extreme | | | ✓ | ✓ | NR7, NR14 | | DN | "Do Nothing" (Accept Risk) |
| Stormwater outlets / pipes (at Lagoon entrance) | High | Extreme | Extreme | ✓ | | ✓ | | | | 11 | Substantial risk reduction and / or |
| Stormwater outlets / pipes (adjacent to Pavilion) | High | Extreme | Extreme | ✓ | | \checkmark | | | | •• | highly effective in managing risk |
| Transport Infrastructure | | | | | | | | | | ~ | effective in managing risk |
| Major roads (Pioneer Road) | Medium | High | High | | | ✓ | \checkmark | NR14 | | ? | Technical feasibility of applying the |
| Local road (beach access into Lagoon restaurant and | Low | | Medium | | | ~ | | | ~ | | "Do Nothing" option is likely to have |
| car park) | LOW | LOW | MCCIUIT | | | | | | · | • | detrimental effect OR result in increased risk over time |

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6.16.3 Assessment of Treatment Options

| Nor | h Beach | | | | | | | | | | | | | |
|-------------|---|--|----------------|--------------------|--------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|--|-------------|
| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for North Beach Beach | Conclusion |
| S2 | Construct seawall along specified alignments to protect specific assets | Current Action: NR2, detailed designs and planning approvals Trigger: Implement at replacement of crib lock wall; Implement salient section following next major storm erosion event | ~ | * | × | | | | | 7 | Yx. | S. | Two sections of seawall are proposed. One section would continue along the cycleway to the planned wall at North Beach Pavillion to past the existing SLSC site. The existing crib lock wall is unlikely to provide erosion protection (to be confirmed through NR2). It is unlikely that the crib lock wall would be permitted to fail or removed and a replacement wall is in keeping with the current character of the beach. The replacement structure will need to include measures to manage overtooping (e.g. deflection barriers, slope and permeability / roughness), given the proximity of development (kiosk, proposed SLSC). A short section of wall is proposed to act as an artificial headland at the salient formed behind the extensive reef in the surf zone (see map), north of the SLSC at Stuart Park. The seawall is aimed to retain the current alignment of the beach and salient, and Stuart Park behind. If no protection is undertaken here, it is likely that as sea level rises and there is reduced dissipation across the surfzone reef, the salient will experience higher rates of recession and erode quickly, as the salient re-aligns with adjacent shorelines. This would result in extensive erosion of Stuart Park which is likely to be highly unacceptable to the local and regional community. | Recommended |
| N | Beach nourishment | Current Action: Determine requirements in combinations with S2 (above) Trigger: following storms whenever sand reserve is below an identified storm demand seaward of seawalls. | ~ | * | × | 0 | S | | | | | | There may be a need for small scale nourishment events following storms to assist protection of the beach and adjacent assets, once S2 seawalls have been implemented. Volumes and design profiles should be prepared in combination with designs for the seawall structures. <i>Refer to Protect Options Table for further cost benefit details for N.</i> ? State Government (Grant Programs) © Council (new levies or increased rates) <i>N/A</i> Private landholders who directly benefit from option | Marginal |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ~ | x | | | | | | | | Dune care works would aim to support beach management activities, and retain windblown sands from nourishment episodes, where this is conducted. Dune care programs must be considerate of sightline requirements for SLSC activities. <i>Refer to Protect Options Table for further cost benefit details for</i> <i>DV.</i> <i>Programs</i> | Recommended |
| ВМ | Beach Sand Management (beach scraping or nature assisted beach management) | Now and continuing | ~ | ~ | x | | | | | | | | Beach management involving scraping and contouring beach sands to accumulate in dunes as storm protection aim to support dune revegetation works and nourishment or seawalls should they be implemented. <i>Refer to Protect Options Table for further cost benefit details for</i> <i>BM.</i> <i>BM.</i> <i>BM.</i> <i>BM.</i> <i>BM.</i> <i>BM.</i> <i>BM.</i> <i>BM.</i> <i>BM.</i> <i>BM.</i> <i>Council (Current Programs)</i> <i>Council (Current Programs)</i> <i>MA Private landholders who</i> <i>directly benefit from option</i> | Recommended |

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202

| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation | Capital Cost | Recurrent Costs | Environmental or | Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Potential Funding Sources (Who may) pay) Conclusion |
|-------------|--|--|----------------|--------------------|----------------------|--------------|-----------------|------------------|---------------|----------------------------|-------------------------------------|-------------------------|-----------------------|---|
| PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | × | | | | | | | | | The loss of Stuart Park through planned retreat is unlikely to be acceptable given the high cultural and community values of the park. The Park is also part of extensive works completed in the area through the Blue Mile Masterplan. This option is suitable to retain the beach through natural retreat at Puckeys Estate and Fairy Lagoon sections of the beach. <i>Refer to Planned Retreat Options Table for further cost benefit</i> details for <i>PR1</i> . |
| PR2 | Relocate SLSC and kiosk structures and Seafield House (?) outside of hazard zone | Current Action: NR3, DCP Trigger: At scheduled time for asset maintenance OR when ZRFC measured from erosion escarpment encroaches onto building foundations, whichever is sooner | ~ | v | × | | | | | | | | | Plans to redevelop North Beach SLSC are already underway, however the proposed site remains within the erosion and recession risk area. The next scheduled refurbishment should consider the need to relocate the structure again, particularly if a seawall is not installed (see S2). Relocation of the heritage klosk structure may be required shouls a seawall not be implemented. Further investigations would be needed to determine if this is possible in a manner which preserves the heritage character. It is unlikely that the ruins of Seafield House should or can be moved from their current location. Refer to Planned Retreat Options Table for further cost benefit details for PR2. |
| PR2 | Relocate stormwater assets landward of hazard zone | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe | ~ | ~ | × | | | | | | | R | | The stormwater outlet adjacent to Fairy Lagoon will need to be moved landward over time. Stormwater assets at North Beach Pavillion will also need to be progressively removed should seawall S2 option not be implemented at this location. Refer to Planned Retreat Options Table for further cost benefit details for PR2. |
| PR2 | Relocate cycleway outside of hazard zone | Current Action: NR6 Trigger: When ZRFC measured from erosion escarpment encroaches cycleway | ~ | v | × | | | 8 | | l | | | | The cycleway sections between North Beach and Wollongong Harbour may need to be relocated or raised (see A2), if a seawall is not installed next to the Pavillion. The original rail embankment heritage features would not be able to relocated with the path. <i>Refer to Planned Retreat Options Table for further cost benefit</i> <i>details for PR2.</i> ? State Government (Grant Programs) © Council (Current Programs, new levies or increased rates?) <i>N/A</i> Private landholders who directly benefit from option |
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | ~ | ~ | x | | | | | | | | | Coastal DCP controls should apply to any proposed redevelopment of existing assets (SLSC, Kiosk, Pavillion, cycleway) in addition to other options, including seawall options, to improve resilience of future structures to coastal risks. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for DCP.</i> ? State Government (Grant programs) |
| A2 | Redesign or retrofit cycleway in current location to withstand impacts. | Current Action: NR6 Trigger: When ZRFC measured from erosion escarpment encroaches cycleway | ~ | ~ | × | | | | | | | | | If a seawall is not implemented, there may be scope to progressively raise the cycleway to withstand impacts. However, this is likely to require some form of revetment. It may provide a more robust outcome to formally implement a seawall (S2) instead. Accommodating impacts to the cycleway additionally allows continued access to heritage rail embankment workings. <i>N/A</i> Private landholders who directly benefit from option details for <i>A</i> ₂ . |

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203

| Sym bol | - Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Ontion | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community | Acceptability Reversible / Adaptable | in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for DCP Beach Sources (Who may Sources (Who may | Conclusion |
|------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|-----------|---|-----------|-------------------------|-----------------------|--|-----------------|
| A2 | Redesign or retrofit kiosk structure and Lagoon Kiosk in current location to withstand impacts. | Current Action: NR3 Trigger: At scheduled time for asset maintenance OR when ZRFC measured from erosion escarpment encroaches onto building foundations, whichever is sooner | ~ | ~ | * | | | | | | | | | The Kiosk structure could be retrofit during asset maintenance to better withstand erosion or overtopping impacts. If a seawall is built, there will still be a need for some actions (presumably less extensive), as the seawall may not feasibly mitigate all overtopping impacts. Should a seawall not be built, retrofit of the Kiosk may be an alternative to relocating the structure, providing there is adequate foundation capacity at the current site. ? State Government (Grant Programs) The Lagoon Kiosk Restaurant should be retrofit to manage inundation impacts from Fairy Lagoon. A Flood Study for Fairy Lagoon should be conducted to better define flood levels at this location (NR10). N/A Private landholders who directly benefit from option Refer to Accommodate Options Table for further cost benefit details for A2. Programs | Recommended |
| A2 | Redesign or retrofit stormwater structures in current location to withstand impacts. | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe <u>OR</u> when asset replacement is required, whichever is sooner; | ~ | ~ | ~ | | | | | | Υ, | ð | 3 | Stormwater assets may be increasingly impacted by inundation with sea level rise (this includes increased frequency of inundation events from storms). Accommodating inundation will need consideration for stormwater assets at North Beach Pavillion, regardless of installation of a seawall. At Fairy Lagoon entrance, depending upon the timeframe of erosion impacts, further upgrades for inundation may or may not be required. The remaining stormwater structures (e.g. Lagoon Kiosk Restaurant, Squires Way) are not affected by erosion but will require upgrade to manage inundation. Designs will depend on outcomes of NR7. Refer to Accommodate Options Table for further cost benefit details for A2. | Recommended |
| FDCF | Update DCP Chapter E13 – Floodplain Management to include areas affected by Coastal Inundation as Low Risk Flood Precincts, and implement DCP to manage inundation impacts as properties are redeveloped and assets replaced. | As property / assets redeveloped, new developments built | × | × | ~ | <u></u> | | P | | | | | | The existing Flood DCP chapter shall be applied to assets (e.g. Lagoon Kiosk) at risk from coastal inundation at the "low risk" level, until a Fairy Lagoon Flood Study is completed (refer NR10). <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for FDCP</i> . | Recommended |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | N/A | N/A | | | | | | | | | Given the number of socially and economically important assets at North Beach, 'do nothing' is not an acceptable option. <i>Refer to "Do Nothing" Option Table for further cost benefit details.</i> Ø Private landholders in Future Generations | Not Recommended |
| NR | NR1, NR2, NR3, NR6, NR7, NR10, NR11, NR12, NR13, NR14 | Now | ~ | ~ | ~ | | | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. ? State Government (Grant Programs) Image: Council (Current Programs) Image: Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |

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6.17 Wollongong Harbour Belmore Basin

6.17.1 Erosion and Recession Risk Level and Treatment Options

There is an existing Coastal Zone Management Plan for Wollongong Harbour and Belmore Basin. Actions such as replacement of the seawall at Belmore Basin which shall protect from erosion has already been constructed, and other improvement works in association with the Blue Mile Masterplan have also commenced.

A complete risk assessment was not possible at this location as hazards have not been mapped at this location. It is considered that existing actions has mitigated the immediate erosion hazard in this location.

The existing seawall will require upgrade again in the future to mitigate sea level rise impacts. There will be loss of a sandy beach in this location over the long term, particularly as large scale nourishment is currently not a feasible option at this time.

6.17.2 Coastal Inundation Risk Level and Treatment Options

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The harbour is a state significant heritage precinct with a number of important features. Permanent inundation and enhanced wave overtopping with sea level rise are likely to impact upon assets in this area. Suitable options to manage the heritage items, for example "burial" with seawater or alternatively, raising the heritage assets, should be investigated at the present time, such as through Option NR13. Immediate action to manage the assets is not required, however Option NR13 would provide a plan for impacts as they manifest in the future.

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6.18 City Beach

6.18.1 Erosion and Recession Risk Level and Treatment Options

| | | | | | | | | | | | | | | | | | | | DV | Revitalise Dune Care Programs |
|---|------------|-----------|-----------|---|----|--------|------------------------|----|-----------|------------------------|---------|---------|--------|-----------------------|--|---|--------------|---------------|--------------|---|
| City Booch | Erosio | n and Red | cession | | | | | Er | ocion | / Poc | occion | Dick | Trootr | monte | | | | | BM PR1 | Manage beach sands |
| City Deach | | Risk Leve | | | | | | | 051011 | / Neu | 6221011 | 1 1/151 | neau | TIEITIS | | | | | PR2 | Relocate out of hazard zone |
| (extending to northern boundary of golf | Erosion | Erosion | Erosion | | | - | | | | | | | | | | | | "Do Nothina" | PR3 | Prohibit development expansion |
| course) | by 2010 | by 2050 | by 2100 | | | Protec | t | | | Plani | ned Re | etreat | | Acc | ommo | odate | No Regrets | (Accept Risk) | PR4 | Voluntary Acquisition |
| Parks, Beaches and open space | | ., | ., | N | S1 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCP | A2 | A3 | Investigate* | DN | PR5 | Buy back then lease back |
| City Beach | High | Extreme | Extreme | | | | <i>√√</i> | | √√ | | | | | X | | | NR14 | | DCP | Apply development controls (future dev't and re-dev't) |
| Open space, parks including City Beach Foreshore | Medium | Medium | High | | | | ~~ | | ~~ | | | | | | | | | | A2 | Redesign / retrofit in current location |
| Football Ground (WIN Stadium) and Showground | High | Extreme | Extreme | ~ | | | ~~ | ~~ | | ~ | | | S | ~~ | | | NR14 | | A3 FDCP | Replace with relocatable structure Apply existing flood development |
| Coastal Dune Systems | High | Extreme | Extreme | | | | $\checkmark\checkmark$ | | V | | | | | | | | | | ND1 | controls (future devt and re-devt) |
| Community Infrastructure | - i i gi i | | | | | | | | | | | | | | | | | | NR2 | Audit existing seawalls |
| Cycleway / Shared Pathway | Medium | High | Extreme | | | | | | | $\checkmark\checkmark$ | | | | ✓ | | | NR6 NR14 | | ND2 | Assess Public Buildings for |
| Transport Infrastructure | moarann | 1 light | Entronino | | | | | | | C | | | | | | | | | INRO | "accommodate" or "relocate" |
| Local Roads: Beach access car parks | Low | Low | Medium | | | | | | 15 | | | | | | | | | 1 | NR4 | Audit Ocean Pool condition |
| Local Roads. Deach access cal parks | LOW | LOW | Medium | | I | | | | | <u> </u> | | | | I | | I | | <u> </u> | NR5 | Assess Roads for "accommodate" or "relocate" |
| | | | | | | | | | | | | | | | NR6 | Assess Cycleways for "accommodate" or "relocate" | | | | |
| NR | | | | | | | | | | | | | | NR7 | Design criteria for Stormwater Assets | | | | | |
| | | | | | | | | • | | | | | | | | | | | NR8 | Design criteria for Waste water, water supply and electricity assets |
| | | | | | | | | | | | | | | | | | | | NR9 | Develop evacuation plans |
| | | | | | | V | | | | | | | | | | | | | NR10 | Conduct Flood Study including ocean water levels |
| | | | | 5 | | | | | | | | | | | | | | | NR11 | Audit EECs and habitats for priority conservation |
| | | | .0 | | • | | | | | | | | | | | | | | NR12 | Use Norfolk Island Pines in new plantings |
| | | • | | | | | | | | | | | | | | | | | NR13 | Manage Aboriginal Heritage Items |
| | | | | | | | | | | | | | | | | | | | NR14 | Monitor erosion & inundation events |
| | | | • | | | | | | | | | | | | | | | | DN | "Do Nothing" (Accept Risk) |
| | | | | | | | | | | | | | | | | | | | ~~ | Substantial risk reduction and / or |
| | | | | | | | | | | | | | | | | | | | | Good risk reduction and / or |
| | | | | | | | | | | | | | | | | | | | \checkmark | effective in managing risk |
| | | | | | | | | | | | | | | | | | | | 2 | Technical feasibility of applying the |
| | | | | | | | | | | | | | | | | | | | · · | option is questionable |
| | | | | | | | | | | | | | | | | | | | • | detrimental effect OR result in |
| | | | | | | | | | | | | | | | | | | | | increased risk over time |

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S1

S2

Nourishment

Seawall - long or majority of beach

Seawall - short sections



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209

| 6.18.2 Coastal Inundation Risk Leve | l and Tre | eatment | Options | | | | | | | Sym- bol | | | |
|---|------------|-------------|------------|-----------------------|----------|-----------|--------|--------------|--------------------|-------------|--|--|--|
| | | | | | | | | | | N | Nourishment | | |
| | | | | | | | | | | S1 | Seawall - long or majority of beach | | |
| | Inun | dation Risk | level | In | undation | n Risk Tr | reatme | onts | | S2 | Seawall - short sections | | |
| | l | | 20101 | | andation | | ocurio | | | DV | Revitalise Dune Care Programs | | |
| City Beach | | | | | | | | | | BM | Manage beach sands | | |
| | | | | Overtopping | ਰ ਦ | | | | "Do | PR1 | Accept loss as sacrificial | | |
| (extending to northern boundary of golf course) | Inundation | Inundation | Inundation | risk treated | ne ea | Acco | mm- | | Nothina" | PR2 | Relocate out of hazard zone | | |
| | by 2010 | by 2050 | by 2100 | by erosion | eti | oda | ate | No Regrets | (Accept | PR3 | Prohibit development expansion | | |
| | 59 2010 | 5, 2000 | 59 2100 | ontion | 교 | 0.00 | | | (7 tooopt Biok) | PR5 | Buy back then lease back | | |
| | | | | option | | 1 | | | RISK) | | Apply development controls (future | | |
| Parks, Beaches and open space | | | | | PR2 | FDCP | A2 | Investigate* | DN | DCP | dev't and re-dev't) | | |
| City Beach | Low | Low | Medium | | | | | | ✓ ✓ | A2 | Redesign / retrofit in current | | |
| Open space, parks including City Beach Foreshore | Low | Low | Medium | | | • | | | ✓ | A3 | Replace with relocatable structure | | |
| Football Ground (WIN Stadium) and Showground | Medium | Medium | High | ✓ | | | | | | FDCP | Apply existing flood development controls (future dev/t and re-dev/t) | | |
| Coastal Dune Systems | Low | Low | Medium | | | | | | ✓ | NR1 | Update Asset Register for Hazards | | |
| Community Infrastructure | | | | XV | | | | | | NR2 | Audit existing seawalls | | |
| Cycleway / Shared Pathway | Medium | Medium | High | | | | | | | NR3 | Assess Public Buildings for "accommodate" or "relocate" | | |
| Transport Infrastructure | | | | | | | | | | NR4 | Audit Ocean Pool condition | | |
| Local Roads: Beach access car parks | Low | Low | Low | | | | | | ✓ | NR5 | Assess Roads for "accommodate" or "relocate" | | |
| Commercial and Industrial Development | | | | | | | | | | NR6 | Assess Cycleways for | | |
| NB: Nuns Pools and Ladies Pool at rock platform off | | | V. | | | | | | , | | "accommodate" or "relocate" Design criteria for Stormwater | | |
| Flagstafff Hill | Low | Low | Low | | | | | | ~ | NR7 | Assets | | |
| | | 0 | • | • | | | | • | | NR8 | Design criteria for Waste water, | | |
| | | | | | | | | | | NR9 | Develop evacuation plans | | |
| | | | | | | | | | | | Conduct Flood Study including | | |
| | C | | | | | | | | | NR10 | ocean water levels | | |
| | <u> </u> | | | | | | | | | NR11 | Audit EECs and habitats for priority | | |
| | | • | | | | | | | | | conservation | | |
| | | | | | | | | | | NR12 | plantings | | |
| | | | | | | | | | | NR13 | Manage Aboriginal Heritage Items | | |
| | | | | | | | | | | NR14 | Monitor erosion & inundation events | | |
| | | | | | | | | | | DN | "Do Nothing" (Accept Risk) | | |
| | | | | | | | | | | ~~ | Substantial risk reduction and / or | | |
| | | | | | | | | | | | Good risk reduction and / or | | |
| | | | | | | | | | | ✓ | effective in managing risk | | |
| | 2 | | | | | | | | | | | | |
| | | | | | | | | | | · · | option is questionable | | |
| | | | | | | | | | | • | detrimental effect OR result in | | |
| | | | | | | | | | | | increased risk over time | | |





Immediate Inundation Risk Levels and Treatment Options Wollongong City Beach

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map. 0 125 250m Approx. Scale



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6.18.3 Assessment of Treatment Options

| City | / | | | | | | | | | | | | | | |
|------------|---|--|----------------|--------------------|----------------------|--------------|-----------------|------------------|---------------|----------------------------|-------------------------------------|-------------------------|-----------------------|--|-------------|
| Sym bol | - Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation | Capital Cost | Recurrent Costs | Environmental or | Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for City Beach Sources (Who may) | Conclusion |
| N | Beach nourishment | Immediately and whenever sand reserve is below the identified storm demand seaward of development being protected (following storms) | ~ | v | × | | | | | | | | | This would involve a targeted nourishment program specifically for protection of the WIN Stadium. Siting and design for the program are thus aimed at a smaller scale, and should be done in combination with dune vegetation programs to build up dune storage in front of the stadium. Placement of sand should consider the typical net northward sediment transport, for example, placing part of the nourishment slightly south of the site. Dunes from the WIN Stadium to the south are limited, requiring work (see Coniston Beach). Refer to Protect Options Table for further cost benefit details for N. | Marginal |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ~ | × | | | | | | 2, | | 0 | Particularly from the Stadium toward the south, dune vegetation, width and height are limited. Further north, the programs have had excellent success, and should be continued (with consideration of sightline requirements for SLSC activities). The program should progress southwards from the Stadium, to take advantage of the typical northward transport of sediment. <i>Refer to Protect Options Table for further cost benefit details for</i> <i>DV.</i> Private landholders who directly benefit from option | Recommended |
| вм | Beach Sand Management (beach scraping or nature assisted beach management) | Now and continuing | ~ | ~ | × | | | 1 | | • | | | | This option would aim to support dune restoration activities from the Stadium south. This involves scraping and contouring beach sands (in combination with dune revegetation) to increase sand volumes held in dune storage for storm protection. <i>Refer to Protect Options Table for further cost benefit details for BM.</i> ? State Government (Grant Programs) ? Private landholders who directly benefit from option | Recommended |
| PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | | x | 0 | | | | | | | | The extensive dunes at the northern end of the beach support this as an excellent option for retaining the beach, by utilising dunes and reserve lands to enable natural retreat of the beach. <i>Refer to Planned Retreat Options Table for further cost benefit details for PR1.</i> ? State Government (Grant Programs) | Recommended |



212

| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for BM Beach Specific Cost Benefit Considerations for BM Beach Cho m as O d C d Day C d D d D d D d D d D d D d D d D d D d D | Conclusion |
|-------------|--|---|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|--|-----------------|
| PR2 | Relocate cycleway outside of hazard zone | Current Action: NR6 Trigger: When ZRFC measured from erosion escarpment encroaches cycleway | ~ | ~ | × | | | | | | | | ? State Government (Grant The cycleway could feasibly be relocated along the street landward of WIN Stadium to rejoin the existing cycleway at Wollongong Golf Course, in the future when erosion impacts manifest. Refer to Planned Retreat Options Table for further cost benefit details for PR2. | Recommended |
| PR2 | Relocate stadium parking and ancillary buildings and minor football ground outside of hazard zone | Trigger: When erosion escarpment encroaches on the assets. | ~ | ~ | x | | | | | | | | ? State Government (Grant There is potential to reconfigure the football ground landward to avoid hazards impacts, likewise, the actual WIN Stadium is currently at very low risk but parking and other small buildings adjacent would need to be relocated. Refer to Planned Retreat Options Table for further cost benefit details for PR2. ? State Government (Grant Programs) ? Council (new levies or increased rates) b Private landholders who directly benefit from option (personal investment or directed by Council) | Recommended |
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | ~ | ~ | x | | | | | × × | X, | 2 | This option shall apply planning controls to re-development of the Stadium and associated grounds to minimise future risk from hazards. ? State Government (Grant programs) Refer to Accommodate Options Table for further cost benefit details for DCP. ☑ Council (Current Programs) | Recommended |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | N/A | A N/A | | | 2 | | | | | For inundation the "do nothing" option is acceptable as risk is generally low. Likewise for managing erosion, however impacts at the Stadium site would not be accepted by community, in which case "do nothing" is not tenable. <i>Refer to "Do Nothing" Option Table for further cost benefit details.</i> ? State Government I Council (new levies and increased rates) I Private landholders in Future Generations | Not Recommended |
| NR | NR1, NR3, NR5, NR7, NR9, NR10, NR11, NR13, NR14 | Now | ~ | | ~ | 0 | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. ? State Government (Grant Programs) Image: Council (Current Programs) Image: Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |


6.19 Coniston Beach

6.19.1 Erosion and Recession Risk Level and Treatment Options

| | | | | | | | | • | | | | | | | | | | DV | Revitalise Dune Car | e Programs |
|--|---|------------|-----------|--------------|--------|--------------|---------------------|--------------|------------------------|------------|---------|----------|--------|------|-------|-------------------|---------------------|----------------|---------------------------------|--------------------|
| | Erosio | n and Rec | ession | | | | | _ | | | | | | | | | | BM | Manage beach sand | ls |
| | | Risk Level | | | | | | Eros | sion / | Recession | on Risi | Ireatr | nents | | | | | PRI | Accept loss as sacri | |
| Coniston Beach | Erosion | Erosion | Erosion | | | | | | | | | | | | | | "Do Nothing" | PR2 | Prohibit dovelopment | t ovpansion |
| | by 2010 | by 2050 | L1031011 | | Р | rotect | | | | Planned I | Retrea | t | Acco | ommo | odate | No Regrets | (Accept Risk) | PR4 | Voluntary Acquisitio | n |
| Parka, Passhas and onen anges | by 2010 | by 2000 | by 2100 | N | C1 | 62 F | w/ | | | | | DDE | | 42 | 12 | Investigate* | | PR5 | Buy back then lease | e back |
| Parks, Beaches and open space | | _ | | IN | 51 | 52 L | | | PRI | PRZ PR | 5 PR4 | PRO | DCP | AZ | AS | Investigate | DN | | Apply development of | controls (future |
| Coniston Beach | High | Extreme | Extreme | | | ~ | ✓ · | √ √ · | $\checkmark\checkmark$ | | | | | * | | NR14 | | DCF | dev't and re-dev't) | |
| Wollongong Golf Course ** for inundation, | | | | | | | | | | | | | | | | | | A2 | Redesign / retrofit in | i current |
| this is only a very small section at far south | Medium | Medium | High | | | ✓ | ✓] · | ~ | ~~ | | | | | | | | | 43 | Boplace with release | table etructure |
| end. | | | | | | | | | | | | | · . | | | | | | Apply existing flood | development |
| Coastal Dune Systems | High | Extreme | Extreme | | | \checkmark | ✓ | √√ | $\checkmark\checkmark$ | | | | | | | | | FDCF | controls (future dev/ | t and re-dev/t) |
| | | | | | | | | | | • | $(\)$ | | | | | | | NR1 | Update Asset Regist | er for Hazards |
| | | | | | | | | | | | | | | | | | | NR2 | Audit existing seawa | ills |
| | | | | | | | | | | | | | | | | | | NR3 | Assess Public Buildi | ings for |
| | | | | _ | | _ | _ | | _ | () | | | | | | | | | "accommodate" or " | relocate" |
| 6.19.1 Coastal Inundation | 7.1 Coastal Inundation Risk Level and Treatment Options | | | | | | | | | | | | | | | INR4 | Audit Ocean Pool co | <u>ndition</u> | | |
| | | | | | | | | | | | | | | | | NR5 | or "relocate" | ccommodate | | |
| | | | | | | | | | | | | | | | | | Assess Cycleways f | or | | |
| | | | | Inun | dation | n Rick | | al | | | Inu | ndatio | n Ric | k Tr | aatma | onte | | INRO | "accommodate" or " | relocate" |
| | | | | mun | uauoi | INSK | Levi | | | | mu | nualiu | 111/13 | | | 51115 | | NR7 | Design criteria for S Assets | tormwater |
| Coniston Beac | h | | | | | / | | | | | oina | | | | | | "Do | NR8 | Design criteria for V | Vaste water, |
| | • | | ام من بما | - t ' | | | 1 | ند ما م د | | wiels tree | on ig | ed at | | ~~~ | ~~ | | N la their aril | NDO | water supply and ele | ectricity assets |
| | | | Inunda | ation | Inun | dation | Inu | Indat | ion | risk trea | ated | ft B | | | | No Rearet | s | INING | Conduct Flood Stud | v including |
| | | | by 20 | 010 | by | 2050 | by | y 210 | 00 | by eros | ion | Re | | oda | ite | j. ie i ie gi e i | (Accept | NR10 |) ocean water levels | , monaanig |
| | | | | | | | | | | optio | n | ш. | | | | | Risk) | NP11 | Audit EECs and hab | itats for priority |
| Parks, Beaches and open space | | | • | | • | | | | | | | PR2 | FD | CP | A2 | Investigate | e* DN | | conservation | |
| Conjeten Boach | | | | | | 0.11 | B./ | lodiuu | - | | | | | •• | | lineeugene | | NR12 | 2 Use Norfolk Island P | ines in new |
| Conision Beach | | | LO | vv | | .OW | IV | lealui | m | | | | | | | | • | NR13 | 3 Manage Aboriginal I | Heritage Items |
| Wollongong Golf Course ** for inund | lation, th | is is only | Medi | um | Mo | dium | | High | | 1 | | | | | | | 1 | NR14 | 4 Monitor erosion & in | undation events |
| a very small section at far south end. | | | IVIEU | um | IVIE | ululli | | riign | | • | | | | | | | • | DN | "Do Nothing" (Accep | pt Risk) |
| Coastal Dune Systems | | | Lov | W | Ŀ | .OW | M | lediu | m | | | | | | | | \checkmark | | Substantial risk red | luction and / o |
| | | | | | | | | | | | | | | | | | | ~~ | highly effective in m | anaging risk |
| | | | | | | | | | | | | | | | | | | | Good risk reduction | and / or |
| | | | | | | | | | | | | | | | | | | • | effective in managin | g risk |
| | | | | | | | | | | | | | | | | | | ? | Technical feasibility | of applying the |
| | | | | | | | | | | | | | | | | | | | "Do Nothing" option | ie likely to have |
| | | | | | | | | | | | | | | | | | | • | detrimental effect O | R result in |
| | | | | | | | | | | | | | | | | | | | increased risk over | time |



Sym-

bol

S1

N Nourishment

S2 Seawall - short sections

Seawall - long or majority of beach



Immediate Erosion Risk Levels and Treatment Options Coniston Beach (north)

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Immediate Erosion Risk Levels and Treatment Coniston Beach (south)

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map. 0 75 150m Approx. Scale



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Filepath: K:\N1965_WollongongCZMP\MapInfo\Workspaces\DRG_123_1104129 Drawing 6-53.WOR

6.19.2 Assessment of Treatment Options

| Cor | niston | | | | | | | | | | | | | | | |
|------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|---|-----------------------|---|---|-------------|
| Sym bol | - Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | | Legal / Approval Risk | Specific Cost Benefit Considerations for Coniston Beach | Potential Funding Sources (Who may pay) | Conclusion |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ~ | × | | | | | | | | 1 | This is a priorty for the beach from WIN Stadium toward the south, as dune vegetation, width and height are limited. The program should progress southwards from the WIN Stadium, to take advantage of the typical northward transport of sediment. Enhanced dune vegetation will also improve protection from wave overtopping which poses a risk along Wollongong Golf Course boundary. <i>Refer to Protect Options Table for further cost benefit details for</i> <i>DV</i> . | ? State Government (Grant Programs) ☑ Council (Current Programs) ? Private landholders who directly benefit from option | Recommended |
| вм | Beach Sand Management (beach scraping or nature assisted beach management) | Now and continuing | ~ | ~ | × | | | | 2 | × | X, | 3 | C | This option would aim to support dune restoration activities from WIN Stadium south. This involves scraping and contouring beach sands (in combination with dune revegetation) to increase sand volumes held in dune storage for storm protection. Refer to Protect Options Table for further cost benefit details for BM. | ? State Government (Grant Programs) ☑ Council (Current Programs) ? Private landholders who directly benefit from option | Recommended |
| PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | × | | (| | | | | | | This is an excellent option for retaining the beach. The golf course will remain a viable land use even if after erosion iimpacts. Dune vegetation works aim to slow the progression of erosion, at least over the short term. Refer to Planned Retreat Options Table for further cost benefit details for PR1. | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | ~ | ~ | × | | | | | | | | | Coastal DCP development controls shally be applied to Wollongong Golf Course lands, in the case of redevelopments on the site. Refer to Accommodate Options Table for further cost benefit details for DCP. | ? State Government (Grant programs) ☑ Council (Current Programs) - cost to prepare DCP and implement for public assets ☑ Private landholders - cost to implement DCP | Recommended |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | N/A | A N/A | | | | | | | | | This is largely an acceptable option with major assets typically at low risk at present. This option is not reversible in the future for development or land that is lost to erosion. Refer to "Do Nothing" Option Table for further cost benefit details. | ? State Government ☑ Council (new levies and increased rates) ☑ Private landholders in Future Generations | Marginal |



219

6.20 Perkins Beach

6.20.1 Erosion and Recession Risk Level and Treatment Options

| | I | | | | | | | | | | | | | | | | | BM | Manage be |
|---|---------|-----------|---------|---|----|------------------------|------------------------|----|------------------------|-------|--------|--------|--------|------------------------|-----------|---------------|---------------|-------|--------------------------|
| | Erosio | n and Red | cession | | | | | Er | osion | / Rec | essior | n Risk | Treatr | nents | | | | PR1 | Accept los |
| Perkins Beach | | Risk Leve | | | | | | | | , | 000.0. | | | | | | | PR2 | Relocate o |
| | Erosion | Erosion | Erosion | | | Drotor | | | | Diam | | otroot | | A a a | o mana da | | "Do Nothing" | PR3 | Prohibit de |
| | by 2010 | by 2050 | by 2100 | | | Protec | CT . | | | Plani | nea Re | etreat | | ACC | ommoda | te No Regrets | (Accept Risk) | PR4 | Voluntary |
| Parks, Beaches and open space | | | | Ν | S1 | S2 | DV | BM | PR1 | PR2 | PR3 | PR4 | PR5 | DCP | A2 / | 3 Investigate | DN | PR5 | Buy back |
| Fishermans Beach & MM Beach | High | Extreme | Extreme | | | | $\checkmark\checkmark$ | | √ √ | | | | | X | | NR14 | | DCP | Apply deve |
| Heritage listed: Hill 60 Nature Reserve | Low | Medium | Medium | | | | | | V V | | | | | | | | ✓ | | Redesign / |
| Port Kembla - Perkins Beach - Windang | | | | | | | | | | | | | | | | | | AZ | location |
| Beach | High | Extreme | Extreme | | | | $\checkmark\checkmark$ | | $\checkmark\checkmark$ | | | | | | | NR14 | | A3 | Replace w |
| Coastal Dune Systems: Pork Kembla | L PL | E. ta | E da a | | | | | | | | | | | | | | | FDCP | Apply exist |
| Beach, Perkins Beach Reserve | High | Extreme | Extreme | | | | ~ ~ | | ~~ | | | | × | | | | | NR1 | Update As |
| Griffith Street Reserve, Port Kembla Beach | | | | | | | | | | | | | | | | | | NR2 | Audit exist |
| Reserve, Windang Beach Reserve, Public | Low | Medium | Medium | | | | | | $\checkmark\checkmark$ | C | | | | | | | ✓ | NR3 | Assess Pu |
| Open Space | | | | | | | | | | |) - | | | | | | | 14140 | "accommo |
| Community Infrastructure | | | | | | | | | | | | | | | | | | NR4 | Audit Ocea |
| Part Kamble Olympia Daal | Lliab | Extreme | Estromo | | | | | | K | | | | | | | NR4, NR2, | | NR5 | Assess Ro or "relocat |
| Port Kembia Olympic Pool | Fign | Extreme | Extreme | | | ** | | | | v | | | | v | | NR14 | | | Assess Cy |
| Port Kembla Pool - | Lliab | Extreme | Extramo | | | | | X | | | | | | | | | | INKO | "accommo |
| Amenities/Kiosk/Lifeguard Tower | Fign | Extreme | Extreme | | | l v v | | K | | v | | | | v | | INRZ | | NR7 | Design cri |
| Windang Surf Club | Low | Low | Low | | | | | | | | | | | $\checkmark\checkmark$ | | | | ⊢ | Assets |
| Windang Beach Dressing rooms / toilets | Low | Low | Low | | | | | | | | | | | $\checkmark\checkmark$ | | | | NR8 | water supp |
| Transport Infrastructure | | | | | | | | | | | | | | | | | | NR9 | Develop ev |
| Lake Illawarra Training Walls | High | Extreme | Extreme | | | V | | | | | | | | | ✓ | NR14 | | NR10 | Conduct F |
| Water and sewage infrastructure | | | | | | | | | | | | | | | | | | 1 | Audit EEC |
| Stormwater outlets & pipes (one adjacent to | | | | | | | | | | | | | | | | NR7, NR2 | | NR11 | conservati |
| Port Kembla Pool) | High | Extreme | Extreme | | × | $\checkmark\checkmark$ | | | | ~ | | | | ~ | | NR14 | | | Use Norfol |
| | | | |) | | | | | | | | | | | | | | | plantings |
| | | | | | | | | | | | | | | | | | | NR13 | Manage A |
| | | | | | | | | | | | | | | | | | | NR14 | Monitor er |
| | | | • | | | | | | | | | | | | | | | DN | "Do Nothin |
| | | | | | | | | | | | | | | | | | | | Substantia |
| | | | | | | | | | | | | | | | | | | ~~ | highly effe |
| | | | | | | | | | | | | | | | | | | 1 | Good risk |
| | | | | | | | | | | | | | | | | | | | effective in |
| | | | | | | | | | | | | | | | | | | 2 | Technical |
| | | | | | | | | | | | | | | | | | | 1 . | loption is a |

S1 Seawall - long or majority of beach S2 Seawall - short sections DV Revitalise Dune Care Programs each sands ss as sacrificial out of hazard zone evelopment expansion Acquisition then lease back elopment controls (future re-dev't) retrofit in current with relocatable structure sting flood development uture dev't and re-dev't) set Register for Hazards ting seawalls ublic Buildings for odate" or "relocate" an Pool condition bads for "accommodate" te" ycleways for odate" or "relocate" iteria for Stormwater iteria for Waste water. ply and electricity assets vacuation plans Flood Study including ter levels cs and habitats for priority ion lk Island Pines in new boriginal Heritage Items osion & inundation events ng" (Accept Risk) I risk reduction and / or ective in managing risk reduction and / or n managing risk feasibility of applying the uestionable "Do Nothing" option is likely to have ٠ detrimental effect OR result in increased risk over time

Sym-

bol N

Nourishment

C:USERSLWATKINS\APPDATALOCAL\HEWLETT-PACKARD\HP TRIM\TEMP\HPTRIM.7124\Z16 242661 ESP - PROJECT MANAGEMENT - WITH TRACK CHANGES.DOCX







222

| 6.20.2 Coastal Inundation Risk Leve | l and Tre | eatment | Options | | | | | | | Sym- | |
|---|------------|-------------|------------|--------------|------------|-----------|--------------|--------------|--------------|--------------|---|
| | | | opnone | | | | | | | N | Nourishment |
| | | | | | | | | | | S1 | Seawall - long or majority of beach |
| | louo | dation Dick | | In | undation | Dick Tr | ootmo | nto | | S2 | Seawall - short sections |
| | mun | | Level | | unualioi | I RISK II | eaune | 1115 | | DV | Revitalise Dune Care Programs |
| | | 1 | | | | r | | | | BM DB1 | Manage beach sands |
| Perkins Beach | | | | Overtopping | ਸ਼ ਕ | | | | "Do | PR1 PR2 | Relocate out of bazard zone |
| | Inundation | Inundation | Inundation | risk treated | nne Tre | Acco | mm- | No Pograte | Nothing" | PR3 | Prohibit development expansion |
| | by 2010 | by 2050 | by 2100 | by erosion | lar Ret | oda | ate | NO Negreis | (Accept | PR4 | Voluntary Acquisition |
| | | | | option | ш — | | | | Risk) | PR5 | Buy back then lease back |
| Parks, Beaches and open space | | | | | PR2 | FDCP | A2 | Investigate* | DN | DCP | Apply development controls (future dev/t and re-dev/t) |
| Fishermans Beach & MM Beach | Low | Low | Medium | | | | | <u> </u> | ✓ | A2 | Redesign / retrofit in current |
| Heritage listed: Hill 60 Nature Reserve | Low | Low | Medium | | | | | | ✓ | A3 | Replace with relocatable structure |
| Port Kembla - Perkins Beach - Windang Beach | Low | Low | Medium | | | | | | ✓ | FDCP | Apply existing flood development |
| Coastal Duna Systems: Park Kambla Boach, Parkins | Low | Low | moarann | | | | | | - | 1 DCI | controls (future dev/t and re-dev/t) |
| Reach Reactive | Low | Low | Medium | | • | | | | \checkmark | NR1 NR2 | Update Asset Register for Hazards |
| Deach Reserve | | | | | | | | | | | Assess Public Buildings for |
| Griffith Street Reserve, Port Kembla Beach Reserve, | Low | Low | Medium | | | | | | \checkmark | INR3 | "accommodate" or "relocate" |
| Windang Beach Reserve, Public Open Space | | | | | | | | | | NR4 | Audit Ocean Pool condition |
| Community Infrastructure | | | X. | | | | | | | NR5 | or "relocate" |
| Port Kembla Olympic Pool | Medium | Medium | High | \checkmark | | | | | | NR6 | Assess Cycleways for |
| Port Kembla Pool - Amenities/Kiosk/Lifeguard Tower | Medium | Medium | High | ✓ | | | | | | | "accommodate" or "relocate" |
| Windang Surf Club | Medium | Medium | High | ✓ | | | \checkmark | | | NR7 | Assets |
| Windang Beach Dressing rooms / toilets | Low | Low | Low | ✓ | | | | | \checkmark | NR8 | water supply and electricity assets |
| Transport Infrastructure | | | | | | | | | | NR9 | Develop evacuation plans |
| Local Roads | Low | Medium | Medium | | | | | | \checkmark | NR10 | conduct Flood Study including |
| Lake Illawarra Training Walls | Low | Low | Medium | | | | | | \checkmark | NR11 | Audit EECs and habitats for priority conservation |
| Water and sewage infrastructure | | | | | | | | | | NP12 | Use Norfolk Island Pines in new |
| Stormwater outlets & pipes (one adjacent to Port | X | F (| F (| 1 | | | | | | ND10 | plantings |
| Kembla Pool) | High | Extreme | Extreme | ~ | | | | | | NR13 NR14 | Manage Aboriginal Heritage items Monitor erosion & inundation events |
| | | | | | | I | | 1 | | DN | "Do Nothing" (Accept Risk) |
| | | | | | | | | | | ~~ | Substantial risk reduction and / or |
| | | | | | | | | | | | nignly effective in managing risk |
| | | | | | | | | | | ~ | effective in managing risk |
| | | | | | | | | | | 2 | Technical feasibility of applying the |
| | | | | | | | | | | | option is questionable |
| | | | | | | | | | | • | detrimental effect OR result in |
| | | | | | | | | | | | increased risk over time |





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6.20.3 Assessment of Treatment Options

| Pei | kins | | | | | | | | | | | | | | | |
|------------|---|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|------------------------|-----------|-------------------------|-----------------------|---|---|-----------------|
| Sym bol | - Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Accentability | Reversible / Adaptable | in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for Perkins Beach | Potential Funding Sources (Who may pay) | Conclusion |
| S2 | Maintain existing seawall along existing alignment | On as needs basis for asset maintenance or to repair storm damage. | ~ | ~ | × | | | | | | | | | This option involves maintaining the existing seawall running adjacent to Port Kembla Olympic Pool. The ability of the wall to provide protection or be upgraded will depend upon outcomes of NR2. It is expected the wall already provides protection to land and pool assets, and could be progressively upgraded on an as needs basis overtime to continue to protect from erosion and wave overtopping (e.g. deflection or other barriers, changes to slope and armour stones). The wall would additionally protect the stormwater asset located beside the Pool. <i>Refer to Protect Options Table for further cost benefit details for</i> \$2. | ? State Government (Grant Programs) ☑ Council (Current Programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Recommended |
| DV | Revitalise and undertake Dune Care Programs | Now and continuing | ~ | ~ | x | | | | | R | XX | | 0 | Perkins Beach already has extensive dunes, and is a high priority area for rehabilitation in the Illawarra Biodiversity Strategy. <i>Refer to Protect Options Table for further cost benefit details for DV.</i> | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | x | ~ | | 2 | | | | | | This is an excellent option for retaining the beach at Port Kembla/Perkins to Windang, as there are extensive dunes and back beach reserve that are suitable to provide a buffer for natural retreat of the beach, and hence continued provision of a beach over the long term. Refer to Planned Retreat Options Table for further cost benefit details for PR1. | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |
| PR1 | Accept loss following hazard event. Implement repairs to maintain public safety as impact occurs. | Repair damages to maintain public safety as impacts occur | ~ | ~ | x | 2 | | | | | | | | If it is not possible to retain the seawall S2 along the Pool boundary, the long term result would be retreat from the Pool, with the structure slowly removed as impacts occurred. This is likely to be at a much later time than the suggested erosion impacts, as the existing wall is likely to provide protection even if it was decided not to maintain the wall. Refer to Planned Retreat Options Table for further cost benefit details for PR1. | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Not Recommended |



RISK LEVELS AND TREATMENT OPTIONS

225

| Sym- bol | Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Option | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | Legal / Approval Risk | Specific Cost Benefit Considerations for PR1 Beach | Potential Funding Sources (Who may pay) | Conclusion |
|-------------|--|---|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|-----------------------|---|---|-----------------|
| PR2 | Relocate stormwater assets landward of hazard zone | Current Action: NR7 Trigger: When erosion or wave overtopping destabilises outlet or pipe OR the pipe requires replacement, whichever is sooner. | ~ | ~ | x | | | | | | | | As an alternative to upgrading the existing seawall, the stormwater asset located beneath the seawall adjacent to the pool would have to be progressively moved landward as the existing wall was impacted by erosion. Refer to Planned Retreat Options Table for further cost benefit details for PR2. | ? State Government (Grant Programs) ☑ Council (Current Programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Not Recommended |
| DCP | Prepare a Coastal Management Development Control Plan (DCP) chapter, to implement controls upon future development and re- development (including minor and major alterations) to manage erosion, recession and wave overtopping risks. | As property / assets redeveloped, new developments built | ~ | ~ | x | | | | | | | | Coastal DCP controls shall apply to redevelopment of Windang SLSC and amenities buildings to manage wave overtopping and additionally erosion at Port Kembla Pool in conjunction with seawall options S2. Refer to Accommodate Options Table for further cost benefit details for DCP. | ? State Government (Grant programs) ☑ Council (Current Programs) - cost to prepare DCP and implement for public assets N/A Private landholders - cost to implement DCP | Recommended |
| A2 | Redesign or retrofit Lake Illawarra Training Walls in current location to withstand impacts. | Current Action: None Trigger: When wave breaking destabilises armour stone and when frequency of overtopping is noted to impair boat passage through the entrance channel. | ~ | ~ | ~ | | | | 1 | ~~ | X. | 2 | With sea level rise, the Training walls are likely to experience increased wave impacts (breaking) and overtopping over time. There will be a need to maintain the walls, such as through increasing their height and replacing or enhancing armour stone to ensure the training walls remain intact overtime. Refer to Accommodate Options Table for further cost benefit details for A2. | Lake Illawarra Authority (State Government) Council (Current programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Recommended |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | N/A | .N/A | S | | l | | | | | For the majority of the beach length where there is no development directly affected, the risk can be accepted, particularly for inundation. Risks to assets at the far south and north end could also be accepted, provided the negative impacts can also be accepted. However, proposed actions to treat these risks are minimal compared with the benefit from retaining the assets. <i>Refer to "Do Nothing" Option Table for further cost benefit details.</i> | ? State Government ☑ Council (new levies and increased rates) <i>N</i> /A Private landholders in Future Generations | Not Recommended |
| NR | NR1, NR2, NR4, NR7, NR13, NR14 | Now | ~ | ~ | ~ | | | | | | | | , Refer to "No Regrets" Options Table for cost benefit details. , | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |









BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

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6.21 Lake Illawarra

6.21.1 Coastal Inundation Risk Level and Treatment Options

| | Inun | dation Risk | Level | In | undatio | n Risk T | Freatme | ents | | | |
|---|-----------------------|-----------------------|-----------------------|-----------------------------------|--------------------|-------------|-------------|--------------|-------------------------------------|-------|---|
| Lake Illawarra Foreshores | Inundation by 2010 | Inundation by 2050 | Inundation by 2100 | Treated by erosion option** | Planned Retreat | Acco oda | omm- ate | No Regrets | "Do Nothing" (Accept Risk) | Sym- | |
| Parks. Beaches and open space | | | | | PR2 | FDCP | A2 | Investigate* | DN | N | Nourishment |
| Lake Illawarra Foresbore | Low | Low | Low | | 1142 | 1 2 01 | , | inteologide | ∠ √ | S1 | Seawall - long or majority of beach |
| Windang Foresbore Park | Low | Low | Low | | | | | | ✓ | S2 | Seawall - short sections |
| Boronia Park / Oval | Low | Low | Low | | | | | | ✓ | DV | Revitalise Dune Care Programs |
| Kully Bay Park | Low | Low | Low | | | | | | ✓ ✓ | BM | Manage beach sands |
| Hooka Point Park | Low | Low | Medium | | | | | | ✓ ✓ | PR1 | Accept loss as sacrificial |
| Fred Finch Park Natural Area | Low | Low | Low | | | | | | ✓ ✓ | PR2 | Relocate out of hazard zone |
| Purrah Bay Reserve | Low | Low | Low | | | | | | · • | PR3 | Prohibit development expansion |
| Koonawarra Bay reserve / park | Low | Low | Medium | | | | | | | PR4 | Voluntary Acquisition |
| Lakeside Drive Reserve | Low | Low | Medium | | | | | | \checkmark | PR5 | Buy back then lease back |
| Holbom Park Sailing Club | Medium | Medium | High | | | ~ | | NR14 | | DCP | Apply development controls (future |
| Windang Bowls Club (private recreation) | Low | Medium | Medium | | | ~ | | TNIXI T | ~ | A2 | devt and re-devt) Redesign / retrofit in current |
| Illawarra Yacht Club (private recreation) | Low | Low | Medium | | | ✓ | | | ✓ | | location |
| EEC Swamp Oak Floodolain Forest | Medium | Medium | High | | | | | NR11 | | A3 | Apply existing flood dovelopment |
| EEC Coastal Swamp Oak Forest | Low | Medium | Medium | | | | | NR11 | ✓ | FDCP | controls (future devt and re-devt) |
| | Low | modium | Modian | | | | | | | NR1 | Update Asset Register for Hazards |
| Windang Tourist Park | Low | Medium | Medium | | | | | | ✓ | NR2 | Audit existing seawalls |
| Other caravan parks | Low | Medium | Medium | | | | | | ✓ | | Assess Public Buildings for |
| Lake Illawarra Cycleway / Shared | Low | Medium | Medium | | C | | | | ✓ | NR4 | "accommodate" or "relocate" |
| Pathway | | | A.4. 11 | | | | | 1 | | | Assess Roads for "accommodate" |
| Windang Memorial Park - Tollets | LOW | LOW | Ivledium | | | ~ | | | ~ | NR5 | or "relocate" |
| Clubbouse (leased) | Low | Low | Low | | | ~ | | | ✓ | NR6 | Assess Cycleways for |
| Boronia Park Dressing Sheds / toilets / | | | 0 | | | | | | | | "accommodate" or "relocate" |
| gardeners | Low | Low | Medium | | | ~ | | | ~ | NR7 | Design criteria for Stormwater |
| Boronia Park Kiosk | Low | Low | Medium | | | ✓ | | | ✓ | | Assets |
| Boronia Park Pigeon Clubroom | Low | Low | Medium | | | ~ | | | ✓ | NR8 | water supply and electricity assets |
| Boronia Park Scout Hall | Low | Low | Medium | | | ✓ | | | ✓ | NR9 | Develop evacuation plans |
| Fred Finch Park Baseball Kiosk | Low | Low | Low | | | ✓ | | | ✓ | NID40 | Conduct Flood Study including |
| Fred Finch Park Pony Clubhouse | Low | Low | Low | | | ✓ | | | ✓ | NR10 | ocean water levels |
| Fred Finch Park - Berkelev Basketball | | | | | | , | | | , | NR11 | Audit EECs and habitats for priority |
| Stadium | Low | Medium | Medium | | | ~ | | | ~ | | conservation |
| Willam Beach Park Exeloo, Brownsville | Low | Low | Medium | | | ✓ | | | ✓ | NR12 | Use Norfolk Island Pines in new |
| Transport Infrastructure | | | | | | | | | | NR13 | Manage Aboriginal Heritage Items |
| Major roads, bridges: Windang Rd and | Lligh | Extromo | Extromo | | | | | | | NR14 | Monitor erosion & inundation events |
| Bridge | Fligh | Extreme | Extreme | | | • | | INFC14 | | DN | |
| Local Roads, car parks | Low | Medium | Medium | | | | | | ✓ | DN | "Do Nothing" (Accept Risk) |
| Port Kembla Sailing Club Boat ramp and | Medium | Medium | High | | | ~ | | | | ~~ | Substantial risk reduction and / or |
| harbour | | | | | | | | | | | highly effective in managing risk |
| Water and sewage infrastructure | | | | | | , | , | | | ✓ | Good risk reduction and / or |
| Stormwater outlets / pipes | Medium | High | High | | | ~ | ~ | NR7, NR14 | | | Technical feasibility of applying the |
| Residential Development | | | | | | , | | | | ? | option is questionable |
| Existing Residences (numerous) | Medium | Medium | High | | | ~ | | | | | "Do Nothing" option is likely to have |
| Vacant Land (Future Development: | Low | Low | Low | | | ~ | | | ✓ | • | detrimental effect OR result in |
| Vacant Land (3 residential zoned blocks | | | | | | | | | | | increased risk over time |
| at Purrah Bay) | Medium | Medium | Medium | | | ✓ | | | | | |
| Note: 674 land parcels affected | | | | | | | | | | | |
| Commercial and Industrial | | | | 1 | | | <u> </u> | | | | |
| Development | | | | | | | | | | | |
| Oasis Resort and Caravan Park | Low | Low | Medium | | | ✓ | | 1 | ✓ | | |
| Tru Energy Gas Powered Station | High | Extreme | Extreme | | | ✓ | 1 | NR14 | | | |
| Institutional Infrastructure | | | | | | | | | | | |
| Windang Public School | Medium | High | High | | | ✓ | | | | | |

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6.21.2 Assessment of Treatment Options

| Lak | e Illawarra | | | | | | | | | | | | | | | |
|-------------|--|--|----------------|--------------------|--------------------------------|--------------|-----------------|-----------------------------------|----------------------------|-------------------------------------|-------------------------|------------------------|-----------------------|--|---|-------------|
| Sym- bol | . Option | Trigger for implementation (following relevant planning, approvals, etc) | Erosion Option | Overtopping Option | Backwater Inundation Ontion | Capital Cost | Recurrent Costs | Environmental or Social Impact | Community Acceptability | Reversible / Adaptable in Future | Effectiveness over time | l egal / Annroval Risk | Legal / Approval Kisk | Specific Cost Benefit Considerations for Lake Illawarra | Potential Funding Sources (Who may pay) | Conclusion |
| A2 | Redesign or retrofit stormwater structures in current location to withstand impacts. | Current Action: NR7 Trigger: When inundation frequency impedes effective conveyance of stormwater OR as asset replacement is required, whichever is sooner; | × | × | ~ | | | | | | | | | Stormwater assets may be increasingly impacted by inundation with sea level rise (this includes increased frequency of inundation events from storms). This option involves redesigning and / or re- siting the stormwater structures at their current location to withstand impacts. Designs will depend on outcomes of NR7. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for A2</i> . | ? State Government (Grant Programs) ☑ Council (Current Programs, new levies or increased rates?) N/A Private landholders who directly benefit from option | Recommended |
| FDCF | Update DCP Chapter E13 – Floodplain Management to include areas affected by Coastal Inundation as Low Risk Flood Precincts, and implement DCP to manage inundation impacts as properties are redeveloped and assets replaced. | As property / assets redeveloped, new developments built | × | x | ~ | | | | 1 | ? ? | X), | 2 | S | Given that the existing Flood Planning Area extends over and beyond the coastal inundation area at Lake Illawarra, all affected properties will already be subject to FDCP. This option re-iterates the use of the FDCP controls, with the flood planning levels from the Flood Study to override levels given for coastal inundation alone. A recent Flood Study was conducted using a combined ocean water level and catchment flood event, providing a current and applicable flood level calculaton for use in planning. <i>Refer to Accommodate Options Table for further cost benefit</i> <i>details for FDCP</i> . | N/A State Government (external funding unlikely to be needed) ☑ Council (Current Programs) ☑ Private landholders - cost to implement FDCP | Recommended |
| DN | No limitations upon existing development or future development / re-development over planning timeframe | Now | N/A | N/A | A N/A | Ş | | | | | | | | The majority of assets affected are considered to be at low risk, which can be accepted. However stormwater is a key local infrastructure. The effect of sea level rise on inundation of stormwater outlets is unlikely to be acceptable as it may increase the frequency and disruption from inundation events. <i>Refer to "Do Nothing" Option Table for further cost benefit details.</i> | ? State Government ☑ Council (new levies and increased rates) ☑ Private landholders in Future Generations | Recommended |
| NR | NR1, NR7, NR11, NR13, NR14 | Now | ~ | ~ | ~ | | | | | | | | | Refer to "No Regrets" Options Table for cost benefit details. | ? State Government (Grant Programs) ☑ Council (Current Programs) N/A Private landholders who directly benefit from option | Recommended |



6.22 Geotechnical Risk Levels and Treatment Options

The majority of areas and assets are at low risk from coastal influenced geotechnical hazards, as demonstrated in the Geotechnical Risk Evaluation Maps in Appendix A. There are some assets at medium or high risk, and this relates to the asset type (e.g. major roads, railway, important public buildings, etc) rather than the likelihood of geotechnical hazard, which is considered 'rare'.

There are very few areas within the Coastal Influenced Geotechnical Hazard Area that are not already within a landslip geotechnical hazard zone, which already have Section 149 notifications provided to landholders by Council. Further, as noted in Section 4.4, there is already a sound process for managing geotechnical risk in the LGA, being Wollongong DCP Chapter E12 – Geotechnical Assessment.

Therefore, it is proposed to apply Accommodate Management Option GDCP (refer Section 5.4.4) to all land within the Coastal Influenced Geotechnical Hazard area. This will provide for assessment of wave action and sea level rise as part of the geotechnical assessment undertaken as properties are re-developed and assets repaired or replaced in the future. It is considered sufficient to manage existing assets and land through future re-development, because the risk of Coastal Influenced Geotechnical Hazard is considered rare.

In addition, the headland area between Thirroul and McCauleys Beaches is known to have high rates of cliff retreat, relating to the softness of bedrock in this location. At present, there are applications by landholders to construct protective revetments (seawalls) to manage cliff retreat. Further, Council is also undertaking construction of a seawall at Corbetts Avenue to manage this hazard at the present time.

Therefore, a seawall alignment along the headland section between Thirroul Beach and McCauleys Beach is proposed, as shown in Figure 6-70. The seawall alignment has been drawn within existing private property boundaries. It is intended that such revetments to manage cliff retreat would be designed, constructed and maintained (including offsite impacts) and development applications prepared and lodged at the individual landholders' expense (as is done along this section at present). The alignment is provided such that Council can manage the location of the walls, to ensure they are constructed upon private property and not public land. Further, under recent changes to the Coastal Protection Act (refer Section 2.2.1.1) Council may consider a levy (coastal protection service charge) on private property owners who construct the walls to fund ongoing maintenance and offsite impacts.

The option at Thirroul / McCauleys should be considered in conjunction with Seawall options S1 and S2 proposed for erosion risk at these beaches, refer Sections 6.7.1 and 6.8.1. That is, the selection of this option at the headland may affect the selection of erosion seawall options at adjacent locations.





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7 RECOMMENDED MANAGEMENT OPTIONS

The assessment of treatment options for individual beaches, as presented in the previous chapter, outlines those options considered to be most suitable for addressing the various risks at each beach. The assessment considered capital and recurrent costs, environmental and social impacts, community acceptance, the reversibility or adaptability of the option, its effectiveness over time, and all legal and approval barriers and risks associated with implementation of the option.

When determining which options should be carried out as a priority in the future, consideration has been given to 1) the highest priority risks (ie the intolerable risks) as discussed in Section 4.6, and 2) the most effective options in treating those high priority risks (as presented in the previous chapter).

Recommended management options have been developed for each beach, as presented in the previous beach by beach assessment. Presented below in Table 7-1 and Table 7-2, is a summary of the recommended management options applicable to each beach along the Wollongong coastline.

Within Table 7-1 and Table 7-2, recommended options to treat the specifically identified 'high' or 'extreme' risks at the current timeframe (2010) are indicated by two ticks (\checkmark), while recommendations to address the highest risks to 2050 and 2100 are given by one tick (\checkmark).

Implementation of this list of recommended management options will ensure that all high and extreme risks up to 2100 (i.e. those considered to be intolerable risks) can be managed, with priority for implementation given to addressing the intolerable risks at the current (2010) timeframe.

These recommended options have subsequently been developed into an Implementation Action Plan for the Wollongong Coastal Zone, which accompanies this document.

Hern 2



| Table 7-1 | Recommended Management Options to | Address Intolerable Risks to | 2100 (Stanwell Park to Bulli) |
|-----------|-----------------------------------|------------------------------|-------------------------------|
|-----------|-----------------------------------|------------------------------|-------------------------------|

| | Stanwell Pk | Coalcliff | Scarb/Wom | Coledale | Sharkies | Little Austin. | Austinmer | Thirroul | McCauleys | Sandon Pt | Bulli |
|---|------------------------|------------------------|------------------------|---------------------------------|------------------------------|------------------------|-------------------------|------------------------|--------------|------------------------|------------------------|
| DV | \checkmark | $\checkmark\checkmark$ | \checkmark | $\checkmark\checkmark$ | $\checkmark\checkmark$ | $\checkmark\checkmark$ | $\checkmark\checkmark$ | $\checkmark\checkmark$ | \checkmark | $\checkmark\checkmark$ | $\checkmark\checkmark$ |
| BM | \checkmark | \checkmark | \checkmark | \checkmark | $\checkmark\checkmark$ | $\checkmark\checkmark$ | $\checkmark\checkmark$ | | | | |
| PR1 | \checkmark | \checkmark | \checkmark | \checkmark | $\checkmark\checkmark$ | \checkmark | | \checkmark | \checkmark | \checkmark | \checkmark |
| PR2 | | | | | | | | | | | |
| - SLSC & public bldgs | \checkmark | | | | | | | \checkmark | | | \checkmark |
| - Stormwater | | \checkmark | $\checkmark\checkmark$ | | | $\checkmark\checkmark$ | | | \checkmark | $\checkmark\checkmark$ | \checkmark |
| - Recreational fac. | | | | \checkmark | | | | | | | |
| - Carpark | | | | | \checkmark | | | | | | |
| - Cycleways | | | | | | | | | | \checkmark | |
| - Roadways | | | | | | | | | | \checkmark | |
| - Assets | | | | | | | | V | | | |
| PR4 | | | | | | | | ▲ | \checkmark | | |
| PR5 | | | | | | | | \checkmark | \checkmark | | |
| A2 | | | | | | 0 | | | | | |
| - stormwater | $\checkmark\checkmark$ | | | \checkmark | | | \checkmark | \checkmark | \checkmark | \checkmark | \checkmark |
| - ocean pool | | \checkmark | | \checkmark | | | $\checkmark\checkmark$ | | | | \checkmark |
| - boatharbour | | | | | $\langle \checkmark \rangle$ | | | | | | |
| SLSC & public bldgs | | | | C | | | \checkmark | | | | |
| - Training walls | | | | $\mathbf{\Lambda}^{\mathbf{r}}$ | | | | | | | |
| A3 | | | | \checkmark | | | | | | | |
| S1 | | 2 | | | | | $\checkmark \checkmark$ | | | | |
| S2 | | | | | | | | | | | |
| - Maintain existing | | | • | | | | | | | | |
| - Construct new Wall | | | | 1 | | | 1 | | | | |
| | | v | vv | V | • | vv | v | v v | V | V V | V V |
| | V VV | | | V V | V | | v | V V | V V | vv | V V |
| DIN NR1: notation for assets | | ./ | ./ | ./ | | | ./ | | ./ | ./ | ./ |
| NR2: seawalls assess | v | v | v | v | v | v | v v | V V | v | v | v |
| NP3: SLSC assoss | | | | ./ | | | | | | ./ | |
| NR3. SEGC assess. | v | ./ | ./ | V | | v | V | | | v | |
| NR4. Ocean poor assess. | | v | v | vv | | ./ | ••• | v v | | ./ | v |
| NRS. Todus assess. | v | | | | | v | v | v | | V | |
| NRO. Cyclewdy assess. | | | | | | | | | V | V | V |
| NR7: Stofffwater assess. | V V | ∨ | V V | V V | V V | V V | V V | \mathbf{v} | \mathbf{v} | | \mathbf{v} |
| NR8: Services assess. | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | √ | ✓ | \checkmark | √ |
| NR9: evac. Planning | | | | | | | | V V | | V | V |
| NR10: flood studies | V V | 1 | | | | | \checkmark | V V | | | V V |
| NR11: vegetation assess. | ✓ | \checkmark | \checkmark | ✓ | | ✓ | | ✓ | \checkmark | ✓ | \checkmark |
| NR12: Nortolk Is. Pines | | | | ✓ | ✓ | ✓ | | ✓ | | ✓ | |
| NR13: Heritage framewk. | ✓ | \checkmark | \checkmark | \checkmark | ✓ | \checkmark | \checkmark | \checkmark | \checkmark | \checkmark | $\checkmark\checkmark$ |
| NR14: Monitoring | \checkmark | \checkmark | \checkmark | $\checkmark\checkmark$ | \checkmark | \checkmark | $\checkmark\checkmark$ | \checkmark | \checkmark | \checkmark | $\checkmark\checkmark$ |

Legend $\sqrt{\sqrt{}}$

 \checkmark

Treats identified 'high' or 'extreme' risks at the current (2010) timeframe Treats identified 'high' or 'extreme' risks at 2050 or 2100 timeframes

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| Table 7-2 Recommended Manager | nent Options to Address Intolerable R | Risks to 2100 (Woonona to Lake Illawarra) |
|-------------------------------|---------------------------------------|---|
|-------------------------------|---------------------------------------|---|

| | Woonona | Bellambi | Bellambi Pt | Corrimal | Towradgi | Fairy Mdw | North | City | Coniston | Perkins | Lake Illaw. |
|--------------------------|------------------------------|--------------|------------------------|------------------------|------------------------|------------------------|------------------------|--------------|--------------|---------------------------|--------------|
| DV | \checkmark | \checkmark | $\checkmark\checkmark$ | \checkmark | \checkmark | $\checkmark\checkmark$ | \checkmark | \checkmark | \checkmark | \checkmark | |
| BM | \checkmark | | | | | | \checkmark | \checkmark | \checkmark | | |
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Legend

Treats identified 'high' or 'extreme' risks at the current (2010) timeframe $\sqrt{\sqrt{}}$ Treats identified 'high' or 'extreme' risks at 2050 or 2100 timeframes \checkmark

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Wollongong Coastal Zone Management Plan: Management Study Appendices

Final Draft June 2012



Wollongong Coastal Zone Management Plan: Management Study Appendices

Offices

Brisbane Denver Mackay Melbourne Newcastle Perth Sydney Vancouver

Prepared For:

Wollongong City Council

Prepared By: BMT WBM Pty Ltd (Member of the BMT group of companies)



APPENDIX A: RISK LEVELS MAPS FOR 2010, 2050 AND 2100

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Immediate Planning Horizon - Sandon Point Beach

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Erosion and Recession Risk Evaluation Immediate Planning Horizon - Coniston Beach (south)

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2050 Planning Horizon - Coniston Beach (north)

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Erosion and Recession Risk Evaluation 2100 Planning Horizon - Sandon Point Beach

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APPENDIX B: ESTUARY PLANS AND BEACH ACCESS ARRANGEMENTS

Estuary Management

Council has prepared two Estuary Management Plans for the 14 coastal creeks and lagoons for which it has management responsibilty. These Plans have been adopted by Council and are now in the implementation stage. They address the estuary health issues. Entrance Management Policies have also been prepared for Fairy and Towradgi lagoons and Council is in the process of preparing one for Bellambi Lagoon. The Estuary Management Plans and Entrance Management Policies are listed below:

- Estuary Management Study and Plan for Fairy, Towradgi, Hewitts/Tramway Creeks;
- Estuary Management Study and Plan for Several Wollongong Creeks and Lagoons;
- Entrance Management Policy for Fairy Lagoon; and
- Entrance Management Policy for Towradgi Lagoon.

Community Use and Beach Access Arrangements

Several Plans of Management (POMs) have been prepared, which guide the management of certain foreshore areas along the Wollongong coastline. These POMs are listed in Section 2.2.7.1 of the Management Study. In addition, Council has Dune Maintenance Program, through which beach access is maintained. Through a Beach Servcies Program, beach combing and lifeguard services are provded at several reaches. Beach access and amenity is therefore considered to be satisfactory at all beaches at the present time. The table below provides a summary of the beach access and amenity arrangements.

| Beach | Access Road | Car Parking | Beach Access | Beach Patrol | Recycling Bin | Other Facilities |
|--------------------------|----------------|----------------|------------------|-----------------|------------------|---|
| Stanwell Park | Yes | Yes | Dune Walkways | Yes | Yes | Surf Club, Kiosk |
| Coalcliff | Yes | Yes | Tracks | Yes | | Surf Club, Rock Pool |
| Scarborough/ Wombarra | Yes | Yes | Tracks | Yes | | Rock Pool |
| Coledale | Yes | Yes | Tracks | Yes | | Surf Club, Rock Pool; Camping Ground |
| Austinmer | Yes | Yes | Tracks | Yes | Yes | Surf Club, Rock Pool, Seating |
| Thirroul | Yes | Yes | Tracks | Yes | Yes | Surf Club, Pool, Kiosk, Seating |
| Sandon Point | Yes | Yes | Dune Walkways | Yes | | Surf Club |



| Beach | Access Road | Car Parking | Beach Access | Beach Patrol | Recycling Bin | Other Facilities |
|---------------------|----------------|----------------|------------------|-----------------|------------------|--|
| Bulli | Yes | Yes | Dune Walkways | Yes | Yes | Surf Club, Rock Pool, Kiosk, Cycleway, Seating |
| Woonona | Yes | Yes | Dune Walkways | Yes | | Surf Club, Pool, Cycleway |
| Bellambi | Yes | Yes | Dune Walkways | Yes | | Surf Club, Rock Pool, Cycleway |
| Corrimal | Yes | Yes | Dune Walkways | Yes | | Surf Club, Cycleway |
| Towradgi | Yes | Yes | Dune Walkways | Yes | | Surf Club, Rock Pool, Kiosk, Cycleway, Seating |
| Fairy Meadow | Yes | Yes | Dune Walkways | Yes | 0 | Surf Club, Cycleway |
| North Wollongong | Yes | Yes | Walkways | Yes | C.S | Surf Club, Pools, Kiosk, Cycleway, Seating |
| City | Yes | Yes | Dune Walkways | Yes | Yes | Surf Club, Kiosk, Cycleway, Seating |
| Port Kembla | Yes | Yes | Paths | Yes | Yes | Surf Club, Pools, Kiosk, Seating |
| Windang | Yes | Yes | Dune Walkways | Yes | | Surf Club |
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APPENDIX C: LEGISLATION SUMMARY

Coastal Protection Act 1979

The NSW *Coastal Protection Act 1979* (the CPA Act) provides guidance on the use, occupation and development of the coastal zone in NSW. The CPA Act was amended in 2002 to better reflect the purpose of the NSW Coastal Policy (1997) and to incorporate the principles of ecologically sustainable development.

The objects of the CPA Act are to provide for the protection of the coastal environment of the State for the benefit of both present and future generations and, in particular:

- to protect, enhance, maintain and restore the environment of the coastal region, its associated ecosystems, ecological processes and biological diversity, and its water quality;
- to encourage, promote and secure the orderly and balanced utilisation and conservation of the coastal region and its natural and man-made resources, having regard to the principles of ecologically sustainable development;
- to recognise and foster the significant social and economic benefits to the State that result from a sustainable coastal environment, including
- benefits to the environment, and
- benefits to urban communities, fisheries, industry and recreation, and
- benefits to culture and heritage, and
- benefits to the Aboriginal people in relation to their spiritual, social, customary and economic use of land and water;
- to promote public pedestrian access to the coastal region and recognise the public's right to access;
- to provide for the acquisition of land in the coastal region to promote the protection, enhancement, maintenance and restoration of the environment of the coastal region;
- to recognise the role of the community, as a partner with government, in resolving issues relating to the protection of the coastal environment; and
- to ensure co-ordination of the policies and activities of the Government and public authorities relating to the coastal region and to facilitate the proper integration of their management activities.

The Act allows the Minister for the Environment to direct a council with land within the coastal zone to prepare a Coastal Zone Management Plan, and gives directions as to how such Plans shall be prepared, approved, gazetted and amended where necessary. The Act also requires Coastal Zone Management Plans to incorporate provisions for emergency beach erosion management and to provide for the unobstructed access to the coastline (beaches, headlands, waterways) by the public.

Changes to the act as part of the *Coastal Protection and Other Legislation Amendment Act* are outlined below.



Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EPA Act) is the key NSW legislation for planning and land use. The Act provides a system of environmental planning and assessment for NSW, and involves developing plans to regulate competing land uses, through 'environmental planning instruments'.

The EPA Act establishes three types of environment planning instruments (EPI):

- Local Environmental Plans;
- Regional Environmental Plans; and
- State Environmental Planning Policies.

The objectives of the EPA Act are to encourage:

- proper management, development and conservation of natural and artificial resources, including
 agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose
 of promoting the social and economic welfare of the community and a better environment;
- promotion and co-ordination of the orderly and economic use and development of land;
- protection, provision and co-ordination of communication and utility services;
- provision of land for public purposes;
- provision and co-ordination of community services and facilities;
- protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats;
- ecologically sustainable development;
- the provision and maintenance of affordable housing;
- promotion of the sharing of the responsibility for environmental planning between the different levels of government in the State;
- provision of increased opportunity for public involvement and participation in environmental planning and assessment.

Approval processes for "development" and "works" in NSW are provided for in Part 3A, Part 4, Part 5 and Part 5A of the EPA Act. Key provisions are outlined briefly below.

Part 3A – Major Infrastructure and Other Projects (now repealed)

Part 3A came into operation in August 2005 and applies to development that is declared to be a project to which the part applies. A project can be declared by:

- A State Environmental Planning Policy (SEPP), with SEPP No. 71 Coastal Protection of relevance to the coastal zone, or
- By order of the Minister for Planning published in the Government Gazette.

There are two types of development that may be declared for Part 3A approval (i.e. in addition to those directed to the Minister via a SEPP):



- Major infrastructure or other development that in the opinion of the Minister is of state or regional environmental significance, or
- Old Part 5 activity approvals where the proponent is the determining authority and an EIS would have been required.

Guidelines regarding Part 3A projects have been provided by the Department of Planning.

Part 4 – Development Assessment

Part 4 of the EPA Act lays out the legislative regime for the standard process for lodgement and consideration of development applications. Part 4 processes essentially apply where the local authority (Council) is the consent authority. The majority of land based development within the Wollongong study area will fall within Part 4 of the EPA Act.

The controls and permissibility for development of particular sites and / or uses are found in the Wollongong Local Environment Plan (LEP) and Wollongong Development Control Plan (DCP) (see Section 2.2.3).

Part 5 – Environmental Assessment

Part 5 outlines the requirements for determining authorities to consider the environmental impact of activities, through an environmental assessment for the proposed activity. The environmental assessment shall outline the effect of the activity on critical habitat, endangered fauna, vulnerable species, conservation agreements (under the *National Parks and Wildlife Act 1974*), plans of management, wilderness areas (under the *Wilderness Act 1987*) and joint management agreements and bio-banking agreements under the *Threatened Species Act, 1995*, and any other legislation pertaining to the proposed activity.

Part 5 of the Act applies to proposed activities that are permissible without development consent under Part 4 of the EPA Act but require approval from a Minister or Public Authority, or is proposed to be carried out by a Minister or Public Authority (and Council is classified as a Public Authority).

Part 5 obliges the "determining authority" for the proposal to consider the environmental impact of any activity. A determining authority is the public authority which is required to approve an activity, and can also be the public authority proposing to carry out the activity. For example, Council is permitted to undertake certain environmental management activities under SEPP (Infrastructure) 2007 without development consent, however may need to complete and environmental assessment under Part 5 of the EPA Act.

Part 5A (Development by the Crown) essentially provides a legislative regime for consideration of Development Applications made by, or for and on behalf of, the Crown.

The remaining parts of the EPA Act relate to: Part 6 – Implementation and Enforcement; Part 7 – Finance and Part 8 – Miscellaneous.



Crown Lands Act 1989

The *Crown Lands Act 1989* (the CL Act) provides for the administration and management of Crown land for the benefit of the people of NSW. The CL Act provides principles for the proper assessment, development, reservation or dedication and conservation of Crown Lands.

Waterbodies such as beaches and foreshores and estuaries / creeks / lagoons to the mean high water mark are designated as Crown Land. The lands below MHW are managed by the Department of Primary Industries (DPI).

In addition to this, there are many other parcels of land within the Wollongong coastal zone that are Crown reserves that are controlled and managed by Council (that is, Council is the Wollongong City Council (WCC) is the reserve trust manager or trustee appointed by the Minister for Lands to care, control and manage the land in accordance with its public purpose). These Crown reserves must be managed in accordance with the public purposes of the land and the principles as set out in Section 11 of the *Crown Lands Act 1989*.

The principles of Crown Land management as defined in Section 11 of the Act are: environmental protection principles be observed in relation to the management and administration of Crown land; natural resources of Crown Land (including water, soil, flora, fauna and scenic quality) be conserved wherever possible; public use and enjoyment of Crown lands be encouraged; where appropriate, multiple uses of Crown land be encouraged; and where appropriate, Crown Land be used and managed in such a manner that the land and its resources are sustained in perpetuity.

In addition to these principles, the objectives of the Coastal Crown Lands Policy 1991 apply to Crown lands within the coastal zone of Wollongong. The policy sets specific objectives for conserving the environmental and cultural qualities of coastal Crown Land, retaining in public ownership coastal lands that are environmentally sensitive and / or required for public purpose, and providing use of coastal crown lands for recreation, tourism, residential and commercial development with due regard to the nature and consequences of coastal processes.

A Plan of Management (POM) should be prepared for Crown land reserves to identify the key attributes and values of the area, general physical improvements to enhance the values and to specify the permissible uses for the land. Division 6 of the Act discusses the preparation and adoption of POMs by the reserve trust and the Minister. Plans of Management relating to Council managed Crown lands in Wollongong are discussed below in relation to the *Local Government Act 1993*.

Local Government Act 1993

The *Local Government Act 1993* (the LG Act) creates local governments and grants them the power to perform their functions, which involve management, development, protection, restoration, enhancement and conservation of the environment for the local government area. The functions of the local government are to be performed in a manner that are consistent with and promote the principles of ecologically sustainable development.

The service functions of local councils are defined in Chapter 6 of the LM Act. The service functions of councils relate to the classification, use and management of public land, including the objectives for management of the community land owned by Council (i.e. that is not Crown Land). Section 35 of the



act provides that community land only be used in accordance with the plan of management applying to the parcel of community land; any law permitting the use of the land for a specified purpose or otherwise regulating the use of the land; and the provisions of Division 2 Chapeter 6 of the Act. Community land can be categorised into a range of categories under Section 36 of the act, and each of these categories have their own core objectives specified under the Act. The categorisation of community lands is important as the Act requires Council to only grant a lease, licence or another estate (other than in respect of public utilities) for a purpose consistent with the core objectives of the category of that community land.

Council has a generic plan of management (POM) and a range of site specific POMs that govern the permissible uses for Community Land (both Council owned land and Council managed Crown Lands). The relevant POMs for coastal Community Lands include:

- Stanwell Park Reserve and Bald Hill Plan of Management August 2009
- Wollongong City Foreshore Plan of Management, January 2008
- Coledale Beach Plan of Management, June 2004
- Judbooley Parade, Windang Plan of Management, June 2008
- The Community Land of Wollongong Generic Plan of Management 2010

There are also other POMs that relate to Andrew Lysaght Park (December, 2002), City Beach (July, 2001 and December 1995), North Beach and Stuart Park (August, 2000), and these areas are now largely covered within the Wollongong City Foreshore POM. The Blue Mile MasterPlan provides more detail regarding the improvements proposed within the Wollongong City Foreshore POM, outlining the series of improvements and actions proposed in the Wollongong City Foreshore POM area.

A review of these POMs indicated that only the Coledale Beach Reserve POM provided a strategy directly relating to the incorporation of coastal hazards in future planning. The strategy requires new development and activities to be located behind the 50 year hazard line and structural protection to protect existing assets seaward of the 50 year hazard line (although, the type of structural protection, or any costs or benefits to structural protection was not indicated). In contrast, the other POMs, particularly the Blue Mile Master Plan (supported by the Wollongong City Foreshore POM), provide for a range of improvements to community facilities, but did not specify that planning for coastal erosion or other hazards be incorporated into the improvement works. The proposed improvements included:

- Replacement of the seawall at North Beach, although the length of this wall (or coastal engineering requirements) was not indicated
- The relocation of the North Beach SLSC, although the proposed location also lies within the 2100 year hazard extent, however designing to accommodate recession and inundation was not noted
- The refurbishment of the North Beach pavilion, again without notation for improving resilience to storm waves and water levels
- Improving access to the northern breakwater of the harbour, without notation for incorporating raising of the breakwater as part of access improvements, that would provide for sea level rise,



• Improving and widening the cycleway and shared pathways from North Beach through Brighton Lawn Reserve to City Beach, again without noting the opportunity to improve the path's resilience to coastal erosion.

While the various POMs provide suitable guidance for use and enjoyment of Community Lands, there is little provision for incorporating improvements of these lands with improving the resilience to coastal hazard impacts.

The NSW Sea Level Rise Policy Statement (2009)

The NSW (2009) Sea Level Rise Policy Statement (the Policy Statement) sets the planning standards for projected sea level rise over the next century that are to be adopted in all forms of coastal assessment, from development applications to coastal hazards definitions studies and coastal zone management plans.

The NSW Government has adopted benchmarks of 0.4 m rise in sea level by 2050 and 0.9 m by 2100 as the best national and international projections for the NSW Coast (at the present time). These benchmarks were used to prepare the Wollongong Coastal Zone Study and hazard lines.

The Policy Statement also provides guidance on the risk-based assessment approach recommended by the NSW Government, and the support the state intends to provide to coastal communities to prepare and adapt to the medium to long term social, economic and environmental impacts of sea level rise.

The NSW Government intends to support local councils through funding assistance for voluntarily purchasing of property or for protection works, provided such actions are based upon thorough assessments (such as a CZMP) that outline the magnitude of the hazard risk, cost-effectiveness of the action including maintenance costs, ability to adequately protect from sea level rise, and the genuine hardship of coastal residents and benefiting landholders. The NSW Government has stated a commitment to:

- promoting risk-based assessment approaches to sea level rise and coastal planning;
- providing guidance to councils to support adaptation planning initiatives;
- encouraging appropriate development on land at risk from sea level rise;
- providing continued emergency management support for damaging storms and floods; and
- providing ongoing updated information to the public about sea level rise and projected impacts.

The Sea Level Rise Policy Statement (2009) supersedes the 1988 Coastline Hazards Policy with respect to managing sea level rise. The Policy Statement is to be used in conjunction with the existing legislation and policies for coastal management.

State Environmental Planning Policy No. 71 – Coastal Protection

State Environmental Planning Policy No. 71 – Coastal Protection (SEPP71) aims to protect and manage the natural, cultural, recreational and economic attributes of the New South Wales coast. SEPP 71 aims for development in the NSW coastal zone to be appropriate and suitably located, in



accordance with the principles of the Ecologically Sustainable Development (ESD). SEPP 71 applies to all lands within the coastal zone of NSW, which is defined on gazetted maps under the SEPP.

The policy provides for: the protection of and improvement to public access compatible with the natural attributes coastal foreshores; and protects and preserves Aboriginal cultural heritage, visual amenities of the coast, the beach environment and amenity, native coastal vegetation, marine environment of New South Wales, and rocky platforms.

SEPP 71 also outlines the conditions for which the Minister for Planning becomes the consent authority for 'significant coastal development'. SEPP 71 defines this as development in 'sensitive coastal locations' namely land within 100 metres of and below mean high water mark of the sea, a bay or an estuary. Development applications received by Council on such lands must be sent to the Director-General of Planning, and Council is required to take the 'matters for consideration' given in Clause 8 of SEPP 71 and any additional matters specified by the Director-General into account when determining the application.

A master plan is required to be submitted and adopted by Minister for Planning (prior to Council granting consent) for subdivision of land within a residential zone or rural residential zone if part or all of the land is in a 'sensitive coastal location'. This would apply to any future subdivision of land in the Study area.

SEPP 71 does not apply to land within the Wollongong city centre.

The NSW Coastal Planning Guideline: Adapting to Sea Level Rise

The NSW Coastal Planning Guideline: Adapting to Sea Level Rise (the Planning Guideline), support the SLR Policy Statement and were finalised by Department of Planning (DP) in August 2010. The Planning Guideline describes how sea level rise should be considered in land use planning and development assessments. The Planning Guideline outlines six coastal planning principles for adapting to climate change, including:

- assessing and evaluating the coastal risks taking into account the sea level rise benchmarks set by the NSW Government (refer the Policy Statement);
- advising the public as to coastal risks to facilitate informed land use planning and development decision making;
- avoiding the intensification of land use in coastal risk areas through appropriate strategic and land use planning;
- considering options to reduce the intensity of land use in coastal risk areas;
- minimising exposure of development to coastal risks; and
- implementing appropriate management responses and adaptation strategies that consider the environmental, social and economic impacts of such responses.

In evaluating coastal risk areas, the Planning Guideline defers to the DECCW (2010) Coastal Risk Management Guideline (see discussion below). The coastal risk areas should be identified through specific local studies, at which point they should be mapped in LEPs, regardless of current land zoning.

The Planning Guideline advises that strategic land use planning shall discourage intensification of development in coastal risk areas. For example, changing land use from rural to urban or increasing housing density shall be avoided in high risk areas due to the potential future risk to life, property and the environment. As changes to land use may affect the future development potential of an area, the Guideline recommends these changes be applicable to the level of risk. Where possible, new coastal subdivisions and urban developments shall be located outside the 2100 coastal risk area.

The Guideline makes reference to the *Coastal Design Guidelines for NSW* (2003) for strategic land use planning (height, scale and setback), retaining foreshores and headlands in public ownership and protecting from storm events and sea level rise.

Coastal Risk Management Guide – Incorporating sea level rise benchmarks in coastal hazards assessments

The Coastal Risk Management Guide – Incorporating sea level rise benchmarks in coastal hazards assessments (DECCW, 2010) states that the identified risk area for coastal planning is to include the existing coastal hazards region plus an additional area affected by sea level rise. DECCW (2010) suggests coastal hazards studies should assess a coastal hazard planning line both with and without sea level rise (at benchmark levels set by the Policy Statement).

The guideline also indicates that the defined coastal inundation hazard should include sea level rise to benchmark levels as part of the assessment, and Design Still Water Levels to be used in such assessments are provided. This Guide was used to prepare the beach erosion and recession and coastal inundation hazard extents in the Wollongong Coastal Zone Study (Cardno, 2010).

The CZMP Guidelines will replace this Guide once adopted by the Minister.

Coastal Protection and Other Legislation Amendment Act 2010

NSW Government's reforms to coastal erosion management were facilitated through the Coastal Protection and Other Legislation Amendment Act 2010 (now repealed) resulting in amendments to the *Coastal Protection Act 1979*, the *Local Government Act 1993* and *Environmental Planning and Assessment Act 1979*. The amendments were passed in October 2010, and came into effect in January 2011. Key amendments are as follows.

- The amendments outline emergency coastal protection works that landholders or public authorities (Council) are permitted to carry out under Part 4C of the *Coastal Protection Act*. The emergency coastal protection works must be consistent with a Code of Practise associated with this Part, which includes the authorised locations for these works, the trigger for their implementation, length of time they are permitted, form of the works (i.e. no higher than 1.5 m AHD, using sand and sand bags placed at toe of erosion scarp only, and only using imported sand), and . There are no authorised locations in the Wollongong LGA.
- Improved order powers for Council officers to order the removal or fine landholders who have placed inappropriate protection works (temporary or otherwise) on public or private land was outlined, including 'stop work' orders, increased penalties for such illegal actions, and

exemptions from liability for Council officers who place the orders (Section 4D of the *Coastal Proection Act 1979*).

- Amendments to enable Council to levy an annual coastal protection service charge to landholders under Section 55B of the *Local Government Act 1993* who have funded or partfunded coastal protection works (such as seawalls), to pay for ongoing maintenance of the works and management of offsite impacts were implemented.
- Legislative amendments were made that permit landholders to submit applications to erect long term coastal protection works, with approval contingent on the landholders demonstrating that potential offsite impacts can be managed, including ongoing works such as beach nourishment, refer Section 55M of the *Coastal Protection Act 1979*. The works can be fully funded by the landholders who submit the application. Ongoing maintenance can be facilitated through annual coastal protection service charge (as above).
- A joint state-local body called the NSW Coastal Panel was established under Part 2A of the Coastal Protection Act 1979 to act as a consent authority for proposed long term protection works (e.g. as above) where a council does not have an adopted CZMP and / or requires further technical assistance in assessing such development applications, and to assist the Minister when requested, such as for reviewing CZMPs.

Coastal Protection Service Charge Guidelines

Also in December 2010 the former DECCW published the Coastal Protection Service Charge Guidelines which outlines the Coastal protection Service Charge, described as a service to maintain and repair coastal protection works or to manage the impacts of coastal protection works. The guidelines detail how it can be used to fund the protection of private property by those property owners deemed to benefit from the works and describing how the amount of the rate should be calculated over the design life of the works. The Minister for Climate Change and the Environment published a notice in the Government Gazette on 31 December 2010 that he had issued these guidelines for the purposes of the Local Government Act.

Eligible coastal protection works for the CPSC include:

- works voluntarily constructed by a benefiting landowner (or landowners)
- works constructed jointly by a public authority (e.g. council) with voluntary contributions from benefiting landowners
- works that existed before section 496B of the Local Government Act 1993 commenced, where the landowner or a previous landowner voluntarily agreed to pay the CPSC
- works that existed before section 496B of the Local Government Act 1993 commenced, where the landowner has voluntarily agreed to upgrade the works. A pro-rata CPSC then applies, based on the incremental additional costs of maintaining the works and managing their off-site impacts.

Residents must agree to pay the CPSC prior to the works being constructed. This annual charge is then attached to the land and becomes the responsibility of all future land owners for the life of the protection works. The amount of the charge is regularly reviewed depending on the cost of



maintaining the works and in ameliorating any adverse impacts. Where works are implemented by Council and Council chooses to contribute to the cost of the works then Council also must accept liability for a portion of the future CPSC.

SEPP (Infrastructure) 2007

SEPP (Infrastructure) 2007 provides a consistent planning regime for infrastructure and the provision of services across NSW, including consultation with relevant public authorities during the assessment process. The intent of the SEPP is to support greater flexibility in the location of infrastructure and service facilities along with improved regulatory certainty and efficiency for the State.

The SEPP also relates to 'waterway or foreshore management activities' (Division 25) which are defined as:

'(a) riparian corridor and bank management, including erosion control, bank stabilisation, resnagging, weed management, revegetation and the creation of foreshore access ways, and

(b) instream management or dredging to rehabilitate aquatic habitat or to maintain or restore environmental flows or tidal flows for ecological purposes, and

(c) coastal management and beach nourishment, including erosion control, dune or foreshore stabilisation works, headland management, weed management, revegetation activities and foreshore access ways.'

Section 129 of the SEPP states that development for the purposes of waterway or foreshore management activities (such as defined above) may be carried out by or on behalf of a public authority (i.e. Council) without consent on any land. Such activities include:

- construction works;
- routine maintenance works;
- emergency works, including works required as a result of flooding, storms or coastal erosion;
- environmental management works.

Thus in the study area, Council is permitted to undertake foreshore management (such as a revetment walls, beach nourishment environmental rehabilitation etc), provided they undertake a Review of Environmental Factors (REF) (under Part 5 of the EPA Act), and any other relevant approvals required relating to the land (e.g. *Crown Lands Act 1989, Fisheries Management Act 1994, Water Management Act 2000* etc).

SEPP (Infrastructure) 2007 repealed SEPP 35 Maintenance Dredging of Tidal Waterways. Further, changes to SEPP Infrastructure are proposed to permit landholders to construct seawalls, as outlined in the the *Coastal Protection and Other Legislation Amendment Bill 2010.*

Coastline Hazard Policy 1988

The NSW Government's Coastline Hazard Policy (1988) aims to reduce the impact of coastal hazards upon land owners and occupiers in the coastal zone, and to reduce public and private losses which may result from coastal hazards. With respect to sea level rise, the 2009 NSW Sea Level Rise



Policy Statement supersedes this policy. The remaining objectives from that policy are incorporated into the NSW Coastal Policy 1997.

Coastline Management Manual (1990)

The Coastline Management Manual (1990) documented the NSW Government's Coastline Hazard Policy (1988) and provided guidance for undertaking the required Coastal Hazards Definition studies, Coastline Management Studies, and the preparation of Coastline Management Plans. This document was the guideline document for the Wollongong City Council Coastal Zone Study (Cardno, 2010) (Wollongong Coastal Zone Study).

OEH (formerly DECCW) adopted the *Guidelines for Preparing Coastal Zone Management Plans* in December 2010 which replace the Coastline Management Manual (and other documents).

tem2. Attachments

APPENDIX D: SUMMARY OF APPROACH TO ASSESSING BEACH EROSION

The SBEACH modelling package calculates cross-shore sediment transport under storm waves and water levels to determine erosion from the beach and dunes during a storm event. The model assumes fine to medium grained sands, and rock layers can be specified within the cross-shore profile used in the model. Geotechnical surveys were conducted at most of the study area beaches, to determine the presence or otherwise of rock layers and sediment grain size data, which was incorporated into the SBEACH model for storm demand analyses, to provide better certainty to the model results.

A key limitation of SBEACH is that it does not include longshore sediment transport, and thus cannot account for the movement of sediment along a beach that may enhance or reduce erosion at any one cross shore profile. SBEACH also does not include rip cell circulation and erosion.

In order to investigate beach erosion, a single design storm condition was adopted by Cardno (2010). The 'design' storm event analysed at Wollongong used the peak 100 year ARI offshore wave height (of 10.6 m H_s) calculated from wave data from Botany Bay over the 1971 to 1985 period (Cardno, 2010). This period of wave data was analysed because it covers the stormiest wave period on record, therefore providing a conservative the 'design' storm wave height for investigation.

Based upon the directional wave data from Sydney, storm waves are expected to originate from the east-south-east to south sector (Cardno, 2010). The critical offshore wave direction, as determined from the nearshore wave modelling was found to be ESE at Wollongong's beaches (the critical offshore wave direction was defined by Cardno (2010) as the offshore wave direction that leads to the largest nearshore wave height, for a specified offshore wave height).

Based upon the nearshore wave modelling, wave heights at the 6 m contour at each beach profile to be modelled in SBEACH was output for the 100 year ARI wave height (presumably for the critical offshore wave direction of ESE).

However, it should be noted that the greatest extents of beach erosion recorded have been in response to a series of closely spaced storms, rather than a single storm, most notably, the series of storms during 1974, particularly May – June. Care is thus required in interpreting storm demand estimates from a single storm event for planning purposes.

Photogrammetric data provides the only available data on change in beach volumes and width overtime. Aerial photographs are analysed in stereo to calculate ground elevations. The use of historical aerial photographs can therefore provide a snapshot of beach volume at that time. The data can provide insight into the response of the beach to storm events, and potential trends in beach volume change over time, for example, long term recession. However, given the large times (years) between dates compared with the varying timescales of beach systems (hours to thousands of years) care must be taken to interpret the photogrammetric data, particularly to recognise inaccuracies and anomalies from long term trends.

Photogrammetric data was available from ten of Wollongong's beaches, namely Austinmer, Thirroul, Coledale, Sandon Point, Bulli, Woonona, Corrimal, North Wollongong, Coniston and Perkins. The data sets variously captured dates between 1936 and 2007, with between four and twelve dates for each beach. At almost all beaches, the 1974 photogrammetric profiles demonstrated the most eroded beach position. Since this time, the photogrammetric data indicated a steady increase in beach volumes to the latest date in 2007 (Cardno, 2010).

Photogrammetric data was processed to determine the largest volume difference between consecutive photogrammetric dates. This was said to provide an indirect estimate of the erosion due to large storm events. Within individual beaches, volume losses between consecutive dates were averaged across all profiles within that beach, to provide a single average value for that beach. It should be noted that this may significantly underestimate the potential erosion at any one location along a beach. For planning future development, the average beach profile volumetric loss will be less than the potential hazard to back beach development relating to both rip cells and longshore sediment transport within an embayment (often termed beach rotation). The photogrammetric data can capture rip cell erosion, which cannot be modelled and which is typically much greater than the average erosion along a beach.

The SBEACH modelling was completed for 2 - 4 profiles on each beach (depending on the length of the beach). The "average" beach profile (i.e. the average beach position from all dates of photogrammetry) at each beach with photogrammetric data, or the current beach profile from ALS data was used as the starting profile for the SBEACH modelling, and to measure the beach erosion hazard adopted. The 'design' storm were modelled over a 7-days storm event (as described by Carley and Cox, 2003, where the wave height and water level increases to its peak at the middle of the 7 day period, then dissipates).

SBEACH model results at each beach were then scaled up based on the scaling of Bulli Beach to the 'high' storm demand estimate of $250 \text{ m}^3/\text{m}$.

The volumetric losses given in the photogrammetric data for some beaches were greater than both the modelled and scaled storm demand values adopted (e.g. measured 'average' volume loss of 206 m³/m compared with an adopted 147 m³/m at central Woonona Beach). This is likely because the photogrammetric volumes were calculated from consecutive dates of photogrammetry that were too widely spaced (> 2 years) to be representative of the single 'design' storm. The widely spaced dates of photogrammetry do not represent a 'design' storm, but do indicate the envelope of beach erosion-accretion cycles that may occur. Therefore, it is possible that the storm demand estimates adopted for each beach will be exceeded, particularly in relation to consecutive storms over longer (decadal) periods.

The potential change in storm erosion due to climate change was not explicitly investigated (Cardno, 2010), as the current climate change projections are inconclusive. In the present climate, long period (inter-annual to inter-decadal) oscillations in climate occur, such as the ENSO phenomenon which is documented to modify the frequency of east coast low events. Current evidence suggests east coast lows can occur twice as often during La Nina compared with El Nino climate cycles (Verdon, et al, 2004). These variable climatic processes affect wave conditions such that it can be expected there will be periods of relatively enhanced storminess over years to decades, such as was reported during the 1970s. Cardno (2010) attempted to include the 1970s period of enhanced storminess by adopting the peak offshore wave height of 100 yr ARI from measured wave data over 1971 to 1985. However,

D-2

the SBEACH modelling of Cardno (2010) did not account for consecutive storms, which are known to have produced the enhanced erosion measured on NSW beaches during the 1970s. Therefore, it is possible that the SBEACH storm demand values adopted for the beach erosion hazard at Wollongong may be exceeded.

An erosion hazard or recession hazard (due to sea level rise) was not defined for the Lake Illawarra foreshore. This was because the very low wave energy within the lake was thought to result in episodic but small erosion events at the shoreline. While it is expected that the lake foreshores shall also recede in response to a rise in sea level, Cardno (2010) again this was assumed to be small.

tem? Attachments



APPENDIX E: BEACH ASSET CONSEQUENCE TABLES

tem? Attachment?



| Stanwell Park Beach | Erosion / Recession | Periodic Inundation | Geotech | Comments / Reason for consequence level | Comments from | Potential Management Options? | Asset # (Council) |
|------------------------------------|------------------------|------------------------|---------|--|--|---|----------------------|
| Parks, Beaches and open space | | | | | | | |
| Stanwoll Park Boach | Major | Insignificant | | Beach and adjacent parkland is regionally recognised, has iconic status as a day trip destination, with many day visitors from Sydney. | | | |
| Starwell Park Recreation Area Park | Moderate | Minor | Xe. | Area is used as a hang-gliding landing area and parking and pack up area. Area has been used by the Stanwell Park Hang Gliding & Paragliding Club (SPHGPC) for many years. They lodged DA in 2002 (still in negotiation in 2009) to use the reserve and Bald Hill sites for this purpose. POM states intent to provide a Lease / Licence to the SPHGPC for hang gliding and paragliding activities carried out in accordance with the DA consent up to 10 years. Consequere for this park and is associated with regional recognition of beach, with regular visitors and users both from the northern LGA and Sydney. It is also the only seach between Coalcliff and the more inaccessible beaches in Royal National Park. | Stanwell Park / Bald Hill POM | Update POM to enable use of other park sections, as required due to inundation / erosion impacts | |
| Coastal Dune Systems | Major | Insigniticant | | Deach and dunal regions are identified as a I ligh Priority site for restoration works. | Illawarra Bindiversity Strategy 2010 (Draft)* | Dune restoration as consistent with bindiversity strategy | |
| Hargraves Creek | Moderate | Minor | | Creek has good structural complexity in estuarine vegetation communities, and does support some Saltmarsh EEC (GHD, 2007a). Crook is said to provide good potential foraging habitat for amphibians, microchiropteran bats, terrestrial and ccastal birds, and birds of prey (GHD, 2007a). Periodic inundation may be beneficial for estuarine habitats and species. | Council staff | | |
| Slarwell Creek | Moderale | Minor | | Stanwell Park lagoon area is said to be a significant Aboriginal area. The estuarine reaches of Stanwell Creek provide good potential habitat for amphibians, microchiropteran bats, and birds (GHD, 2007a). Structural complexity is moderate, and a number or estuarine vegetation communities are supported including Saltmarsh EEC and Swamp Oak Forest EEC (GHD, 2007a). Periodic inundation may be beneficial for estuarine habitats/species. | Council staff / LALC | | |
| Community Infrastructure | | | | | | | |
| Helensburgh / Stanwell Park SLSC | Major | Moderate | Major | Desire to increase footprint of SLSC, no plans to move (see POM notes) Currently operate out of this building (not separate tower) = need to retain line of sight Storage facility was intended / has been built (recommended in POM) POM noted "The surf club building is significantly constrained by bushfire threat, coastal hazards, a protected tree to the west and its proximity to the boundery of the adjoining privately owned property to the east". The POM indicates that the SLSC could be altered privately owned to improve usefulness for SLSC. Future expansion / alteration only possible within these contraints, and as suitable to character of Starwell Park / Bald Hill | Council staff / Stanwell Park Bald Hill POM | Consider accorrmodate or relocate options in more detail | B02030 |



| Stanwell Park Beach | Erosion / Recession | Periodic Inundation | Geotech | Comments / Reason for consequence level | Comments from | Potential Management Options? | Asset # (Council) |
|---|------------------------|------------------------|---------------|---|------------------|--|----------------------|
| Stanwell Park SLSC Storage Shed | | | Minor | | | | B03455 |
| Stanwell Park Beach Toilets (South) | | Insignificant | 4 | Consequence value assumes damage/spills from the sewerage system would not occur during periodic inundation. Unknown if inundation levels may affect sewerage systems in this location | | | B02006 |
| Kiosk (in Stanwell Park Recreation Area) | | Moderate | Moderate | Plans for expansion and refurbishing, possible knockdown and rebuild. Assessing structure at present (to compare with cost of knockdown and rebuild). Structure is currently on ground. Consider possibility of reising structure (if choose not to knockdown and rebuild) The kiosk has a private residence (leased out, typically to manager of kiosk, not a caretaken). The kiosk has a private residence (leased out, typically to manager of kiosk, not a caretaken). Building is in good repair. Asset provides a valuable community resource, particularly for the northern section of the LGA and visitors from Sydney, as it is only sandy beach between Coalcliff and the more inaccessible beaches in Royal viational Park. | Council Staff | Ensure re-design of Klosk accounts for coastal processes and sea level rise (inundation) | B02240 |
| Stanwell Park Reserve Dwelling | | Moderate | | Building is currently rented out as part of Kiosk facility, as noted above. | | | B02559 |
| Stanwell Park Reserve Toilets | | Minor | Minor | | | | B02241 |
| Transport Infrastructure Local Roads, (including car parks) | Minor | Moderate | Minor | Main access to beach for cars is unaffected by erosion. | | | |
| Water and sewage infrastructure | | | | | | | |
| Stormwater outlets and pipes | | Major | Major | Area is steep sided, requires suitable infrastructure | | | |
| Residential Development | | | | | | | |
| Existing Residences (4 ppty S end, 1 centre of beach) | Moderate | | | | | | |
| Vacant Land (Future Development) (1 blocks) | Minor | | | | | Setting development controls or preclude future development | |
| Existing Residences (7 ppty S end, edge of 1 centre of beach, edge of 9 ppties at end of creek) | | Moderate | | No flood study completed for Hargraves or Stanwell Creeks as yet, therefore the inundation levels are the first pass. Residents etc will not have been subject to flood controls (or Section 149) previously. Guidance and education required. | | | |
| Vacant Land (Future Development) (3 blocks) | | Insignificant | | 3 | | as above | |
| Existing Residences (19 ppty S end, 2 centre of beach) | | | Moderate | | | | |
| Vacant Land (Future Development) (1 blocks) | | | Insignificant | | | as above | |



| Coalcliff | Erosion / | Periodic | Geotech | Comments / | Comments | Potential Management Options? | Asset # |
|--|-----------|---------------|----------|---|---------------|----------------------------------|---------|
| Parks Beaches and onen space | | | | | | | |
| Coalcliff Beach | Major | Insignificant | Major | | | | |
| Coalcliff Beach Reserve Nature Area, Coalcliff Beach Reserve | Minor | Insignificant | S | This area provides a buffer for recession of the beach amenity as there are little to no backing dunes, while stil providing habitat value. | | | |
| Leeder Park | | Minor | Minor | Park contains a childrens playground, likely to be one of few for the area, and access through to Coalcliff pool | | | |
| Stoney Creek | Minor | Minor | | Rocky creek relatively steep before flowing to a limited outlet directly to beach. Only the area of outlet onto beach is likely to be affected, upper reaches of creek likely to be above impacts. Creek has low structural complexity in estuarine vegetation communities, although does support some Saltmarsh EEC (GHD, 2007a). The estuarine reaches provide limited habitat for fauna (GHD, 2007a). | | | |
| Community Infrastructure | | | | | | | |
| Coalcliff Surf Club | Moderate | | Moderate | Surf club is lower priority - this is just a shed (for storage) with a viewing platform (newly constructed storage building) | Council staff | | B02031 |
| Coalcliff SLSC Public Toilets Extension | Minor | | Minor | Attached to SW end of SLSC | | | B03172 |
| Coalcliff Boatshed | Minor | | Minor | Building to south of SLSC | | | B02908 |
| Leeder Park facility Toilet Block | | | Minor | | | | B02242 |
| Coalcliff Tidal Rock Pool (S end) | Major | Minor | | Pool considered highly utilised / important to community, should be maintained. Council has indicated an engineering solution may be required. | Council staff | | |
| Transport Infrastructure | _ | | | | | | |
| Beach access road and car park | Minor | Insignificant | | Access to beach for cars will still be possible even with erosion impacts. Access to beach or properties during periodic inundation is not significantly affected. | | | |
| Water and sewage infrastructure | _ | | | | | | |
| Stormwater outlets and pipes | | | Major | | | | |
| Residential Development | _ | | | | | | |
| Existing Residences (11 ppties N end, but edge of ppty below cliff) | Moderate | Moderate | | Effect of this on redevelopment potential of properties | Community | | |
| Existing Residences (19 N end but edge of ppty not houses, 26 centre of beach) | | | Moderale | Area has measured rates of movement (landslip), leading to strong controls on development. Development is allowed, so long is a suitable and correct design (in this area, can be expensive) | Council staff | | |
| Vacant Land (Future Development) (4 N end) | | | Minor | | | | |

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| Clifton | Erosion / Recession | Periodic Inundation | Geotech | Comments / Reason for consequence level | Comments from | Potential Management Options? | Asset # (Council |
|--|------------------------|------------------------|----------|---|------------------|----------------------------------|---------------------|
| Parks, Beaches and open space | | | | | | | |
| Moranga Park | | | Minor | | | | |
| EEC Habitat Moranga Park Cliff | | | | | | | |
| Vegetation (local significance to | | | Moderate | | | | |
| heritage also) | | | | | | | |
| Community Infrastructure | | | | | | | |
| Heritage Site: Coalcliff Colliery mine | | | Maior | See comments in Appendix G from Hazards Study | Cardno 2010 | | |
| shaft (state significance) | | | - Chan | | | | |
| Heritage Site: Imperial Hotel | | | Major | | | | |
| Heritage Site: Stand of Norfolk | | | Minor | ~ | | | |
| Island Pines | | | | | | | |
| Heritage Site: Scarborough Hotel | | | Major | | | | |
| Heritage Site: Police Station | | | Major | 2 | | | |
| Transport Infrastructure | | | | | | | |
| Seacliff Bridge and Lawrence | | | | Bridge has been built to withstand geotechnical hazards, therefore risk is mitigated. | | | |
| Hargrave Drive | | | Major | (Likelihood reduced to rare, consequence reduced to moderate (as impacts accounted | | | |
| | | | | for in design), risk level reduced to Low) | | | |
| Water and sewage infrastructure | | | - | | | | |
| Stormwater outlets and pipes | | | Major | | | | |
| Residential Development | | | | S | | | |
| Existing Residences (22) | | | Moderate | | | | |
| Institutional Infrastructure | | | | | | | |
| Primary School (heritage listed) | | | Major | | | | |
| | | | | 3 | | | |
| | | | | | | | |

| Scarborough & Wombarra | Erosion / Recession | Periodic Inundation | Geotech | Comments / Reason for consequence level | Comments from | Potential Management Options? | Asset # (Council) |
|--|------------------------|------------------------|----------|---|------------------|---|----------------------|
| Parks, Beaches and open space | | | | | | | |
| Scarborough Wombarra Beaches | Major | Insignificant | | | | | |
| Scarborough Recreation Reserve, Jim Allen Oval Natural Area | Minor | Insignificant | Minor | Area presents a buffer for recession of the beach amenity, particularly as there are no significant dunes at the beaches (rocky pocket beach type). | | | |
| Jim Allen Oval | Minor | Minor | | Park additionally has grounds for use in sports by community. Likely to be more limited facilities in northern end of LGA. | | | |
| Littoral Rainforest (N end of Scarborough Beach) | Moderate | Minor | Moderate | | | | |
| Small creek / drainage line (S end of Scarborough beach) | Minor | Insignificant | × | Stormwater outlets feed into this creek (consequence for stormwater reviewed below). Likely to have limited habitat value as highly developed / existing stormwater impacts. | | | |
| Important Habitat (Scattered Blackbutt Forest EEC) | | | Moderate | Scattered trees interspersed with residential development, likely to have lower habitat value. | | | |
| Community Infrastructure | | | | | | | |
| Wombarra Rock Pool | Minor | Insignificant | | Pool not considered as important to community, currently being managed to fail, is in poor repair and failing, no maintenance. However, pool requires tidal input and so may benefit from SLR | Council staff | | |
| Wombarra Rock Pool Amenities | Minor | Insignificant | | | | | B03720 |
| Heritage Site: Scarborough Cemetary | | | Minor | The heritage asset covers a large area, likely to be able to relocate affected burial sites. | | | |
| Seawall? | N/A | N/A | N/A | Apparently there is a failing seawall built in the Depression (1920s) located along Scarborough Beach. Unknown capacity of wall to protect from erosion impacts. | Workshop | Audit condition of existing structure. Refurbish as required. | |
| Scarborough/Wombarra SLSC | | | Major | | | | B02032 |
| Jim Allan Oval, Illawarra Park, Changerooms-toilets | | | Minor | | | | B02243 |
| Jim Allan Oval, Illawarra Park, Kiosk | | | Minor | č | | | B02244 |
| Wombarra Community Hall and Child- Care Preschool | | | Moderate | | | | B02143 |
| Wombarra Community Hall and Preschool garage | | | Minor | | | | B03745 |
| Transport Infrastructure | | | | | | | |
| Lawrence Hargrave Drive | | | Major | Major Coastal Road linking to Seacliff Bridge | | | |
| Haig Street Reserve (Local Road and car park at Scarborough Beach) | | | Moderate | Boulders have been used to protect road area. Impacts to roadway would limit access to private properties in this location | Council staff | | |
| Local road reserves and local roads | | | Minor | 5 | | | |
| Local roads (inc road access within William Sweeney park area at Wombarra) | Minor | | | | | | |
| Railway System | | | Major | STA already undertaking action to reduce risk of landslip (both consequence and likelihood), risk level reduced to Low. | | | |
| Water and sewage infrastructure | | | | | | | |
| Stormwater outlets and pipes | Major | Major | Major | | | | |
| Residential Development | | | | | | | |
| Existing Residences (60) | | | Moderate | | | | |
| Coledale Hospital | | | Major | | | | |


| Coledale Beach | Erosion / | Periodic Inundation | Geotech | Comments / | Comments Potential Management | Asset # |
|---|-----------|------------------------|----------|--|---|---------|
| exterioring to N edge of Sharkys Parks. Beaches and open space | | | | | | |
| Coledale Beach | Major | Insignificant | Major | | | |
| Carricks Creek | Minor | Insignificant | | Creek is essentially stormwater outlet located immediately south of SLSC. Likely to have C ilimited habitat value, high disturbance. | oledale Beach Reserve POM | |
| Stockyard Creek | Minor | Insignificant | | Creek is essentially stormwater outlet located at northern end of the beach. EEC adjacent C to creek further upstream. | oledale Beach Reserve POM | |
| Dalys Creek | Minor | Insignificant | | Creek is essentially stormwater outlet located at centre of the beach. Likely to have limited C habitat value, high disturbance. | oledale Beach Reserve POM | |
| EEC - Coastal Headland Banksia Scrub | Moderate | Minor | Moderate | EEC adjacent to Stockyard Creek. | | |
| Community Infrastructure | | | X | | | |
| Colodalo Surf Club | Minor | Modorato | Major | Colledate Beach Reserve POM stated that any new storaye shed and / or SLSC needed to bb behind the 50 yr line. At time of plan, club was operational and included a caretakers residence, but the facilities were inadequate, need for new storage shed (or new SLSC depending on funds) was flagged. Concept from a portable tower crane removal will cost around \$5000 Concept designs in place for a relocatable structure (~\$20,000-\$30,000) that will have executely and sewage connections, but can be moved by a crane at notice of a pending storm. With rolecatable structure (needed by a crane at notice of a pending storm. | Relocatable structure design for now SLSC, roducing risk (likelihnord) from coastal oledale Beach Azards kesowo POM / Council staff | B02033 |
| Coledale Beach Camping and Caravan Park | Minor | Minor | Minor | The campground also provides a buffer for recession of the beach. | | |
| Coledale Beach Camping Reserve - Amenities Building | Minor | | Minor | This is an aging asset, and redevelopment will be required in future, relocation or redesign is then possible | Council staff Redesign / relocation of structure when replaced | B02011 |
| Heritage Site. Nor folk Island Pines | Minor | Insignificant | Minor | See contrients for Thirrout | Council staff | |
| Coledale seawall | N/A | A/A | N/A | There is a seawall located along the southern part of the beach (beginning adjacent but not in front of SLSC), extending ~ 200m. Coledale Beach Reserve POM (2004) stated the C wall to be decaying and in need of repair. Unsure of protective ability, the wall may be just to provide beach access. | Audit of condition of seawall, oledale Beach repair/remove as recommended Reserve POM | |
| Coledale Rock Pool | Major | Minor | | Money has been spent here to retain structure - seen as important to community - also recent cba showed its cheaper to fix than fill / decommission - the way its cut restricts water movement SLR woul probably help with this | Workshop | |
| Coledale Rock Pool toilets | | | Minor | West of Coledale Rock Pool | | B02012 |
| Transport Infrastructure | | | | | | |
| Lawrence Hargrave Drive (Major Coastal Road) | | | Major | | | |
| Local Beach Access Road and car parking | Minor | Insignificant | Minor | Entire stretch of roadway backing the beach will be lost to erosion, however allows for recession of beach. Would require carpark further westward (immediately behind campground) and Lawrence Hargrave Drive to become main beach access route. (NB cadastral boundary for roadway extends beyond actual roadway). Periodic inundation likely to heve limited damages or impacts. | Council staff | |
| Water and sewage infrastructure | | | | | | |
| Stormwater outlets and pipes | Major | Major | Major | | | |
| Residential Development | | | | | | |
| Existing Residences (33 at S end of beach) | | | Moderate | Geotechnical issues unknown of in some of these areas | Community | |
| Institutional Infrastructure | | | | | | |
| Coledale Public School - Grounds only | Minor | | Minor | Erosion hazard only affects school grounds, not main building | | |
| Coledale Public School - Buildings | | | Moderate | | | |





| Sharkys Beach | Erosion / Recession | Periodic Inundation | Geotech | Comments / Reason for consequence |
|---|------------------------|------------------------|---------|---|
| Parks, Beaches and open space | | | 2 | - |
| Sharkys Beach | Major | Insignificant | Major | C |
| Public open space | Minor | Insignificant | Minor | This area immediately bac particularly as there is little |
| Community Infrastructure | | | | |
| Heritage Site: Norfolk Island Pines (backing entire beach) | Minor | Insignificant | Minor | See comments for Thirro |
| Shark Beach toilet block (mural painted) | | | Minor | South end of car park |
| Austinmer Boat Harbour toilets | | | Minor | Western side of car park |
| Transport Infrastructure | | | | |
| Lawrence Hargrave Drive (Major Coastal Road) | | | Major | |
| Car park (behind Sharkys beach and at boat harbour) | Minor | Minor | Minor | This area provides a buffe relocation to enable contin Harbour. |
| Sharkys / Austinmer Boat Harbour (Heritage listed) | Major | Major | Major | Concerns raised over ava harbours available in Woll |
| Water and sewage infrastructure | | | | |
| Stormwater outlets and pipes | Major | Major | Major | |
| Residential Development | | | | |
| | | | | Charle Darls accume this |

| | | _ | | | | | - |
|---|------------------------|------------------------|---------|--|------------------|----------------------------------|----------------------|
| Sharkys Beach | Erosion / Recession | Periodic Inundation | Geotech | Comments / Reason for consequence level | Comments from | Potential Management Options? | Asset # (Council) |
| Parks, Beaches and open space | | | 2 | • | | | |
| Sharkys Beach | Major | Insignificant | Major | | | | |
| Public open space | Minor | Insignificant | Minor | This area immediately backing beach provides buffer to enable recession of the beach, particularly as there is little to no backing dunes. | | | |
| Community Infrastructure | | | | | | | |
| Heritage Site: Norfolk Island Pines (backing entire beach) | Minor | Insignificant | Minor | See comments for Thirrout | Council staff | | |
| Shark Beach toilet block (mural painted) | | | Minor | South end of car park | | | B02013 |
| Austinmer Boat Harbour toilets | | | Minor | Western side of car park that is adjacent to the harbour | | | B02412 |
| Transport Infrastructure | | | | | | | |
| Lawrence Hargrave Drive (Major Coastal Road) | | | Major | | | | |
| Car park (behind Sharkys beach and at boat harbour) | Minor | Minor | Minor | This area provides a buffer for recession of the beach amenity. Would need to be relocation to enable continued provision of parking for community associated with the Harbour. | | | |
| Sharkys / Austinmer Boat Harbour (Heritage listed) | Major | Major | Major | Concerns raised over availability of harbours for community use - there are very few harbours available in Wollongong. | Committee | | |
| Water and sewage infrastructure | | | | | | | |
| Stormwater outlets and pipes | Major | Major | Major | | | | |
| Residential Development | | | | | | | |
| Vacant Land (Shark Park) | Minor | Insignificant | Minor | Shark Park - assume this is Council owned land, but is still currently zoned as residential land. (First residential cadastral block at N end of beach). The land could provide a buffer for recession of the beach amenity. | | Rezoning to public open space | |
| | | | | 3 | | | |



| Little Austinmer | Erosion / | Periodic | | Comments / | Comments | Potential Management | Asset # | Council |
|---|--------------|---------------|--------------|---|---------------|--|-----------|---------|
| (Austinmer North) Beach | Recession | Inundation | Geotecn | Reason for consequence level | from | Options? | (Council) | asset # |
| Parks, Beaches and open space | | | | | | | | |
| Little Austinmer Beach | Major | Insignificant | Major 🐂 📗 | | | | | |
| Public open space | Minor | | | | | | | |
| Coastal Dune Systems | Major | Insignificant | Major | | | | | |
| Community Infrastructure | | | | | | | | |
| Heritage Site: Norfolk Island Pines (backing entire beach) | Minor | Insignificant | Minor | See comments for Thirroul | Council staff | | | |
| Heritage Site: Glastonbury Gardens | | | Moderate | The gardens, as a heritage asset, are more spreadout, and therefore, the impacts can be managed across the site without loss of all heritage value. | | | | |
| Tuckerman Park Toilet/Shed | Minor | Insignificant | Minor | | | | | B02249 |
| Transport Infrastructure | | | | | | | | |
| Lawrence Hargrave Drive (Major Cuastal Road) | Catastrophic | | Catastrophic | Major access route to Northern Wolongong LGA, limited and area for relocation. | | Major access route to Northern Wollongong LGA, limited land area for relocation. | | |
| Local roads and car park | Minor | | Minor | Ś | | | | |
| Water and sewage infrastructure Stormwater outlets and pipes | Maior | Maior | Maior | | | | | |
| Residential Development | | | | | | | | |
| Existing Residences (2) | Moderate | | | Community needs to have better information about development potential, development controls, and DA assessment requirements for coastal hazards, should they wish to subdivide (or sell) | Community* | | | |
| Existing Residences (14) | | | Moderate | | | | | |
| Commercial and Industrial Development | | | | | | | | |
| Heritage site: Austinmer Headland Hotel | | | Major | While a private commercial asset, the site is heritage listed. | | | | |
| | | | | 5 | | | | |

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| Austinmer Beach | Erosion / Recession | Periodic Inundation | Periodic Inundation | Comments / Reason for consequence level | Comments from | Potential Management Options? | Asset # (Council) |
|--|------------------------|------------------------|------------------------|---|----------------------------------|--|----------------------|
| Parks, Beaches and open space | | | | | | | |
| Austinmer Beach | Major | Insignificant | Major | | | | |
| Austinmer Beach Reserve and Tuckermans Park | Minor | Minor | | | | | |
| Community Infrastructure | | | | | | | |
| Austinmer Surf Club | Major | Moderate | Major | Surfclub said to have been relocated in the 1980s. | 52 | | B02034 |
| Heritage Site: Norfolk Island Pines (backing entire beach) | Minor | Insignificant | | See comments for Thirroul | Council staff | | |
| Geologic Site: Rock headland / platform | | Insignificant | Major | Little detail regarding this site. | | | |
| Austinmer Rock Pool | Major | Minor | Ĉ, | Council has indicated Austimmer is a priority pool for community, and engineering solution may be required to retain pool. Walk from Thirroul to Austimmer Pool only possible at low tide, this will become impassable with sea level rise. Pool is easily accessible from Austimmer Beach, however. | Community* / Council staff | | |
| Changeroom & toilets | Minor | Insignificant | Minor | | | | B02014 |
| Austinmer Boatshed | Insignificant | Minor | Insigificant | Immediately south of SLSC, site is associated with functioning of surf club Concept plans have been provided for an extension to the boatshed, to provide changerooms, gym, kitchenette and viewing facility. The plans have taken coastal hazards into consideration, therefore lower consequence from coastal erosion impacts is expected. Structure to be built on ground level at 4.8 m RL. | Council staff | | B02015 |
| Austinmer Seawall | N/A | N/A | N/A | There is said to be a substantial wall along this beach. Coastal engineering condition and protection from wall unknown. (PMA (Brian Dooley) has photographs. | LPMA / LIA Authority | Assessment of seawall condition. Repair and update hazard lines or remove as recommended. | |
| Transport Infrastructure | | | | | | | |
| Lawrence Hargrave Drive (Major Coastal Road) | Catastrophic | Major | | Major access route to Northern Wollongong LGA limited land area for relocation. | | | |
| Lawrence Hargrave Drive (Major Coastal Road) in area between Austinmer & Thirroul Beaches | | | Catastrophic | Major access route to Northern Wollongong LGA limited land area for relocation. Given history of geotechnical hazards in this location, risk level reduced to low (likelihood rare, consequence minor as designed to accommodate landslip). | | | |
| Beach access and car park | Minor | Insignificant | | Periodic Inundation would have limited impact to community services and limited damages. | | | |
| Water and sewage infrastructure | | | | | | | |
| Stormwater outlets and pipes | Major | Major | | | | | |
| Stormwater outlets and pipes in area between Austinmer & Thirroul Beaches | | | Major | 0 | | | |
| Residential Development | | | | | | | |
| Existing Residences (~ 30) in area between Austinmer & Thirroul Beaches | | | Moderate | | | | |
| Commercial and Industrial Development | | | | | | | |
| Neighbourhood Business Centre (local shops) | | Moderate | | Local shops said to have been raised and are on piles (done by developer), to accommodate inundation | Council | | |



| Thirroul Beach | Erosion / Recession | Periodic Inundation | Geotech | Comments / Reason for consequence level | Comments from | Potential Management Options? | Asset # (Council) |
|--|------------------------|------------------------|---------|--|-------------------------|--|----------------------|
| Parks, Beaches and open space | | | | | | | |
| Thirroul Beach | Major | Insignificant | | Said to be small amount of change in beach position in last 70 years. 1911 photograph of Thirroul Beach taken from southern and provided by local resident shows unvegetated dunes (higher than present), beach is similar position (refer copy of photograph). | Community* | Undertake dure establishment works to protect back beach development (inc residential ppties) May include sacrificing some assets to provide area for re-establishment (RA Wortshop) | |
| Tingara Park | Minor | Insignificant | | Except for small area (noted below) majority of beach has no coastal dune protection. Unsure of seawall structural condition for providing protection. Park area provides only available land for migration of beach amenity. | | | |
| Flanagans Creek | Minor | Insignificant | S | The creek is quite large, with vegetated foreshores. However the creek provides limited habitat for fauna and no EECs and limited estuarine vegetation types (GHD, 2007a). Therefore, impacts to habitat value from erosion considered minor, and from periodic inundation considered insignificant. | Council Staff | | |
| Coastal Dune System (small area adjacent to creek outlet) | Major | Insignificant | | Remaincter of beach (ie, infront of seawall) has no dune system | Workshop | | |
| Community Intrastructure | | | | | | | |
| Thirroul Surf Club | Major | Moderate | | 10 yr horizon for replacement of building | Council staff | Rebuild on same foctrpint (e.g. double storey) to accommodate inundation, or relocate landward (RA Workstrop) | B02035 |
| Thirroul Pcol (also heritage site) | Major | Minor | | Pool shell will require replacement in next 5 - 10 yrs. Greater expectation from community for management from heritage perspective. Highly valued community assot | Council staff | Allow pcol to become a tidal pool, rebuild new pool landward (RA Workshop) | |
| Thirroul Pool office and amenitics | Major | Moderate | | Assume part of pool asset, therefore of higher consequence. | | | B02052 |
| Thirroul Pool toilet | Major | Moderate | | South end of pool. Assume part of pool asset, therefore of higher consequence. | | | B02053 |
| Thirroul Pool storage shed (large) | Major | Moderate | | South end of pool. Assume part of pool asset, therefore of higher consequence. | | | D03183 |
| Thirroul Pool intake | Major | Moderate | Major | Blue building and pipes, southern end of beach. Provides for filling of pool, therefore part of pool assot and so higher consequence. | | | B02066 |
| Heritage site: Thirroul Pavillion (being used as kiosk / restaurant) and residence | Major | Moderate | | Council is currently processing a DA for refurbishment of the Pavillion (as both proponent and consent authority). Hazard assessment and design being completed by Cardno for this project. Seawall has possibly been incorporated into hazard assessment. Using State Govt guidelines for hazards consideration, in lieu of Whilbogong specific hazard guidelines. | Council staff | Ensure refurbishment adequately considers design elements to accommodate coasial hazards | B02016 |
| Heritage Site: Thirroul Beach Reserve (S of pool) | Moderate | Minor | | Public open space that has heritage value, as part of Thirror Beach precinct. | | | |
| Heritage Site: Norfolk Island Pines | Minor | Insignificant | | Pines are a marker of the foreshore area. Currently strong restrictions on development near the pines, cannot be removed. Pines will have a limited lifespan and may perish over next 100 years. In future, the Pines are unlikely to be able to be relocated, but could be replanted (when undermined in future). The species is still commonly used in foreshore plantings. Protection may not be a viable option where pine will perish at some point in future. | Council staff | | |
| I hirroul Beach seawall | Ν/Α | N/A | Ν/Α | Unsure of ability of seawall to protect against ercsion. Was completely exposed after 1974 storms, apparently has piles to stronger foundation, however stormater erosion shows base of concrete at 1 - 2 m AHD. Wall built in early 1950s (further information may be available from Brian Dooley at LPMA) | Council staff / LPMA | Rebuilding or enhancement along entire beach may be appropriate, as part of a local area planning strategy for Thirroul (RA Workshop) | |
| Heritage site: DH Lawrence House | | | Major | At southern "headland", house where DH Lawrence was staying when wrote "Kangaroo". | Council staff | | |
| Heritage site: Former Quest House | | Moderate | | | | | |



| Thirroul Beach | Erosion / Recession | Periodic Inundation | Geotech | Comments / Reason for consequence level | Comments from | Potential Management Options? | Asset # (Council) |
|--|------------------------|------------------------|----------|---|--|--|----------------------|
| Transport Infrastructure | | | | | | | |
| Major Roads (Lawrence Hargrave Drive) | | Major | | | | | |
| Local Roads (Bath St linking to the Esplanade, Henley St, Road reserve for Harbord & Ocean Sts) | Minor | Moderate | | | | | |
| Beach access and car park (N end of beach) | Minor | Minor | | | | | |
| Beach access and car park (S end of heach) | Minor | Minor | | | | | |
| Local Roads (*at headland south) | | | Minor | | | | |
| Water and sewage infrastructure | | K | | | | | |
| Stormwater outlets and pipes | Major | Major | | Cause erosion on beach during heavy catchment rainfall events | | Scour protection for drainage outlets (RA Workshop) | |
| Thomas Gibson Creek - Stormwater outlet | Major | Major | 0 | This is the main stormwater line back through houses west of beach, exits to beach at southern end adjacent to pool intake. Flood management plan completed as part of Hewitts Creek FRMP. FRMP suggested opening the creek at 2.8 m RL, but this is essentially a stormwater outlet /drainage line rather than an entrance berm that would essentially impede flood flows?? As above, outlet causes erosion during heavy rainfall events. Residents affected by inundation (below) should already have Section 149 notation of flooding, as this creek (and its floodplain risk areas as per the FRMP) is contained in DCP E13. Creek is essentially a piped stormwater outlet, does not appear to have any associated heater. | Hewitts Creek FRMP | | |
| Stormwater outlets and pipes (*at headland south) | | | Major | | | | |
| Residential Development | | | | 3 | | | |
| Existing Residences (10 ppty at S end of beach toward DH Lawrence heritage site: 1 property at centre of beach) | Moderate | | Moderate | chin | | Set foreshore building line, communicate risk and signal council intent (ie will not protect), develop local adaptation strategy, develop evacuation plan (RA Wortshop) | |
| Existing Residences (extensive, relating to creek and stormwater pipe) | | Moderate | | Flanagans Creek & Stormwater drainage line - no food study completed as yet, therefore the inundation levels provide first pass. Residents etc. will not have been subject to flood controls (or Section 149) previously. Cuidance and education required. Filling of 186 Lavence Hangrave Drive residential property caused more flooding from upstream to ppty e.g. 182 / 184 L. H Drive. 1998 flood level reached laundry below house. Residents have raised concerns over changes to Section 149 - there negets to be better notation on what the risk actually is (ie, more than just "affected by coastal hazards", but caption on what the risk actually is (ie, more than just "affected by coastal hazards", but caption on what the risk. Understandably, the residents have raised questions over high tide) and perhaps likelihood (e.g. possible / likely by 2100), to better convey to owners / potential buyers the risk. Understandably, the residents have raised questions about the science and modelling (e.g. neighbours there for 50 years have never seen inundation), as they are concerned about how the science affects their property value. However, they would be more confortable to accept the science if better notation was on the Section 149 / available to community and buyers. | Community** / Community** * / Hewitts Creek FRMP | As above. For future development, DCP controls for inundation, potentially constal inundation hazard zones, develop an evacuatio plan (RA Workshop) plan (RA Workshop) | |
| Existing Residences (21 from 157 Lawrence Hargrave Dr on headland north, 11 south to Cnr Craig St) | | | Moderate | At residence adjacent to pool intake = has a concrete seawall (headland), acting well to protect from cliff erosion . There is an informal coal shaft within the two properties to the south of the seawalled ppty. Coal seam at base of cliff - unstable, sprayed concrete to fix* | Council staff / Community* | Set a Foreshore Building Line for geotech hazard (e. g. rock, platform and cliff along the pullevarde), to manage land redevelopment (RA Workshop). | |

| McCauleys Beach | Erosion / Recession | Periodic Inundation | Geotech | Comments / Reason for consequence level | Comments from | Potential Management Options? | Asset # (Council) |
|---|------------------------|------------------------|----------|---|---|----------------------------------|----------------------|
| Parks, Beaches and open space | | | | | | | |
| McCauleys Beach | Major | Insignificant | | Beach is reported to have undergone extensive erosion over last 12 months, with active erosion escarpment migrating landward | LALC | | |
| Woodland Avenue Reserve & Corbett Ave Reserve (public open space) | Minor | Insignificant | | Known ciff erosion issues (highly erodable mudstones) at properties and "surfers car park" at end of street. Council plans to build wall to protect the end of street and provide improved beach access. | Council staff / Community | | |
| McCauleys Beach Reserve (park & open space) | Major | Moderate | | Area listed as an Aboriginal Place (see below) | Council staff | | |
| Hewitts Creek | Moderzie | Minor | | Hewilt Creek estuartine condition is classified as good (Cardino, 2010 C2S) Block at north eastern side, adjacent to creek = issues (high hazard area). Habitat and thick vegetation provide good refuge. Hewits: Creek FRMP recommends Council open lagoon / elear entrance when berm Hewits: Creek FRMP recommends Council open lagoon / elear entrance when berm reacties RL 2.8 m. Needs to confirm will: Council if this is done at present?? Creek and carchment may prientially he of higher value due to good condition of habitats However, their good condition may assist to adapt (e.g. migrate) in response to coastal impacts. | Community* / Community / Hewills Ck FRMP | | |
| Tramway Creek | Moderate | Minor | | Tramway Creek estuarine condition is classified as good (Cardno, 2010 C2S) Hewitts Creek FRMP recommends Ccurcil open lagoon / elear entrance of Tramway when berm reaches RL 2.8 m. Needs to confirm with Council if this is done at present?? Creek and catchment may potentially be of higher value due to good condition of habitats. However, their good condition may assist to adapt (e.g. migrate) in response to coastal impacts. | Hewitts Ck FRMP | | |
| Coastal Dune Systems (S end) | Major | Insignificant | Major | | | | |
| Community Intrastructure | | | | | | | |
| Significant Aboriginal Site (Tent Embassy). | Major | Major | - | Heritage significance, also likely to be one of few Aboriginal areas. Council is purchasing land (- \$1.5 million) between and south of current tent embassy and cycleway. Other land (- \$1.5 million) between and south of current tent embassy as long as required. The Sandon Point Stockland development (West of Council / Aboriginal land) has been approved. Some landing back of lands to Council for public use. Land botwoon Tont Embassy and Stockland development (West of Council for public use. Land botwoon Tont Embassy and Stockland dovolopmont is privately ownod, but not developable. There are no plans to build any community or other structures on the Council land, land is to be manatened as open space (consistent with its heritage status). LALC recordly compiled a vogetation management plan for the area around the Tont Embassy with a CMA grant. | Council staff | | |
| Cycleway / Shared Pathway (Northern Coastal Cycleway) | Moderate | Moderate | Moderate | | | | |
| Transport Infrastructure | | | | | | | |
| Local Roads (inc Woodlands Ave, Corbett Ave) | Minor | Moderate | | During inundation some houses could be cutoff. | | | |
| Water and sewage infrastructure Stormwater outlets and pipes (N end of beach) | Major | Major | | S | | | |
| Residential Development | | | | | | | |
| Existing Residences (1 ppty at N end of beach | Moderate | Moderate | Moderate | As bslow for flooding / inundation from Hewitts Ck | | | |
| Existing Residences (/ ppty at N end of beach, not inc ppty above) | | Moderate | | Inese properties are already located in the Medium Kisk Flood Planning area, covered by Hewitts Creek FRMP, which sets development controls | | | |
| Existing Residences (10 ppty at N end of beach, south of DH Lawrence heritage site) | | | Moderate | Residents have raised concerns over crumbling cliff in this region. One resident raised question why hazard line isn't even larger, even greater hazard south of woodlands ave (Check with Peter Tobin). Want to protect properties against cliff ensoin. No approval of coastal rataining walls, rejected DAs, but now eysores constructed with no guidancne?? C Want clear strategy for how to address crumbling cliffline, including protection of Wordt clear strategy for how to address cumuling cliffline, including protection of Wordt base acceptable. | Community** | | |
| Vacant Land (Future Development?) (2 lots N end of Beach) | Minor | Insignificant | Minor | As above for flooding / inundation from Hewitts Ck | | | |

| Sandon Point Beach | Erosion & | Periodic | Geotech | Comments / | Comments | Potential Management | Asset # |
|--|-----------|---------------|----------|--|--|--|----------|
| Boundary ends at car park on S | Recession | Inungation | | Keason for consequence level | шош | | (Lounou) |
| Parks, Beaches and open space | | | | | | | |
| Sandon Point Beach Sandon Point Beach Reserve (not including Sandon Point Heritage | Major | Insignificant | | Reserve provides buffer area for roll back of beach and dunes. | | | |
| Slacky Creek | Minor | Minor | | Slacky Ck comes under the Hewitts Ck FRMP, which recommends Council open lagoon / clear entrance when berm reaches RL 2.8 m. Needs to confirm with Council if this is done at present?? (also check EMPs). The lower estuarine reaches of Slacky Creek provide limited habitat for fauna, and structural complexity is low at the entrance bar, with only two estuarine vegetation communities and no EECs supported in the creek. (GHD, 2007a). Much further upstream there may be an EEC with good riparian habitat, may be affected by inundation, but not ension. | Hewitts Ck FRMP | | |
| Coastal Dune Systems (N end of | Major | Insignificant | | | | | |
| Community Infrastructure | | | | | | | |
| Sandon Point Surf Club | Major | Moderate | Major | Re-development of SLSC in current location is planned. Not possible to relocate structure from current position to outside of hazard zone due to Significant money (smillons) planned for redevelopment. Site was subject to specific hazard study. Results have not been made available for CZMP (as yet), unknown what design or other provisions have been made to accommodate the immediate beach erosion hazard - it is expected the structure shall have foundation piles to rock and be designed to accommodate erosion, wave forces. Given location of SLSC near to Sandon Pt, likely to find stable rock for foundations, but current location to the wave forces, erosion of sand, and occassional inundation in current obset. | Council staff | Redevelopment of SLSC is currently underway - ensure redevelopment is built to withstand erosion, inundation hazards and wave impacts. | B02037 |
| Heritate Site: Sandon Point (also under NPW Act) | | Minor | Major | Heritage site includes for Aboriginal significance. Have received grant functing to do revegetation of Sandon Point. Nearshore reef is of high value to community (e.g. recognised surfing location, sonckelling, fishing). Weedy See Dragon habitat exists off Sandon Point | Council staff / Community / Community** | | |
| Heritage Site: Sandon Point Boat Sheds | | Minor | Moderate | Located along northern margin of Sandon Point itself (north around point from SLSC) Unusual lease arrangement (100yr with Lands) but if destroyed, current management approach is that they will not be rebuilt or protected. Currently in a state of disrepair, known to be subject to coastal processs in very vulnerable location. Still used cocassionation | Council staff | Retain current management approach | B03095 |
| Northern Cycleway / Shared Pathway (at S end of beach) | Moderate | | | Where the cycleway eroded, a stormwater outlet was also replaced. No erosion design code for stormwater at present. Rocks used to prop up cycleway in this location. | Council staff | | |
| Northern Cycleway / Shared Pathway | | Minor | Moderate | | | | |
| Heritage Site: Norfolk Island Pines (S end of beach) | Minor | Insignificant | | See comments for Thirrout | Council staff | | |
| Transport Infrastructure | | | | | | | |
| Local Roads: Blackall St, Ursula St, Alroy St) | Minor | Moderate | | | | | |
| Beach car parks (S end of Beach) | Minor | Minor | | | | | |
| Water and sewage infrastructure | | | | | | | |
| Stormwater outlets and pipes (S end of beach) | Major | | | I rinity Kow inadequate drainage pipes at Ursula road and south between Ursula and Airoy Streets | Community* | | |
| Residential Development | | | | | | | |
| Existing Residences (8 at S end of beach) | Moderate | | | Clarity required on effect of hazard on redevelopment potential of land. | | | |
| Existing Residences (adjacent to creek) | | Moderate | | As above, plus most of the affected ppties will already have Section 149 notation and be subject to Medium Risk Flood development controls (DCP E13). Only an extra 4 ppties affected by inundation compared with flood planning area (which was prob modelled without SLR) | Community / Hewitts Ck FRMP | | |

| Bulli Beach | Erosion & | Periodic | Geotech | Comments / | Comments | Potential Management | Asset # |
|--|-----------|---------------|----------|---|------------------------|--|----------|
| Parks. Beaches and open space | | | | | | | (mmm) |
| Bulli Beach | Major | Insignificant | Maior | Note the Bulli Area is listed on the Register of the National Estate* | | | |
| Bulli Beach Reserve | Minor | Insignificant | Minor | Reserve provides a buffer to enable roll back of beach | | | |
| Occan Park | Minor | Insignificant | | The area of land affected at Ocean Park is open space grassed area | | | |
| Whartons Creek | Minor | Insignificant | | Creek supports only a few estuarine vegetation communities (no EECs), and structural complexity is low at the entrance bar. The estuarine reaches of Whartons Creek provide limited habitat for fauna (GHD, 2007a). | | | |
| Collins Creek | Moderate | Minor | | The estuarine reaches of Collins Creek provide good potential foraging habitat for amphibinars, microchinopleran bals, terrestrial and coastal birds arm birds of prey Structural complexity is outbe high at the entrance bar, with a mixed assemblage of satimarsh spreised (an FFC), beach grasses and created dure vegetation. The coastal dure vegetation has been recently planted (GHD, 2007e). | | | |
| Coastal Dune Systems | Major | Insignificant | | Dunes have be established at Bulli specifically to provide a buffer to erosion | | Maintain dunes to provide erosion buffer (RA Workshop) | |
| Waniora Point (Heritage site) | Major | Moderate | Major | Area has high heritage significance. Grant recently received to protect Aboriginal midden, and rehabilitate from axisting erosion impacts. Works will commence after summer, to reduce likelihood of public access / damage to works. | Council staff | | |
| Community Infrastructure | | | | | | | |
| Buli Surf Club | Major | Moderate | Major | DA on surfeub was refused. Norfolk Pine may limit mowing the club, Dune vegetation and line of sight issues at this site - expressed an interest in helping with dune vegetation | Council / Community | Determine suitable relocation site, and relocate structure when trigger is reached (replacement schedule or distance from erosion scarp, Workshop, (RA | B02036 |
| Bulli Kiosk and residence | Muderale | Moderate | Moderate | Plan to maintain current building (nct rebuild as yet), with ~25 years life remaining on building. Recent maintemance works on building with grant including water tank (\$50 - 1100K) Kosk also has a residence, recently signded 10 yr lease for tenants. | Council staff | | B02017 |
| Dulli Tourist Park (caravan park) | Moderate | Minor | | Very high commercial value to Council, will be aining to retain asset into the future. A new kosk (temporary facility) has recently been built within the tourist park. | Council staff | Relocate cabins into adjacent park area when trigger is reached (replacement or distance from scarp), to maintain current commercial assot. (RA workshop) | Various* |
| Cycloway / Sharod Pathway | Modorato | Minor | Modorato | At Wan, or and the cycleway was undermined during storms, prompting Council to robuild and protect the path using rock to stop further crosion (unknown if was also reisod for inundaron). | | | |
| Bulli Pool | Moderate | Minor | | Gets inundated with sand, requiring regular costly ceaning (~ \$6K per clean). Woonona pool is located nearby however site is said to also have community value. | Council staff | Engineering option to increase height of walls, with trigger of 0.2 m SLR for implementation (RA Workshop) | |
| Heritage Site: Bulli Cemetary | | Minor | | The heritage asset is covers a large area, likely to be able to relocate affected burial sites | | | |
| Transport Infrastructure Car parks (Buli SLSC, Collins Pt reserve) | Minor | Minor | | Š | | | |
| Local Road (Campbells St, Ocean St road reserve) | | Moderate | | | | | |
| Water and sewage infrastructure | | | | 2 | | | |
| Stormwater outlets and pipes | Major | Major | | > | | | |
| residential Levelopment Existing Residences (adjacent to creek() | | Moderate | | Residents have raised concerns over changes to Section 149, there needs to be botter notation on what the rask actually is (ie, more than just "affected by coastal hazards", but explaining what hazard (e.g. inundation), what impact this may have (e.g. couple heurs over high field) and perhaps likelihood (e.g. possible / likely vot 2100), to beter convey to owners / potential buyers the risk. Understandabsly, the residents have raised questions owner the science and modelling (e.g. neighbours there for 50 years have newer seen nundation), seince and modelling (e.g. neighbours there for 50 years have newer seen inundation), seince and modelling (e.g. neighbours there for 50 years have newer seen inundation) as they are concerned about how the science affects their property value. However, they would be more comfortable to accept the science if better notation was on the Section 149 / valuable to community and buyers. Also requested ground fruthing / spot checks on ground along inundation houndary. In Also requested ground fruthing / spot checks on ground along inundation houndary. | Corrmunity** | Section 149 notification, redesign of structures (e.g. raising floor lovels) (RA Workshop) | |
| Existing Residences (8 behind Warrior e Pt) | | | Moderate | as above | | | |
| Institutional Infrastructure Bulli High School | | Moderate | | | | | |
| > | | | | | | | |

| Woonona Reach | Erosion & | Periodic | | Comments / Comments / | s Potential Management | Council |
|--|-----------|---------------|----------|---|---|----------|
| (extends to creek at centre of beach) | Recession | Inundation | Geotecn | Reason for consequence level from | Options? | a sset # |
| Parks, Beaches and Open Space | | | | | | |
| Noonona Beach | Major | Insignificant | | At high tide, no beach, as dunes and incipient dunes with spinifex and Acacla sophone in particular have grown and advanced significantly seawards (particularly compared with the wide beach area with no dunes duing the 1970s). At high tide, the water extends to incipient dunes, no beach width for sunbathers. | iff, y | |
| Vicholson Park, Beach reserve | Minor | Insignificant | | Provides buffer for recession of beach amenity. Sports grounds on Nicholson Park would not be affected. | | |
| Jnnamed Creek and adjacent habitat | Moderate | Minor | | Evidence of stormwater outlets flowing into the creek. Appears to be some habitat surrounding creek. Unsure of habitat value. | | |
| Coastal Dune Systems | Major | Insignificant | and i | Request for change in dunal species to allow viewing of the beach, removal of snakes/vermin and weeds. NB - better education required to explain to community value of coastal dunes for ension protection and habitat]. Concents raised over dune species height (and dune height) that is now too high and too wide. One concents raised over dune species height (and dune height) that is now too high and too wide. One resident stated the dune height has locked views from SLSC for members, and from roadway for surfers and passers by. This resident has lived in area whole life and remembers the beach in J068 and 708 as and passers by. This resident has lived in area whole life and remembers the beach in J068 and 708 as and passers by. This resident and how beach. On occassion, sand blown up over the road (either and and intro Nichsloon Park). The sand was then mechanically shifted back onto the beach. After pacelase could see water and have a wide beach for sun bating, SLSC activites. Resident also said the dunes house rats, rabbits and weeds (picty pear, bitou, asparagas weed), walk ways are overgrown. Believes can see beach for sun the flored. Wernber fron Woonona SLSC also noted the dune species were too high (blocking views at present) and | Maintain dunes to provide erosion buffer (RA Workshop) (- | |
| Community Infrastructure | | | | • | | |
| Noonona Surf Club | Major | Moderate | | Resident noted surf club has piers extending 18 m through the sand down to clay (there is no solid rock), Commur when built. | λ | B02038 |
| _ifeguard Tower | Minor | Insignificant | | | | B03116 |
| Voonona pool | Moderate | Insignificant | | Pool may in fact improve with SLR, as currently pool only fills at top of tide, although pump station may be at risk. Pool is located on Collins Point at Northern end of beach. Pool has fairly high community value. | Engineering option to increase height of walls, with trigger of 0.4 m SLR for implementation (RA Workshop) | |
| Noonona Rock Pool Dressing Shed | Minor | Insignificant | | Not actually beneath the erosion or inundation lines, but immediately adjacent to where they end. Possible that will be protected from erosion as nonder on rock immediately behind the rock pool. | | B02019 |
| Cycleway / Shared Pathway | Minor | Minor | | | Relocate cycleway | |
| Fransport Infrastructure | A firmer | Miner | Miner | | | |
| peach access and car parks | Minor | Moderate | Minor | Access to residential property is possible to be retained, even where local roads affected. | Alter traffic routes (inc bus), redesign road network to maintain access to residential properties, then allow road to be eroded (i.e. retreat) (RA | |
| Water and sewage infrastructure | | | | | VVORSTIOD) | |
| Stormwater outlets and pipes | Major | Major | | 3 | Redesign network (over typical replacement schedule) to accommodate / mitigate inundation. | |
| Residential Development | | | | | | |
| ≟xisting Residences (19 at centre of be | Moderate | Moderate | | Concerned about effect of notation on property value and insurance | For erosion: Section 149 notation, DCP controls for redesign, reducing development density, consider relocatable y housing designs. For inundation: Section 149 notification, redeain of structures (e.g. raising floor levels) (RA Workshop) | |
| Existing Residences (5 at N end) | | | Moderate | | | |
| ≣xisting Residences (adjacent to creek) | | Moderate | | | | |

| Bellambi Beach (not inc Bellambi Pt) | Erosion & Recession | Periodic Inundation | Geotech | Comments / Reason for consequence level | Comments from | Potential Management Options? | Asset # (Council) |
|---|------------------------|------------------------|----------|--|------------------|----------------------------------|----------------------|
| Parks, Beaches and open space | | | | | | | |
| Bellambi Beach | Major | Insignificant | | | | | |
| Beach Drive Park, Bellambi Natural Area, Bellambi Point Reserve, Bellambi Pool Reserve | Minor | Insignificant | | Provides buffer for recession of beach amenity. | | | |
| Bellambi Gully and adjacent habitat | Moderate | Moderate | KC. | Bellambi Gully estuarine condition is classified as extensively modified (Cardno, 2010 CZS). However, the estuarine reaches of Bellambi Gully provide excellent potential foraging habitat for amphibians, microchiropteran bats, terrrestrial, estuarine and coastal birds, and birds of prey (GHD, 2007a). Structural complexity is quite high at the entrance vegetation (GHD, 2007a), such a mixed assemblage of saltmarsh species, beach grasses and coastal dune vegetation (GHD, 2007a). Bellambi Creek and Farrahers Creek run into Gully. | | | |
| Coastal Dune Systems | Major | Insignificant | | | | | |
| Community Infrastructure | | | | | | | |
| Bellambi SLSC | | Moderate | | Mural painted | Council | | B02039 |
| Cycleway / Shared Pathway | Moderate | Minor | | | | | |
| Bellambi Pool | Major | Minor | | Pool has been maintained to better withstand wave impacts, \$700000 recently spent on concorse and toddler pool upgrades. Recent works will have increased financial and community value. | Workshop | | |
| Bellambi Pool Toilet Block | | Insignificant | | | | | B02851 |
| Bellambi Gully training wall | N/A | N/A | | Not designed for hazards protection. Will probably need to be maintained to protect property. | | | |
| Bellambi boat ramp toilets (Old Coastguard building) - located at southen end of formal carpar area on Bellambi Point) | | Insignificant | Minor | | Council | | B02596 |
| Transport Infrastructure | | | | | | | |
| Bellambi pool car park | Minor | Insignificant | | | | | |
| Bellambi Boat Harbour | Major | Minor | | Concerns raised over community usage of this - there are very few harbours available in Wollongong, functionality of ramp will be an issue | Committee | | |
| Local Access road along coastline | Moderate | Moderate | Moderate | Access is constrained along this shoreline section, therefore local road needs to be retained, which could be done if area of parkland / open space / STP land used for local road. | | | |
| Water and sewage infrastructure | | | | | | | |
| Stormwater outlets and pipes | Major | Major | | | | | |
| Sewage Treatment Plant | Major | Major | Major | | | | |
| Residential Development | | | | | | | |
| Existing Residences (~ 20 in 3 developments) | | | Moderate | | | | |





| E-17 | 7 |
|------|---|
|------|---|

| Bellambi Point Beach | Erosion & | Perlodic | Gentech | Comments / Commen | ts Potential Management | Asset # |
|---|-----------|---------------|---------|--|--|-----------|
| (to Lagoon entrance) | Recession | Inundation | | Reason for consequence level from | Options? | (Council) |
| Parks, Beaches and open space | | | | | | |
| Bellambi Point Beach | Major | Insignificant | N. | | | |
| EEC area | | Minor | 5 | EEC located within residential area, likely to be disturbed. | | |
| Coastal Dune Systems | Major | Insignificant | | Based on aerial photographs (see below) frontal dunes were vegetated very recently. Vegetation mapping describes the dunes as highly disturbed. | | |
| Heritage Site: Bellambi Lagoon (Lake), Sandpit Point and associated habitat | Major | Moderate | | Bellambi Lagoon is listed as being of local heritage significance, and also has high habitat value. There has been an ongoing problem relating to the breakout and northwards migration of the nertrance channel, which is causing erosion of the northern dunes adjacent to entrance. There have been concerns raised by community over the erosion, which is council state destabilising attempts to revedetate the northern bank, and concerns the erosion within is beyond the immediate erosion area, which are located further back within the dunes beyond the immediate erosion area, beyond the model area of the descreted between (Discussion of an area beyond the model area beyond the immediate erosion area beyond the erosion area beyond the erosion area beyond the the descreted between (Discussion of a the area of the descreted between (BHO (2007a) found the estuarine sufficiend as extensively modified (Cardno, 2010 excellent potential for amphibians, microchicopteran basis, terrestrial, beyond excellent potential for amphising. microchicopteran basis, terrestrial, | DECC study recommended aff / o / o / in / ity 310 | |
| Community Infrastructure | | | | | | |
| Heritage Sites: Bellambi Point | Major | Moderate | Major | There are likely to be sites of Aboriginal heritage significance in this location. The area is Council standard a nominated Aboriginal Place | Need to develop strategy for aff / managing hazard impacts to different types of heritage sites (e.g middens) | |
| Water and sewage infrastructure | | | | | | |
| Sewage Treatment Plant | Major | Major | Major | | | |
| | | | | | | |



| n & Period | lic Geotech | Comments / | Comments | Potential Management Options? | Asset # |
|------------|-------------|--|--|----------------------------------|---------|
| 5 | | | | | |
| ant | × | | | | |
| ant | 6 | las been illegal clearing recorded in the past. Vegetation mapping describes the dunes is highly disturbed with weeds, even though vegetation appears to be well established. | Council staff | | |
| ate | | Dhe resident has concerns over "the effect of backup flooding due to the backup of water rom Towradgi Creek. Have contacted the school re block of stormwater drain at the rear of 4 Gregory Ave - no response forthcoming". Southern side of lagoon is identified as a High Priority site for restoration works. Firgger Level for opening: 1.6 m (with rain falling or impending), with alert level at 1.4 m ie, to mobilise equipment for opening). If lagoon doesn't breakout and rainfall not meending, emergency trigger level set at 1.85 m, to alleviate flooding of property and assets beyond this level (e.g at 1.8 m some stormweter assets on Lake Pde and Parker ad antifooding of ppty (nor floors) on Parker Rd Arm, Parker Rd crossing at 1.94 m, owardgi Lagoon estuarine condition is classified as extensively modified (Cardno, 2010 225) | Community* / Illawarra Biodiversity Strategy 2010 (Draft)** / Towradgi Lagoon Entrance Management Policy | | |
| cant | | | | | |
| | | | | | |
| L | | fas removable structure (sled system , no power or water supply) | Check this info?? | | B02040 |
| cant | | There are two blue roofed buildings at the far southern end of the beach (adjacent to oadway dividing this from Towradgi Beach). The mens amenities is slightly further north and in both hazard zones | | | B02020 |
| | | The womens building is slightly further south and not in inundation hazard zone. | | | B03148 |
| | | | | | |
| ite | | The inundation extents (at 2100) lie wintin the existing High or Medium Risk Flood Manning area from the Towradgi Creek FRMP. Therefore, development controls and Section 149 notation shall already have been issued to residents. Noted by Committee that voluntary acquisition was offered to flood affected residents. | Towradgi Ck FRMP / Committee | | |

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| | | - | ~ | | | |
|---|------------|---------------|--|-----------|----------------------|-----------|
| Towradgi Beach | Erosion & | Periodic | Comments / | Comments | Potential Management | Asset # |
| (extending to just north of Fairy | Recession | Inundation | Contection Reason for consequence level | from | Options? | (Council) |
| arks, Beaches and open space | | | ç | | | |
| owradgi Beach | Major | Insignificant | | | | |
| owradgi Beach Park: Coastal Dune | Major | Insignificant | Some areas of good vegetation, some areas of high disturbance (based upon vegetation | | | |
| oystems | | | (phuga) | | | |
| community Infrastructure | | | | | | |
| Cycleway / Shared Pathway | Moderate | Minor | | | | |
| | | | Tidal, would require an engineering solution, highly utilised by the community (NB | | | |
| owradgi Pool | Major | Minor | amenities buildings for the pool are located north, behind Corrimal Beach - see this | | | |
| | | | beach for hazard details) | | | |
| owradgi Beach Lifeguard Tower | Minor | | Near (south east of) Towradgi SLSC. | | | B02049 |
| owradgi Protection Structure - | VIN | VIV | At north end of Towradgi there is a Gabion mattress with toe 1m x 1m to protect the road | | | |
| raining wall? | V N | K N | and houses | | | |
| ransport Infrastructure | | | | | | |
| .ocal Roads: Towradgi Road, | Moderate | Moderate | There may be difficulties maintaining access to some properties (as well as beach | | | |
| Aarine Parade (N end of beach) | MODELAIE | MIDUEI ALE | visitors) that will make these local roads more important and complicated to manage. | | | |
| Vater and sewage infrastructure | | | | | | |
| Stormwater outlet / pipe (N end) | Major | | | | | |
| Residential Development | | | | | | |
| Existing Residences (4 at N end) | Moderate | Moderate | Clarity required on effect of hazard on redevelopment potential of properties | Committee | | |
| /acant Land - 15 lots N end | | | These properties appear to be part of Towradoi heach Park and Chastal Dune Systems | | | |
| urrently vegetated with coastal | Minor | Insignificant | Should not be zoned residential but maintained as environment protection / public | | | |
| aure vegeri (minieuratery aujaceni) o 2100 line) | | | recreation | | | |
| | | | 3 | | | |

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| Fairy Meadow Beach | Erosion & | Periodic | Geotech | Comments | Comments | Potential Management | Asset # |
|--|-----------|---------------|---------|--|--|----------------------|-----------|
| (extends to immediately north of | Recession | Inundation | | Reason for consequence level | from | | (Council) |
| Parks, Beaches and open space | | | | | | | |
| Fairy Meadow Beach | Major | Insignificant | | Beach currently in eroded state, narrow beach face covered at high tide | Community | | |
| Fairy Lagoon Habitat (part of Puckeys Estate lands) | Moderate | Moderate | | Puckeys Estate (extending from northern edge of Lagoon northwards along Fairy Meadow Beach) is identified as a Highest priority site for restoration works. Puckeys Estate heritage assets included in North Beach assessment. | Illawarra Biodiversity Strategy 2010 (Draft)* | | |
| Towradgi - Fairy Meadow Foreshore: Ccastal Dune Systems | Major | Insignificant | | Adjacent to Thomas Dalton Park. See above for proposed rehabilitation works. | | | |
| Community Infrastructure | | | | | | | |
| Fairy Meadow SLSC Lifeguard Tower | Minor | Insignificant | | Small structure south east of SLSC | | | B03088 |
| | | | | nents | | | |



| Wollongong North Beach | Erosion & Recession | Periodic Inundation | Geotech | Comments / Reason for consequence level | Comments from | Potential Management Options? | Asset # (Council) |
|--|------------------------|------------------------|---------|---|---|--|----------------------|
| Parks, Beaches and open space | | | | | | | |
| North Beach | Major | Insignificant | | | | | |
| Fairy Lagoon | Moderate | Moderate | Ke. | Trigger Level for opening: 1.6 m (with rain falling or impending), with alert level at 1.3 m (ie, to mobilise equipment for opening). If lagoon doesn't breakout and rainfall not impending, can be broken out at 1.8 m, to alleviate flooding of Live Steamers Site beyond this level. Fain Creek/Lagoon estuarine condition is classified as modified (Cardno, 2010 CZS) | Fairy Lagoon Entrance Management Policy | Allow retreat of lagoon (RA Workshop) | |
| Stuart Park (on heritage list, local significance) | Moderate | Minor | | The site is heritage listed but provides open space that beach could recede into. At site of existing carpark - Strategy 6A Multi-deck public carpark with commercial / retail component with northern aspect overlooking Stuart Park | Blue Mile Foreshore Masterplan | Allow erosion/recession (je retreat) (RA Workshop) | |
| Community Infrastructure | | | | | | | |
| Puckeys Estate including Seafield House and gardens ruins | Major | Major | | At edge of Fairy Lagoon (NW of entrance), there are workings of a "satt" mine, used by Puckey. Periodic inundation could further degrade the limited house and garden remains | Council staff | | |
| Lagoon Kiosk/Restaurant | | Moderate | | This is located at the end of the car parking immediately south of the lagoon (in the park). | | Over the short term, build a bund to protect from coastal inundation to a certain trigger level. Abandon location after trigger/bund is reached, and refor-ata behind hazard area | B02607 |
| | | | | S | | (RA Workshop) | |
| Stuart Park toilet block | | Insignificant | | South of Lagoon Kiosk/Restaurant | _ | | B02314 |
| North Beach Surf Club | Major | Moderate | Major | Strategy 6B Construction of new SLSC to the north of existing building maintaining full access to beach with commerical component and public toilets, creating grassed terraced plaza with public seating and lighting [on old SLSC step]. Plans to knock down and rebuild this site (with State govt assistance) was flagged in the Wolongong City Foreshore POM. The former site will be grassed for public access and use (Strategy 6F). Designs for rebuilding SLSC have not yet been completed, but are intended to address coastal hazards. Unclear if relocation was considered (as proposed site is within hazard area), or if there were other constraints to relocation. Capability of existing seawall in front of site as protection from beach erosion is unknown, but suggested by Council to be inadequate. Pavilion seawall is intended to extend to future] surf club in the future. | Blue Mile Foreshore Masterplan / Council staff | Ensure design is adequate to withstand future recession and inundation. Ensure extension of seawall to protect SLSC and adjacent buildings | B02043 |
| Heritage Site: North Beach Kiosk | Major | | Major | The structure is located next to the SLSC. The Kiosk structure is heritage listed and Council owned/ managed. It has high community value, as well as commercial value as functioning restuarant / kiosk. The Wollonong City Foreshore POM indicated this structure was removated prior homeration of restaurant and kinck. | Foreshore POM | Extend new seawall at the Pavilion to protect this site also. | B02025 |

| Wollongong North Beach | Erosion & Recession | Periodic Inundation | Geotech | Comments / Reason for consequence level | comments P. from O | otential Management ptions? | Asset # (Council) |
|--|------------------------|------------------------|----------|--|--|--|----------------------|
| Heritage Site: North Beach Pavilion | Major | Moderate | Major | Site is seen as a significant community asset with high heritage value. Community noted the pavilion to be a beautiful building of high value. Replacement of seawall across this property (see below) will protect this asset from Co coastal hazards, reducing the likelihood and impacts of coastal hazards. Strategy 6H Existing Bathers Pavillion building redeveloped incorporating restuarants, Fi public toilets and improved access in accordance with NSW Heritage Office guidelines Mu and DA approval process. | ouncil staff S Norkshop / at ommunity / Blue Mile oreshore lasterplan | eawall constructed to protect sset. | B02024 |
| North Wollongong Beach Toliet Block | | | Minor | West of Pavilion (ie, immediately behind, likely to be protected by Pavillion wall). | | | B02023 |
| North Beach Seawall | | | | Seawall is to be replaced (cost ??~ \$8 m). Existing crib lock wall is said to be on sand [not suitable toe for long term protection]. New seawall will be emplaced in front and fruther east. As per Blue Mile, is will additionally provide beach access stairs and large seating stairs for public access. At present, the seawall will only protect the Pavillion. It is wintended to be extended to the SLSC in the future. Has been designed to address coastal hazard issues (and the hazard lines assume this also, stopping at the wall). | ouncil staff E Blue Mile fu orreshore an asterplan / /ollongong City POM | nsure design is adequate for ture sea level rise recession nd inundation | |
| Heritage Site: Norfolk Island Pines | Minor | Insignificant | | There are ~ 150 Pines in North Beach to Brighton foreshores. See comments on pines for Thirrout | ouncil staff | | |
| Cycleway / Shared Pathway | Major | Minor | | Path between North Beach and Brightor Beach has heritage value as the former railway contramway, with former cutting remains. Path behind North Beach Pavillion to SLSC and Contramway, with former cutting remains of existing shared use path with seating, shade, Fightling etc. The improvements are intended to also include improved erosion protection Mit for cycleway. | ouncil staff Blue Mile oreshore fasterplan | nsure improvements include ofection from coastal hazards | |
| Heritage listed: Battery Park Emplacements | | | Moderate | The emplacements are the concrete structures within Battery Park, and are heritage listed. | | | B02352 |
| Water and sewage infrastructure | | | | | | | |
| Stormwater outlets / pipes (in Stuart Park) | Major | Major | | | | | |
| Transport Infrastructure | | | | | | | |
| Major roads (Pioneer Road) | | Major | | Some parts of this road are RTA road | <u>o E</u> | pportunistic raising of road &A Workshop) | |
| Local road (beach access into Lagoon restaurant and car park) | | Minor | | | | | |



| Brighton Lawn Reserve and Wollongong Harbour | Erosion & Recession | Inundation | Geotech | Comments / Reason for consequence level | Comments from | Potential Management Options? | Asset # (Council) |
|---|------------------------|---------------|---------|--|--------------------------------------|----------------------------------|----------------------|
| Parks, Beaches and open space | | | | Coastal Management Plan for this area has recently been completed; copy provided to consultants. | Council staff | | |
| Brighton Lawn Reserve Beach (Heritage listed) | Major | Insignificant | X | Wave focussing to S end of beach (through harbour mouth). Reported northerly sand drift, captured inside breakwalls at northern end of beach. Installation of seawall will result in loss of beach with sea level rise and recession, without mitigation. | Council staff | | |
| Brighton Lawn Reserve: (Heritage Listed) | Minor | | 3 | This land is protected by recently replaced Gabion rock wall (S end of beach) using plastic gabion baskets, to improve protection from erosion, therefore impacts from erosion will be mitigated. Was a former Lands/LPMA proposal for large scale development of the area, not approved. | Council staff | | |
| Community Infrastructure | | | | | | | |
| Heritage Site: Flagstaff Hill and Lighthouse | | | Major | Strategy 3C involves construction of a Flagstaff Hill Visitors Centre (with kiosk, public toilets) within the park; and other strategies to improve / install walkways along perimeter for public use and access. | Blue Mile Foreshore Masterplan | | |
| Heritage Site (state): Brighton Lawn Reserve / Harbour Precinct, including convict built steps and harbour breakwall | Major | Minor | | The harbour is a very important asset from a heritage, community and economic (tourism, boating) view point. Need to consider how this can be maintained with sea level rise. (tourism, boating) view point. Need to consider how this can be maintained with sea level size. Issues regarding how to preserve the assets with SLR without reducing their heritage value (e.g. building up the convict built breakwater or relocating it would reduce its value constance (e.g. building up the convict built breakwater or relocating it would reduce its value breakwall which extends back into the edge of the lawn reserve (where lion statue is), the breakwall which harbour boat area and boat steps, and other younger features. the northern breakwall is relatively recent (~ 70 , ϑ). The harbour, including heritage assets and working harbour, is seen as a significant community asset | / workshop | | |
| Cycleway / Shared Pathway | | | Major | Path has heritage value as the former railway tramway, with former cutting remains between here and North Beach. Major upgrade to cycleway and pedestrial pathways between North and Brigton Beaches as below. The upgrades to cycleway are intended to also improve their protection from erosion. Unsure if SLR considered at this stage in upgrades. Strategy 56 Roardwak projected over rock platform adjacent to lower tramway cutting (at Strategy 56 Board Strategy 56 widen existing lower tramway shared way where appropriate, replace handrail, provide viewing platforms with shade seating and interpretive material. | Blue Mile Foreshore Masterplan | | |

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|---|------------------------|---------------|---------|--|---|---|----------------------|
| Brighton Lawn Reserve and Wollongong Harbour | Erosion & Recession | Inundation | Geotech | Comments / Reason for consequence level | Comments from | Potential Management Options? | Asset # (Council) |
| Mens and Childrens Tidal Pools (Heritage listed) | Moderate | Insignificant | | These are open ended pools, already being maintained to fail. (gentlemens baths are highly valued). Strategy 5H Maintain access to rock pool (formerly gentlemens baths) and pebbly beach. This suggests that will not be maintained to fail? Contradiction between advise from Council staff and BlueMile plan for pool management? | Council staff / Blue Mile Foreshore Masterplan | Continue current management, ie do nothing allowing pools to fail (RA Workshop) | |
| Continental Pool | Major | Minor | Majo | Greater expectation from community for management from heritage perspective. Seen as a significant community asset. Stralegy 5L potential upgrade of Continental Baths and building with potential commercial element. Unsure if this was to incorporate SLR or erosion provision. | Council staff / workshop / Blue Mile Foreshore Masterplan | Protect as a priority (RA Workshop) | |
| Continental Pool - Office/Amenities/Residence | Major | Moderate | Major | 2 | | | B02057 |
| Continental Pool - Pumphouse/Garage | Major | Moderate | Major | South end of pools | | | B02067 |
| Continental Pool - Storage Shed (North) | Major | Moderate | Major | North end of pools | | | B02068 |
| Brighton Lawn Reserve Seawall | N/A | N/A | | Strategy 4J - Major upgrade to seawall to additionally include improved beach access pathway network and seating, furniture and lighting for public. Cabion rock wall has been replaced (S end of beach) using plastic gabion baskets, to improve protection from erosion (as per CZMP for this area, see above). Design included access and seating arrangements as per the Blue Mile masterplan (photographs provided by Council). | Blue Mile Foreshore Masterplan | | |
| Brighton Lawn Kiosk (heritage isted) | Major | Moderate | Major | Building in middle of reserve, behind harbour. The Kiosk building is heritage listed, part of the harbour precinct. A contractor operates a restaurant / kiosk from the building (see below) | Council Staff | | B02301 |
| Transport Infrastructure | | | | | | | |
| Local Roads (Cliff Rd, Endeavour Dr) and car parks | | | Minor | | | | |
| Mollonana Horhour /horitoan | | | | There is already pressure upon the heritage aspects, as the harbour is still commercially | Council staff | Raise harbour walls as | |
| vvolutigorig nar bout (neritage listed, state significant) | Major | Minor | Major | useu. Strategy 4 A is to improve access to northern breakwater (built in 1970s) for public. Unsure if upgrade includes increasing height for SLR impacts | Foreshore Masterplan | heressary. For the miller harbour, do nothing. (RA Workshop) | |
| Water and sewage infrastructure | | | | 6 | | | |
| Stormwater outlets / pipes | | | Major | | | | |
| Commercial and Industrial Development | | | | | | | |
| Harbour Front Café Bar Restaurant | | Moderate | | This site is relatively recent (~ 10 yrs old). Strategy 4 X is for possible expansion of commercial opportunities to provide more dining, café and other recreation / leisure options. | Council staff | | |

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| City Beach (extending to end of showground/N Parks, Beaches and open space | Erosion & Recession | Inundation | Geotech | Commets / Commeter / Commete | ents Potential Management m Options? | Asset # (Council) |
|---|------------------------|---------------|---------|--|---|----------------------|
| City Beach | Major | Insignificant | | Before the dune revegetation works around 20 yrs ago, sand used to get blown across roadway into Brighton Beach, would be up to 3 -4 ft deep across roadway, roadway closed until this was removed. [NB - This would have allowed for sandbypassing into harbour and further north - arosion impects on Brighton Beach will be partly caused by revege works on City Beach that have slupped windblown sand supply] | unity* | |
| Open space, parks etc | Minor | Insignificant | | | | |
| Football Cround (WIN Stadium) and Showground | Major | Moderate | | Concern raised over potential impact to this site. Grounds are likely to have high community significance, beyond their commercial value, Works representing the region's team. | doh | |
| Coastal Dune Systems | Major | Insignificant | xer i | Extensive revegetation work done after 1970s, has allowed build up of dunes to protect beach. However, now have concerns over aesthetics for SLSC members and users of cycleway because cant see beach over dunes. The Wollongong City Foreshore POM recommended additional view platforms be brovided along this stretch, to facilitate better viewing by community (this does not appear to have been done). When estoration works are strategies (1t, 2L) in blue Mile Masterplan (as well as other improvements to park plantings). | nrity / Mile hore plan | |
| Community Infrastructure | | | | | | |
| City Beach Surf Club | Major | Moderate | | Only designed for a 50 yr timeframe. Has 14 m deep pier foundations down to rock. Was built in 2004 with a 50 yr lease for developer (2 function centres, bar / restuarant and kiosk), in return for providing bottom evel for SLSC use. SLSC doesn't have much view of beach, were apparently supposed to build at same height as the dunes, but have built behind and lower - only views from top levels. There are two lifeguarding towers (at either end of club, one for clubbies (5 tower), one for council lifeguards, with suitable storage). The towers provide a good view of entire beach. Some trouble with accessing beach to set up equipment after storms, and for this reason lower future species have been requested. (SLSC also requested shaving of dune there into rowate them with views from the club - but there are no issues for lifeguarding from their towers). They don't have any portable towers. | Istaff unity² | B02907 |
| Heritage Site: Former RC Cemetary, Graves and Monument | Moderate | Minor | | Area has been redesigned to take advantage of historic significance. However, the historic sites are rejocatable | | |
| Site of former SI SC (now public viewing platform) | Minor | | | SLSC member notes erosion after 1964 storms - scarp was only 15 m seaward of the current road, then dropped 5 m to waterline. The scoreboard at the football stadium was washed away. The former SLSC had a pile wall built around it which was then back filled with basalt boulders, for protection. This unternabe, and that is why eurded up rebuilding. The scarp from the 1964 shorm extended close to the current 2/100 hazard (7FFC) line This demonstrates the value of the dune revegetation works, in now providing a builter from excision. Old photos of city beach from 1900 on are available on Councils libraries website. | | |
| Cycleway / Shared Pathway | Moderate | Minor | | | | |
| Transport Infrastructure | | | | | | |
| Local Roads (Marine Drive, Endeavour Drive, Quilkey Place) and beach access car parks | Minor | Minor | | Access roads are not linked to residential property, thus periodic inundation less consequential | | |
| Commercial and Industrial Development | | | | | | |
| WIN Entertainment Centre | Moderate | Moderate | | Concern raised over potential impact to this site Vorks | dots | |
| NB: Nuns Pools and Ladies Pool at rock platform off Flagstafff Hill | | Minor | | Nurs pool does not have proper public access and Ladies pool has minor steep accoss. Noithcr of the pools are acting as viable pools at prosent. Heritage assets are already highly degraded, with reduced functionality. | Istaff | |

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| Perkins Beach | Erosion & Recession | Inundation | Geotech | Comments / Reason for consequence level | Comments from | Potential Management Options? | Asset # (Council) |
|--|------------------------|---------------|----------|---|--|----------------------------------|----------------------|
| Parks, Beaches and open space | | | | | | | |
| Fishermans Beach (MM Beach?) | Major | Insignificant | | There are likely to be midden sites at MM Beach | LALC | | |
| Heritage listed: Hill 60 Nature Reserve | Minor | Minor | Moderate | Hill 60 area is heritage listed, however is mostly public open space. | | | |
| Port Kembla - Perkins Beach | Major | Insignificant | 5 | There are known to be Aboriginal burial sites at Windang | Council / LALC | | |
| Coastal Dune Systems: Pork Kembla Beach, Perkins Beach Reserve | Major | Insignificant | | Entire length of beach and coastal dune system is identified as a Highest priority site for restoration works. 4WD and trail bike access through dunes and along beach is destabilising dunes. Believe Council is not as involved in revegetation, updating dune fencing, weed control on dunes any more. More maintenance required. Wany areas classified as high disturbance (based on vegetation mapping). | Illawarra Biodiversity Strategy 2010 (Draft)* | | |
| Community Infrastructure | | | | | | | |
| Hill 60 Battery viewing platform | | | Minor | | | | B02407 |
| Hill 60 Lookout/Battery | | | Minor | | | | B02411 |
| Coastguard Complex Port Kembla | | | Minor | | | | B03080 |
| Port Kembla Olympic Pool | Major | Minor | | More community expectation to maintain this pool (from heritage and community perspective). Pool has been maintained to better withstand wave impacts | Council staff / Workshop | | |
| Port Kembla Pool - Amenities/Kiosk/Lifeguard Tower | Major | Moderate | Major | North-west of pool | | | B03182 |
| Port Kembla Pool - Pumphouse | | Moderate | Major | South end of pool | | | B02059 |
| Port Kembla Pool - Residence & pool office | | Moderate | Major | North end of pool | | | B02058 |
| Port Kembla SLSC - Lower boat shed | | | Major | North of pool complex | | | B02026 |
| Windang Surf Club | | Moderate | | Concern raised over community impact from damage to this structure | Workshop | | B02046 |
| Windang Beach Dressing rooms / toilets | | Insignificant | | Immediately behind SLSC. | | | B02027 |
| Transport Infrastructure | | | | 5 | | | |
| Lake Illawarra Training Walls | Major | Minor | | Concern raised over community impact from damage to this structure, expensive structure | Workshop | | |
| Water and sewage infrastructure | | | | | | | |
| Port Kembla Sewage Treatment Plant | | | Major | | | | |



BEACH ASSET CONSEQUENCE TABLES

| Lake Illawarra Foreshores | Inundation | Comments / Reason for consequence level (if diff't from main grouping) | Comments from | Potential Management Options? | Council asset # |
|---|---------------|--|-------------------------|-------------------------------------|--------------------|
| Parks, Foreshores and open space | Consequence | | | | |
| Lake Illawarra Foreshore | Minor | Foreshore land is largely open space that could enable | | | |
| Windong Foreshere Dark | Minor | recession / inundation | | | |
| Windang Foreshore Park Recencie Bark / Ovel | Minor | as above | | | |
| Kully Bay Dark | Minor | as above | | | |
| Hooka Doint Dark | Minor | as above | | | |
| Fred Finch Park Natural Area | Minor | as above | | | |
| Purrah Bay Reserve | Minor | as above | | | |
| Koonawarra Bay reserve / park | Minor | as above | | | |
| Lakeside Drive Reserve | Minor | as above | | | |
| Holbom Park Sailing Club | Minor | | | | |
| Windang Bowls Club (private recreation) | Minor | | | | |
| Illawarra Yacht Club (private recreation) | Minor | | | | |
| EEC Swamp Oak Floodplain Forest | Moderate | | | | |
| EEC Coastal Swamp Oak Forest | Moderate | | | | |
| Community Infrastructure | | | | | |
| Windang Tourist Park | Moderate | Concern raised over community impact from inundation of this location. Social equity - caravan park residents and other residents along Windang Peninsula foreshores - cant afford to help themselves. Community concerns indicate such parks in this area are more like residential development. | Workshop / Community | | |
| Other caravan parks | Moderate | | | | |
| Lake Illawarra Cycleway / Shared Pathway | Minor | Cycleway around foreshore is too low. New cycleways need to take into consideration sea level rise and setbacks | Community | | |
| Windang Memorial Park - Toilets | Minor | | | | B02368 |
| Windang Memorial Park - Tennis Clubhouse (leased) | Minor | X | | | B02502 |
| Boronia Park Dressing Sheds / toilets / gardeners | Minor | | | | B02370 |
| Boronia Park Kiosk | Minor | | | | B02371 |
| Boronia Park Pigeon Clubroom | Minor | | | | B02369 |
| Boronia Park Scout Hall | Minor | | | | B02441 |
| Fred Finch Park Baseball Kiosk | Minor | | | | B02376 |
| Fred Finch Park amenities | Minor | | | | B03161 |
| Fred Finch Park Pony Clubhouse | Minor | | | | B02404 |
| Fred Finch Park - Berkeley Basketball Stadium | Moderate | | | | B02831 |
| Willam Beach Park Exeloo, Brownsville | Minor | | | | B02391 |
| Transport Infrastructure | | | | | |
| Major roads, bridges: Windang Rd and Bridge | Major | | | | |
| Local Roads, car parks | Mederate | | | | |
| Water and sewage infrastructure | Widderate | XU | | | |
| Stormwater outlets / pines | Major | | | | |
| Residential Development | major | | | | |
| Existing Residences (numerous) | Moderate | Resident concerned about future redevelopment, subdivision, on existing properties along Mullet Ck. His example is the Lakeline retirement village, which was developed by placing fill on the floodplain to raise the height of the development. He does not want this type of development to occur on the other remaining blocks. Beleives that the Lakeline village development has increased the flooding problem for his property | | | |
| Vacant Land (Future Development: Tourist zone at Kully Bay) | Insignificant | | | | |
| Vacant Land (3 residential zoned blocks at Purrah Bay) | Insignificant | | | | |
| Note: 674 land parcels affected | | | | | |
| Commercial and Industrial Development | | | | | |
| Oasis Resort and Caravan Park | Moderate | See notes on Windang Caravan Park. This site is also a private commercial enterprise. | | | |
| Tru Energy Gas Powered Station | Major | | | | |
| Institutional Infrastructure | | | | | |
| Windang Public School | Moderate | | | | |
| Primbee Heights | | Geotecn nazard (Barry, 118 Lakeview Parade Primbee) - resident wants to understand what this means | | | |





APPENDIX F: THIRROUL CASE STUDY ECONOMIC ANALYSIS OF MANAGEMENT OPTIONS: GILLESPIE ECONOMICS

tem2. Attachments



Benefit Cost Analysis

of

Sea Level Rise Management Options

Thirroul Beach Case Study (

Draft Report

Prepared for

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By



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May 2011

1.0 INTRODUCTION

Predicted sea level rise as a result of climate change can have a number of consequences for the coastal environment, including for infrastructure assets and recreational use. Investments to reduce the impacts of sea level rise also have a range of costs and benefits to the community. Consideration of the magnitude and distribution of these costs and benefits is necessary to ensure that decision-makers are fully informed of the consequences of different policy options.

This report uses a benefit cost analysis (BCA) framework to undertake a case study analysis of different investment options to reduce the impacts of sea level rise on Thirroul beach and its environs. To undertake this quantitative analysis it was necessary to make a range of assumptions around which there is considerable uncertainty. While some sensitivity testing of these assumptions has been undertaken, the analysis can be updated if better information becomes available.

2.0 BENEFIT COST ANALYSIS

2.1 Introduction

BCA involves the following key steps:

- identification of the base case or "without" investment case;
- identification of the "with" investment options;
- identification of the incremental costs and benefits of investment options;
- physical quantification and valuation of the investment options' incremental benefits and costs;
- consolidation of values using discounting to account for the different timing of costs and benefits;
- application of decision criteria;
- sensitivity testing; and
- consideration of non-quantified benefits and costs, where applicable.

2.2 IDENTIFICATION OF THE BASE CASE

In the absence of any form of investment, sea level rise is predicted to result in both inundation and erosion effects at Thirroul.

An increase in the occurrence of inundation will result in periodic damage to up to 71 properties¹, with the probability of an occurrence assumed to increase from 1:100 in 2011 to 1:10 in 2050 and 1: 1 in 2100. Damage costs are assumed at \$70,000 per property per incident.

Erosion is assumed to result in the loss of a number of beach side assets in 2011, including Thirroul Surf Club, Thirroul Pool, Thirroul Pavillion and Thirroul beach reserve. These facilities have a range of economic use values. Heritage sites such as the Thirroul Pool, Thirroul Pavillion and Thirroul Beach Reserve also have non-use heritage values. These values will be lost under the base case.

The economic value of nine private residences will be lost in 2050 if no investment occurs to reduce the consequences of sea level rise.

Under the base case, the coastal dune system is assumed to migrate naturally landward and hence there is no loss of use values associated with Thirroul Beach.

This dune migration does however result in some loss of stormwater assets.

¹ An additional 80 properties would also be subject to periodic damage from an increase in the occurrence of inundation, however, these are already subject to planning controls.

2.3 IDENTIFICATION OF INVESTMENT OPTIONS

Three investment options to reduce the impacts of sea level rise are analysed in this BCA:

- Option 1 sea wall with beach nourishment;
- Option 2 sea wall without beach nourishment;
- Option 3 planned retreat.

2.4 IDENTIFICATION OF THE INCREMENTAL COSTS AND BENEFITS

The categories of costs and benefits of these options relative to the base case are summarised in Table 1.

| COST AND BENEFIT CATEGORIES | OPTION 1 - SEA WALL - WITH BEACH NOURISHMENT | OPTION 2 - SEA WALL - NO NOURISHMENT | OPTION 3 - PLANNED RETREAT |
|---|---|--|----------------------------------|
| Costs | | | |
| Cost of relocating Thirroul surf club | 0 | | * |
| Cost of relocating Thirroul pool | | | * |
| Cost of relocating Thirroul pavillon | | | * |
| Cost of planning controls on 9 properties plus 151 properties | | | * |
| Capital costs of seawall | * | * | |
| Maintenance costs of seawall | * | * | |
| Beach nourishment costs | * | | |
| Costs of maintaining pool, pavillion, surf club plus beach | | | * |
| Costs of maintaining pool, pavillion, surf club, reserve plus beach | * | | |
| Costs of maintaining pool, pavillion, surf club and reserve | | * | |
| Loss of beach use values | | * | |
| Benefits | | | |
| Avoided Inundation damage | | | * |
| Avoided Erosion Damage | | | |
| Avoid loss of Thirroul Surf Club | * | * | * |
| Avoid loss of Thirroul pool - use | * | * | * |
| Avoide loss of Thirroul pool lost - heritage site | * | * | * |
| Avoid loss of Thirroul pavillion use values -restaurant and residence | * | * | * |
| Avoid loss of Thirroul pavillion - heritage site | * | * | * |
| Avoid loss of Thirroul beach reserve - use | * | * | |
| Avoid loss of Thirroul Beach reserve - heritage site | * | * | |
| Avoid stormwater asset lost - end of pipe | * | * | |
| Avoid/delay loss of private properties (2050) | * | * | * |

2.5 VALUATION OF COSTS AND BENEFITS

Valuation of costs and benefits required a number of assumptions about the annual use for different coastal assets as well as assumptions about the use and non-use economic values. Assumptions area specified in the attached spreadsheets.

2.6 **CONSOLIDATION OF VALUE ESTIMATES**

The present value of costs and benefits for each option are presented in Table 2.

| | OPTION 1 - SEA WALL - WITH BEACH NOURISHMENT | OPTION 2 - SEA WALL - NO NOURISHMENT | OPTION 3 - PLANNED RETREAT |
|---|---|---|----------------------------------|
| COST | | | |
| Cost of relocating Thirroul surf club | | | \$233,645 |
| Cost of relocating Thirroul pool | | | \$560,748 |
| Cost of relocating Thirroul pavillon | | | \$233,645 |
| Cost of planning controls on 9 properties | | | \$1,104,060 |
| Capital costs of seawall | \$3,831,776 | \$3,831,776 | |
| Maintenance costs of seawall | \$2,730,343 | \$2,730,343 | |
| Beach nourishment costs | \$12,091,865 | | |
| Costs of maintaining pool, pavillion, surf club plus beach | | | \$1,477,581 |
| Costs of maintaining pool, pavillion, surf club, reserve plus beach | \$1,603,010 | 0 | |
| Costs of maintaining pool, pavillion, surf club and reserve | | \$1,555,974 | |
| Loss of beach use values | | \$142,533,279 | |
| TOTAL COSTS | \$20,256,994 | \$150,651,372 | \$3,609,678 |
| BENEFITS | | | |
| Avoided Inundation damage | \$0 | \$0 | \$1,612,819 |
| Avoided Erosion Damage | | | |
| Avoid loss of Thirroul Surf Club | \$712,666 | \$712,666 | \$712,666 |
| Avoid loss of Thirroul pool - use | \$71,266,640 | \$71,266,640 | \$71,266,640 |
| Avoid loss of Thirroul pool lost - heritage site | \$475,523 | \$475,523 | \$475,523 |
| Avoid loss of Thirroul pavillion use values -restaurant and residence | \$8,979,597 | \$8,979,597 | \$8,979,597 |
| Avoid loss of Thirroul pavillion - heritage site | \$475,523 | \$475,523 | \$475,523 |
| Avoid loss of Thirroul beach reserve - use | \$28,506,656 | \$28,506,656 | |
| Avoid loss of Thirroul Beach reserve - heritage site | \$475,523 | \$475,523 | |
| Stormwater asset lost - end of pipe | \$0 | \$0 | |
| Avoid/delay loss of private properties (2050) | \$5,500,001 | \$5,500,001 | \$5,162,471 |
| TOTAL BENEFITS | \$116,392,128 | \$116,392,128 | \$88,685,238 |
| NET BENEFITS | \$96,135,134 | -\$34,259,244 | \$85,075,561 |
| BCR* | 6.2 | -4.2 | 83.8 |
| NPV/I** | \$5.2 | -\$5.2 | \$82.8 |

| Table 2 - | Benefit (| Cost Ana | lysis Results | s (7% | discount | rate) |
|-----------|-----------|----------|---------------|-------|----------|-------|
|-----------|-----------|----------|---------------|-------|----------|-------|

*Cost in BCR is capital and operating cost of the action e.g. seawall capital and operating costs and beach nourishment for option 1. **I is defined to include capital, maintenance and beach nourishment costs.

There are two main decision criteria for assessing the economic desirability of an investment to society:

net present value (NPV) which is the present value of benefits less the present value of costs. • Under this decision rule, an investment is potentially worthwhile (or viable) if the NPV is greater than zero. Both Option 1 and Option 3 are therefore economically viable.

• benefit cost ratio (BCR) which is the present value of benefits divided by the present value of costs. An investment is potentially worthwhile if the BCR is greater than 1. Under this criterion both Options 1 and Option 3 are economically viable.

Where investments are mutually exclusive and there is no capital constraint, the investment which yields the highest NPV would be chosen as the most economically efficient – Option 1. However, this option also requires considerable capital and ongoing costs – 16 times that of Option 3. Where there are constraints on capital funds the problem facing decision-makers is to rank investments in terms of return to the constrained input. The BCR does this to a certain extent (depending on which costs are included in the denominator) however more explicitly NPV per dollar of total capital invested (NPV/I) can be used to maximises the total NPV obtained from a limited capital works budget. In this case, however, funds for both the capital and direct ongoing costs of options are constrained. NPV per dollar invested (both capital and operating costs) has therefore been estimated. On this basis, Option 3 is the preferred option.

2.7 SENSITIVITY ANALYSIS

This NPVs presented in Table 2.2 are based on a range of assumptions around which there is some level of uncertainty. Uncertainty in a BCA can be dealt with through changing the values of critical variables in the analysis to determine the effect on the NPV or NPV/I. From Table 2 it is evident that the key drivers in the analysis relate to loss of beach use values, avoided loss of Thirroul pool use values and avoided loss of Thirroul beach reserve use.

For Option 2 the main cost that drives the analysis is the loss of beach use values. A 24% reduction in loss of beach use values is required to make Option 2 have a positive NPV and a 84% reduction is required for Option 2 to have a higher NPV than Option 3. However, even if there is no loss in beach use under this Option 2 the NVP/I is less than for Option 3.

Avoided loss of Thirroul pool use values is a major and common benefit to Option 1, 2 and 3. Changes in this assumption therefore do not change the relative ranking of the investment options. Even if these benefits are assumed to be zero both Options 1 and 2 have a positive NPV with Option 3 having the highest NPV/I.

Avoided loss of use values from Thirroul beach reserve is another major benefit of Options 1 and 2. A 520% increase in the avoided loss of use benefits from Thirroul beach reserve would be required for Option 1 to have an NPV/I greater than Option 3.

2.8 DISTRIBUTIONAL AND FINANCING CONSIDERATIONS

The main benefit of the preferred investment, Option 3, accrues to those people who use the Thirroul pool and to a lesser extent the tenants of the Thirroul Pavillion and private property owners. Private property owners bear all the costs (i.e. the cost of planning controls) that result in their individual benefit (delay in property erosion). The remainder of the costs are borne by Council in the first instance. There is therefore some rationale under this option for Council to recoup costs from users of the relocated pool and tenants of the Thirroul Pavillion. Whether this is feasible will depend to some extent on size of the charge and the price elasticity of demand of users. For instance, if recouping the costs results in a larger user fee for the Thirroul pool than other pools in the region and users have elastic demand curves they may simply use other pools in the region an alternative would be an additional levy on all households.

3.0 CONCLUSION

Option 3 – Planned Retreat would result in the greatest net benefit per dollar (capital and maintenance costs) invested. Given that Thirroul beach is only one of many that may be impacted by

sea level rise, options that provide greater net benefits e.g. Option 1, but come at a greater capital and maintenance cost burden could be considered to be inferior to those providing a greater NPV/I. With a planned retreat option there is some rationale for the recoupment of costs from users of the relocated Thirroul Pool and tenants of Thirroul Pavillion. An alternative would be a levy on all households in the Wollongong LGA.

tem?

| | 4% | 7% | 10% | 1 2011 | 2 2012 | 3 2013 | 4 2014 | 5 2015 | 6 2016 | 7 2017 | 8 2018 | 9 2019 | 10 2020 |
|---|--------------------------------|-------------------------------|---------------------------|-------------------|-------------|-------------|-------------|-------------|-------------|-------------|------------------------|-------------|-------------|
| BASE CASE | No loss of beach | under base case | as natural migr | ation of dune occ | urs | | | | | | | | |
| Probability | | | | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 |
| Houses impacted | | | | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 |
| Inundation damage | \$13,623,861 | \$3,982,725 | \$1,822,269 | 49,700 | 61,169 | 72,638 | 84,108 | 95,577 | 107,046 | 118,515 | 129,985 | 141,454 | 152,923 |
| Erosion | _ | | | | | | | | | | | | |
| Thirroul Surf Club lost | \$1,213,364 | \$712,666 | \$499,906 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 |
| Thirroul pool use lost | \$121,336,388 | \$71,266,640 | \$49,990,589 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 500000 | 5000000 | 5000000 |
| Thirroul pool lost - heritage site | \$809,610 | \$475,523 | \$333,560 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 |
| I hirroul pavillion lost use values -restaurant | ¢15 000 005 | ¢0.070.507 | ¢(000 01 (| (20000 | (20000 | (20000 | (20000 | (20000 | (20000 | (20000 | (20000 | (20000 | (20000 |
| and residence | \$15,288,385 | \$8,979,597 | \$6,298,814 | 630000 | 630000 | 630000 | 630000 | 630000 | 030000 | 630000 | 630000 | 630000 | 630000 |
| | \$009,010 | \$475,525 | \$333,000 \$10,006,236 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 |
| Thirroul Beach reserve - heritage site | \$40,534,555 | \$20,500,050 \$475 523 | \$333 560 | 33362 22949 | 33362 22949 | 33362 22949 | 33362 22949 | 33362 22949 | 33362 22949 | 33362 22949 | 33362 22949 | 33362 22949 | 33362 22949 |
| Stormwater asset lost - end of pipe | \$0 | \$0 | \$0 | 00002.22717 | 00002.22717 | 00002.22717 | 00002.22717 | 00002.22717 | 00002.22717 | 00002.22717 | 00002.22717 | 00002.22717 | 00002.22717 |
| Private properties lost (2050) | \$27,389,785 | \$5,500,001 | \$1,315,778 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total costs | \$229,815,169 | \$120,374,853 | \$80,924,270 | 7,829,787 | 7,841,256 | 7,852,725 | 7,864,194 | 7,875,664 | 7,887,133 | 7,898,602 | 7,910,071 | 7,921,541 | 7,933,010 |
| | | | | | | | | | | | | | |
| Benefits | | | | | | | | | | | | | |
| Avoided maintenance costs of pool, pavillions | | | | | | | | | | | X | | |
| SLSC, OS and Beach | \$2,729,235 | \$1,603,010 | \$1,124,445 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 |
| | | | | | | | | | | • | | | |
| | no loss of boach | under this option | 2 | | | | | | | | | | |
| Costs | TIO IOSS OF DEACH | | | | | | | | | | | | |
| Capital costs | \$3 942 308 | \$3 831 776 | \$3 727 273 | \$4 100 000 | | | | | | | | | |
| Maintenance costs | \$4,777,677 | \$2,730,343 | \$1,863,251 | 0 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 |
| Beach nourishment costs | \$19,642,766 | \$12,091,865 | \$8,862,225 | 2250000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 |
| Costs of maintaining pool pavillion, surf club | | | | | | | | | | | | | |
| and beach | \$2,729,235 | \$1,603,010 | \$1,124,445 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 |
| Total costs | \$31,091,985 | \$20,256,994 | \$15,577,193 | \$6,462,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 |
| Benefits | * | ** | ** | | | | | | | | | | |
| Avoided Inundation damage | \$0 | \$0 | \$0 | - | - | - | - | - | | - | - | - | - |
| Avoid loss of Thirrow Surf Club | \$1 212 264 | \$712 666 | \$100.004 | 50,000 | 50,000 | 50.000 | 50.000 | 50.000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| Avoid loss of Thirroul pool - use | \$121 336 388 | \$71 266 640 | \$49,990,589 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 |
| Avoide loss of Thirroul pool lost - heritage site | \$809,610 | \$475,523 | \$333.560 | 33,362 | 33.362 | 33.362 | 33.362 | 33.362 | 33.362 | 33.362 | 33.362 | 33.362 | 33.362 |
| Avoid loss of Thirroul pavillion use values -rest | \$15,288,385 | \$8,979,597 | \$6,298,814 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 |
| Avoid loss of Thirroul pavillion - heritage site | \$809,610 | \$475,523 | \$333,560 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Avoid loss of Thirroul beach reserve - use | \$48,534,555 | \$28,506,656 | \$19,996,236 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 |
| Avoid loss of Thirroul Beach reserve - heritage s | \$809,610 | \$475,523 | \$333,560 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Stormwater asset lost - end of pipe | \$0 | \$0 | \$0 | - | - | - | - | - | - | - | - | - | - |
| Avoid loss of Private properties (2050) | \$27,389,785 | \$5,500,001 | \$1,315,778 | - | - | - | - | - | - | - | - | - | - |
| Not Ropefits | \$210,191,308 \$195,000,222 | \$110,392,128 \$06 125 124 | \$79,102,002 | 1,780,087 | /,/80,08/ | 7,780,087 | 6,712,621 | 7,780,087 | 7,780,087 | 7,780,087 | 7,780,087 6 712 621 | 7,780,087 | 7,780,087 |
| BCR | \$105,077,525 | \$70,133,134 | \$03,524,007 | 1,317,021 | 0,712,021 | 0,712,021 | 0,712,021 | 0,712,021 | 0,712,021 | 0,712,021 | 0,712,021 | 0,712,021 | 0,712,021 |
| NPV/I | | 25.1 | | | | | | | | | | | |
| NPV/I k + op costs | | 5.2 | | | | | | | | | | | |
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| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|------------------------|-------------|-------------|-------------|-------------|------------------------|-------------|-------------|-------------------------|----------------------|-------------|------------------------|------------------------|-------------------------|--|------------------------|-------------------------|-------------|------------------------|-------------|
| | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 |
| BASE CASE | | | | | | | | | | | | | | | | | | | | |
| Inundation | | | | | | | | | | | | | | | | | | | | |
| Probability | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.06 | 0.06 | 0.06 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.08 |
| Houses impacted | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 |
| Inundation damage | 164 392 | 175 862 | 187 331 | 198 800 | 210 269 | 221 738 | 233 208 | 244 677 | 256 146 | 267 615 | 279 085 | 290 554 | 302 023 | 313 492 | 324 962 | 336 431 | 347 900 | 359 369 | 370 838 | 382 308 |
| Frosion | 101,072 | 110,002 | 107,001 | 170,000 | 210,207 | 221,700 | 200,200 | 211,077 | 200,110 | 207,010 | 217,000 | 270,001 | 002,020 | 010,172 | 021,702 | 000,101 | 011,700 | 007,007 | 070,000 | 002,000 |
| Thirroul Surf Club lost | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 |
| Thirroul pool use lost | 500000 | 500000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 500000 | 5000000 | 5000000 | 5000000 | 5000000 |
| Thirroul pool lost - heritage site | 33362.22949 | 33362.22949 | 33362.22949 | 33362,22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362,22949 | 33362.22949 | 33362,22949 | 33362.22949 | 33362,22949 | 33362.22949 | 33362.22949 |
| Thirroul pavillion lost use values -restaurant | | | | | | | | | | | | | | | | | | | | |
| and residence | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 |
| Thirroul pavillion lost - heritage site | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 |
| Thirroul beach reserve - use lost | \$2.000.000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2.000.000 | \$2.000.000 | \$2.000.000 | \$2.000.000 | \$2.000.000 | \$2,000,000 | \$2.000.000 | \$2,000.000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2.000.000 |
| Thirroul Beach reserve - heritage site | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 |
| Stormwater asset lost - end of pipe | | | | | | | | | | | | | | | | | | | | |
| Private properties lost (2050) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total costs | 7,944,479 | 7,955,948 | 7,967,417 | 7,978,887 | 7,990,356 | 8,001,825 | 8,013,294 | 8,024,764 | 8,036,233 | 8,047,702 | 8,059,171 | 8,070,641 | 8,082,110 | 8,093,579 | 8,105,048 | 8,116,517 | 8,127,987 | 8,139,456 | 8,150,925 | 8,162,394 |
| | | , , | | | | | | | | | | | | | -, -, -, -, -, -, -, -, -, -, -, -, -, - | -, -,- | ., | -, - , | -,, | |
| Benefits | | | | | | | | | | | | | | | | | | | | |
| Avoided maintenance costs of pool, pavillions | | | | | | | | | | | | | X | | | | | | | |
| SLSC, OS and Beach | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 |
| | | | | | | | | | | | | | | | | | | | | |
| OPTION 1 - SEA WALL - WITH BEACH | | | | | | | | | | | | | | | | | | | | |
| NOURISHMENT | | | | | | | | | | | | | | | | | | | | |
| Costs | | | | | | | | | | | | | | | | | | | | |
| Capital costs | | | | | | | | | | | | | | | | | | | | |
| Maintenance costs | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 |
| Beach nourishment costs | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 |
| Costs of maintaining pool pavillion, surf club | | | | | | | | | | | | • | | | | | | | | |
| and beach | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 |
| Total costs | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 |
| Benefits | | | | | | | | | | C | | | | | | | | | | |
| Avoided Inundation damage | - | - | - | - | - | - | - | - | - | - | · - | - | - | - | - | - | - | - | - | - |
| Avoided Erosion Damage | | | | | | | | | | | | | | | | | | | | |
| Avoid loss of Thirroul Surf Club | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| Avoid loss of Thirroul pool - use | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| Avoide loss of Thirroul pool lost - heritage site | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Avoid loss of Thirrout pavillion use values -rest | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 |
| Avoid loss of Thirroul pavillion - heritage site | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Avoid loss of Thirrout Deach reserve - use | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 |
| Avoid loss of Thirrout Beach reserve - heritage s | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Stormwater asset lost - end of pipe | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Avoid loss of Private properties (2050) | - | - | - | - | - | - | - | - | - 700.007 | - | - | - 7 700 007 | - | - | - | - | - | - | - | - |
| Not Ropofits | /,/8U,U8/ 6 710 401 | 1,18U,U87 | /,/8U,U8/ | 1,10U,U0/ | /,/8U,U8/ | 1,100,00/ 4 710 401 | 1,180,087 | 1,100,08/ | 1,100,00/ 4 710 4 01 | 1,100,00/ 4710401 | 1,100,007 | 1,100,00/ 4 710 401 | 1,10U,U8/ 4 710 401 | 1,100,00/ 4 710 4 01 | 1,10U,U0/ | 1,100,001 4 710 401 | 1,100,00/ 4 710 4 01 | 1,10U,U0/ | /,/0U,U0/ 4 710 401 | 1,180,087 |
| | 0,/12,021 | 0,/12,021 | 0,712,021 | 0,712,021 | 0,712,021 | 0,/12,021 | 0,712,021 | 0,712,021 | 0,/12,021 | 0,/12,021 | 0,712,021 | 0,712,021 | 0,712,021 | 0,712,021 | 0,712,021 | 0,712,021 | 0,712,021 | 0,712,021 | 0,712,021 | 0,712,021 |
| | | | | | | | • | | | | | | | | | | | | | |
| NPV/1k + op costs | | | | | | | | | | | | | | | | | | | | |
| 11 V/1K · OP 00313 | | | | | | | | | | | | | | | | | | | | |

Hen

| | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
|--|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 | 2048 | 2049 | 2050 | 2051 | 2052 | 2053 | 2054 | 2055 |
| BASE CASE | | | | | | | | | | | | | | | |
| Inundation | | | | | | | | | | | | | | | |
| Probability | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 | 0.09 | 0.09 | 0 10 | 0 10 | 01 | 0.12 | 0.14 | 0 15 | 0 17 | 0.19 |
| Houses impacted | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 |
| Inundation damage | 393 777 | 405 246 | 416 715 | 428 185 | 439 654 | 451 123 | 462 592 | 474 062 | 485 531 | 497.000 | 586 460 | 675 920 | 765,380 | 854 840 | 944.300 |
| Erosion | 0,0,111 | 100/210 | 110,710 | 120/100 | 107/001 | 101/120 | 102/072 | 17 1/002 | 100/001 | 1771000 | 0001100 | 0101120 | , 00,000 | 00 1/0 10 | 711,000 |
| Thirroul Surf Club lost | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 |
| Thirroul pool use lost | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 500000 |
| Thirroul pool lost - heritage site | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 |
| Thirroul pavillion lost use values -restaurant | | | | | | | | | | | | | | | |
| and residence | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 |
| Thirroul pavillion lost - heritage site | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 |
| Thirroul beach reserve - use lost | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 |
| Thirroul Beach reserve - heritage site | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 |
| Stormwater asset lost - end of pipe | | | | | | | | | | | | | | | |
| Private properties lost (2050) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 |
| Total costs | 8,173,864 | 8,185,333 | 8,196,802 | 8,208,271 | 8,219,741 | 8,231,210 | 8,242,679 | 8,254,148 | 8,265,617 | 13,677,087 | 13,766,547 | 13,856,007 | 13,945,467 | 14,034,927 | 14,124,387 |
| | | | | | | | | | | | | | | | |
| Benefits | | | | | | | | | | | | | | | |
| Avoided maintenance costs of pool, pavillions | | | | | | | | | | | | X | | | |
| SLSC, OS and Beach | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 |
| | | | | | | | | | | | | | | | |
| OPTION 1 - SEA WALL - WITH BEACH | | | | | | | | | | | | | | | |
| NOURISHMENT | | | | | | | | | | | | | | | |
| Costs | | | | | | | | | | | | | | | |
| Capital costs | | | | | | | | | | | | | | | |
| Maintenance costs | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 |
| Beach nourishment costs | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 |
| Costs of maintaining pool pavillion, surf club | | | | | | | | | | | | | | | |
| and beach | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 |
| Total costs | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 |
| Benefits | | | | | | | | | | | | | | | |
| Avoided Inundation damage | - | - | - | - | - | - | - | - | - | | - | - | - | - | - |
| Avoided Erosion Damage | | | | | | | | | | | | | | | |
| Avoid loss of Thirroul Surf Club | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| Avoid loss of Thirroul pool - use | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| Avoide loss of Thirroul pool lost - heritage site | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Avoid loss of Thirroul pavillion use values -rest; | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 |
| Avoid loss of Thirroul pavillion - heritage site | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Avoid loss of Thirroul beach reserve - use | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 |
| Avoid loss of Thirroul Beach reserve - heritage s | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Stormwater asset lost - end of pipe | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Avoid loss of Private properties (2050) | - | - | - | - | - | - | - | - | - | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 |
| I otal Benefits | 7,780,087 | 7,780,087 | 7,780,087 | 7,780,087 | 7,780,087 | 7,780,087 | 7,780,087 | 7,780,087 | 7,780,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 |
| Net Benefits | 6,712,621 | 6,712,621 | 6,712,621 | 6,712,621 | 6,712,621 | 6,712,621 | 6,712,621 | 6,712,621 | 6,712,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 |
| BCR | | | | | | | | | | | | | | | |
| NPV/I | | | | | | | | | | | | | | | |
| NPV/I K + op costs | | | | | | | | | | | | | | | |

ten

| 46 | 47 | 48 | 49 | 50 |
|-------------|-------------|----------------|----------------|----------------|
| 2056 | 2057 | 2058 | 2059 | 2060 |
| | | | | |
| | | | | |
| 0.21 | 0.23 | 0.24 | 0.26 | 0.28 |
| 71.00 | 71.00 | 71.00 | 71.00 | 71.00 |
| 1,033,760 | 1,123,220 | 1,212,680 | 1,302,140 | 1,391,600 |
| 50000 | 50000 | 50000 | 50000 | 50000 |
| 5000000 | 5000000 | 5000000 | 5000000 | 5000000 |
| 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 |
| 630000 | 630000 | 630000 | 630000 | 630000 |
| 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 |
| \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 |
| 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 |
| \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 |
| 14,213,847 | 14,303,307 | 14,392,767 | 14,482,227 | 14,571,687 |
| 112,466 | 112,466 | 112,466 | 112,466 | 112,466 |
| \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 |
| 750000 | 750000 | 750000 | 750000 | 750000 |
| 112,466 | 112,466 | 112,466 | 112,466 | 112,466 |
| \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 |
| - | - | - | - | - |
| 50.000 | 50.000 | 50.000 | 50.000 | 50.000 |
| 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| 630,000 | 630,000 | 630,000 | 630,000 | 630,000 |
| 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 |
| 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| - 5.400.000 | - 5.400.000 | - 5.400.000 | - 5,400,000 | - 5,400,000 |
| 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 |
| 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 |
| | | | | |

| | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | 2061 | 2062 | 2063 | 2064 | 2065 | 2066 | 2067 | 2068 | 2069 | 2070 | 2071 | 2072 | 2073 | 2074 | 2075 | 2076 | 2077 | 2078 | 2079 | 2080 |
| BASECASE | | | | | | | | | | | | | | | | | | | | |
| Inundation | | | | | | | | | | | | | | | | | | | | |
| Probability | 0.30 | 0.32 | 0.33 | 0.35 | 0.37 | 0.39 | 0.41 | 0.42 | 0.44 | 0.46 | 0.48 | 0.50 | 0.51 | 0.53 | 0.55 | 0.57 | 0 59 | 0.60 | 0.62 | 0.64 |
| Houses impacted | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 |
| Inundation damage | 1 481 060 | 1 570 520 | 1 659 980 | 1 749 440 | 1 838 900 | 1 928 360 | 2 017 820 | 2 107 280 | 2 196 740 | 2 286 200 | 2 375 660 | 2 465 120 | 2 554 580 | 2 644 040 | 2 733 500 | 2 822 960 | 2 912 420 | 3 001 880 | 3 091 340 | 3 180 800 |
| Frosion | 1,101,000 | 1,070,020 | 1,007,700 | 1,717,110 | 1,000,700 | 1,720,000 | 2,017,020 | 2,107,200 | 2,170,710 | 2,200,200 | 2,010,000 | 2,100,120 | 2,001,000 | 2,011,010 | 2,700,000 | 2,022,700 | 2,712,120 | 0,001,000 | 0,071,010 | 0,100,000 |
| Thirroul Surf Club lost | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 |
| Thirroul pool use lost | 500000 | 5000000 | 5000000 | 5000000 | 5000000 | 500000 | 5000000 | 5000000 | 500000 | 5000000 | 5000000 | 500000 | 5000000 | 5000000 | 5000000 | 5000000 | 500000 | 5000000 | 5000000 | 500000 |
| Thirroul pool lost - heritage site | 33362,22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362,22949 | 33362,22949 | 33362.22949 | 33362,22949 | 33362,22949 | 33362,22949 | 33362,22949 | 33362.22949 | 33362,22949 | 33362.22949 | 33362.22949 | 33362,22949 | 33362.22949 | 33362,22949 | 33362,22949 |
| Thirroul pavillion lost use values -restaurant | | | | | | | | | | | | | | | | | | | | |
| and residence | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 |
| Thirroul pavillion lost - heritage site | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 |
| Thirroul beach reserve - use lost | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2.000.000 | \$2.000.000 | \$2.000.000 | \$2.000.000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2.000.000 | \$2,000,000 | \$2.000.000 | \$2.000.000 | \$2,000,000 |
| Thirroul Beach reserve - heritage site | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 |
| Stormwater asset lost - end of pipe | | | | | | | | | | | | | | | | | | | | |
| Private properties lost (2050) | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 |
| Total costs | 14,661,147 | 14,750,607 | 14,840,067 | 14,929,527 | 15,018,987 | 15,108,447 | 15,197,907 | 15,287,367 | 15,376,827 | 15,466,287 | 15,555,747 | 15,645,207 | 15,734,667 | 15,824,127 | 15,913,587 | 16,003,047 | 16,092,507 | 16,181,967 | 16,271,427 | 16,360,887 |
| | | | | | | | | | | | | | | | | | | | | |
| Benefits | | | | | | | | | | | | | | | | | | | | |
| Avoided maintenance costs of pool, pavillions | | | | | | | | | | | | X | | | | | | | | |
| SLSC, OS and Beach | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 |
| | | | | | | | | | | | | | | | | | | | | |
| OPTION 1 - SEA WALL - WITH BEACH | | | | | | | | | | | | | | | | | | | | |
| NOURISHMENT | | | | | | | | | | | | | | | | | | | | |
| Costs | | | | | | | | | | | | | | | | | | | | |
| Capital costs | | | | | | | | | | | | | | | | | | | | |
| Maintenance costs | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 |
| Beach nourishment costs | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 |
| Costs of maintaining pool pavillion, surf club | | | | | | | | | | | | | | | | | | | | |
| and beach | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 |
| lotal costs | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 |
| Benefits | | | | | | | | | | C A | | | | | | | | | | |
| Avoided Inundation damage | - | - | - | - | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - |
| Avoid loss of Thirrow Surf Club | 50,000 | F0 000 | 50,000 | 50,000 | 50.000 | 50,000 | 50,000 | 50,000 | F0 000 | F0 000 | 50,000 | F0 000 | F0 000 | F0 000 |
| Avoid loss of Thirrout pool uso | 50,000 | 5 000 000 | 5 000 000 | 5 000 000 | 50,000 | 50,000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 50,000 | 5 000 000 | 5 000 000 |
| Avoid loss of Thirrout pool lost poritage site | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 3,000,000 |
| Avoid loss of Thirrout pavillion use values arest | 630,002 | 630,000 | 630,000 | 630,000 | 630,002 | 630,002 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 |
| Avoid loss of Thirroul pavillion - beritage site | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 |
| Avoid loss of Thirrout beach reserve - use | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 |
| Avoid loss of Thirroul Beach reserve - beritages | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 |
| Stormwater asset lost - end of nine | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Avoid loss of Private properties (2050) | 5,400.000 | 5,400.000 | 5,400.000 | 5,400.000 | 5,400.000 | 5,400.000 | 5,400.000 | 5,400,000 | 5,400.000 | 5,400.000 | 5,400.000 | 5,400.000 | 5,400.000 | 5,400.000 | 5,400.000 | 5,400.000 | 5,400.000 | 5,400.000 | 5,400.000 | 5,400.000 |
| Total Benefits | 13,180.087 | 13,180.087 | 13,180.087 | 13,180.087 | 13,180.087 | 13,180.087 | 13,180.087 | 13,180.087 | 13,180.087 | 13,180.087 | 13,180.087 | 13,180.087 | 13,180.087 | 13,180.087 | 13,180.087 | 13,180.087 | 13,180.087 | 13,180.087 | 13,180.087 | 13,180.087 |
| Net Benefits | 12.112.621 | 12.112.621 | 12.112.621 | 12.112.621 | 12.112.621 | 12.112.621 | 12.112.621 | 12.112.621 | 12.112.621 | 12.112.621 | 12.112.621 | 12,112,621 | 12.112.621 | 12.112.621 | 12.112.621 | 12.112.621 | 12,112,621 | 12.112.621 | 12,112,621 | 12,112,621 |
| BCR | ,: | , | | | | , | | , / | , | =,==, | =,==, | | ,, | , | | | | | , -, | ,,, |
| NPV/I | | | | | | | Ť | | | | | | | | | | | | | |

NPV/I k + op costs

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| | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
|--|-------------|-------------|---------------------|-------------|---------------------|---------------------|-------------|---------------------|---------------------|---------------------|-------------|-------------|---------------------|---------------------|---------------------|-------------|-------------|---------------------|---------------------|---------------------|
| | 2081 | 2082 | 2083 | 2084 | 2085 | 2086 | 2087 | 2088 | 2089 | 2090 | 2091 | 2092 | 2093 | 2094 | 2095 | 2096 | 2097 | 2098 | 2099 | 2100 |
| | | | | | | | | | | | | | | | | | | | | |
| BASE CASE | | | | | | | | | | | | | | | | | | | | |
| Inundation | | | | | | | | | | | | | | | | | | | | 0 |
| Probability | 0.66 | 0.68 | 0.69 | 0.71 | 0.73 | 0.75 | 0.77 | 0.78 | 0.80 | 0.82 | 0.84 | 0.86 | 0.87 | 0.89 | 0.91 | 0.93 | 0.95 | 0.96 | 0.98 | 1.00 |
| Houses impacted | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 | 71.00 |
| Inundation damage | 3,270,260 | 3,359,720 | 3,449,180 | 3,538,640 | 3,628,100 | 3,717,560 | 3,807,020 | 3,896,480 | 3,985,940 | 4,075,400 | 4,164,860 | 4,254,320 | 4,343,780 | 4,433,240 | 4,522,700 | 4,612,160 | 4,701,620 | 4,791,080 | 4,880,540 | 4,970,000 |
| Erosion | | | | | | | | | | | | | | | | | | | | |
| Thirroul Surf Club lost | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 | 50000 |
| Thirroul pool use lost | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 5000000 | 500000 | 500000 | 500000 | 500000 | 5000000 | 5000000 | 5000000 | 500000 | 500000 | 5000000 | 500000 | 500000 | 500000 | 500000 |
| Thirroul pool lost - heritage site | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 |
| Thirroul pavillion lost use values -restaurant | | | | | | | | | | | | | | | | | | | | |
| and residence | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 | 630000 |
| Thirroul pavillion lost - heritage site | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 |
| Thirroul beach reserve - use lost | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 |
| Thirroul Beach reserve - heritage site | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 | 33362.22949 |
| Stormwater asset lost - end of pipe | | | | | | | | | | | | | - | | | | | | | |
| Private properties lost (2050) | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$5,400,000 | \$77,142,857 |
| Total costs | 16,450,347 | 16,539,807 | 16,629,267 | 16,718,727 | 16,808,187 | 16,897,647 | 16,987,107 | 17,076,567 | 17,166,027 | 17,255,487 | 17,344,947 | 17,434,407 | 17,523,867 | 17,613,327 | 17,702,787 | 17,792,247 | 17,881,707 | 17,971,167 | 18,060,627 | 89,892,944 |
| D G | | | | | | | | | | | | | | | | | | | | |
| Benefits | | | | | | | | | | | | | | | | | | | | |
| Avoided maintenance costs of pool, pavillions | | | | | | | | | | | | | | | | | | | | |
| SLSC, US and Beach | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 | 112,466 |
| | | | | | | | | | | | | | | | | | | | | |
| OPTION 1 - SEA WALL - WITH BEACH | | | | | | | | | | | | | | | | | | | | |
| Costs | | | | | | | | | | | | | | | | | | | | |
| Costs | | | | | | | | | | | | | | | | | | | | |
| Maintananca coste | ¢205 000 | \$20E 000 | ¢205 000 | ¢205.000 | ¢20E 000 | ¢205.000 | ¢205 000 | ¢205.000 | ¢205.000 | ¢205 000 | \$20E 000 | \$20E 000 | \$20E 000 | ¢205.000 | ¢205 000 | ¢20E 000 | ¢205 000 | ¢205 000 | \$ 20E 000 | ¢205 000 |
| Roach nourishmont costs | \$205,000 | \$203,000 | \$203,000 750000 | \$205,000 | \$203,000 750000 | \$203,000 750000 | \$205,000 | \$203,000 750000 | \$203,000 750000 | \$203,000 750000 | 750000 | 750000 | \$203,000 750000 | \$203,000 750000 | \$203,000 750000 | \$205,000 | \$203,000 | \$203,000 750000 | \$203,000 750000 | \$203,000 750000 |
| Costs of maintaining, nool pavillion, surf club | 750000 | 750000 | 750000 | 750000 | /30000 | 750000 | /50000 | 750000 | 750000 | 750000 | 150000 | 750000 | /30000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 | 750000 |
| and heach | 112 466 | 112 466 | 112 466 | 112 466 | 112 466 | 112 466 | 112 466 | 112 466 | 112 466 | 112 466 | 112 466 | 112 466 | 112 466 | 112 466 | 112 466 | 112 466 | 112 466 | 112 466 | 112 466 | 112 466 |
| Total costs | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1.067.466 | \$1,067,466 | \$1.067.466 | \$1.067.466 | \$1,067,466 | \$1.067.466 | \$1.067.466 | \$1.067.466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1,067,466 | \$1.067.466 | \$1.067.466 | \$1,067,466 | \$1,067,466 |
| Benefits | \$1,007,100 | \$1,007,100 | \$1,007,100 | ¢1,007,100 | \$1,007,100 | \$1,007,100 | \$1,007,100 | \$1,007,100 | \$1,007,100 | \$1,007,100 | \$1,007,100 | \$1,007,100 | \$1,007,100 | \$1,007,100 | \$1,007,100 | ¢1,007,100 | \$1,007,100 | \$1,007,100 | ¢1,007,100 | ¢1,007,100 |
| Avoided Inundation damage | - | - | - | - | - | - | - | - | - | _ | • <u>-</u> | - | - | - | - | - | - | - | - | - |
| Avoided Erosion Damage | | | | | | | | | | | | | | | | | | | | |
| Avoid loss of Thirroul Surf Club | 50.000 | 50.000 | 50.000 | 50.000 | 50.000 | 50.000 | 50.000 | 50.000 | 50.000 | 50.000 | 50.000 | 50.000 | 50.000 | 50.000 | 50.000 | 50.000 | 50.000 | 50,000 | 50.000 | 50.000 |
| Avoid loss of Thirroul pool - use | 5.000.000 | 5.000.000 | 5.000.000 | 5.000.000 | 5.000.000 | 5.000.000 | 5.000.000 | 5.000.000 | 5.000.000 | 5.000.000 | 5.000.000 | 5.000.000 | 5.000.000 | 5.000.000 | 5.000.000 | 5.000.000 | 5,000,000 | 5.000.000 | 5.000.000 | 5.000.000 |
| Avoide loss of Thirroul pool lost - heritage site | 33.362 | 33.362 | 33.362 | 33.362 | 33,362 | 33.362 | 33.362 | 33.362 | 33.362 | 33.362 | 33.362 | 33.362 | 33,362 | 33.362 | 33.362 | 33,362 | 33,362 | 33,362 | 33,362 | 33.362 |
| Avoid loss of Thirroul pavillion use values -resta | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 |
| Avoid loss of Thirroul pavillion - heritage site | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Avoid loss of Thirroul beach reserve - use | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 |
| Avoid loss of Thirroul Beach reserve - heritage s | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Stormwater asset lost - end of pipe | - | - | - | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - |
| Avoid loss of Private properties (2050) | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 77,142,857 |
| Total Benefits | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 84,922,944 |
| Net Benefits | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 12,112,621 | 83,855,478 |
| BCR | | | | | | | | | | | | | | | | • | | | · • | |
| NPV/I | | | | | | | | | | | | | | | | | | | | |

NPV/I k + op costs

tenik

| | 4% | 7% | 10% | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|--|--|--|---|--|--|--|--|--|---|---|---|---|
| OPTION 2 - SEA WALL - NO NOURISHMENT | Loss of beach un | der this option | | | | | | | | | | | |
| Costs | | | | | | | | | | | | | |
| Capital costs | \$3,942,308 | \$3.831.776 | \$3.727.273 | \$4,100,000 | | | | | | | | | |
| Maintenance costs | \$4,777,677 | \$2,730,343 | \$1.863.251 | 0 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 |
| Costs of maintaining pool pavillion, surf club | + ., , | | + . , , | | +===,=== | | + | | + | | | + | |
| and reserve | \$2.649.153 | \$1.555.974 | \$1.091.451 | 109.166 | 109,166 | 109,166 | 109,166 | 109,166 | 109.166 | 109,166 | 109,166 | 109,166 | 109,166 |
| Lose beach | \$242 672 776 | \$142 533 279 | \$99 981 178 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 |
| Total costs | \$254 041 913 | \$150 651 372 | \$106 663 153 | \$14 209 166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 |
| Benefits | \$201101117710 | ¢100/001/072 | ÷100/000/100 | ¢11/207/100 | \$10,011,100 | ¢10/011/100 | ¢10/011/100 | \$10,011,100 | ¢10/011/100 | \$10/011/100 | ¢10/011/100 | ¢.0/011/100 | \$10,011,100 |
| Avoided Inundation damage | \$0 | \$0 | \$0 | - | - | - | - | - | - | - | - | - | - |
| Avoided Frosion Damage | \$0 | \$0 \$0 | \$0 | | | | | | | | | | |
| Avoid loss of Thirroul Surf Club | \$1 213 364 | \$712 666 | \$499 906 | 50,000 | 50,000 | 50,000 | 50,000 | 50.000 | 50,000 | 50,000 | 50,000 | 50,000 | 50.000 |
| Avoid loss of Thirrout pool - use | \$121 336 388 | \$71,266,640 | \$40,000,580 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 |
| | \$121,330,300 | \$71,200,040 | φ 4 7,770,307 | 3,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 3,000,000 | 5,000,000 | 3,000,000 | 3,000,000 |
| Avoide loss of Thirroul pool lost - beritage site | \$809.610 | \$475 523 | \$333 560 | 33 363 | 33 363 | 33 363 | 33 363 | 33 363 | 33 363 | 33 363 | 33 363 | 33 363 | 33 363 |
| Avoid loss of Thirroy pavillion use values | \$007,010 | φ470,020 | \$333,300 | 33,302 | 33,302 | 55,502 | 55,502 | 55,502 | 55,502 | 55,502 | 55,502 | 33,302 | 55,502 |
| Avoid loss of milliour pavillion use values - | ¢1E 200 20E | ¢0.070.E07 | ¢4 000 014 | 620.000 | 620,000 | 620.000 | 420.000 | 620.000 | 620.000 | 620.000 | (20.000 | 620.000 | 620.000 |
| Avoid loss of Thirroy pavillion boritago sito | \$13,288,383 | \$8,979,097 ¢475 500 | \$0,298,814 \$222 E40 | 030,000 | 030,000 | 030,000 | 030,000 | 030,000 | 030,000 | 030,000 | 030,000 | 030,000 | 030,000 |
| Avoid loss of Thirrout baseb recently use | \$609,010 | \$470,023 | \$333,000 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 |
| Avoid loss of Thirrout Deach reserve - use | \$48,534,555 | \$28,506,656 | \$19,996,236 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 |
| Avoid loss of militour beach reserve - heritage | \$000 (A0 | A 175 500 | **** F (* | 00.0/0 | 00.0/0 | 00.040 | 00.0/0 | 00.040 | ~~~~ | 00.040 | 00.040 | | 00.040 |
| sile Shewana hara a shekara a shekara | \$809,610 | \$475,523 | \$333,560 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Stormwater asset lost - end of pipe | \$0 | \$0 | \$0 | - | - | - | - | - | - | - | - | - | - |
| Avoid loss of Private properties (2050) | \$27,389,785 | \$5,500,001 | \$1,315,778 | - | - | - | - | - | - | - | | - | - |
| Total Benefits | \$216,191,308 | \$116,392,128 | \$79,102,002 | 7,780,087 | 7,780,087 | 7,780,087 | 7,780,087 | 7,780,087 | 7,780,087 | 7,780,087 💊 | 7,780,087 | 7,780,087 | 7,780,087 |
| Net Benefits | -\$37,850,605 | -\$34,259,244 | -\$27,561,151 - | 6,429,079 - | 2,534,079 - | 2,534,079 - | 2,534,079 - | 2,534,079 - | 2,534,079 - | 2,534,079 - | 2,534,079 · | 2,534,079 - | 2,534,079 |
| BCR | | -4.2 | | | | | | | | | | | |
| NPV/I | | -8.9 | | | | | | | | | | | |
| NPV/I k + op costs | | -5.2 | | | 50 | | | | | | | | |
| | | | | | | | | | | | | | |
| OPTION 3 - PLANNED RETREAT | No loss of beach | under this optio | ns 🛽 🛔 | No opportunity co | ost of land used for re | location as spare op | en space | | | | | | |
| | | | | | | | | | | | | | |
| Cost of relocating Thirroul surf club | \$240,385 | \$233,645 | \$227,273 | 250,000 | | | | | | | | | |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool | \$240,385 \$576,923 | \$233,645 \$560,748 | \$227,273 \$545,455 | 250,000 600,000 | | | | | | | | | |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon | \$240,385 \$576,923 \$240,385 | \$233,645 \$560,748 \$233,645 | \$227,273 \$545,455 \$227,273 | 250,000 600,000 250,000 | | | | | X | | | | |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus | \$240,385 \$576,923 \$240,385 | \$233,645 \$560,748 \$233,645 | \$227,273 \$545,455 \$227,273 | 250,000 600,000 250,000 | | | | | X | | | | |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties | \$240,385 \$576,923 \$240,385 \$1,718,575 | \$233,645 \$560,748 \$233,645 \$1,104,060 | \$227,273 \$545,455 \$227,273 \$793,185 | 250,000 600,000 250,000 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties Costs of maintaining pool pavillion, surf club | \$240,385 \$576,923 \$240,385 \$1,718,575 | \$233,645 \$560,748 \$233,645 \$1,104,060 | \$227,273 \$545,455 \$227,273 \$793,185 | 250,000 600,000 250,000 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties Costs of maintaining pool pavillion, surf club and beach | \$240,385 \$576,923 \$240,385 \$1,718,575 \$2,515,683 | \$233,645 \$560,748 \$233,645 \$1,104,060 \$1,477,581 | \$227,273 \$545,455 \$227,273 \$793,185 \$1,036,461 | 250,000 600,000 250,000 80000 103,666 | 80000 103,666 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 103,666 | 80000 103,666 | 80000 103,666 |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties Costs of maintaining pool pavillion, surf club and beach Total Cost | \$240,385 \$576,923 \$240,385 \$1,718,575 \$2,515,683 \$5,291,950 | \$233,645 \$560,748 \$233,645 \$1,104,060 \$1,477,581 \$3,609,678 | \$227,273 \$545,455 \$227,273 \$793,185 \$1,036,461 \$2,829,647 | 250,000 600,000 250,000 80000 103,666 1,283,666 | 80000 103,666 183,666 | 80000 103,666 183,666 | 80000 103,666 183,666 | 80000 103,666 183,666 | 80000 103,666 183,666 | 80000 103,666 183,666 | 80000 103,666 183,666 | 80000 103,666 183,666 | 80000 103,666 183,666 |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties Costs of maintaining pool pavillion, surf club and beach Total Cost | \$240,385 \$576,923 \$240,385 \$1,718,575 \$2,515,683 \$5,291,950 | \$233,645 \$560,748 \$233,645 \$1,104,060 \$1,477,581 \$3,609,678 | \$227,273 \$545,455 \$227,273 \$793,185 \$1,036,461 \$2,829,647 | 250,000 600,000 250,000 80000 103,666 1,283,666 71 | 80000 103,666 183,666 70 | 80000 103,666 183,666 68 | 80000 103,666 183,666 67 | 80000 103,666 183,666 65 | 80000 103,666 183,666 64 | 80000 103,666 183,666 62 | 80000 103,666 183,666 61 | 80000 103,666 183,666 60 | 80000 103,666 183,666 58 |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits | \$240,385 \$576,923 \$240,385 \$1,718,575 \$2,515,683 \$5,291,950 | \$233,645 \$560,748 \$233,645 \$1,104,060 \$1,477,581 \$3,609,678 | \$227,273 \$545,455 \$227,273 \$793,185 \$1,036,461 \$2,829,647 | 250,000 600,000 250,000 80000 103,666 1,283,666 71 | 80000 103,666 183,666 70 | 80000 103,666 183,666 68 | 80000 103,666 183,666 67 | 80000 103,666 183,666 65 | 80000 103,666 183,666 64 | 80000 103,666 183,666 62 | 80000 103,666 183,666 61 | 80000 103,666 183,666 60 | 80000 103,666 183,666 58 |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage | \$240,385 \$576,923 \$240,385 \$1,718,575 \$2,515,683 \$5,291,950 \$2,660,675 | \$233,645 \$560,748 \$233,645 \$1,104,060 \$1,477,581 \$3,609,678 \$1,612,819 | \$227,273 \$545,455 \$227,273 \$793,185 \$1,036,461 \$2,829,647 \$1,082,145 | 250,000 600,000 250,000 80000 103,666 1,283,666 71 49,700 | 80000 103,666 183,666 70 59,946 | 80000 103,666 183,666 68 69,733 | 80000 103,666 183,666 67 79,061 | 80000 103,666 183,666 65 87,931 | 80000 103,666 183,666 64 96,342 | 80000 103,666 183,666 62 104,294 | 80000 103,666 183,666 61 111,787 | 80000 103,666 183,666 60 118,821 | 80000 103,666 183,666 58 125,397 |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club | \$240,385 \$576,923 \$240,385 \$1,718,575 \$2,515,683 \$5,291,950 \$2,660,675 \$1,213,364 | \$233,645 \$560,748 \$233,645 \$1,104,060 \$1,477,581 \$3,609,678 \$1,612,819 \$712,666 | \$227,273 \$545,455 \$227,273 \$793,185 \$1,036,461 \$2,829,647 \$1,082,145 \$499,906 | 250,000 600,000 250,000 80000 103,666 1,283,666 71 49,700 50,000 | 80000 103,666 183,666 70 59,946 50,000 | 80000 103,666 183,666 68 69,733 50,000 | 80000 103,666 183,666 67 79,061 50,000 | 80000 103,666 183,666 65 87,931 50,000 | 80000 103,666 183,666 64 96,342 50,000 | 80000 103,666 183,666 62 104,294 50,000 | 80000 103,666 183,666 61 111,787 50,000 | 80000 103,666 183,666 60 118,821 50,000 | 80000 103,666 183,666 58 125,397 50,000 |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use | \$240,385 \$576,923 \$240,385 \$1,718,575 \$2,515,683 \$5,291,950 \$2,660,675 \$1,213,364 \$121,336,388 | \$233,645 \$560,748 \$233,645 \$1,104,060 \$1,477,581 \$3,609,678 \$1,612,819 \$712,666 \$71,266,640 | \$227,273 \$545,455 \$227,273 \$793,185 \$1,036,461 \$2,829,647 \$1,082,145 \$499,906 \$49,990,589 | 250,000 600,000 250,000 80000 103,666 1,283,666 71 49,700 50,000 5,000,000 | 80000 103,666 183,666 70 59,946 50,000 5,000,000 | 80000 103,666 183,666 68 69,733 50,000 5,000,000 | 80000 103,666 183,666 67 79,061 50,000 5,000,000 | 80000 103,666 183,666 65 87,931 50,000 5,000,000 | 80000 103,666 183,666 64 96,342 50,000 5,000,000 | 80000 103,666 183,666 62 104,294 50,000 5,000,000 | 80000 103,666 183,666 61 111,787 50,000 5,000,000 | 80000 103,666 183,666 60 118,821 50,000 5,000,000 | 80000 103,666 183,666 58 125,397 50,000 5,000,000 |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use | \$240,385 \$576,923 \$240,385 \$1,718,575 \$2,515,683 \$5,291,950 \$2,660,675 \$1,213,364 \$121,336,388 | \$233,645 \$560,748 \$233,645 \$1,104,060 \$1,477,581 \$3,609,678 \$1,612,819 \$712,666 \$71,266,640 | \$227,273 \$545,455 \$227,273 \$793,185 \$1,036,461 \$2,829,647 \$1,082,145 \$499,906 \$49,990,589 | 250,000 600,000 250,000 80000 103,666 1,283,666 71 49,700 50,000 5,000,000 | 80000 103,666 183,666 70 59,946 50,000 5,000,000 | 80000 103,666 183,666 68 69,733 50,000 5,000,000 | 80000 103,666 183,666 67 79,061 50,000 5,000,000 | 80000 103,666 183,666 65 87,931 50,000 5,000,000 | 80000 103,666 183,666 64 96,342 50,000 5,000,000 | 80000 103,666 183,666 62 104,294 50,000 5,000,000 | 80000 103,666 183,666 61 111,787 50,000 5,000,000 | 80000 103,666 183,666 60 118,821 50,000 5,000,000 | 80000 103,666 183,666 58 125,397 50,000 5,000,000 |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoide loss of Thirroul pool lost - heritage site | \$240,385 \$576,923 \$240,385 \$1,718,575 \$2,515,683 \$5,291,950 \$2,660,675 \$1,213,364 \$121,336,388 \$809,610 | \$233,645 \$560,748 \$233,645 \$1,104,060 \$1,477,581 \$3,609,678 \$1,612,819 \$712,666 \$71,266,640 \$475,523 | \$227,273 \$545,455 \$227,273 \$793,185 \$1,036,461 \$2,829,647 \$1,082,145 \$499,906 \$49,990,589 \$333,560 | 250,000 600,000 250,000 80000 103,666 1,283,666 71 49,700 50,000 5,000,000 33,362 | 80000 103,666 183,666 70 59,946 50,000 5,000,000 33,362 | 80000 103,666 183,666 68 69,733 50,000 5,000,000 33,362 | 80000 103,666 183,666 67 79,061 50,000 5,000,000 33,362 | 80000 103,666 183,666 65 87,931 50,000 5,000,000 33,362 | 80000 103,666 183,666 64 96,342 50,000 5,000,000 33,362 | 80000 103,666 183,666 62 104,294 50,000 5,000,000 33,362 | 80000 103,666 183,666 61 111,787 50,000 5,000,000 33,362 | 80000 103,666 183,666 60 118,821 50,000 5,000,000 33,362 | 80000 103,666 183,666 58 125,397 50,000 5,000,000 33,362 |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoide loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - | \$240,385 \$576,923 \$240,385 \$1,718,575 \$2,515,683 \$5,291,950 \$2,660,675 \$1,213,364 \$121,336,388 \$809,610 | \$233,645 \$560,748 \$233,645 \$1,104,060 \$1,477,581 \$3,609,678 \$1,612,819 \$712,666 \$71,266,640 \$475,523 | \$227,273 \$545,455 \$227,273 \$793,185 \$1,036,461 \$2,829,647 \$1,082,145 \$499,906 \$49,990,589 \$333,560 | 250,000 600,000 250,000 80000 103,666 1,283,666 71 49,700 50,000 5,000,000 33,362 | 80000 103,666 183,666 70 59,946 50,000 5,000,000 33,362 | 80000 103,666 183,666 68 69,733 50,000 5,000,000 33,362 | 80000 103,666 183,666 67 79,061 50,000 5,000,000 33,362 | 80000 103,666 183,666 65 87,931 50,000 5,000,000 33,362 | 80000 103,666 183,666 64 96,342 50,000 5,000,000 33,362 | 80000 103,666 183,666 62 104,294 50,000 5,000,000 33,362 | 80000 103,666 183,666 61 111,787 50,000 5,000,000 33,362 | 80000 103,666 183,666 60 118,821 50,000 5,000,000 33,362 | 80000 103,666 183,666 58 125,397 50,000 5,000,000 33,362 |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoide Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoide loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence | \$240,385 \$576,923 \$240,385 \$1,718,575 \$2,515,683 \$5,291,950 \$2,660,675 \$1,213,364 \$121,336,388 \$809,610 \$15,288,385 | \$233,645 \$560,748 \$233,645 \$1,104,060 \$1,477,581 \$3,609,678 \$1,612,819 \$712,666 \$71,266,640 \$475,523 \$8,979,597 | \$227,273 \$545,455 \$227,273 \$793,185 \$1,036,461 \$2,829,647 \$1,082,145 \$499,906 \$49,990,589 \$333,560 \$6,298,814 | 250,000 600,000 250,000 80000 103,666 1,283,666 71 49,700 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 70 59,946 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 68 69,733 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 67 79,061 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 65 87,931 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 64 96,342 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 62 104,294 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 61 111,787 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 60 118,821 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 58 125,397 50,000 5,000,000 33,362 630,000 |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoide Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence Avoid loss of Thirroul pavillion - heritage site | \$240,385 \$576,923 \$240,385 \$1,718,575 \$2,515,683 \$5,291,950 \$2,660,675 \$1,213,364 \$121,336,388 \$809,610 \$15,288,385 \$809,610 | \$233,645 \$560,748 \$233,645 \$1,104,060 \$1,477,581 \$3,609,678 \$1,612,819 \$712,666 \$71,266,640 \$475,523 \$8,979,597 \$475,523 | \$227,273 \$545,455 \$227,273 \$793,185 \$1,036,461 \$2,829,647 \$1,082,145 \$499,906 \$49,990,589 \$333,560 \$6,298,814 \$333,560 | 250,000 600,000 250,000 80000 103,666 1,283,666 71 49,700 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 70 59,946 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 68 69,733 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 67 79,061 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 65 87,931 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 64 96,342 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 62 104,294 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 61 111,787 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 60 118,821 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 58 125,397 50,000 5,000,000 33,362 630,000 33,362 |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoide Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence Avoid loss of Thirroul pavillion - heritage site Avoid loss of Thirroul pavillion - heritage site Avoid loss of Thirroul pavillion - heritage site Avoid loss of Thirroul pavillion - heritage site | \$240,385 \$576,923 \$240,385 \$1,718,575 \$2,515,683 \$5,291,950 \$2,660,675 \$1,213,364 \$121,336,388 \$809,610 \$15,288,385 \$809,610 \$23,026,109 | \$233,645 \$560,748 \$233,645 \$1,104,060 \$1,477,581 \$3,609,678 \$1,612,819 \$712,666 \$71,266,640 \$475,523 \$8,979,597 \$475,523 \$5,162,471 | \$227,273 \$545,455 \$227,273 \$793,185 \$1,036,461 \$2,829,647 \$1,082,145 \$499,906 \$49,990,589 \$333,560 \$6,298,814 \$333,560 \$1,287,755 | 250,000 600,000 250,000 80000 103,666 1,283,666 71 49,700 50,000 5,000,000 33,362 630,000 33,362 0 | 80000 103,666 183,666 70 59,946 50,000 5,000,000 33,362 630,000 33,362 0 | 80000 103,666 183,666 68 69,733 50,000 5,000,000 33,362 630,000 33,362 0 | 80000 103,666 183,666 67 79,061 50,000 5,000,000 33,362 630,000 33,362 0 | 80000 103,666 183,666 65 87,931 50,000 5,000,000 33,362 630,000 33,362 0 | 80000 103,666 183,666 64 96,342 50,000 5,000,000 33,362 630,000 33,362 0 | 80000 103,666 183,666 62 104,294 50,000 5,000,000 33,362 630,000 33,362 0 | 80000 103,666 183,666 61 111,787 50,000 5,000,000 33,362 630,000 33,362 0 | 80000 103,666 183,666 60 118,821 50,000 5,000,000 33,362 630,000 33,362 0 | 80000 103,666 183,666 58 125,397 50,000 5,000,000 33,362 630,000 33,362 0 |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoide Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool lost - heritage site Avoide loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence Avoid loss of Thirroul pavillion - heritage site Avoide loss of private property Total Benefits | \$240,385 \$576,923 \$240,385 \$1,718,575 \$2,515,683 \$5,291,950 \$2,660,675 \$1,213,364 \$121,336,388 \$809,610 \$15,288,385 \$809,610 \$23,026,109 \$165,144,141 | \$233,645 \$560,748 \$233,645 \$1,104,060 \$1,477,581 \$3,609,678 \$1,612,819 \$712,666 \$71,266,640 \$475,523 \$8,979,597 \$475,523 \$5,162,471 \$88,685,238 | \$227,273 \$545,455 \$227,273 \$793,185 \$1,036,461 \$2,829,647 \$1,082,145 \$499,906 \$49,990,589 \$333,560 \$6,298,814 \$333,560 \$1,287,755 \$59,826,329 | 250,000 600,000 250,000 103,666 1,283,666 71 49,700 50,000 5,000,000 33,362 630,000 33,362 0 5,796,424 | 80000 103,666 183,666 70 59,946 50,000 5,000,000 33,362 630,000 33,362 0 5,806,670 | 80000 103,666 183,666 68 69,733 50,000 5,000,000 33,362 630,000 33,362 0 5,816,457 | 80000 103,666 183,666 67 79,061 50,000 5,000,000 33,362 630,000 33,362 0 5,825,786 | 80000 103,666 183,666 65 87,931 50,000 5,000,000 33,362 630,000 33,362 0 5,834,655 | 80000 103,666 183,666 64 96,342 50,000 5,000,000 33,362 630,000 33,362 0 5,843,066 | 80000 103,666 183,666 62 104,294 50,000 5,000,000 33,362 630,000 33,362 0 5,851,018 | 80000 103,666 183,666 61 111,787 50,000 5,000,000 33,362 630,000 33,362 0 5,858,511 | 80000 103,666 183,666 60 118,821 50,000 5,000,000 33,362 630,000 33,362 0 5,865,546 | 80000 103,666 183,666 58 125,397 50,000 5,000,000 33,362 630,000 33,362 0 5,872,121 |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoide Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoide loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence Avoid loss of Thirroul pavillion - heritage site Avoide loss of private property Total Benefits Net Benefits | \$240,385 \$576,923 \$240,385 \$1,718,575 \$2,515,683 \$5,291,950 \$2,660,675 \$1,213,364 \$121,336,388 \$809,610 \$15,288,385 \$809,610 \$23,026,109 \$165,144,141 \$159,852,191 | \$233,645 \$560,748 \$233,645 \$1,104,060 \$1,477,581 \$3,609,678 \$1,612,819 \$712,666 \$71,266,640 \$475,523 \$8,979,597 \$475,523 \$5,162,471 \$88,685,238 \$85,075,561 | \$227,273 \$545,455 \$227,273 \$793,185 \$1,036,461 \$2,829,647 \$1,082,145 \$499,906 \$49,990,589 \$333,560 \$6,298,814 \$333,560 \$1,287,755 \$59,826,329 \$56,996,682 | 250,000 600,000 250,000 103,666 1,283,666 71 49,700 50,000 5,000,000 33,362 630,000 33,362 0 5,796,424 4,512,759 | 80000 103,666 183,666 70 59,946 50,000 5,000,000 33,362 630,000 33,362 0 5,806,670 5,623,005 | 80000 103,666 183,666 68 69,733 50,000 5,000,000 33,362 630,000 33,362 0 5,816,457 5,632,792 | 80000 103,666 183,666 67 79,061 50,000 5,000,000 33,362 0 5,825,786 5,642,120 | 80000 103,666 183,666 65 87,931 50,000 5,000,000 33,362 630,000 33,362 0 5,834,655 5,650,990 | 80000 103,666 183,666 64 96,342 50,000 5,000,000 33,362 630,000 33,362 0 5,843,066 5,659,400 | 80000 103,666 183,666 62 104,294 50,000 5,000,000 33,362 630,000 33,362 0 5,851,018 5,667,352 | 80000 103,666 183,666 61 111,787 50,000 5,000,000 33,362 630,000 33,362 0 5,858,511 5,674,846 | 80000 103,666 183,666 60 118,821 50,000 5,000,000 33,362 630,000 33,362 0 5,865,546 5,681,880 | 80000 103,666 183,666 58 125,397 50,000 5,000,000 33,362 630,000 33,362 0 5,872,121 5,688,456 |
| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoide Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoide loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence Avoid loss of Thirroul pavillion - heritage site Avoide loss of private property Total Benefits Net Benefits BCR | \$240,385 \$576,923 \$240,385 \$1,718,575 \$2,515,683 \$5,291,950 \$2,660,675 \$1,213,364 \$121,336,388 \$809,610 \$15,288,385 \$809,610 \$23,026,109 \$165,144,141 \$159,852,191 | \$233,645 \$560,748 \$233,645 \$1,104,060 \$1,477,581 \$3,609,678 \$1,612,819 \$712,666 \$71,266,640 \$475,523 \$8,979,597 \$475,523 \$5,162,471 \$88,685,238 \$85,075,561 83,8 | \$227,273 \$545,455 \$227,273 \$793,185 \$1,036,461 \$2,829,647 \$1,082,145 \$499,906 \$49,990,589 \$333,560 \$6,298,814 \$333,560 \$1,287,755 \$59,826,329 \$56,996,682 | 250,000 600,000 250,000 103,666 1,283,666 71 49,700 50,000 5,000,000 33,362 630,000 33,362 0 5,796,424 4,512,759 | 80000 103,666 183,666 70 59,946 50,000 5,000,000 33,362 630,000 33,362 0 5,806,670 5,623,005 | 80000 103,666 183,666 68 69,733 50,000 5,000,000 33,362 630,000 33,362 0 5,816,457 5,632,792 | 80000 103,666 183,666 67 79,061 50,000 5,000,000 33,362 630,000 33,362 0 5,825,786 5,642,120 | 80000 103,666 183,666 65 87,931 50,000 5,000,000 33,362 630,000 33,362 0 5,834,655 5,650,990 | 80000 103,666 183,666 64 96,342 50,000 5,000,000 33,362 630,000 33,362 0 5,843,066 5,659,400 | 80000 103,666 183,666 62 104,294 50,000 5,000,000 33,362 630,000 33,362 0 5,851,018 5,667,352 | 80000 103,666 183,666 61 111,787 50,000 5,000,000 33,362 630,000 33,362 0 5,858,511 5,674,846 | 80000 103,666 183,666 60 118,821 50,000 5,000,000 33,362 630,000 33,362 0 5,865,546 5,681,880 | 80000 103,666 183,666 58 125,397 50,000 5,000,000 33,362 630,000 33,362 0 5,872,121 5,688,456 |
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| Cost of relocating Thirroul surf club Cost of relocating thirroul pool Cost of relocating Thirroul pavillon Cost of planning controls on 9 properties plus 71 properties Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoide Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence Avoide loss of private property Total Benefits BCR NPV/I NPV/I k + op costs Results - Option 1 or 3 both good but Option 1 very expensive - under a budget constraint BCR best and where lots of other beaches - planned retreat preferred. | \$240,385 \$576,923 \$240,385 \$1,718,575 \$2,515,683 \$5,291,950 \$2,660,675 \$1,213,364 \$121,336,388 \$809,610 \$15,288,385 \$809,610 \$23,026,109 \$165,144,141 \$159,852,191 | \$233,645 \$560,748 \$233,645 \$1,104,060 \$1,477,581 \$3,609,678 \$1,612,819 \$712,666 \$71,266,640 \$475,523 \$8,979,597 \$475,523 \$5,162,471 \$88,685,238 \$85,075,561 83.8 \$82.8 \$82.8 | \$227,273 \$545,455 \$227,273 \$793,185 \$1,036,461 \$2,829,647 \$1,082,145 \$499,906 \$49,990,589 \$333,560 \$6,298,814 \$333,560 \$1,287,755 \$59,826,329 \$56,996,682 | 250,000 600,000 250,000 103,666 1,283,666 71 49,700 50,000 5,000,000 33,362 630,000 33,362 0 5,796,424 4,512,759 | 80000 103,666 183,666 70 59,946 50,000 5,000,000 33,362 630,000 33,362 0 5,806,670 5,623,005 | 80000 103,666 183,666 68 69,733 50,000 5,000,000 33,362 630,000 33,362 0 5,816,457 5,632,792 | 80000 103,666 183,666 67 79,061 50,000 5,000,000 33,362 630,000 33,362 0 5,825,786 5,642,120 | 80000 103,666 183,666 65 87,931 50,000 5,000,000 33,362 630,000 33,362 0 5,834,655 5,650,990 | 80000 103,666 183,666 64 96,342 50,000 5,000,000 33,362 630,000 33,362 0 5,843,066 5,659,400 | 80000 103,666 183,666 62 104,294 50,000 5,000,000 33,362 630,000 33,362 0 5,851,018 5,667,352 | 80000 103,666 183,666 61 111,787 50,000 5,000,000 33,362 630,000 33,362 0 5,858,511 5,674,846 | 80000 103,666 183,666 60 118,821 50,000 5,000,000 33,362 0 5,865,546 5,681,880 | 80000 103,666 183,666 58 125,397 50,000 5,000,000 33,362 630,000 33,362 0 5,872,121 5,688,456 |
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| | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 |
|---|---------------|--------------|---------------|--------------|---------------|--------------|--------------|--------------|--------------|--------------|-----------------------|-----------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| OPTION 2 - SEA WALL - NO NOURISHMENT | | | | | | | | | | | | | | | | | | | | |
| Costs | | | | | | | | | | | | | | | | | | | | |
| Capital costs | | | | | | | | | | | | | | | | | | | | |
| Maintenance costs | \$205,000 | \$205 000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205 000 | \$205 000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205.000 |
| Costs of maintaining pool pavillion, surf club | \$200,000 | \$200,000 | \$200,000 | \$200,000 | 4200,000 | \$200,000 | 4200,000 | 4200,000 | 4200,000 | 4200,000 | \$200,000 | \$200,000 | 4200/000 | \$200,000 | \$200,000 | 4200/000 | \$200,000 | 4200,000 | \$200,000 | \$200,000 |
| and reserve | 109 166 | 109 166 | 109 166 | 109 166 | 109,166 | 109 166 | 109,166 | 109.166 | 109.166 | 109 166 | 109 166 | 109 166 | 109 166 | 109 166 | 109.166 | 109.166 | 109 166 | 109 166 | 109 166 | 109 166 |
| Lose beach | 10 000 000 | 10 000 000 | 10 000 000 | 10,000,000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10,000,000 | 10 000 000 | 10 000 000 |
| Total costs | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 |
| Benefits | \$10,011,100 | ¢10/011/100 | ¢10/011/100 | \$10,011,100 | ¢.0/011/100 | \$10,011,100 | ¢10/011/100 | ¢.0/011/100 | ¢10/011/100 | 410/011/100 | <i><i><i></i></i></i> | <i><i><i></i></i></i> | ¢10/011/100 | \$1010111100 | \$10,011,100 | ¢10/011/100 | \$1010111100 | ¢.0/011/100 | ¢10/011/100 | \$10,011,100 |
| Avoided Inundation damage | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | _ | - | - |
| Avoided Frosion Damage | | | | | | | | | | | | | | | | | | | | |
| Avoid loss of Thirroul Surf Club | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 |
| | 5,000,000 | 5,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 5,000,000 | 3,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 3,000,000 |
| Avoide loss of Thirroul pool lost - heritage site | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Avoid loss of Thirroul pavillion use values - | | | | | | | | | | | | | | | | | | | | |
| restaurant and residence | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 |
| Avoid loss of Thirroul pavillion - heritage site | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Avoid loss of Thirroul beach reserve - use | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 |
| Avoid loss of Thirroul Beach reserve - heritage | | | | | | | | | | | | | | | | | | | | |
| site | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Stormwater asset lost - end of pipe | - | - | - | - | - | - | - | - | - | - | - | - | | - | - | - | - | - | - | - |
| Avoid loss of Private properties (2050) | - | - | - | - | - | - | - | - | - | - | - | - | | - | - | - | - | - | - | - |
| Total Benefits | 7 780 087 | 7 780 087 | 7 780 087 | 7 780 087 | 7 780 087 | 7 780 087 | 7 780 087 | 7 780 087 | 7 780 087 | 7 780 087 | 7 780 087 | 7 780 087 | 7 780 087 | 7 780 087 | 7 780 087 | 7 780 087 | 7 780 087 | 7 780 087 | 7 780 087 | 7 780 087 |
| Net Benefits | 2 534 079 | 2 534 070 | - 2 53/ 070 | 2 53/ 070 | 2 534 070 | 2 53/ 070 | 2 53/ 070 | 2 53/ 070 | 2 53/ 070 | 2 53/ 070 | 2 53/ 070 | 2 534 070 | 2 534 079 | 2 534 070 | 2 53/ 070 | 2 534 070 | 2 534 070 | 2 534 079 | 2 534 070 | 2 534 070 |
| BCR | 2,334,077 | 2,004,017 | 2,004,077 | 2,004,077 | 2,334,077 | 2,334,077 | 2,334,077 | 2,334,077 | 2,334,077 | 2,334,077 | 2,004,077 | - 2,004,077 | 2,334,077 - | 2,334,077 - | 2,334,077 - | 2,334,077 - | 2,004,077 - | 2,334,077 - | 2,334,077 - | 2,334,077 |
| NDV/I | | | | | | | | | | | | | | | | | | | | |
| NPV/Ik + op costs | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| OPTION 3 - PLANNED RETREAT | | | | | | | | | | | | | | | | | | | | |
| Cost of relocating Thirroul surf club | | | | | | | | | | | | | | | | | | | | |
| Cost of relocating thirrout pool | | | | | | | | | | | \frown | | | | | | | | | |
| Cost of relocating Thirrout pavillon | | | | | | | | | | | | | | | | | | | | |
| Cost of planning controls on 9 properties plus | | | | | | | | | | | | | | | | | | | | |
| 71 properties | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 |
| Costs of maintaining nool navillion surf club | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 | 00000 |
| and boach | 102 666 | 102 666 | 102 666 | 102 666 | 102 666 | 102 666 | 102 666 | 102 666 | 102.666 | 102 666 | 102 666 | 102 666 | 102 666 | 102 666 | 102 666 | 102 666 | 102 666 | 102 666 | 102 666 | 102 666 |
| Total Cost | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 |
| | 103,000 E7 | 103,000 | 103,000 E4 | 103,000 | 103,000 E1 | 103,000 | 103,000 | 103,000 | 103,000 | 105,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 |
| Deposite | 57 | 22 | 54 | 23 | 21 | 50 | 48 | 47 | 40 | 44 | 43 | 41 | 40 | 38 | 37 | 30 | 34 | 33 | 31 | 30 |
| Denenics Avoided Inundation domage | 101 514 | 107 170 | 140 071 | 147 110 | 151 204 | 155 017 | 150 501 | 141 407 | 142.024 | 1/5 000 | 147 451 | 140 501 | 140 122 | 140.004 | 140.000 | 140 015 | 144 000 | 145 210 | 142 140 | 140 540 |
| Avoided Indidation damage | 131,314 | 137,172 | 142,371 | 147,112 | 151,394 | 100,217 | 108,081 | 101,487 | 103,934 | 100,922 | 107,431 | 108,521 | 109,133 | 109,280 | 108,980 | 108,213 | 100,992 | 100,310 | 103,109 | 100,309 |
| Avoid loss of Thirrow pool upo | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| Avoid loss of Thirtour pool - use | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| Avoide loss of Thirroul pool lost - heritage site | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33.262 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 360 |
| Avoid loss of Thirrout pavillion use values | 00,002 | 00,002 | 30,002 | 50,002 | 30,002 | 00,002 | 30,002 | 50,002 | 50,002 | 30,002 | 30,002 | 30,002 | 00,002 | 30,002 | 50,002 | 50,002 | 50,002 | 30,002 | 50,002 | 00,002 |
| restaurant and residence | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630.000 | 630,000 | 630,000 | 630,000 |
| Avoid loss of Thirrout pavillion - beritage site | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 |
| Avoided loss of private property | 0 | 03,302 | 0,302 | 55,502 | 55,502 | 0,502 | 0,302 | 03,302 | 0,502 | 33,302 | 33,302 | 33,302 | 0 | 03,302 | 55,502 | 55,502 | 03,302 | 0 | 0 | 03,302 |
| Total Benefits | 5 979 229 | 5 992 906 | 5 990 006 | 5 902 926 | 5 000 110 | 5 001 0/1 | 5 005 206 | 5 009 211 | 5 010 659 | 5 012 646 | 5 01/ 175 | 5 015 246 | 5 015 957 | 5 016 010 | 5 015 704 | 5 014 040 | 5 012 716 | 5 012 024 | 5 000 902 | 5 007 204 |
| Not Ropofits | 5,070,230 | 5,003,070 | 5,007,070 | 5,075,050 | 5,070,110 | 5,701,741 | 5,705,500 | 5,700,211 | 5,710,050 | 5,712,040 | 5,714,175 | 5,715,240 | 5,715,057 | 5,710,010 | 5,715,704 | 5,714,740 | 5,713,710 | 5,712,034 | 5,707,075 | 5,707,274 |
| | 0,094,075 | 3,700,231 | 5,705,450 | 5,710,171 | 3,714,433 | 5,716,270 | 5,721,040 | 3,724,340 | 3,120,992 | 3,720,900 | 5,750,510 | 3,731,360 | 0,132,192 | 0,752,540 | 0,132,039 | 3,731,274 | 3,730,031 | 3,120,309 | 3,720,220 | 3,723,020 |
| NDV/I | | | | | | | | | | | | | | | | | | | | |
| NPV/1 k - op costo | | | | | | | | | | | | | | | | | | | | |
| NF V/I K + UP CUSIS | | | | | | | | | | | | | | | | | | | | |
| Results - Option 1 of 5 both good but Option 1 | | | | | | | * | | | | | | | | | | | | | |
| Very expensive - under a budget constraint | | | | | | | | | | | | | | | | | | | | |
| but best and where lots of other beaches - | | | | | | | | | | | | | | | | | | | | |
| planned retreat preierred. | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |

| | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 | 2048 | 2049 | 2050 | 2051 | 2052 | 2053 | 2054 | 2055 | 2056 | 2057 | |
|--|--|---|---|---|---|---|---|---|---|---|---|---|---|---|--|--|---|----|
| OPTION 2 - SEA WALL - NO NOURISHMENT | | | | | | | | | | | | | | | | | | |
| Costs | | | | | | | | | | | | | | | | | | |
| Capital costs | | | | | | | | | | | | | | | | | | |
| Maintenance costs | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | |
| Costs of maintaining pool pavillion, surf club | | | | | | | | | | | | | | | | | | |
| and reserve | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | |
| Lose beach | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | |
| Total costs | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$ |
| Benefits | | | | | | | | | | | | | | | | | | |
| Avoided Inundation damage Avoided Erosion Damage | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Avoid loss of Thirroul Surf Club | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | |
| Avoid loss of Thirroul pool - use | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | |
| Avoide loss of Thirroul pool lost - heritage site | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | |
| Avoid loss of Thirroul pavillion use values - | | | | | | | | | | | | | | | | | | |
| restaurant and residence | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | |
| Avoid loss of Thirroul pavillion - heritage site | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | |
| Avoid loss of Thirroul beach reserve - use | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | |
| Avoid loss of Thirroul Beach reserve - heritage | | | | | | | | | | | | | | | | | | |
| site | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | |
| Stormwater asset lost - end of pipe | - | - | - | - | - | - | - | - | - | - | - | X | - | - | - | - | - | |
| Avoid loss of Private properties (2050) | - | - | - | - | - | - | - | - | - | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | |
| Total Benefits | 7,780,087 | 7,780,087 | 7,780,087 | 7,780,087 | 7,780,087 | 7,780,087 | 7,780,087 | 7,780,087 | 7,780,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | |
| Net Benefits | - 2,534,079 - | 2,534,079 - | 2,534,079 - | 2,534,079 - | 2,534,079 - | 2,534,079 - | 2,534,079 - | 2,534,079 - | 2,534,079 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | |
| BCR | | | | | | | | | | | | | | | | | | |
| NPV/I | | | | | | | | | | | | | | | | | | |
| NPV/I k + op costs | | | | | | | | | | | | | | | | | | |
| OPTION 3 - PLANNED RETREAT | | | | | | | | | | | | | | | | | | |
| Cost of relocating Thirroul surf club | | | | | | | | | | | | | | | | | | |
| Cost of relocating thirroul pool | | | | | | | | | | | | | | | | | | |
| Cost of relocating Thirroul pavillon | | | | | | | | | | | | | | | | | | |
| Cost of planning controls on 9 properties plus | | | | | | | | | | | | | | | | | | |
| 71 properties | 00000 | | | | | | | | | | | | | | | | | |
| | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | |
| Costs of maintaining pool pavillion, surf club | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | 80000 | |
| Costs of maintaining pool pavillion, surf club and beach | 103,666 | 80000 103,666 | 80000 | 80000 | 80000 103,666 | 80000 103,666 | 80000 103,666 | 80000 103,666 | 80000 103,666 | 80000 103,666 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost | 103,666 183,666 | 80000 103,666 183,666 | 80000 103,666 183,666 | 80000 103,666 183,666 | 80000 103,666 183,666 | 80000 103,666 183,666 | 80000 103,666 183,666 | 80000 103,666 183,666 | 80000 103,666 183,666 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost | 103,666 183,666 28 | 80000 103,666 183,666 27 | 80000 103,666 183,666 26 | 80000 103,666 183,666 24 | 80000 103,666 183,666 23 | 80000 103,666 183,666 21 | 80000 103,666 183,666 20 | 80000 103,666 183,666 18 | 80000 103,666 183,666 17 | 80000 103,666 183,666 16 | 80000 103,666 183,666 14 | 80000 103,666 183,666 13 | 80000 103,666 183,666 11 | 80000 103,666 183,666 10 | 80000 103,666 183,666 9 | 80000 103,666 183,666 7 | 80000 103,666 183,666 6 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits | 103,666 183,666 28 | 80000 103,666 183,666 27 | 80000 103,666 183,666 26 | 80000 103,666 183,666 24 | 80000 103,666 183,666 23 | 80000 103,666 183,666 21 | 80000 103,666 183,666 20 | 80000 103,666 183,666 18 | 80000 103,666 183,666 17 | 80000 103,666 183,666 16 | 80000 103,666 183,666 14 | 80000 103,666 183,666 13 | 80000 103,666 183,666 11 | 80000 103,666 183,666 10 | 80000 103,666 183,666 9 | 80000 103,666 183,666 7 | 80000 103,666 183,666 6 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage | 103,666 183,666 28 157,511 | 80000 103,666 183,666 27 153,994 | 80000 103,666 183,666 26 150,018 | 80000 103,666 183,666 24 145,583 | 80000 103,666 183,666 23 140,689 | 80000 103,666 183,666 21 135,337 | 80000 103,666 183,666 20 129,526 | 80000 103,666 183,666 18 123,256 | 80000 103,666 183,666 17 116,527 | 80000 103,666 183,666 16 109,340 | 80000 103,666 183,666 14 117,292 | 80000 103,666 183,666 13 121,666 | 80000 103,666 183,666 11 122,461 | 80000 103,666 183,666 10 119,678 | 80000 103,666 183,666 9 113,316 | 80000 103,666 183,666 7 103,376 | 80000 103,666 183,666 6 89,858 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club | 103,666 183,666 28 157,511 50,000 | 80000 103,666 183,666 27 153,994 50,000 | 80000 103,666 183,666 26 150,018 50,000 | 80000 103,666 183,666 24 145,583 50,000 | 80000 103,666 183,666 23 140,689 50,000 | 80000 103,666 183,666 21 135,337 50,000 | 80000 103,666 183,666 20 129,526 50,000 | 80000 103,666 183,666 18 123,256 50,000 | 80000 103,666 183,666 17 116,527 50,000 | 80000 103,666 183,666 16 109,340 50,000 | 80000 103,666 183,666 14 117,292 50,000 | 80000 103,666 183,666 13 121,666 50,000 | 80000 103,666 183,666 11 122,461 50,000 | 80000 103,666 183,666 10 119,678 50,000 | 80000 103,666 183,666 9 113,316 50,000 | 80000 103,666 183,666 7 103,376 50,000 | 80000 103,666 183,666 6 89,858 50,000 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use | 103,666 183,666 28 157,511 50,000 5,000,000 | 80000 103,666 183,666 27 153,994 50,000 5,000,000 | 80000 103,666 183,666 26 150,018 50,000 5,000,000 | 80000 103,666 183,666 24 145,583 50,000 5,000,000 | 80000 103,666 183,666 23 140,689 50,000 5,000,000 | 80000 103,666 183,666 21 135,337 50,000 5,000,000 | 80000 103,666 183,666 20 129,526 50,000 5,000,000 | 80000 103,666 183,666 18 123,256 50,000 5,000,000 | 80000 103,666 183,666 17 116,527 50,000 5,000,000 | 80000 103,666 183,666 16 109,340 50,000 5,000,000 | 80000 103,666 183,666 14 117,292 50,000 5,000,000 | 80000 103,666 183,666 13 121,666 50,000 5,000,000 | 80000 103,666 183,666 11 122,461 50,000 5,000,000 | 80000 103,666 183,666 10 119,678 50,000 5,000,000 | 80000 103,666 183,666 9 113,316 50,000 5,000,000 | 80000 103,666 183,666 7 103,376 50,000 5,000,000 | 80000 103,666 183,666 6 89,858 50,000 5,000,000 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoide loss of Thirroul pool - use | 103,666 183,666 28 157,511 50,000 5,000,000 33,362 | 80000 103,666 183,666 27 153,994 50,000 5,000,000 33,362 | 80000 103,666 183,666 26 150,018 50,000 5,000,000 33,362 | 80000 103,666 183,666 24 145,583 50,000 5,000,000 33,362 | 80000 103,666 183,666 23 140,689 50,000 5,000,000 33,362 | 80000 103,666 183,666 21 135,337 50,000 5,000,000 33,362 | 80000 103,666 183,666 20 129,526 50,000 5,000,000 33,362 | 80000 103,666 183,666 18 123,256 50,000 5,000,000 33,362 | 80000 103,666 183,666 17 116,527 50,000 5,000,000 33,362 | 80000 103,666 183,666 16 109,340 50,000 5,000,000 33,362 | 80000 103,666 183,666 14 117,292 50,000 5,000,000 33,362 | 80000 103,666 183,666 13 121,666 50,000 5,000,000 33,362 | 80000 103,666 183,666 11 122,461 50,000 5,000,000 33,362 | 80000 103,666 183,666 10 119,678 50,000 5,000,000 33,362 | 80000 103,666 183,666 9 113,316 50,000 5,000,000 33,362 | 80000 103,666 183,666 7 103,376 50,000 5,000,000 33,362 | 80000 103,666 183,666 6 89,858 50,000 5,000,000 33,362 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoid loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - | 103,666 183,666 28 157,511 50,000 5,000,000 33,362 | 80000 103,666 183,666 27 153,994 50,000 5,000,000 33,362 | 80000 103,666 183,666 26 150,018 50,000 5,000,000 33,362 | 80000 103,666 183,666 24 145,583 50,000 5,000,000 33,362 | 80000 103,666 183,666 23 140,689 50,000 5,000,000 33,362 | 80000 103,666 183,666 21 135,337 50,000 5,000,000 33,362 | 80000 103,666 183,666 20 129,526 50,000 5,000,000 33,362 | 80000 103,666 183,666 18 123,256 50,000 5,000,000 33,362 | 80000 103,666 183,666 17 116,527 50,000 5,000,000 33,362 | 80000 103,666 183,666 16 109,340 50,000 5,000,000 33,362 | 80000 103,666 183,666 14 117,292 50,000 5,000,000 33,362 | 80000 103,666 183,666 13 121,666 50,000 5,000,000 33,362 | 80000 103,666 183,666 11 122,461 50,000 5,000,000 33,362 | 80000 103,666 183,666 10 119,678 50,000 5,000,000 33,362 | 80000 103,666 183,666 9 113,316 50,000 5,000,000 33,362 | 80000 103,666 183,666 7 103,376 50,000 5,000,000 33,362 | 80000 103,666 183,666 6 89,858 50,000 5,000,000 33,362 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoid loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence | 103,666 183,666 28 157,511 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 27 153,994 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 26 150,018 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 24 145,583 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 23 140,689 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 21 135,337 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 20 129,526 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 18 123,256 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 17 116,527 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 16 109,340 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 14 117,292 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 13 121,666 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 11 122,461 50,000 5,000,000 333,362 630,000 | 80000 103,666 183,666 10 119,678 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 9 113,316 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 7 103,376 50,000 5,000,000 33,362 630,000 | 80000 103,666 183,666 6 89,858 50,000 5,000,000 33,362 630,000 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoid loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence Avoid loss of Thirroul pavillion - heritage site | 103,666 183,666 28 157,511 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 27 153,994 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 26 150,018 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 24 145,583 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 23 140,689 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 21 135,337 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 20 129,526 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 18 123,256 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 17 116,527 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 16 109,340 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 14 117,292 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 13 121,666 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 11 122,461 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 10 119,678 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 9 113,316 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 7 103,376 50,000 5,000,000 33,362 630,000 33,362 | 80000 103,666 183,666 6 89,858 50,000 5,000,000 33,362 630,000 33,362 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoid loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence Avoid loss of Thirroul pavillion - heritage site Avoid loss of Thirroul pavillion - heritage site Avoid loss of Thirroul pavillion - heritage site Avoid loss of Thirroul pavillion - heritage site | 103,666 183,666 28 157,511 50,000 5,000,000 33,362 630,000 33,362 0 | 80000 103,666 183,666 27 153,994 50,000 5,000,000 33,362 630,000 33,362 0 | 80000 103,666 183,666 26 150,018 50,000 5,000,000 33,362 630,000 33,362 0 | 80000 103,666 183,666 24 145,583 50,000 5,000,000 33,362 630,000 33,362 0 | 80000 103,666 183,666 23 140,689 50,000 5,000,000 33,362 630,000 33,362 0 | 80000 103,666 183,666 21 135,337 50,000 5,000,000 33,362 630,000 33,362 0 | 80000 103,666 183,666 20 129,526 50,000 5,000,000 33,362 630,000 33,362 0 | 80000 103,666 183,666 18 123,256 50,000 5,000,000 33,362 630,000 33,362 0 | 80000 103,666 183,666 17 116,527 50,000 5,000,000 33,362 630,000 33,362 0 | 80000 103,666 183,666 16 109,340 50,000 5,000,000 33,362 630,000 33,362 5400000 | 80000 103,666 183,666 14 117,292 50,000 5,000,000 33,362 630,000 33,362 5400000 | 80000 103,666 183,666 13 121,666 50,000 5,000,000 33,362 630,000 33,362 5400000 | 80000 103,666 183,666 11 122,461 50,000 5,000,000 33,362 630,000 33,362 5400000 | 80000 103,666 183,666 10 119,678 50,000 5,000,000 33,362 630,000 33,362 5400000 | 80000 103,666 183,666 9 113,316 50,000 5,000,000 33,362 630,000 33,362 5400000 | 80000 103,666 183,666 7 103,376 50,000 5,000,000 33,362 630,000 33,362 5400000 | 80000 103,666 183,666 6 89,858 50,000 5,000,000 33,362 630,000 33,362 5400000 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoid loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence Avoid loss of Thirroul pavillion - heritage site Avoid loss of private property Total Benefits | 103,666 183,666 28 157,511 50,000 5,000,000 33,362 630,000 33,362 0 5,904,235 | 80000 103,666 183,666 27 153,994 50,000 5,000,000 33,362 630,000 33,362 0 5,900,718 | 80000 103,666 183,666 26 150,018 50,000 5,000,000 33,362 630,000 33,362 0 5,896,742 | 80000 103,666 183,666 24 145,583 50,000 5,000,000 33,362 630,000 33,362 0 5,892,307 | 80000 103,666 183,666 23 140,689 50,000 5,000,000 33,362 630,000 33,362 0 5,887,414 | 80000 103,666 183,666 21 135,337 50,000 5,000,000 33,362 630,000 33,362 0 5,882,061 | 80000 103,666 183,666 20 129,526 50,000 5,000,000 33,362 630,000 33,362 0 5,876,250 | 80000 103,666 183,666 18 123,256 50,000 5,000,000 33,362 630,000 33,362 0 5,869,980 | 80000 103,666 183,666 17 116,527 50,000 5,000,000 33,362 630,000 33,362 0 5,863,252 | 80000 103,666 183,666 16 109,340 50,000 5,000,000 33,362 630,000 33,362 5400000 11,256,064 | 80000 103,666 183,666 14 117,292 50,000 5,000,000 33,362 630,000 33,362 5400000 11,264,016 | 80000 103,666 183,666 13 121,666 50,000 5,000,000 33,362 630,000 33,362 5400000 11,268,390 | 80000 103,666 183,666 11 122,461 50,000 5,000,000 33,362 630,000 33,362 5400000 11,269,185 | 80000 103,666 183,666 10 119,678 50,000 5,000,000 33,362 630,000 33,362 5400000 11,266,402 | 80000 103,666 183,666 9 113,316 50,000 5,000,000 33,362 630,000 33,362 5400000 11,260,040 | 80000 103,666 183,666 7 103,376 50,000 5,000,000 33,362 630,000 33,362 5400000 11,250,100 | 80000 103,666 183,666 6 89,858 50,000 5,000,000 33,362 630,000 33,362 5400000 11,236,582 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoid loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence Avoid loss of Thirroul pavillion - heritage site Avoid loss of private property Total Benefits Net Benefits | 103,666 183,666 28 157,511 50,000 5,000,000 33,362 630,000 33,362 0 5,904,235 5,720,570 | 80000 103,666 183,666 27 153,994 50,000 5,000,000 33,362 630,000 33,362 0 5,900,718 5,717,052 | 80000 103,666 183,666 26 150,018 50,000 5,000,000 33,362 630,000 33,362 0 5,896,742 5,713,076 | 80000 103,666 183,666 24 145,583 50,000 5,000,000 33,362 630,000 33,362 0 5,892,307 5,708,642 | 80000 103,666 183,666 23 140,689 50,000 5,000,000 33,362 630,000 33,362 0 5,887,414 5,703,748 | 80000 103,666 183,666 21 135,337 50,000 5,000,000 33,362 630,000 33,362 0 5,882,061 5,698,396 | 80000 103,666 183,666 20 129,526 50,000 5,000,000 33,362 630,000 33,362 0 5,876,250 5,692,585 | 80000 103,666 183,666 18 123,256 50,000 5,000,000 33,362 630,000 33,362 0 5,869,980 5,686,315 | 80000 103,666 183,666 17 116,527 50,000 5,000,000 33,362 630,000 33,362 0 5,863,252 5,679,586 | 80000 103,666 183,666 16 109,340 50,000 5,000,000 33,362 630,000 33,362 5400000 11,256,064 11,072,399 | 80000 103,666 183,666 14 117,292 50,000 5,000,000 33,362 630,000 33,362 5400000 11,264,016 11,080,351 | 80000 103,666 183,666 13 121,666 50,000 5,000,000 33,362 630,000 33,362 5400000 11,268,390 11,084,724 | 80000 103,666 183,666 11 122,461 50,000 5,000,000 33,362 630,000 33,362 5400000 11,269,185 11,085,520 | 80000 103,666 183,666 10 119,678 50,000 5,000,000 33,362 630,000 33,362 5400000 11,266,402 11,082,736 | 80000 103,666 183,666 9 113,316 50,000 5,000,000 33,362 630,000 33,362 5400000 11,260,040 11,076,375 | 80000 103,666 183,666 7 103,376 50,000 5,000,000 33,362 630,000 33,362 5400000 11,250,100 11,066,435 | 80000 103,666 183,666 6 89,858 50,000 5,000,000 33,362 630,000 33,362 5400000 11,236,582 11,052,916 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoid loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence Avoid loss of Thirroul pavillion - heritage site Avoid loss of private property Total Benefits Net Benefits BCR | 103,666 183,666 28 157,511 50,000 5,000,000 33,362 630,000 33,362 0 5,904,235 5,720,570 | 80000 103,666 183,666 27 153,994 50,000 5,000,000 33,362 630,000 33,362 0 5,900,718 5,717,052 | 80000 103,666 183,666 26 150,018 50,000 5,000,000 33,362 630,000 33,362 0 5,896,742 5,713,076 | 80000 103,666 183,666 24 145,583 50,000 5,000,000 33,362 630,000 33,362 0 5,892,307 5,708,642 | 80000 103,666 183,666 23 140,689 50,000 5,000,000 33,362 630,000 33,362 0 5,887,414 5,703,748 | 80000 103,666 183,666 21 135,337 50,000 5,000,000 33,362 630,000 33,362 0 5,882,061 5,698,396 | 80000 103,666 183,666 20 129,526 50,000 5,000,000 33,362 630,000 33,362 0 5,876,250 5,692,585 | 80000 103,666 183,666 18 123,256 50,000 5,000,000 33,362 630,000 33,362 0 5,869,980 5,686,315 | 80000 103,666 183,666 17 116,527 50,000 5,000,000 33,362 630,000 33,362 0 5,863,252 5,679,586 | 80000 103,666 183,666 16 109,340 50,000 5,000,000 33,362 630,000 33,362 5400000 11,256,064 11,072,399 | 80000 103,666 183,666 14 117,292 50,000 5,000,000 33,362 630,000 33,362 5400000 11,264,016 11,080,351 | 80000 103,666 183,666 13 121,666 50,000 5,000,000 33,362 630,000 33,362 5400000 11,268,390 11,084,724 | 80000 103,666 183,666 11 122,461 50,000 5,000,000 33,362 630,000 33,362 5400000 11,269,185 11,085,520 | 80000 103,666 183,666 10 119,678 50,000 5,000,000 33,362 5400000 11,266,402 11,082,736 | 80000 103,666 183,666 9 113,316 50,000 5,000,000 33,362 630,000 33,362 5400000 11,260,040 11,076,375 | 80000 103,666 183,666 7 103,376 50,000 5,000,000 33,362 630,000 33,362 5400000 11,250,100 11,066,435 | 80000 103,666 183,666 6 89,858 50,000 5,000,000 33,362 630,000 33,362 5400000 11,236,582 11,052,916 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoid loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence Avoid loss of Thirroul pavillion - heritage site Avoide loss of Thirroul pavillion - heritage site Avoide loss of Thirroul pavillion se values - restaurant and residence Avoid loss of Thirroul pavillion - heritage site Avoide loss of Thirroul pavillion - heritage site | 103,666 183,666 28 157,511 50,000 5,000,000 33,362 630,000 33,362 0 5,904,235 5,720,570 | 80000 103,666 183,666 27 153,994 50,000 5,000,000 33,362 630,000 33,362 0 5,900,718 5,717,052 | 80000 103,666 183,666 26 150,018 50,000 5,000,000 33,362 630,000 33,362 0 5,896,742 5,713,076 | 80000 103,666 183,666 24 145,583 50,000 5,000,000 33,362 630,000 33,362 0 5,892,307 5,708,642 | 80000 103,666 183,666 23 140,689 50,000 5,000,000 33,362 630,000 33,362 0 5,887,414 5,703,748 | 80000 103,666 183,666 21 135,337 50,000 5,000,000 33,362 630,000 33,362 0 5,882,061 5,698,396 | 80000 103,666 183,666 20 129,526 50,000 5,000,000 33,362 630,000 33,362 0 5,876,250 5,692,585 | 80000 103,666 183,666 18 123,256 50,000 5,000,000 33,362 630,000 33,362 0 5,869,980 5,686,315 | 80000 103,666 183,666 17 116,527 50,000 5,000,000 33,362 630,000 33,362 0 5,863,252 5,679,586 | 80000 103,666 183,666 16 109,340 50,000 5,000,000 33,362 630,000 33,362 5400000 11,256,064 11,072,399 | 80000 103,666 183,666 14 117,292 50,000 5,000,000 33,362 630,000 33,362 5400000 11,264,016 11,080,351 | 80000 103,666 183,666 13 121,666 50,000 5,000,000 33,362 630,000 33,362 5400000 11,268,390 11,084,724 | 80000 103,666 183,666 11 122,461 50,000 5,000,000 33,362 630,000 33,362 5400000 11,269,185 11,085,520 | 80000 103,666 183,666 10 119,678 50,000 5,000,000 33,362 5,000,000 33,362 5400000 11,266,402 11,082,736 | 80000 103,666 183,666 9 113,316 50,000 5,000,000 33,362 630,000 33,362 5400000 11,260,040 11,076,375 | 80000 103,666 183,666 7 103,376 50,000 5,000,000 33,362 630,000 33,362 5400000 11,250,100 11,066,435 | 80000 103,666 183,666 6 89,858 50,000 5,000,000 33,362 5400000 11,236,582 11,052,916 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoid loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence Avoid loss of Thirroul pavillion - heritage site Avoid loss of Thirroul pavillion - heritage site Avoid loss of Thirroul pavillion - heritage site Avoid loss of private property Total Benefits Net Benefits BCR NPV/I NPV/I k + op costs | 103,666 183,666 28 157,511 50,000 5,000,000 33,362 630,000 33,362 0 5,904,235 5,720,570 | 80000 103,666 183,666 27 153,994 50,000 5,000,000 33,362 630,000 33,362 0 5,900,718 5,717,052 | 80000 103,666 183,666 26 150,018 50,000 5,000,000 33,362 630,000 33,362 0 5,896,742 5,713,076 | 80000 103,666 183,666 24 145,583 50,000 5,000,000 33,362 630,000 33,362 0 5,892,307 5,708,642 | 80000 103,666 183,666 23 140,689 50,000 5,000,000 33,362 630,000 33,362 0 5,887,414 5,703,748 | 80000 103,666 183,666 21 135,337 50,000 5,000,000 33,362 630,000 33,362 0 5,882,061 5,698,396 | 80000 103,666 183,666 20 129,526 50,000 5,000,000 33,362 630,000 33,362 0 5,876,250 5,692,585 | 80000 103,666 183,666 18 123,256 50,000 5,000,000 33,362 630,000 33,362 0 5,869,980 5,686,315 | 80000 103,666 183,666 17 116,527 50,000 5,000,000 33,362 630,000 33,362 0 5,863,252 5,679,586 | 80000 103,666 183,666 16 109,340 50,000 5,000,000 33,362 630,000 33,362 5400000 11,256,064 11,072,399 | 80000 103,666 183,666 14 117,292 50,000 5,000,000 33,362 630,000 33,362 5400000 11,264,016 11,080,351 | 80000 103,666 183,666 13 121,666 50,000 5,000,000 33,362 630,000 33,362 5400000 11,268,390 11,084,724 | 80000 103,666 183,666 11 122,461 50,000 5,000,000 33,362 630,000 33,362 5400000 11,269,185 11,085,520 | 80000 103,666 183,666 10 119,678 50,000 5,000,000 33,362 630,000 33,362 5400000 11,266,402 11,082,736 | 80000 103,666 183,666 9 113,316 50,000 5,000,000 33,362 630,000 33,362 5400000 11,260,040 11,076,375 | 80000 103,666 183,666 7 103,376 50,000 5,000,000 33,362 630,000 33,362 5400000 11,250,100 11,066,435 | 80000 103,666 183,666 6 89,858 50,000 5,000,000 33,362 5400000 11,236,582 11,052,916 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoid loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence Avoid loss of Thirroul pavillion - heritage site Avoid loss of private property Total Benefits Net Benefits BCR NPV/I NPV/I k + op costs Results - Option 1 or 3 both good but Option 1 | 103,666 183,666 28 157,511 50,000 5,000,000 33,362 630,000 33,362 0 5,904,235 5,720,570 | 80000 103,666 183,666 27 153,994 50,000 5,000,000 33,362 630,000 33,362 0 5,900,718 5,717,052 | 80000 103,666 183,666 26 150,018 50,000 5,000,000 33,362 630,000 33,362 0 5,896,742 5,713,076 | 80000 103,666 183,666 24 145,583 50,000 5,000,000 33,362 630,000 33,362 0 5,892,307 5,708,642 | 80000 103,666 183,666 23 140,689 50,000 5,000,000 33,362 630,000 33,362 0 5,887,414 5,703,748 | 80000 103,666 183,666 21 135,337 50,000 5,000,000 33,362 630,000 33,362 0 5,882,061 5,698,396 | 80000 103,666 183,666 20 129,526 50,000 5,000,000 33,362 630,000 33,362 0 5,876,250 5,692,585 | 80000 103,666 183,666 18 123,256 50,000 5,000,000 33,362 630,000 33,362 0 5,869,980 5,686,315 | 80000 103,666 183,666 17 116,527 50,000 5,000,000 33,362 630,000 33,362 0 5,863,252 5,679,586 | 80000 103,666 183,666 16 109,340 50,000 5,000,000 33,362 5,000,000 33,362 5400000 11,256,064 11,072,399 | 80000 103,666 183,666 14 117,292 50,000 5,000,000 33,362 5400000 11,264,016 11,080,351 | 80000 103,666 183,666 13 121,666 50,000 5,000,000 33,362 630,000 33,362 5400000 11,268,390 11,084,724 | 80000 103,666 183,666 11 122,461 50,000 5,000,000 33,362 630,000 33,362 5400000 11,269,185 11,085,520 | 80000 103,666 183,666 10 119,678 50,000 5,000,000 33,362 630,000 33,362 5400000 11,266,402 11,082,736 | 80000 103,666 183,666 9 113,316 50,000 5,000,000 33,362 630,000 33,362 5400000 11,260,040 11,076,375 | 80000 103,666 183,666 7 103,376 50,000 5,000,000 33,362 630,000 33,362 5400000 11,250,100 11,066,435 | 80000 103,666 183,666 6 89,858 50,000 5,000,000 33,362 630,000 33,362 5400000 11,236,582 11,052,916 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoid loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence Avoid loss of Thirroul pavillion - heritage site Avoid loss of private property Total Benefits Net Benefits BCR NPV/I NPV/I k + op costs Results - Option 1 or 3 both good but Option 1 very expensive - under a budget constraint | 103,666 183,666 28 157,511 50,000 5,000,000 33,362 630,000 33,362 0 5,904,235 5,720,570 | 80000 103,666 183,666 27 153,994 50,000 5,000,000 33,362 630,000 33,362 0 5,900,718 5,717,052 | 80000 103,666 183,666 26 150,018 50,000 5,000,000 33,362 630,000 33,362 0 5,896,742 5,713,076 | 80000 103,666 183,666 24 145,583 50,000 5,000,000 33,362 630,000 33,362 0 5,892,307 5,708,642 | 80000 103,666 183,666 23 140,689 50,000 5,000,000 33,362 630,000 33,362 0 5,887,414 5,703,748 | 80000 103,666 183,666 21 135,337 50,000 5,000,000 33,362 630,000 33,362 0 5,882,061 5,698,396 | 80000 103,666 183,666 20 129,526 50,000 5,000,000 33,362 630,000 33,362 0 5,876,250 5,692,585 | 80000 103,666 183,666 18 123,256 50,000 5,000,000 33,362 630,000 33,362 0 5,869,980 5,686,315 | 80000 103,666 183,666 17 116,527 50,000 5,000,000 33,362 630,000 33,362 0 5,863,252 5,679,586 | 80000 103,666 183,666 16 109,340 50,000 5,000,000 33,362 5400000 11,256,064 11,072,399 | 80000 103,666 183,666 14 117,292 50,000 5,000,000 33,362 630,000 33,362 5400000 11,264,016 11,080,351 | 80000 103,666 183,666 13 121,666 50,000 5,000,000 33,362 630,000 33,362 5400000 11,268,390 11,084,724 | 80000 103,666 183,666 11 122,461 50,000 5,000,000 33,362 630,000 33,362 5400000 11,269,185 11,085,520 | 80000 103,666 183,666 10 119,678 50,000 5,000,000 33,362 630,000 33,362 5400000 11,266,402 11,082,736 | 80000 103,666 183,666 9 113,316 50,000 5,000,000 33,362 630,000 33,362 5400000 11,260,040 11,076,375 | 80000 103,666 183,666 7 103,376 50,000 5,000,000 33,362 630,000 33,362 5400000 11,250,100 11,066,435 | 80000 103,666 183,666 6 89,858 50,000 5,000,000 33,362 630,000 33,362 5400000 11,236,582 11,052,916 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoid loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence Avoid loss of Thirroul pavillion - heritage site Avoid loss of there site BCR best and where lots of other beaches - | 103,666 183,666 28 157,511 50,000 5,000,000 33,362 630,000 33,362 0 5,904,235 5,720,570 | 80000 103,666 183,666 27 153,994 50,000 5,000,000 33,362 630,000 33,362 0 5,900,718 5,717,052 | 80000 103,666 183,666 26 150,018 50,000 5,000,000 33,362 630,000 33,362 0 5,896,742 5,713,076 | 80000 103,666 183,666 24 145,583 50,000 5,000,000 33,362 630,000 33,362 0 5,892,307 5,708,642 | 80000 103,666 183,666 23 140,689 50,000 5,000,000 33,362 630,000 33,362 0 5,887,414 5,703,748 | 80000 103,666 183,666 21 135,337 50,000 5,000,000 33,362 630,000 33,362 0 5,882,061 5,698,396 | 80000 103,666 183,666 20 129,526 50,000 5,000,000 33,362 630,000 33,362 0 5,876,250 5,692,585 | 80000 103,666 183,666 18 123,256 50,000 5,000,000 33,362 0 5,869,980 5,686,315 | 80000 103,666 183,666 17 116,527 50,000 5,000,000 33,362 630,000 33,362 0 5,863,252 5,679,586 | 80000 103,666 183,666 16 109,340 50,000 5,000,000 33,362 630,000 33,362 5400000 11,256,064 11,072,399 | 80000 103,666 183,666 14 117,292 50,000 5,000,000 33,362 630,000 33,362 5400000 11,264,016 11,080,351 | 80000 103,666 183,666 13 121,666 50,000 5,000,000 33,362 630,000 33,362 5400000 11,268,390 11,084,724 | 80000 103,666 183,666 11 122,461 50,000 5,000,000 33,362 630,000 33,362 5400000 11,269,185 11,085,520 | 80000 103,666 183,666 10 119,678 50,000 5,000,000 33,362 5400000 11,266,402 11,082,736 | 80000 103,666 183,666 9 113,316 50,000 5,000,000 33,362 630,000 33,362 5400000 11,260,040 11,076,375 | 80000 103,666 183,666 7 103,376 50,000 5,000,000 33,362 630,000 33,362 5400000 11,250,100 11,066,435 | 80000 103,666 183,666 6 89,858 50,000 5,000,000 33,362 630,000 33,362 5400000 11,236,582 11,052,916 | |
| Costs of maintaining pool pavillion, surf club and beach Total Cost Benefits Avoided Inundation damage Avoid loss of Thirroul Surf Club Avoid loss of Thirroul pool - use Avoid loss of Thirroul pool lost - heritage site Avoid loss of Thirroul pavillion use values - restaurant and residence Avoid loss of Thirroul pavillion - heritage site Avoid loss of private property Total Benefits Net Benefits BCR NPV/I NPV/I k + op costs Results - Option 1 or 3 both good but Option 1 very expensive - under a budget constraint BCR best and where lots of other beaches - planned retreat preferred. | 103,666 183,666 28 157,511 50,000 5,000,000 33,362 630,000 33,362 0 5,904,235 5,720,570 | 80000 103,666 183,666 27 153,994 50,000 5,000,000 33,362 630,000 33,362 0 5,900,718 5,717,052 | 80000 103,666 183,666 26 150,018 50,000 5,000,000 33,362 630,000 33,362 0 5,896,742 5,713,076 | 80000 103,666 183,666 24 145,583 50,000 5,000,000 33,362 630,000 33,362 0 5,892,307 5,708,642 | 80000 103,666 183,666 23 140,689 50,000 5,000,000 33,362 630,000 33,362 0 5,887,414 5,703,748 | 80000 103,666 183,666 21 135,337 50,000 5,000,000 33,362 630,000 33,362 0 5,882,061 5,698,396 | 80000 103,666 183,666 20 129,526 50,000 5,000,000 33,362 630,000 33,362 0 5,876,250 5,692,585 | 80000 103,666 183,666 18 123,256 50,000 5,000,000 33,362 0 5,869,980 5,686,315 | 80000 103,666 183,666 17 116,527 50,000 5,000,000 33,362 630,000 33,362 0 5,863,252 5,679,586 | 80000 103,666 183,666 16 109,340 50,000 5,000,000 33,362 630,000 33,362 5400000 11,256,064 11,072,399 | 80000 103,666 183,666 14 117,292 50,000 5,000,000 33,362 630,000 33,362 5400000 11,264,016 11,080,351 | 80000 103,666 183,666 13 121,666 50,000 5,000,000 33,362 630,000 33,362 5400000 11,268,390 11,084,724 | 80000 103,666 183,666 11 122,461 50,000 5,000,000 33,362 5400000 11,269,185 11,085,520 | 80000 103,666 183,666 10 119,678 50,000 5,000,000 33,362 5400000 11,266,402 11,082,736 | 80000 103,666 183,666 9 113,316 50,000 5,000,000 33,362 5,000,000 33,362 5400000 11,260,040 11,076,375 | 80000 103,666 183,666 7 103,376 50,000 5,000,000 33,362 630,000 33,362 5400000 11,250,100 11,066,435 | 80000 103,666 183,666 6 89,858 50,000 5,000,000 33,362 630,000 33,362 5400000 11,236,582 11,052,916 | |

| 2053 | 2054 | 2055 | 2056 | 2057 | 2058 | 2059 | 2060 |
|---------------------------------|---|---|---|---|---|---|---|
| | | | | | | | |
| 205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 |
| 09,166 00,000 314,166 | 109,166 10,000,000 \$10,314,166 |
| - | - | - | - | - | - | - | - |
| 50,000 00,000 | 50,000 5,000,000 |
| 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| 30,000 33,362 00,000 | 630,000 33,362 2,000,000 |
| 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| - 00,000 80,087 65,921 | - 5,400,000 13,180,087 2,865,921 |

| 000 | 80000 | 80000 | 80000 | 80000 | 80000 |
|-----|------------|------------|------------|------------|------------|
| 66 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 |
| 66 | 183,666 | 183,666 | 183,666 | 183,666 | 183,666 |
| 9 | 7 | 6 | 4 | 3 | 1 |
| 16 | 103,376 | 89,858 | 72,761 | 52,086 | 27,832 |
| 00 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| 00 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 62 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| 00 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 |
| 62 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| 000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 |
| 40 | 11,250,100 | 11,236,582 | 11,219,485 | 11,198,810 | 11,174,556 |
| 75 | 11,066,435 | 11,052,916 | 11,035,820 | 11,015,144 | 10,990,891 |
| | | | | | |

| | 2061 | 2062 | 2063 | 2064 | 2065 | 2066 | 2067 | 2068 | 2069 | 2070 | 2071 | 2072 | 2073 | 2074 | 2075 |
|---|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| OPTION 2 - SEA WALL - NO NOURISHMENT Costs | | | | | | | | | | | | | | | |
| Capital costs | | | | | | | | | | | | | | | |
| Maintenance costs | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 |
| Costs of maintaining pool pavillion, surf club | | | | | | | | | | | | | | | |
| and reserve | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 | 109,166 |
| Lose beach | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 |
| Total costs | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 | \$10,314,166 |
| Benefits | | | | | | | | | | | | | | | |
| Avoided Inundation damage | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Avoided Erosion Damage | | | | | | | | | | | | | | | |
| Avoid loss of Thirroul Surf Club | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| Avoid loss of Thirroul pool - use | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| Avoide loss of Thirroul pool lost - heritage site | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Avoid loss of Thirroul pavillion use values - | | | | | | | | | | | | | | | |
| restaurant and residence | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 |
| Avoid loss of Thirroul pavillion - heritage site | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Avoid loss of Thirroul beach reserve - use Avoid loss of Thirroul Beach reserve - heritage | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 |
| site | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Stormwater asset lost - end of pipe | - | - | - | - | - | - | - | - | - | - | - | X | - | - | - |
| Avoid loss of Private properties (2050) | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 |
| Total Benefits | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 |
| Net Benefits | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 |
| BCR | | | | | | | | | | | | | | | |
| NPV/I | | | | | | | | | | | | | | | |
| NPV/I k + op costs | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| OPTION 3 - PLANNED RETREAT | | | | | | | | | | | | | | | |
| Cost of relocating Thirroul surf club | | | | | | | | | | | | | | | |
| Cost of relocating thirroul pool | | | | | | | | | | | | | | | |
| Cost of relocating Thirroul pavillon | | | | | | | | | | | | | | | |
| Cost of planning controls on 9 properties plus | | | | | | | | | | C A | | | | | |
| /1 properties | | | | | | | | | | | | | | | |
| Costs of maintaining pool pavillion, sufficiub | 102 / / / | 100 / / / | 100 / / / | 100 / / / | 102 / / / | 100 / / / | 100 / / / | 100 / / / | 102 /// | 100 /// | 100 / / / | 100 / / / | 100 / / / | 102 / / / | 102 / / / |
| and beach | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 |
| Total cost | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 | 103,000 |
| Benefits | | | | | | | | | | | | | | | |
| Avoided Inundation damage | - | - | - | - | - | - | - | - | | - | - | - | - | - | - |
| Avoid loss of Thirroul Surf Club | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| Avoid loss of Thirroul pool - use | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| Avoide loss of Thirroul pool lost - heritage site | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Avoid loss of Thirroul pavillion use values - | | | | | | | | | | | | | | | |
| restaurant and residence | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 |
| Avoid loss of Thirroul pavillion - heritage site | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Avoided loss of private property | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 540000 |
| Iotal Benefits | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 |
| | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 |
| BCK NDV// | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| NPV/IK + OP COSIS | | | | | | | | | | | | | | | |
| Results - Option For 3 both good but Option F | | | | | | | * | | | | | | | | |

very expensive - under a budget constraint BCR best and where lots of other beaches planned retreat preferred.

| 2076 | 2077 | 2078 | 2079 | 2080 |
|---|---|---|---|---|
| | | | | |
| \$205,000 | \$205,000 | \$205,000 | \$205,000 | \$205,000 |
| 109,166 10,000,000 \$10,314,166 | 109,166 10,000,000 \$10,314,166 | 109,166 10,000,000 \$10,314,166 | 109,166 10,000,000 \$10,314,166 | 109,166 10,000,000 \$10,314,166 |
| - | - | - | - | - |
| 50,000 5,000,000 | 50,000 5,000,000 | 50,000 5,000,000 | 50,000 5,000,000 | 50,000 5,000,000 |
| 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| 630,000 33,362 2,000,000 | 630,000 33,362 2,000,000 | 630,000 33,362 2,000,000 | 630,000 33,362 2,000,000 | 630,000 33,362 2,000,000 |
| 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| - 5,400,000 13,180,087 2,865,921 | - 5,400,000 13,180,087 2,865,921 | - 5,400,000 13,180,087 2,865,921 | - 5,400,000 13,180,087 2,865,921 | - 5,400,000 13,180,087 2,865,921 |

| 6 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 |
|----|------------|------------|------------|------------|------------|------------|
| 6 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 |
| | | | | | | |
| | | | | | | |
| | - | - | - | - | - | - |
| 0 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| 0 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| | | | | | | |
| 2 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| | | | | | | |
| 0 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 |
| 2 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| 00 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 |
| 4 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 |
| 9 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 |
| | | | | | | |

| | 2081 | 2082 | 2083 | 2084 | 2085 | 2086 | 2087 | 2088 | 2089 | 2090 | 2091 | 2092 | 2093 | 2094 | 2095 | 2096 | 2097 | 2098 | 2099 | 2100 |
|---|--------------|--------------|--------------|--------------|--------------|---------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-----------------------|---------------------|
| OPTION 2 - SEA WALL - NO NOURISHMENT | | | | | | | | | | | | | | | | | | | | |
| Costs | | | | | | | | | | | | | | | | | | | | |
| Capital costs | | | | | | | | | | | | | | | | | | | | |
| Maintenance costs | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 | \$205.000 |
| Costs of maintaining pool pavillion, surf club | +===,=== | | + | | | | + | + | +===;=== | +=++,+++ | + | + | | | | + | | | +===1==== | + |
| and reserve | 109 166 | 109.166 | 109,166 | 109,166 | 109.166 | 109 166 | 109 166 | 109,166 | 109 166 | 109 166 | 109.166 | 109 166 | 109 166 | 109.166 | 109 166 | 109 166 | 109 166 | 109 166 | 109 166 | 109 166 |
| Lose beach | 10,000,000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10,000,000 | 10,000,000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 | 10,000,000 | 10 000 000 | 10 000 000 | 10 000 000 | 10 000 000 |
| Total costs | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 | \$10 314 166 |
| Benefits | ¢10,011,100 | ¢10,011,100 | \$10,011,100 | \$10,011,100 | \$10,011,100 | <i>\</i> 10,011,100 | ¢10,011,100 | \$10,011,100 | \$10,011,100 | ¢10,011,100 | \$10,011,100 | \$10,011,100 | ¢10,011,100 | ¢10,011,100 | ¢10,011,100 | \$10,011,100 | \$10,011,100 | ¢10,011,100 | <i><i><i></i></i></i> | <i>\</i> 10,011,100 |
| Avoided Inundation damage | - | - | - | | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Avoided Frosion Damage | | | | | | | | | | | | | | | | | | | | |
| Avoid loss of Thirroul Surf Club | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50 000 |
| Avoid loss of Thirrout pool _uso | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 | 5 000 000 |
| | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 3,000,000 | 3,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| Avoide loss of Thirroul pool lost - heritage site | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 | 33 362 |
| Avoid loss of Thirrout pavillion uso values | 33,302 | 55,502 | 33,302 | 55,502 | 55,502 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 55,502 | 55,502 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 55,502 | 55,502 |
| rostaurant and rosidonco | 620.000 | 620.000 | 620.000 | 620.000 | 620.000 | 620.000 | 420.000 | 420.000 | 620.000 | 420.000 | 620.000 | 620.000 | 420.000 | 620.000 | 420.000 | 620.000 | 620.000 | 620.000 | 620.000 | 620.000 |
| Δv_{oid} loss of Thirrout pavillion - beritage site | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 | 22 262 |
| Avoid loss of Thirrout basch reserve use | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 | 2 000 000 |
| Avoid loss of Thirroul Beach reserve - use | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 |
| site | 22.27.2 | 22.272 | 22.272 | 22.27.2 | 22.272 | 22.27.2 | 22.2/2 | 22.272 | 22.2/2 | 22.2/2 | 22.27.2 | 22.27.2 | | 22.2/2 | 22.2/2 | 22.27.2 | 22.27.2 | 22.27.2 | 22.2/2 | 22.2/2 |
| Sile | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 | 33,302 |
| Stormwater asset lost - end of pipe | - | - | - | - | - | - | - | - | - | - | - | | - | - | - | - | - | - | - | - |
| Avoid loss of Private properties (2050) | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | 5,400,000 | //,142,85/ |
| Total Benefits | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 13,180,087 | 84,922,944 |
| Net Benefits | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 2,865,921 | 74,608,778 |
| BCR | | | | | | | | | | | | | | | | | | | | |
| NPV/I | | | | | | | | | | | | | | | | | | | | |
| NPV/I k + op costs | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| OPTION 3 - PLANNED RETREAT | | | | | | | | | | | | | | | | | | | | |
| Cost of relocating Thirroul surf club | | | | | | | | | | | | | | | | | | | | |
| Cost of relocating thirroul pool | | | | | | | | | | | | | | | | | | | | |
| Cost of relocating Thirroul pavillon | | | | | | | | | | | | | | | | | | | | |
| Cost of planning controls on 9 properties plus | | | | | | | | | | | | | | | | | | | | |
| 71 properties | | | | | | | | | | | | | | | | | | | | |
| Costs of maintaining pool pavillion, surf club | | | | | | | | | | | | | | | | | | | | |
| and beach | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 |
| Total Cost | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 | 103,666 |
| | | | | | | | | | X | | | | | | | | | | | |
| Benefits | | | | | | | | | | | | | | | | | | | | |
| Avoided Inundation damage | - | - | - | - | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - |
| Avoid loss of Thirroul Surf Club | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 50,000 |
| Avoid loss of Thirroul pool - use | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| | | | | | | | | | | | | | | | | | | | | |
| Avoide loss of Thirroul pool lost - heritage site | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Avoid loss of Thirroul pavillion use values - | | | | | | | | | | | | | | | | | | | | |
| restaurant and residence | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 | 630,000 |
| Avoid loss of Thirroul pavillion - heritage site | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 | 33,362 |
| Avoided loss of private property | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | 5400000 | -\$71,742,857 |
| Total Benefits | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 | 11,146,724 - | 65,996,133 |
| Net Benefits | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 | 11,043,059 - | 66,099,798 |
| BCR | | | | | | | | | | | | | | | | | | | | |
| NPV/I | | | | | | | | | | | | | | | | | | | | |
| NPV/I k + op costs | | | | | | | | | | | | | | | | | | | | |
| Results - Option 1 or 3 both good but Option 1 | | | | | | | | | | | | | | | | | | | | |
| very expensive - under a budget constraint | | | | | | VV) | | | | | | | | | | | | | | |
| BCR best and where lots of other beaches - | | | | | | | | | | | | | | | | | | | | |
| planned retreat preferred. | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | - | | | | | | | | | | | | | | |

| | 4% | 7% | 10% | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|-------------|-------------|----------------|--------------------|------------------|-------------------------|---------------------------|-------------------|------------------|------|------|------|------|
| | | | | Wollon | gong populat | 184,213 | | | | | | | |
| | | | | | | 2.5 | | | | | | | |
| | Sensitivity | | | HH | | 73685.2 | | | | | | | |
| Assumptions | | | | | | | | | | | | | |
| Inundation | | | | PV cost | | \$2,505,618 | | | | | | | |
| Probability of event in 2011 | 0.01 | | | PV of c | ost per hh | \$34.00 | | | | | | | |
| Probability of event in 2050 | 0.1 | | | Annual | cost per hh | \$2.38 | | | | | | | |
| Probability of event in 2100 | 1 | | | | | | | | | | | | |
| Consequence of event per property | 70000 | 1 This rela | tes to 0.2 to | 0.5m of flooding . | We dont known | what level will be with | n sea level rise inundati | ion | | | | | |
| Number of properties | 71 | 1 80 alrea | dy in FDCP w | hich requires alts | and rebulidng to | have floor levels abov | e certain heights - we d | dont know how man | y have done this | | | | |
| Growth rate of development to avoid flood dar | 0% | - but cor | ntrols already | exist so marginal | cost and benefit | only applies to the dif | ference | | | | | | |
| Frosion | | | | | | | | | | | | | |

| Growth rate of development to avoid flood da | ır 0% | 2 | - but controls already exist so marginal cost and benefit only applies to the difference |
|--|-------------|-------------|--|
| ELOSIOIT | | | |
| | | | |
| Thirroul surf club visitors pa | 5000 |) 1 | |
| consumer surplus for surf club use | 10 |) 1 | |
| Thirrow pool visitors pa | 500.000 | 1 | Implicitly assume revenue covers operating costs so no loss of PC or cost saving - but probably a cost saving if it disappears |
| cs for pool visitors | 10 | 1 | implicity assume revenue covers operating costs so no loss of r5 or cost saving - but probably a cost saving in traisappears. |
| Haritage site value per person per appum | 0.01 | 1 | |
| Aggregation to 70% of Aust bh | 6 022 052 | 1 | |
| | 0,032,933 | 1 | Assumed not of maintenance agets |
| open space al ound pool visitors pa | 200000 | / I | Assumed net of maintenance costs |
| | \$10 | | |
| pavillion - restaurant producer surplus | 600000 | | Assumed net of maintenance costs |
| pavillion - value as a residence - rent pa | 30000 | | Assumed net of maintenance costs |
| Private properties no. | 9 | 1 | |
| Private property values | \$2,000,000 |) 1 | |
| private discoutn rates | 30% |) | |
| | | | |
| Maintenance costs | Asset value | Maintenance | |
| Pool | 1300000 | \$20,450 | |
| Other pool buildings | 641532 | \$10,092 | |
| Pavillion | 2745498 | \$43,189 | |
| SLSC | 1693183 | \$26,635 | |
| Reserve | 112875 | \$8,800 | |
| Beach | | \$3,300 | |
| Total | | \$112,466 | |
| | _ | | |
| OPTION 1 - SEAL WALL - WITH NOURISHMEN | Γ | | |
| Initial beach nourishment (m3) | 90000 |) 1 | X |
| Ongoing beach nourishment (m3) | 30000 |) 1 | |
| Cost per m3 of beach nourishment | 25 | i 1 | |
| Avoid Thirroul beach use lost | 500000 |) 1 | |
| Consumer surplus for beach use | 20 |) 1 | |
| | | | |
| | | | |
| OPTION 2 - SEAL WALL - NO NOURISHIVIENT | | | |
| Capital costs / metre | \$10,000 |) 1 | |
| Metres | 410 |) 1 | |
| Mainenance costs pa | 5% | · 1 | |
| Lost beach | | | |
| Annual visit days | 500,000 | 1.00 | |
| \$/visit day | 20 |) 1 | |
| SLSC asset value | | | |
| Maintenance costs | | | |
| Pavillion asset value | | | |
| Maintenance costs | | | |
| Pool asset value | | | |
| Operating costs including maintenance | | | |
| Thirroul Reserve area | | | |
| Maintenance costs | | | |
| | | | - |
| | | | |
| | | | |
| OPTION 3 - PLANNED RETREAT | | | |
| Relocation costs per tonne | 1000 |) 1 | |

OPTION 1 - SEAL WALL - WITH NOURISHMENT

| Initial beach nourishment (m3) | 90000 | 1 |
|----------------------------------|--------|---|
| Ongoing beach nourishment (m3) | 30000 | 1 |
| Cost per m3 of beach nourishment | 25 | 1 |
| Avoid Thirroul beach use lost | 500000 | 1 |
| Consumer surplus for beach use | 20 | 1 |

OPTION 2 - SEAL WALL - NO NOURISHMENT

| Capital costs / metre | \$10,000 | 1 |
|---------------------------------------|----------|------|
| Metres | 410 | 1 |
| Mainenance costs pa | 5% | 1 |
| Lost beach | | |
| Annual visit days | 500,000 | 1.00 |
| \$/visit day | 20 | 1 |
| SLSC asset value | | |
| Maintenance costs | | |
| Pavillion asset value | | |
| Maintenance costs | | |
| Pool asset value | | |
| Operating costs including maintenance | | |
| Thirroul Reserve area | | |
| Maintenance costs | | |

OPTION 3 - PLANNED RETREAT

| Relocation costs per tonne | 1000 | 1 |
|-------------------------------------|---------|---|
| Pavillion tonnes | 250 | 1 |
| Pool tonnes | 600 | 1 |
| SLSC | 250 | 1 |
| Rate at which redevelopment happens | 2% | 1 |
| Number of properties | 9 | 1 |
| No of inundation properties | 71 | 1 |
| Value of properties | 2000000 | 1 |
| private discoutn rates | 30% | |
| Cost of DCP works per property | 50000 | 1 |

| 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|

| Thirroul surf club visitors pa consumer surplus for surf club use |
|---|
| Thirroul pool visitors pa cs for pool visitors |
| Heritage site value per person per annum Aggregation to 79% of Aust hh |
| open space around pool visitors pa cs for use of open space |
| pavillion - restaurant producer surplus pavillion - value as a residence - rent pa |
| Private properties no. Private property values private discoutn rates |

Maintenance costs Pool Other pool buildings Pavillion SLSC Reserve Beach Total

OPTION 1 - SEAL WALL - WITH NOURISHMENT Initial beach nourishment (m3) Ongoing beach nourishment (m3) Cost per m3 of beach nourishment Avoid Thirroul beach use lost Consumer surplus for beach use

OPTION 2 - SEAL WALL - NO NOURISHMENT Capital costs / metre Metres Mainenance costs pa Lost beach Annual visit days \$/visit day SLSC asset value Maintenance costs Pavillion asset value Maintenance costs Pool asset value Operating costs including maintenance Thirroul Reserve area Maintenance costs

OPTION 3 - PLANNED RETREAT Relocation costs per tonne Pavillion tonnes Pool tonnes SLSC Rate at which redevelopment happens Number of properties No of inundation properties Value of properties private discoutn rates Cost of DCP works per property tem2. Attachments

2036

2037

2038

2039

| 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 | 2048 | 2049 | 2050 | 2051 | 2052 | 2053 | 2054 | 2055 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|

Thirroul surf club visitors pa consumer surplus for surf club use Thirroul pool visitors pa cs for pool visitors Heritage site value per person per annum Aggregation to 79% of Aust hh open space around pool visitors pa cs for use of open space pavillion - restaurant producer surplus pavillion - value as a residence - rent pa Private properties no. Private property values private discoutn rates

Maintenance costs Pool Other pool buildings Pavillion SLSC Reserve Beach Total

OPTION 1 - SEAL WALL - WITH NOURISHMENT Initial beach nourishment (m3) Ongoing beach nourishment (m3) Cost per m3 of beach nourishment Avoid Thirroul beach use lost Consumer surplus for beach use

OPTION 2 - SEAL WALL - NO NOURISHMENT Capital costs / metre Metres Mainenance costs pa Lost beach Annual visit days \$/visit day SLSC asset value Maintenance costs Pavillion asset value Maintenance costs Pool asset value Operating costs including maintenance Thirroul Reserve area Maintenance costs

OPTION 3 - PLANNED RETREAT Relocation costs per tonne Pavillion tonnes Pool tonnes SLSC Rate at which redevelopment happens Number of properties No of inundation properties Value of properties private discoutn rates Cost of DCP works per property tem?

| 2001 2002 2003 2004 2003 2000 2007 2008 2009 2070 2071 2072 2073 2074 | 2061 | 2062 | 2063 | 2064 | 2065 | 2066 | 2067 | 2068 | 2069 | 2070 | 2071 | 2072 | 2073 | 2074 | 2075 |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|

| Thirroul surf club visitors pa |
|--|
| consumer surplus for surf club use |
| Thirroul pool visitors pa |
| cs for pool visitors |
| Heritage site value per person per annum |
| Aggregation to 79% of Aust hh |
| open space around pool visitors pa |
| cs for use of open space |
| pavillion - restaurant producer surplus |
| pavillion - value as a residence - rent pa |
| Private properties no. |
| Private property values |
| private discoutn rates |

Maintenance costs Pool Other pool buildings Pavillion SLSC Reserve Beach Total

OPTION 1 - SEAL WALL - WITH NOURISHMENT Initial beach nourishment (m3) Ongoing beach nourishment (m3) Cost per m3 of beach nourishment Avoid Thirroul beach use lost Consumer surplus for beach use

OPTION 2 - SEAL WALL - NO NOURISHMENT Capital costs / metre Metres Mainenance costs pa Lost beach Annual visit days \$/visit day SLSC asset value Maintenance costs Pavillion asset value Maintenance costs Pool asset value Operating costs including maintenance Thirroul Reserve area Maintenance costs

OPTION 3 - PLANNED RETREAT Relocation costs per tonne Pavillion tonnes Pool tonnes SLSC Rate at which redevelopment happens Number of properties No of inundation properties Value of properties private discoutn rates Cost of DCP works per property tem2. Attachments

2076 2077 2078 2079 2080

| 2081 | 2082 | 2083 | 2084 | 2085 | 2086 | 2087 | 2088 | 2089 | 2090 | 2091 | 2092 | 2093 | 2094 | 2095 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|

| Thirroul surf club visitors pa |
|--|
| consumer surplus for surf club use |
| Thirroul pool visitors pa |
| cs for pool visitors |
| Heritage site value per person per annum |
| Aggregation to 79% of Aust hh |
| open space around pool visitors pa |
| cs for use of open space |
| pavillion - restaurant producer surplus |
| pavillion - value as a residence - rent pa |
| Private properties no. |
| Private property values |
| private discoutn rates |

Maintenance costs Pool Other pool buildings Pavillion SLSC Reserve Beach Total

OPTION 1 - SEAL WALL - WITH NOURISHMENT Initial beach nourishment (m3) Ongoing beach nourishment (m3) Cost per m3 of beach nourishment Avoid Thirroul beach use lost Consumer surplus for beach use

OPTION 2 - SEAL WALL - NO NOURISHMENT Capital costs / metre Metres Mainenance costs pa Lost beach Annual visit days \$/visit day SLSC asset value Maintenance costs Pavillion asset value Maintenance costs Pool asset value Operating costs including maintenance Thirroul Reserve area Maintenance costs

OPTION 3 - PLANNED RETREAT Relocation costs per tonne Pavillion tonnes Pool tonnes SLSC Rate at which redevelopment happens Number of properties No of inundation properties Value of properties private discoutn rates Cost of DCP works per property tem2. Attachments

APPENDIX G: WOLLONGONG COASTAL EROSION EMERGENCY ACTION SUB PLAN

tem?



G-1

Wollongong Coastal Erosion Emergency Action Sub Plan

January 2012

Offices

Brisbane Denver Mackay Melbourne Newcastle Perth Sydney Vancouver

Prepared For:

Wollongong City Council

Prepared By: BMT WBM Pty Ltd (Member of the BMT group of companies)



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| Title: | Wollongong Coastal Erosion Emergency Action Sub Plan | | | | |
|------------|---|--|--|--|--|
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| Synopsis : | This Wollongong Coastal Erosion Emergency Action Sub Plan forms an Appendix to the Wollongong Coastal Zone Management Study and Plan. This sub-plan outlines actions to be performed before, during and after an erosion emergency and the roles and responsibilities for coastal erosion emergencies. | | | | |

REVISION/CHECKING HISTORY

| and responsibilities for coastal erosion emergencies. | | | | | | | | | |
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CONTENTS

Contents

| 1 | INTRO | DUCTION | 1 | | |
|---|---------------|--|---|--|--|
| | 1.1 | Coastal Zone Management Planning | | | |
| | 1.2 | The Role of the Coastal Erosion Emergency Action Subplan | | | |
| | 1.3 | Extent of the Coastal Erosion Emergency Action Subplan | 1 | | |
| | 1.4 | Minimum Requirements for Emergency Action Subplans | 2 | | |
| 2 | EMER | GENCY PLANNING HIERARCHY | 3 | | |
| | 2.1 | Declared Storm Emergency | 3 | | |
| | 2.2 | Coastal Erosion Emergency (not triggered by a storm) | 4 | | |
| | 2.3 | Assets and Development at Threat | 4 | | |
| 3 | Emer | GENCY RESPONSES | 6 | | |
| | 3.1 | Communication | 6 | | |
| | 3. | 1.1 Storm Emergency | 6 | | |
| | 3. | 1.2 Non Storm Erosion Emergency | 6 | | |
| | 3.2 | Landowner Initiated Actions | 6 | | |
| | 3.3 | Council Actions Prior to a Coastal Erosion Emergency | 7 | | |
| | 3.4 | Council Actions During a Coastal Erosion Emergency | 7 | | |
| | 3.5 Emerç | Council Actions Following the Cessation of a Coastal Erosion gency | 8 | | |
| 4 | Resp | ONSIBILITIES | 9 | | |
| 5 | PLAN REVIEW 1 | | | | |
| | | | | | |



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ACRONYMS

| CEEAS | Coastal Erosion Emergency Action Sub-plan | |
|--------|--|---|
| СРА | Coastal Protection Act (1979) | |
| DECCW | Department of Environment Climate Change and Water (former department, now OEH) | |
| LEMC | Local Emergency Management Committee | |
| LEOCON | Local Emergency Operations Controller | |
| OEH | Office of Environment and Heritage | 0 |
| SERM | State Emergency and Rescue Management | Э |
| SERMA | State Emergency and Rescue Management Act | |
| wcc | Wollongong City Council | |

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1 INTRODUCTION

1.1 Coastal Zone Management Planning

The process for managing coastal hazards and coastal risks along the New South Wales coast is through the preparation of Coastal Zone Management Plans. Through the development and subsequent implementation of these plans, the coastal hazards are identified and, as appropriate, the risks are addressed through a range of planning and protection measures. In this way the likelihood of emergencies resulting from erosion during storm events is minimised. The need for unplanned protection is reduced and the risk to life and property managed. The residual risk to properties, assets and life until such time as the key elements of the plan have been adopted or as a result of potential unforeseen outcomes or storm severity are covered by this Coastal Erosion Emergency Action Subplan (CEEAS).

The CEEAS is a required component of the preparation of a Coastal Zone Management Plan (CZMP) as set out in the NSW *Coastal Protection Act 1979* (the CPA). Section 55C(1)(b) of the CPA states a CZMP must provide for 'emergency actions carried out during periods of beach erosion, including the carrying out of related works, such as works for the protection of property affected or likely to be affected by beach erosion, where beach erosion occurs through storm activity or an extreme or irregular event'. Section 4 of the CPA states that the part of a CZMP that deals with the matters specified in Section 55C(1)(b) is an emergency action sub plan (OEH 2011, page 1).

1.2 The Role of the Coastal Erosion Emergency Action Sub-plan

"The emergency action sub-plan forms an integral component of a CZMP. It outlines a council's intended response to a coastal erosion emergency and explains ways in which and where beachfront property owners can place emergency coastal protection works according to the Coastal Protection Act 1979 (CPA)" (OEH 2011, page 1).

"Section 55C(2)(a) of the CPA requires that CZMPs **must not** include matters dealt with in any plan made under the State Emergency and Rescue Management Act 1989 (SERMA) in relation to emergency responses.

The roles and responsibilities of government agencies, councils and other relevant organisations during severe storm events (including events that cause erosion) are detailed in the NSW State Storm Plan (SES 2007)" (OEH 2011, page 1).

1.3 Extent of the Coastal Erosion Emergency Action Sub-plan

The OEH Guide (2011) advises that "The minimum area to be covered by an emergency action subplan would be either:

- any area defined by a direction from the Minister according to Section 55B of the CPA; or
- all beachfront margins where erosion is likely to threaten public and private infrastructure or assets.



The sub-plan may also cover areas of the coastline accessed or utilised by the general public where there is an identified threat posed by erosion, e.g. walking tracks through coastal parkland."

No direction has been issued under Section 55B for the Wollongong Local Government Area (LGA) coastal zone. The extent of this CEEAS is, therefore defined as the coastal margins of the ocean beaches and headlands within the city boundaries, extending from the Royal National Park at Stanwell Park in the North to the Lake Illawarra entrance in the south (excluding the Port Kembla Harbour foreshores).

1.4 Minimum Requirements for Emergency Action Sub-plans

The CEEAS must be consistent with and not duplicate or contradict any plans prepared under the *State Emergency and Rescue Management Act 1989* (SERM Act). The relationship between these two planning frameworks is indicated in Table 1 which has been adapted from OEH, 2011 (page 14).

| Emergency Action Sub Plans | SERM Act Plans |
|--|---|
| Any coastal protection works or other actions to be carried out by council when coastal erosion is imminent or occurring, or in recovering from coastal erosion. | Actions in relation to the prevention of, preparation for, response to and recovery from emergencies, excluding permanent or temporary coastal protection works. |
| Any additional requirements for landowner placement of emergency coastal protection works beyond those in the <i>Coastal Protection</i> <i>Act 1979</i> (e.g. constraints on access and the location of works) * | Actions are consistent with the NSW State Disaster Plan and the State Storm Sub Plan. |

Table 1 Contents of CEEAS and SERM Act plans (adapted from OEH, 2011)

* No locations for emergency coastal protection works in accordance with the CPA 1979 have been identified in the Wollongong LGA coastal zone.

Where landowners are eligible to place emergency coastal protection works, the CEEAS is to be prepared with direct consultation with landowners affected by the subplan. In the Wollongong LGA coastal zone at present there are no private properties identified as eligible to place emergency coastal protection works in accordance with the CPA 1979 (Part 4C). Therefore, this requirement is not currently applicable.

The minimum requirements for a Coastal Erosion Emergency Action Subplan are set out in the NSW Government Guideline (OEH, 2011) which reflects the requirements expressed in the CPA 1979. These are:

- describing intended emergency actions to be carried out during periods of beach erosion, such as coastal protection works for property or asset protection, other than matters dealt with in any plan made under the *State Emergency and Rescue Management Act 1989* relating to emergency response (sections 55C(1)(b) and (g) of the CPA *1979*)
- describing any site-specific requirements for landowner emergency coastal protection works
- describing the consultation carried out with the owners of land affected by a subplan.



2 EMERGENCY PLANNING HIERARCHY

2.1 Declared Storm Emergency

There is a clear hierarchy in planning and responsibility that applies to emergency management in NSW, including those emergencies resulting from a defined storm or disaster. In these events, the NSW State Emergency Services are designated as the lead combat agency and are in charge of the emergency response. The various roles and responsibilities are defined in the NSW Storm Plan and within the City of Wollongong Local Disaster Plan (DISPLAN). The DISPLAN states at paragraphs 114 and 115 that:

"**114** Subject to the requirements and provisions of the SERM Act, and under the provisions of the SES Act, for the emergencies of flood and damage control for storms, including the coordination of evacuation and welfare of affected communities, the overall control of operations in response to these emergencies is vested in the Director General of the State Emergency Service.

115 In both flood or storm emergencies, the DISPLAN for the District and/or any Local Area to which the emergency applies is automatically active and Police, the other Emergency Services and Functional Areas are to provide support as required by the Combat Agency Controller. The Local or District Emergency Operations Controller is then to be prepared to coordinate support if requested by the appointed Local/Division State Emergency Service Controller."

Therefore, the Wollongong DISPLAN informs this Coastal Erosion Emergency Action Sub-plan.

The role of Council in a storm emergency is limited to those activities that may be requested by the SES to assist with the emergency relief or to activities (including protection works) undertaken by the Council to protect assets under Council control. Where any proposed protection works require development approval, Council must only undertake such works during an emergency where the consent has been obtained in advance. Where the works are exempt (such as minor works or emergency works to protect a road or stormwater system under SEPP (Infrastructure) 2007) Council must first undertake an assessment to determine that the works will not result in a significant adverse environmental impact. Before undertaking any works, Council must also confirm that the works proposed are in accordance with the currently gazetted (or adopted) Coastal Zone Management Plan.

There are no protection works proposed for emergency management purposes under this CEEAS that require development consent.

Following the emergency, Council is involved in the remediation of damage or hazards and the reinstatement of the dunes, beaches and accessways in an appropriate and safe manner. This will include works of varying priorities and timeframes in accordance with usual Council maintenance procedures.



2.2 Coastal Erosion Emergency (not triggered by a storm)

Where the erosion emergency arises from events other than a declared storm event, then the requirement of the State Storm Plan and Wollongong DISPLAN are not activated. Such an event could arise for example from a period of high tides and large swell, resulting in substantial erosion to the back of the beach. For these conditions it is likely that the erosion resulting would be substantially less than that which would result from the design storm event (unless such an event was to occur immediately following a severe storm event).

It is not possible to determine a trigger event for such an occurrence. Therefore, the determination to invoke the this emergency sub-plan (in this case by Council) would need to be based on monitoring of the beach state. In such a case, the CEEAS would be implemented following a request from the designated Council Officer.

2.3 Assets and Development at Threat

The extent of coastal hazards within the Wollongong LGA coastal zone is defined in the Wollongong City Council Coastal Zone Study (Cardno, 2010). This study maps the landward extent of erosion hazards that may be anticipated for various planning timeframes. Specifically, the landward extent of erosion hazards at present are defined in Maps included in the Wollongong Coastal Zone Study (Cardno, 2010) at Figures 8.5 to 8.13 and form the basis for defining the extent of the erosion hazard at present.

Within the Wollongong LGA coastal zone the extent of storm erosion resulting from a severe design storm event at present is mainly restricted to the sandy beach area with little public infrastructure or private property likely to be affected. Significant encroachments of the storm erosion extent threatening existing development are limited to the following locations:

- the parking area and ramp at Austinmer Boat Harbour (Cardno, 2010 Fig 8.5);
- the seaward portion of the Tuckerman Park carpark at Austinmer North (Cardno, 2010 Fig 8.6); and
- Thirroul Beach carpark and promenade (Cardno, 2010 Fig 8.7).

At each of these locations the development likely to be impacted is protected by a seawall of unknown design. The potential encroachment of the erosion into these paved areas was calculated on the basis that the seawall at present offered no protection to beach erosion.

In addition to these specific developments there are different types of activities, development and areas that may be impacted during an erosion emergency. These include:

- stormwater and drainage outlet structures located on beaches;
- ocean baths and rock pools;
- defined beach and dune access tracks under care and control of Council; and
- the beaches and dunes.



These exist within an area of known high hazard and are either designed to accommodate the erosion events (such as the stormwater outlets and pools), or are temporarily affected by erosion, limiting their use by the community (such as beaches and accessways). In each case the opportunity to protect the asset prior to an erosion event is low and the risk to life during an event is low. Similarly, the opportunity to undertake emergency works during an event is low and the preferred approach is to identify impacts, assess and repair the asset following the event. In most instances this becomes a routine maintenance role.

The landward extent of the erosion hazard as considered in this CEEAS may increase into the future as sea level rises. The impacts on the future revisions of the CEEAS should take this into account at each plan review.





3 EMERGENCY RESPONSES

3.1 Communication

3.1.1 Storm Emergency

Where coastal erosion is anticipated as a result of a declared storm emergency, the responsibility for communicating the potential hazards defaults to the SES and the Local Emergency Operations Controller (LEOCON). Activation of the Wollongong DISPLAN would trigger this CEEAS. Council would assist in the provision of information on the current state of beaches and ocean pools as well as potential for impacts on beach access. Internally, Council staff with relevant responsibilities should be placed on standby and commence monitoring the impacts. Council employed Lifeguards and local Surf Life Saving Clubs should be contacted with a view to closure of beaches and ocean pools.

As the emergency progresses Council is required to continue monitoring these areas and updating information through the LEOCON as appropriate. Where specific hazards are resulting in damage, Council will provide this information to the LEOCON and for distribution through the media or directly to community as appropriate.

Following the emergency, Council is responsible for advising the current state of beaches and pools in the Council area (when/if they are re-opened for the public). Where residual hazards remain to be addressed, Council should take appropriate action to convey this to local communities including the use of signage and the release of media bulletins.

3.1.2 Non Storm Erosion Emergency

Where the emergency does not trigger the State Storm Plan or Wollongong DISPLAN, Council is responsible for initially monitoring the potential progress of erosion and subsequently implementing this CEEAS. The roles and responsibilities of Council in communicating the emergency to the community remain the same except that information needs to be provided by Council directly through the media rather than through the LEOCON as outlined in Section 3.1.1 above.

3.2 Landowner Initiated Actions

There are no locations in the Wollongong LGA coastal zone at which temporary emergency coastal protection works (CPA 1979, Part 4c Sand/Sandbags ECPW) are permitted. This includes properties within the immediate erosion hazard line in the LGA, such as at Thirroul Beach. Temporary emergency coastal protection works are only permitted under the CPA 1979 at locations listed in Schedule 1 of that act, none of which exist in Wollongong LGA.

Property owners, such as those at locations within the immediate erosion hazard line, are permitted to submit development applications to install permanent protection works, provided such works are consistent with the Wollongong CZMP once it is certified.

Where property owners wish to install permanent protection works (either prior to or during a coastal erosion emergency):

• they must submit a development application for the works,



- they must have a valid approval, and
- they must comply with all conditions of consent applying to that approval, before proceeding with the works.

Any illegal works placed by a property owner may result in prosecution of the person and removal of the works.

A property owner may be able to undertake minor works to minimise damage to their property and/or dwelling where such works do not require development approval and do not result in adverse impacts. The types of things permitted without consent are unlikely to provide significant protection from any coastal erosion that is occurring but may limit consequent damage, for example: Sealing of the space at the bottom of a doorway to limit water entry, repair/replacement of damaged windows, cladding or roofing, clearing of drains, pumping of ponded water, removal of objects from proximity to an escarpment (such as fences, sheds, furniture), etc.

The owner of a property has the right to undertake a wide variety of activities/maintenance in relation to their property which may or may not result from damage during a storm event and which, generally are of a minor nature. As with all activities there is a common law obligation not to cause a nuisance to neighbours or damage to adjacent properties. Generally those works resulting in structural alterations to a building (de including demolition or removal), or significant construction (such as a retaining wall or underpinning a structure) or significant earthworks (excavation or placement of fill) would require prior development/building approval.

3.3 Council Actions Prior to a Coastal Erosion Emergency

- Where the likelihood of an emergency event is identified (e.g. Storm warnings or damaging wave warnings from the SES/BOM), the local Lifeguards (employed by Council) will inform the local Surf Life Saving Clubs. The Council Lifeguards and / or the local SLSCs will then take the appropriate action in terms of closing the beaches and/or ocean pools.
- Where difficulties/damage are known to exist on beach accessways and these are likely to be exacerbated by storm erosion, then Council at their discretion may close those walkways and place appropriate signage.
- Council will commence monitoring the effects of the erosion on assets and development potentially at threat (section 5).
- As appropriate, the Council CEEAS controller will initiate the CEEAS.

3.4 Council Actions During a Coastal Erosion Emergency

The following activities would be undertaken by Council during the emergency:

 Council activities during a coastal erosion emergency will be guided by issues relating to the safety of Council staff.



- Where damage to walkways is identified and/or reported to Council, as practical Council will take appropriate action to close off the accessways and/or advise the local community of the hazards at the first opportunity.
- Where damage to assets is identified through monitoring (Section 5), Council will assess the damage and any opportunities for limiting further damage that may be appropriate during the event.
- Where repairs are permissible (as outlined in Section 2.1) and may be readily and safely undertaken, this will be done at the first opportunity.
- At the appropriate time the CEEAS controller will determine that the emergency has passed and that the remediation stages of the plan are to commence.

3.5 Council Actions Following the Cessation of a Coastal Erosion Emergency

The following activities would be undertaken by Council following the emergency, within their usual maintenance programs.

- Following the erosion emergency, Council will undertake an inspection of all beach accessways to establish any damage to the access or dangers to the public in using the access to the beach.
- Where an accessway is considered unsafe, action will be taken to close the access (top and/or bottom) and to place appropriate signage warning the access is unsafe for use.
- Council will prioritise the work required to repair and reopen any damaged or unsafe accessways in accordance with the Council maintenance works schedule.
- Where an erosion escarpment has been created at the back of the beach (height greater than 1.5m), Council will document the extent of the escarpment and at the earliest opportunity undertake a risk assessment of the likely hazard to beach users (both to persons on the beach and to persons on the dune above the scarp) from collapse of the erosion scarp.
- Where the risk is deemed unacceptable, Council will at the earliest opportunity undertake appropriate mitigation works which may include:
 - regrading the escarpment to a stable slope (following approval from Council's environment division);
 - fencing and signposting escarpments, to discourage public access (top and/or bottom) until such time as the beach recovers naturally; and
 - o keeping the beach closed until such time as the risk has reduced to an acceptable level.
- At the appropriate time the Council CEEAS controller will declare the emergency has finished and the CEEAS is no longer operative.



4 **RESPONSIBILITIES**

Specific responsibilities under the CEEAS are tabulated in Table 2.

Council through the nominated CEEAS controller must tabulate relevant Council positions and responsibilities for implementation and execution of the CEEAS. This will require an up to date list (names and contact numbers) for relevant contacts to be maintained by Council and updated as positions or responsibilities change. This list is to be readily available within Council and communicated to each of the nominated contact persons following any update.

| Position | Responsibilities | | |
|--|--|--|--|
| Local Emergency Operations Controller (LEOCON) | Execution of the Local DISPLAN, including aspects relating to coastal erosion | | |
| Council CEEAS controller | Liaison with LEOCON during storm emergency. Implementation of the CEEAS during non-storm erosion emergency | | |
| Council Recreation Services Manager | Monitoring repair of beaches and dunes. Closure of Beaches and ocean pools as appropriate. Post storm remediation. | | |
| Council Media Liaison Officer | Distribution of warnings and closures via the media. | | |
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Table 2 Specific Responsibilities in implementation of the CEEAS



5 **PLAN REVIEW**

This coastal erosion emergency management plan should be maintained as required and reviewed at intervals not exceeding 5 years from its initial adoption. Earlier review may be triggered by:

- occurrence of a coastal erosion emergency that exceeds the defined hazard extent as outlined • in the Wollongong City Council Coastal Zone Study (Cardno, 2010) to redefine the extent of the area covered by the Plan;
- revision of the NSW State Storm Plan, the Local DISPLAN (revised each five years) or the • Coastal Protection Legislation and associated guides, to ensure the plan remains consistent with their objectives;
- unsatisfactory outcomes or concerns following a coastal erosion emergency; or
- proposed changes to the gazetted Coastal Zone Management Plan,

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6 **R**EFERENCES

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Front Cover Design 'Let's Stop Coastal Destruction' by Lorraine Brown and Narelle Thomas, Coomaditchie United Aboriginal Corporation.

The artwork shows waves at the bottom, then the middens, the people, the rivers, the helping hand, gathering places and meeting circles and plant life.



Lossaine Braun

Davalle Slaval

Lorraine Brown is the premier artist of the Coomaditchie United Aboriginal Corporation. Lorraine is a Jerrinjah woman born in Bega, one of 7 children. Lorraine views her ability to paint as a gift. She uses bold colours that reflect her coastal upbringing. "We're East Coast Saltwater People", Lorraine says. "My colours symbolise my life. I had a great childhood, great parents and family and extended family".

Narelle Thomas is one of Lorraine's sisters and they paint together. Lorraine does the fine work and Narelle fills in the details. Lorraine and Narelle work like professional dancers, one leads and the other follows and no-one steps on any toes. It is clear they have been working together for many, many years. The Coomaditchie United Aboriginal Corporation is an Aboriginal organisation dedicated to raising the esteem, pride and dignity of young Aboriginal people in their Aboriginal culture and heritage. The Coomaditchie Artists' Cooperative is a vital organisation.

In addition to the Artists' Cooperative, as custodians of the Coomaditchie Lagoon and surrounding area, the Corporation provides employment and training for local community members. The Corporation is also committed to the regeneration and care of the land around the Coomaditchie Lagoon. Each time a product is purchased from the Coomaditchie United Aboriginal Corporation, a significant contribution towards these objectives is made.

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| CONTENT | 115 | | |
|---------|--|---|--------------|
| CONT | TENTS | 7 MONITORING (M) | |
| CONT | ILNIS | 8 OCEAN POOLS (P) | |
| | Contents | i | |
| | List of Figures | i 9 PRIVATE LAND ACQUISITION (PL) | |
| | | 10 ROADWAYS & PARKING (R) | |
| | 1 INTRODUCTION & BACKGROUND | 1 11 RECREATIONAL FACILITIES (RF) | |
| | 1.1 Purpose | 1 | |
| | 1.2 Coastal Hazards | 12 SEAWALLS & TRAINING WALLS (S) | |
| | 1.3 Summary of Coastal Processes and Interactions at Wolle | | |
| | 1.3.1 Geomorphology | 1 13 SURF CLUBS & FUBLIC BUILDINGS (S | 0) |
| | 1.3.2 Wave Climate | ¹ 14 FURTHER STUDIES & PLANS (SP) | |
| | 1.3.3 Sediment Transport | 1 | |
| | 1.3.4 Water Levels | 2 15 STORMWATER (ST) | |
| | 1.3.5 Coastal Entrances | 2 | |
| | 1.3.6 Stormwater Outlets | 3 16 VEGETATION & HABITATS (V) | |
| | 1.3.7 Aeolian (Windborne) Transport and Dune Vegetation | | |
| | 1.3.8 Climate Change | 3 3 | |
| | 1.4 Summary of Coastal Values and Features | 4 18 MAPS FOR INDIVIDUAL BEACHES | |
| | 1.4.1 Ecological Values | 4 | |
| | 1.4.2 Human Values and Features | 4 19 EVALUATION AND REPORTING | |
| | 1.4.3 Recreational Values | 4 19.1 Performance Evaluation | |
| | 1.4.4 Aboriginal Heritage | 5 19.1.1 Primary Performance Measure | es |
| | 1.4.5 Non-indigenous Heritage | 5 19.1.2 Secondary Performance Meas | sure |
| | 1.4.6 Economic Values | 5 19.2 Factors for Success | |
| | 1.5 Coastal Risks | 5 19.3 Plan Review | |
| | 1.6 Management Approaches & Options | 6 | |
| | 1.7 How to Read This Document | 6 20 REFERENCES | |
| | 2 BEACH MANAGEMENT (BM) | 8 21 ACRONYMS | |
| | 3 CYCLEWAYS (C) | 11 APPENDIX A: PROPERTY RISK AND |) RI |
| | 4 DEVELOPMENT CONTROLS (DC) | 13 LIST OF FIGURES | |
| | 5 HERITAGE (H) | 18 Figure 1 Risk Management Framework use Wollongong Coastline. adapted fr | ed to rom |
| | 6 INFRASTRUCTURE, ASSETS & BOAT HARBOURS (I) | Figure 2 Risk Hierarchy based on likelihoo defined. | od a |
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| | | Т |
|--------------------|-----|---|
| | 22 | |
| | 24 | |
| | 27 | |
| | 29 | |
| | 32 | |
| | 34 | |
| | 38 | |
| | 40 | |
| | 42 | |
| | 45 | |
| | 48 | |
| | 52 | |
| | 55 | |
| | 64 | |
| | 64 | |
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1.1 Purpose

The Wollongong Coastal Zone Management Plan (CZMP) has been prepared to direct management of risks from coastal hazards along the Wollongong LGA coastline (see study area map in Section 18). The CZMP covers lands currently affected and potentially affected by coastal hazards up to the year 2100. The Wollongong CZMP comprises this Implementation Action Plan and the companion Management Study [CZM Study].

Coastal hazards have been quantified through the Wollongong City Council Coastal Zone Study (Cardno, 2010), while risks associated with these hazards have been identified and evaluated as part of the Wollongong Coastal Zone Management Plan: Management Study (BMT WBM, 2012). This document (the CZMP: Implementation Action Plan) presents the strategies and actions required to manage and mitigate the risks to existing and future development and community assets and values in Wollongong associated with coastal hazards, both now and in the future.

The Wollongong CZMP has been prepared in accordance with the NSW Coastal Protection Act 1979, the NSW Coastal Policy and the Guidelines for Preparing Coastal Zone Management Plans (DECCW, 2010), as well as other legislation applicable to managing the coastal zone (refer Chapter 2 of the CZM Study for details).

An Australian Standards Risk Management Framework (ISO 31000: 2009 Risk Management Principles and Guidelines) has been applied in identifying, evaluating and treating risks associated with coastal hazards (refer Figure 1). The risk assessment has considered impacts of coastal hazards on public and private properties, infrastructure and uses of coastal land. Risks were classed as 'low', 'medium', 'high' and 'extreme' at 2011, 2050 and 2100 timeframes. Differences between risks today and those in the future relate primarily to the predicted response of the Wollongong coastline to future climate change, and sea level rise in particular (as prescribed by the NSW Government's Sea Level Rise Policy Statement, 2009). Generally, 'high' and 'extreme' risks were considered to be intolerable, 'medium' risks were seen to be tolerable, and 'low' risks were seen to be acceptable. Management of 'high' and 'extreme' risks present at the current (2011) timeframe is considered to be the highest priority.

The objectives of the CZMP therefore are to reduce or mitigate the risks associated with coastal hazards, focusing on the 'extreme' and 'high' risks at the current (2011) timeframe as a priority. This CZMP Implementation Action Plan also guides management of future intolerable risks (i.e., 'high' and 'extreme' risks at 2050 and 2100), in the instance where such risk manifest earlier than projected.



1.2 Coastal Hazards

Natural coastal processes create hazards when they interact and conflict with current uses and assets located within the coastal zone. A summary of coastal processes and coastal values at Wollongong is given in Sections 1.3 and 1.4. The main coastal hazards affecting Wollongong's coast are:

- height and/or direction);

- Lagoons);

All of the above hazards were assessed by Cardno (2010) for the current year (2010), 2050 and 2100 timeframes taking into account climate change, specifically sea level rise, with hazard mapping provided for the beach erosion and shoreline recession, coastal inundation and geotechnical hazards for the current, 2050 and 2100 timeframes.

Beach erosion (during a short term storm event or series of events in close succession) and resulting dune slope instability. Erosion of beaches is typically balanced by accretion during non-storm periods, as the sand eroded is temporarily stored as nearshore storm bars, which are moved onshore under normal wave conditions;

Shoreline recession, where there is a net long term migration of the shoreline in a landward direction. Shoreline recession typically occurs in response to man-made coastal structures, an increase in mean sea level or permanent changes to typical wave climate (wave

Coastal inundation (during high tides combined with storms and sea level rise) can occur as both wave overtopping of beaches and dunes or inundation of land behind the open coastline via coastal creeks, estuaries or stormwater systems connecting to the ocean (note that the level of coastal inundation within Lake Illawarra is much lower than the 1 in 100yr flood level from catchment rainfall);

Cliff instability and geotechnical hazards, which may be exacerbated by higher sea levels and therefore greater wave attack at the base of coastal cliffs. A Coastal-Influenced Geotechnical Hazard Zone has been defined (GHD, 2010) representing the areas along the Wollongong Coastline where coastal processes (including climate change) will directly affect geotechnical hazards;

Coastal entrance instability (notably at creeks and lagoons that have a variable entrance condition, such as Bellambi and Fairy

Erosion of beaches at stormwater outlets / drainage lines (although this is very localised to the proximity of the stormwater outlet and would not have an influence on overall beach conditions):

Sand drift, which apart from Windang and Port Kembla, has practically been eliminated due to extensive dune rehabilitation works along Wollongong's beaches.



1.3 Summary of Coastal Processes and Interactions at Wollongong

1.3.1 Geomorphology

The beaches of Wollongong's coastline range from long, south-easterly facing sandy beaches (such as Perkins and City Beaches), to highly embayed pocket beaches (such as Austinmer and Stanwell Park) towards the northern end of the LGA coastline. The coastal ranges comprising the Illawarra Escarpment are located along the shoreline at the northern end of the LGA, and the higher backing cliffs and shoreline rock platforms tend to form short embayed (or closed) beach units. As the Escarpment trends away from the shoreline, the beach embayments become longer, with outcropping of rocks forming smaller headlands and rock platforms, such as Sandon Point and Bellambi Head. Further south, the beach units tend to become longer and continuous, with Wollongong Harbour / Flagstaff Hill and Port Kembla forming larger headland features to separate the longer embayments. The shoreline generally is oriented towards the south east, with City Beach, Bellambi Beach, Woonona and Bulli facing slightly more east, and Perkins beach facing slightly more south compared to the other embayments.



1.3.2 Wave Climate

The Wollongong coastal zone is exposed to waves from the north east to south east sectors. Waves dominantly arrive from the south to south east sector throughout the year at Wollongong, with easterly and north easterly waves occurring in the wave record over the summer to autumn months. Typical for most NSW locations, the largest waves typically arrive from the south-east to south sector.

Over all months, south easterly swell waves and storm waves can arrive at Wollongong generated by storms in the Southern Ocean and Tasman Sea travelling northwards to NSW. During winter, south east is the dominant wave direction. The storm systems in the Tasman Sea and Southern Ocean form closer to the NSW coast during winter, generating storm waves at the coastline. During the summer months, strong afternoon sea breezes from the north east can generate short period wind swell from the north east to east, although south east sector waves remain the dominant wave direction. During late summer to autumn, tropical cyclones off the Queensland coast can send storm waves propagating southwards into the Wollongong area, however this is rare as such waves are usually dissipated before reaching the Wollongong coastal zone. During autumn, east coast low cyclones may form off the NSW coast, and can generate large storm waves arriving from the east to south east at Wollongong, in addition to the southerly storm systems which continue through autumn. East coast low cyclones are said to be the most damaging storm system for the NSW coast forming close to the shoreline (Short, 2007). The low pressure of east coast low storm systems also generate high water levels (due to barometric pressure set up), and as the high water levels coincide with high waves, this enhances the erosion potential of these storms.

While the dominant storm wave direction at Wollongong is south east, the nearshore wave modelling has indicated that east-south-east (ESE) is the critical offshore wave direction for Wollongong, as this direction produces the largest nearshore wave heights for a specified offshore wave height (Cardno, 2010). That is, for the same offshore wave height from all directions, wave heights are largest at the shoreline from the ESE direction. East coast low cyclones are typically associated with ESE wave directions, as these storm cells form at easterly locations off the NSW coast.

The greatest erosion extents on record in the NSW coast are associated with the series of storms during 1974, particularly the storms of May to June of that year. These storms generated extensive erosion on many beaches in NSW, including Wollongong. The May-June storms were also associated with unusually high water levels, which significantly enhanced the erosion. The storms of 1974 occurred during the highly stormy decade of the 1970s, during which there were a series of erosive coastal storms. After the 1970s until recently (~2007), the wave record has been relatively calmer, although isolated large storms have still occurred. Since 2007, there have been a number of notable storms occurring along the NSW coast, including at Newcastle and south east Queensland in 2007 and sequential storms in 2009 that have caused extensive recession on the mid north NSW coast.

Wollongong's beaches are highly embayed by headlands, rock platforms and rocky reefs. The larger headland features and reefs, such as Flagstaff Hill, Port Kembla and the Five Islands immediately offshore and Bellambi Point, will refract incoming waves from the south to south east direction, and shorelines in the lee of these larger headlands and reefs are more protected from incoming waves. However, the majority of beach length in Wollongong is highly exposed to wave impacts.

Inside Lake Illawarra, the wave climate is comprised of locally generated wind waves, as there is no penetration of offshore swell energy into the lake. Given the limited fetch within the Lake to generate waves, the wind waves are typically short period, steep and small.

1.3.3 Sediment Transport

Sediment transport on beaches is typically generated by waves that induce currents in the surf zone. Sediment may be transported onshore, offshore and / or alongshore, causing the beach to undergo erosion and accretion cycles over periods of time ranging from days to decades (NSW Government, 1990).

Longshore sediment transport refers to the movement of sand parallel to the shoreline, and this is typically driven by waves arriving at an angle to the shoreline. Cross shore sediment transport refers to sand moving both onshore or offshore perpendicular to the shoreline. Cross-shore transport is driven by breaking waves and currents, including rip currents, which form perpendicular to the shoreline. Under low swell wave conditions, transport is directed onshore to assist accretion of sand onto the beach face (and associated movement of sand bars in the surfzone in a landward direction). Under storm wave conditions, the breaking waves generate offshore transport, and the higher waves breaking at the shoreline will erode the beach face. Rip currents form under low and high waves, however the strength and width of the current is greater during high waves, and these currents allow for significant transport of sediment offshore from the beach during a storm.

Embayed beaches, as are typical of Wollongong's coastline, are assumed to experience longshore and cross shore sediment transport that is retained within the embayment. The dominant south easterly swell arriving at the longer, south easterly sandy embayments in Wollongong (such as Perkins, City and Fairy Meadow Beaches) will generate longshore sediment transport towards the north. This will allow for movement of beach sand from south to north, which is retained within the closed embayments. At the more easterly facing beaches, south easterly swell is likely to generate a smaller rate of northerly transport within the embayment. Under north easterly waves (such as may occur in summer), the sediment transport may be directed towards the south. However, the net transport will be towards the north under dominant south easterly waves. The processes of sediment shifting from south to north to south again is often termed 'beach rotation'.



Within embayed beaches, the offshore sediment transport generated under storm wave conditions is retained within the embayment, and will be returned to beach face under regular swell waves. While the storm erosion may occur quickly (hours, days) the recovery period occurs more slowly (months to years). Cumulative storms may have a severe impact upon beaches, as there is insufficient time to allow the beach to recover before the next storm arrives.

Rip currents are generated in most wave conditions as a mechanism for water arriving at shore under breaking waves to flow back offshore. During storm conditions, rip currents tend to be more widely spaced, however the current itself is much wider and stronger. The landward end of these currents typically generates an eroded scarp and under storm conditions, the erosion formed at the landward end of rip currents can be significant, in fact greater than the erosion generated elsewhere along the beach under breaking waves.

1.3.4 Water Levels

Another important component of erosion during storms is water level. The low pressure of storm systems causes the water level to increase (called barometric set up), onshore winds during a storm can cause water to pile up on the shoreline and further increase the water level (wind set up), and the high waves also increase the water level through the release of energy during wave breaking (wave set up). When storm water levels are additionally combined with a high tide, the high water levels enable the breaking waves to reach higher on the beach face and cause erosion at the sand dunes behind the beach.



The high water levels during storms (combined with high tide) can also penetrate into coastal creek and lagoon entrances and stormwater systems, and this can cause inundation of low lying land behind the beach.

The tidal range at Wollongong is ~ 1.8 m, with the highest astronomical tide (HAT) up to 1.13 m above AHD (Cardno, 2010). Extreme water levels (that is barometric set up with some wind set up, but excluding wave set up and wave run up) from Fort Denison were adopted for Wollongong. The 100 year Average Recurrence Interval (ARI) Still Water Level at Fort Denison that was adopted at Wollongong is 1.44 m AHD (which includes high tide). The use of Fort Denison statistics has been recommended by OEH (DECCW, 2009c), as there is little difference in tidal range for open coastal regions of the NSW Coast and the Fort Denison data set provides a far longer record from which to derive reliable extreme value analysis. The contribution of wave set up to water levels is typically 10 - 20% of the breaking wave height. Cardno (2010) used nearshore wave modelling to determine the wave set up component of still water levels at each beach profile location in the study area.

In addition to changes in water levels during storms, there may also be variability in the sea level relating to climatic processes such as the El Nino Southern Oscillation (ENSO), which can vary sea levels by ~ 0.1 m, and coastal trapped waves that can vary sea levels by up to 0.2 m (Cardno, 2010).

Wave run up is important in causing overtopping of dunes behind the beach during a storm. Wave run up is defined as the maximum vertical height that a breaking wave reaches on the shoreline. Modelling to investigate wave run up was conducted at Wollongong. Wave run-up includes water levels discussed above (i.e. high tide, barometric, wind and wave set up) plus the vertical height of wave uprush after breaking.

1.3.5 Coastal Entrances

Wollongong's coastline is also shaped by a number of coastal creek entrances, some of which also convey stormwater, and occasional stormwater outlets. Lake Illawarra is, conversely, a very large coastal lake system, that forms the southern end of the LGA. Lake Illawarra remains typically open due to the recent emplacement of training walls at the lake mouth at Windang.

The remaining creeks in the Wollongong LGA are far smaller, and typically classified as Intermittently Closed and Open Lakes or Lagoons (ICOLLs). These small water bodies from south to north include:

- Tom Thumb Lagoon (within Port Kembla):
- Fairy Lagoon, which divides North Beach and Fairy Meadow Beach;
- Towradgi Lagoon, which exits at the southern end of Corrimal Beach,

- adjacent property;
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- Coledale Beach respectively;



Waves, which generate longshore and cross shore transport, combined with tides, form a sandy berm across the creek entrances. Coastal processes act to build an entrance berm across the creeks however, where

Bellambi Lagoon, located south of Bellambi Head and exiting to the ocean on the northern end of Corrimal Beach, and is opened either naturally, or artificially by Council to alleviate flooding of low-lying

Bellambi Gully, located at the southern end of Bellambi Beach, which has a small training wall at the northern side of its entrance, and rock protection along its southern side;

An unnamed creek which exits to the ocean at the boundary between Woonona and Bellambi Beaches,

Collins and Whartons Creeks which exit at the south and towards the north on Bulli Beach respectively

Slacky Creek on Sandon Point Beach

Hewitts Creek and Tramway Creek on the northern and southern ends of McCauleys Beach respectively

Flanagans Creek and Thomas Gibson Creek which exit to the north and south respectively on Thirroul Beach

A small creek / drainage outlet on Little Austinmer Beach

Carricks, Stockyard and Dalys Creek which are now essentially stormwater drainage outlets at the south, north and centre of

A small creek / drainage outlet on Scarborough Beach;

Stoney Creek on Coalcliff Beach;

Stanwell Creek and Hargraves Creek on Stanwell Beach.



there is sufficient flow out of the creeks through the entrance, the entrance will remain typically open. Where flows from the creeks are not sufficient to counter-balance coastal processes, the entrances will typically remain closed. The majority of coastal creek entrances in Wollongong are typically closed, as waves dominate the coastal entrance behaviour.

Catchment rainfall of sufficient volume will cause a breakout through the entrance berm, enabling flow out of the creek into the ocean. Many of the coastal creeks on Wollongong's coast respond quickly to rainfall and may open frequently. Fairy and Towradgi Lagoons respond quickly to rainfall, with water levels rising rapidly and which generates natural lagoon breakouts. Likewise, Bellambi lagoon opens frequently with sufficient rainfall (DECC, 2008). However, the small sized catchments and waterways have limited flow, and so waves and tides act quickly to re-close the entrance.

Where property has been sited too close to the lagoon edge, Council may be required to artificially open the lagoon entrance to alleviated inundation of such properties. To protect low-lying property (particularly the Live Steamers Site at 1.8 m AHD at Fairy Lagoon, and Park Parade crossing, stormwater assets and floor levels above 1.94 m), both Towradgi and Fairy Lagoons are opened artificially at 1.6 m (when rain is falling or impending), or 1.8 m and 1.85 m, respectively, to alleviate potential flooding (Cardno, 2007a; b).

The process of entrance breakouts may enable erosion of the entire unvegetated area of the entrance berm, and in extreme cases, (e.g. very high creek outflows combined with high wave conditions) there may be erosion of adjacent vegetated dune regions also.

At present, the migration of the Bellambi Lagoon entrance channel to the north is causing erosion of the northern dunes. Historical aerial photography indicates that vegetation of the foredune regions both south and particularly north of the channel has increased markedly since the late 1970s, from an active unvegetated region to a well-established vegetated dune. The erosion is said to be threatening sites of Aboriginal heritage significance within the northern dunes.

1.3.6 Stormwater Outlets

Under high rainfall events, as water is conveyed to the ocean via outlets on the beach, the high velocity flows may cause significant erosion around the outlet. Some of the smaller drainage lines and creeks noted in the section above act to convey stormwater from the urbanised catchment (such as Carricks, Dalys and Stockyard Creeks on Coledale Beach, and the unnamed creeks on Little Austinmer, Sharkies and Scarborough Beaches), and some of these creek lines contain stormwater infrastructure. The erosion around such outlets can also pose a hazard, and inundation in the future with sea level rise may cause flooding into urban areas upstream.

1.3.7 Aeolian (Windborne) Transport and Dune Vegetation

The key process for dune building is wind which transports sand landward from the sub-aerial beach berm (i.e. dry beach face) to form incipient dunes and foredunes. Dune vegetation will act to trap windborne sediments, allowing for ongoing accretion and increase in dune height. Dune evolution over thousands of years can allow for very high sand dunes to form (where the beach position remains stable over this time), for example up to 10 - 15 m high on the NSW north coast. However, on the Wollongong coastline, dunes are typically less than 5 m in height, demonstrating that such features formed relatively recently.

Unvegetated regions are termed active dunes or blowouts, where the sand is free to be mobilised by wind. In some cases, the sand blown from active dunes landward can represent a loss from the beach system (where it is not captured by dune vegetation). Sands can also drift into back beach development to become a nuisance.

Dune revegetation programs occurred widely across the Wollongong coast in the 1980s and 1990s, following damaging storms during the 1970s. It was recognised that dune vegetation captures beach sand, to provide a buffer to erosion during high wave and water level events. Dune heights have increased significantly across the Wollongong coastline since the revegetation program, as the revegetated areas have acted to capture mobile windborne sand. It is not known whether dunal systems were generally active and unvegetated in the Wollongong coastal zone prior to urban settlement. It is possible that the small sediment stores held within the rocky embayments typical of Wollongong's coast may have been frequently reworked by both storm events and wind, and so significant dune vegetation could not establish. Since the establishment of urban settlement, there has been a need to minimise losses of sediment from the



beach system through windborne transport. Further, the sediment stores held within dune vegetation provide a buffer from storms. The revegetation program has provided well established dunes that can act to buffer back beach development from coastal erosion during storms.

In some locations, active dunes allow for sand to be transported between embayments. One example of this is the sand drift that once formed on the road way below Flagstaff Hill between City Beach and Brighton Beach. Local community noted such drifts could form up to 1 - 2 m deep. This sand drift probably enabled sediment transport from City Beach into Brighton Beach. Since dune revegetation works commenced at City Beach, the windborne sediment transport is now captured within the City Beach dunal system and sand drifts across the roadway are rare. The contribution of this to ongoing erosion observed at the southern end of Brighton Beach is unknown. However, it is widely accepted that the enhancement of sediment stores at City Beach (and other locations within Wollongong) through dune revegetation works has afforded protection from short term storm impacts.

1.3.8 Climate Change

Climate change induced by anthropogenic forces, particularly the burning of fossil fuels for energy (coal, oil and gas) is now widely accepted. In relation to coastal processes, climate change may increase sea levels and change rainfall (annual, seasonal, extreme), wind (speed and direction) and the frequency and intensity of extreme events. Current projections for these parameters were investigated during the Wollongong Coastal Zone Study. A summary of the parameters used by Cardno (2010) is given below:

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Sea level rise is projected to rise by up to 0.4 m by 2050 and 0.9 m by 2100, according to the latest science incorporated with the NSW Government's Sea Level Rise Policy Statement;

Rainfall in the Illawarra region was assumed to increase in intensity by 10% to 2050 and by 20% to 2100, based on CSIRO predicted seasonal changes in average runoff depth of an increase in summer (-1% to +22%), possible increase in autumn (-6% to +14%), decrease in winter (-12% to +3%) and decrease in spring (-19% to

Wind change predictions by CSIRO (2007) contained large uncertainty, and so no change from current and historical recorded winds were assumed for the study; and

Frequency of Extreme Events is also highly uncertain, with IPCC (2007) suggesting the potential for an increase in frequency and intensity of coastal storms, compared with recent studies (CSIRO, 2007; McInnes et al., 2007) that are inconclusive as to whether storm events shall increase or decrease, depending on the model and / or climate change scenario selection, therefore there was



assumed to be no change in the frequency or intensity of coastal storm conditions from the current climatology and historical records.

While it is probable that, in addition to sea level rise, climate change will alter wind, rainfall and wave conditions and frequency of storm events, there is as yet no consensus regarding to what extent changes may occur. Climate change induced changes may modify the extent of coastal hazards experienced in the future, however, the current projections suggest changes that are within the natural climate variability already experienced. In this case, it is reasonable to assume the current wave and storm conditions for future time periods

1.4 Summary of Coastal Values and Features

1.4.1 Ecological Values

Key ecological attributes of the Wollongong coastal zone were investigated and mapped. A variety of different environments exist within the coastal zone including marine, intertidal, estuarine and terrestrial zones, resulting in a high diversity of flora and fauna.

Endangered Ecological Communities (EECs) in the study area (which are protected under the Threatened Species Conservation Act 1995) include (Cardno, 2010):

- Coastal Saltmarsh
- Freshwater Wetlands in the Sydney Basin Bioregion
- Freshwater Wetlands on Coastal Floodplains
- Swamp Oak Floodplain Forest
- Swamp Schlerophyll Forest on Coastal Floodplains
- Littoral Rainforest
- Illawarra Subtropical Rainforest
- **Bangalay Sand Forest**
- Illawarra Coastal Grassy Woodlands
- Southern Sydney Sheltered Forest and
- Themeda Grasslands.

Mapping of the EECs within the coastal zone has been included within the risk assessment conducted in preparing this CZMP. The study area also contains some SEPP No. 14 - Coastal Wetlands. There are also a number of threatened flora and fauna species listed on the Threatened Species Conservation Act 1995, Fisheries Management Act 1994 or Environment Protection and Biodiversity Conservation Act 1999 (including migratory terrestrial and marine species) that are likely or known to occur within the Wollongong coastal zone. The species were listed within the Wollongong Coastal Zone study (Cardno, 2010), and have been considered within the mapping databases used as part of the risk assessment to prepare this CZMP.

A condition assessment for coastal vegetation was also conducted, comparing changes in such vegetation observed between aerial photography dates (1977, 1987, 1999, 2006). In general, it was found that over the ~ 30 year period, the total observed area of dune vegetation has increased, most likely as a result of extensive dune rehabilitation works, such as on Perkins Beach, carried out by on in partnership with Council. In contrast, the total observed area of estuarine vegetation has slightly decreased, mainly in areas around Port Kembla, as the port and industrial area has expanded. The majority of restoration works by Council over the last five years has occurred within the coastal zone, and has included both dune and estuarine areas.

An estuary condition assessment was also conducted, based upon estuary type (e.g. wave-dominated etc); catchment land use; waterway use; water quality (based upon monitoring data from Council); probability of acid sulphate soils; tributaries; entrance management (e.g. artificial, natural breakouts); and vegetation types. The condition assessment found:

- Hewitts Creek and Tramway Creek to be in good condition;
- Bellambi Gully, Bellambi Lagoon, Towradgi Creek and Lake Illawarra to be in extensively modified condition; and
- Fairy Creek to be in modified condition.

The other coastal creeks and lagoons in the study area were not investigated.

1.4.2 Human Values and Features

Mapping of infrastructure, such as roads, railways, stormwater features, parks, car parks, and public buildings (including SLSCs, amenities blocks) and heritage items was conducted as part of preparing the Wollongong CZMP.

1.4.3 Recreational Values

Coastal areas are known to have a high recreational value and offer aesthetic values to urban dwellers (DCC, 2009). The Wollongong coastal zone offers numerous recreational opportunities, particularly at the open coastal beaches and lagoon entrances. Recreational activities include (Cardno, 2010):

Water based activities such as swimming (including within the numerous tidal rock pools along the coast), surfing, fishing and prawning, scuba diving, snorkelling, sailing, canoeing, kayaking, water skiing, wind surfing, kite surfing, boating (with many boat ramps in Lake Illawarra, as well as boat ramps at Bellambi, Sharkies Beach and Wollongong Harbour itself), parasailing and model boats;

- and other sports; and



Commercial operators, such as kiosks and restaurants also offer leisure and dining at a number of Wollongong's beaches.

There are a number of recreational clubs that operate from the coastal zone, including the Illawarra Yacht Club, Koonawarra Bay Sailing Club, the Port Kembla Sailing Club and the 17 Surf Life Saving Clubs (SLSCs) in the LGA. The facility of 17 patrolled beaches, through both volunteer and Council lifeguard patrols, is said to be a key attractant for residents and visitors to the Wollongong coast (Cardno, 2010). Further, the SLSCs provide for a sense of community for local beach users and members of the clubs, which run a range of competitions, sporting and social activities in addition to volunteer patrols for the community.

Private recreational facilities include the Wollongong Golf Club behind City/Coniston Beach, the Port Kembla Golf Club at Primbee, WIN Football Stadium (and associated Entertainment Centre) at City Beach. There are additional leisure centres, sports grounds, gyms in the coastal zone, however not in proximity to the identified hazard areas. Each of the private and public recreational assets of the coastal zone was mapped as part of preparing the Wollongong CZMP.

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Land based activities such as walking and running (using the numerous coastal paths, bushland trails, including the cycleway), cycling (for example, using the shared coastal cycleway, or numerous off-road mountain bike trails in the area), bird-watching, pet exercising, picnicking (with the majority of beaches offering either park or coastal reserve with facilities), abseiling, rock climbing,

Air based activities, such as hang gliding and paragliding (including the oldest hang gliding and paragliding club at Stanwell Park), and sky diving (such as into Stuart Park in North Wollongong).



1.4.4 Aboriginal Heritage

The Aboriginal custodians of the Illawarra (from Stanwell Park to Bass Point, south of Wollongong) are the Wodi Wodi (Wadi Wadi), or are also known as the Dharawal, Tharawal or Thurrawal (Cardno, 2010 citing Organ and Speechley, 1997). Aboriginal people are thought to have inhabited the Illawarra region for 20,000 - 30,000 years. The land and landscape of the Illawarra is central to the culture of the local Aboriginal people, including the coastal zone. Cardno (2010) make reference to a number of documents outlining the occupation of coastal areas, first contact with Europeans and the impact on the Aboriginal people, including local land rights struggles until the 1960s.

Aboriginal objects and sites (listed or unlisted) are protected under the National Parks and Wildlife Act 1974. There are a number of significant Aboriginal places within the study area, for example the areas of Sandon Point, the Bulli Area, and Breakfast Creek area. There are also known to be midden sites located near to Bellambi Lagoon, Sandon Point, Waniora Point and Fairy Lagoon. There are known burial sites in the Windang and Lake Illawarra regions also. There are at least 766 recorded Aboriginal sites within the study area, and the number of unrecorded sites is likely to be many more than this. The exact location of Aboriginal sites and places of significance must be kept confidential, not only for their cultural sensitivity, but often to protect the sites from vandalism or (unwitting) damage by the wider public. Management of these sites particularly when they are uncovered due to the impacts of coastal processes (for example, erosion at midden sites) is outlined within the CZMP.

1.4.5 Non-indigenous Heritage

The Illawarra region was explored by European settlers in the early 1800s, with settlement soon after (from around 1817). The coastal zone, particularly Wollongong Harbour and Port Kembla has been utilised from the beginning of settlement, including shipping coal from the harbour until the late 1800s. After that time, Port Kembla became the primary facility for coal exports, due to its size and industrial development.

Wollongong Harbour itself has a convict built wall and steps, comprising the southern boundary of the harbour. The site is listed on the state heritage register. There are numerous other sites of local and state historical importance along the coastal zone, including North Beach Bathers Pavilion and nearby kiosk building, the many tidal rock pools, Continental Pool, Thirroul Pool and the nearby kiosk building, coal cuttings at the cycleway leading from the harbour, and stands of Norfolk Island Pines which form a marker of beachside settlement. Heritage items have been included in the coastal asset mapping prepared for the Wollongong CZMP.



1.4.6 Economic Values

Commercial and industrial operations in Wollongong form a significant part of the economy. Wollongong City is a local, regional and state level economic hub, comprising nearly half of the businesses within the region.

In terms of the coastal zone, the port facility at Port Kembla (although not strictly included within the plan) is a major facility of the region, providing for coal and steel exports, and base for general and bulk cargoes, containers, motor vehicle imports and grain exports. Port Kembla contributes \$418 million to the regional economy annually. Another key industry that is supported by the coastal zone is the Tallawarra natural gas power station located on the Lake Illawarra foreshore at Yallah, which powers 200,000 homes.

The coastal zone including beach and lake amenity are vital to Wollongong's tourism industry. After dining out, the next most popular activity for tourists (international and domestic) was going to the beach. This demonstrates the importance of the beach amenity to visitors as well as the resident community.

The scenic qualities and recreational activities supported by the beach amenity directly support the tourism industry. There are 4100 business that are tourist operations including surf schools, scuba diving, boat and fishing trips, sky diving, hotels, motels, camp grounds and other accommodation services, cafes, as well as restaurants and other food and beverage facilities that require the additional visiting population to survive.

The various beach reserves, tidal and formal ocean pools, parks and coastal kiosks business that support both the resident and visiting community were included in the coastal asset mapping prepared as part of the Wollongong CZMP.

1.5 Coastal Risks

Risk is defined as the combination of the likelihood of occurrence of an event and the consequence of the impacts if the event occurs.

The likelihood of coastal risks is determined as part of the definition of coastal hazards, and in accordance with the Australian Standard Risk Management Framework, ranges from 'almost certain' to 'rare'. The consequence of risks is dependent on the uses and values attributed to the coastal land affected by the hazard, and can range from 'insignificant' to 'catastrophic'. This means that shoreline recession within a National Park will have a different risk level than recession of an existing suburban development, given different land uses and community values.

Council's Enterprise-wide Risk Management Risk Ranking Tool outlines the risk hierarchy from 'low' to 'extreme' based on the combination of risk likelihood and consequence in Error! Reference source not found..

| | | CONSEQUENCE | | | | |
|---------|-------------------|---------------|--------|----------|---------|--------------|
| | | Insignificant | Minor | Moderate | Major | Catastrophic |
| | Almost Certain | Medium | High | Extreme | Extreme | Extreme |
| Q | Likely | Low | Medium | High | Extreme | Extreme |
| кегіноо | Possible | Low | Medium | Medium | High | Extreme |
| | Unlikely | Low | Low | Medium | Medium | High |
| | Rare | Low | Low | Low | Low | Medium |

Figure 2 Risk Hierarchy based on likelihood and consequence of risk

Determining what risks to treat as part of the CZMP is based upon Council (and the community's) tolerance to risk, within Council's Enterprise-wide Risk Management Risk Ranking Tool. Thus the prioritised objectives for management actions in this CZMP are:

- in this Implementation Action Plan
- 2.
- 3.

C:USERS/LWATKINS/APPDATA/LOCAL/HEWLETT-PACKARD/HP TRIM/TEMP/HPTRIM.7124/Z16 242669 ESP - PROJECT MANAGEMENT - REPORTING - WOLLONGONG COASTAL ZONE MANAGEMENT PLAN - IMPLEMENTATION ACTION PLAN - FINAL ~ WITH TRACK CHANGES.DOCX

Risk = likelihood x consequence

1. 'High' and 'extreme' risks are intolerable and must be treated as a priority to eliminate or reduce the risk, and accept residual risk providing it is understood. Specific management actions are detailed

'Medium' risks are tolerable, and may be reduced or accepted providing the residual risk is understood. Specific management actions were noted in the CZM Study for future use as required.

'Low' Risks are acceptable, with care given to monitoring to ensure management response can be changed should the risk level increase in the future. Specific management actions are not required.



Giving consideration to both likelihood and consequence, coastal risks along the Wollongong Coastline were defined as 'Low', 'Medium', 'High' or 'Extreme'. Risks were established for 2010, 2050 and 2100 timeframes, highlighting a shift in risk profile with time, as sea levels rise and other climate change impacts begin to manifest. 'Extreme' and 'High' risks were considered to be intolerable. That is, these risks cannot be accepted by the community, and as such, require mitigation or treatment through specific risk management actions. The land and assets determined to have the highest levels of risk along the coastline include:

- Beaches themselves (in terms of amenity and social value) and associated coastal dunes.
- Wollongong's impressive list of ocean (rock) pools;
- Various Surf Club buildings, amenities and pavilions (some of which are heritage-listed);
- Existing seawalls and promenades;
- Stormwater infrastructure;
- Beach access and carparks, local roads servicing residential properties, and a couple of arterial roads (including Lawrence Hargrave Drive);
- The coastal cycleway that extends from Thirroul to City Beach;
- Infrastructure, such as Bellambi and Austinmer Boat Harbours, Bellambi STP and WIN stadium;
- Important habitat areas (such as EECs) and coastal vegetation; and

Residential properties (some potentially affected by coastal erosion and recession, while many more are potentially affected by coastal inundation).

1.6 Management Approaches & Options

This CZMP has approached management of coastal risks in a number of ways. Firstly, risks associated with Future Development are different from risks to Existing Development. For Future Development, risks can be 'avoided' by not permitting vulnerable developments within high-risk areas (considered over the full design life of the development). Future development can also 'accommodate' risks by including provisions that reduce the consequence of impacts (e.g. having minimum floor levels to reduce property damage resulting from future coastal inundation) or 'accept' the risk where appropriate to the design life of the development.

Existing development is typically much harder to manage as works and infrastructure are already in place that limits the opportunity for both 'avoiding' and 'accommodating' the risk. Thus, risk management options become either 'protecting' the land or asset, or 'accepting' the potential for damage or loss given the expected timeframe and likelihood of impact. Replacement structures should either be relocated landward, thus progressively retreating from high-risk areas; or redesigned to accommodate the risk, where appropriate. Options for managing existing development therefore include the following approaches:

<u>Protection options</u>, which aim at protect existing coastal development (private or public) from erosion and recession and / or wave overtopping. Protection may be in the form of hard structures (e.g. seawalls, groynes, offshore breakwaters or reefs, artificial headlands) or soft measures (e.g. beach nourishment). Some protection works can cause impacts to adjacent areas ('offsite impacts'), and therefore, the decision to implement a 'protect' option must consider all potential impacts;

<u>Retreat options</u>, which aim to preserve beach amenity by allowing natural retreat due to coastal processes, particularly in response to future sea level rise. The options for existing development involve relocating or sacrificing infrastructure, public assets or private property, if and when impacts occur. The retreat options typically include compensation to private property owners where feasible, if existing landuse is diminished; and

<u>Accommodate options</u>, which aim to re-develop or retrofit existing infrastructure, public assets and private property in a manner that minimises losses from potential impacts (e.g. stronger foundations) or avoids losses from potential impacts (e.g. relocatable structures) through careful design.

A series of <u>'No regrets' options</u> have also been considered that offer a range of assessments and works to provide further information (including approvals) required prior to implementing larger scale options for specific assets, particularly where a more costly or difficult option may be needed. The 'no regrets' options also include activities that will improve resilience and preparedness for coastal risks in the future.

1.7 How to Read This Document

The technical assessment associated with identifying and defining the coastal risks and evaluating the potential management options is contained within the <u>accompanying CZM Study</u>. This Implementation Action Plan details the recommended Management Strategies that were found to be the most effective for management of the coastal risks along the Wollongong Coastline.

The following pages present a series of 'Implementation Schedules' for key management strategies. These schedules include specific details on what actions need to be undertaken and a timeframe or trigger for commencement. The schedules also include relative prioritisation, estimated costs and responsibilities for the various actions.

<u>A series of maps</u> is given in Section 18 immediately after the Implementation Schedules that show the relevant locations for actions from

the 15 Management Strategies, where they can be feasibly shown, for each beach along the Wollongong Coastline.

Recommended Management Strategies, in alphabetical order are:

| BM | Beach |
|----|----------|
| С | Cyclew |
| DC | Develo |
| н | Heritag |
| I | Infrastr |
| М | Monito |
| Р | Ocean |
| PL | Private |
| R | Roadw |
| RF | Recrea |
| S | Seawa |
| SC | Surf Cl |
| SP | Further |
| ST | Stormw |
| V | Vegeta |
| W | Whole |

- Management
- vays
- pment Controls
- je
- ucture, Assets and Boat Harbours
- ring
- Pools
- Land Acquisition
- ays and Parking
- ational Facilities
- lls and Training Walls
- ubs and Public Buildings
- Studies and Plans
- vater
- ation and Habitats
- of Council Actions




2 BEACH MANAGEMENT (BM)

Description:

Beach Management involves moving sand on individual beaches to promote the formation of dunes in the upper beach profile. Coastal dunes are critical in providing protection to land and assets located behind beaches. The dunes provide for sacrificial losses of beach sand during severe storm events. Thus, the more sand held within the dunes, the greater the protection for land and assets behind.

The purpose of beach management is to move sand from the beach berm (which is affected by average wave action) into the dunes (where it is not affected by average wave action, and thus remains stored until the next storm event). Beach scraping is carried out when the beach begins to recover following beach erosion events, with sand taken as thin layers from the intertidal zone and moved above the area of fair weather wave action. Re-contouring of eroded profiles is not covered by this strategy, but rather is an emergency action to provide safe beach access following storms, as detailed in the Wollongong Emergency Action Sub Plan, Appendix G to the CZM Study.

Beach management generally requires earthmoving plant and equipment to move sand from the lower and intertidal sections of the beach profile up into the upper dune profile. Vegetation of the dunes is then required to help contain the sand from wind-blown drift and capture additional sands blown from the beach face.

Beach management in the form of 'beach scraping' was trialled by Wollongong City Council (WCC) at Bellambi Lagoon entrance in mid 2010. While the trial was aimed at management of the lagoon entrance, the success of the trial does justify the use of beach scraping elsewhere along the Wollongong coast, in this case to increase sand volume held within the beach dunes and thus enhance protection of the coastline.

Management of beaches and associated assets that are at a 'high' or 'extreme' level of risk at the current timeframe (2011) takes highest priority (i.e. Priority ranking '1'), while 'high' or 'extreme' risks that are not expected to materialise until 2050 or 2100 are given secondary priority (i.e. Priority ranking '2'). It is noted that, while all beaches are at high – extreme risk from erosion, beach management has only been suggested for those beaches where dunes are currently limited and need to be enhanced to protect the beach or back beach assets and / or the action is considered likely to be successful in enhancing coastal dune volumes.

Risks Addressed by Implementation of Strategy:

| | Risk at 2011 | Risk at 2050 | Risk at 2100 | |
|--|-----------------|-----------------|-----------------|---|
| Helensburgh / Stanwell Park SLSC | Medium | High | Extreme | Woonona Beach |
| Coalcliff Beach | High | Extreme | Extreme | North Beach |
| Scarborough Wombarra Beaches | High | Extreme | Extreme | North Beach: Stuart Park (on heritage list, local significance) |
| Coledale Beach | High | Extreme | Extreme | City Beach: Football Ground (WIN Stadium) and Showground |
| Sharkys Beach | High | Extreme | Extreme | Coniston Beach |
| Little Austinmer Beach | High | Extreme | Extreme | Coniston Beach: Wollongong Golf Course |
| Austinmer Beach | High | Extreme | Extreme | Coniston Beach: Coastal Dune Systems |
| Sandon Point Local Roads: Blackall St, Ursula St, Alroy St | Medium | Medium | High | |

Refer accompanying CZM Study for beach by beach assessment of erosion/recession risks and inundation risks



| Risk at 2011 | Risk at 2050 | Risk at 2100 |
|-----------------|-----------------|-----------------|
| High | Extreme | Extreme |
| High | Extreme | Extreme |
| Medium | High | Extreme |
| High | Extreme | Extreme |
| High | Extreme | Extreme |
| Medium | Medium | High |
| High | Extreme | Extreme |



BEACH MANAGEMENT (BM)

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or | Preceding | Further Info. |
|------|--|---|----------|---|------------------------|-----------------------------------|-------------|---|
| | | | | | | Resources Req'd | Actions | |
| BM.1 | Develop, adopt and implement a Council policy that requires any sand removed from estuary/lagoon entrances to be returned to the adjacent beaches, along with any local excavation material from construction sites immediately adjacent to beaches that have a suitable particle size distribution. | Entire LGA coastline | 1 | 2012 or as soon as practical | WCC | Staff time only | nil | See 'BM' Option in Sect.5.4.2 of CZM Study report |
| BM.2 | Undertake beach scraping and re-contouring to increase sand volumes of dunes directly in front of Helensburgh / Stanwell Park SLSC | Helensburgh / Stanwell Park | 2 | Opportunistically when monitoring shows that beaches are accreted following recovery from storm erosion | wcc | \$5,000 - \$10,000 per episode | M.1 | See 'BM' Option in Sect.5.4.2 of CZM Study report |
| BM.3 | Undertake beach scraping and re-contouring to increase sand volumes of dunes in front of existing wall. | Austinmer | 1 | Opportunistically when monitoring shows that beaches are accreted following recovery from storm erosion | WCC | \$5,000 - \$10,000 per episode | M.1 | See 'BM' Option in Sect.5.4.2 of CZM Study report |
| BM.4 | Undertake beach scraping and beach re-contouring to increase sand volumes of dunes directly in front of WIN Stadium. Investigate opportunities for financial contributions from stadium owner/manager | City Beach | 1 | Opportunistically when monitoring shows that beaches are accreted following recovery from storm erosion | wcc | \$5,000 - \$10,000 per episode | M.1 | See 'BM' Option in Sect.5.4.2 of CZM Study report |
| BM.5 | Undertake beach scraping and beach re-contouring to increase sand volumes held in upper beach profile dunes, thus enhancing storm protection. Investigate opportunities for financial contributions from golf course owner/manager for section on Coniston Beach | Coalcliff Scarborough / Wombarra Coledale Sharkys Little Austinmer Woonona North Beach Coniston (including golf course and dunes) | | Opportunistically when monitoring shows that beaches are accreted following recovery from storm erosion | WCC | \$7,000 - \$10,000 per episode | M.1 | See 'BM' Option in Sect.5.4.2 of CZM Study report |
| BM.6 | Undertake revegetation works for sand dunes supplemented through beach scraping and re-contouring episodes (see also Action V.1 – Dune Management Strategy) | Helensburgh / Stanwell Park Coalcliff Scarborough / Wombarra Coledale Sharkys Little Austinmer Austinmer Sandon Point Woonona North Beach City Beach Coniston | 1 | Immediately following beach scraping and re-contouring episodes | WCC Bushcare Groups | \$2,000 per episode | BM.2 – BM.5 | See 'BM' Option in Sect.5.4.2 of CZM Study report |



BEACH MANAGEMENT (BM)

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Req'd | Preceding Actions | Further Info. |
|------|--|--|----------|---|------------------|------------------------------------|----------------------|---|
| BM.7 | Undertake beach scraping and re-contouring to increase sand volumes of dunes directly in front of Blackall St, Ursula St, Alroy St | Sandon Point Beach: Blackall St, Ursula St, Alroy St | 2 | Opportunistically when monitoring shows that beaches are accreted following recovery from storm erosion | WCC | \$5,000 - \$10,000 per episode | M.1 | See 'BM' Option in Sect.5.4.2 of CZM Study report |

Relevant Programs and Possible Funding Opportunities:

- NSW Government Coastal Management Program (for one-off beach scraping / dune building episodes)
- Council's parks and reserves maintenance and works program •
- New Council levies or increased land rates •
- SRCMA / State Government assisted Dunecare Program

tem2. Attachment A



10

CYCLEWAYS (C) 3

Description:

The Wollongong Coastline is served well by a sealed coastal cycleway extending from Thirroul to Coniston Beaches. The cycleway is an important recreational facility for the community, and provides a commuter link for many city workers living along the northern beaches. The cycleway is also an excellent pedestrian walkway, with commanding vistas over the beaches and headlands along the coastline.

Sections of the cycleway have been damaged due to storm erosion in the past, such as at Bellambi, resulting in ad hoc emplacement of protection works as an emergency response. It is expected that sections of the cycleway will again be damaged in the future due to storm erosion and sea-level rise induced shoreline recession. This strategy aims to provide a coordinated response to management of future damage to the cycleway as part of a whole of coastline plan. Remediation of the cycleway shall form part of Council's existing Asset Management Plan. That is, the cycleway needs to first be included as a specific Council asset, with future maintenance and repairs provided in accordance with Council's forward planning schedule for asset management.

Repairs to the cycleway following an erosion event will still need to be carried out as prioritised emergency works, while longerterm retreat and relocation of the cycleway in certain vulnerable sections needs to be planned in conjunction with future maintenance and as opportunities for relocation arise.

Land ownership and available space for landward retreat of the cycleway are two issues that will need to be resolved as part of long term management of this special and highly valued community asset.



Risks Addressed by Implementation of Strategy:

| | Risk at 2011 | Risk at 2050 | Risk at 2100 | | Risk at 2011 | Risk at 2050 | Risk at 2100 |
|---|-----------------|-----------------|-----------------|---|-----------------|-----------------|-----------------|
| McCauleys Beach Cycleway / Shared Pathway (Northern Coastal Cycleway) | Medium | Medium | High | Bellambi Point Beach: Cycleway / Shared Pathway (W of Bellambi Lagoon, along Dobbie & Murray Ave) | Medium | Medium | High |
| Sandon Point Northern Cycleway / Shared Pathway (at S end of beach) | Medium | Medium | High | Corrimal: Cycleway (across & next to Towradgi Lagoon) | Medium | Medium | High |
| Bulli Beach Cycleway / Shared Pathway (extent between beach and tourist park) | Medium | High | Extreme | Towradgi Beach Cycleway / Shared Pathway | Medium | High | High |
| Woonona Beach Cycleway / Shared Pathway | Medium | Medium | High | North Beach Cycleway / Shared Pathway (includes heritage railway cuttings and embankments) | Medium | High | Extreme |
| Bellambi Beach Cycleway / Shared Pathway (N of Bellambi Gully entrance) | Low | Medium | Medium | City Beach Cycleway / Shared Pathway | Medium | High | Extreme |
| Bellambi Beach Cycleway / Shared Pathway (S of Bellambi Gully entrance) | Medium | Medium | High | | | | |

Refer accompanying CZM Study for beach by beach assessment of erosion/recession risks and inundation risks





| CYCLEWAYS (C) | | | | | | | | |
|---------------|---|--|----------|---|------------------|---|----------------------|--|
| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
| C.1 | Undertake audit of cycleway to identify options available for at-risk sections. Where relocation is not possible due to constraints from other land uses, consider the feasibility (technical and financial) for rock protection and / or raising the cycleway. | McCauleys Sandon Point Bulli Woonona Bellambi Bellambi Point Towradgi North Beach City Beach | 1 | 2012, or as soon as practical | WCC | Staff time only or minor consultancy (say approx. \$25,000) | nil | See 'NR6' Option in Sect.5.4.1 of CZM Study report |
| C.2 | Add cycleways to Council's Asset Management Plan, and based on the outcomes of the audit, incorporate remediation, maintenance, relocation or retrofit works into forward works programs. <i>Actions C.3 to C.6 apply if supported by the Asset Management</i> <i>Plan.</i> | As above | 1 | 2012/3 (as soon as practical following Action C.1) | WCC | Staff time only | C.1 | See 'NR6' Option in Sect.5.4.1 of CZM Study report |
| C.3 | Secure ownership of land (if not currently public land) and undertake detailed design, site investigations, and approvals as necessary to relocate cycleway outside of hazard zone. There appears to be sufficient land to relocate all of the at risk cycleway sections in the future, conducted progressively as impacts manifest. | Sandon Point Bulli Woonona | 2 | When monitoring shows that the Zone of Reduced Foundation Capacity (ZRFC) measured from erosion escarpment encroaches cycleway | WCC | Dependent on scale of works required and existing land ownership (say \$100 – 200,000, at each location) | C.2 SP.3 M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |
| C.4 | Secure ownership of land (if not currently public land) and undertake detailed design, site investigations, and approvals as necessary to relocate cycleway outside of hazard zone. There appears to be sufficient land to relocate all of the at risk cycleway sections in the future when erosion impacts manifest. The cycleway section between Bellambi Gully and the pool may be protected by the existing seawall if this structure is maintained (refer Action S.5). | Bellambi | 2 | When monitoring shows that ZRFC measured from erosion escarpment encroaches cycleway There is a low to medium risk at present, thus there is no immediate need for action. | WCC | Dependent on scale of works required and existing land ownership (say \$100 – 200,000) | C.2 M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |
| C.5 | Secure ownership of land (if not currently public land) and undertake detailed design, site investigations, and approvals as necessary to relocate cycleway outside of hazard zone. There are alternative locations for the at risk sections of cycleway. | Towradgi | 2 | When monitoring shows that ZRFC measured from erosion escarpment encroaches cycleway A long section of cycleway is at risk over time. | WCC | Dependent on scale of works required and existing land ownership (say \$100 – 200,000) | C.2 M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |
| C.6 | Secure ownership of land (if not currently public land) and undertake detailed design, site investigations, and approvals as necessary to relocate cycleway outside of hazard zone. The cycleway could feasibly be relocated along the street landward of WIN Stadium to rejoin the existing cycleway at Wollongong Golf Course, in the future when erosion impacts manifest. | City Beach | 2 | When monitoring shows that ZRFC measured from erosion escarpment encroaches cycleway | WCC | Dependent on scale of works required and existing land ownership (say \$100 – 200,000) | C.2 M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |

Relevant Programs and Possible Funding Opportunities:

- NSW Government Coastal Management Program or other recreational/leisure-based funding program
- State and Federal Government Grants (especially climate change adaptation and resilience building funds) •
- Council's routine asset maintenance and works program •
- New Council levies or increased land rates



12

Description:

Wollongong's coastal zone is largely developed, with only a handful of undeveloped "greenfields" sites remaining. Most future development therefore will consist of either complete redevelopment of a site, including possible subdivision, or major alterations or refurbishments to existing structures and dwellings.

Redevelopment of coastal land offers an opportunity to avoid or accommodate existing and future coastal risks through the application of development controls, expected to last for the duration of the development. For residential development, a design life of 100 years is considered practical. This means that new developments today needs to accommodate coastal risks that span to approximately 2100. For other development types, the design life may be shorter or longer.

Applying development controls as properties are redeveloped improves resilience to potential future climate change impacts. Importantly, development controls do not affect the future ability to protect or indeed retreat from the properties. The development controls can be revised and updated in the future in line with improving knowledge of climate change, including sea level rise, and the predicted coastline responses to these changes.

Development controls are already imposed in Flood Planning Areas across the Wollongong LGA as part of Council's integrated Development Control Plan (DCP) Chapter E13 Floodplain Management. Areas of coastal inundation should be specifically incorporated into the existing Chapter E13 Flood DCP provisions. Geotechnical hazard areas are already included in Council's Geotechnical DCP Chapter E12 Geotechnical Assessment, however the DCP chapter requires update to include actions of the sea as part of geotechnical assessments.



It is proposed that new development controls relating to coastal erosion and recession and wave overtopping be captured within a new Coastal DCP Chapter. Different development controls can apply based on different levels of coastal risk, subject to further development of these planning provisions by Council.

Development Controls will address a range of intolerable risks, many of these being intolerable at the current timeframe (2011). Although the level of risk differs from one beach to the next, the Development Controls are to be prepared for the whole LGA at the same time. As such, the actions for preparing and implementing Development Controls take highest priority (i.e. Priority ranking '1').

Risks Addressed by Implementation of Strategy:

All risks to existing development and infrastructure, as well as potential future development along every beach within the Wollongong LGA (literally too many to itemise here – refer beach by beach assessment in Chapter 6 of the accompanying CZM Study report for details. Note that for Council's use, a summary table of recommended current and future actions for all private properties at risk to 2100 is given in Appendix A.



| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|------|--|--|----------|------------------------------|------------------|--------------------------------------|----------------------|---|
| DC.1 | Prepare, adopt and implement a new Coastal Management Chapter of Council's Development Control Plan (DCP) that specifies controls upon future development and re-development (including minor and major alterations and extensions) in erosion / recession risk areas. Different levels of development control will reflect the different levels of risk to individual properties. That is, less stringent controls are applied to land at lower risk and / or land uses considered to have a shorter timeframe (design life), and vice versa. The types of controls may relate to foundation capacity (bedrock), structural design (relocatable or permanent), minimum floor levels, distance to hazard zones (development setbacks) or distance based approvals. The controls shall address wave overtopping as well as erosion, and shall apply to all land uses including roads and stormwater infrastructure, and both private and public landholders. The DCP shall also apply to properties where a protection option is proposed (e.g. seawall) until such time as the protection option is implemented and risk level for properties revised. | All beaches All lands affected by coastal risks. (<u>See further details below</u>) | 1 | 2012 or as soon as practical | WCC | Staff time only | Nil | See Sect.5.3 and 'DCP' option in Section 5.4.4 of CZM Study report |
| DC.2 | Revise/update, adopt and implement Chapter E13 – Floodplain Management of Council's Development Control Plan (DCP) to include areas affected by Coastal Inundation as Low Risk Flood Precincts. This option involves assigning areas within the Coastal Inundation Area but outside of the existing Flood Planning Area into the Low Flood Risk Precinct of the Flood Planning Area, then managing this area according to the provisions in DCP Chapter E13 – Floodplain Management. This will include flood proofing or relocatable structures etc as required on a site by site basis as assets are redeveloped or replaced. | Stanwell Park Coledale Sharkys Austinmer Thirroul McCauleys Sandon Point Bulli Woonona Bellambi Bellambi Bellambi Point Corrimal North Beach Lake Illawarra (See further details below) | 1 | 2012 or as soon as practical | WCC | Staff time only | nil | See Sect.5.3 and 'FDCP' option in Section 5.4.4 of CZM Study report |
| DC.3 | Revise/update, adopt and implement Chapter E12 – Geotechnical Assessment of Council's Development Control Plan (DCP) to ensure actions of the sea (overtopping, sea level rise) are included in the assessment of geotechnical stability and the DCP is applied to all areas of geotechnical hazard area on a case by case basis as property (private or public) is developed or re-developed. | Areas of identified geotechnical hazard | 1 | 2012 or as soon as practical | WCC | Staff time only | nil | See Sect.6.22 and 'GDCP' option in Section 5.4.4 of CZM Study report |



Further Details:

| Beach | Coastal DCP Details | Flood DCP details |
|---------------------------|---|--|
| Stanwell | Erosion and inundation impacts are likely to affect private land holdings at the southern end of the beach (refer map), however, the buildings are not likely to be affected for some time. Applying development controls when these buildings are redeveloped would improve their structural integrity and therefore the longevity of the developments. Management options to either retreat from or protect the buildings can be revised in the future, as the estimates for hazard impact change or impacts become imminent. | The existing Flood DCP ch coastal inundation, until Flo Hargraves Creeks (for com see Action SP.2). Developr level. |
| | | |
| Coalcliff | Private Properties Erosion and overtopping impacts are shown to affect private properties, however, the residences are situated far landward and higher than the area identified at risk. Applying development controls to redevelopment ensures coastal erosion and overtopping are considered, but given the distance and building footprint, controls are unlikely to be extensive or burdensome. | Inundation at Coalcliff is rel inundation, and should be r |
| | Public Assets: SLSC, Boatshed, carpark | |
| | These public assets are currently at low risk, so there is no immediate need for action. Investigations and action can be delayed until asset replacement is required. | |
| Scarborough / Wombarra | The amenities building and local access road are currently at low risk, so there is no immediate need for action. Investigations and action can be delayed until asset replacement is required. | Inundation at Scarborough rather than backwater inune DCP controls. |
| Coledale | The amenities and roadway are currently at low risk, so there is no immediate need for action. | The existing Flood DCP ch |
| | The risk to the school applies to the grounds only. Applying the DCP will flag investigations to ensure future re-developments/developments consider and mitigate erosion and overtopping risks if required. | risk from coastal inundation Dalys, Stockyard and Carri Development controls are t |
| Sharkys | Vacant Land at Shark Park, Sharkys carpark and Austinmer Boat Harbour amenities building are currently at low risk, so there is no immediate need for action. Investigations and action can be delayed until asset replacement is required. The Coastal DCP shall manage both inundation related to wave overtopping as well as erosion and recession. | The existing Flood DCP ch Lawrence Hargrave Drive a applied at the "low risk" leve undertaken at this location. |
| Little Austinmer | There is one private property where the Coastal DCP should be applied. The buildings on the property are at the edge of the risk zones and may not be affected for some time. Applying the DCP allows redesign of buildings upon the land when the buildings are redeveloped, thus improving longevity of the development. Additional controls can be considered as needed in the future, should risk levels be revised or hazard impacts advance more quickly. | While the majority of inunda controls, the backwater inu stormwater assets should o water level event. In the int |
| | The DCP shall also be applied to public assets such as Lawrence Hargrave Drive, as well as the local carpark and amenities. Again, this will ensure that investigations that will govern the redesign or relocation of these assets are prepared, when the asset needs to be replaced (either through wear and tear or coastal damage). | to be applied at the low hs |
| Austinmer | Planning controls shall apply to development in areas at risk regardless of protective structural options. Public assets including Lawrence Hargrave Drive, SLSC, carpark, boatshed and amenities are potentially at risk. The DCP will trigger investigations that will govern whether the asset needs to be relocated or redesigned to withstand impacts, either independently or prior to a seawall being implemented. | As above |
| | Given risk is currently high at assets affected, the DCP controls may be imposed in conjunction with the expected cost and timeframe for asset maintenance and replacement, or sooner should erosion and wave overtopping impacts threaten the development. | |
| Thirroul | Planning controls should apply to development that reflect the level of risk to the property and expected functional life of the development. DCP controls will apply to affected land prior to implementation of any seawall options, should seawalls be maintained or implemented in the future. | The existing Flood DCP ch risk from coastal inundation "low risk" level, until Flood S Creek and Thomas Gibson affected by coastal inundat within the existing Flood Pla additional effect on existing |
| McCauleys | Coastal DCP controls shall apply to any redevelopments in areas at risk. This includes the Aboriginal Tent Embassy and the beachfront property at the northern end of the beach. The DCP controls will reflect the level of risk and development lifespan. The DCP will trigger investigations regarding foundation capacity (depth to bedrock), alternative locations, distance to erosion escarpments, permissible fixed | The existing Flood DCP ch risk from coastal inundation "low flood risk" level prior to |

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apter is to be applied to properties at risk of ood Studies are conducted for Stanwell and bined catchment and ocean water level events, ment controls are to be applied at the "low risk"

lated to wave overtopping, rather than backwater managed through Coastal DCP controls.

and Wombarra is related to wave overtopping, dation and should be managed through Coastal

napter is to be applied to those areas identified at n, as an interim measure until Flood Studies for icks Creek are completed (refer Action SP.2). to be applied at the "low risk" level.

apter is to be applied to the small area of affected by coastal inundation. The controls are el, until more detailed studies as to flood levels are

lation will be managed in combination with erosion undation risk to Lawrence Hargrave Drive and to consider the combined catchment flood and ocean terim, the existing Flood DCP chapter controls are sk" level, until such studies are conducted.

hapter is to be applied to those areas identified at n outside of the existing Flood Planning Area at the Studies are completed and updated for Flanagans n Creek, respectively. The majority of properties tion in the Thomas Gibson catchment are also lanning Area, therefore this strategy would have no g development restrictions.

apter is to be applied to those areas identified at noutside of the existing Flood Planning Area at the pupdated Flood Studies for Hewitts and Tramway



| Beach | Coastal DCP Details | Flood DCP details |
|------------------------------|---|---|
| | structures etc that will govern the relocation or suitable design for developments. | Creeks. There are limited at Area. The majority of prope the existing Flood Planning additional effect on existing properties. |
| Sandon Pt | Planning controls shall apply to four (4) private properties and some public assets currently in areas at risk, with less stringent controls applied to land at lower risk and / or land uses considered to have a shorter timeframe (design life), and vice versa. For the Sandon Point SLSC, a new development at the current site is already underway. Applying the DCP controls will ensure any future re-development adequately considers alternative locations outside of the hazard zone. | The existing Flood DCP charisk from coastal inundation "low risk" level, until Flood S Creek and Slacky Creek, re around Slacky Creek, with r Area, however, properties a planning area. |
| Bulli | Public assets at risk including the SLSC, kiosk, caravan park, cycleway and stormwater assets shall be subject to Coastal DCP controls. The DCP will ensure that future upgrades/redevelopment involve assessments to determine whether the asset shall to be relocated or redesigned to withstand impacts at the current location. | The existing Flood DCP charisk from coastal inundation "low flood risk" level, until Fl Collins Creeks (for combine Action SP.2). A flood study priority, as many houses ma |
| Woonona | Coastal DCP controls are to apply to redevelopment of 18 existing properties and public assets currently in areas at risk. Controls are applied such that less stringent controls apply to land at lower risk and / or land uses considered to have a shorter timeframe (design life), and vice versa. The DCP may require assessment of foundation capacity (depth to bedrock), alternative locations, distance to erosion escarpments, etc as relevant to the level of risk, to determine design controls for assets to remain in their current location or require relocation of developments landward of hazard zones. Wave overtopping shall also be managed by the Coastal DCP, as existing Flood DCP controls may not be applicable to the overtopping risk. | The existing Flood DCP charisk from coastal inundation Area applied at the "low floo and ocean water level even creek at Lighthorse Drive as |
| Bellambi / Bellambi Point | This option applies proposed Coastal DCP controls to any redevelopments on the Sewage Treatment Works site, as well as cycleways, Bellambi Pool and associated pool infrastructure (amenities etc) until such time as S.5 is implemented and local road access to the harbour (until such time as action R.4 is implemented). | The existing Flood DCP cha carpark, and local roads, ca Lagoon at the "low flood rish Bellambi Lagoon are condu |
| Corrimal | The Coastal DCP shall apply to minor public buildings (amenities blocks), to ensure erosion and overtopping risks are adequately managed (including relocating the structures) in the future when the assets require redevelopment. | The existing Flood DCP charisk from coastal inundation "low flood risk" level, until a combined catchment and or majority of land and assets within the Flood Planning A would result in little to no ch |
| Towradgi | Coastal DCP controls shall apply to redevelopments of at risk private property and public assets, and shall also manage wave overtopping. The development controls will reflect the level of risk and lifespan of the (re-)development. The location of the private properties and local road at the northern end of the beach suggests there may be stable foundation zone (bedrock) at close depth. In this case, private landowners (or Council's road) may be able to accommodate the risk to their buildings and / or the hazard estimate for recession could be revised. The geotechnical investigation for suitable foundation capacity would be initiated through the Coastal DCP for any proposed re-developments. | Inundation is related to wav and so shall be managed th |
| Fairy Meadow | Coastal DCP controls should apply to any future re-development of the lifeguard tower or other recreational facilities. | |
| North | Coastal DCP controls should apply to any proposed redevelopment of existing assets (SLSC, Kiosk, Pavilion, cycleway) in addition to other options, including seawall options, to improve resilience of future structures to coastal risks. The controls shall accommodate wave overtopping impacts. | The existing Flood DCP cha Restaurant) at risk from coa Lagoon Flood Study is com level events, see Action SP |
| City | The Coastal DCP shall apply to re-development of the Stadium and associated grounds to minimise future risk from hazards. The controls shall encompass both erosion and overtopping impacts. | Inundation is related to wav and so shall be managed th |
| Coniston | Coastal DCP development controls shall apply to Wollongong Golf Course lands, in the case of redevelopments on the site. The controls shall | Inundation is related to wav |
| | | |

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dditional properties outside the Flood Planning rties affected by coastal inundation are also within Area, therefore this strategy would have no development restrictions for the majority of

apter is to be applied to those areas identified at outside of the existing Flood Planning Area at the Studies are completed and updated for Whartons espectively. There are limited additional properties most properties already within the Flood Planning along Trinity Row are not currently within a flood

apter is to be applied to those areas identified at outside of the existing Flood Planning Area at the lood Studies are conducted for Whartons and ed catchment and ocean water level events, see should be completed at Whartons Creek as a ay be affected.

apter is to be applied to all properties identified at that are outside of an existing Flood Planning od risk". A Flood Study (for combined catchment its, see Action SP.2) should be completed for the s a priority, as many houses may be affected.

apter is to be applied to Bellambi SLSC and arpark and 10 properties adjacent to Bellambi k" level, until Flood Studies for Bellambi Gully and icted.

apter is to be applied to those areas identified at outside of the existing Flood Planning Area at the Flood Study is updated for Towradgi Lagoon (for cean water level events, see Action SP.2). The within the coastal inundation area are already rea for Towradgi Lagoon, therefore this strategy nange to extent of existing development controls.

e overtopping, rather than backwater inundation nrough Coastal DCP controls.

apter is to be applied to assets (e.g. Lagoon astal inundation at the "low risk" level, until a Fairy pleted (for combined catchment and ocean water .2).

e overtopping, rather than backwater inundation nrough Coastal DCP controls.

e overtopping, rather than backwater inundation

16



| Beach | Coastal DCP Details | Flood DCP details |
|----------------|--|--|
| | encompass both erosion and overtopping impacts. | and so shall be managed th |
| Perkins | Coastal DCP controls shall apply to redevelopment of Windang SLSC and amenities buildings to manage wave overtopping and additionally erosion at Port Kembla Pool in conjunction with seawall options. | |
| Lake Illawarra | | Given that the existing Floo coastal inundation area at L be subject to the Flood DCF DCP throughout Lake Illawa Study to override levels give Study was conducted using flood event, providing a curr in planning. |
| Relevant Pro | external funding required. To be undertaken by Council staff. | |

nrough Coastal DCP controls.

d Planning Area extends over and beyond the ake Illawarra, all affected properties will already P. This strategy re-iterates the use of the Flood arra, with the flood planning levels from the Flood en for coastal inundation alone. A recent Flood a combined ocean water level and catchment rent and applicable flood level calculation for use



5 HERITAGE (H)

Description:

The Wollongong Coastline is rich in heritage value from both an indigenous and non-indigenous perspective. While the nonindigenous heritage value is tied to specific features and structures, such as Norfolk Island Pines, War Memorials and Pavilions, the indigenous heritage value is more ubiquitous across the landscape. There are still many specific sites of significance to local Aboriginal people within the coastal zone, including middens, burial sites and significant places, however, many of these are not publicly known or listed for privacy and preservation purposes. A particular issue may arise in the future when coastal erosion starts to uncover previously buried heritage items in coastal dunes and foreshore lands.

Risks to heritage locations identified through the CZM process have therefore weighed in favour of non-indigenous heritage, as these have been more easily identified. Managing heritage locations that are under threat from existing or future hazards is a particular challenge for Council. While specific structures can feasibly be relocated to safer sites (e.g. a war memorial or even a building), others cannot be relocated (e.g. a jetty or an avenue of trees), and as such, may need to be sacrificed or abandoned in the future. Compensatory heritage may need to be considered, such as planting new Norfolk Island Pines to maintain the cultural connection with this species along the Wollongong coastline (see Action V.2). Heritage actions outlined below relate to identified sensitive sites as well as currently unidentified sites. For identified non-indigenous heritage items, specific strategies are contained as part of other strategies within this Implementation Action Plan (e.g. ocean pools, surf clubs and public buildings, etc).



Risks Addressed by Implementation of Strategy:

| | Risk at 2011 | Risk at 2050 | Risk at 2100 | | Risk at 2011 | Risk at 2050 | Risk at 2100 | |
|---|-----------------|-----------------|-----------------|--|-----------------|-----------------|-----------------|--|
| Coledale: Heritage Site: Norfolk Island Pines | Medium | Medium | High | Heritage Site: Sandon Point (also under NPW Act) | High | Extreme | Extreme | |
| Sharkys: Heritage Site: Norfolk Island Pines (backing entire beach) | Medium | Medium | High | Heritage Site: Sandon Point Boat Sheds | Medium | High | High | |
| Sharkys: Heritage Site: Site of Austinmer Jetty | High | Extreme | Extreme | Heritage Site: Sandon Pt Norfolk Island Pines (S end of beach) | Medium | Medium | High | |
| Sharkys / Austinmer Boat Harbour (Heritage listed) | High | Extreme | Extreme | Bulli: Waniora Point (Heritage site) Note works already in progress at site. | High | Extreme | Extreme | |
| Little Austinmer Heritage Site: Norfolk Island Pines (backing entire beach) | Medium | Medium | High | Bellambi Pt Heritage Site: Bellambi Lagoon and associated habitat | High | Extreme | Extreme | |
| Austinmer Heritage Site: Norfolk Island Pines (backing entire beach) | Medium | Medium | High | Heritage Sites: Bellambi (Sandpit) Point | High | Extreme | Extreme | |
| Austinmer War Memorial (Heritage Site) | High | Extreme | Extreme | North Beach: Stuart Park (on heritage list, local significance) | Medium | High | Extreme | |
| Thirroul Pool (also heritage site) | High | Extreme | Extreme | North Beach: Puckeys Estate including Seafield House, Saltworks and gardens ruins | High | Extreme | Extreme | |
| Heritage site: Thirroul Pavilion (being used as kiosk / restaurant) and residence | High | Extreme | Extreme | Heritage Site: North Beach Kiosk | Low | Medium | High | |
| Heritage Site: Thirroul Beach Reserve (S of pool) | Medium | High | Extreme | Heritage Site: North Beach Pavilion | Low | Medium | Medium | |
| Thirroul Heritage Site: Norfolk Island Pines | Low | Low | Medium | North Beach Heritage Site: Norfolk Island Pines | Medium | Medium | High | |
| McCauleys Significant Aboriginal Site (Tent Embassy). | Medium | High | High | North Beach Cycleway / Shared Pathway (includes heritage railway cuttings and embankments) | Medium | High | Extreme | |
| Perkins Beach Heritage listed: Hill 60 Nature Reserve | | | | | | | | |

Refer accompanying CZM Study for beach by beach assessment of erosion/recession risks and inundation risks

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Action List:

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|------|--|--|----------|---|------------------|--------------------------------------|----------------------|---|
| H.1 | In close consultation with NPWS, Local Aboriginal Groups and Historical Societies, develop a decision framework for managing Aboriginal and Non-Indigenous Heritage Items and places affected by coastal hazards. The decision framework would include what actions are necessary when currently buried sites are uncovered by erosion. This may include relocating the item (for example, as is conducted for burial sites), re-burying the item elsewhere (for example as is done for midden sites), sacrificing the item or protecting the item (as is done for midden sites also). | Applicable to all beaches. Specific sites of known heritage have not been identified for privacy reasons. This option also aims to manage assets that are currently unidentified. | 1 | 2012 or as soon as practical. Implementation of the Framework is then only triggered once heritage items are uncovered or seriously threatened by future coastal erosion. | WCC | Staff time only | nil | See 'NR13' Option in Sect.5.4.1 of CZM Study report |
| | See also Norfolk Pines Planting - Action V.2, for Coledale: Heritage Site: Norfolk Island Pines Sharkys: Heritage Site: Norfolk Island Pines (backing entire beach) Little Austinmer Heritage Site: Norfolk Island Pines (backing entire beach) Austinmer Heritage Site: Norfolk Island Pines (backing entire beach) Thirroul Heritage Site: Norfolk Island Pines Sandon Point Norfolk Island Pines (S end of beach) North Beach Heritage Site: Norfolk Island Pines | | | chinent | | | | |
| | Sharkys / Austinmer Boat Harbour – See Action I.4 | | X | | | | | |
| | Austinmer War Memorial (Heritage Site) – See Action S.4 | | | | | | | |
| | Thirroul Pool - See Action P.4 | | | | | | | |
| | Thirroul Pavilion (being used as kiosk / restaurant) and residence – See Action SC.6 | 2 | | | | | | |
| | Heritage Site: Thirroul Beach Reserve (S of pool) – See Action S.1 | | | | | | | |
| | North Beach: Stuart Park (on heritage list, local significance) – See Action S.8 | | | | | | | |
| | See Action S.7 for: Heritage Site: North Beach Kiosk Heritage Site: North Beach Pavilion North Beach Cycleway / Shared Pathway (includes heritage railway cuttings and embankments) | | | | | | | |

Relevant Programs and Possible Funding Opportunities:

• No external funding required. To be undertaken by Council staff.



6 INFRASTRUCTURE, ASSETS & BOAT HARBOURS (I)

Description:

In addition to the cycleways, seawalls, roadways and stormwater assets, which are addressed separately, there are other assets and infrastructure along the Wollongong Coastline that are under current and future risk of damage due to coastal processes and hazards. These include the boat harbours and associated boatramps and facilities at Austinmer and Bellambi, as well as the Bellambi Sewage Treatment Plan (STP).

Other services are also at risk, including electricity, telecommunications, gas, water and wastewater services, which are located on both public and private lands within the affected coastal zone. Indeed loss of key services and infrastructure may potentially affect a much larger catchment area, and should be considered and managed very carefully by the service providers.

The infrastructure, assets and boat harbours identified all have 'high' or 'extreme' level of risk at the current timeframe (2011). As such, all actions associated with this strategy take highest priority (i.e. Priority ranking '1').

Risks Addressed by Implementation of Strategy:

| | Risk at 2011 | Risk at 2050 | Risk at 2100 |
|--|-----------------|-----------------|-----------------|
| Sharkys / Austinmer Boat Harbour (Heritage listed) | High | Extreme | Extreme |
| Bellambi Boat Harbour | High | Extreme | Extreme |
| Bellambi / Bellambi Point Sewage Treatment Plant | High | Extreme | Extreme |
| Lake Illawarra Tru Energy Gas Powered Station | High | Extreme | Extreme |

Refer accompanying CZM Study for beach by beach assessment of erosion/recession risks and inundation risks

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|------|---|-------------------|----------|------------------------------|------------------|--------------------------------------|----------------------|--|
| l.1 | For all Council assets within their Asset Management Plan, add a notation indicating its proximity to the coastal hazard zones and the type of coastal hazard(s) relevant (i.e., erosion/recession, inundation, geotechnical) and estimated timeframe for impacts on the assets (immediate/2010, 2050, 2100). Prioritisation and maintenance scheduling of forward works programs should then be re-considered based on the timeframe and type of hazard exposure. All relevant information is readily available to Council. | All beaches | 1 | 2012 / Immediately | WCC | Staff time only | nil | See 'NR1' Option in Sect.5.4.1 of CZM Study report |
| 1.2 | Ensure all Council infrastructure, including boat harbours and other relevant services, are included in Council's Asset Management Plan, with appropriate consideration given to asset condition and functional life such that redesign, upgrade and protection works are included into forward works programs. <i>Actions I.4 and I.6 apply if supported by the Asset Management Plan</i> | All beaches | 1 | 2012 or as soon as practical | WCC | Staff time only | nil | See 'NR2 to NR7' Options in Sect.5.4.1 of CZM Study report |





INFRASTRUCTURE, ASSETS & BOAT HARBOURS (I)

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|------|---|--|----------|--|--|---|----------------------|--|
| 1.3 | For non-Council assets, such as water supply, wastewater, gas, telecommunications and electricity services infrastructure, undertake an audit and investigate design elements for infrastructure to withstand inundation with seawater and / or wave action. This would be facilitated by Council providing relevant coastal hazard mapping to all infrastructure owners and managers. The audit will identify where and when non-Council infrastructure will be affected by wave attack and/or permanent inundation with sea level rise. The audit is also to determine functional lifespan of existing infrastructure, noting that seawater is expected to yield shorter design life. | All beaches, notably: Trinity Row (Sandon Pt Beach), Woonona Beach (Beach Drive, Kurraba Road), STP at Bellambi, Marine Parade (Towradgi Beach), and other locations where erosion may affect infrastructure positions within road reserves and vulnerable private properties | 1 | 2012 or as soon as practical | WCC to advise asset owners of risks and encourage them to adopt this action, in consultation with WCC. Asset Owners include: SWC Ausgrid AGL Optus Telstra etc | Staff time only with financial contributions from asset owners | nil | See 'NR8' Option in Sect.5.4.1 of CZM Study report |
| 1.4 | Undertake detailed design, assessment, planning and works to redesign or retrofit Austinmer Boat Harbour to withstand wave forces and inundation due to sea level rise. Austinmer Boat Harbour could feasibly be redesigned, including raising the boat ramp and breakwalls, to remain a functional regional recreational boat access point. Given there is a small patch of sandy beach below the ramp at present, the redesign will need to consider retaining the sandy strip with nourishment following storm events. Alternative designs without sand that retain or improve current functioning may also be acceptable. | Sharkys | 1 | 2012 or as soon as practical. Investigate options, prepare designs and approvals (as required) Undertake works when wave overtopping and mean sea level inundation causes the harbour to not be functional for the majority of sea conditions OR at major asset maintenance cycles, as required. | WCC NSW Public Works | Dependent on scale of works required (say \$1 – 2m) | 1.2 | See 'A2' Option in Sect.5.4.4 of CZM Study report |
| 1.5 | Undertake detailed design, assessment, planning and works to relocate activities on Sewage Treatment Plant compound. There appears to be sufficient vacant land within the Plant to relocate activities within the site to allow retreat. There may also be bedrock at shallow depth that could provide further protection from erosion, which would be confirmed through a geotechnical investigation. | Bellambi Pt | 8 | Move activities as erosion impacts manifest | WCC to advise SWC of risks and encourage SWC to adopt this action, in consultation with WCC | Dependent on scale of works required (say \$1 – 2m) | 1.3 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |
| 1.6 | Undertake detailed design, assessment, planning and works to upgrade Bellambi Boat Harbour in current location to withstand impacts. The boatramp and associated carpark and revetment could be raised and upgraded over time, to ensure the structure remains viable for boat use with sea level rise and to continue to withstand wave overtopping and impacts during storms. Actions to preserve the Harbour additionally offer protection to the Sewage Treatment Plant behind. | Bellambi | 1 | As maintenance to revetment and boat ramp is required over time, or following storm damage | WCC NSW Public Works | Dependent on scale of works required (say \$1 – 2m) | 1.2 | See 'A2' Option in Sect.5.4.4 of CZM Study report |

Relevant Programs and Possible Funding Opportunities:

- NSW Government Coastal Management Program or other recreational boating/maritime/leisure-based funding program
- Other State and Federal Government Grants (especially climate change adaptation and resilience building funds)
- Council's routine asset maintenance and works program
- New Council levies or increased land rates
- Sydney Water Corporation funding, and responsible for own infrastructure costs
- Contributions from other infrastructure owners / managers (e.g. SWC at Bellambi Boat Harbour)



7 MONITORING (M)

Description:

The approach generally adopted for management of risks to existing assets and infrastructure is to wait until the risks have materialised to a level that is no longer considered tolerable (i.e. it reaches a 'trigger' level) before acting. Monitoring of key indicators is therefore necessary in order to determine when the 'trigger' has been reached.

Beaches are expected to erode and accrete in response to individual storms or series of storm events, and intervening quiet periods. Superimposed on this erosion / accretion cycle, however, is expected to be a longer-term trend of shoreline recession, which is induced by projected sea level rise. Monitoring of beach profiles is necessary to determine beach response to storms, and also to identify any underlying recession signals.

Most triggers for action presented in this Implementation Action Plan relate to the proximity of the Zone of Reduced Foundation Capacity (ZRFC) to a structure. The ZRFC is important for structures, as erosion scarps in dune sands will slump to a more stable dune profile shortly after a storm event, which may impact upon the area landward behind the erosion scarp. This zone is determined based on the landward erosion position, the erosion scarp slope, the dune or land height and the back beach material. It is noted that the ZRFC defined in Cardno (2010) assumes the back beach comprises dune sands. While the back beach area may comprise materials of greater structural integrity (which may reduce the ZRFC extent), for simplicity of monitoring, calculation of the ZRFC should assume the back beach and dunes comprise sand.

Other monitoring is also recommended, relating to coastal processes and responses to catchment rainfall and ocean storm conditions, including coastal inundation.



Monitoring is also important in the evaluation of the effectiveness of the Management Plan. As part of the monitoring, and as detailed further in Section 19, the risk evaluation process used to prioritise coastal risks should be repeated in the future to ensure that the highest priority risks always remain the focus of the CZMP.

Monitoring aims to help address a wide range of 'high' or 'extreme' risks across multiple beaches at the current timeframe (2011). As such, all actions associated with the monitoring strategy take highest priority (i.e. Priority ranking '1')

Risks Addressed by Implementation of Strategy:

Monitoring will not address identified risks specifically. Instead, monitoring will support the implementation of other strategies, will be used to define triggers for future action, and will provide information for future analysis and re-evaluation of risks as climate change impacts manifest.

| Action List: | | | | | | | | |
|--------------|---|--|----------|---|------------------|---|----------------------|---|
| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
| M.1 | Monitor beach profile and distance of immediate impact zone and ZFRC from structural assets located behind the beach. Regular survey profiles should be established at approximately 100 metres along each beach, and adjacent to significant assets (e.g. seawalls, surf clubs, pavilions, cycleways, residences at risk). | All beaches, especially Thirroul Pool and Pavilion, Woonona (Beach Dr), and Sandon Point (Trinity Row) | 1 | 2012, and minimum 6 months thereafter, and immediately after storm events | WCC | Staff time only (internal cost of about \$20,000 per year) | Nil | See 'NR14' Option in Sect.5.4.1 of CZM Study report |



| Monitor | RING (M) | G (M) 23 | | | | | | | | | | |
|---------|---|---|----------|---|------------------|--|----------------------|---|--|--|--|--|
| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. | | | | |
| M.2 | Monitor lagoon / coastal creek entrance breakout level, frequency and berm height, as sea level rise (including recession) impacts upon the entrance configuration. | Stanwell Park (Hargraves & Stanwell Cks); Thirroul (Flanagans Ck); McCauleys (Hewitts & Tramway Cks); Sandon Pt (Slacky Ck); Bulli (Whartons and Collins Ck); Bellambi Gully; Bellambi Lagoon; Fairy Lagoon | 1 | Berm heights to be captured by beach profile monitoring | WCC | Staff time only | Nil | See 'NR14' Option in Sect.5.4.1 of CZM Study report | | | | |
| M.3 | Monitor frequency, depth and spatial extents of coastal inundation events. | Priority locations include: Stanwell Park (Hargraves & Stanwell Creeks); Thirroul (Flanagans & Thomas Gibson Creeks), Bulli (Whartons Creek), Woonona, Bellambi Lagoon, and Fairy Lagoon. | 1 | Event-based monitoring | WCC | Staff time only | nil | See 'NR14' Option in Sect.5.4.1 of CZM Study report | | | | |
| M.4 | Re-run risk assessment based on monitoring results and revise management response if risk level changes (i.e. increase or decrease in level of risk). | All beaches | 1 | After 5 – 10 years of monitoring | WCC | Staff time only, or minor sub- consultancy (up to \$25,000) | M.1 – M.3 | See 'NR14' Option in Sect.5.4.1 of CZM Study report | | | | |

Relevant Programs and Possible Funding Opportunities:

- State Government Coastal Management Program (particularly for re-evaluation of risks in future)
- Council's routine monitoring and works program •
- New Council levies or increased land rates ٠
- Contributions from Sydney Water Corporation and other infrastructure owners (managers (where monitoring also determines on-going risks to non-Council assets and infrastructure)



8 OCEAN POOLS (P)

Description:

Wollongong is privileged to have a number of ocean pools along the coastline, which are mostly constructed on intertidal rock platforms. The pools are heritage listed as they date back to settlement of the Wollongong area. Given their age, they require reasonable annual maintenance to keep them functional. Bulli Pool is particularly vulnerable to sand build-up, and has required regular (~ 6 monthly) works to remove the sand from inside the pool.

Most pools are already overtopped during high tides, however, with future sea level rise, the pools will essentially become permanently submerged unless works are undertaken to raise the walls in line with future ocean levels. Given that the Wollongong Northern Beaches community is well served by no less than nine ocean pools, some rationalisation may be required in terms of future sea level rise accommodation works, with some pools raised and some pools abandoned.

Weighing into this decision is the current condition of each pool, and the ability of the structure to accommodate necessary structural modifications associated with raising of the walls.

Thirroul Pool is located behind the existing seawall in the middle of Thirroul Beach. It is possible for Thirroul Pool (and the heritage listed Thirroul Pavilion) to be relocated landward, further away from the existing and future potential erosion zone. An economic assessment carried out as part of the CZM Study (refer Appendix F of CZM Study) found that the amenity value of Thirroul Beach itself far outweighed the costs of relocating the structures further landward (Thirroul Pool, Pavilion etc).

Coledale, Austinmer, Bellambi and Towradgi are at 'high' or 'extreme' levels of risk at the current timeframe (2011), and as such management of these pools takes highest priority (Priority level '1'). Those pools that won't reach 'high' or 'extreme' risks until 2050 or 2100 (e.g. Woonona Pool) are given a secondary priority (Priority level '2').



Risks Addressed by Implementation of Strategy:

| | Risk at 2011 | Risk at 2050 | Risk at 2100 | | Risk at 2011 | Risk at 2050 | Risk at 2100 |
|------------------------------------|-----------------|-----------------|-----------------|--|-----------------|-----------------|-----------------|
| Coalcliff Tidal Rock Pool (S end) | Medium | High | High | Bulli Pool | Medium | High | Extreme |
| Wombarra Rock Pool | Medium | Medium | High | Woonona Ocean Pool (Collins Pt) | Medium | High | Extreme |
| Coledale Rock Pool | High | Extreme | Extreme | Bellambi Pool | High | Extreme | Extreme |
| Austinmer Rock Pool | High | Extreme | Extreme | Towradgi Pool | High | Extreme | Extreme |
| Thirroul Pool (also heritage site) | High | Extreme | Extreme | Port Kembla Olympic Pool | High | Extreme | Extreme |
| Thirroul Pool office and amenities | High | Extreme | Extreme | Port Kembla Pool - Amenities/Kiosk/Lifeguard Tower | High | Extreme | Extreme |
| Thirroul Pool toilet | Medium | High | Extreme | | | | |
| Thirroul Pool storage shed (large) | Medium | High | Extreme | | | | |
| Thirroul Pool intake | High | Extreme | Extreme | | | | |
| | | | | | | | |

Refer accompanying CZM Study for beach by beach assessment of erosion/recession risks and inundation risks





| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estim Reso |
|------|--|---|--|---|------------------|-------------------------------------|
| P.1 | Undertake audit of all Ocean Pools in Wollongong LGA. The audit shall investigate the relative sensitivity of the pools to wave impacts and sea level rise, in addition to their current condition, maintenance regime, and community usage. Where necessary, future adaptation/modification should be identified (e.g. raise seaward parapet wall, modify inlet/outlet system etc.). The audit shall prioritise pools based on their ability to withstand hazard impacts versus maintenance regimes and other community needs. | Coalcliff Wombarra Coledale Austinmer Thirroul Bulli Woonona Bellambi Towradgi Port Kembla | 1 | 2012 or as soon as practical | WCC | Staff t |
| P.2 | Update / include ocean pools in Council's Asset Management Plan and, based on the outcomes of the audit, incorporate maintenance plans and priorities into forward works programs. If it is determined that Ocean Pool(s) cannot be progressively repaired to withstand wave and sea level rise impacts into the future, the pool(s) will need to be abandoned and slowly removed as they fail over time, and this should be contained in the Asset Management Plan. <i>Actions P.3 to P.5 apply if supported by the Asset Management Plan</i> | As above | 1 | 2012/3 or as soon as possible after Action P.1 | WCC | Staff t |
| P.3 | Undertake detailed design, assessment, planning and works to retrofit Ocean Pools in current locations to withstand impacts. The decision to progressively retrofit selected Ocean Pools over time to withstand wave and sea level rise impacts shall depend upon the suitability of pool condition for this purpose, based upon outcomes of Action P.1. It is likely Woonona Pool is more suitable to being maintained as the pool walls are already higher, buffering from sea level rise impacts. | Coalcliff Wombarra Coledale Austinmer Bulli Woonona Bellambi Towradgi | 2 2 1 1 2 2 2 1 1 1 | When damage to pool shell occurs OR the pool is being inundated at water levels lower than MSL OR as part of major asset refurbishment in accordance with the Asset Management Plan | WCC | Deper of wor (say \$ pool) |
| P.4 | Undertake detailed design, assessment, planning and works to relocate Thirroul Pool outside of hazard zone. Consideration will need to be given to ensure that a relocated Thirroul Pool retains heritage character and value. (See also Action SC.6) | Thirrou | 1 | When monitoring shows that ZRFC measured from erosion escarpment threatens pool foundations <u>OR</u> when pool reaches end of functional life and requires major refurbishment in accordance with Asset Management Plan. | | Deper of wor (say \$ |
| P.5 | Undertake detailed design, assessment, planning and works to raise Thirroul Pool intake. Thirroul Pool intake will be affected by inundation with sea level rise, and this impact will need to be accommodated (for example, raising the pipe line) if the structure cannot be relocated and the Pool is to be protected or retained in a similar form to present. | Thirroul | 1 | When Thirroul Pool undergoes major refurbishment / relocation as required OR when replacement / refurbishment of the Pool intake is required | | Appro \$100,0 |
| | Port Kembla Olympic Pool (+Amenities/Kiosk/Lifeguard Tower) – See Action S.9 | | | | | |

| ated Costs or Irces Reqd | Preceding Actions | Further Info. |
|--|---|--|
| me only | nil | See 'NR4' Option in Sect.5.4.1 of CZM Study report |
| me only | P.1 | See 'NR4' Option in Sect.5.4.1 of CZM Study report |
| dent on scale ks required 1 – 2m per | P.2 | See 'A2' Option in Sect.5.4.4 of CZM Study report |
| dent on scale ks required 2 – 4m) | P.2 M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |
| kimately 100 | P.4 unless intake affected before pool | See 'A2' Option in Sect.5.4.4 of CZM Study report |
| | | |



Relevant Programs and Possible Funding Opportunities:

- State and Federal Government Grants (especially climate change adaptation and resilience building funds)
- Council's routine asset maintenance and works program
- New Council levies or increased land rates
- Potential revenue generated from public entry to pool (Thirroul Pool only)

tem? Attachment A





9 PRIVATE LAND ACQUISITION (PL)

Description:

There are many private properties along the Wollongong Coastline that are potentially affected by existing and future coastal risks. Coastal inundation is considered a relatively low risk, as it is temporary and usually does not occur with destructive impacts. Storm erosion on the other hand is of much greater consequence, as loss of land or foundation capacity can completely destroy buildings and other assets located within the impact zone.

There are two existing residential dwellings that are at significant risk in the future from storm erosion, one located at Thirroul Beach, and the other located at McCauleys Beach. It is impractical to protect these individual properties without having significant impact on the overall beach amenity. These properties should therefore be returned to public ownership, and abandoned/sacrificed in the future as the beaches slowly recede.

Given the anticipated timeframe for impact, it is expected that these dwellings could continue to be occupied until erosion directly threatens their structural integrity. As such, they could be leased back so that residents can continue to enjoy the amenity they offer, and to help recover the costs of the market-priced acquisition.

Neither of the two properties are at 'high' or 'extreme' risk at the current timeframe (2011), and as such, actions associated with this strategy are given a secondary priority (i.e. Priority Level '2').

Risks Addressed by Implementation of Strategy:

| | Risk at 2011 | Risk at 2050 | Risk at 2100 |
|---|-----------------|-----------------|-----------------|
| Thirroul: Existing Residences 1 ppty at centre of beach | Medium | High | Extreme |
| McCauleys: Existing Residences 1 ppty at N end of beach | Medium | Medium | High |

Refer accompanying CZM Study for beach by beach assessment of erosion/recession risks and inundation risks

| Action | | | | | | | | |
|--------|---|--|----------|---|------------------|--------------------------------------|----------------------|--|
| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
| PL.1 | Voluntary buy back – lease back. Council to seek finance to acquire affected property, at market value, on a voluntary basis. Once under Council ownership, the property is then leased at market rates, as a way of recouping financial investment, until such time as the hazard impact is imminent. If the sale of the property is delayed significantly, then the market value of the property is likely to reduce due to the increasing coastal risks. Once the hazard impact is imminent, the property shall be demolished. | Thirroul – 1 property in middle of the beach | 2 | 2012 – consider options for financing of acquisition and commence consultation with landholder. Offer acquisition once funding becomes available. Arrange lease once under Council ownership. Terminate lease and demolish property when erosion impacts threaten building foundations or impacts are considered imminent (see Action M.1). | WCC | Current market value of property | Nil | See 'PR5' Option in Sect.5.4.3 of CZM Study report |





PRIVATE LAND ACQUISITION (PL)

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|------|---|---|----------|---|------------------|--------------------------------------|--|---|
| PL.2 | Voluntary acquisition. Council to seek finance to acquire affected property, at market value, on a voluntary basis. If the sale of the property is delayed significantly, then the market value of the property is likely to reduce due to the increasing coastal risks (thus incentive for private landholder to sell sooner). This action is an alternative to PL.1 if lease-back is not possible (meaning that recouping of acquisition costs also not possible). | Thirroul – 1 property in middle of the beach | 2 | If and when buy-back / lease-back option is determined to not be feasible, seek finance for voluntary acquisition. Offer acquisition once funding becomes available. <i>Property would be demolished upon</i> <i>acquisition. (see Action PL.5)</i> | WCC | Current market value of property | PL.1 | See 'PR4' Option in Sect.5.4.3 of CZM Study report |
| PL.3 | Voluntary buy back – lease back. Council to seek finance to acquire affected property, at market value, on a voluntary basis. Once under Council ownership, the property is then leased at market rates, as a way of recouping financial investment, until such time as the hazard impact is imminent. If the sale of the property is delayed significantly, then the market value of the property is likely to reduce due to the increasing coastal risks. Once the hazard impact is imminent, the property shall be demolished. | McCauleys Beach – 1 property at the northern end of the beach | 2 | 2012 – consider options for financing of acquisition and commence consultation with landholder. Offer acquisition once funding becomes available. Arrange lease once under Council ownership. Terminate lease and demolish property when erosion impacts threaten building foundations or impacts are considered imminent (see Action M.1). | WCC | Current market value of property | nil | See 'PR5' Option in Sect.5.4.3 of CZM Study report |
| PL.4 | Voluntary acquisition. Council to seek finance to acquire affected property, at market value, on a voluntary basis. If the sale of the property is delayed significantly, then the market value of the property is likely to reduce due to the increasing coastal risks (thus incentive for private landholder to sell sooner). This action is an alternative to PL.3 if lease-back is not possible (meaning that recouping of acquisition costs also not possible). | McCauleys Beach – 1 property at the northern end of the beach | 2 | If and when buy-back / lease-back option is determined to not be feasible, seek finance for voluntary acquisition. Offer acquisition once funding becomes available. <i>Property would be demolished upon</i> <i>acquisition. (see Action PL.5)</i> | WCC | Current market value of property | PL.3 | See 'PR4' Option in Sect.5.4.3 of CZM Study report |
| PL.5 | Demolish properties, following termination of any leasing arrangements (if Actions PL.1 and/or PL.3 were adopted) | Thirroul – 1 property in middle of the beach, and McCauleys Beach – 1 property at the northern end of the beach | 2 | Assuming properties are in public ownership, demolish property when monitoring shows that the ZRFC encroaches the building foundations. | WCC | Approx. \$50,000 | M.1 PL.1 or PL.2 and PL.3 or PL.4 | See 'PR4 and PR5' Options in Sect.5.4.3 of CZM Study report |

Relevant Programs and Possible Funding Opportunities:

- NSW Government Coastal Management Program
- NSW Government Coastal Lands Protection Scheme
- Other State or Federal Government Grants (especially climate change adaptation and resilience building funds)
- New Council levies or increased land rates
- Private financial institutions (e.g. banks) if lease-back arrangement can repay capital + interest.



10 ROADWAYS & PARKING (R)

Description:

Wollongong City is precariously positioned on the coastal plain that separates the Illawarra Escarpment from the Pacific Ocean. With distance north, the escarpment gets closer and closer to the coast, meaning that the coastal plain becomes narrower and narrower. Along the coastline, and particularly along the northern Wollongong Beaches, major and minor roads are positioned close to the coast. This culminates just north of Wollongong, wherein the coastal access road is perched hard against the sea cliffs, where the Illawarra Escarpment meets the ocean.

Lawrence Hargraves Drive is a major access road for the northern beaches, and is at risk of damage in the vicinity of Austinmer and Little Austinmer Beaches. Trinity Row at Sandon Point is also a major road positioned immediately behind the beach within the potential future erosion and recession zone. Other minor roads that mostly serve as access to local residences are also under threat at a number of locations along the coastline.

Where possible, roadways and parking should be relocated outside the areas of immediate coastal risk. Given the anticipated timeframe for impact, planning should commence now in earnest in order to reserve lands and access provisions for future road relocations.

No roadways are under an immediate (2011 timeframe) intolerable risk (i.e. 'high' or 'extreme' level of risk), and therefore, aside from planning actions, all actions associated with management of roadways and parking are given secondary priority (i.e. Priority ranking '2').



| Risk at 2011 | Risk at 2050 | Risk at 2100 | | Risk at 2011 | Risk at 2050 | Risk at 2100 |
|-----------------|---|--|--|---|---|--|
| Medium | Medium | High | Sandon Point Local Roads: Trinity Row, Ursula St, Alroy St | Medium | Medium | High |
| Medium | High | Extreme | Woonona Local Roads (Kurraba Rd) | Medium | Medium | High |
| Medium | Medium | High | Woonona Local Roads (Beach Drive, Liamina Ave, Robertson Rd, Dorrigo Ave) | Medium | Medium | High |
| Medium | High | Extreme | Bellambi Beach Local access road along coastline to Bellambi Boat Harbour (does not service houses, but provides access to Pool and Harbour) | Medium | High | Extreme |
| Medium | Medium | High | Towradgi Local Roads: Marine Parade (N end of beach) | Low | Medium | Medium |
| | Risk at 2011MediumMediumMediumMediumMedium | Risk at 2011Risk at 2050MediumMediumMediumHighMediumMediumMediumHighMediumHighMediumMedium | Risk at 2011Risk at 2050Risk at 2100MediumMediumHighMediumHighExtremeMediumMediumHighMediumHighExtremeMediumMediumHigh | Risk at 2011Risk at 2050Risk at 2100MediumMediumHighSandon Point Local Roads: Trinity Row, Ursula St, Alroy StMediumHighExtremeWoonona Local Roads (Kurraba Rd)MediumMediumHighWoonona Local Roads (Beach Drive, Liamina Ave, Robertson Rd, Dorrigo Ave)MediumHighExtremeBellambi Beach Local access road along coastline to Bellambi Boat Harbour (does not service houses, but provides access to Pool and Harbour)MediumMediumHighTowradgi Local Roads: Marine Parade (N end of beach) | Risk at 2011Risk at 2000Risk at 2100Risk at 2011MediumMediumHighSandon Point Local Roads: Trinity Row, Ursula St, Alroy StMediumMediumHighExtremeWoonona Local Roads (Kurraba Rd)MediumMediumMediumHighWoonona Local Roads (Beach Drive, Liamina Ave, Robertson Rd, Dorrigo Ave)MediumMediumHighExtremeBellambi Beach Local access road along coastline to Bellambi Boat Harbour (does not service houses, but provides access to Pool and Harbour)MediumMediumMediumHighTowradgi Local Roads: Marine Parade (N end of beach)Low | Risk at 2011Risk at 2000Risk at 2100Risk at 2010Risk at 2010Risk at 2010MediumMediumHighSandon Point Local Roads: Trinity Row, Ursula St, Alroy StMediumMediumMediumMediumHighExtremeWoonona Local Roads (Kurraba Rd)MediumMediumMediumMediumMediumMediumHighVoonona Local Roads (Beach Drive, Liamina Ave, Robertson Rd, Dorrigo Ave)MediumMediumMediumHighExtremeBellambi Beach Local access road along coastline to Bellambi Boat Harbour)MediumHighMediumHighTowradgi Local Roads: Marine Parade (N end of beach)LowMedium |

Refer accompanying CZM Study for beach by beach assessment of erosion/recession risks and inundation risks





ROADWAYS & PARKING (R)

Action List:

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|------|---|--|----------|--|------------------|---|----------------------|--|
| R.1 | Undertake traffic assessments to determine the feasibility and costs associated with redirection of traffic compared with redesign/protection of roadways at risk of recession. The assessments would be carried out for those local roads and major roads (Lawrence Hargrave Drive) that may be affected by recession in the future. The assessment needs to consider the broader impacts of redirected traffic and feasibility of maintaining access to residences. Redirection options may also include purchase of land to construct a new roadway connection. Where redirection is unlikely due to road/traffic constraints, protection and /or accommodation options for the roadway shall be considered as part of the traffic assessments. | Little Austinmer Austinmer Sandon Point Woonona Bellambi Towradgi | 1 | 2012 or as soon as practical | WCC | Staff time only or minor consultancy (say \$25,000) | nil | See 'NR5' Option in Sect.5.4.1 of CZM Study report |
| R.2 | Update local roads and major roads in Council's Asset Management Plan and, based on the outcomes of the traffic assessment, incorporate relocation/redirection and/or protection works into forward works programs. Actions R.3 to R.7 apply if supported by the Asset Management Plan. | As above | 1 | 2012/3 or as soon as possible after R.1 | WCC | Staff time only | R.1 | See 'NR5' Option in Sect.5.4.1 of CZM Study report |
| R.3 | Undertake detailed design, assessment, planning and works to relocate beach access road and carpark to beach. | Little Austinmer | 2 | When erosion impacts occur to roadway foundations | WCC | Less than \$50,000 | R.2 M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |
| R.4 | Undertake detailed design, assessment, planning and works to relocate Austinmer Boat Harbour carpark. As part of retaining a functioning boat harbour for the community, car parking facilities for boat users need to be retained. There is public open space landward of the current car park. Relocation to this site would need to be determined in conjunction with remodelling the harbour to remain functional with sea level rise inundation impacts (refer Action 1.4). | Sharkys | 2 | When erosion or wave overtopping damages carpark such that it is not functional OR when Harbour is being redesigned | WCC | Less than \$100,000 | R.2 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |
| R.5 | Undertake detailed design, assessment, planning and works to relocate roadway (Trinity Row). The ability to redirect traffic off Trinity Row will need to be confirmed through Action R.1. Residential access would be permitted, with through traffic directed elsewhere. The current roadway would be sacrificed to allow for planned retreat of the beach. | Sandon Point | 2 | when ZRFC from erosion escarpment encroaches upon Trinity Row | WCC | Approximately \$500,000 | R.2 M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |
| R.6 | Undertake detailed design, assessment, planning and works to relocate roadway (Kurraba Rd), based upon the outcomes of Action R.1. Access to residential properties must be retained. | Woonona | 2 | When ZRFC measured from erosion escarpment encroaches onto the roadway. | wcc | Approximately \$500,000 | R.2 M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |
| R.8 | Undertake detailed design, assessment, planning and works to relocate roadways (Beach Drive, Liamina Ave, Robertson Rd, Dorrigo Ave). | Woonona | 2 | When ZRFC measured from erosion escarpment encroaches onto the roadway. | WCC | Approximately \$500,000 | R.2 SP.3 M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |

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ROADWAYS & PARKING (R)

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. | | | | |
|---------------|--|-------------------|----------|---|------------------|--------------------------------------|----------------------|--|--|--|--|--|
| R.7 | Undertake detailed design, assessment, planning and works to relocate roadway (Marine Drive), as necessary. Marine Drive is currently at low risk, with impacts not expected for many years. Initiating plans to redirect the roadway at the present time assists future traffic planning. Access to residential properties will need to be maintained. | Towradgi | 2 | At scheduled time for asset maintenance OR when ZRFC measured from erosion escarpment encroaches onto building foundations or cabins, whichever is sooner | WCC | Less than \$100,000 | R.2 M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report | | | | |
| | See Action S.4 for: Austinmer Lawrence Hargrave Drive (Major Coastal Road) Austinmer Beach access and car park | | | | | | | | | | | |
| | Bellambi access road along coastline to Bellambi Boat Harbour – refer Action S.5 | | | × | × | | | | | | | |
| | WIN Stadium carparking – refer Action RF.4. | City | 2 | | | | | | | | | |
| <u>Releva</u> | WIN Stadium carparking - refer Action RF.4. City 2 Relevant Programs and Possible Funding Opportunities: • State and Federal Government Grants (especially climate change adaptation and resilience building funds) • Council's routine asset maintenance and works program • • New Council levies or increased land rates • | | | | | | | | | | | |

Relevant Programs and Possible Funding Opportunities:

- State and Federal Government Grants (especially climate change adaptation and resilience building funds)
- Council's routine asset maintenance and works program •
- New Council levies or increased land rates

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RECREATIONAL FACILITIES (RF) 11

Description:

There are many formal and informal recreational facilities located along the Wollongong Coastline. These include beach accessways, playgrounds, seating, campgrounds and tourist parks, and the WIN football stadium (note the cycleway and other major assets and infrastructure have been discussed separately). Recreational facilities also includes parklands and reserves, which can allow for natural retreat of the beach at the sacrifice of some parkland, without significant overall reduction in the functionality of the park. Allowing this natural retreat of the beach is the key to retaining a sandy beach for public enjoyment, the environmental and the economic benefits associated with the beach.

Recreational facilities (stand alone or within parks) require on-going maintenance and periodic replacement as they approach the end of their design life. As part of the Asset Management process that guides maintenance and remediation of Council assets, these facilities should be repaired as required following storm events, with the longer-term objective of relocation away from the area of immediate coastal risk (for example, relocating tourist cabins or picnic tables within a tourist park or reserve, to allow retreat of the beach). Given the anticipated timeframe for major impact on these facilities, it is expected that progressive landward relocation can be easily achieved as part of future upgrades and replacements.

No specific recreational facilities are under an immediate (2011 timeframe) intolerable risk (i.e. 'high' or 'extreme' level of risk), and therefore, most actions associated with management of recreational facilities are given secondary priority (i.e. Priority ranking '2'). The exception is the general maintenance and repair of existing minor facilities, such as beach access tracks, which is required after any major storm event, and as such, is given a Priority Level of '1'.



It is noted that there are a number of parks and reserves at low to medium risk to 2100. Based upon the low levels of risk, no specific action is required at the current time (indeed, some of these assets are affected by inundation, for which no action is likely

to be taken). Should impacts to these parks and reserves occur earlier than anticipated, again, repair storm damage to minor recreational facilities, access tracks etc to maintain public safety would occur in accordance with the EASP.

Risks Addressed by Implementation of Strategy:

| Risk at 2011 | Risk at 2050 | Risk at 2100 | | Risk at 2011 | Risk at 2050 | Risk at 2100 |
|-----------------|--|--|--|---|---|---|
| Medium | Medium | High | McCauleys Beach Reserve | High | Extreme | Extreme |
| Medium | Medium | High | Sandon Point Beach Reserve (not including Sandon Point Heritage area) | Medium | Medium | High |
| Medium | Medium | High | Bulli Beach Reserve, Ocean Park (Bulli Beach) | Medium | Medium | High |
| Medium | Medium | High | Bulli Tourist Park (caravan park) | Medium | Medium | High |
| Medium | Medium | High | Woonona: Collins Point Reserve, Woonona Beach Reserve, Beach Drive Park | Medium | Medium | High |
| Medium | Medium | High | Bellambi: Beach Drive Park, Bellambi Natural Area, Bellambi Point Reserve, Bellambi Pool Reserve | Medium | Medium | High |
| Medium | Medium | High | Stuart Park (on heritage list, local significance) | Medium | High | Extreme |
| Medium | Medium | High | City Beach: Open space, parks including City Beach Foreshore | Medium | Medium | High |
| Medium | High | Extreme | City Beach: Football Ground (WIN Stadium) and Showground | High | Extreme | Extreme |
| Medium | Medium | High | Coniston: Wollongong Golf Course ** for inundation, this is only a very small section at far south end. | Medium | Medium | High |
| | RISK at 2011 Medium Medium | Risk at 2011Risk at 2050Medium | Risk at 2011Risk at 2100MediumHighMediumHighMediumHighMediumHighMediumHigh | Risk at 2011Risk at 2050Risk at 2100MediumMediumHighMcCauleys Beach ReserveMediumMediumHighSandon Point Beach Reserve (not including Sandon Point Heritage area)MediumMediumHighBulli Beach Reserve, Ocean Park (Bulli Beach)MediumMediumHighBulli Tourist Park (caravan park)MediumMediumHighBulli Tourist Park (caravan park)MediumMediumHighBellambi: Beach Drive Park, Bellambi Natural Area, Bellambi Point Reserve, Bellambi Pool ReserveMediumMediumHighStuart Park (on heritage list, local significance)MediumMediumHighCity Beach: Open space, parks including City Beach ForeshoreMediumHighCity Beach: Football Ground (WIN Stadium) and ShowgroundMediumHighConiston: Wollongong Golf Course ** for inundation, this is only a very small section at far south end. | Risk at 2011Risk at 2000Risk at 2100Risk at 2011MediumMediumHighMcCauleys Beach ReserveHighMediumMediumHighSandon Point Beach Reserve (not including Sandon Point Heritage area)MediumMediumMediumHighBulli Beach Reserve, Ocean Park (Bulli Beach)MediumMediumMediumHighBulli Tourist Park (caravan park)MediumMediumMediumHighBulli Tourist Park (caravan park)MediumMediumMediumHighWoonona: Collins Point Reserve, Woonona Beach Reserve, Beach Drive ParkMediumMediumMediumHighBellambi: Beach Drive Park, Bellambi Natural Area, Bellambi Point Reserve, BellambiMediumMediumMediumHighStuart Park (on heritage list, local significance)MediumMediumMediumHighCity Beach: Open space, parks including City Beach ForeshoreMediumMediumHighExtremeCity Beach: Football Ground (WIN Stadium) and ShowgroundHighMediumHighList AreaConiston: Wollongong Golf Course ** for inundation, this is only a very small section at farMedium | Risk at 2010Risk at 2000Risk at 2000Risk at 2010Risk at 2011Risk at 2010MediumMediumHighMcCauleys Beach ReserveHighExtremeMediumMediumHighSandon Point Beach Reserve (not including Sandon Point Heritage area)MediumMediumMediumMediumHighBulli Beach Reserve, Ocean Park (Bulli Beach)MediumMediumMediumMediumMediumHighBulli Tourist Park (caravan park)MediumMediumMediumMediumMediumHighWoonona: Collins Point Reserve, Woonona Beach Reserve, Beach Drive ParkMediumMediumMediumMediumHighBellambi: Beach Drive Park, Bellambi Natural Area, Bellambi Point Reserve, BealMediumMediumMediumMediumHighStuart Park (on heritage list, local significance)MediumMediumHighMediumHighCity Beach: Open space, parks including City Beach ForeshoreMediumMediumMediumMediumHighCity Beach: Football Ground (WIN Stadium) and ShowgroundHighExtremeMediumMediumHighConistor: Wollongong Golf Course ** for innundation, this is only a very small section at at a south end.MediumMedium |

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Action List:

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|------|---|---|----------|---|---|--|----------------------|--|
| RF.1 | Within the context of accepting loss (sacrifice) of park land to allow natural retreat of beaches into parklands behind, repair storm damage to minor recreational facilities, access tracks etc on an as- needed basis to maintain public safety. Where damage is extensive, consider abandoning and relocating assets and access as described in other actions. | Stanwell Park Coalcliff Coledale Sharkys Little Austinmer Austinmer Thirroul McCauleys Sandon Point Bulli Woonona Bellambi Bellambi Bellambi Pt Corrimal Towradgi Fairy Meadow City Coniston Perkins | 1 | As needed following damaging erosion and/or inundation events | WCC, WCC in co- ordination with facilities owner for Golf Course land | Dependent on the degree and extent of storm damage. Assume damage would be relatively minor, else the facilities would be relocated and replaced | nil | See 'PR1' Option in Sect.5.4.3 of CZM Study report |
| RF.2 | Physically relocate/reposition Bulli tourist cabins. Tourist cabins are typically low key structures that are relatively easily relocatable. | Bulli | 2 | When ZRFC measured from erosion escarpment encroaches onto cabins foundations | WCC | Less than \$100,000 | M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |
| RF.3 | Undertake detailed design, assessment, planning and works to relocate WIN Stadium parking and ancillary buildings and minor football ground outside of hazard zone. There is potential to reconfigure the football ground landward to avoid hazards impacts. The actual WIN Stadium is currently at very low risk but parking and other small buildings adjacent would need to be relocated. | Coniston | 2 | When erosion escarpment encroaches on the assets | WCC to advise facilities owner of risk and encourage adoption of this action in consultation with WCC. | More than \$500,000 | M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |
| | Thirroul Beach Reserve – see Action S.1 | °. | | | | | | |
| | Austinmer Beach Reserve and Tuckermans Park – see Action S.1 and Action S.4 | | | | | | | |
| | Stuart Park (North Beach) – see Action S.8 | | | | | | | |

Relevant Programs and Possible Funding Opportunities:

- State and Federal Government Grants (especially climate change adaptation and resilience building funds)
- Council's routine asset maintenance and works program
- Funding of private works by private facilities owners



SEAWALLS & TRAINING WALLS (S) 12

Description:

There are a few coastal structures located along the Wollongong Coastline that offer protection to land and assets behind the structures to varying degrees of assurance. These include seawalls at Austinmer Beach, Thirroul Beach, Bellambi Beach (behind Bellambi Pool), Bellambi Boat Harbour and boat ramp, North Beach (from Pavilion to the kiosk) and Perkins Beach (at Port Kembla Olympic Pool). There are reports of a possible structure at Scarborough Beach, however details are minimal. Note that there are also extensive seawalls and breakwater structures at Port Kembla Harbour, which are under the direct management responsibility of Port Kembla Port Corporation (PKPC), and as such, are excluded from this CZMP.

The condition of the existing seawalls is expected to be variable, especially for the older structures. Foundation conditions are largely unknown. Storms in 1974 depleted many beaches of sand, and exposed the foundation piles of the structure at Thirroul Beach. The structure at North Beach adjacent to the North Beach Pavilion is currently being replaced.

The Lake Illawarra Entrance training walls have been constructed recently in order to provide a more consistent water level within the lake (the prolonged drought conditions in the early 2000's resulted in lake levels falling more than half a metre below normal ocean levels, causing extensive die-off of algae and seagrass). Whilst the design of these walls considered future sea level rise, on-going maintenance of the structures will still be required as overtopping frequency increases. Raising of the walls may be considered necessary in the future to minimise on-going damage.

Management of seawalls and training walls that are at 'high' or 'extreme' levels of risk at the current timeframe (2011) takes highest priority (i.e. Priority ranking '1'), while actions to address 'high' or 'extreme' risks that won't materialise until 2050 or 2100 are given secondary priority (i.e. Priority ranking '2').



Property Risk Categories (in accordance with the Coastal Protection Regulation, 2011) for private properties affected by erosion and recession; and Property Response Categories (in accordance with DECCW 2010) that outlines the potential for response in terms of protection works only for such private properties is listed in Appendix A. It is noted that this CZMP has adopted a far more detailed assessment of risk, and investigated many alternative actions additional to protection options. Thus, for Council's use, a summary table of recommended current and future actions for all private properties at risk to 2100 is given in Appendix A.

Risks Addressed by Implementation of Strategy:

| | Risk at 2011 | Risk at 2050 | Risk at 2100 | | Risk at 2011 | Risk at 2050 | Risk at 2100 |
|--|-----------------|-----------------|-----------------|--|-----------------|-----------------|-----------------|
| Austinmer Beach | | | | Thirroul cont. | | | |
| Austinmer Beach Reserve and Tuckermans Park | Medium | Medium | High | Existing Residences (8 ppty at S end of beach, plus 8 ppties for geotechnical hazards extending along headland to McCauleys) | Medium | High | Extreme |
| Austinmer Surf Club | Medium | High | Extreme | Bellambi | | | |
| Heritage Site: Norfolk Island Pines (backing entire beach) | Medium | Medium | High | Cycleway / Shared Pathway (S of Bellambi Gully entrance) | Medium | Medium | High |
| Austinmer changeroom & toilets | Low | Medium | Medium | Bellambi Pool Toilet Block | Low | Medium | Medium |
| Austinmer Boatshed | Low | Low | Low | Bellambi Pool car park | Low | Medium | Medium |





| SEAWALLS & TRAINING WALLS (S) | | | | | | | 3 |
|--|-----------------|-----------------|-----------------|---|-----------------|-----------------|-----------------|
| | Risk at 2011 | Risk at 2050 | Risk at 2100 | | Risk at 2011 | Risk at 2050 | Risk at 2100 |
| Austinmer War Memorial (Heritage Site) | High | Extreme | Extreme | Bellambi Beach Local access road along coastline to harbour (does not service houses) | Medium | High | Extreme |
| Lawrence Hargrave Drive (Major Coastal Road) at Austinmer | Medium | High | Extreme | Bellambi Point | | | |
| Austinmer beach access and car park | Medium | Medium | High | Stormwater outlets and pipes (adjacent to STP) | High | Extreme | Extreme |
| Stormwater outlets and pipes at Austinmer | High | Extreme | Extreme | Sewage Treatment Plant | High | Extreme | Extreme |
| Thirroul Beach | | | | North Beach | | | |
| Thirroul Surf Club | High | Extreme | Extreme | Stuart Park (on heritage list, local significance) | Medium | High | Extreme |
| Thirroul Pool (also heritage site) | High | Extreme | Extreme | Public open space adjacent to Pavilion, Kiosk | Low | Medium | Medium |
| Thirroul Pool office and amenities | High | Extreme | Extreme | North Beach Surf Club | High | Extreme | Extreme |
| Thirroul Pool toilet | Medium | High | Extreme | Heritage Site: North Beach Kiosk | Low | Medium | High |
| Thirroul Pool storage shed (large) | Medium | High | Extreme | Cycleway / Shared Pathway (includes heritage railway cuttings and embankments) | Medium | High | Extreme |
| Heritage site: Thirroul Pavilion (being used as kiosk / restaurant) and residence | High | Extreme | Extreme | Stormwater outlets / pipes (adjacent to Pavilion) | High | Extreme | Extreme |
| Heritage Site: Thirroul Beach Reserve (S of pool) | Medium | High | Extreme | Perkins Beach | · | · | |
| Local Roads (Bath St) | Low | Medium | Medium | Port Kembla Olympic Pool | High | Extreme | Extreme |
| Beach access and car park (S end of Beach) | Low | Low | Medium | Port Kembla Pool - Amenities/Kiosk/Lifeguard Tower | High | Extreme | Extreme |
| Stormwater outlet to Flanagans Creek | Medium | High | High | Stormwater outlets & pipes (one adjacent to Port Kembla Pool) | High | Extreme | Extreme |
| Thomas Gibson Creek - Major stormwater outlet | High | Extreme | Extreme | Lake Illawarra Training Walls | High | Extreme | Extreme |
| Refer accompanying CZM Study for beach by beach assessment of erosion/recession risk | s and inund | lation risks | | | | | |
| Action List: | \bigcirc | 7 | | | | | |

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|------|---|--|----------|--|------------------|--|----------------------|--|
| S.1 | Conduct audit (dilapidation survey) of existing seawall structures and training walls, to determine their current condition, effectiveness, expected functional life, and future potential to mitigate storm erosion and wave overtopping under higher sea levels. The audit should be used to guide subsequent decisions at the relevant beaches, including future replacement with seawall protection or "manage to fail" (planned retreat) options. | Scarborough Austinmer Thirroul Bellambi Bellambi Pt North Perkins Lake Illawarra Entrance | 1 | 2012 Repeated on a 5 – 10yr cycle (or shorter for structures nearing the end of their functional life). | WCC | Staff time only, or minor consultancy (say \$20,000) | nil | See 'NR2' Option in Sect.5.4.1 of CZM Study report |

| 2 | E |
|---|---|
| J | J |



SEAWALLS & TRAINING WALLS (S)

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|------|--|--|----------|---|---|--|----------------------|--|
| S.2 | Update hazard estimates for 2010, 2050 and 2100 where relevant to account for existing seawall protection, and update this action list, as necessary, to account for condition (life) of existing seawalls | As above | 1 | 2012/3 (as soon as practical following Action S.1). | WCC | Staff time only or consultant | S.1 | See 'NR2' Option in Sect.5.4.1 of CZM Study report |
| S.3 | Add seawalls and training walls to Council's Asset Management Plan, and based on the outcomes of the audit, incorporate remediation, maintenance and replacement works into forward works programs. Actions S.4 to S.9 apply if supported by the Asset Management Plan. | As above | 1 | 2012/3 (as soon as practical following Action S.1). | wcc | Staff time only | S.1 | See 'NR2' Option in Sect.5.4.1 of CZM Study report |
| S.4 | Undertake detailed design, site investigations, approvals and works associated with repair or replacement of existing seawall along existing alignment, and associated beach nourishment. The design and approvals shall describe ongoing maintenance arrangements for any replacement structure and management of offsite impacts from the structure. | Austinmer | 1 | When end of functional life is reached (refer Action S.3) OR when wall is structurally damaged by storm event, whichever is sooner. | WCC WCC to advise RTA of risks and lobby for funding assistance, as this action additionally protects an RTA road. | Depending on scope of works. An entirely new wall may be up to \$3.5m | S.3 | See 'S1' Option in Sect.5.4.2 of CZM Study report |
| S.5 | Undertake detailed design, site investigations, and approvals as necessary for maintenance and upgrading works of existing seawall along existing alignment, and extension of wall along shoreline section between Bellambi Boat Harbour and Pool. The upgrade design shall provide for protection from wave overtopping; and shall describe adequate arrangements for ongoing maintenance management of impacts from the structure. There is potentially bedrock below the site that could form suitable foundations e.g. between the Pool and Harbour along the roadway. | Bellambi, from Bellambi Gully entrance to Bellambi Pool, then to Bellambi Boat Harbour | 2 | On as needs basis for asset maintenance (refer Action A.3) or to repair storm damage (e.g. to roadway). | WCC WCC to advise SWC of risks and lobby for funding assistance, as this action additionally protects SWC assets and land. | Depending on scope of works. Indicative budget of \$1m | S.3 | See 'S2' Option in Sect.5.4.2 of CZM Study report |
| S.6 | Undertake detailed design, site investigations, and approvals as necessary for maintenance and upgrading works of existing seawall along existing alignment. Specific provision of stormwater outlet required in design of upgrading. The upgrade design shall also describe ongoing maintenance arrangements and management of offsite impacts from the structure. | Bellambi Pt along the boundary of the Sewage Treatment Plant between Bellambi Lagoon and Bellambi Point | 1 | On as needs basis for asset maintenance (refer Action A.3) or to repair storm damage. | WCC to advise SWC of risks and lobby for whole or partial funding for this action that protects SWC assets and land. | Depending on scope of works. Indicative budget of \$0.5m | S.3 | See 'S2' Option in Sect.5.4.2 of CZM Study report |
| S.7 | Undertake detailed design, site investigations, approvals and works associated with the construction of new seawall sections, to the south of North Beach Pavilion, and to north to replace the existing crib-lock wall. The seawall design shall provide for protection from wave overtopping. Design and approvals shall also describe ongoing maintenance arrangements and management of offsite impacts from the structure. | North Beach, (along cycleway to south of Pavilion and to north past existing SLSC, replacing existing crib-lock wall | 1 | 2012: detailed designs and planning approvals. Construct crib-wall replacement section subject to audit outcomes (refer Action S.1) and works program (refer Action S.3). Construct section following next major storm erosion event. | WCC | Depending on scope of works, but expected to be in the order of \$2 million | S.3 | See 'S2' Option in Sect.5.4.2 of CZM Study report |



SEAWALLS & TRAINING WALLS (S)

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|------|--|---|----------|---|---|--|----------------------|---|
| S.8 | Undertake detailed design, site investigations, approvals and works associated with the construction of a new seawall section along specified alignment to retain salient and Stuart Park. Design and approvals shall also describe ongoing maintenance arrangements and management of offsite impacts from the structure. | North Beach: short wall section along salient landward of nearshore reef at seaward edge of Stuart Park | 2 | When monitoring indicates commencement of ongoing recession at salient behind nearshore reef on North Beach. | WCC | Depending on scope of works, but expected to be in the order of \$2 million | M.1 | See 'S2' Option in Sect.5.4.2 of CZM Study report |
| S.9 | Undertake detailed design, site investigations, and approvals as necessary for maintenance and upgrading works of existing seawall along existing alignment. Specific provision of stormwater outlet required in design of upgrading. The upgrade design shall also describe ongoing maintenance arrangements and management of offsite impacts from the structure. | Perkins (adjacent to Port Kembla Olympic Pool) | 1 | On as needs basis for asset maintenance (refer Action A.3) or to repair storm damage. | WCC | Depending on scope of works. Indicative budget of \$0.5m | S.3 | See 'S2' Option in Sect.5.4.2 of CZM Study report |
| S.10 | Redesign or retrofit Lake Illawarra Training Walls in current location to withstand impacts, such as through increasing their height and replacing or enhancing armour stone to ensure the training walls remain intact overtime. | Lake Illawarra Entrance | 1 | When end of functional life is reached (refer Action S.3) OR when wave breaking destabilises armour stone OR when frequency of overtopping presents significant risk to pedestrian and boating public. | LIA | In the order of \$1m for significant raising of training wall height. | S.3 | See 'A2' Option in Sect.5.4.4 of CZM Study report |
| S.11 | Undertake detailed design, site investigations, approvals and works associated with the construction of new seawall sections connecting along the headland from Thirroul to McCauleys Beach. The seawall design shall provide for protection from wave overtopping. Design and approvals shall also describe ongoing maintenance arrangements and management of offsite impacts from the structure. As the seawall only protects private property, in accordance with Section 55 of the <i>Coastal Protection Act 1979</i> , Council can require construction and ongoing maintenance to be funded by the private property owners. | Southern end of Thirroul to McCauleys headland, covering 16 properties, for both erosion (8 ppties) and geotechnical hazards (8 ppties). | 2 | Prior to redevelopment / upgrading of any development identified as "at risk" or when the Immediate Impact Zone (including foundation stability allowance) intersects existing buildings. | Private property owners are responsible for seawall construction and maintenance. Seawalls must be constructed on private land only, not public land. WCC responsible for development assessment. | Depending on scope of works. Indicative budget of \$1m. | nil | See 'S2' Option in Sect.5.4.2 of CZM Study report |

Relevant Programs and Possible Funding Opportunities:

- State and Federal Government Grants (especially climate change adaptation and resilience building funds)
- RTA funding (for on-going protection of Lawrence Hargrave Dr) •
- Sydney Water Corporation funding (for on-going protection of STP directly through works on Bellambi Pt, and indirectly through works to protect roadway between Pool and Harbour) •
- Lake Illawarra Authority funding (for retrofit of Lake Illawarra Entrance training walls as required)
- Council's routine asset maintenance and works program ٠
- New Council levies or increased land rates ٠



13 SURF CLUBS & PUBLIC BUILDINGS (SC)

Description:

Surf Club buildings are generally located immediately behind beaches to provide easy access for lifesaving crews and equipment, as well as commanding views over patrolled and unpatrolled sections of beach. This unfortunately means that the buildings are usually at risk of coastal inundation and storm erosion. With future sea level rise, many of the Surf Club buildings will also be at risk from shoreline recession.

The Surf Club buildings along the Wollongong coastline are in variable condition. City Beach Surf Club has recently been constructed, while there are plans in place for the imminent refurbishment of Sandon Point Surf Club building. A relocatable lifeguard structure is intended for Coledale, which would allow for the structure to be moved landward when beach conditions threaten to impact on the structure.

Other public buildings, such as Pavilions, Kiosks and amenities building are also at risk from current and future coastal erosion and shoreline recession. Relocation (i.e. rebuilding on a more landward site) at the end of their functional life is a viable option for many of these structures. A few of these structures are heritage-listed (e.g. Thirroul Pavilion, North Beach Pavilion, North Beach Kiosk), signifying their importance to the local community. Relocation of these structures to avoid loss and damage in the future may be a viable option.

Management of Surf Clubs and Public Buildings that are at 'high' or 'extreme' levels of risk at the current timeframe (2011) takes highest priority (i.e. Priority ranking '1'), while actions to address 'high' or 'extreme' risks that are not expected to materialise until 2050 or 2100 are given secondary priority (i.e. Priority ranking '2').



Risks Addressed by Implementation of Strategy:

| | Risk at 2011 | Risk at 2050 | Risk at 2100 | | Risk at 2011 | Risk at 2050 | Risk at 2100 |
|---|-----------------|-----------------|-----------------|---|-----------------|-----------------|-----------------|
| Helensburgh / Stanwell Park SLSC | Medium | High | Extreme | Sandon Point Surf Club | High | Extreme | Extreme |
| Coalcliff Surf Club | Low | Medium | Medium | Bulli Surf Club | High | Extreme | Extreme |
| Coledale Surf Club | Low | Medium | Medium | Bulli Kiosk and residence | Medium | Medium | High |
| Coledale Beach Camping Reserve - Amenities Building | Low | Medium | Medium | Woonona Surf Club | Low | Medium | High |
| Austinmer Surf Club | Medium | High | Extreme | Bellambi Surf Club (affected by inundation) | Medium | High | Extreme |
| Austinmer Boatshed (affected by wave overtopping) | Medium | Medium | High | Corrimal Surf Club (affected by inundation) | Medium | Medium | High |
| Thirroul Surf Club | High | Extreme | Extreme | Fairy Meadow SLSC Lifeguard Tower | Low | Medium | Medium |
| Thirroul Pavilion (Heritage site: currently being used as kiosk / restaurant and residence) | High | Extreme | Extreme | North Beach Kiosk (Heritage Site) | Low | Medium | High |
| Thirroul: Former Quest House (heritage site) affected by inundation | Medium | High | Extreme | | | | |

Refer accompanying CZM Study for beach by beach assessment of erosion/recession risks and inundation risks



SURF CLUBS & PUBLIC BUILDINGS (SC)

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|------|---|--|----------|--|------------------|--|----------------------|--|
| SC.1 | Conduct audit (dilapidation survey) of substantial public buildings (including Surf Clubs) to determine current condition, as well as site constraints for future redevelopment, including foundation capacity, and land availability to relocate the structures. Where the site is constrained, the audit shall identify the possibility of replacement with a relocatable structure. The outcomes of the audit shall specify for each asset the future action being "relocate", "redesign", "retrofit" or "relocatable". The audit shall also make note of suitable triggers for implementation of future action, and guide implementation of future works on these public structures. | Helensburgh Surf Club Coalcliff Surf Club Coledale Surf Club Coledale Camping Amenities Austinmer Boatshed Austinmer Surf Club Thirroul Surf Club Thirroul Pavilion Sandon Pt Surf Club Bulli Surf Club Bulli Kiosk Woonona Surf Club Bellambi Surf Club Corrimal Surf Club North Beach Kiosk North Beach Pavilion | 1 | 2012 or as soon as practical | WCC | Staff time only, or minor consultancy (say \$30,000) | nil | See 'NR3' Option in Sect.5.4.1 of CZM Study report |
| SC.2 | Add public buildings (including Surf Clubs) to Council's Asset Management Plan, and based on the outcomes of the audit, incorporate remediation, maintenance and replacement works into forward works programs, with specific notification of "relocate", "redesign", "retrofit" or "relocatable". <i>Actions SC.3 to SC.17 apply if supported by the Asset Management Plan.</i> | As above | 1 | 2012/13 (as soon as practical following Action SC.1) | WCC | Staff time only | SC.1 | See 'NR3' Option in Sect.5.4.1 of CZM Study report |
| SC.3 | Undertake detailed design, site investigations, and approvals as necessary to relocate and redesign Coledale SLSC to withstand coastal impacts, particularly inundation (the proposed relocatable lifeguard structure at Coledale reduces need to have clubhouse in close proximity to the shoreline, enabling relocation, subject to outcomes of SC.1) | Coledale | 2 | When monitoring shows that ZRFC measured from erosion escarpment threatens building foundations <u>OR</u> when building reaches end of functional life and requires major refurbishment. | WCC | More than \$500,000 | SC.2 | See 'A3' Option in Sect.5.4.4 of CZM Study report |
| SC.4 | Undertake detailed design, site investigations, and approvals as necessary to relocate Helensburgh / Stanwell Park SLSC outside of hazard zone. There are likely to be some site constraints (Norfolk Is Pine) that limit relocating the surf club (subject to audit – SC.1). | Stanwell Park | 2 | When monitoring shows that ZRFC measured from erosion escarpment threatens building foundations <u>OR</u> when building reaches end of functional life and requires major refurbishment. (within 20 years expected) | WCC | More than \$500,000 | SC.2 M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |
| SC.5 | Undertake detailed design, site investigations, and approvals as necessary to redesign or retrofit construction of Austinmer SLSC in current location to withstand coastal impacts, such as wave impacts and inundation. Design parameters for the structure (e.g foundation requirements) will be dependent upon the presence and condition of a seawall structure (refer Action S.4). Subject to outcomes of audit (Action SC.1), relocation of the SLSC is unlikely due to land constraints. | Austinmer | 2 | When monitoring shows that ZRFC measured from erosion escarpment threatens building foundations <u>OR</u> when building reaches end of functional life and requires major refurbishment. (within 20 years expected) | WCC | More than \$500,000 | SC.2 M.1 | See 'A2' Option in Sect.5.4.4 of CZM Study report |



SURF CLUBS & PUBLIC BUILDINGS (SC)

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|-------|---|-------------------|----------|---|------------------|--------------------------------------|----------------------|--|
| SC.6 | Undertake detailed design, site investigations, and approvals as necessary to relocate Thirroul Pavilion outside of hazard zone. Consideration will need to be given to ensure that a relocated Thirroul Pavilion retains heritage character and value (i.e. by physically moving existing structure). | Thirroul | 1 | When monitoring shows that ZRFC measured from erosion escarpment threatens building foundations <u>OR</u> when building reaches end of functional life and requires major refurbishment. (within 20 years expected) | WCC | More than \$500,000 | SC.2 M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |
| SC.7 | Undertake detailed design, site investigations, and approvals as necessary to relocate Thirroul SLSC outside of hazard zone (i.e. by constructing a new replacement structure). | Thirroul | 1 | When monitoring shows that ZRFC measured from erosion escarpment threatens building foundations <u>OR</u> when building reaches end of functional life and requires major refurbishment. | wcc | More than \$1m | SC.2 M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |
| SC.8 | Undertake detailed design, site investigations, and approvals as necessary to relocate Bulli Surf Club and Kiosk. There is likely to be sufficient space for relocating the surf club and kiosk in the future (subject to audit – SC.1). | Bulli | 1 | When buildings reach end of functional life and require major refurbishment. (within 20 years expected) | WCC | More than \$500,000 | SC.2 M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |
| SC.9 | Undertake detailed design, site investigations, and approvals as necessary to relocate Woonona SLSC outside of hazard zone. There is likely to be sufficient space for relocating the surf club in the future (subject to audit – SC.1). | Woonona | 2 | When building reaches end of functional life and requires major refurbishment. (within 20 years expected) | WCC | More than \$500,000 | SC.2 M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |
| SC.10 | Undertake detailed design, site investigations, and approvals as necessary to redesign or retrofit construction of Bellambi Surf Club in current location to withstand wave inundation. Development controls (such as the Flood DCP) would constrain redesign in respect to still water inundation. | Bellambi | 2 | When building reaches end of functional life and requires major refurbishment. (within 20 years expected) | WCC | More than \$200,000 | SC.2 M.1 | See 'A2' Option in Sect.5.4.4 of CZM Study report |
| SC.11 | Undertake detailed design, site investigations, and approvals as necessary to redesign or retrofit construction of Corrimal Surf Club in current location to withstand inundation impacts. Development controls (such as the Flood DCP) would constrain redesign in respect to still water inundation. | Corrimal | 2 | When building reaches end of functional life and requires major refurbishment. (within 20 years expected) | WCC | More than \$200,000 | SC.2 M.1 | See 'A2' Option in Sect.5.4.4 of CZM Study report |
| SC.12 | Relocate lifeguard tower structure outside of hazard zone. The lifeguard tower is at low risk, and there is no immediate need for action. When impacts become imminent, the tower is a low key structure that will be easily relocatable. | Fairy Meadow | 2 | When monitoring shows that ZRFC measured from erosion escarpment encroaches onto structure foundations | WCC | Approx. \$20,000 | SC.2 M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |
| SC.13 | Undertake detailed design, site investigations, and approvals as necessary to redesign or retrofit construction of the North Beach Kiosk structure in current location to withstand coastal impacts, such as wave erosion and inundation. The Kiosk structure could be retrofit during asset maintenance. Design parameters for the structure (e.g. foundation requirements) and possible future location will be dependent upon the presence and condition of a seawall structure (refer Action S.7). | North | 2 | When building requires significant maintenance OR when monitoring shows that ZRFC measured from erosion escarpment encroaches onto building foundations, whichever is sooner | WCC | More than \$200,000 | SC.2 M.1 | See 'A2' Option in Sect.5.4.4 of CZM Study report |



SURF CLUBS & PUBLIC BUILDINGS (SC)

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|-------|--|-------------------|----------|---|------------------|--------------------------------------|----------------------|--|
| SC.14 | Ensure re-development of Sandon Point Surf Club is designed to withstand wave inundation and coastal erosion impacts (e.g. suitable foundation capacity, floor levels, etc). | Sandon Point | 1 | Currently in progress | WCC | More than \$ 1m | nil | See 'PR2' Option in Sect.5.4.3 of CZM Study report |
| SC.15 | Undertake detailed design, site investigations, and approvals as necessary to redesign or retrofit Austinmer Boatshed in current location to withstand wave impacts and wave inundation. Design parameters for the structure (e.g foundation requirements) will be dependent upon the presence and condition of a seawall structure (refer Action S.4). | Austinmer | 2 | When monitoring shows that wave inundation frequency is greater than 1/month <u>OR</u> when building reaches end of functional life and requires major refurbishment. (within 20 years expected) | wcc | More than \$500,000 | SC.2 S.4 M.1 | See 'A2' Option in Sect.5.4.4 of CZM Study report |
| SC.16 | Undertake detailed design, site investigations, and approvals as necessary to retrofit the former Quest House in current location to withstand inundation impacts. Flood DCP provisions would provide guidance for requirements. May involve raising existing structure in current location. | Thirroul | 2 | At next major refurbishment of the heritage site (within 20 years expected) | WCC | More than \$200,000 | SC.2 M.1 | See 'A2' Option in Sect.5.4.4 of CZM Study report |
| SC.17 | Undertake detailed design, site investigations, and approvals as necessary to relocate Coalcliff SLSC outside of hazard zone. There is likely to be sufficient space for relocating the surf club in the future (subject to audit – SC.1). (Redesign with suitable foundations is a secondary option, if relocation is not possible). Coalcliff is highly constrained by bedrock, making the need for the SLSC to remain in current location unlikely, because of retreat of the shoreline. Relocation of the SLSC would require reconfiguring of the access road and carpark – this would be required with a retreated shoreline in any case. | Coalcliff | 2 | When building reaches end of functional life and requires major refurbishment. | WCC | More than \$500,000 | SC.2 M.1 | See 'PR2' Option in Sect.5.4.3 of CZM Study report |

Relevant Programs and Possible Funding Opportunities:

- State and Federal Government Grants (especially climate change adaptation and resilience building funds, or community infrastructure funds)
- Council's routine asset maintenance and works program
- New Council levies or increased land rates
- Revenue generated from hire or rental of public buildings and amenities (e.g. pavilions and kiosks)





14 FURTHER STUDIES & PLANS (SP)

Description:

While this CZMP has considered the impacts and risks of coastal processes, it is clear that risks can be amplified when coastal storms and inundation coincide with heavy rainfall and catchment-derived flooding. Consideration of future sea level rise is an important part of strategic flood planning.

There are a number of areas along the Wollongong Coastline where coastal inundation can combine with catchment flooding to exacerbate impacts and flood conditions. Further studies are required to investigate the likely flood levels and inundation extents under these conditions. Key areas needing investigation include Thirroul, where some 150 residences are potentially affected by coastal inundation, and Woonona, where up to 100 properties could be flooded through backwater inundation and wave overtopping of the coastal dunes.

Flooding and inundation of the narrow coastal plain along the Wollongong northern beaches is likely to have severe ramifications for traffic and access for emergency response crews, with Lawrence Hargrave Drive potentially affected. As such, an Emergency Response Plan should be developed in concert with Emergency Services (e.g. SES, NSW Police) and co-ordinated with the regional DISPLAN.

Some further studies and plans are required to help address 'high' or 'extreme' level of risk at the current timeframe (2011), and as such, these take highest priority (i.e. Priority ranking '1'), while studies and plans to address 'high' or 'extreme' risks that won't' materialise until 2050 or 2100 are given secondary priority (i.e. Priority ranking '2').



Risks Addressed by Implementation of Strategy:

| | Risk at 2011 | Risk at 2050 | Risk at 2100 | | Risk at 2011 | Risk at 2050 | Risk at 2100 |
|---|-----------------|-----------------|-----------------|--|-----------------|-----------------|-----------------|
| Stanwell Park: Existing Residences (edge of 6 ppties at S end of beach next to Stanwell Ck) | Medium | High | Extreme | Thirroul: Existing Residences (151 cadastral parcels) | Medium | High | Extreme |
| Stanwell Park: Existing Residences (Edge of 13 ppties at upper reach of Stanwell Ck) | Medium | High | Extreme | McCauleys: Existing Residences (8 ppties at N end of beach) | Medium | High | Extreme |
| Stanwell Park: Vacant Land (Future Development) (edge of 4 ppties at S end of beach next to Stanwell Ck) | Low | Medium | High | Sandon Point: Existing Residences (adjacent to Slacky Creek; S end of beach off Blackall St) | Medium | High | Extreme |
| Stanwell Park: Kiosk (in Stanwell Park Recreation Area) | Medium | High | Extreme | Bulli Tourist Park (caravan park) | Medium | Medium | High |
| Stanwell Park: Reserve Dwelling | Medium | High | Extreme | Bulli: Existing Residences (adjacent to Whartons Creek & Stormwater System) | Medium | High | Extreme |
| Stanwell Park: Reserve Toilets | Medium | Medium | High | Existing Residences (19 at centre of beach) | Medium | Medium | High |
| Coledale Beach Camping and Caravan Park | Medium | Medium | High | Woonona: Existing Residences (80 along creek & stormwater alignments, centre of beach) | Medium | High | Extreme |
| Austinmer: Lawrence Hargrave Drive (Major Coastal Road) | Medium | High | Extreme | Bellambi: Bellambi SLSC and cycleways, next to Bellambi Gully | Medium | High | Extreme |
| Austinmer: Neighbourhood Business Centre (local shops) | Medium | Medium | High | Bellambi Point: Existing Residences (10 adjacent to Bellambi Lagoon) | Medium | Medium | High |
| Thirroul: Major Roads (Lawrence Hargrave Drive) | High | Extreme | Extreme | Corrimal: Existing Residences (37 adjacent to Towradgi Lagoon / Creek) | Medium | High | High |
| Thirroul: Local Roads (Bath St linking to the Esplanade, Henley St, Road reserve for Harbord & Ocean Sts) | Medium | High | Extreme | North Beach (Fairy Lagoon): Major roads (Pioneer Road) | Medium | High | High |
| | | | | North Beach (Fairy Lagoon): Cycleway / Shared Pathway (adjacent to Squires Way) | Medium | Medium | High |

Refer accompanying CZM Study for beach by beach assessment of erosion/recession risks and inundation risks

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FURTHER STUDIES & PLANS (SP)

Action List:

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|------|--|---|----------|--|------------------|---|---|---|
| SP.1 | Develop interim flood emergency response and evacuation plans for roads and properties affected by coastal inundation outside of existing flood planning areas. This includes arterial roads, such as Lawrence Hargrave Drive. As flood studies are completed for these areas (refer Action SP.2), update flood emergency response plans with more considered floodplain management strategies. | Austinmer | 2 | 2012 / Immediately | WCC | Staff time only or | nil | See 'NR9' |
| | | Thirroul (Lawrence Hargrave Drive, local roads, affected properties) | 1 | ent | SES LEMC | minor consultancy (say \$25,000) | | Option in Sect.5.4.1 of CZM Study report |
| | | Sandon Point to Bulli Beach (Whartons Ck) | 2 | | | | | |
| | | Woonona (Beach Dr, affected properties) | 2 | | | | | |
| | | Bellambi Lagoon (local roads & properties). | 2 | | | | | |
| | | Bellambi Gully (local roads, SLSC, cycleways). | 2 | | | | | |
| | | Fairy Lagoon (Pioneer Rd, cycleway, Stuart Park access) | 2 | | | | | |
| SP.2 | Update or commence flood studies at all catchments that are impacted by elevated ocean water levels in flood mapping and management. Update Flood Planning Areas and manage accordingly, such as through the NSW Government's Floodplain Risk Management process. Flood studies should consider combined catchment flooding and elevated oceanic water levels, including the latest sea level rise predictions (refer NSW Sea Level Rise Policy Statement 2009, DECCW 2009, Cardno 2010). The combined flood modelling shall then by used to determine the level of risk from such hazards (i.e. clarify Flood Risk Precincts) and therefore the appropriate planning controls that should apply (i.e. based on WCC DCP Chapter E13). | Stanwell Park (Hargraves & Stanwell Creeks) | 1 | As soon as practical, with priority to areas where a significant number of private properties are potentially affected. | WCC OEH | Depending on the scope and extents of flood areas (typically \$40,000 - \$80,000 per major catchment / floodplain) | nil | See 'NR10' Option in Sect.5.4.1 of CZM Study report |
| | | Coledale (Carricks, Daly, Stockyard Creeks) | 2 | | | | | |
| | | Austinmer | 1 | | | | | |
| | | Thirroul (Flanagans & Thomas Gibson Creeks) | 1 | | | | | |
| | | Bulli (Whartons Creek) | 1 | | | | | |
| | | Woonona (Creek at Lighthorse Drive) | 1 | | | | | |
| | | Bellambi Lagoon, Bellambi Gully | 2 | | | | | |
| | | Fairy Lagoon | 2 | | | | | |
| | | Update existing flood studies to include sea level rise and elevated oceanic water levels. | 1 | | | | | |
| SP.3 | Undertake further investigations to determine an appropriate response to managing risks to both Council assets and 19 properties at risk by 2100 on Woonona Beach. | Woonona Beach | 1 | 2012 / Immediately | WCC | Staff time only, or minor consultancy | R.2 (for Beach Drive) | See Section 6.11 of CZM Study report |
| | Risks to private properties on Woonona Beach are not expected to naterialise until 2100. However, services to the properties, in particular road access along Beach Drive, are likely to be affected well before 2100. Indeed the seaward edge of the road may be mpacted by extreme storm erosion at present. Therefore, a decision is required at the present time regarding the response to managing the private properties, as this affects how the road and services shall be managed and vice versa. The key long term options available are: construction of seawall protection, which would significantly | | | | | | cylceway along beach) ST.2 (for outlet under Beach Drive) | |
| | alter the morphology and amenity of the beach; or | | | | | | | |

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FURTHER STUDIES & PLANS (SP)

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|--------|---|-------------------|----------|------------------|------------------|--------------------------------------|----------------------|---------------|
| | • acquisition of the 19 private properties and relocation of Council's assets, to allow the beach to retreat landward, preserving the sandy beach amenity for the greater community and environment. | | | | | | | |
| | However, selecting one of these options for Woonona Beach is complicated by the following factors, and therefore requires further investigation through detailed studies: | | | | | | | |
| | ensuring ongoing services to the properties, such as road access, sewer, water and stormwater, all of which are likely to be affected well before the properties themselves SWC in particular must be involved in the selection of a preferred management option for their sewer pipeline (that is seaward of the properties) that is considerate of Council, private properties owners and other beach users and stakeholders; the legal implications of current legislation, particularly the <i>Coastal Protection Act, 1979</i>, that may limit / constrain options for managing the private properties; and the political will and financial assistance required for either of the options. | | | nent | | | | |
| | Further details to be considered as part of this Action are outlined below | | | | | | | |
| Furthe | er Details for SP.3 at Woonona: | · | | 2 | | | <u>.</u> | • |

Further Details for SP.3 at Woonona:

| Beach | Aspects to be considered as part of further investigations |
|---------|---|
| Woonona | As a seawall would additionally protect private property owners, Council may levy such owners for ongoing maintenance of the wall under the Coastal Protection Act, 1979. H owners for the capital cost of a seawall, which would be a significant upfront expense (> \$5 million) for either private owners and / or Council. |
| | Seawall construction would significantly affect the character and amenity of the beach. With sea level rise, it will not be sustainable to maintain sand across the walled section form a headland, with adjacent beach sections retreating further landward. Current legislation requires minimal impacts and ongoing maintenance of beach amenity as a concat Woonona may not be able to meet such requirements. |
| | Council may not need to protect its own assets, and this should be determined through Action R.2, Action C.2 and Action ST.2. <u>A key consideration will also be the approach assets and of the properties</u> . Any decision by SWC will necessarily affect the approach taken by Council and also affect the private properties, and vice versa. Collaboration on a <u>Council's</u> The roadways (and SWC sewer and water assets) are largely provided for the residential properties and therefore are not required unless the properties are retained access to these properties). The cycleway and stormwater assets adjacent and below the road can be relocated. However, should Council choose to sacrifice and abandon its would be affected. Further, should Council abandon its own assets and permit private property owners to construct a seawall at their own expense, it is not possible to mainta protecting Councils assets, and therefore any privately funded seawall would still need to be constructed on public land. This is inconsistent with current legislation, unless Co Acquisition of the 19 properties and relocation of Council's assets would provide the best outcome for the beach environment and the larger number of nearby residents and assets and properties would be removed to allow the beach to retreat, therefore retaining a sandy beach amenity. The "buy back/ lease back" option would enable the private is impacted to a level that it is no longer safe, enabling some recouping of costs for property purchase. However, there is currently no suitable or sufficient financial assistance mortgage arrangements or otherwise. That is, while mortgage repayments would be assisted by long term leasing of the properties, the initial deposit for property purchase arrangements or otherwise. |
| | or Federal government assistance. There is currently no arrangement or mechanism for Council to apply for such assistance. <u>In considering acquisition and retreat as an option owners, and the potential for long term impacts to rear properties (i.e. well into the future when the front lots have been eroded) needs also to be considered.</u> |
| | Should long term acquisition and retreat be the selected action, it is imperative that concerted community education be undertaken to ensure that the greater community under action (compared with seawall protection that favours the individual seafront owners protected because of the long term impacts on beach amenity discussed above). |

Relevant Programs and Possible Funding Opportunities:

- NSW Government Grants (including the Floodplain Management Program)
- Federal and State Government Emergency Management Funding •

lowever, there is no mechanism to levy private

of beach. Instead, the seawall would essentially dition for new seawall construction, thus a seawall

of SWC to managing its sewer pipeline, located an approach from the three parties is required. d (indeed there is a possibility of provision of rear s assets, services to the 19 private properties in access to the private properties without uncil is a partner in construction of the option.

other community users. This is because the properties to be utilised until the roadway access for Council to undertake such an action, through nd low interest loan arrangements require State ion, the human impacts to the 19 property

erstands the advantages to them from such an

15 STORMWATER (ST)

Description:

Catchment runoff from the Illawarra Escarpment and the coastal plain is all directed into the ocean through natural waterways and urban stormwater systems. There are a large number of stormwater outlets that discharge directly onto beaches along the Wollongong Coastline. As outlined previously, there is a small local hazard associated with erosion of sand at these stormwater outlets, however, these typically do not have major implications for broader beach erosion or shoreline recession.

The stormwater outlets themselves are structures that are at risk from coastal processes and hazards. Erosion around the structures can compromise their integrity, causing failure, while coastal inundation may create backwater effects along the stormwater system, or prevent effective drainage during heavy rains.

It is recommended that stormwater outlets be relocated landward wherever feasible, as part of Council's on-going stormwater maintenance and refurbishment program. Where it is not feasible for relocation, then stormwater outlets would need to be redesigned or retrofitted to withstand coastal impacts in the future, without compromising their function from a drainage perspective.

Management of stormwater assets that are at 'high' or 'extreme' level of risk at the current timeframe (2011) takes highest priority (i.e. Priority ranking '1'), while actions to address 'high' or 'extreme' risks to stormwater that won't materialise until 2050 or 2100 are given secondary priority (i.e. Priority ranking '2').



Risks Addressed by Implementation of Strategy:

| | Risk at 2011 | Risk at 2050 | Risk at 2100 | | Risk at 2011 | Risk at 2050 | Risk at 2100 |
|---|-----------------|-----------------|-----------------|---|-----------------|-----------------|-----------------|
| Stanwell Park: Stormwater outlets and pipes (servicing upper reaches surrounding Stanwell Ck) | High | Extreme | Extreme | Woonona: Stormwater outlets and pipes (N end at Kurraba Rd) | High | Extreme | Extreme |
| Stanwell Park: Stormwater outlets and pipes (servicing across Stanwell Park adjacent to Kiosk and from N carpark to Hargraves Ck) | High | Extreme | Extreme | Woonona: Stormwater outlets and pipes (connecting line from Kurraba Rd to Beach Drive along beachfront) | High | Extreme | Extreme |
| Coalcliff: Stormwater outlet and pipe (S end of beach) | Low | Medium | High | Woonona: Stormwater outlets and pipes (along seaward edge of Beach Drive) | High | Extreme | Extreme |
| Scarborough / Wombarra: Stormwater outlets and pipes (3 at S end Wombarra Beach) | High | Extreme | Extreme | Bellambi: Stormwater outlets and pipes (adjacent to Bellambi Pool carpark) | High | Extreme | Extreme |
| Coledale: Stormwater outlets and pipes (1 at S end at Carrick Ck, 2 beach parallel at Dalys Ck) | High | Extreme | Extreme | Bellambi: Stormwater outlets and pipes (under Bellambi SLSC carpark) | High | Extreme | Extreme |
| Sharkys: Stormwater outlets and pipes | High | Extreme | Extreme | Bellambi Point: Stormwater outlets and pipes (adjacent to STP) | High | Extreme | Extreme |
| Little Austinmer : Stormwater outlets and pipes | High | Extreme | Extreme | Bellambi Point: Stormwater outlets and pipes (into Bellambi Lagoon) | High | Extreme | Extreme |
| Austinmer: Stormwater outlets and pipes | High | Extreme | Extreme | Corrimal: Stormwater outlets and pipes | High | Extreme | Extreme |
| Thirroul: Stormwater outlet to Flanagans Creek | Medium | High | High | Towradgi: Stormwater outlet / pipe (N end) | High | Extreme | Extreme |
| Thirroul: Stormwater outlets and pipes to upper Flanagans Ck catchment | High | Extreme | Extreme | North Beach: Stormwater outlets / pipes (at Lagoon entrance) | High | Extreme | Extreme |
| Thirroul: Thomas Gibson Creek - Major stormwater outlet | High | Extreme | Extreme | North Beach: Stormwater outlets / pipes (adjacent to Pavilion) | High | Extreme | Extreme |
| McCauleys: Stormwater outlets and pipes (N end of beach) | High | Extreme | Extreme | North Beach: Stormwater outlets / pipes (at Lagoon Restaurant) | High | Extreme | Extreme |

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STORMWATER (ST)

| STORIWATER (ST) | | | | | | | |
|---|------|---------|---------|--|--------|---------|---------|
| Sandon Pt: Stormwater outlets and pipes (S end of beach) | High | Extreme | Extreme | Perkins: Stormwater outlets & pipes (one adjacent to Port Kembla Pool) | High | Extreme | Extreme |
| Sandon Pt: Stormwater outlets and pipes (Centre of beach) | High | Extreme | Extreme | Lake Illawarra: Stormwater outlets / pipes | Medium | High | High |
| Bulli: Stormwater outlets and pipes | High | Extreme | Extreme | | | | |

Refer accompanying CZM Study for beach by beach assessment of erosion/recession risks and inundation risks

Action List:

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|------|--|---|----------|---|------------------|--|----------------------|--|
| ST.1 | Undertake stormwater asset audit and investigate appropriate design elements for stormwater infrastructure for periodic inundation with seawater and / or wave action and utilise as assets are replaced. The audit will identify where and when stormwater assets will be affected by wave attack and/or permanent inundation with sea level rise, to determine future conveyance capacity. The audit is also to determine functional lifespan of existing stormwater assets, noting that seawater is expected to yield shorter design life. For assets affected by erosion, simply withstanding wave attack may not be sufficient if erosion of land around the structure makes it impractical. | Stanwell Park Coalcliff Scarborough / Wonbarra Coledale Sharkys Little Austinmer Austinmer Thirroul McCauleys Sandon Pt Bulli Woonona Bellambi Bellambi Bellambi Pt Towradgi Corrimal North Beach Perkins Lake Illawarra | | 2012 or as soon as practical | WCC | Staff time only, or minor consultancy (say \$50,000) | nil | See 'NR7' Option in Sect.5.4.1 of CZM Study report |
| ST.2 | Update stormwater assets in Council's Asset Management Plan, and based on the outcomes of the audit, incorporate remediation, maintenance, relocation and replacement works into forward works programs. Actions ST.3 and ST.4 apply if supported by the Asset Management Plan. | As above | 1 | 2012/13 or as soon as possible after ST.1 | WCC | Staff time only | ST.1 | See 'NR7' Option in Sect.5.4.1 of CZM Study report |
| ST.3 | Undertake detailed design, assessment, planning and works to | Coalcliff | 2 | When erosion or wave overtopping | WCC | Dependent on size, | ST.2 | See 'PR2' |
| | confirmation by Action ST.1, it is likely that the outlets and pipes can | Scarborough / Wombarra | 1 | inundation frequency impedes | | relocation of the | | Sect.5.4.3 of |
| | occurs. However, the new outlets will also need to be designed to | Little Austinmer | 1 | OR when asset replacement is | | stormwater outlet. | | CZM Study report |
| | withstand inundation with sea level rise and wave overtopping. | Thirroul | 1 | required, whichever is sooner. | | \$50,000 each. | | |
| | Relocation of outlet to Thomas Gibson Creek at Thirroul will be dependent upon outcomes of Action S.1 | McCauleys (N end of beach) | 2 | | | | | |
| | | Sandon Pt | 1 | | | | | |
| | | Bulli | 2 | | | | | |

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46



| STORMW | ATER (ST) | | | | | | | 47 |
|--------|--|-------------------------------------|----------|---|------------------|--|----------------------|---------------|
| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
| | | Woonona | 1 | | | | | |
| | | Towradgi (N end of beach) | 2 | | | | | |
| | | North (Fairy Lagoon) | 1 | | | | | |
| ST.4 | Undertake detailed design, assessment, planning and works to | Stanwell Park | 1 | When erosion or wave overtopping | WCC | Dependent on size, | ST.2 | See 'A2' |
| | withstand impacts. In the first instance, stormwater assets should be | Coledale | 1 | inundation frequency impedes | | protection required at | | Sect.5.4.4 of |
| | relocated out of the hazard zone (refer ST.3), but for some locations this will not be practical or feasible. The outcomes of Action ST.1 shall guide suitable designs for ensuring conveyance of stormwater with more frequent inundation with sea level rise. | Sharkys (Austinmer Boat Harbour) | 1 | OR when asset replacement is required, whichever is sooner. | × | the stormwater outlet. Typically less than \$50,000 each. | | report |
| | | Austinmer | 2 | | | | | |
| | (i.e. Austinmer; Bellambi adjacent to pool carpark; Bellambi Point | McCauleys | 1 | | | | | |
| | adjacent to STP; and Perkins Beach adjacent to Port Kembla Pool) | Sandon Pt (Trinity Row) | 1 | | | | | |
| | | Bulli | 1 | | | | | |
| | | Woonona (Lighthourse Dr Ck) | 1 | | | | | |
| | | Bellambi (pool carpark) | 1 | | | | | |
| | | Bellambi Pt (next to STP) | 1 | | | | | |
| | | Corrimal | 1 | | | | | |
| | | North Beach | | | | | | |
| | | Perkins | 2 | | | | | |
| | | Lake Illawarra | 2 | | | | | |

Relevant Programs and Possible Funding Opportunities:

- State and Federal Government Grants (especially climate change adaptation and resilience building funds)
- Council's routine asset maintenance and works program
- New Council levies or increased land rates





16 VEGETATION & HABITATS (V)

Description:

Although much of the Wollongong Coastline is developed, it still retains a number of pockets of vegetation that provide significant habitat value. Indeed there are several Endangered Ecological Communities (EEC) located within the Wollongong Coastal Zone.

The vegetated coastal dune systems also provide significant habitat value to coastal species. Significant efforts have been made over the past 30 years to vegetate and rehabilitate coastal dunes through Council's Dunecare program. This has effectively eliminated risks associated with sand drift, and has helped to secure healthy sand reserves along many of the beaches to act as a buffer against future storm erosion events.

Bitou bush and other invasive species are still problematic along the coast, meaning that Council's efforts in coastal dune rehabilitation will be on-going for many years to come. There are also local issues associated with dune vegetation, for example the monoculture of *Acacia sophorae* dominating dune vegetation at Woonona Beach (and other beaches) that is affecting beach amenity. The development of a Dune Management Strategy shall seek to address issues associated with weeds and dune vegetation species, to alleviate such local concerns. The sightline requirements of the surf clubs, particularly in those locations where lifeguard towers are not able to be provided, is also of key concern.

All beaches and beach dunes are under 'high' or 'extreme' risk at the current timeframe (2011), and as such, dune revegetation works are given the highest priority (Priority Level '1'). With the exception of Bellambi Lagoon, other important habitats along the coastal zone are not under immediate risk ('high' or 'extreme' risks won't materialise until 2050 or 2100), and therefore are given a secondary priority (Priority Level '2').



Risks Addressed by Implementation of Strategy:

| | Risk at 2011 | Risk at 2050 | Risk at 2100 | | Risk at 2011 | Risk at 2050 | Risk at 2100 |
|--|-----------------|-----------------|-----------------|---|-----------------|-----------------|-----------------|
| Stanwell Park Beach | High | Extreme | Extreme | Bulli: Collins Creek | Medium | High | Extreme |
| Stanwell Park Coastal Dune Systems | High | Extreme | Extreme | Woonona Beach | High | Extreme | Extreme |
| Stanwell Park: Hargraves Creek | Medium | Medium | High | Woonona Coastal Dune Systems | High | Extreme | Extreme |
| Stanwell Park: Stanwell Creek | Medium | High | High | Woonona: Creek at Lighthorse Drive and adjacent habitat | Medium | Medium | High |
| Coalcliff Beach | High | Extreme | Extreme | Bellambi Beach | High | Extreme | Extreme |
| Coalcliff: Stoney Creek | Medium | Medium | High | Bellambi Beach Coastal Dune Systems | High | Extreme | Extreme |
| Scarborough and Wombarra Beaches | High | Extreme | Extreme | Bellambi Gully and adjacent habitat | Medium | High | Extreme |
| Scarborough / Wombarra: Small creek / drainage lines (S end and centre of Scarborough beach) | Low | Medium | Medium | Bellambi Point Beach | High | Extreme | Extreme |
| Scarborough Recreation Reserve, Jim Allen Oval Natural Area | Low | Medium | Medium | Bellambi Point Coastal Dune Systems | High | Extreme | Extreme |
| Coledale Beach | High | Extreme | Extreme | Heritage Site: Bellambi Lagoon and associated habitat | High | Extreme | Extreme |
| Coledale: Carricks Creek | Medium | High | Extreme | Corrimal Beach | High | Extreme | Extreme |

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| VEGETATION & HABITATS (V) | | | | | | | 49 |
|--|-----------------|-----------------|-----------------|--|-----------------|-----------------|-----------------|
| | Risk at 2011 | Risk at 2050 | Risk at 2100 | | Risk at 2011 | Risk at 2050 | Risk at 2100 |
| Coledale: Stockyard Creek | Medium | High | Extreme | Corrimal Coastal Dune Systems (Corrimal Beach Natural Area, Towradgi Park) | High | Extreme | Extreme |
| Coledale: Dalys Creek | Medium | Medium | High | Corrimal Beach: Towradgi Lagoon and adjacent EEC Habitat | Medium | High | Extreme |
| Coledale: EEC - Coastal Headland Banksia Scrub | Medium | Medium | High | Towradgi Beach | High | Extreme | Extreme |
| Sharkys Beach | High | Extreme | Extreme | Towradgi Coastal Dune Systems | High | Extreme | Extreme |
| Little Austinmer Beach | High | Extreme | Extreme | Towradgi Beach Reserve (dune vegetation) | Low | Low | Medium |
| Little Austinmer Coastal Dune Systems | High | Extreme | Extreme | Fairy Meadow Beach | High | Extreme | Extreme |
| Austinmer Beach | High | Extreme | Extreme | Fairy Meadow Coastal Dune Systems | High | Extreme | Extreme |
| Thirroul Beach | High | Extreme | Extreme | Fairy Lagoon and Habitat (part of Puckeys Estate lands) | Medium | High | Extreme |
| Thirroul: Tingara Park | Medium | Medium | High | North Beach | High | Extreme | Extreme |
| Thirroul: Flanagans Creek | Medium | Medium | High | North Beach: Stuart Park (on heritage list, local significance) | Medium | High | Extreme |
| Thirroul Coastal Dune System (small area adjacent to creek entrance) | High | Extreme | Extreme | City Beach | High | Extreme | Extreme |
| McCauleys Beach | High | Extreme | Extreme | Open space, parks including City Beach Foreshore, dune lands part of WIN Stadium Grounds | Medium | High | Extreme |
| McCauleys: Hewitts Creek | Medium | Medium | High | City Beach Coastal Dune Systems | Medium | Medium | High |
| McCauleys: Tramway Creek | Low | Medium | Medium | Coniston Beach | High | Extreme | Extreme |
| McCauleys Coastal Dune Systems (S end) | High | Extreme | Extreme | Coniston Coastal Dune Systems; dune lands part of Wollongong Golf Course | High | Extreme | Extreme |
| Sandon Point Beach | High | Extreme | Extreme | Fishermans Beach & MM Beach | High | Extreme | Extreme |
| Sandon Point: Slacky Creek | Medium | Medium | High | Perkins Beach, including Port Kembla Beach and Windang Beach | High | Extreme | Extreme |
| Sandon Pt Coastal Dune Systems (N end of beach) | High | Extreme | Extreme | Coastal Dune Systems: Pork Kembla Beach, Perkins Beach Reserve, Windang Beach | High | Extreme | Extreme |
| Bulli Beach | High | Extreme | Extreme | Lake Illawarra: EEC Swamp Oak Floodplain Forest | Medium | Medium | High |
| Bulli Coastal Dune Systems | High | Extreme | Extreme | Lake Illawarra: EEC Coastal Swamp Oak Forest | Low | Medium | Medium |
| Bulli: Whartons Creek | Medium | Medium | High | | | | |

Refer accompanying CZM Study for beach by beach assessment of erosion/recession risks and inundation risks



49

Action List:

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|------|--|---|----------|------------------------------------|------------------|---|----------------------|---|
| V.1 | Revitalise Prepare and implement an LGA-wide Dune Management Strategy that incorporates reviewing and enhancing existing dunecare programs, recruits new volunteers (including targeting SLSC members) and prioritised locations for dune vegetation and weed removal across the LGA and within individual beach compartments. Where existing dune vegetation is sufficient or substantial, the Dune Management Strategy shall focus on weeds and vermin removal, plant species diversity and vegetation height management, to ensure beach amenity values are not substantially degraded. For example, where monocultures of <i>Acacia sophorae</i> (or other species) are found, the Dune Management Strategy provides a mechanism for Council to introduce greater species diversity to reduce the proliferation of the species. Dune vegetation programs must be considerate of sightline requirements of all Surf Clubs in the LGA, such as detailed in Council's Draft Beach Sightline Strategy (2007). Liaison with SLSC and use of appropriate low-growing species across key sightlines is required (in some cases this may involve replacement of existing tall species with suitable low growing species). The Coastal Dune Management Manual (2001) shall also be a reference document for Council in developing and implementing the Dune Management. Strategy. Dune vegetation works can be used as an opportunity to educate the community regarding the growth of dune volumes and value as beach protection. The increase of dune height which occurs as dune species capture sediments within the beach system additionally provides a higher barrier to mitigate wave overtopping effects. | All beaches and coastal dune systems along the Wollongong coastline | 1 | 2012 or as soon as practical | WCC | Staff time only Costs for on-going dunecare works subject to funding availability | Nil | See 'DV' Option in Sect.5.4.2 of CZM Study report |
| V.2 | Utilise Norfolk Island Pines in new coastal plantings by Council, as appropriate. This would ensure continued use of this plant as a marker of coastal settlement. Where possible, new plantings to replicate or replace perished or eroded trees should be sought, outside of hazard zones. This action recognises the cultural importance of Norfolk Island Pines in coastal development along the Wollongong Coastline. | All beaches (see Heritage strategy for listings), especially: Coledale Sharkys Little Austinmer Thirroul Sandon Pt North Beach | 2 | 2012 / immediately | WCC | Staff time only | Nil | See 'NR12' Option in Sect.5.4.1 of CZM Study report |



VEGETATION & HABITATS (V)

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|------|--|---|----------|------------------------------------|------------------|---|----------------------|---|
| V.3 | Undertake an audit of all EECs and important habitat areas within the hazard zones and implement buffers and rehabilitation as appropriate. This option would involve: Identifying important flora/fauna species that, due to their limited distribution, will need to be translocated; Prioritising rehabilitation requirements based upon the relative threat to distributions from coastal hazard impacts, to ensure lower risk distributions are protected and enhanced; and Identifying areas that can be designated buffers around important habitats, to enable migration in response to hazard impacts, i.e. erosion and recession, as well as migration in response to sea level rise. The outcomes of the audit should feed into existing biodiversity strategies (e.g. <i>Illawarra Regional Biodiversity Strategy, 2010</i>). Hazards impacts investigated should include both permanent inundation as well as recession due to sea level rise. | All known EEC and important habitat areas, including parks, reserves and waterways at: Stanwell Park (including Stanwell and Hargraves Creeks) Coalcliff (including Stoney Creek) Scarborough / Wombarra Coledale (including Carricks, Daly and Stockyards Creeks) Little Austinmer Thirroul (including Flanagans Creek) McCauleys (including Hewitts and Tramway Cks) Sandon Pt (including Slacky Creek) Bulli (including Whartons and Collins Creeks) Woonona (inc. Creek at Lighthorse Drive) Bellambi Gully & Lagoon Towradgi Lagoon Fairy Lagoon North Beach City Beach Coniston Beach Perkins Beach Lake Illawarra foreshores | 2* | 2012 or as soon as practical | WCC | Staff time only or minor consultancy (say \$40,000) | nil | See 'NR11' Option in Sect.5.4.1 of CZM Study report |

* Bellambi Lagoon habitat is under intolerable risks at the current timeframe (2011) and as such should be given priority for assessment.

Relevant Programs and Possible Funding Opportunities:

- State and Federal Government Grants (especially climate change adaptation and resilience building funds)
- Department of Lands (weed control / dune management)
- Council's annual dunecare and community education / participation programs
- New Council levies or increased land rates

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17 WHOLE OF COUNCIL ACTIONS (W)

Description:

In the past, without a whole of LGA coastal hazards assessment or management plan, consideration of coastal hazards in Council decision making has been undertaken on an as needs basis. In some cases this has meant decisions are made prior to assessing risk from coastal hazards, then retrospectively designing the asset or infrastructure to cater for a hazards impact. Further, only one of the existing Community and Crown Lands Plans of Management (POMs) for coastal areas specifically note coastal hazards as an issue requiring consideration in planning new facilities, structures or uses of the land.

With a CZMP, including hazard lines, coastal risks can now be considered at the outset in Council decision making. From a whole of Council / LGA perspective, this is a crucial milestone, particularly as Council is the owner of key assets affected by coastal hazards, and can set the benchmark for private landholders and community in the coastal zone.

Listed below are over-arching actions that should be undertaken by Council to better incorporate coastal risk management into Council decision making processes.

Whole of Council Actions will address a range of intolerable risks, many of these being intolerable at the current timeframe (2011). Although the level of risk differs from one beach to the next, the Whole of Council actions apply to Council's operations, strategic approach such as through the LEP, and so variously affect the approach to management for the whole coast. As such, the actions for preparing and implementing Whole of Council Actions take highest priority (i.e. Priority ranking '1').

Risks Addressed by Implementation of Strategy:

All risks to existing recreational assets and land (including beaches), existing development and infrastructure and future development along the beaches variously within the Wollongong LGA.

Action List:

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|------|--|--------------------------------|----------|------------------------------|------------------|--------------------------------------|----------------------|--|
| W.1 | Conduct internal Council training to educate the different departments about coastal hazards and the coastal hazard lines, to support greater consideration of hazards in Council planning. The aim of internal education is two-fold. First, this allows better use of the existing hazard mapping in preparing decisions internally by Council, for example, in prioritising asset replacement or designing assets for hazard impacts. Second, it will facilitate explanation of the hazards to community by Councillors, particularly as planning and other actions may affect the general community. There is a need for better education within Council (and the general community, see below) regarding what the hazard lines mean and how they should be utilised and applied. | Relates to entire coastal zone | 1 | 2012 or as soon as practical | WCC | Staff time only | Nil | See Sect.5.2 of CZM Study report |





WHOLE OF COUNCIL ACTIONS (W)

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|------|--|--|----------|---|------------------|--------------------------------------|-------------------------------|--|
| W.2 | Preparation of Community & Crown Land Plans of Management and Masterplans In the past, decisions regarding facilities and works as described in such plans considered hazards once the decision to refurbish or construct a facility had been made from the Masterplan perspective. Now that hazard lines are available, the development of such plans should consider the hazard extents and timeframes prior to specifying actions within such plans. That is, depending on the expected life of a facility it may or may not be appropriate to construct within a 2050 hazard area. Once again, guidance as to appropriate timeframes for development is given in the Future Development section | All Community and Crown Lands | 1 | At next update to POMs and masterplans for Community and Crown Lands, i.e.: Stanwell Park Reserve and Bald Hill Plan of Management August 2009 Wollongong City Foreshore Plan of Management, January 2008 and Blue Mile Masterplan Coledale Beach Plan of Management, June 2004 Judbooley Parade, Windang Plan of Management, June 2008 The Community Land of Wollongong Generic Plan of Management 2010 | WCC | Staff time only | Nil, but preferably W.1 | See Sect.5.2 of CZM Study report |
| W.3 | Consideration of hazards and development controls for Council works not requiring development consent. Where development consent is required for a Council action, then the DCP controls apply. However, there are many works undertaken by Council where development consent is not required (for example, environmental management works under SEPP Infrastructure (2007)). In this case, there needs to be an internal process for taking consideration of coastal hazards constraints when undertaking exempt development by Council. Part of this will be through internal Council education (see below), however, a checklist or guideline should be prepared for internal Council use for exempt developments. | All Council works within the Wollongong coastal zone | | At time of preparing REFs for Council works not requiring development consent. | WCC | Staff time only | Nil, but preferably W.1 | See Sect.5.2 of CZM Study report |
| W.4 | Prepare a foreshore building line for entire LGA based upon the existing hazard lines The foreshore building line would present the starting point from which setbacks for development can be drawn. This would be a key tool for use in managing future development and redevelopment in conjunction with a Coastal Management DCP (refer Action DC.1). The foreshore building line may be modified in the future in concert with implementation of specific management actions, such as construction of a seawall for a specific beach. For those beaches where seawall protection is being considered as an option, a recommended seawall alignment was mapped in the CZM Study. At all other locations, the immediate (2010) ZRFC line is recommended as an appropriate foreshore building line to be adopted by Council. The foreshore building line shall be adopted within the LEP and any future LEP review. The foreshore building line should be updated as and when coastal hazard zones are redefined as part of the revision of the CZMP (e.g. every 5 to 10 yrs). This will ensure that the foreshore building line progressively retreats in line with the impacts of sea level rise over time. | Entire LGA of Wollongong, to form part of LEP | 1 | 2012 or as soon as practical | WCC | Staff time only. | Nil | See Sect.5.2 of CZM Study report |



WHOLE OF COUNCIL ACTIONS (W)

| Ref. | Action | Beach Location(s) | Priority | Timing / Trigger | Responsibilities | Estimated Costs or Resources Reqd | Preceding Actions | Further Info. |
|------|---|---|----------|--|------------------|---|----------------------|--|
| W.5 | Community Education for Resilience Building To support the implementation of this Plan, there will need to be ongoing community education about coastal risks. The risk approach is a valid way of expressing to community both likelihood and consequence from coastal hazards. This will assist community to make their own judgements regarding how they perceive the risk from coastal hazards, and make decisions regarding this risk over likely timeframes of impact. It is important that community begin to understand now the types of impacts relating to storms and how Council proposes to manage this, as well as how such risks may change with sea level rise. This action supports the overarching approach to implement "no regrets" options now and delay more difficult or costly options for when impacts are imminent. There may be many years before impacts eventuate, however, at that time, the community will be better prepared to accept and implement the action that has been signalled many years in advance within the CZMP. | At various locations across the LGA | 1 | 2013, with ongoing repeats of community consultation every 2 years | WCC | Staff time only, with possibly minor consultancy assistance (\$10,000 - \$20,000) | Nil | See Sect.5.2 of CZM Study report |
| W.6 | Consideration of coastal risk zones when reviewing land zones in the Wollongong Local Environment Plan This would allow for rezoning of land where appropriate to the level of risk from coastal hazards at the time that land zones are revised as part of a review of the Wollongong LEP. A key location that should be rezoned is Sharkys Park at Sharkys Beach. The land is zoned residential, but owned by Council, so can feasibly be rezoned to public recreation or environmental management without the need for compensation. This ensures the land is not considered for development at any time in the future, which is appropriate to the high level of risk to this land. | Wollongong LGA Sharkys Park – rezoned from residential to public recreation land | 1 | At the next LEP review (~ 5 – 10 yrs) | WCC | Staff time only | Nil | See Sect.5.2 of CZM Study report |

Relevant Programs and Possible Funding Opportunities:

- Largely no external funding required, with actions to be undertaken by Council staff.
- State and Federal Government Grants (especially climate change adaptation and resilience building funds) for community and internal staff education actions



54

18 MAPS FOR INDIVIDUAL BEACHES

A series of maps is provided in Section 18, after the Implementation Schedules, to show the relevant locations for actions from the Management Strategies, where they can be feasibly shown, for each beach along the Wollongong Coastline (e.g. BM strategies are shown, DC strategies that apply to numerous assets are not shown).

The Coastal Erosion Hazard and Coastal Inundation Hazard areas on the strategy maps present the entire risk areas from present to 2100 (including the zone of reduced foundation capacity for the Erosion Hazard).

The Flood Hazard presents Council's Flood Planning Area, which is Council's known High to Low Flood Risk Precincts combined. The Flood Hazard relates to inundation due to catchment rainfall only, except at Lake Illawarra where the flood study investigated the combined impacts from catchment rainfall, 1 in 20 year ocean water levels and sea level rise. As specified by the Further Studies and Plans strategy, the most accurate estimation for potential inundation impact should consider the combined impact of catchment rainfall, ocean storm water levels and future sea level rise.

The Flood Hazard has been overlain on the Coastal Inundation Hazard on the maps to clearly portray those areas of backwater coastal inundation that are outside of existing Flood Planning Areas, and which require further action through this plan. Actions to address wave overtopping have been specified where required in this Plan, as this is a separate component of the Coastal Inundation Hazard that is not necessarily addressed by existing controls on Flood Precincts.

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19 **EVALUATION AND REPORTING**

19.1 Performance Evaluation

The Wollongong Coastal Zone Management Plan requires evaluation and reporting regarding its successful implementation, and thus the successful management of existing and future coastal risks. Where implementation performance is sub-optimal, contingencies should be emplaced to remedy the situation. A series of performance measures to assist in the evaluation process are discussed below.

19.1.1 Primary Performance Measures

The first set of performance measures should ascertain whether the strategies are actually being implemented or not in accordance with the timeframe and triggers designated in the Plan. As such, the primary performance measures are simply a measure of action initiation.

Organisations (mostly WCC) responsible for implementation will need to review the Plan carefully and ensure that adequate funding and resources are allocated to the various strategies and actions to ensure that the timeframe for implementation is achieved.

Specific questions to be answered as part of an evaluation process are:

- What strategies have actually been implemented (regardless of outcome - see Secondary Performance Measure)?
- What strategies are outstanding, and should have been implemented within this nominated timeframe?

If it is determined that the strategies are not being implemented in accordance with the nominated timeframe, then one or both of the following contingencies should be adopted:

- Determine the cause for the delay in implementation. If delays are funding based, then seek alternative sources of funding. If delays are resource-based, seek additional assistance from stakeholder agencies and/or consider using an external consultancy to coordinate implementation of the Plan; and
- Modify and update the Coastal Zone Management Plan to reflect a timeframe for implementation that is more achievable. The revised Plan would need to be endorsed by all relevant stakeholders and agencies responsible for implementation.

19.1.2 Secondary Performance Measures

The second set of performance measures are aimed at measuring the overall outcomes of the Plan in terms of actually managing and reducing the risks to the community associated with existing and future coastal hazards. That is, 'how has the Plan made a difference?'

The main mechanism for gauging whether the overall outcomes of the Plan have been achieved, or not, is to re-evaluate the risks through a follow-up risk reassessment process. As for the first risk assessment, consideration will need to be given to all relevant mechanisms in place that assist with managing future risks and increasing Council's and the community's resilience to a changing climate as associated coastline responses (including erosion, recession and ocean inundation).

The specific question to be answered here is:

Have the identified risks been adequately managed / mitigated? ٠

If, after a reasonable period of time it is determined that the risks have not been adequately managed/mitigated, then the following contingencies should be adopted:

- Carry out a formal review of the implemented management strategies, identifying possible avenues for increasing the effectiveness of the strategy in managing the risks along the coastline:
- Commence implementation of additional management strategies that may assist in meeting the objectives of the Coastal Zone Management Plan (possibly 'fast-tracking' some longer term strategies as necessary);
- Reconsider the objectives of the risk management. For example, accommodating future changes may no longer be feasible and an alternative approach of abandonment and planned retreat may be necessary. Any such changes to the Plan would need to be endorsed by the stakeholders and relevant government agencies, as well as the public.

19.2 Factors for Success

The success of the Wollongong Coastal Zone Management Plan can be improved by the following factors:

- Certification by the Minister and Adoption by Council;
- Broad stakeholder and community agreement on the overall Plan strategies and objectives for risk management;
- Understanding and agreement on implementation responsibilities and funding opportunities by Council and other government agencies, stakeholders and the general community;

- and

A particularly important aspect is the acceptance and agreement by the local community. Without significant support and pressure by the local community, Council may find it difficult to prioritise coastal management works when considering the full range of Council assets and lands requiring attention in the future.

19.3 Plan Review

It is recommended that this Implementation Action Plan be reviewed annually, to determine progress with individual actions and strategies, while a broader audit and update be conducted every 5 years. The annual review should focus on funding, resources and barriers to implementation of the individual actions and strategies, whereas the 5 year audit should target re-evaluation of risks to determine progress with overall risk management and reduction. From the 5 year audit, changes can be made to the Plan to ensure the document remains current, and relevant to the changing landuse and community demands along the Wollongong Coastline.

Commitment by organisations involved to dedicate appropriate time and resources to achieve the objectives and timeframe of the Plan;

Actively sourcing of appropriate resources and funds, through grants, user contributions, and in-kind commitments from the agencies, stakeholders and community.



20 **REFERENCES**

BMT WBM (2011) Wollongong Coastal Zone Management Study, prepared for Wollongong City Council by BMT WBM, Broadmeadow, NSW. (Companion document to this Implementation Action Plan)

Cardno (2010), Wollongong City Council Coastal Zone Study, prepared for Wollongong City Council by Cardno Lawson Treloar, June 2010.

DECCW (2009a), NSW Sea Level Rise Policy Statement, October 2009.

DECCW (2010), Guidelines for Preparing Coastal Zone Management Plans, December 2010.

GHD (2010), Report on Wollongong Coastal Study Geotechnical Assessment, Final Report, prepared for Cardno Lawson Treloar, June 2010.

21 ACRONYMS

| CZM | Coastal Zone Management | | | | |
|---------|---|--|--|--|--|
| CZMP | Coastal Zone Management Plan | | | | |
| DCP | Development Control Plan | | | | |
| DISPLAN | Wollongong Local Disaster Action Plan | | | | |
| EEC | Endangered Ecological Community | | | | |
| FDCP | Flood Development Control Plan | | | | |
| GDCP | Geotechnical Development Control Plan | | | | |
| LEMC | Wollongong Local Emergency Management Cttee | | | | |
| LGA | Local Government Area | | | | |
| LIA | Lake Illawarra Authority | | | | |
| MSL | Mean Sea Level | | | | |
| NPW Act | NSW National Parks & Wildlife Act 1974 | | | | |
| NPWS | National Parks & Wildlife Service (part of OEH) | | | | |
| OEH | NSW Office of Environment & Heritage | | | | |
| PKPC | Port Kembla Port Corporation | | | | |
| SES | State Emergency Service | | | | |
| SLSC | Surf Life Saving Club | | | | |
| STP | Sewage Treatment Plant | | | | |
| SWC | Sydney Water Corporation | | | | |
| RTA | Roads & Traffic Authority | | | | |
| WCC | Wollongong City Council | | | | |
| ZRFC | Zone of Reduced Foundation Capacity | | | | |





APPENDIX A: PROPERTYRISKANDRESPONSE CATEGORIES

DECCW (2010) and the Coastal Protection Regulation (2011) require the risk to properties to be specified according to the estimated timeframe for impact, i.e. current year, 2050 or 2100. The Coastal Protection Regulation (2011) indicates that the risk category and the year it was assessed be indicated on planning certificates under Section 149 of the Environmental Planning and Assessment Act, 1979. Risk Categories specified by the Coastal Protection Regulation (2011) are provided in Table 1 below.

In addition, DECCW (2010) advise that the intended response to the potential hazard impact be indicated within a CZMP (i.e., the intended response does not need to be attached to the Section 149 certificate). Response Categories specified by DECCW (2010) are provided in Table 2 below. Property risk and response categories of a format specified by DECCW (2010) and the Coastal Protection Regulation (2011) are provided herein.

It is noted that this Wollongong CZMP has provided considerably greater detail as to the likely risk to private property, and furthermore, has provided a range of suitable actions for such risks to private property that go far beyond structural protection options. For Council's use, a summary table of recommended current and future actions for all private properties at risk to 2100 is given in Table 4.

It is noted that the guidance provided by DECCW (2010) indicated the risk category need only refer to the coastal erosion and recession hazard (and not the coastal inundation hazard), and this is the approach taken to the list of properties provided in Table 3.

| Table 1 Coastal Hazard RISK Category (NSW Government, 201 | Table 1 | Coastal Hazard Risk Category (NSW Government, 2011) |
|---|---------|---|
|---|---------|---|

| Risk Category | Intended public authority response |
|------------------|---|
| 1 | The land is, or is likely to be, adversely affected by the coastal hazard at the present time (a current coastal hazard) . |
| 2 | The land is not, and is not likely to be, adversely affected by the coastal hazard at the present time, but is likely to be adversely affected by the coastal hazard in the year 2050 (a 2050 coastal hazard). |
| 3 | the land is not, and is not likely to be, adversely affected by the coastal hazard at the present time or in the year 2050, but is likely to be adversely affected by the coastal hazard in the year 2100 (a 2100 coastal hazard) |

Table 2 Coastal Hazard Response Category (DECCW, 2010)

| Response Category | Intended public authority response |
|----------------------|---|
| A | Coastal protection works are considered technically feasible and cost-effective funding is being sought for implementation |
| В | Coastal protection works are considered technically feasible but not cost effective for public funding – unlikely to be implemented by a public authority |
| С | Coastal protection works are not considered technically feasible – no intended public authority works |

Table 3 Wollongong Risk and Response Categories

| Parcel_Details | Suburb | Risk Category | Response Category | Comment |
|--------------------|---------------|------------------|----------------------|---|
| Lot 1 DP 948547 | STANWELL PARK | 3 | С | Only 1 property in middle of beach; Sea wall in front of property will affect beach amenity in future |
| Lot 74 DP 7664 | STANWELL PARK | 3 | В | CZMP recommends monitoring and DCP implementation for now. |
| Lot 73 DP 7664 | STANWELL PARK | 2 | В | CZMP recommends monitoring and DCP implementation for now. |
| Lot 721 DP 1075403 | STANWELL PARK | 2 | В | CZMP recommends monitoring and DCP implementation for now. |
| Lot 71 DP 7664 | STANWELL PARK | 2 | В | CZMP recommends monitoring and DCP implementation for now. |
| Lot 1 DP 849241 | STANWELL PARK | 2 | В | CZMP recommends monitoring and DCP implementation for now. |
| Lot 35 DP 8450 | COALCLIFF | 1 | С | Affected property at bottom of cliff and house at top. Impacts unlikely to reach residential building |
| Lot 27 DP 8450 | COALCLIFF | 1 | С | Affected property at bottom of cliff and house at top. Impacts unlikely to reach residential building |
| Lot 36 DP 8450 | COALCLIFF | 1 | С | Affected property at bottom of cliff and house at top. Impacts unlikely to reach residential building |
| Lot 34 DP 8450 | COALCLIFF | 1 | С | Affected property at bottom of cliff and house at top. Impacts unlikely to reach residential building |
| Lot 29 DP 8450 | COALCLIFF | 1 | С | Affected property at bottom of cliff and house at top. Impacts unlikely to reach residential building |
| Lot E DP 25596 | COALCLIFF | 1 | С | Affected property at bottom of cliff and house at top. Impacts unlikely to reach residential building |
| Lot 30 DP 8450 | COALCLIFF | 1 | С | Affected property at bottom of cliff and house at top. Impacts unlikely to reach residential building |
| Lot 33 DP 8450 | COALCLIFF | 1 | С | Affected property at bottom of cliff and house at top. Impacts unlikely to reach residential building |
| Lot 31 DP 8450 | COALCLIFF | 1 | С | Affected property at bottom of cliff and house at top. Impacts unlikely to reach residential building |
| Lot 32 DP 8450 | COALCLIFF | 1 | С | Affected property at bottom of cliff and house at top. Impacts unlikely to reach residential building |
| Lot 3 DP 1119139 | AUSTINMER | 3 | В | CZMP recommends monitoring and DCP implementation for now. |
| Lot 3 DP 206574 | THIRROUL | 1 | С | In middle of beach; not advisable to protect; CZMP recommends acquisition |
| Lot 2 DP 508419 | THIRROUL | 1 | В | CZMP provdes for protection |
| Lot B DP 421085 | THIRROUL | 1 | В | CZMP provdes for protection |
| Lot 6 DP 5736 | THIRROUL | 1 | В | CZMP provdes for protection |
| Lot 1 DP 508419 | THIRROUL | 1 | В | CZMP provdes for protection |
| Lot 4 DP 5736 | THIRROUL | 1 | В | CZMP provdes for protection |
| Lot 5 DP 5736 | THIRROUL | 1 | В | CZMP provdes for protection |



Table 3 continued Wollongong Risk and Response Categories

| Parcel_Details | Suburb | Risk Category | Response Category | Comment | |
|-------------------|----------|------------------|----------------------|--|--|
| Lot 1 SP 12590 | THIRROUL | 1 | С | In middle of beach; not advisable to protect; CZMP recommends acquisition | |
| Lot 2 SP 12590 | THIRROUL | 1 | С | In middle of beach; not advisable to protect; CZMP recommends acquisition | |
| Lot 3 SP 12590 | THIRROUL | 1 | С | In middle of beach; not advisable to protect; CZMP recommends acquisition | |
| Lot 4 SP 12590 | THIRROUL | 1 | С | In middle of beach; not advisable to protect; CZMP recommends acquisition | |
| Lot 3 DP 5736 | THIRROUL | 1 | В | CZMP provdes for protection | |
| Lot A DP 421085 | THIRROUL | 1 | В | CZMP provdes for protection | |
| Lot 24 DP 7133 | THIRROUL | 2 | С | Isolated property surrounded by public lands; not feasible to protect; CZMP recommends acquisition | |
| Lot 37 DP 7525 | BULLI | 3 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 35 DP 7525 | BULLI | 3 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 102 DP 714032 | BULLI | 3 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 101 DP 714032 | BULLI | 3 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 36 DP 7525 | BULLI | 3 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 4 DP 201691 | WOONONA | 3 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 71 DP 12235 | WOONONA | 2 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 73 DP 12235 | WOONONA | 2 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 65 DP 12235 | WOONONA | 3 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 72 DP 12235 | WOONONA | 2 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 67 DP 12235 | WOONONA | 3 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 61 DP 12235 | WOONONA | 3 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 70 DP 12235 | WOONONA | 2 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 1 DP 825544 | WOONONA | 3 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 62 DP 12235 | WOONONA | 3 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 1 SP 57806 | WOONONA | 2 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 2 SP 57806 | WOONONA | 2 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 63 DP 12235 | WOONONA | 3 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 64 DP 12235 | WOONONA | 3 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 77 DP 12235 | WOONONA | 3 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 76 DP 12235 | WOONONA | 3 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 74 DP 12235 | WOONONA | 2 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 75 DP 12235 | WOONONA | 2 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 66 DP 12235 | WOONONA | 3 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 68 DP 12235 | WOONONA | 2 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 69 DP 12235 | WOONONA | 2 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 210 DP 13182 | TOWRADGI | 2 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 2 SP 13877 | TOWRADGI | 2 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 208 DP 13182 | TOWRADGI | 3 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 4 SP 13877 | TOWRADGI | 2 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 209 DP 13182 | TOWRADGI | 2 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 5 SP 13877 | TOWRADGI | 2 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 207 DP 13182 | TOWRADGI | 3 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 3 SP 13877 | TOWRADGI | 2 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 1 SP 13877 | TOWRADGI | 2 | В | CZMP recommends monitoring and DCP implementation for now. | |
| Lot 6 SP 13877 | TOWRADGI | 2 | В | CZMP recommends monitoring and DCP implementation for now. | |

C:USERSUWATKINS/APPDATA/LOCAL/HEWLETT-PACKARD/HP TRIM.TEMP/HPTRIM.7124/Z16 242669 ESP - PROJECT MANAGEMENT - REPORTING - WOLLONGONG COASTAL ZONE MANAGEMENT PLAN - IMPLEMENTATION ACTION PLAN - FINAL ~ WITH TRACK CHANGES.DOCX



Table 4 Summary of Recommended Future Action for Private Properties at Erosion and Recession Risk

This table provides a summary of the recommended future action for all private land found to be at low to extreme risk by 2100. In many cases only implementation of the proposed Coastal Management DCP is recommended at the current time, due either to the low level of risk to 2100, the physical location of building footprints compared with the hazard line estimate, and so on. In some cases, specific additional actions have been provided in this plan. Further details are given in the table below.

| | Risk at 2011 | Risk at 2050 | Risk at 2100 | Coastal DCP | FDCP | Recommended Future Strategy |
|---|-----------------|-----------------|-----------------|-------------------|--------------------|--|
| Stanwell Park: Existing Residences (1 centre of beach) | Low | Medium | Medium | ~ | | Low risk, therefore no action required at p Likely to be suitable for acquisition (e.g. P property affected, to ensure beach ameni |
| Stanwell Park: Existing Residences (4 ppties S end) | Medium | Medium | High | v | | Building footprints are landward of 2100 h required. DCP controls will trigger geotect properties are redeveloped, properties like recommend acquisition (e.g. PL.1/PL.2) a |
| Stanwell Park: Vacant Land (Future Development) (1 block at S end) | Low | Low | Medium | ~ | (| Low to medium risk, no current action req |
| Coalcliff: Existing Residences (10 ppties N end, but only affects edge of ppty below cliff (i.e. not the buildings) | Medium | Medium | High | ~ | $\mathbf{\Lambda}$ | Hazard affects land within property bound Further action unlikely to be required. |
| Vacant Land (Shark Park, currently zoned residential) | Medium | Medium | High | | | Refer Action W.6, which recommends rez |
| Little Austinmer: Existing Residences (1 at N end) | Low | Medium | Medium | \checkmark | | Future action dependent upon outcome to |
| Thirroul: Existing Residences 1 ppty at centre of beach | Medium | High | Extreme | $\mathbf{\nabla}$ | | Refer Action PL.1/PL.2 & PL.5 |
| Thirroul, McCauleys: Existing Residences (8 ppty at S end of beach, plus 8 ppties for geotechnical hazards extending along headland to McCauleys) | Medium | High | Extreme | G , | | Refer Action S.11. |
| McCauleys: Existing Residences 1 ppty at N end of beach | Medium | Medium | High | ~ | ~ | Refer Action PL.3/PL.4 & PL.5 |
| Sandon Point: Existing Residences (edge of 5 ppties at S end of beach) | Low | Medium | Medium | ~ | | Low risk at present, no action currently reproperties re-developed. |
| Woonona: Existing Residences (19 ppties at centre of beach) | Medium | Medium | High | ✓ | | Refer Action SP.3 |
| Towradgi: Existing Residences (3 ppties at N end) | Low | Medium | Medium | ~ | | Likely to be bedrock at depth to provide st would be triggered through DCP, mitigatir |
| Towradgi: Existing Residences (1 ppty at N end) | Medium | Medium | High | ~ | | Likely to be bedrock at depth to provide so would be triggered through DCP, mitigatir |
| L'E | | | | | | · |

oresent.

PL.1/PL.2) and retreat in future, as only one ty is retained.

nazard estimate, further action unlikely to be hnical investigation for foundation capacity as ely to be located near bedrock. Otherwise, and retreat in future.

uired. Suitable location for acquisition (e.g. PL.2)

daries at the base of cliffs, not the buildings.

coning to public recreation

manage Lawrence Hargrave Drive.

quired. DCP will manage building setbacks as

table foundation. Geotechnical investigation ng risk.

table foundation. Geotechnical investigation ng risk.





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Summary of submissions

Exhibition period 8 June – 8 July 2016

TRIM ESP-100.02.021

| Author | Summary of submission | Council Response |
|--------------------------|--|---|
| Neighbourhood Forum 5 | Support the proposed amendments subject to the following changes. | Noted. |
| | <u>B1 Residential Development</u> Recommend amendment to include Boarding Houses as being subject to the same controls for private open space, car parking, built form, solar access, front, side and rear building setbacks as multi-dwelling houses or residential flat buildings. | Noted. Boarding houses have recently been subject to a separate review adopted by Council 14 March 2016. |
| | Recommends amendment to prefer deep soil zone in the front setback and not merely allow for this. Submission suggests trees throughout their locality are planted in creeks or street frontages. | Noted. The location of a deep soil zone is site and context specific and is not always best located in the front setback of a dual occupancy development. |
| | <u>B1 Residential Development and D13 Wollongong City Centre</u> Recommend amendment to require all buildings over four stories to have at least 50% of green roofs or solar panels. | Noted. This approach is not consistent with the NSW Apartment Design Guide for SEPP 65 Development (residential flat buildings). For this reason this approach is not supported. |
| | level of compliance with Liveable Housing Design Standards for every dwelling. | Noted. Although this approach may result in a higher level of compliance with the Livable Housing Design Guideline, this would increase the cost of a development application when comparing those assessed by Council under Wollongong DCP, with those assessed as complying development. For this reason this approach is not supported. |
| | <u>E3 Car Parking</u> and <u>D13 Wollongong City Centre</u> Recommends requirement for green travel plan if the proposal for commercial, institutional or industrial purposes exceeds 2,000 m ² or 50 workers whichever is the higher. | Noted. Green Travel Plans are a new introduction to the Wollongong DCP and for this reason it is recommended Council encourage their use in the first instance. |
| | Submission recommends inclusions of character statements in the sustainability review of the DCP review. | Report to Council 30 May 2016 noted exclusion of the Character statements from sustainability review. Discussion with Neighbourhood Forum 5 in relation to the Desired Future |

| | | Character Statements for Keiraville/ Gwynneville continues to occur and is subject to separate review |
|--------------|--|--|
| Umow Lai P/L | Submission comments in relation to references 'encouraging' application of certain provision. E.g. encourage the use of green roofs and green walls, and encourage use of green travel plans. Submission advises applicants will not adopt or build such provisions unless mandated by Council. Submission | Noted. |
| | questions their inclusion in the DCP. Submission suggests Council should offer bonuses for installation of green roofs and walls. | development are investigated in the report to Council. |
| | A1 Introduction | Noted. On 30 May 2016 Council |
| | Comment relating to <i>ensuring development conforms to the principles of ESD</i> however remainder of the DCP does not ensure true sustainability. | resolved to vary the Council Report recommendation. Refer to Council meeting minutes (item |
| | A2 Ecologically Sustainable Development | N I |
| | Comment provided in relation to: | |
| | definition of sustainability as per EPA Act and proposed amendments not adopting that outlined in the Brundtland Report 1993. Good objectives however no measureable controls provided. Sustainability principles appear to focus on landscaping. Reference to Council encouraging use of environmental building rating tool e.g. Greenstar and NABERS. Submission advises the industry will always adopt the easiest path. Submission states unless Council specifies how they will assess 'equivalence' of such tools, this will not drive change. | Noted. A discussion paper formed the basis basis of the Sustainability Review. The discussion paper included a review of definitions and development controls which Council has scope to implement change. |
| | <u>B1 Residential Development</u> Landscaping provisions appear to be an improvement however lawn is environmentally unfriendly. Submission generally supports minimum number of trees provisions proposed however no control provided over the type of tree and thus unsure of ecological benefit. | Noted. The recommended amendments look to introduce a minimum number of trees onsite for categories of residential development. Related development objectives encourage the planting of native vegetation. Chapter E6 Landscaping includes recommended plant species for the Wollongong Local Government Area. |
| | <u>B5 Industrial Development</u> Objectifies are good. Refinements of controls suggested requiring further measurable change. | Noted. The industrial development chapter applies to a wide range of development types and for this reason specific controls are difficult to define. Additional examples of controls have been included post exhibition. |
| | D13 Wollongong City Centre | |
| | c5.2.2 comment regarding applicants choice between Greenstar and NABERS and demonstrating commitment as previously summarized. | Noted. |

| | E3 Car Parking, Access, Servicing, Loading Facilities | |
|-------------------------------------|---|--|
| | Comment relating to green ravel plans and reiteration there is no reason to use these. | Noted. As this is a new introduction for Wollongong DCP, Council is looking to encourage use in the first instance. |
| Resident | No opposition to the DCP changes proposed overall. Submission provides further comment in relation to aspects of the Wollongong DCP 2009 not proposed for amendment as part of the sustainability review, as well as Council processes in development assessment. | Noted. Submission forwarded to relevant internal division for action. |
| Edmiston Jones Architects P/L | Submission congratulations council's initiative in reviewing the DCP for sustainability purposes. Submission recommends consideration has been given to providing credits (e.g. increased FSR or height, less car parking, reduced contributions). | Noted. Refer to Council Report for discussion relating to incentives. |
| | A1 Introduction Submission suggests applicants could be required to address the objectives of ESD as contained in chapter A2 via a Statement of Environmental Effects required for development. | Noted. Development controls relating to ESD have been integrated throughout the DCP and are required to be addressed accordingly. |
| | B1 Residential Development In relation to adaptable housing and livable housing provisions, submission suggests potential contradiction with the National Construction Code for developments with less than 6 dwellings. | Noted. All development is required to comply with the NCC. NCC includes provisions relating to Design for Access and Mobility (AS 1428). Adaptable housing (AS 4299) and the Livable Housing Design Guide are additional. Council may specify an additional level of compliance with such provisions. |
| | Submission recommends the definition of the landscaped area include decks and paving in their area calculation. | Noted. Objectives for landscaped areas (Chapter B1) include aims to preserve and retain vegetation, and encourage planting of additional vegetation, to allow for water infiltration and minimise urban run-off. Additionally the definition of landscaped area as per the standard instrument LEP and Wollongong LEP 2009 means a part of a site used for growing plants, grasses and trees, but does not include any building, structure or hard paved area. |
| | No reference to compliance with Part J of the NCC for non- residential development is noted. Certifiers will require compliance with the NCC as part of a Construction Certificate. | 1979 and associated regulations, all works must be carried out in accordance with the BCA. |

| Property Council of Australia | Thanked Council for the opportunity to comment and supports the review of the DCP to better achieve sustainability outcomes | Noted. |
|-------------------------------------|--|--|
| | Submission raised concern that the proposed DCP amendments do not improve the overall energy performance for residential development, but focus on landscaping, deep soil zones and adaptable housing. | Noted. Requirements of BASIX SEPP specify Council cannot mandate anything above BASIX in relation to energy or water efficiency or thermal comfort for residential developments. |
| | Submission notes the increase in landscaping and deep soil zone requirements and implication in increasing the cost of building medium density dwellings and the longer term flow on effects. Submission suggests such amendments will disproportionally increase costs of medium density developments. | Noted. Proposed controls have been benchmarked against other NSW Councils and SEPP (Exempt and complying development codes) and are in line with such provisions. |
| | Submission suggests there are broader amendments to the DCP that WCC could pursue in order to improve the density, design outcomes and affordability of medium density dwellings which are provided by other local government areas. | Noted. Discussions to occur upon commencement of Housing Study. |
| | Submission suggests the definition of landscaped area should include decks and paving to provide flexibility for medium density develops and enable landscaped areas to be more functions, achieve broader sustainability objectives having comment entertainment areas. | Noted however not supported. Objectives for landscaped areas (Chapter B1) include (in short) aims to preserve and retain vegetation, and encourage planting of additional vegetation. Additionally to allow for water infiltration and minimise urban run-off. The definition of landscaped area as per the standard instrument LEP and Wollongong LEP 2009 means a part of a site used for growing plants, grasses and trees, but does not include any building, structure or hard paved area. |
| | Submission asks Council to consider planning controls that provide incentive to development to improve sustainability performance of buildings. Examples provided include incentives through increased FSR or height, less car parking or reduced contributions. | Noted. See report to Council. |

Part A – Introduction

hapter A1: Introduction

Contents

- 1 NAME OFTHIS DEVELOPMENT CONTROL PLAN
- 2 **REVIEW OF THIS DCP**
- 3 **PURPOSE OF THE DEVELOPMENT CONTROL PLAN**
- **AIMS & OBJECTIVES OF THIS DEVELOPMENT** 4 **CONTROL PLAN**
- **RELATIONSHIP WITH OTHER PLANS AND POLICIES** 5
- HOW TO USE THE DCP 6
- SAVINGS AND TRANSITIONAL PROVISIONS 7
- VARIATIONS TO DEVELOPMENT CONTROLS IN THE 8 DCP
- SITE AND CONTEXT ANALYSIS 9
- 9.1 Objectives
- Minimum Requirements for Site and Context Analysis 9.2

| 10 | PRE-LODGEMENT MEETINGS FOR DEVELOPMENT PROPOSALS | 7 |
|----|---|-----|
| 11 | WHEN IS A DEVELOPMENT APPLICATION REQUIRE | D 7 |
| 11 | 1 Requirements for the lodgement of a Development Application | 9 |
| 12 | DEVELOPMENT APPLICATION ASSESSMENT PROCESS | 11 |
| 12 | 1 What matters will Council take into consideration in the assessment of a Development Application? | 11 |
| 12 | 2 Lodgement of a modifications to development consent | 12 |
| Fi | gures | |

1

1

1

2

2

2

3

3

3

4

| Figure 1: Typical Site and Context Analysis – dwelling | 6 |
|--|---|
| Figure 2: Assessment Process | 8 |

| Document Control | | | | |
|---------------------------|-----------------------|--|--|--|
| | | Document ID: Wollongong DCP 2009 – A1 Introduction | | |
| Adoption Date | In Force Date | Revision Details | | |
| TO BE INSERTED IF ADOPTED | DATE OF PUBLIC NOTICE | Updated aim resulting from sustainability review. | | |
| | | | | |
| | | | | |

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1 NAME OF THIS DEVELOPMENT CONTROL PLAN

This plan is known as Wollongong Development Control Plan (DCP) 2009. DCP 2009 was adopted by Council on 15 December 2009 and came into effect on 3 March 2010.

This DCP 2009 has been prepared in accordance with Section 74C of the Environmental Planning and Assessment Act 1979 and clause 16 of the Environmental Planning and Assessment Regulation 2000.

2 **REVIEW OF THIS DCP**

Council reviews this DCP on a periodic basis. It is recommended that applicants contact Council's Customer Service Centre to confirm that this version is current. Table of Amendments is available as part of the Table of Content.

3 PURPOSE OF THE DEVELOPMENT CONTROL PLAN

The purpose of this DCP is to outline built form controls to guide development. This DCP supplements the provisions of Wollongong Local Environmental Plan 2009, Wollongong Local Environmental Plan (West Dapto) 2010, Wollongong Local Environmental Plan 1990 and Wollongong Local Environmental Plan No 38 (1984). In the event of any inconsistency between this DCP and the relevant LEP, the LEP will prevail.

Under Section 79C of the Environmental Planning and Assessment Act 1979, the consent authority is required to take into consideration the relevant provisions of this DCP in determining a Development Application for development in the City of Wollongong.

The DCP also contains administrative provisions including details on how Development Applications will be publicly notified and what meetings may be available, to enable stakeholders to discuss any issues concerning an application.

4 AIMS & OBJECTIVES OF THIS DEVELOPMENT CONTROL PLAN

The objectives of this DCP are:

- a) To provide detailed development controls within a single document which support the Local Environmental Plan.
- b) To ensure appropriate information is submitted with Development Applications.
- c) To ensure development conforms with the principles of Ecologically Sustainable Development.
- d) To ensure that development contributes to the quality of the natural and built environments.
- e) To encourage development that contributes to the quality of the public domain.
- f) To ensure future development responds positively to the qualities of the site and the character of the surrounding locality.
- g) To encourage the provision of development that is accessible and adaptable to meet the existing and future needs of all residents, including people with a disability.
- h) To ensure development is of a high design standard and energy efficient.
- i) To ensure new development is consistent with the desired future character for the area.

- j) To ensure the threat of bushfire is assessed.
- k) To protect areas of high scenic and aesthetic value.
- I) To ensure new development contributes to the safe and liveable environments.

5 RELATIONSHIP WITH OTHER PLANS AND POLICIES

- 1. This plan applies to all lands within the City of Wollongong Local Government Area (LGA) excluding sites approved under Part 3A of the Act.
- 2. Wollongong Local Environmental Plan 2009 (Wollongong LEP 2009), Wollongong Local Environmental Plan (West Dapto) 2010 (WDLEP 2010) are the principal environmental planning instruments which apply to the majority of lands within City of Wollongong. Wollongong Local Environmental Plan 1990 and Wollongong Local Environmental Plan No. 38 continue to apply to certain lands which have been "deferred" under West Dapto LEP 2010.
- 3. State Environmental Planning Policies (SEPPs) or State Codes may also apply to certain lands in the City of Wollongong. The statutory provisions of any SEPP or State Code will also prevail over this DCP, in the event of any inconsistency.
- 4. Different SEPPs cover a range of development including but not limited to secondary dwelling, boarding houses, education facilities, hospitals, seniors living, infrastructure and complying development.

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6 HOW TO USE THE DCP

1. This DCP is divided into following Parts:-

| Part A | Introduction |
|------------|--|
| Part B | Land Use Based Controls (eg Residential Development, Residential Subdivision, Development in the Mixed Use, Business, Industrial, Rural Zones and Development in the Illawarra Escarpment) |
| Part C | Specific Land Use Controls (City Wide) |
| Part D | Locality Based DCPs / Precinct Plans |
| Part E | General Controls |
| Appendices | (Public Notification and Advertising Procedures for applications, Definitions etc) |

- 2. Applicants will need to comply with the requirements of all relevant parts of the DCP. The guidelines contained in Wollongong DCP 2009 must be taken into account in the preparation of any Development Application for the proposed land use or development.
- 3. Compliance with the provisions of this DCP may not guarantee that consent will be granted to a Development Application (DA), particularly where the objectives of the DCP have not been met.

7 SAVINGS AND TRANSITIONAL PROVISIONS

Wollongong DCP 2009 applies to any development application which was lodged with Council but not finally determined before the commencement of this Plan. Any application lodged before the

commencement of this plan will be assessed in accordance with any previous development control plan, technical policy or other Council policy which applied to the site at the time of application lodgement including exhibited draft plans and policies.

8 VARIATIONS TO DEVELOPMENT CONTROLS IN THE DCP

The DCP aims to allow flexibility in the application of such development controls to promote innovation and design excellence. Council may consider variations to the requirements of the WDCP in certain circumstances.

Variation to development control will be considered on a case by case basis and will only be considered where written justification is provided to the satisfaction of Council, that the objectives of the development control have been achieved.

- 1. The variation statement must address the following points:
 - (a) The control being varied; and
 - (b) The extent of the proposed variation and the unique circumstances as to why the variation is requested; and
 - (c) Demonstrate how the objectives are met with the proposed variations; and
 - (d) Demonstrate that the development will not have additional adverse impacts as a result of the variation.
- 2. The variation statement should be contained within the Statement of Environmental Effects accompanying a development application.
- 3. Any written variation request must be supported by detailed site analysis and other necessary documentation.
- 4. The fact that an existing development may not comply with one or more of the development controls, does not necessarily mean that the development control is unreasonable or unnecessary, when applied to future development.
- 5. More specific requirements relating to variation statements may be included under the individual chapters of this DCP.

9 SITE AND CONTEXT ANALYSIS

9.1 **Objectives**

A Site and Context Analysis is prepared prior to inform the design process. It enables the applicant, neighbours and Council to appreciate the site's natural and contextual features; identify the relationship of the site to adjacent properties; and ensure that the proposal appropriately respects and responds to its context and the prevailing character of a street.

The objectives of this clause are:

- a) To ensure that a Site and Context Analysis is undertaken for sites subject of a development application.
- b) To promote development with good design by ensuring the consideration of existing characteristics, opportunities and constraints of the site and its surrounds.
- c) To ensure that consideration is given to all relevant site and locality issues in the formulation of development proposals.

d) To identify the minimum requirements for the preparation of a detailed Site and Context Analysis to lead and support the design process for developments.

9.2 Minimum Requirements for Site and Context Analysis Plan

- 1. A Site and Context Analysis involves two (2) phases which includes a site survey and the analysis
- 2. The site and context analysis plan must also demonstrate that the development is well proportioned, both as an individual element and within the streetscape.
- 3. A Site and Context Analysis Plan must accompany ALL development applications for residential development, with the exception of internal alterations to existing buildings. The level of information required may vary depending on the extent of work being carried out.
- 4. The Site and Context Analysis must comprise an annotated plan and should be accompanied by written information. A Site Analysis plan must be based on a survey drawing produced by a registered surveyor. The site analysis plan should also contain a reference number and the date it was prepared.
- 5. The Site and Context Analysis Plan must be prepared to scale and accurately show all relevant information, as follows:
 - a) Contours and levels to Australian Height Datum (AHD);
 - b) Land description including lot dimensions, true north point and scale;
 - c) The footprint, height and use of existing and proposed buildings on the site including immediately adjoining sites. Larger developments will include a wider context analysis;
 - d) Any endangered ecological community (EEC), existing trees, significant trees or other vegetation (including any High Conservation Value native vegetation);
 - e) Site orientation and dimensions and local climatic features such as wind direction;
 - f) Site constraints including flood affected land, overland flow paths, slope instability, contaminated land, landfill areas, heritage items on or in the vicinity of the site and archaeological sites;
 - g) Services and utilities including location of drainage infrastructure and connection for utility services;
 - h) Easements, tences, boundaries and site access;
 - i) The location of any sewer main upon the site, where development involves the construction of a basement level;
 - j) Views to and from the site and the existence of any significant nearby view corridors from public spaces and nearby residences (where relevant);
 - k) Movement corridors including local streets and pedestrian pathways;
 - I) Any other notable natural landform features or other characteristics of the site.
 - m) Difference in levels between the site and adjacent properties;
 - n) Location of significant environmental features adjacent to the site including watercourses, noise, pollution sources and environmentally sensitive land;
 - o) Sites with adjoining boundaries; and
 - p) Those sites directly across any road adjacent to the site.
 - q) Inner and outer protection zone areas.
 - r) Trees required to be removed for any development or Asset Protection Zones.
- 6. Larger development must also consider the footprint, height and use of buildings on a minimum of:
 - a) Two lots either side of the development site;
 - b) Any allotments which abut the rear boundary of the development site;
 - c) Setback distances, areas of private open space and windows overlooking the site; and
 - d) Direction and distance to local facilities including shops, schools, public transport and recreation and community facilities.

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Figure 1: Typical Site and Context Analysis - dwelling



10 PRE-LODGEMENT MEETINGS FOR DEVELOPMENT PROPOSALS

- 1. A formal pre-lodgement meeting is recommended prior to the lodgement of a Development Application. Generally development for the purpose of a dwelling houses, alterations and additions to dwellings, secondary dwellings, dual occupancies and ancillary structures will not require a pre-lodgement. Contact Council to establish a pre-lodgement meeting.
- 2. The preliminary concept plans required for the formal pre-lodgement meeting should include the following: site plan, floor layout plans, elevation plans, sectional plans and a survey plan.
- 3. Pre-lodgement meetings are held on a weekly basis and will include Council's assessment team. Relevant consultants and advisors used by the applicant should also attend these meetings.
- 4. The quality of advice provided by Council staff on a project will be based upon the level of information provided to Council by the applicant / applicant's consultant(s) prior to and at that meeting.
- 5. Further pre-lodgement meetings may be warranted for very major or technically complex projects. In some cases, it may be prudent (but not mandatory) for the applicant to provide Council with the Draft Statement of Environmental Effects (SEE) or Draft Environmental Impact Statements (EIS) or other supporting technical studies, especially where the proposal involves very complex environmental impact assessment matters.
- 6. Pre-lodgement meeting notes will be made after each meeting. The meeting notes will reflect the main issues discussed at the pre-lodgement meeting. The pre-lodgement meeting notes will include what supporting information / reports are required to be submitted with the Development Application. The pre-lodgement meeting notes will be provided to the applicant.
- 7. Council reserves the right to seek additional information at the Development Application stage where such information is, in the opinion of Council, necessary to enable the proper assessment of the application, notwithstanding any previous pre-lodgement meeting.

11 WHEN IS A DEVELOPMENT APPLICATION REQUIRED

- 1. The lodgement of a Development Application is required for any proposed development where the relevant LEP or any other environmental planning instrument specifies that a proposed development may only be carried out with development consent upon the land to which the instrument applies.
- 2. Certain proposed developments may be classified as either under "designated development" or an "integrated development" under the Environmental Planning and Assessment Act 1979 or Regulation 2000.

Designated development requires the preparation of an Environmental Impact Assessment (EIS) which must be undertaken in accordance with the requirements of the Director-General of the NSW Department of Planning.

Integrated development requires formal concurrence approval from one or more public authorities. Council is required to obtain general terms of approval which if granted consent form part of the conditions of consent.

3. A Development Application is not required for any proposed development which is classified as "exempt development" or "complying development" under the relevant LEP, any State Environmental Planning Policy or State Code.

Figure 2: Assessment Process



11.1 Requirements for the lodgement of a Development Application

- 1. A Development Application may be required to be accompanied by specialist reports and plans depending on the nature of the site, including constraints and development proposed.
- 2. Site constraints and relevant planning controls and standards are identified on a Section 149 Certificate.
- 3. Development Application fees for registered charities will be waived.
- 4. Where a Development Application proposes a variation to a development standard the applicant must clearly identify the proposed variation on the development application form. This will enable Council to notify and exhibit the proposed variation to the development standard. Failure on behalf of the applicant to clearly identify a proposed variation at lodgement may result in re-notification of the application.
- 5. The requirements for the lodgement of a Development Application for a particular type of development are addressed in the Matrix for Minimum Lodgement Requirements, in section 11.2 of Chapter A1 (Table 1).

11.1.1 Matrix of minimum lodgement requirements

The matrix table is designed to provide a brief summary of the minimum information requirements for lodgement with a Development Application for common types of development. However, a full review of the DCP is recommended in order to ensure that all necessary information is lodged in support of a Development Application.

In the event that a proposed development is not listed in the matrix table, it is recommended that the applicant contact Council, to determine the minimum information required for lodgement of a Development Application.

Further additional documentation may be required for a specific type of developments during the assessment process.

| | Subdivision | Dwelling House | Dual Occupancy | Multi Dwelling Development | Residential Apartment Building | Mixed Use Development | Child Care Centre | Retail Development | Commercial Office Development | Industrial Development | Warehouse Distribution Centre | Bulky Goods Showroom | Educational Establishment | Tele-Communications |
|--|-------------|----------------|----------------|-------------------------------|-----------------------------------|-----------------------|-------------------|--------------------|----------------------------------|------------------------|----------------------------------|----------------------|------------------------------|---------------------|
| Site and Context Analysis | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Statement of Environmental Effects / EIS | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Site Plan | NA | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
| Subdivision Plan | ✓ | • | • | • | • | • | • | • | • | • | • | • | NA | NA |
| Floor Layout Plans | NA | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |

Table 1 Minimum Information Requirements for lodgement of a Development Application

| | Subdivision | Dwelling House | Dual Occupancy | Multi Dwelling Development | Residential Apartment Building | Mixed Use Development | Child Care Centre | Retail Development | Commercial Office Development | Industrial Development | Warehouse Distribution Centre | Bulky Goods Showroom | Educational Establishment | Tele-Communications |
|---|-------------|----------------|----------------|-------------------------------|-----------------------------------|-----------------------|-------------------|--------------------|----------------------------------|------------------------|----------------------------------|----------------------|------------------------------|---------------------|
| Elevation Plans | NA | ~ | ~ | ~ | ~ | ✓ | ✓ | ✓ | ~ | ~ | ~ | ~ | ~ | ✓ |
| Section Plans | NA | ~ | ✓ | ~ | ~ | ~ | ~ | ~ | ~ | ✓ | ~ | ~ | ~ | NA |
| Shadow Diagrams | NA | • | ✓ | ~ | ~ | ~ | • | • | • | • | • | • | • | • |
| Streetscape Perspective | NA | • | • | ~ | ~ | ~ | • | • | • | • | • | • | • | • |
| Photomontage | NA | • | • | ~ | ~ | ~ | ~ | ~ | ~ | • | | • | • | • |
| 3D Model | NA | NA | NA | • | • | • | • | • | • | | • | • | • | • |
| SEPP 65 Design Verification Statement | NA | NA | NA | • | • | • | NA | NA | NA | NA | NA | NA | NA | NA |
| BASIX Certificate | NA | • | • | • | • | • | NA | NA | NĂ | NA | NA | NA | NA | NA |
| Landscape Plan | NA | • | • | • | • | • | • | • | • | • | • | • | • | • |
| Schedule of External Finishes | NA | • | • | ~ | ~ | ~ | X | ~ | ~ | ~ | ~ | ~ | • | • |
| Tree Survey | • | • | • | ~ | 1 | X | • | • | • | ~ | ~ | ~ | ~ | • |
| Arborist Report | • | • | • | ~ | ~ | ~ | • | • | • | • | • | • | • | • |
| Economic Impact Assessment Report | NA | NA | NA | NA | NA | • | NA | ~ | • | NA | NA | • | NA | NA |
| Noise Impact Assessment Report | • | • | . { | | • | • | • | • | • | • | • | • | • | NA |
| Geotechnical Impact Assessment Report | • | × | | • | • | • | • | • | • | • | • | • | • | • |
| Acid Sulfate Soil Assessment Report | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| Traffic Impact Assessment Report | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| Heritage Impact Assessment Report | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| Aboriginal Archaeological | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| Assessment Report | | | | | | | | | | | | | | |
| Bushfire Assessment Report | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| Threatened Species Impact Assessment Report | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| Drainage Concept Plan & Calculations | • | ~ | ~ | ~ | ✓ | ✓ | ✓ | ✓ | ~ | ~ | ~ | ~ | ~ | • |
| On-site Detention | • | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | • | • |

| | Subdivision | Dwelling House | Dual Occupancy | Multi Dwelling Development | Residential Apartment Building | Mixed Use Development | Child Care Centre | Retail Development | Commercial Office Development | Industrial Development | Warehouse Distribution Centre | Bulky Goods Showroom | Educational Establishment | Tele-Communications |
|--|-------------|----------------|----------------|-------------------------------|-----------------------------------|-----------------------|-------------------|--------------------|----------------------------------|------------------------|----------------------------------|----------------------|------------------------------|---|
| Plan | | | | | | | | | | | | | | |
| Flood Study | • | • | • | • | • | • | • | • | • | • | • | • | • | • |
| Preliminary Contamination Audit – Review of Existing & Previous Site History | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ | * | ~ | Image: A state of the state of |
| Erosion & Sedimentation Control Plan | ~ | • | • | • | • | • | • | • | • | í | v | ~ | ~ | • |
| Demolition Work Plan | • | • | • | • | • | • | • | • | · Ç | · | • | • | • | • |
| Waste Management Plan | • | ~ | ~ | ~ | ~ | ~ | ~ | ~ | J. | ~ | ~ | ✓ | ~ | ~ |

LEGEND

- Information required
- Information may be required (Determined at pre-lodgement meeting with Council staff).
- NA Not Applicable

12 DEVELOPMENT APPLICATION ASSESSMENT PROCESS

12.1 What matters will Council take into consideration in the assessment of a Development Application?

- 1. Each application will be considered on its own merits in terms of the achievement of the objectives of this DCP. Any variations must comply with Clause 8 of Chapter A1.
- 2. In assessing an application, Council will take into consideration a range of the matters, including (but not necessarily limited to) the following:
 - (a) Environmental Planning and Assessment Act 1979, in particular the "matters for consideration" as listed under Section 79C of the Act;

In determining a development application, a consent authority is to take into consideration such of the following matters as are of relevance to the development the subject of the development application: (a) the provisions of:

- (i) any environmental planning instrument, and
- (ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Director-General has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and
- (iii) any development control plan, and
- (iii) any planning agreement that has been entered into under section 93F, or any draft planning agreement that a developer has offered to enter into under section 93F, and

- (iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph), and
- (v) any coastal zone management plan (within the meaning of the <u>Coastal Protection Act 1979</u>), that apply to the land to which the development application relates,
- (b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,
- (c) the suitability of the site for the development,
- (d) any submissions made in accordance with this Act or the regulations,
- (e) the public interest.
- 6. A development application may be determined by a planning officer, Independent Hearing and Assessment Panel (IHAP), Joint Regional Planning Panel (JRPP) or Council.
- 7. A review of determination application may be lodged with Council if an applicant is dissatisfied with Council's original decision on the application in accordance with Section 82A of the EPA Act.

12.2 Lodgement of a modifications to development consent

The EPA Act allows applicants to modify approved development applications [Section 96(1) and Section 96(2)] where a modification involves:

- a) Minor error, misdescription or miscalculations; or
- b) Modifications involving minimal environmental impact; or
- c) Other modifications
- 1. Development Application for modifications must include
 - a) Written evidence documenting the changes
 - b) Where changes are proposed to the built form internally or externally, plans are required that clearly illustrate the variation to the original approved development. These plans must highlight any changes on the plans via different colours or other visual means.
 - c) Demonstrate which development controls apply to the proposed modification and how they are complied with under the modification.



Part A – Introduction

un dis terms to the terms of ter **Chapter A2: Ecologically Sustainable Development**

Contents

- 1.1 Introduction
- 1.2 Objectives
- 1.3 Sustainability principles
- 1.4 **Development Objectives and Controls**
- 1.5 Resources for further information

| Document Control | | |
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| Adoption Date | In Force Date | Revision Details |
| TO BE INSERTED IF ADOPTED | DATE OF PUBLIC NOTICE | New chapter resulting from sustainability review of DCP |
| | | |
| | | |

tem? Attachment?

1.1 Introduction

Council encourages the application of ecologically sustainable development (ESD) for all development in the Wollongong local government area. Ecologically sustainable development, as defined by the *Environmental Planning and Assessment Act 1979,* requires the effective integration of economic and environmental considerations in decision-making processes. Ecologically sustainable development can be achieved through the implementation of the following principles and programs:

(a) the precautionary principle—namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

In the application of the precautionary principle, public and private decisions should be guided by:

(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

(ii) an assessment of the risk-weighted consequences of various options,

- (b) inter-generational equity—namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,
- (c) conservation of biological diversity and ecological integrity—namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,
- (d) improved valuation, pricing and incentive mechanisms—namely, that environmental factors should be included in the valuation of assets and services, such as:
 - (i) polluter pays—that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,
 - (ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,
 - (iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

The State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004 mandates provisions relating to reduced consumption of mains-supplied potable water, reduction of greenhouse gases emissions and improved thermal comfort for all residential development. Council encourages applicants to go beyond the minimum BASIX requirements for their development.

1.2 Objectives

Through the application of ESD, development should be sited, designed and constructed taking into consideration the principles of ESD, and comply with the following objectives.

- (a) Greenhouse gas emissions will be reduced.
- (b) Potable water use will be reduced.
- (c) Development can adapt to climate change.

- (d) Waste will be reduced.
- (e) Recycling of waste and use of products from recycled sources will be increased.
- (f) Energy that is used will be renewable and low carbon.
- (g) Indoor environmental quality is improved.
- (h) The environmental impacts from building materials will be reduced through reduction, reuse and recycling of materials, resources and building components.
- (i) Biodiversity values are improved.

Council also encourages the application of an environmental building rating tool e.g. Green Star or NABERS, to document and demonstrate the environmental performance of a proposed development.

1.3 Sustainability principles

Taking into consideration the site and context analysis, the principles of passive solar design should be used to refine the design and siting of the development. Passive solar design involves designing a development for the local climate, orientating to achieve good passive solar heating in winter and cooling in summer, insulating, glazing and considering the thermal mass of construction materials.

Council encourages the use of the most efficient water and energy appliances and systems, natural ventilation, efficient heating and cooling systems and renewable energy in order to minimise greenhouse gas emissions resulting from the development.

The development must aim to maintain, conserve and enhance indigenous species, populations and ecological communities present prior to, during and post construction. Consideration should also be given to:

- The use of local indigenous species to enhance wildlife corridors and contribute to the amenity of the area.
- Maintaining and enhancing existing vegetation. Landscaped areas should aim to enhance existing wildlife corridors onsite and adjacent to the site, and may include the preservation and reuse of topsoil.
- The use of deciduous trees to provide shade in summer and allow sunlight infiltration during winter.
- Increasing landscaped areas to enable water infiltration and decrease hard surfaces.
- For larger developments, the incorporation of green roofs and walls is encouraged. Green roofs and walls assist in the regulation of the buildings temperature, as well as acting as insulation, improving air quality, enhancing biodiversity and reducing stormwater runoff.

Careful analysis and selection of building materials can result in improvements to the thermal comfort and long term efficiency of the development. The embodied energy of construction materials should be considered when selecting building materials and during construction. Embodied energy includes all the energy associated with mining and processing of materials, manufacturing, transportation and eventual delivery of the product.



Above: Dwelling diagram incorporating passive solar design principles (source <u>www.yourhome.gov.au).</u>



Above: Examples of residential lots orientated towards a street and a preferred living / sleeping zone orientation for passive solar performance (source www.yourhome.gov.au).

1.4 Development Controls

Development controls to improve the sustainability of development throughout Wollongong are integrated into the relevant chapters of this DCP. The Land Use based DCP chapters, for example B1 Residential Development, B3 Mixed Use Development, B5 Industrial Developments, and B6 Development in the Illawarra Escarpment, relay objectives relating to the application of ESD, for example energy efficiency, maximising retention of significant remnant trees and other vegetation, and encouraging innovative housing design. These DCP chapters include development controls relating to landscaping, deep soil zones, building character and form, adaptable and universally designed housing.

Chapter B2: Residential Subdivision and D16 West Dapto Urban Release Area include objectives and development controls which aim to ensure subdivisions are designed to take into account the principles of ecological sustainable development. They include focus on lot orientation for future solar efficiency and walkability. The DCP chapter includes development controls relating to subdivision design, lot layout, provision for street tree planting and stormwater drainage.

Chapter D13 Wollongong City Centre Precinct includes objectives relating to the application of ESD, as well as provisions relating to energy and water efficiency and conservation for non-residential developments.

Please refer to relevant chapters of the Wollongong DCP 2009 for additional development controls.

1.5 Resources for further information

Australian Government, 2013, Your Home Australia's guide to environmentally sustainable homes, http://www.yourhome.gov.au/, viewed February 2016.

City of Sydney, December 2014, Green roofs resource manual, <u>http://www.cityofsydney.nsw.gov.au,</u> viewed February 2016.

7Part B - Land Use Based Controls Chapter B1: Residential Development

Contents

| 2OBJECTIVES33DEFINITIONS34GENERAL RESIDENTIAL CONTROLS44.1Number of Storeys44.2Front Setbacks64.3Side and Rear Setbacks64.4Site Coverage64.5Landscaped Area74.6Private Open Space84.7Solar Access94.8Building Character and Form104.9Fences114.10Car parking and Access134.11Storage Facilities144.12Site Facilities144.13Fire Brigade Servicing154.14Services154.15Development near the Coastline164.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for Semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 1 | INTRODUCTION | 3 |
|---|------|---|----|
| 3DEFINITIONS34GENERAL RESIDENTIAL CONTROLS44.1Number of Storeys44.2Front Setbacks54.3Side and Rear Setbacks64.4Site Coverage64.5Landscaped Area74.6Private Open Space84.7Solar Access94.8Building Character and Form104.9Fences114.10Car parking and Access134.11Storage Facilities144.12Site Facilities144.13Fire Brigade Servicing154.14Services154.15Development near the Coastline164.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for Semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 2 | OBJECTIVES | 3 |
| 4GENERAL RESIDENTIAL CONTROLS44.1Number of Storeys44.2Front Setbacks54.3Side and Rear Setbacks64.4Site Coverage64.5Landscaped Area74.6Private Open Space84.7Solar Access94.8Building Character and Form104.9Fences114.10Car parking and Access134.11Storage Facilities144.12Site Facilities144.13Fire Brigade Servicing154.14Services154.15Development near the Coastline164.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for Semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 3 | DEFINITIONS | 3 |
| 4.1Number of Storeys44.2Front Setbacks54.3Side and Rear Setbacks64.4Site Coverage64.5Landscaped Area74.6Private Open Space84.7Solar Access94.8Building Character and Form104.9Fences114.10Car parking and Access134.11Storage Facilities144.12Site Facilities144.13Fire Brigade Servicing154.14Services154.15Development near the Coastline164.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4 | GENERAL RESIDENTIAL CONTROLS | 4 |
| 4.2Front Setbacks54.3Side and Rear Setbacks64.4Site Coverage64.5Landscaped Area74.6Private Open Space84.7Solar Access94.8Building Character and Form104.9Fences114.10Car parking and Access134.11Storage Facilities144.12Site Facilities144.13Fire Brigade Servicing154.14Services154.15Development near the Coastline164.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.1 | Number of Storeys | 4 |
| 4.3Side and Rear Setbacks64.4Site Coverage64.5Landscaped Area74.6Private Open Space84.7Solar Access94.8Building Character and Form104.9Fences114.10Car parking and Access134.11Storage Facilities144.12Site Facilities144.13Fire Brigade Servicing154.14Services154.15Development near the Coastline164.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.2 | Front Setbacks | 5 |
| 4.4Site Coverage64.5Landscaped Area74.6Private Open Space84.7Solar Access94.8Building Character and Form104.9Fences114.10Car parking and Access134.11Storage Facilities144.12Site Facilities144.13Fire Brigade Servicing154.14Services154.15Development near the Coastline164.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.3 | Side and Rear Setbacks | 6 |
| 4.5Landscaped Area74.6Private Open Space84.7Solar Access94.8Building Character and Form104.9Fences114.10Car parking and Access134.11Storage Facilities144.12Site Facilities144.13Fire Brigade Servicing154.14Services154.15Development near the Coastline164.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.4 | Site Coverage | 6 |
| 4.6Private Open Space84.7Solar Access94.8Building Character and Form104.9Fences114.10Car parking and Access134.11Storage Facilities144.12Site Facilities144.13Fire Brigade Servicing154.14Services154.15Development near the Coastline164.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.5 | Landscaped Area | 7 |
| 4.7Solar Access94.8Building Character and Form104.9Fences114.10Car parking and Access134.11Storage Facilities144.12Site Facilities144.13Fire Brigade Servicing154.14Services154.15Development near the Coastline164.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.6 | Private Open Space | 8 |
| 4.8Building Character and Form104.9Fences114.10Car parking and Access134.11Storage Facilities144.12Site Facilities144.13Fire Brigade Servicing154.14Services154.15Development near the Coastline164.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.7 | Solar Access | 9 |
| 4.9Fences114.10Car parking and Access134.11Storage Facilities144.12Site Facilities144.13Fire Brigade Servicing154.14Services154.15Development near the Coastline164.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.8 | Building Character and Form | 10 |
| 4.10Car parking and Access134.11Storage Facilities144.12Site Facilities144.13Fire Brigade Servicing154.14Services154.15Development near the Coastline164.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.9 | Fences | 11 |
| 4.11Storage Facilities144.12Site Facilities144.13Fire Brigade Servicing154.14Services154.15Development near the Coastline164.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.10 | Car parking and Access | 13 |
| 4.12Site Facilities144.13Fire Brigade Servicing154.14Services154.15Development near the Coastline164.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.11 | Storage Facilities | 14 |
| 4.13Fire Brigade Servicing154.14Services154.15Development near the Coastline164.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.12 | Site Facilities | 14 |
| 4.14Services154.15Development near the Coastline164.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.13 | Fire Brigade Servicing | 15 |
| 4.15Development near the Coastline164.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.14 | Services | 15 |
| 4.16View Sharing174.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.15 | Development near the Coastline | 16 |
| 4.17Retaining Walls184.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.16 | View Sharing | 17 |
| 4.18Swimming Pools and Spas204.19Development Near Railway Corridors and Major Road224.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.17 | Retaining Walls | 18 |
| 4.19Development Near Railway Corridors and Major Road224.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.18 | Swimming Pools and Spas | 20 |
| 4.20Additional controls for semi-detached dwellings – alterations and additions234.21Additional Controls for Dual Occupancy's - Minimum Site Width23 | 4.19 | Development Near Railway Corridors and Major Road | 22 |
| 4.21 Additional Controls for Dual Occupancy's - Minimum Site Width 23 | 4.20 | Additional controls for semi-detached dwellings – alterations and additions | 23 |
| | 4.21 | Additional Controls for Dual Occupancy's - Minimum Site Width | 23 |

| | 4.22 | Additional Controls for Dual Occupancy's - Building Character and Form | 24 |
|---|-------------------|--|----|
| | 4.23 | Additional Controls for Dual Occupancy's – Deep Soil Zones | 24 |
| | 5 | ATTACHED DWELLINGS AND MULTI - | |
| | $\mathbf{\nabla}$ | DWELLING HOUSING | 25 |
| 6 | 5.1 | Minimum Site Width Requirement | 25 |
| r | 5.2 | Number of Storeys | 26 |
| | 5.3 | Front Setbacks | 27 |
| | 5.4 | Side and Rear Setbacks | 27 |
| | 5.5 | Building Character and Form | 29 |
| | 5.6 | Access / Driveway Requirements | 30 |
| | 5.7 | Car Parking Requirements | 31 |
| | 5.8 | Landscaping Requirements | 32 |
| | 5.9 | Deep Soil Planting | 33 |
| | 5.10 | Communal Open Space | 34 |
| | 5.11 | Private Open Space | 34 |
| | 5.12 | Solar Access Requirements | 35 |
| | 5.13 | Additional Control for Multi Dwelling Housing - Dwelling Mix and Layout | 36 |
| | 5.14 | Additional Control for Multi Dwelling Housing - Adaptable and Universally Designed Housing | 37 |
| | 5.15 | Additional Control for Multi Dwelling Housing - Crime Prevention through Environmental Design | 37 |
| | 6 | RESIDENTIAL FLAT BUILDINGS | 38 |
| | 6.1 | General | 38 |
| | 6.2 | Minimum Site Width Requirement | 38 |
| | 6.3 | Front Setbacks | 40 |
| | 6.4 | Side and Rear Setbacks / Building Separation | 41 |
| | 6.5 | Built Form | 42 |

| 6.6 | Visual privacy | 44 |
|-----|--|----|
| 6.7 | Acoustic privacy | 46 |
| 6.8 | Car Parking Requirements | 47 |
| 6.9 | Basement Car Parking | 47 |
| 6.1 | D Access Requirements | 48 |
| 6.1 | 1 Landscaping Requirements | 49 |
| 6.1 | 2 Deep Soil Zone | 52 |
| 6.1 | 3 Communal Open Space | 52 |
| 6.1 | 4 Private Open Space | 53 |
| 6.1 | 5 Adaptable and Universally Designed Housing | 55 |
| 6.1 | 6 Access for People with a Disability | 56 |
| 6.1 | 7 Apartment Size and Layout Mix for Larger Residential | |
| | Flat Building Developments | 56 |
| 6.1 | 8 Solar Access | 58 |
| 6.1 | 9 Natural Ventilation | 59 |

Figures

| | · · · · · · | |
|--------|---|-----|
| 6.17 | Apartment Size and Layout Mix for Larger Residential | |
| | Flat Building Developments | 56 |
| 6.18 | Solar Access | 58 |
| 6.19 | Natural Ventilation | 59 |
| Fia | ures | |
| г | a 1. Cliff ton sitting of building | 17 |
| Figure | e 1: Cliff top sitting of building | .17 |
| Figure | e 2: (Top) Where y- x is less than or equal to 2 metres, | |
| the se | etdack equais x or y | .41 |
| Figure | e 3: (Bottom) Where y-x is greater than 2 metres, the | |
| setba | ck equals the average of x and y | .41 |
| Figure | e 4: Examples of Residential Flat Building design | .44 |
| Figure | e 5: Examples of balcony screening and climate control | 0 |
| eleme | ents. Reference: Residential Flat Design Code | 55 |
| Figure | e 6: Natural Ventilation, Corner apartments encourage | |
| natur | al ventilation flows. (Ref: Residential Flat Design Code) | 59 |
| Figure | e 7: This optimal layout allows air flow directly from | |
| one si | ide of the apartment to the other | .59 |
| | | |
| | | |
| | | |
| | | |
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| Document Control | | | | | | | | |
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1 INTRODUCTION

This chapter contains residential development controls for dwelling-house, secondary dwelling, semidetached dwelling, dual occupancy, attached dwelling, multi-dwelling housing (villas and townhouses), residential flat building developments in standard residential zones.

This chapter of the DCP applies to all residential zoned land within the City of Wollongong Local Government Area (LGA) including E4 Environmental Living.

Section 4 provides general development controls which apply to the erection of all dwelling-house, dual occupancy, secondary dwelling, ancillary structures and semi detached dwellings within urban areas.

Section 5 provides controls for Attached dwellings and Multi-dwelling housing.

Section 6 provides controls for Residential Flat Buildings.

This chapter of the DCP should be read in conjunction with the relevant LEP and Part A, any relevant Part D and Part E chapter including E7 Waste Management, E14 Stormwater Management, E15 Water Sensitive Urban Design, E13 Floodplain Management, E19 Earthworks (Land Re-Shaping Works), E22 Soil and Sediment Control.

2 **OBJECTIVES**

The key objectives of Chapter B1 of the DCP are:

- (a) To ensure a high standard of residential development within the City of Wollongong LGA.
- (b) To encourage new residential development that is sympathetic to the existing streetscape and neighbourhood character of a particular locality.
- (c) To encourage residential development that reflects the desired future character of individual suburbs within the Wollongong City LGA.
- (d) To manage residential development in order to maximise the retention of significant remnant trees and other natural features in particular localities.
- (e) To encourage innovative housing design and energy efficient housing which embraces the highest possible architectural, environmental and amenity standards.
- (f) To promote residential development that achieves the principles of ecologically sustainable development.
- (g) To encourage a mix of housing forms within the city to assist in achieving urban consolidation initiatives particularly in localities close to business centres and railway stations and to assist in providing housing affordability.
- (h) To ensure that Crime Prevention through Environmental Design (CPTED) principles are holistically embraced in the design of any residential development.

3 DEFINITIONS

For the definitions of the following terms as applied in the DCP refer to the relevant LEP.

- a) Attached dwelling
- b) Dual occupancy
- c) Dwelling
- d) Dwelling-house
- e) Multi dwelling housing

- f) Residential flat building
- g) Secondary dwelling (also refer to the Affordable Housing SEPP)
- h) Semi-detached dwelling.

4 **GENERAL RESIDENTIAL CONTROLS**

4.1 Number of Storeys

The maximum building height is set by the Local Environmental Plans generally

- a) R2 Low Density Residential Zones permit a maximum height of 9m a maximum of 2 storeys
- b) R3 Medium Density Residential Zones permit a maximum of height of 13m a maximum 3 storeys.

The number of storeys acceptable will be dependant on the surrounding development, the future desired character of the area, the impacts that the proposed development has on solar access, privacy, visual amenity and overshadowing.

4.1.1 Objectives

- a) To encourage buildings which integrate within the streetscape and the natural setting whilst maintaining the visual amenity of the area.
- b) To minimise the potential for overlooking on adjacent dwellings and open space aeas.
- c) To ensure that development is sympathetic to and addresses site constraints.
- d) To encourage split level stepped building solutions on steeply sloping sites.
- e) To encourage a built form of dwellings that does not have negative impact on the visual amenity of the adjoining residences.
- f) To ensure ancillary structures have appropriate scale and are not visually dominant compared to the dwelling.
- g) To ensure appropriate correlation between the height and setbacks of ancillary structures.
- h) To encourage positive solar access outcomes for dwellings and the associated private open spaces.

4.1.2 Development Controls

- 1. Dwelling houses on battleaxe allotments are restricted to 1 storey unless it can be demonstrates that the proposed development achieves the objectives in Clause 4.1.1 and complies with the maximum height maps in the LEP.
- 2. Ancillary structures are restricted to 1 storey unless it can be demonstrates that the proposed development achieves the objectives in Clause 4.1.1 and complies with the maximum height maps in the LEP.
- 3. Habitable roof space may provide additional habitable area only when the height of the building does not exceed the maximum building heights specified in the relevant LEP.

- 4. In R2 Low Density Residential zones, where development occurs within the 8m rear setback the development is limited to single storey, so as to not adversely impact on the amenity of the adjoining property.
- 5. Landscaping may be required within the side and read setbacks to mitigate the visual impact of the building form from adjoining properties.

4.2 Front Setbacks

4.2.1 Objectives

- (a) To reinforce the existing character of the street and locality by acknowledging building setbacks.
- (b) To ensure that buildings are appropriately sited, having regard to site constraints.
- (c) To ensure building setbacks are representative of the character of the area.
- (d) To provide for compatibility in front setbacks to provide unity in the building line.
- (e) To ensure that setbacks do not have a detrimental effect on streetscape or view corridors.
- (f) To ensure that hard stand areas can be provided in front of garage without imposing on movement corridors (pathways, cycle ways and road reserves).

4.2.2 Development Controls

- 1. The following setback requirements apply from the primary street frontage to the front facade of the building:
 - a) Infill development sites require a minimum setback of 6m from the front property boundary, or
 - b) Less than 6 metres where the prevailing street character permits and the future desired character of the area is not prejudiced. Reduced setbacks must be demonstrated through a Site and Context Analysis (Chapter A.1 cl.11.1).
 - c) Garages and carports must be setback a minimum of 5.5 metres to enable a vehicle to park or stand in front of the garage or carport.
 - d) Greenfield sites require a minimum setback of 4m (excluding garages and carports which must be setback at least 5.5 metres).
- 2. Corner allotments
 - (a) Infill development sites require a minimum setback of 6m, or
 - (b) Less than 6 metres where the prevailing street character permits and the future desired character of the area is not prejudiced. Reduced setbacks must be demonstrated through a Site and Context Analysis (Chapter A.1 cl.11.1).
 - (c) Secondary building line must be setback a minimum of 3 metres, except for garages which must be setback at least 5.5 metres from the property boundary on the secondary road.
- 3. Any secondary dwelling shall be setback behind the front building alignment of the principal dwelling.

7Part B – Land Use Based Controls Chapter B1: Residential Development

4.3 Side and Rear Setbacks

4.3.1 Objectives

- (a) To create a consistent pattern of building separation along streets.
- (b) To provide adequate setbacks from boundaries to retain privacy levels and minimise overlooking/overshadowing.
- (c) To ensure that buildings are appropriately sited having regard to site constraints.
- (d) To control overshadowing of adjacent properties and private or shared open space.
- (e) To ensure improved visual amenity outcomes for adjoining residences.

4.3.2 Development Controls

- 1. Walls must be setback at least 900mm from any side or rear property boundary and eaves/gutters must be setback at least 450mm from the side and rear property boundaries.
- 2. Walls (including gable ends and parapets) that exceed 7 metres overall height must be setback at least 3 metres from the side and rear boundaries.
- 3. Freestanding garages or outbuildings with habitable roof spaces or second storey must be setback at least 900mm from a side or rear property boundary.

Detached single storey garages/outbuildings must be setback at least 500mm from a side or rear boundary, unless constructed of masonry, in which case a lesser setback may be considered in accordance with the criteria for variations stated below.

- 5. All balconies and windows of habitable rooms (excluding bedrooms) within a proposed dwelling-house or secondary dwelling must be designed to minimise any direct overlooking impact upon any adjoining property.
- 6. Walls in excess of 8m in length may not be considered for a variation to side setbacks.
- 7. The side and rear setback controls may only be varied where the following is demonstrated to Council's satisfaction:
 - (a) The objectives of 4.4.1 are met.
 - (b) The walls and footings are located wholly on the subject land.
 - (c) There are no windows facing the adjoining property that enable overlooking.
 - (d) Walls provide articulation so as to not impact the amenity of adjoining dwellings.
 - (e) Landscaping is appropriately provided to screen development.

4.4 Site Coverage

4.4.1 Objectives

- (a) To limit the building footprint and ensure adequate provision is made for landscaped areas, deep soil zones, permeability and private open space.
- (b) To control site density.

(c) To minimise adverse impacts arising from large dwellings and ancillary structures on the amenity of adjoining and adjacent properties.

4.4.2 Development Controls

 Site coverage is defined in accordance with Wollongong LEP 2009 and means the proportion of a site area covered by buildings. However, the following are not included for the purpose of calculating site coverage:

a) any basement,

b) any part of an awning that is outside the outer walls of a building and that adjoins the street frontage or other site boundary,

<mark>c) any eaves,</mark>

d) unenclosed balconies, decks, pergolas and the like.

2. The maximum site coverage for a dwelling, dual occupancy, and combined maximum coverage for a principle dwelling and secondary dwelling, is as follows:

55% of the area of the lot, if the lot has an area less than 450m².

50% of the area of the lot, if the lot has an area of at least 450m² but less than 900m².

40% of the area of the lot, if the lot has an area of at least 900m².

- For dual occupancy development, maximum site coverage for both dwellings combined must be less than or equal to that specified based on lot area above.
- 4. Where a two lot Torrens Title subdivision is proposed for dual occupancy development, the site coverage for each dwelling must be less than or equal to the maximum site coverage as specified above.

4.5 Landscaped Area

4.5.1 Objectives

- (a) To preserve and retain existing mature native trees and vegetation and encourage the planting of additional significant native vegetation.
- (b) To encourage the linkage of habitat corridors along the rear of sites.
- (c) To allow for increased water infiltration and minimise urban run-off.
- (d) To facilitate pleasant views from within dwellings and backyard settings.
- (e) To reduce privacy and amenity impacts at the rear of residential properties.

4.5.2 Development Controls

1. Significant trees are to be maintained on the site.

7Part B – Land Use Based Controls Chapter B1: Residential Development

- The minimum landscaped area required is based on lot size as outlined below. This percentage is the minimum At least 20% of the land must be provided as 'Landscaped area' which is a permeable area capable of growing trees, shrubs, groundcovers and / or lawn and does not include any building, structure or hard paved area.
 - i) lot area less than 600m² 20% landscaped area
 - j) lot area from 600m2 to 900m² 120m² + 30% of the site area > 600m² landscaped area
 - k) lot area greater than $900m^2$ 210m² + 40% of the site area > 900m² landscaped area.
- 3. At least 50% of the landscaped area must be located behind the building line to the primary road boundary.
- 4. Landscaped areas must be integrated with the drainage design. The location of drainage lines, pits and detention areas should not conflict with landscaped areas including proposed and existing trees.
- 5. For development proposing a dwelling, a minimum of one (1) semi mature small to medium evergreen or deciduous tree (minimum pot size 45 litre) is to be provided within the landscape area. This tree is to be planted at least 3m from any existing or proposed dwelling or structure present onsite. No additional tree is required for a secondary dwelling.
- 6. Dual occupancy development requires:
 - (a) a minimum of 1.5 metre wide landscape strip within the front setback for the majority of the site width (excluding the driveway). This area must be mulched and planted with appropriate trees, shrubs and/or groundcovers. A minimum of one (1) semi mature small to medium evergreen or deciduous tree (minimum pot size 45 litre) is to be provided within this landscape bed.
 - (b) second semi mature small to medium tree (minimum pot size 45L) is to be provided onsite in the landscaped area or deep soil zone, planted at least 3m from any existing or proposed dwelling, building or structure on the lot.

4.6 Private Open Space

4.6.1 Objectives

- (a) To ensure that private open spaces are large enough to accommodate a range of uses and are accessible and connected to indoor spaces.
- (b) To ensure that private open space is suitability located taking into account existing and potential surrounding development.
- (c) To minimise amenity impacts to neighbours.
- (d) To ensure functionality of the private open space area by reducing overlooking, overshadowing and amenity impacts onto / from adjoining properties, through the provision of appropriate buffer screen planting around the perimeter of the open space area, where necessary.
- (e) To protect existing trees and other vegetation in the immediate locality which contribute to the natural setting of the site.

4.6.2 **Development Controls**

- 1. Private open space must be provided in accordance with the following requirements:
 - a) A 24m2 area of private open space must be directly accessible from the living areas of each proposed dwelling and have a minimum width of 4 metres and be no steeper than 1:50.
 - b) Private open spaces and private courtyards should not be located on side boundaries or front yard. Variations may be permitted where the private open space is sufficiently setback as to ensure that the private open space will not be impacted upon by existing or future complying dwellings on adjoining lots.
 - c) Private open space must be defined through the use of planting, fencing, or landscape features.
 - d) Private open space shall be screened where necessary to ensure privacy between dwellings in a dual occupancy and secondary dwellings.
 - e) Private open space areas including balconies and decks must not extend forward of the front building line by greater than 900mm.
 - f) Space shall be provided for clothes lines and waste/recycling bins and rain water tanks behind the front building line but outside of the private open space area.
 - g) Secondary dwellings will be required to provide private open space with a minimum area of 24m2.

4.7 Solar Access

4.7.1 Objective

- (a) To minimise the extent of loss of sunlight to living areas of adjacent dwellings and private open space areas of adjoining properties.
- (b) To maximise solar access into living rooms and private open space of dwellings in the subject development.

4.7.2 Development Controls

- 1. Windows to living rooms of adjoining dwellings must receive at least 3 hours continuous sunlight, between hours of 9.00am and 3.00pm on 21 June.
- 2. At least 50% of the private open areas of adjoining residential properties must receive at least 3 hours of continuous sunlight, between hours of 9.00am and 3.00pm on June 21.
- 3. Shadow diagrams are required for 9.00am, 12:00pm and 3.00pm for the 21 June winter solstice period for two storey dwellings. In certain circumstances where the extent of solar impacts is uncertain hourly intervals may be required. Additional hourly interval shadow diagrams for the equinox period may be necessary to determine the full extent of overshadowing upon the dwelling and / or private open space area of an adjoining property.

4. Dwellings should be designed to maximise natural sunlight to main living areas and the private open space.

4.8 Building Character and Form

4.8.1 Objectives

- (a) To ensure that development responds to both its natural and built context.
- (b) To design residential development that responds to the existing character and the future character of the area.
- (c) To ensure building design contributes in to the locality through a design that considers building scale, form, articulation and landscaping.
- (d) To encourage colour schemes that are of similar hues and tones to that within the streetscape.
- (e) To ensure buildings address the primary street frontage via entry doors and windows.
- (f) To ensure that dwellings provide appropriate passive surveillance of public spaces and street frontage.
- (g) To ensure that ancillary structures are not the dominate feature of built form.

4.8.2 **Development Controls**

- 1. The design, height and siting of a new development must respond to its site context taking into account both natural and built form features of that locality. The design of the development must have particular regard to the topography of the site to minimise the extent of cut and fill associated with dwelling construction.
- 2. Large bulky forms are to be avoided, particularly in visible locations. The use of extended terraces, balconies, sun shading devices and awnings will help reduce the apparent bulk of buildings.
- 3. New dwelling-houses within established residential areas should be sympathetic with the existing character of the immediate locality. New innovative contemporary building designs may also be permitted, where, in the opinion of Council, the development will not result in an adverse impact upon the streetscape or residential amenity of that locality, as compared to a more traditional design.
- 4. All residential buildings must be designed with building frontages and entries clearly addressing the street frontage. On corner allotments, the development should address the street on both frontages.
- 5. The appearance of blank walls or walls with only utility windows on the front elevation will not be permitted. Note: Utility windows include windows for toilets, bathrooms, laundries etc which are small and / or translucent and hence, are not permitted within the front elevation of a dwelling.
- 6. Where garages are proposed on the front elevation they must be articulated from the front façade.
- 7. Additions to an existing dwelling-house must be compatible in terms of design, roof configuration and materials with the existing dwelling, unless the existing part of the dwelling is also upgraded to be sympathetic with the design, roof configuration and materials of the new addition.

- 8. Any secondary dwelling shall be designed and constructed of external building materials and colour finishes which are sympathetic to the principal dwelling.
- 9. Existing garages and outbuildings must not be used as a secondary dwelling, except where the required Development Application is supported with appropriate evidence which proves that the structure complies with the relevant provisions of the Building Code of Australia.
- 10. Fences in the front building line should be predominately constructed in transparent fence materials, allowing for visual connection between the dwelling and the street.
- 11. Where the garage door addresses the street they must be a maximum of 50% of the width of the dwelling.

4.9 Fences

4.9.1 Objectives

- (a) To allow for the physical separation of properties for resident privacy.
- (b) To define the boundaries between public and private land.
- (c) To enhance the usability of private open space areas / courtyards.
- (d) To ensure that the design, heights and materials of fencing are appropriately selected.
- (e) To ensure that fencing design and location complements the building design, enhance the streetscape and complement the objectives of passive surveillance
- (f) To ensure that the design allows for casual surveillance of the lot.
- (g) To ensure that clear lines of sight are maintained for motorists and pedestrians to and from the lot.
- (h) To provide suitable fencing to improve the acoustic and visual privacy for residential properties fronting major (busy) roads, where appropriate slight line distances can be maintained.

4.9.2 Development Controls

- All fences are to be constructed to allow the natural flow of stormwater drainage or runoff. Fences must not significantly obstruct the free flow of floodwaters and must be constructed so as to remain safe during floods and not obstruct moving debris. Fences must not be constructed of second hand materials without the consent of Council.
- 2. Fences within the front and secondary building lines should be predominantly constructed in transparent fence materials, allowing visual connection between the dwelling and the street.
- 3. Any fence and associated retaining wall within the front setback area from the primary road frontage must be a maximum 1.2 metres in height, above existing ground level. Where the front fence is located on the front property boundary line, the height of the fence is to be measured above the existing ground level of the adjacent footpath or verge.
- 4. Front fences must be open for at least 50% of the upper 2/3 of the area of the fence. Any brick or other solid portion of the fence above 600mm must not be more than 250mm wide.

7Part B – Land Use Based Controls Chapter B1: Residential Development

- 5. All front fences must be designed to ensure the safety of all pedestrians using any adjacent public footpath, including children and people with a visual disability. Metal spike picket infill pickets or sharply shaped timber pickets will not be permitted.
- 6. Front and return fences should reflect the design of the residential building, wherever practicable.
- 7. Front and return fences should be designed of materials which are compatible with other fences within the immediate streetscape, wherever practicable.
- 8. Side fences on corner blocks shall be a maximum of 1.2 metres in height within the front setback area (ie up to the front alignment of the dwelling) from the primary road frontage and shall be a maximum of 1.8m in height for the remainder of the secondary road frontage (ie behind the front building alignment).
- 9. Dividing fences between the front building line and the rear property boundary must be a maximum of 1.8 metres in height.
- 10. A fence or a fence and an associated retaining wall on a sloping site may be stepped, provided the height of each step is not more than:
 - (a) 1.6 metres above the existing ground level, if it is located within a setback area from a primary road, or
 - (b) 2.2 metres above the existing ground level for side or rear fences, behind the front building line.
- 11. The height and design of any proposed fence on top of a retaining wall must be included in the consideration of the overall height of the fence and retaining wall.
- 12. Fences which exceed the maximum fence heights above will only be considered in exceptional circumstances where Council is of the opinion that the variation is reasonable in the circumstances. For example, the erection of a higher front fence for a property fronting a major arterial road, in order to improve the privacy or amenity of the property. In such cases, any fence will be required to be well articulated and landscaped with appropriate planting, to help soften the visual impact and improve the streetscape appearance of the fence.
- 13. Fences must be constructed of timber, metal, lightweight materials or masonry. Fences in bush fire prone areas shall be of a metal or masonry construction only.
- 14. Front and return fences are not to be of a timber paling, Colorbond, or chain wire mesh design.
- 15. When the trunk of a significant tree exists within the location of a proposed fence, then the fence must be designed around the tree or an application made to Council for the proposed removal of the tree (ie in which case Council will assess whether or not the tree removal is appropriate based upon the assessment criteria contained in Chapter E17: Preservation and Management of Trees and Vegetation).
- 16. Fences within a floodway or high-risk flood precinct are not permitted except for security/ permeable / open style safety fences of a design approved by Council.
- 17. All fences are to be at or upslope of the foreshore building line and shall be of an open, permeable steel style to maintain views to / from the water body.
- 18. Any gates associated with the front fence should open inwards so as to not obstruct the road reserve.

19. Fencing must be in keeping with the streetscape.

4.10 Car parking and Access

4.10.1 Objectives

- (a) To provide car parking for residents.
- (b) To ensure that there is adequate provision for vehicular access and manoeuvring.
- (c) To minimise the impact of garages upon the streetscape.

4.10.2 Development Controls

- 1. The provision of car parking shall be as follows:
 - (a) 1 space per dwelling with a gross floor area of less than 125m
 - (b) 2 spaces per dwelling with a gross floor area of 125m² or greater
- 2. Carports must be setback behind the front building line of the dwelling. Council may consider a variation to this control for carports that are compatible with the design of the dwelling in instances where an existing streetscape includes carports within the front setback or a site is too steep for driveway access to the front building line.
- 3. Garages must be setback a minimum of 5.5m from the front property boundary.
- 4. Where garage door openings face a road they shall:
 - (a) Be a maximum of 50% of the width of the dwelling.
- 5. The car parking spaces may be an open hard stand space, driveway, carport or a garage, whether attached to or detached from the dwelling.
- 6. The minimum dimension for a single car parking space shall be 5.5 metres x 2.6 metres where unenclosed. The minimum dimension for double car parking space shall be 6 metres x 6 metres, unenclosed.
- 7. The minimum internal dimensions for a single garage shall be 6 metres (depth) x 3 metres (width). The minimum internal dimensions for a double garage shall be 6 metres (depth) x 6 metres (width).
- 8. The siting of ancillary buildings, extensions and swimming pools associated with a dwelling-house shall not reduce the number of on site parking spaces behind the building line to less than one.
- 9. Driveways shall be separated from side boundaries by a minimum of 1 metre.
- 10. Driveways shall have a maximum cross-over width of 3 metres.
- 11. Dual Occupancy Access for a rear dwelling must be provided by a dedicated access corridor attached to the same ownership of the rear property. A right of carriageway over the front public road frontage lot in favour of the rear lot will generally not be supported, except where, in the opinion of Council, this

access arrangement would provide a more functional arrangement and not pose any adverse impact upon the amenity or streetscape character of the locality.

4.11 Storage Facilities

4.11.1 Objective

(a) To provide accessible storage for larger household items that cannot be readily accommodated within dwellings.

4.11.2 Development Controls

1. Storage must be provided in accordance with the following minimum requirements:

| Dwelling | Storage Volume | Storage Area |
|------------------------|------------------|-----------------|
| Studio/1 bedroom | 6m ³ | 3m² |
| Two bedroom | 8m ³ | 4m ² |
| Three or more bedrooms | 10m ³ | 5m ² |
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4.12 Site Facilities

4.12.1 Objectives

(a) To ensure that site facilities (such as clothes drying, mail boxes, recycling and garbage disposal units/areas, screens, lighting, storage areas, air conditioning units, rainwater tanks and communication structures) are effectively integrated into the development and are unobtrusive.

4.12.2 Development Controls

- 1. Provide letterboxes for all residential dwellings in a location, which is accessible. Where a development involves two or more dwellings letterboxes should be grouped in one location adjacent to the main entrance to the development. Letterboxes must be secure and large enough to accommodate articles such as newspapers. In developments involving two or more dwellings they should be integrated into a wall where possible and be constructed of materials that are aligned with the appearance of the building.
- 2. Locate satellite dish telecommunication antennae, air conditioning units and any ancillary structures:
 - (a) Away from the street frontage;
 - (b) In a position where such facilities will not become a skyline feature at the top of any building; and
 - (c) Adequately setback from the perimeter wall or roof edge of buildings.
- 3. All dwellings must be provided with open air clothes drying facilities that are easily accessible and which are screened from the public domain and communal open spaces. Clothes drying areas must have a

high degree of solar access. Clothes drying areas must not be located between the building line and a public road or accessway, unless adequately screened.

4. Air conditioning units shall be located so that they are not visible from the street or other public places.

4.13 Fire Brigade Servicing

4.13.1 Objective

(a) To ensure that all dwellings can be serviced by fire fighting vehicles.

4.13.2 Development Controls

- 1. All dwellings, particularly dual occupancy and dwellings on battle axe allotment must be located within 60m of a fire hydrant, or the required distance as required by Australian Standard AS2419.1. Provision must be made so that Fire and Rescue NSW vehicles can enter and leave the site in a forward direction where:
 - a) Fire and Rescue NSW cannot park their vehicles within the road reserve due to the distance of hydrants from dwellings and/or restricted vehicular access to hydrants; and
 - b) The site has an access driveway longer than 15m.
- 2. For developments where a fire brigade vehicle is required to access the site, vehicular access, egress and manoeuvring must be provided on the site in accordance with the Fire and Rescue NSW *Code of Practice Building Construction NSWFB Vehicle Requirements*.

4.14 Services

4.14.1 Objective

(a) To encourage early consideration of servicing requirements, to ensure that all residential development can be appropriately serviced.

4.14.2 Development Controls

- 1. Applicants shall contact service authorities early in the planning stage to determine their requirements regarding conduits, contributions, layout plans, substations and other relevant details.
- 2. Consideration shall be given to the siting of any proposed substation during the design stage, to minimise its visual impact on the streetscape. Any required substation must not be located in a prominent position at the front of the property.
- 3. Water, sewerage, gas, underground electricity and telephone are to be provided to the proposed development by the developer in accordance with Council and servicing authority requirements.
- 4. Developments must be connected to a reticulated sewerage scheme.
- 5. Where a reticulated scheme is not available, an on-site sewage management system will be required in accordance with the On-site Sewage Management System chapter in Part E of the DCP. The full details of the proposed on-site sewage management system must be provided with the Development Application. A section 68 approval will also be required under the *Local Government Act 1993* in these instances.

4.15 Development near the Coastline

4.15.1 Objectives

- (a) To minimise built intrusions into the coastal landscape.
- (b) To protect property from the threat of coastal hazards and land instability.
- (c) To retain views to the ocean from roads and public spaces.
- (d) To facilitate buildings that are consistent with a coastal character.

4.15.2 Development Controls

- 1. All development must be setback at least 10m from a beach or cliff top to reduce the potential risk of instability and long term coastal erosion. In some instances, restricted building zones indicated on the Deposited Plan for an allotment of land will also need to be considered when situating buildings on the site.
- 2. Any development near coastal foreshore areas is to be sited and designed so to be protected from long term coastal erosion.
- (Note: A Geotechnical Report will be required which confirms that the structural adequacy of the development near a coastal foreshore area from any long term coastal erosion effects. The Geotechnical Report must be prepared in accordance with the requirements contained in the Geotechnical chapter in Part E of the DCP).
- 4. Development on land with frontage to natural features including the ocean, a clifftop, beach or public open space fronting the ocean is to be sited so as to provide a minimum side boundary setback from any building(s) or structures of 3 metres or 25% of the total width of the site, whichever is the lesser. This setback is required in order to provide a public view corridor and is to be unencumbered with any structures or significant vegetation that restricts public views through the site to the relevant coastal feature.
- 5. In the circumstances where there is an existing public view corridor specifically provided on immediately adjoining land, then development may be provided with a reduced setback, subject to the combined corridor on the immediately adjoining sites be no less than 4 metres in width and unencumbered with any structures and significant vegetation.
- 6. Buildings within the coastal zone are to incorporate the following design features:
 - (a) Development should generally be designed in a contemporary Australian coastal style which incorporates elements such as varied roof lines, a modest scale, light weight materials where appropriate, wide eaves and covered outdoor living areas, and consistent with the desired future character outlined for the relevant suburb or locality as contained in Character Statements in Part A of the DCP.
 - (b) Consideration is to be given to the appearance of buildings from all public areas. Buildings are to be well articulated by the use of such features as indentations, off-set wall alignments, shading devices, balconies, window openings, awnings, and a mix of external materials and/or colours.

- (c) Skillion and/or peaked roof forms with overhangs, which bring the roof line down towards the earth and therefore blend with the landscape, are preferred on sites adjacent to coastal foreshores.
- (d) Buildings must not incorporate an unbroken horizontal elevation of more than 16 metres in length. Elevations are to be broken up by building articulation and/or variation in external colours and materials.
- (e) Buildings shall be designed to utilise a composite of construction materials (such as a combination of masonry, glass, timber, weatherboard cladding and powder coated metal). The preferred roofing material is corrugated metal sheeting similar to "Colorbond®".
- (f) In most instances the use of low-reflective materials will be required although this may vary in circumstances where a building seeks to echo the existing character of part of a neighbourhood (as reflected in the desired future character statement contained in Part A of the DCP). The use of curtain wall glazing and large expanses of framed glass will not be permitted in the vicinity of main roads in order to minimise reflectivity impacts.
- (g) Colour schemes are to incorporate a mix of finishes drawn from colours found in the natural environment of the coastline. This does not however preclude the use of colour highlights on façade elements. Colour schemes in visually exposed areas must be recessive (i.e. backdrop colour or darker) to allow the development to blend with the coastal landscape.



Figure 1: Cliff top sitting of building

4.16 View Sharing

4.16.1 Objectives

- (a) To encourage view sharing from adjoining or nearby properties, public places, and new development.
- (b) To protect and enhance significant view corridors from public places.
- (c) To encourage the siting and design of new buildings which open up significant views from public areas.

4.16.2 Development Controls

1. Visual impact assessment should include an:

7Part B – Land Use Based Controls Chapter B1: Residential Development

- (a) Assessment of views likely to be affected.
- (b) Assessment of what part of the property the views are obtained from.
- (c) Assessment as to the extent of the potential view loss impact.
- (d) Assessment as to the reasonableness of the proposal causing the potential view loss impact.
- 2. A range of view sharing measures shall be considered for incorporation into the design of a building including:
 - (a) Appropriate siting of the building on the land so as to provide a strip of land, unencumbered with structures, down one side of the dwelling. This strip of land must be a minimum width of 3m or 25% of the lot width whichever is the greater.
 - (b) A reduced view corridor width may be accepted, where it is located adjacent to a view corridor on the adjacent site, subject to the combined width having a minimum of 4m.
 - (c) Appropriate placement of the bulk of the building on a site.
 - (d) Provision of greater separation between buildings, where necessary to retain view corridors.
 - (e) Articulation within the buildings design.
 - (f) Careful selection of roof forms and slope.
 - (g) Placement of vents, air conditioning units, solar panels and similar structures in locations which will not restrict views.

4.17 Retaining Walls

4.17.1 General

The provisions of State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 identify certain retaining walls which do not require the formal lodgement of a Development Application and may be approved through a Complying Development Certificate.

However, if the proposed retaining wall does not comply with the maximum height or minimum setback dimensions off side or rear property boundaries, as set out in SEPP (Exempt and Complying Development Codes) 2008, then the lodgement of a Development Application with Council is necessary and must be in compliance with the requirements mentioned below.

4.17.2 Objectives

- (a) To ensure that retaining walls are structurally sound and are located to minimise any adverse stormwater drainage, visual, amenity or overlooking impacts upon adjoining properties.
- (b) To guide the design and construction of low height aesthetically pleasing retaining walls.
- (c) To ensure any retaining wall is well designed, in order to achieve long term structural integrity of the wall.
- (d) To ensure slope stabilisation techniques are implemented to preserve and enhance the natural features and characteristics of the site and to maintain the long term structural integrity of any retaining wall.

4.17.3 Development Controls

- 1. A retaining wall or embankment should be restricted to a maximum height above or depth below natural ground level of no more than:
 - (a) 600mm at any distance up to 900mm setback from any side or rear boundary; or
 - (b) 1 metre, if the toe of the retaining wall or embankment is setback greater than 900mm from any side or rear boundary.

Note: Council may consider a variation to the abovementioned maximum height / depth of a retaining wall, in cases where the subject site is steeply sloping and the proposed retaining wall is setback more than 1 metre from any side or rear common property boundary. Additionally, appropriate structural design details will be required and in some cases appropriate landscape buffer screen planting may be required, where necessary.

- 2. Any retaining wall over a meter in height must be designed by an Engineer.
- 3. Within areas of suspected slope instability or subject to known slope instability, Council may also require a report prepared by a suitably qualified geotechnical and structural engineer relating to the proposed retaining wall. Council will assess the suitability of any retaining within these areas, based upon the findings and recommendations contained in the report.
- 4. To limit the overall height impact, terracing of retaining walls is required, limiting the maximum vertical rise of a retaining wall to 1 metre, with a minimum horizontal setback of 1 metre.
- 5. Any retaining wall with a vertical height exceeding 1 metre in any one vertical rise must be supported by appropriate justification demonstrating how the proposal meets the objectives above.
- 6. Balustrading will be required in accordance with the *Building Code of Australia*, to ensure the safety of the public, where the retaining wall adjoins a public place and where there is a change in level greater than 1 metre to the surface beneath.
- 7. Open window face type retaining walls must not be permitted within 1.5 metres of an adjoining property boundary. These include crib block and similar type walls that permit the free flow of solid material through the wall.
- 8. A fence and any associated retaining wall located within the setback area from a primary road shall be restricted to:
 - (a) A maximum 1.2 metre height above existing ground level, and
 - (b) An open style for at least 50 per cent of the upper 2/3 of the area of the fence, and
 - (c) Any brick or other solid portion of the fence above 600mm being not more than 250mm wide.
- 9. The fence or the fence and associated retaining wall on a sloping site may be stepped, provided the height of each step is not more than:
 - (a) 1.6 metres above existing ground level if it is located within a setback area from a primary road, or
 - (b) 2.2 metres above existing ground level for side or rear boundaries (where it is behind the front building line).

7Part B – Land Use Based Controls Chapter B1: Residential Development

- 10. Adequate provision must be made for the proper disposal of surface and subsurface drainage associated with the erection of the walls. The method of disposal must be approved by Council and could include:
 - (a) The connection of sub-surface drainage from the retaining wall to the street gutter.
 - (b) Disposal via properly constructed absorption trench/es on the property containing the retaining wall designed and located in accordance with Council's Fact Sheet on Domestic Stormwater Drainage Systems.
 - (c) Disposal via piped or channelled drainage easement/s.
 - (d) Other means as determined by Council.
- 11. All surface and sub-surface drainage must not discharge directly onto other adjoining properties unless a drainage easement has been created. Council's Fact Sheet on Retaining Walls provides further information regarding the construction of retaining walls.

4.18 Swimming Pools and Spas

4.18.1 Objective

- (a) To ensure that swimming pools meet relevant safety standards and meet user needs.
- (b) To ensure swimming pools and spas are sited and designed to maintain the amenity of the surrounding residential neighbourhood.

4.18.2 Development Controls

- 1. Ancillary development comprising a swimming pool and / or spa for private use must be located on land:
 - a) That contains an existing dwelling or a dwelling is constructed on the land at the same time the swimming pool and / or spa is constructed.
 - b) Behind the building line of a primary road setback.
- 2. For corner sites or where a property has two road frontages, the location of the swimming pool or spa is not to be in the primary frontage.
- 3. Where a swimming pool or spa is proposed between the building façade and the secondary road frontage, appropriate landscape buffer screen planting will be required within the pool enclosure, behind the child resistant barrier, (i.e. so as not to affect the performance of the child resistant barrier) surrounding the pool enclosure.
- 4. Where a boundary fence is proposed to form part of the pool fence and it adjoins a public road the fence must be 1.8m high.
- 5. A swimming pool or spa must not be located:
 - a) Over an easement or restricted building zone.
 - b) Within a zone of influence of a public sewer main.
 - c) Within a zone of influence of a public drainage pipe.

- d) Within a riparian buffer zone:
- e) Without appropriate approval by the relevant authority or person benefiting from the easement of covenant.
- 6. The swimming pool water line or spa water line must have a setback of at least 900mm from any side or rear boundary.
- 7. Any decking around a swimming pool or spa must not be more than 600mm above ground level (existing).
- 8. Coping around a swimming pool must not be more than:
 - a) 1.4m above ground level (existing), and
 - b) 300mm wide if the coping is more than 600mm above ground level (existing).
- 9. Any in-ground swimming pool or spa should be constructed so that the top edge of the swimming pool / spa is as close as possible to the existing ground level. On sloping sites, this may require excavation on the high side of the site, in order to ensure miminal out of ground exposure of the swimming pool at the low side.
- 10. Water from paved areas must not be discharged to any watercourse.
- 11. Overflow paths must be provided to allow for surface flows of water in paving areas around the pool and shall not be directed or connected at any point onto the adjoining property.
- 12. Discharge and/or overflow pipe(s) from the swimming pool and filtration unit are:
 - a) To be discharged in accordance with an approval under the Local Government Act 1993 if the lot is not connected to a sewer main.
 - b) In the case of land within Rural / non-urban or Environmental Protection zones having an area greater than 1000m2, to incorporate disposal pits located a minimum of 3m from any property boundary except where on-site disposal is not recommended in a geotechnical report prepared for the land or for the development.
 - c) Not to discharge water to any watercourse.
- 13. Pool excavations are not to conflict with the position of any stormwater drainage trench or line (including any inter-allotment drainage line), the position of which must be ascertained and shown on the site plan before pool excavation commences.
- 14. A swimming pool must be surrounded by a child resistant barrier complying with the requirements of the *Swimming Pools Act 1992* (and Regulations) and the appropriate Australian Standard as referenced by the *Building Code of Australia*.
- 15. The wall of a residential building may form part of the child restraint barrier so long as the wall contains no openable door, window or other opening through which access may at any time be gained to the swimming pool.
- 16. A minimum of 50% of the perimeter of a pool must be accessible for rescue purposes.

7Part B – Land Use Based Controls Chapter B1: Residential Development

- 17. A spa pool is not required to be surrounded by a child resistant barrier provided that the spa pool is covered or secured by way of a child-safe structure (eg door, lid, grill or mesh) that is fastened to the spa pool by a child-resistant device, at all times, when the spa pool is not in actual use.
- 18. Structures such as tool sheds garages, barbeques, clotheslines or other like structures not appurtenant to a swimming pool must be located outside the fenced pool enclosure.
- 19. The pool pump / filter must be located as far away as practicable from any adjoining dwelling and should be enclosed in an acoustic enclosure / structure.

4.19 Development Near Railway Corridors and Major Road

4.19.1 Objectives

- 1. To ensure that development near rail corridors and major roads are protected from noise and vibration.
- 2. To ensure development does not affect the operation or rail corridors or their safety.
- 3. To ensure compliance with the SEPP Infrastructure.

4.19.2 Development Controls

- Development immediately adjacent to rail corridors needs to take into consideration the provisions of the SEPP Infrastructure under clause 85. Council may required to refer the development application to the Rail Authority.
- 2. Council must consider the provisions of the NSW Department of Planning's "Development near Rail Corridors and Busy Roads Interim Guideline dated December 2008 for any development on land in or immediately adjacent to a rail corridor where it:
 - a) Is likely to have an adverse effect on rail safety, or
 - b) Involves the placing of a metal finish on a structure and the rail corridor concerned is used by electric trains, or
 - c) Involves the use of a crane in air space above any rail corridor.
 - d) Any excavation within 25m of the rail corridor.
- 3. Excavation in, above or adjacent to rail corridors may also be referred to the Rail Authority and must be in accordance with clause 86 and the NSW Department of Planning's "Development near Rail Corridors and Busy Roads Interim Guideline dated December 2008
- 4. Impacts of rail and road noise or vibration on non-rail development must also be considered under clause 87 of the SEPP Infrastructure.

4.20 Additional controls for semi-detached dwellings – alterations and additions

4.20.1 Objectives

- (a) To recognise that each semi-detached dwelling represents only one of a pair of dwellings and hence any external alterations and additions to one dwelling must be sympathetic with the other dwelling to which it is attached.
- (b) To ensure any alteration or addition to an individual semi-detached dwelling is responsive to the style, character, form and external appearance of the other dwelling to which it is attached.

4.20.2 Development Controls

- 1. Alterations and additions to one existing semi-detached dwelling must be compatible in terms of building form and design, roof configuration and external building materials with the other existing dwelling to which it is attached, unless the other existing dwelling is also upgraded to be sympathetic with the design, roof configuration and materials in line with the other dwelling. In this regard, it is preferable that alterations and additions be carried out at the same time for both semi-detached dwellings.
- 2. Where symmetry is the dominant character it should be respected. Conversely, where asymmetry is the dominant and leads to an appearance of a single building, the design should attempt to maintain that character.
- 3. Any first floor addition to a semi-detached dwelling should be setback from the principal street frontage to maintain the existing prevailing roof form at the front of the dwelling and to locate the bulk of the new additions to the rear of the dwelling.
- 4. New additions to semi-detached dwellings should be located behind the main gable or hipped roof feature of the building on the principal street frontage.
- 5. The use of dormer windows, balconies and skylights on the first floor of the dwelling should be located at the rear of the dwelling, rather than the principal street frontage.
- 6. The style and pitch of the proposed roof of the dwelling should match and complement the existing roof form of the other semi-detached dwelling to which it is attached.
- 7. Any special elements of the existing roof should be incorporated in the proposed roof form.

4.21 Additional Controls for Dual Occupancy's - Minimum Site Width

4.21.1 Objectives

- (a) To permit dual occupancy developments upon sites which are of sufficient size to accommodate the required building envelope, car parking, private open space, landscaping and other requirements, whist maintaining the amenity of surrounding residential development and the streetscape character of the locality.
- (b) To allow for development of sites only where the land is not significantly constrained by flood, geotechnical or other environmental hazards.
4.21.2 Development Controls

- 1. A minimum site width of 15 metres is required for a dual occupancy development. Site width shall be measured for the full width of the site, perpendicular to the side property boundaries. Variations may be granted for irregular shaped blocks or where development can demonstrate compliance with privacy, solar access, private open space, visual amenity, built form, car parking and landscaping requirements.
- 2. For corner allotments, a minimum 15 metre site width must be achieved for at least one (1) of the street frontages and a minimum 12 metre site width must be achieved for the other street frontage.

4.22 Additional Controls for Dual Occupancy's - Building Character and Form

4.22.1 Development Controls

- 1. On corner allotments, the dual occupancy development must address the street on both frontages. The garage and / or carport for each dwelling must be placed on each street frontage, at the furthest point of the site, from the intersection.
- 2. Where garages are proposed on the front elevation they must be articulated from the front façade of the dual occupancy dwelling(s).
- 3. Any external alterations and additions to a dual occupancy dwelling must be compatible in design, roof configuration and building materials with the other adjoining dwelling in the original dual occupancy development.
- 4. Existing garages and outbuildings can not be used as a dual occupancy second dwelling unless it can be demonstrated that the structure complies with the relevant provisions of the Building Code of Australia.

4.23 Additional Controls for Dual Occupancy's – Deep Soil Zones

4.23.1 Objectives

- (a) To protect existing mature trees on a site and encourage the planting of additional significant vegetation.
- (b) To encourage the linkage of adjacent deep soil zones on development sites, to provide habitat for native indigenous plants and birdlife.
- (c) To allow for increased water infiltration.
- (d) To contribute to biodiversity.

4.23.2 Controls

1. A minimum of half of the landscaped area must be provided as a deep soil zone. The deep soil zone may be located in any position on the site including the front setback, subject to this area having a minimum dimension of 3m. The deep soil zone must be located outside the minimum private open space required. may be included in private open space but is not included in the minimum private open space area required.

- The siting of the deep soil zone shall be determined following a Site and Context Analysis to investigate whether this area should be located:
 - (a) At the rear of the site to allow for separation from adjacent dwellings and to provide a corridor of vegetation; or
 - (b) Elsewhere within a site to allow for retention of significant trees and attain maximum access to sunlight.
- No structures, basement carparks, driveways, hard paving, decks, balconies or drying areas are permitted within the deep soil zone.
- 4. The deep soil zone shall be densely planted with trees and shrubs. Where the development is to be strata titled, the deep soil zone may be retained within the common property or allocated to an individual unit entitlement, where such dwelling is directly adjacent.

5 ATTACHED DWELLINGS AND MULTI - DWELLING HOUSING

This section provides additional controls to those in Section 4 (excluding 4.1 to 4.11 and 4.19 to 4.22) of this chapter that must also be taken into consideration when preparing a development application for attached dwellings and multi-dwelling housing.

5.1 Minimum Site Width Requirement

5.1.1 Objectives

- (a) To allow for development of sites which are of sufficient size to accommodate the required building envelope, car parking and landscaping requirements.
- (b) To encourage amalgamation of allotments to provide for improved design outcomes.

5.1.2 Development Controls

- 1. The Wollongong LEP requires a minimum site width of 18 metres for multi-dwelling development. Site width is measured for the full width of the site, perpendicular to the property side boundaries.
- 2. A minimum site width of 18m is required for attached dwelling development. Site width is measured for the full width of the site, perpendicular to the property side boundaries. This control may be varied for irregular shaped lots or where the development meets the requirements of setbacks, private open space, visual amenity, solar access, built form and landscaping.
- 3. Sites should be amalgamated, where required, to achieve the minimum site width requirement.
- 4. Within the R1 General Residential and R3 Medium Density Residential zones, development for the purpose of an attached dwelling development must not result in the creation of an "isolated lot". An "isolated lot" is a lot which is bounded on both sides by properties (or a property and a second street frontage) which comprise existing development other than a single dwelling house and redevelopment of such adjoining properties is unlikely. This includes cases where there is high separation of ownership of dwellings ownership in the adjoining developments. Amalgamation of allotments will be required in the circumstance where an isolated allotment would otherwise be created.
- 5. Council will only allow development which would result in the creation of an "isolated lot", where it is satisfactorily demonstrated that:

- (a) The "isolated lot" achieves a site width of 18 metres or more and is capable of accommodating an attached dwelling or multi-dwelling development.
- (b) The following planning principles as outlined in the NSW Land and Environment Court judgment in *Melissa Grech v Auburn Council*[2004] NSWLEC 40 are met:
 - (i) Where a property will be "isolated" by a proposed development and that property cannot satisfy the minimum lot width requirements then negotiations between the owners of the properties should commence at an early stage and prior to the lodgement of the Development Application.
 - (ii) Where no satisfactory result is achieved from the negotiations, the Development Application should include details of the negotiations between the owners of the properties. These details should include offers to the owner of the isolated lot. A reasonable offer for the purposes of determining the Development Application and addressing the planning implications of an "isolated lot", is to be based at least on one recent independent valuation report and may include other reasonable expenses likely to be incurred by the owner of the "isolated lot" in the sale of that property.
 - (iii) The level of negotiation and any offers made for the "isolated lot" are matters that will be given weight in the consideration of the Development Application. The amount of weight will depend on the level of negotiation, whether any offers are deemed reasonable or unreasonable, any relevant planning requirements and the "matters for consideration" under Section 79C of the Environmental Planning & Assessment Act 1979.
- 6. In cases where the subject site is an existing "isolated lot", Council may consider a variation to the minimum site width requirement provided, in the opinion of Council, the proposed development will not cause any significant adverse overshadowing, privacy or amenity impact upon any adjoining development.
- 7. In certain existing "isolated lot" cases, a proposed development may not achieve its maximum development potential (eg maximum floor space ratio and height) where side and rear setbacks are varied and the development does not, in the opinion of Council, achieve:
 - (a) Adequate separation between buildings to maintain reasonable levels of solar access, privacy and amenity to neighbouring dwellings;
 - (b) Adequate landscaping screening of the development to maintain the amenity of adjoining dwellings; and
 - (c) Maintain the streetscape amenity of the locality.

5.2 Number of Storeys

5.2.1 Objectives

- (a) To encourage buildings which integrate within the existing streetscape and the desired future character for the area.
- (b) To minimise the potential impacts of overshadowing and overlooking on adjacent dwellings and open space areas.

5.2.2 Development Controls

1. The maximum number of storeys for attached and multi dwelling housing is set out in the table below.

| Zone | No. Storeys |
|---|-------------------|
| R1 General Residential zone | Three (3) storeys |
| R2 Low Density Residential zone | Two (2) storeys |
| R3 Medium Density Residential zone | Three (3) storeys |
| R4 High Density Residential zone (<i>for Multi-Dwelling Housing Only</i>) | Three (3) storeys |

- 2. Habitable roof space may provide additional habitable area only when the height of the building does not exceed the overall ridge heights specified in the maximum building height tables (above) and the maximum building heights specified in the LEP.
- 3. Where the roof space is used as habitable area in accordance with the above requirements, it is not classified as an additional storey.

5.3 Front Setbacks

5.3.1 Objectives

- (a) To reinforce the existing character of the street by acknowledging building setbacks.
- (b) To promote compatibility in front setbacks to provide for unity in the building line.

5.3.2 Development Controls

- 1. A 6m setback requirements applies from the front property boundary to the front façade of the building.
- 2. On corner allotments a minimum setback of 3m to the secondary street frontage from the dwelling façade must be provided.
- 3. Balconies, front courtyard fences and other building extrusions may be set back up to 900mm closer than the required front or secondary setback.
- 4. An increase in setbacks may be required to retain existing trees or respect adjacent heritage items.

5.4 Side and Rear Setbacks

5.4.1 Objectives

(a) To provide adequate setbacks from boundaries and adjoining dwellings to retain privacy levels, views, sunlight and daylight access and to minimise overlooking.

7Part B – Land Use Based Controls Chapter B1: Residential Development

- (b) To provide appropriate separation between buildings to achieve the desired urban form.
- (c) To optimise the use of land at the rear of the property and surveillance of the street at the front of the property.
- (d) To minimise overshadowing of adjacent properties and private or shared open space.

5.4.2 Development Controls

1. For an attached and multi-dwelling housing, the rear boundary setbacks are measured from the wall of the building or the outer edge of a balcony/deck, to the adjacent property boundary. The minimum rear boundary setbacks are as follows:

| Side and Rear Boundary Setbacks Attached and Multi-Dwelling Development | | | |
|--|-------------------------------|---|--|
| Zone | Minimum side and rear setback | Minimum side and rear setbacks where balconies or windows of living areas face the rear boundary at first floor level or above | |
| All zones | 1.5m | 1.5m | |
| R2 Low Density Residential Zone | 0.8 x ceiling height | 1.0 x ceiling height | |
| R3 Medium Density Residential Zone | 0.8 x ceiling height | 1.0 x ceiling height | |
| R4 High Density Residential Zone | 0.4 x ceiling height | 0.6 x ceiling height | |

- 2. Where a basement parking area is provided for an attached dwelling development, the controls relative to basement parking areas for residential flat buildings will apply.
- 3. For attached dwelling developments containing three storeys and 4 or more dwellings, the additional separation/side setback requirements for residential flat buildings will apply.
- 4. Council may only consider granting a variation to the setback requirements where the following can be demonstrated to Council's satisfaction:
 - (a) The siting of the building satisfies the setback objectives; and
 - (b) Windows which are located on the side or rear boundary are primarily provided for natural light or ventilation purposes. This would include highlight windows with a minimum 1.7m sill, fixed obscure glass windows, glass bricks or windows with fixed louvres; and
 - (c) The amenity of the adjoining property is not unreasonably affected; and

(d) The design will result in a significant improvement in amenity for residents who will occupy the proposed dwelling.

5.5 Building Character and Form

5.5.1 Objectives

- (a) To design residential development to respond to the streetscape character. The Site and Context Analysis must inform the development proposal.
- (b) To complement and enhance the visual character of the street and neighbourhood through appropriate building scale, form and detail.
- (c) To reduce the visual dominance of garages as viewed from the street.
- (d) To promote high quality architectural design that is contemporary and innovative.
- (e) To ensure corner sites are developed as visually significant elements to promote a strong and legible character.
- (f) To provide an identifiable and desirable street address to each building and dwelling.
- (g) To define the street edge by creating a clear transition between private and public spaces along the street frontage.
- (h) To allow for outlook and surveillance towards the street and the public domain.

5.5.2 Development Controls

- 1. The following elements must be incorporated in the building design of attached and multi-dwelling development:
 - (a) Articulate and fragment building walls that address the street and add visual interest. The appearance of blank walls or walls with only utility windows on the front elevation is not permitted.
 - (b) Avoid expanses of any single material.
 - (c) Utilise high quality and durable materials and finishes.
 - (d) Entrances must be visible at eye level from the street and well lit.
 - (e) For those dwellings adjacent to the street frontage, the habitable rooms must face the street.
 - (f) Ensure entrances can accommodate the movement of furniture.
 - (g) Air conditioning units must not be visible from the street. Space shall be allocated and shown on plans for air conditioning units in order to demonstrate that this can be achieved.
 - (h) All residential buildings must be designed with building frontages and entries clearly addressing the street frontage. Dwellings adjacent to the street boundary must have individual entries from the street.

- (i) For attached dwellings on corner sites, each frontage of the development must present as the primary street frontage.
- (j) Where garages are proposed on the front elevation they must be articulated, unless it can be demonstrated that the garages will not visually dominate the streetscape appearance of the building.

5.6 Access / Driveway Requirements

5.6.1 Objectives

- (a) To provide adequate and safe vehicular access to all dwellings.
- (b) To encourage driveways to be provided from lanes or secondary streets instead of major roads or primary street frontages, where such alternate access is available.

5.6.2 **Development Controls**

- 1. The development proposal must provide access to the site in accordance with the following controls:
 - (a) Paving colour, texture and material should be sympathetic with the character of the precinct and reflect a pleasant visual appearance.
 - (b) Provide driveways to parking areas from lanes and secondary streets rather than the primary road or street, wherever practicable.
 - (c) The number of access points to a development must be kept to a minimum.
 - (d) Locate driveways taking into account any services within the road reserve, such as power poles, drainage inlet pits and existing street trees.
 - (e) Long straight driveways should be avoided because these adversely dominate the streetscape and landscape. Curved driveways are more desirable. Landscaping between the buildings and the driveways is encouraged to soften the appearance of the hard surface.
 - (f) All driveways must be located a minimum of 6 metres from the perpendicular of any intersection of any two roads.
 - (g) Any driveway servicing a residential development is to be setback a minimum of 1.5m from any side property boundary.
 - (h) Driveways are to be a maximum of 6m in width.
 - (i) The design of driveway and crossovers must be in accordance with council's standard vehicle entrance designs.
- 2. All vehicles within a multi dwelling development must provide vehicular manoeuvring areas to all parking spaces so vehicles do not need to make more than a single point turn to leave the site in a forward direction. Direct reversing onto the street will only be considered where the garage fronts a secondary road, carrying reduced traffic volume and all other requirements of the policy are met.

- 3. Driveway grades, vehicular ramp width/grades and passing bays must be in accordance with the relevant Australian Standard, being AS 2890.1.
- 4. Crossover and driveway widths relating must comply with the following:

Table 1: Crossover and driveway widths

| No. Dwellings | Crossover Width | Driveway Width | |
|---------------|--|--|--|
| 1 to 2 | Minimum 2.75m | Minimum 2.75m | |
| 3 to 5 | 3 –4m combined | Minimum 3m | |
| 6 to 20 | 4 – 6m combined to within 6m internally of the front property boundary | Minimum 3m | |
| 21 to 50 | 6 –8m combined | 6m | |
| > 50 | 3-4m each, separated | Minimum 3m each or 6m when combined | |

5. A minimum 6 metre wide driveway reserve/carriageway width is required for a battle-axe access handle upon a battle-axe lot.

5.7 Car Parking Requirements

5.7.1 Objectives

- (a) To provide an adequate level of on site car parking based upon anticipated occupancy rates and proximity to public transport.
- (b) To ensure that there is adequate provision for access to and manoeuvring within the development.
- (c) To ensure that residential developments are designed to be accessible for pedestrians, cyclists and motorists.
- (d) To ensure that integrated design of car parking facilities to minimise visual impacts.
- (e) To ensure the provision of facilities such as bike racks, which encourage the use of alternative methods of transport.

5.7.2 Development Controls

- 1. On site car parking must be positioned to minimise impacts on the streetscape. Car parking must be located behind the building setback and be screened from view with well designed structures and vegetation. Car parking may also be located within a basement.
- 2. Car parking areas should be designed to conveniently, efficiently and appropriately serve residents and visitors of the site. This can be achieved in the following ways:
 - (a) Ensuring that car parking areas are located close to entrances and access ways.
 - (b) Car parking areas to be secure yet easily accessible for all residents.
 - (c) Have clearly defined areas for visitor parking and disabled parking.

3. Parking for cars, motorcycles and bicycles must be provided and designed in accordance with the requirements contained in Traffic, Access, Parking and Servicing Chapter contained in Part E of this DCP.

5.8 Landscaping Requirements

5.8.1 Objectives

- (a) To preserve and retain existing mature native trees and vegetation and encourage the planting of additional native vegetation.
- (b) To enhance the appearance of housing through integrated landscape design.
- (b) To improve the visual amenity by increasing the volume of substantial vegetation in urban areas.
- (c) To reduce impervious areas on sites and increase soft landscape screening between side orientations of residential developments.

5.8.2 Development Controls

- 1. A minimum of 30% of the total site area must be provided as landscaped area. Landscaped area is defined in the Wollongong LEP 2009 as part of a site used for growing plants, grasses and trees, but does not include any building, structure or hard paved area. as 'is any part of the site which is not occupied by any building, basement or hard surface such as driveways, parking areas or paved areas of courtyards, decks, balconies or terraces. The landscaped area may also include s landscaping on the a podium, where that section of the podium is less or equal to than 1.2 metres in height and the minimum soil standards depth requirements of this DCP (clause 6.11.2) are achieved. Any landscaped area on the site which is less than 1.5 metres in width is not included within the landscaped area calculations.
- 2. A minimum of two semi mature medium large trees (minimum pot size 45L) are to be provided onsite in the landscaped area or deep soil zone and at least 3m from any existing or proposed dwelling, building or structure on the lot. In the instance where there is an existing mature tree/s onsite and these will be retained post development, only one additional semi mature medium large tree is required.
- 3. Any landscaped or grassed areas within the front setback area will be included in the landscaped area calculations. Landscaping in this area must be in context with the scale and height of the multi dwelling housing development.
- 4. The required landscaped area must include a minimum 1.5 metre wide landscaping bed, which is provided along the side and rear boundaries of the site.
- 5. The following matters must be addressed within the submitted landscape plan:
 - (a) Site landscaping must be integrated with the stormwater management controls. In particular, the location and nature of the on site stormwater detention basins should not conflict with landscaping areas and objectives.
 - (b) Select appropriate species that are likely to survive in the specific environmental conditions of the site, orientation and microclimate.

- (c) Identify and retain where possible existing mature trees.
- (d) Garden beds to be mulched and be separated from driveways or open space areas by an appropriate border or edge.
- (e) The width of the landscape bed does not include kerbs or other hard borders or edges.
- (f) Where driveways are located parallel to a property boundary, a minimum 1.5m landscape strip is required adjacent to the driveway.
- (g) Landscaping to separate driveways from dwellings is also required to minimise the expanse of hardstand surfaces, define dwellings from common driveway areas and to promote variation in the alignment of driveway areas.
- (h) Manoeuvring areas immediately adjacent to the living/dining rooms of dwellings is not permitted.
- 6. Street trees are required to be planted in accordance with the requirements contained in the Landscaping Chapter in Part E of this DCP.

5.9 Deep Soil Planting

5.9.1 Objectives

- (a) To protect existing mature trees on a site and encourage the planting of additional significant vegetation.
- (b) To encourage the linkage of adjacent deep soil zones on development sites, to provide habitat for native indigenous plants and birdlife.
- (c) To allow for increased water infiltration.
- (d) To contribute to biodiversity.

5.9.2 Development Controls

- 1. The siting of the deep soil zone shall be determined following a Site and Context Analysis to investigate whether this area should be located:
 - (a) Centrally within the site to allow for overlooking from dwellings within a development;
 - (b) At the rear of the site to allow for separation from adjacent dwellings and to provide a continuous corridor of vegetation of native fauna; or
 - (c) Elsewhere within a site to allow for retention of significant trees and attain maximum access to sunlight.
- 2. A minimum of half of the landscaped area (i.e. 15% of the site) must be provided as a deep soil zone, where the deep soil zone is not located at the rear of the site. The deep soil zone may be located in any position on the site, other than forward of the building line, subject to this area having a minimum dimension of 6m. Alternatively, the deep soil may extend along the full length of the rear of the site, with a minimum width of 6m. The area of deep soil planting must be continuous to ensure that the deep soil planting area is a singular uniform area and is not fragmented.

- 3. No structures, basement carparks, driveways, hardpaving, decks, balconies or drying areas are permitted within the deep soil zone.
- 4. The deep soil zone shall be densely planted with trees and shrubs. Where a multi dwelling housing development is to be strata titled, the deep soil zone may be retained within the common property or allocated to an individual unit entitlement, where such dwelling is directly adjacent.

5.10 Communal Open Space

5.10.1 Objectives

- (a) To ensure that communal open spaces are of adequate size to be functional.
- (b) To provide communal open space, which is accessible by all residents.

5.10.2 Development Controls

- 1. Developments with more than 10 dwellings must incorporate communal open space. The minimum size of this open space is to be calculated at 5m² per dwelling. Any area to be included in the communal open space calculations must have a minimum dimension of 5 metres. The communal open space must be easily accessible and within a reasonable distance from each dwelling be integrated with site landscaping, allow for casual social interaction, and be capable of accommodating recreational activities.
- 2. Where a minimum of 15% of the site is provided as a deep soil zone, combined use of part of the deep soil zone as communal open space may occur. The combined communal open space/deep soil area may be grassed but must contain significant shade trees. A maximum of 1/3 of the required communal open space area may be combined with the deep soil zone.
- 3. Areas of the communal open space should contain paving, children's playground equipment, barbeques, shade structures, swimming pools or the like, however these cannot be located within the deep soil zone.
- 4. At least 50% of the communal open space area must receive at least 3 hours of direct sunlight between 9.00am and 3.00pm on June 21.

5.11 Private Open Space

5.11.1 Objectives

- (a) To ensure that private open spaces are of sufficient size to accommodate a range of uses and are accessible and connected to indoor spaces where appropriate
- (b) To ensure functionality of private open space by reducing overlooking and overshadowing of such spaces

5.11.2 Development Standards

1. Private open space must be provided for each dwelling within an attached dwelling development in the form of a balcony, courtyard, terrace and/or roof garden.

- 2. Private open space for each dwelling within an attached dwelling housing development must comply with the following:
 - (a) Private open space must be provided at the ground level or podium level. The courtyard or terrace must have a minimum dimension of 4 metres x 5 metres. This area must be separated from boundaries by at least 1.5 metres with a vegetated landscaping bed and must not encroach upon deep soil zone landscaping areas. Where a level courtyard is not possible, a deck or split level courtyard must have a minimum depth of 3 metres.
 - (b) The primary private open area of at least 70% of the dwellings within a multi dwelling housing development must receive a minimum of three hours of direct sunlight between 9.00am and 3.00pm on June 21.
 - (c) Private open space areas (courtyards) must not extend forward of the front building setback by greater than 900mm.
 - (d) Private open space should be sited in a location, which provides privacy, solar access, and pleasing outlook and has a limited impact upon adjoining neighbours.
 - (e) Design private open spaces so that they act as direct extensions of the living areas of the dwellings they serve.
 - (f) Clearly define private open space through use of planting, fencing or landscaping features.
 - (g) Screen private open space where appropriate to ensure privacy.
- 3. Where part of the private open space is also provided in the form of a balcony, the following requirements must also be met:
 - (a) The primary balconies must not address side setbacks.
 - (b) The balcony must have a minimum area of 8m² open space and a minimum width of 2 metres.
 - (c) Balconies must be designed and positioned to ensure sufficient light can penetrate into the building at lower levels.
 - (d) The total combined area of all balconies in a building must not exceed 25% of the building floor space.
 - (e) Individual balcony enclosures are not supported. Balcony enclosures must form part of an overall building façade design treatment and should not compromise the functionality of a balcony as a private open space area

5.12 Solar Access Requirements

5.12.1 Objectives

(a) To minimise the extent of loss of sunlight to living areas and private open space areas of adjacent dwellings.

7Part B – Land Use Based Controls Chapter B1: Residential Development

- (b) To maximise solar access into living rooms and private open space of dwellings in the subject development.
- (c) To use a consistent sunlight access assessment approach for the assessment of solar access issues.

5.12.2 Development Controls

- 1. Windows to living rooms of adjoining dwellings must receive 3 hours of sunlight between 9.00am and 3.00pm on 21 June.
- 2. At least 50% of the private open areas of adjoining residential properties must receive at least 3 hours of sunlight between 9.00am and 3.00pm on June 21.
- 3 The primary balcony of at least 70% of the dwellings within a multi dwelling housing development shall receive a minimum of three hours of direct sunlight between 9.00am and 3.00pm on June 21.
- 4. Windows to north facing living rooms for each of the subject dwellings in the development must receive at least 3 hours of sunlight between 9.00am and 3.00pm on 21 June.
- 5. At least 50% of the private open space area for each of the subject dwellings in the development must receive at least 3 hours of sunlight between 9.00am and 3.00pm on 21 June.
- 6. Shadow diagrams will be required for hourly intervals between 9.00 am and 3.00 pm for the 21 June winter solstice period which show the extent of overshadowing upon dwellings and rear private open space areas of adjoining dwellings. In certain cases, Council may require additional hourly interval shadow diagrams for the equinox period where it is necessary to determine the full extent of overshadowing upon the dwelling and / or private open space area of an adjoining property.

5.13 Additional Control for Multi Dwelling Housing - Dwelling Mix and Layout

5.13.1 Objectives

- (a) To provide variety in dwelling sizes and layouts to cater for a range of household types and to assist housing affordability initiatives.
- (b) To ensure that the internal arrangement of dwellings is functional and satisfies occupant's needs.
- (c) To design dwellings to promote resident amenity and adaptability of use.

5.13.2 Development Controls

- 1. Provide a mix of dwelling sizes and layouts within larger multi-dwelling developments having ten (10) or more dwellings. This could include both variation in the number of bedrooms and gross floor areas of apartments, variety in the internal design or incorporating one, two and three bedroom dwellings to accommodate various resident requirements.
- 2. The selection of the number of bedrooms within developments shall be determined having regard to the sites context, geographic location and anticipated demographic characteristics.

3. Dwellings should be designed with internal spaces, which are flexible and adaptable to resident's requirements. This should involve the efficient utilisation of available floor space to maximise useable room areas. Apartment layouts should also respond to the sites opportunities, including views and aspect.

5.14 Additional Control for Multi Dwelling Housing - Adaptable Housing

5.14.1 Objectives

- (a) To ensure that dwelling layout is sufficiently flexible for residents changing needs over time.
- (b) To ensure that building design is sufficiently robust to accommodate mixed use and potential changes in use such as accommodating an office.
- (c) To ensure a sufficient proportion of dwellings include accessible layouts and features to accommodate changing requirements of residents.
- (d) To ensure the provision of housing that will, in its adaptable features, meet the access and mobility needs of any occupant.

5.14.2 Development Controls

- 1. Within a multi dwelling development incorporating more than six (6) dwellings, 10% of all dwellings (or at least 1 dwelling) must be designed to be capable of adaptation for disabled or elderly residents. Dwellings must be designed in accordance with the Australian Adaptable Housing Standard (AS 4299-1995), which includes "pre-adaptation" design details to ensure visitability is achieved.
- 2. Where an adaptable dwelling is provided in the form of a villa and a double garage is required to be provided, Council will accept a single garage, which complies with the minimum adaptable car parking dimensions contained in the Traffic, Access, Parking and Servicing Chapter in Part E of this DCP. The single garage will be counted as two car parking spaces for the purpose of car parking calculations.
- 4. The Development Application must be accompanied by certification from a suitably qualified and experienced Access Consultant which confirms that the adaptable dwellings are capable of being modified, when required by the occupant, to comply with the Australian Adaptable Housing Standard (AS 4299-1995).

5.15 Additional Control for Multi Dwelling Housing - Crime Prevention through Environmental Design

1. Compliance with the requirements of Chapter E2 Crime Prevention through Environmental Design (CPTED) in this DCP.

6 **RESIDENTIAL FLAT BUILDINGS**

6.1 General

- Development of Residential Flat Buildings is guided through SEPP 65 Design Quality of Residential Flat Development. For development required to comply with SEPP 65 and the Apartment Design Guide 2015, the objectives, design criteria and design guidance relating to:
 - (a) visual privacy,
 - (b) solar and daylight access,
 - (c) natural ventilation,
 - (d) ceiling heights,
 - (e) apartment size and layout,
 - (f) private open space and balconies,
 - (g) common circulation and spaces, and
 - (h) storage,

as detailed in Part 3 and Part 4 of the Apartment Design Guide, prevail over any inconsistent objective or control in this DCP.

- In addition to the controls in this Section the controls within Section 4 (excluding 4.1 to 4.11 4.12 and 4.19 4.20 to 4.22 4.23) of this chapter that must also be taken into consideration when preparing a development application for Residential Flat Buildings.
- 3. This chapter should be read in conjunction with other relevant chapters of the DCP including but not limited to E2 CPTED, E3 Car Parking Access Servicing/Loading Facilities and Traffic Management; E6 Landscaping.

6.2 Minimum Site Width Requirement

6.2.1 Objectives

- (a) To allow for development of sites, which are of sufficient width to accommodate the required building envelope, car parking and landscaping requirements.
- (b) To promote the efficient utilisation of land.
- (c) To encourage amalgamation of allotments to provide for improved design outcomes including greater solar access and amenity.

6.2.2 Development Controls

1. The Wollongong LEP 2009 requires a minimum site width of 24 metres is required for residential apartment buildings. The width must be measured for the full length of the building envelope and perpendicular to the side boundary. Exceptions will only be considered for social housing developments.



Ensure site is of sufficient width (24m) to accommodate setback and landscaping requirements

(Ref: Residential Flat Desian Code)

- 2. Within the R1 General Residential, R3 Medium Density Residential and R4 High Density Residential zones, development for the purpose of a residential flat building must not result in the creation of an "isolated lot". "An "isolated lot" is a lot which is bounded on both sides by properties (or a property and a second street frontage) which comprise existing development other than a single dwelling house and redevelopment of such adjoining properties is unlikely. This includes cases where there is high separation of ownership of dwelling ownership in the adjoining developments. Amalgamation of allotments will be required in the circumstance where an isolated allotment would otherwise be created.
- 3. Council will only allow development which would result in the creation of an "isolated lot", where it is demonstrated that:
 - (a) The "isolated lot" achieves a site width of 24 metres or more and is capable of accommodating the proposed residential flat building, taking into account other relevant development controls..
 - (b) The following planning principles as outlined in the NSW Land and Environment Court judgment in *Melissa Grech v Auburn Council*[2004] NSWLEC 40 are met:
 - (i) Where a property will be "isolated" by a proposed development and that property cannot satisfy the minimum lot width requirements then negotiations between the owners of the properties should commence at an early stage and prior to the lodgement of the Development Application.
 - (ii) Where no satisfactory result is achieved from the negotiations, the Development Application should include details of the negotiations between the owners of the properties. These details should include offers to the owner of the isolated lot. A reasonable offer for the purposes of determining the Development Application and addressing the planning implications of an "isolated lot", is to be based at least on one recent independent valuation report and may include other reasonable expenses likely to be incurred by the owner of the "isolated lot" in the sale of that property.
 - (iii) The level of negotiation and any offers made for the "isolated lot" are matters that will be given weight in the consideration of the Development Application. The amount of weight will depend on the level of negotiation, whether any offers are deemed reasonable or unreasonable, any relevant planning requirements and the "matters for consideration" under Section 79C of the Environmental Planning & Assessment Act 1979.
- 4. In cases where the subject site is an existing "isolated lot", Council may consider a variation to the minimum site width requirement provided, in the opinion of Council, the proposed development will not cause any significant adverse overshadowing, privacy or amenity impact upon any adjoining development.
- 5. In certain existing "isolated lot" cases, a proposed development may not achieve its maximum development potential (eg maximum floor space ratio and height) where side and rear setbacks are varied and the development does not, in the opinion of Council, achieve:
 - (a) Adequate separation between buildings to maintain reasonable levels of solar access, privacy and amenity to neighbouring dwellings;

- (b) Adequate landscaping screening of the development to maintain the amenity of adjoining dwellings; and
- (c) Maintain the streetscape amenity of the locality.

6.3 Front Setbacks

6.3.1 Objectives

- (a) To reinforce the existing character of the street by acknowledging building setbacks.
- (b) To define the spatial proportions of the street and define the street edge.
- (c) To provide a transition between the public and private domain.
- (d) To promote compatibility in front setbacks to provide unity in the building line.

6.3.2 Development Controls

- 1. For residential flat buildings the following setback requirements apply from the front property boundary to the front façade of the building:
 - (a) The same distance as one or other of the adjoining buildings, provided the difference between the setbacks of the two adjoining dwellings is less than 2.0m.
 - (b) The average of the setbacks of the two adjoining buildings, if the difference between the setbacks of the buildings is greater than 2.0m.
 - (c) A minimum front setback of 6m applies to residential apartment buildings where calculations of a) or b) result in a front setback of less than 6m.
- 2. On corner allotments, a minimum setback of 3m to the secondary street frontage from the dwelling façade must be provided.
- 3. Balconies, front courtyard fences and other building extrusions may be setback up to 900mm closer than the required front or secondary setback.
- 4. An increase in setbacks may be required to retain existing trees or respect adjacent heritage items.





Figure 2: (Top) Where y- x is less than or equal to 2 metres, the setback equals x or y

Figure 3: (Bottom) Where y-x is greater than 2 metres, the setback equals the average of x and y

6.4 Side and Rear Setbacks / Building Separation

6.4.1 Objectives

- (a) To provide adequate setbacks from boundaries and adjoining dwellings to retain privacy levels, views, sunlight and daylight access and to minimise overlooking.
- (b) To optimise the use of land at the rear of the property and surviellance of the street at the front of the property.
- (c) To control overshadowing of adjacent properties and private or shared open space.
- (d) To encourage setbacks which reflect the rhythm of building siting and the separation between.
- (e) To ensure that new development is scaled to support the desired area character with appropriate massing and space between buildings.

6.4.2 Development Controls

1. For residential flat buildings the following minimum setbacks shall be provided.

| Side and Rear Setbacks Residential Apartment Buildings | | |
|--|---|--|
| Building Height | Minimum Side and Rear Setback | |
| Buildings up to 4 storeys (12 metres) | 6 metres where a habitable room/balcony on development site | |
| 2 | 3.5 metres where a non-habitable room/blank wall | |
| Buildings of 5 to 8 storeys (up to 25 metres) | 9 metres where a habitable room/balcony faces an adjacent property | |
| • | 4.5 metres where a non-habitable room/blank wall faces an adjacent property | |

Note: The setback is measured from the side or rear wall of the building or balcony to the adjacent boundary.

2. Where Council proposes to provide a laneway adjacent to the rear or side boundary of a property, an additional setback, equal to the identified width of the laneway, must be provided.

6.5 Built Form

6.5.1 Objectives

- (a) To promote high quality architectural design that is responsive and innovative.
- (b) To ensure that new developments have well articulated and harmonious facades which define the public domain.
- (c) To ensure corner sites are developed as visually significant elements to promote a strong and legible character.
- (d) To provide an identifiable and desirable street address to each building and dwelling.
- (e) To define the street edge by creating a clear transition between private and public spaces along the street frontage.
- (f) To allow for outlook and surveillance towards the street and the public domain.

6.5.2 Development Controls

- All residential flat buildings must be designed by a qualified designer in accordance with State Environmental Planning Policy No. 65 – Design Quality of Residential Flat Apartment Development. A Design Verification Statement must accompany the Development Application.
- 2. The design, height and siting of the development must respond to its context, being both the natural and built features of an area. The Site and Context Analysis must be utilised as the process by which the opportunities and constraints of the site are identified and the character of a local area defined.
- 3. The appearance of new development must be in harmony with the buildings around it and the character of the street. New development must contain or respond to the essential elements that make up the







Examples of built form controls

character of the surrounding urban environment. This character is created by elements such as building height, setbacks, architectural style, window treatment and placement, materials and landscaping.

4. The following elements must be incorporated into the building design:

- (a) Define a base, middle and top related to the overall proportion of the building.
- (b) Articulate all building elevations in both plan and section to reduce monotonous flat facades.
- (c) Highly reflective finishes and curtain wall glazing are not permitted above ground level.
- (d) Avoid expanses of any single material.
- (e) Utilise high quality and durable materials and finishes.
- (f) Avoid blank or solid walls and the use of dark or obscured glass on street frontages.
- (g) Air conditioning units must be screened and not be visible from the street.
- (h) For those dwellings adjacent to the street frontage, the habitable rooms must face the street.
- (i) The main pedestrian entrance or a foyer must be 1.2m or less above natural ground level.
- (j) Entrances must be visible at eye level from the street and well lit. Ensure entrances can accommodate the movement of furniture.
- 5. The design of roof forms must address the following:
 - (a) Lift over runs and service plants must be concealed within the roof of the building or relate to adjacent roof top rooms or open space.
 - (b) Where flat roofs are proposed, lift overruns and rooftop plant and machinery are to be obscured from view by parapets or designed to be incorporated with rooftop activities/features. Details of any rooftop overruns or equipment must accompany the development application for the residential apartment building.
 - (c) The siting of ventilation stacks within the landscaped areas will not be permitted.
 - (d) Landscaped and shaded areas on the roof of residential apartment buildings for private use by residents will be considered where residential amenity is not unreasonably affected.
- 6. Residential flat buildings which are located on corner sites must address the following:
 - (a) Emphasise verticality at corners, where possible, by concentrating the tallest portion of the building on the corner itself. Utilise design devices such as increased wall heights, splayed corner details, increased heights, expression of junction of building planes and other architectural features to reinforce the way finding attributes of street corners.
 - (b) Design corners to add variety and interest to the street and clarify the street hierarchy.
 - (c) Present each frontage of a corner building as a main street frontage.



Figure 4: Examples of Residential Flat Building design

Useful references:

"Residential Flat Design Code"

http://www.planning.nsw.gov.au/programservices/dcode.asp

"Residential Flat Design Pattern Book"

http://www.patternbook.nsw.gov.au/

6.6 Visual privacy

6.6.1 General

Visual privacy measures are designed to protect the privacy and amenity of occupants within a residential apartment or serviced apartment. Visual privacy measures allow occupants to carry out private functions within all rooms in the apartment as well as private balconies or open space courtyards, through limiting direct views or overlooking issues from adjoining buildings.

6.6.2 Objectives

- (a) To provide reasonable levels of visual privacy externally and internally, during the day and at nighttime.
- (b) To maximise outlook and views from principal rooms and private open space without compromising visual privacy.

6.6.3 Development controls

- 1. New buildings should be sited and oriented to maximise visual privacy between buildings through compliance with minimum front, side and rear setback / building separation requirements.
- 2. The internal layout of buildings should be designed to minimise any direct overlooking impacts occurring upon habitable rooms and private balcony / open space courtyards, wherever possible by separating communal open space and public domain areas from windows of rooms, particularly sleeping room and living room areas.
- 3. Buildings are to be designed to increase privacy without compromising access to sunlight and natural ventilation through the following measures:
 - (a) Off-setting of windows in new buildings from windows in existing adjoining building(s).
 - (b) Living room windows, balconies and outdoor living areas are not to allow direct views into neighbouring dwellings or neighbouring private open space.
 - (c) Recessed balconies and / or vertical fin elements between adjoining balconies to improve visual privacy.
 - (d) Provision of solid, semi-solid or dark tinted glazed balustrading to balconies.
 - (e) Orientate balconies and outdoor living areas to either the front or rear of the building and not side boundaries where potential overlooking or amenity impacts may occur upon directly adjoining dwellings or private open space areas of side adjoining development.
 - (f) Provision of louvers or screen panels to windows and / or balconies.
 - (g) Provision of perimeter landscaped screen / deep soil planting.
 - (h) Incorporating planter boxes onto apartment balconies to improve visual separation between apartments within the development and adjoining buildings.
 - (i) Provision of pergolas or shading devices to limit overlooking of lower apartments or private open space courtyards / balconies.
- 4. Habitable room windows in the subject building with a direct sightline to habitable room windows in an adjacent dwelling within 12 metres must be:
 - (a) Off-set from the edge of one window to the edge of the other by a distance sufficient to limit views into the windows of the adjacent building; or
 - (b) Sill heights at least 1.7 metres above floor level; or

- (c) Fixed obscure glazing in any part of the window below 1.7 metres above floor level.
- 5. Windows, balconies, stairs, terraces, decks, verandahs or other private areas which provide direct overlooking opportunities from the development into the private open space courtyard of an adjoining property must be obscured or screened. However, no screening is required where such windows have sill heights of at least 1.7 metres above the floor level or the windows are obscured glazing.

6.7 Acoustic privacy

6.7.1 General

- 1. This clause applies to proposals involving the erection of new residential flat buildings upon land directly adjoining or opposite a business or industrial zone or in cases where there is an existing nearby land use which generates external noise from either the land use activity itself or from patrons attending or leave the nearby premises.
- 2. Acoustic privacy is a measure of sound insulation between residential apartments and between external and internal spaces.

6.7.2 Objective

(a) To ensure a high level of amenity by protecting the privacy of occupants both within apartments and in private open space areas / balconies in the building.

6.7.3 Development Control

- 1. Residential apartments and / or serviced apartments should be arranged in a building, to minimise noise transition between apartments by:
 - (a) Locating busy, noisy areas next to each other and quieter areas, next to other quieter areas (eg living rooms with living rooms and bedrooms with bedrooms);
 - (b) Using storage or circulation zones within an apartment to buffer noise from adjacent apartments, mechanical services or corridors and lobby areas; and
 - (c) Minimising the amount of party (shared) walls with other apartments.
- 2. All residential apartments and / or serviced apartments within a building should be designed and constructed with double-glazed windows and / or laminated windows, solid walls, sealing of air gaps around doors and windows as well as appropriate insulating building elements for doors, walls, roofs and ceilings etc; to provide satisfactory acoustic privacy and amenity levels for occupants within the residential and / or serviced apartment(s).
- 3. Appropriate sound attenuation measures should be considered between each floor in the development, to minimise potential sound transmission into any residential apartment below.
- 4. Any residential apartment which faces towards a major (busy) road must be designed in accordance with the requirements contained in Chapter E4: Development near Railway Corridors and Major (Busy) Roads in this DCP.
- 5. The Statement of Environmental Effects (SEE) accompanying the development must demonstrate what acoustic measures will be provided to windows of sleeping areas and living areas for each

residential apartment or serviced apartment in the development. The proposed acoustic measures must also be shown on the required architectural floor layout and elevation plans for the development.

Alternatively, the Statement of Environmental Effects (SEE) may include an acoustical impact assessment study which outlines alternative acoustic treatment measures for residential apartment(s) and / or serviced apartment(s) in the development. The acoustic impact assessment study must be carried out by a suitably qualified and experienced acoustic consultant (ie a person who is a Member of the Australian Acoustical Society, the Institution of Engineers or the Association of Australian Acoustical Consultants).

6.8 Car Parking Requirements

6.8.1 Objectives

- (a) To provide an adequate level of on site car parking based upon anticipated occupancy rates.
- (b) To ensure that residential developments are designed to be accessible for pedestrians, cyclists and motorists.
- (c) To ensure integrated design of car parking facilities to minimise visual impacts.
- (d) To provide underground parking, wherever feasible.
- (e) To ensure the provision of facilities such as bike racks, which encourage the use of alternative methods of transport.

6.8.2 Development Controls

Refer to E3 Car Parking, Access, Servicing/Loading Facilities and Traffic Management.

6.9 Basement Car Parking

6.9.1 Objective

(a) To integrate the siting, scale and design of basement parking into the site and building design.

6.9.2 Development Controls

- 1. Where parking is provided within a basement level(s), the scale and siting of the basement car park must not impact upon the ability of the development to satisfy minimum landscaping and deep soil zone requirements.
- 2. The roof of any basement podium, measured to the top of any solid wall located on the podium must not be greater than 1.2m above natural or finished ground level, when measured at any point on the outside walls of the building. On sites with a greater slope, a change in level in the basement must be provided to achieve this maximum 1.2m height.

Generally variation to this 1.2m podium height limit will not be supported, however Council recognises that there may be occasions where this standard cannot be achieved. Should such a circumstance arise, the additional portion of the basement podium above 1.2m height must be included in the total gross floor area calculation for the development.

- 3. In addition, the following must be satisfied:
 - (a) Landscaped terraces are provided in front of the basement podium to reduce the overall visual impact;
 - (b) The height of the basement does not result in the building having a bulk and scale which dominates the streetscape; and
 - (c) The main pedestrian entry to the building is identifiable and readily accessible from the street frontage, including access by disabled persons.
- 4. The following setbacks from side and rear boundaries apply to basement podiums:
 - (a) Where the height of the basement podium (measured to the top of any solid wall located on the podium) is less than 1.2m above natural or finished ground level (whichever distance is greater), the basement podium may extend to the property boundary. A minimum 1.5m wide landscaped planter must be provided on the perimeter of any section of the basement podium which is located on a side or rear property boundary. Such planter must prevent direct access to the outer edge of the podium, to minimise direct overlooking of adjacent dwellings and open space areas.
 - (b) Any portion of the basement (measured to the top of any solid wall located on the podium) which exceeds 1.2m above natural or finished ground level (whichever distance is greater) must be setback from the property boundaries by a ratio of 1:1 (height:setback). A minimum setback of 1.5m applies in this instance, with this area to be landscaped.
- 5. Where parking is provided in a basement, ventilation structures/openings/exhausts for basement parking and air-conditioning units must be orientated away from windows of habitable rooms and private open space areas on the subject land as well as adjoining sites. Ventilation grills must be integrated into the design of the façade of the building to minimise their visual impact.
- 6. The visual impact of all basement walls must be minimised through the use of various design techniques including well proportioned ground level articulation and relief, mixed finishes and materials, terracing and/or dense landscaping.
- 7. Basements must be protected from inundation from 100-year ARI flood levels (or greater).
- 8. Basement car park areas must be located to optimise deep soil planting around the building and allow for natural ventilation to be achieved. Integrating the podium design into the overall design of the development and limiting the extent to which the podium extends beyond the building footprint will minimise the impact of the basement parking areas on the streetscape.

6.10 Access Requirements

6.10.1 Objectives

- (a) To provide adequate and safe vehicular access to basement car parking areas.
- (b) To ensure that all car parking areas have satisfactory manoeuvring areas to enable vehicles to leave the site in a forward direction.

6.10.2 Development Controls

- 1. The development proposal must provide access to the site which is compliant with the following controls:
 - (a) Provide driveways to parking areas from lanes and secondary streets rather than the primary street, wherever practical.
 - (b) Locate driveways taking into account any services within the road reserve, such as power poles, drainage inlet pits and existing street trees.
 - (c) All driveways must be located a minimum of 6 metres from the perpendicular of any intersection of any two roads.
 - (d) Any driveway servicing a residential development is to be setback a minimum of 1.5m from any side property boundary.
 - (e) Driveways are to be a maximum of 6m in width.
 - (f) The design of driveway crossovers must be in accordance with council's standard vehicle entrance designs.
- 2. All vehicles within a residential apartment building must provide vehicular manoeuvring areas to all parking spaces so vehicles do not need to make more than a single point turn to leave the site in a forward direction.
- 3. Driveway grades, vehicular ramp width/grades and passing bays must be in accordance with the relevant Australian Standard, being AS 2890.1. Crossover and driveway widths relating must comply with the following:

| No. Dwellings | Crossover Width | Driveway Width |
|---------------|---|--|
| 3 to 5 | 3 –4m combined | Minimum 3m |
| 6 to 20 | 4 –6m combined to within 6m internally of the front property boundary | Minimum 3m |
| 21 to 50 | 6 –8m combined | 6m |
| > 50 | 3-4m each, separated | Minimum 3m each or 6m when combined |

4. Minimum 6 metre wide driveway reserve/carriageway width required for battleaxe lots – battle-axe handles.

6.11 Landscaping Requirements

6.11.1 Objectives

- (a) To preserve and retain existing mature native trees and vegetation and encourage the planting of additional significant vegetation,
- (b) To ensure landscape design responds to the existing site conditions including changes in levels, views, and significant landscape features including trees and rock outcrops.
- (c) To enhance the appearance of housing through integrated landscape design.

7Part B – Land Use Based Controls Chapter B1: Residential Development

- (d) To improve the visual amenity of the City by increasing the volume of substantial vegetation in urban areas.
- (e) To reduce impervious areas on sites and increase soft landscape screening between side orientations of residential developments.
- (f) To encourage the use of green walls and roofs in communal open space and to enhance the environmental performance of the development.

6.11.2 Development Controls

1. A minimum of 30% of the total site area must be provided as landscaped area. Landscaped area is defined in the Wollongong LEP 2009 as part of a site used for growing plants, grasses and trees, but does not include any building, structure or hard paved area. as 'is any part of the site which is not occupied by any building, basement or hard surface such as driveways, parking areas or paved areas of courtyards, decks, balconies or terraces'. The landscaped area may also include s landscaping on the a podium, where that section of the podium is less or equal to than 1.2 metres in height and the minimum soil standards below depth requirements of this DCP are achieved. Any landscaped area on the site which is less than 1.5 metres in width is not included within the landscaped area calculations.

| Plant type | Definition | Soil Volume | Soil Depth | Soil Area |
|---------------------|--|--------------------------------------|--------------------------------------|--|
| Large trees | 12-18m high, up to 16m crown spread at maturity | 150m ³ | <mark>1,200mm</mark> | <mark>10m x 10m or</mark> equivalent |
| Medium trees | 8-12m high, up to 16m crown spread at maturity | <mark>36m³</mark> 35m2 | <mark>1,000mm</mark> | <mark>6 x 6m or equivalent</mark> |
| Small trees | <mark>6-8m high, up to 16m</mark> crown spread at maturity | 16m ³ 9m2 | <mark>800mm</mark> | <mark>4 x 4m-3.5m x 3.5m or equivalent</mark> |
| <mark>Shrubs</mark> | | | <mark>500-600mm</mark> | |
| Ground cover | | | <mark>300-450mm</mark> | |
| Turf | | | <mark>300 <mark>200</mark> mm</mark> | |

Minimum soil standards for planting on structures or podiums

*Sub-surface drainage requirements are in addition to the above minimum soil depths.

Source: adapted from Apartment Design Guide (July 2015)

- 2. Any landscaped or grassed areas within the front setback area will be included in the landscaped area calculations. Landscaping in this area must be in context with the scale and height of the residential flat building.
- 3. Landscaped planters located on the podium level over any basement carparking will also be included within the landscaped area requirements, where such landscaping provides minimum soil depths for growth of vegetation.

- 4. The required landscaped area must include a minimum 1.5 metre wide landscaping bed, which is provided along the side and rear boundaries of the site.
- 5. Where private or communal open space is located on the rooftop provide 1.5 metre wide landscaped beds or screening devices, setback 1.5 metre from the edge of the building façade, to avoid overlooking into neighbouring properties.
- 6. The minimum number of trees to be planted onsite is as specified in the table below [or a minimum of 1 medium tree (minimum pot size 45L), whichever is greater]. Trees are to be planted in the deep soil zone or landscaped area on the site and at least 3m from any existing or proposed dwelling, building or structure.

| Site area | Tree planting |
|----------------------|---|
| Up to 1,500m2 | 1 large tree or 2 medium trees per 90m2 of deep soil zone. |
| | For sites with less than 90m2 of deep soil zone, 1 medium tree is required. |
| Greater than 1,500m2 | 1 large tree or 2 medium trees per 80m2 of deep soil zone |
| | |

Source: Apartment Design Guideline, July 2015

- 7. The following matters must be addressed within the submitted landscape plan:
 - (a) Site landscaping must be integrated with the stormwater management controls. In particular, the location and nature of the on site stormwater detention basins should not conflict with landscaping areas and objectives.
 - (b) Select appropriate species that are likely to survive in the specific environmental conditions of the site, orientation and microclimate.
 - (c) Identify and retain where possible existing mature trees.
 - (d) Garden beds to be mulched and be separated from driveways or open space areas by an appropriate border or edge.
 - (e) The width of the landscape bed does not include kerbs or other hard borders or edges.
 - (f) Where driveways are located parallel to a property boundary, a minimum 1.5m landscape strip is required adjacent to the driveway.
 - 7. Landscaping on podiums shall provide a minimum soil depth that allows for plant establishment and growth as follows:

| Plant Type | Soil Depth |
|--------------|-------------------|
| Shrubs | 600mm |
| Small trees | 800mm |
| Medium trees | 1000mm |

8. Street trees are required to be planted in accordance with the requirements contained in the Landscaping Chapter in Part E of this DCP.

6.12 Deep Soil Zone

6.12.1 Objectives

- (a) To protect existing mature trees on a site and encourage the planting of additional significant vegetation.
- (b) To encourage the linkage of adjacent deep soil zones on development sites, to provide habitat for native indigenous plants and birdlife and provide privacy and amenity for existing and future residents.
- (c) To allow for increased water infiltration.
- (d) To contribute to urban biodiversity.

6.12.2 Development Controls

- 1. The siting of the deep soil zone must be determined following a site analysis to investigate whether this area should be located:
 - (a) Centrally within the site to allow for overlooking from dwellings within a development;
 - (b) At the rear of the site to allow for separation from adjacent dwellings and to provide a continuous corridor of vegetation of native fauna; or
 - (c) Elsewhere within a site to allow for retention of significant trees and attain maximum access to sunlight.
- 2. A minimum of half of the landscaped area (i.e. 15% of the site) must be provided as a deep soil zone, where the deep soil zone is not located at the rear of the site. The deep soil zone may be located in any position on the site, other than forward of the building line, subject to this area having a minimum dimension of 6m. Alternatively, the deep soil may extend along the full length of the rear of the site, with a minimum width of 6m. The area of deep soil planting must be contiguous.
- 3. No structures, basement car parks, driveways, hard paving, decks, balconies or drying areas are permitted within the deep soil zone.
- 4. The deep soil zone must be densely planted with trees and shrubs. Where a residential apartment building is to be strata titled, the deep soil zone must be retained in the common property and be managed by the body corporate.

6.13 Communal Open Space

6.13.1 Objectives

- (a) To ensure that communal open spaces are of adequate size to be functional.
- (b) To provide communal open space which is accessible by all residents.

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6.13.2 Development Controls

- 1. Developments with more than 10 dwellings must incorporate communal open space. The minimum size of this open space is to be calculated at 5m² per dwelling. Any area to be included in the communal open space calculations must have a minimum dimension of 5 metres.
- 2. The communal open space must be easily accessible and within a reasonable distance from apartments, be integrated with site landscaping, allow for casual social interaction and be capable of accommodating recreational activities.
- 3. Where a minimum of 15% of the site is provided as a deep soil zone, combined use of part of the deep soil zone as communal open space may occur. The combined communal open space/deep soil area may be grassed but must contain significant shade trees. A maximum of 1/3 of the required communal open space area may be combined with the deep soil zone.
- 4. Areas of the communal open space which are to be paved or which will contain shade structures, swimming pools or the like cannot be located within the deep soil zone.
- 5. The communal open space area must receive at least 3 hours of direct sunlight between 9.00am and 3.00pm on June 21.

6.14 Private Open Space

6.14.1 Objectives

- (a) To ensure that private open spaces are of sufficient size to accommodate a range of uses and are accessible and connected to indoor spaces where appropriate.
- (b) To ensure functionality of private open space by reducing overlooking and overshadowing of such spaces.
- (c) To ensure that balconies are integrated into the overall architectural form and detail of residential flat buildings.
- (d) To ensure balconies are functional and responsive to local context and climate thereby promoting the enjoyment of outdoor living for residents.

6.14.2 Development Controls

- 1. Private open space must be provided for each dwelling within a residential apartment building in the form of a balcony, courtyard, terrace and/or roof garden.
- 2. Private open space for each dwelling within a residential apartment building must comply with the following:
 - (a) The courtyard/terrace for the ground level dwellings must have a minimum area of 25m² and width of 2 metres. This area must be separated from boundaries by at least 1.5m with a vegetated landscaping bed and must not encroach upon deep soil zone landscaping areas.
 - (b) The primary private open area of at least 70% of the dwellings within a residential apartment building must receive a minimum of three hours of direct sunlight between 9.00am and 3.00pm on June 21.

- (c) Private open space areas (courtyards) must not extend forward of the front building setback by greater than 900mm.
- (d) Private open space should be sited in a location which provides privacy, solar access, and pleasing outlook and has a limited impact upon adjoining neighbours.
- (e) Design private open spaces so that they act as direct extensions of the living areas of the dwellings they serve.
- (f) Clearly define private open space through use of planting, fencing or landscaping features.
- (g) Screen private open space where appropriate to ensure privacy.
- 3. Where private open space is provided in the form of a balcony, the following requirements must also be met:
 - (a) Avoid locating the primary balconies where they address side setbacks.
 - (b) The balcony must have a minimum area of 12m² open space and a minimum depth of 2.4 metres.
 - (c) The primary balcony of at least 70% of the dwellings within a multi dwelling housing development shall receive a minimum of three hours of direct sunlight between 9.00am and 3.00pm on June 21.
 - (d) Balconies must be designed and positioned to ensure sufficient light can penetrate into the building at lower levels.
- 4. The enclosure of balconies on existing residential flat buildings will generally not be permitted due to their negative impact on maximum floor space controls, fire rating, building aesthetics and form, and the availability and functionality of private open space.
- 5. Balcony screening and climate control elements shall be provided in the initial design of <u>new</u> residential flat buildings. Operable screens, pergolas, shutters, operable walls or similar shall be provided in locations where noise or high winds prohibit reasonable outdoor use (i.e. next to rail corridors, busy roads and tall towers).
- 6. Balcony screening and climate control will only be permitted by Council for <u>existing</u> residential flat buildings if the following requirements are met:
 - (a) A proposal is submitted for an overall building façade design treatment. This need not include the installation of building elements to all balconies but shall exhibit an appropriate pattern and proportion within the overall façade composition (i.e. treatments may vary depending upon the type and location of balconies at the base, middle or top of facades).
 - (b) The proposal involves the written agreement of all of the owners of unit facades that will be affected (e.g. if screening is proposed to four out of six balconies located on the north façade, the agreement of all owners of units on the north façade is required even if all units are not directly affected by the works).
 - (c) The proposal does not compromise the functionality of a balcony as a private <u>open</u> space area nor reduce the aesthetic quality or articulation of the building.

- (d) The proposal improves the functionality of the balcony and thereby promotes the enjoyment of the outdoor living area
- (e) The use of curtain wall glazing or an expanse of glazing is not permitted. Any glazing used to screen balconies shall be broken up by framing (e.g. louvers) which also casts shadows on the glass in order to reduce reflectivity and building bulk.
- (f) The design integrates with existing balustrades and/or involves the removal of balustrades to ensure the additions do not appear as a 'retrofit'.
- (g) The design integrates with the existing façade composition and increases the variety in façade design particularly for existing facades that exhibit little variation in materials, finishes and form. This may necessitate other modifications to façades such as the installation of awnings, pergolas and/or blade walls, a new colour scheme, and/or cornice treatment.
- (h) Coloured elevations and a photomontage shall be submitted with a Development Application.
- (i) If staged installation is proposed then the approved design shall be included as a by-law attached to the strata plan of the residential flat building prior to issue of an Occupation Certificate for the first stage in order to ensure that the installation of screening/climate control elements accord with an overall building façade design treatment and can be undertaken by various owners when it suits them.



Figure 5: Examples of balcony screening and climate control elements. Reference: Residential Flat Design Code

6.15 Adaptable and Universally Designed Housing

6.15.1 Objectives

- (a) To ensure that dwelling layout is sufficiently flexible for residents' changing needs over time.
- (b) To ensure a sufficient proportion of dwellings include accessible layouts and features, and universally designed features to accommodate changing requirements of residents.

(c) To ensure the provision of housing that will, in its adaptable features, meet the access and mobility needs of any occupant.

6.15.2 Development Controls

- 1. Within a residential apartment building, 10% of all dwellings (or at least one dwelling) must be designed to be capable of adaptation for disabled or elderly residents. Dwellings must be designed in accordance with the Australian Adaptable Housing Standard (AS 4299-1995), which includes "pre-adaptation" design details to ensure visitability is achieved.
- 2. Where possible, adaptable dwellings shall be located on the ground floor, for ease of access. Dwellings located above the ground level of a building may only be provided as adaptable dwellings where lift access is available within the building. The lift access must provide access from the basement to allow access for people with disabilities.
- 3. The development application must be accompanied by certification from an accredited Access Consultant confirming that the adaptable dwellings are capable of being modified, when required by the occupant, to comply with the Australian Adaptable Housing Standard (AS 4299-1995).
- 4. Car parking and garages allocated to adaptable dwellings must comply with the requirements of the Traffic, Access, Parking and Servicing Chapter in Part E of this DCP.
- 5. Within a residential apartment building incorporating more than six (6) dwellings, 10% of all dwellings (or at least 1 dwelling) must be designed to achieve the Silver Standards of the Livable Housing Design Guideline (Livable Housing Australia 2015). All proposed livable dwellings must be clearly identified on the submitted DA plans.

6.16 Access for People with a Disability

6.16.1 General

1. The provision of continuous path of travel is required to the development to ensure equitable access for all people including people with a disability. Refer to Access for People with a Disability in Part E of this DCP.

6.17 Apartment Size and Layout Mix for Larger Residential Flat Building Developments

6.17.1 Objectives

- (a) To provide variety in apartment sizes and layouts to cater for a range of household types.
- (b) To ensure that the internal arrangement of apartments is functional and satisfies occupant's needs.
- (c) To design apartments to promote resident amenity and adaptability of use.

6.17.2 Development Controls

1. A mix of apartment sizes and layouts is required for larger residential apartment buildings involving ten (10) or more dwellings. This could include both variation in the number of bedrooms and gross

floor areas of apartments, variety in the internal design or incorporating single and two level apartments to accommodate various resident requirements.

- 2. The selection of the number of bedrooms within developments shall be determined having regard to the site's context, geographic location and anticipated market demands. For residential apartment buildings having ten (10) or more dwellings, a minimum of 10% of the apartments must be one bedroom and/or studio apartments, to provide for housing choice.
- 3. Consideration should be given to the design of apartments to encourage future flexibility. This may include opportunities to combine smaller apartments with adjacent dwellings should residents' lifestyle change or may include the ability to accommodate home office opportunities. Consideration should also be given to the location of one and three bedroom apartments on the ground level where accessibility is more easily achieved for disabled, elderly people or families with children.
- 4. Apartments must be designed with internal spaces which are flexible and adaptable to resident's requirements. This should involve the efficient utilisation of available floor space to maximise useable room areas. Apartment layouts must respond to the site's opportunities, including views and aspect.
- 5. Ceiling heights of apartments must be selected to encourage the penetration of natural sunlight into all areas of the building. Provide the following minimum floor to ceiling heights, for residential flat buildings:
 - (a) 2.7m minimum for all habitable rooms on all floors;
 - (b) 2.25 to 2.4m minimum for non habitable rooms on all floors;
 - (c) For two storey apartments, 2.4m minimum for the second storey if 50% or more of the apartment has 2.7m minimum ceiling heights;
 - (d) For 2 storey units with a two storey void space, 2.4m minimum ceiling heights;
 - (e) Attic spaces, 1.5m minimum wall height at edge of room with a 30 degree minimum ceiling slope.



6.18 Solar Access

6.18.1 Objectives

- (a) To minimise the extent of loss of sunlight to living areas and private open space areas of adjacent dwellings.
- (b) To maximise solar access into living rooms and private open space of dwellings in the subject development.
- (c) To provide an appropriate level of natural sunlight to living spaces to improve residential amenity and minimise the use of artificial light.
- (d) To use a consistent sunlight access assessment approach for the assessment of solar access issues.

6.18.2 Development Controls

Solar Access into Residential Apartment Buildings

- 1. Residential apartment buildings must aim to maximise their level of northern exposure to optimise the number of dwellings having a northern aspect. Where a northern aspect is available, the living spaces and balconies of such apartments must typically be orientated towards the north.
- 2. The development must maximise the number of apartments with a dual orientation. Single aspect, single storey apartments should preferably have a northerly or easterly aspect and a reduced depth to allow for access of natural light to all habitable spaces.
- 3. Shading devices should be utilised where necessary, particularly where windows of habitable rooms are located on the western elevation.
- 4. The living rooms and private open space of at least 70% of apartments should receive a minimum of three hours of direct sunlight between 9.00am and 3.00pm.
- 5. The number of single aspect apartments with a southerly aspect (south-westerly to south-easterly) is limited to a maximum of 10% of the total number of apartments proposed.
- 6. Provide vertical shading to eastern and western windows. Shading can take the form of eaves, awnings, colonnades, balconies, pergolas, external louvres and planting.

Solar Access into Living Areas and Private Open Space Area of Adjoining Properties

- 1. The design of the development must have regard to the existing and proposed level of sunlight which is received by living areas and private open space areas of adjacent dwellings. Sensitive design must aim to retain the maximum amount of sunlight for adjacent residents. Council will place greatest emphasis on the retention of sunlight within the lower density residential areas.
- 2. Windows to living rooms and private space areas in adjacent residential buildings must receive at least 3 hours of direct sunlight between 9.00am and 3.00pm on June 21.
- 3. In determining access to sunlight, overshadowing by fences, roof overhangs and changes in level must be taken into consideration. Overshadowing by vegetation should also be considered, where dense vegetation appears as a solid fence.

- 4. In areas undergoing change, the impact of overshadowing on development likely to be built on adjoining sites must be considered, in addition to the impacts on existing development.
- 5. At least 50% of the private open areas of adjoining residential properties must receive at least 3 hours of sunlight between 9.00am and 3.00pm on June 21.
- 6. Shadow diagrams will be required for hourly intervals between 9.00 am and 3.00 pm for the 21 June winter solstice period which show the extent of overshadowing upon dwellings and rear private open space areas of adjoining dwellings. Additional hourly interval shadow diagrams for the equinox period where it is necessary to determine the full extent of overshadowing upon the dwelling and / or private open space area of an adjoining property.

6.19 Natural Ventilation

6.19.1 Objectives

- (a) To encourage apartment design which allows for natural ventilation of habitable rooms.
- (b) To provide natural ventilation in non -habitable rooms, where possible.
- (c) To reduce energy consumption by minimising the use of mechanical ventilation.



Figure 6: Natural Ventilation, Corner apartments encourage natural ventilation flows. (Ref: Residential Flat Design Code)



Figure 7: This optimal layout allows air flow directly from one side of the apartment to the other (Ref: Residential Flat Design Code)

6.19.2 Development Controls

1. All residential apartment buildings shall have a building depth of between 10 and 18 metres. The depth is measured across the shortest dimension of the building. Dwellings should be a maximum depth of 21 metres, measured from the outside of the balcony.
Variation to this standard will only be considered where it can be demonstrated that apartments will achieve the minimum requirements with regard to natural ventilation. This may be achieved where apartments have a wider frontage, or increased ceiling and window height to allow for greater penetration of natural light. The building depth is measured across the shortest access, excluding the depth of any unenclosed balconies.

- 2. A minimum of sixty percent (60%) of all residential apartments shall be naturally cross ventilated.
- 3. Twenty five (25%) of kitchens within a development must have access to natural ventilation. Where kitchens do not have direct access to a window, the back of the kitchen must be no more than 8 metres from a window.
- Single aspect apartments must be limited in depth to 8 metres from a window. 4.

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Part B - Land Use Based Controls Chapter B3: Mixed Use Development

Contents

| 1 | INTRODUCTION | 1 |
|------|---|----|
| 2 | OBJECTIVES | 1 |
| 3 | DEFINITIONS | 2 |
| 4 | DESIGN REQUIREMENTS - MIXED USE BUILDINGS | 3 |
| 4.1 | Minimum Site Width | 3 |
| 4.2 | Maximum Floor Space Ratio / Density | 4 |
| 4.3 | Building Height | 4 |
| 4.4 | Front Setbacks | 4 |
| 4.5 | Side and Rear Setbacks / Building Separation | 5 |
| 4.6 | Built Form | 7 |
| 4.7 | Active Street Frontages | 12 |
| 4.8 | Awnings | 13 |
| 4.9 | Car Parking | 13 |
| 4.10 | Basement Car Parking | 15 |
| 4.11 | Driveways | 16 |
| 4.12 | Landscaping | 17 |
| 4.13 | Communal Open Space | 19 |
| 4.14 | Private Open Space | 19 |
| 4.15 | Solar Access | 20 |
| 4.16 | Visual privacy | 21 |
| 4.17 | Acoustic privacy | 22 |
| 4.18 | Adaptable and Universally Designed Housing | 22 |
| 4.19 | Residential Component - Apartment Mix and Layout | 23 |
| 4.20 | Natural Ventilation | 25 |
| 4.21 | Adaptive Re-use | 26 |
| 4.22 | Crime Prevention Through Environmental Design (Safety | |
| | and Security) | 27 |

| 5 | GENERAL REQUIREMENTS FOR ALL MIXED USE | |
|------|---|----|
| - | DEVELOPMENT | 28 |
| 5.1 | Floodplain Management | 28 |
| 5.2 | Land Re-Shaping Works (Cut and Fill Earthworks) | 28 |
| 5.3 | Retaining Walls | 29 |
| 5.4 | Soil Erosion and Sediment Control | 30 |
| 5.5 | Fences | 30 |
| 5.6 | Access for People with a Disability | 31 |
| 5.7 | Services | 31 |
| 5.8 | Swimming Pools | 32 |
| 5.9 | Fire Brigade Servicing | 33 |
| 5.10 | Site Facilities | 33 |
| 5.11 | Storage Facilities | 34 |
| 5.12 | Waste Management | 34 |

Figures

| Figure 1: Provides a continuous facade along main commercial streets at the lower levels (Ref: Residential Flat Design Code 5 |
|---|
| Figure 2: Ground floor residential units with residential entrances directly accessed from the street (Ref: Residential Flat Design Code) |
| Figure 3: Mixed Use Development – Residential flat building on top of commercial premises |
| Figure 4: Good cross ventilation can be achieved with cross over apartments and corner apartments (Ref: Residential Flat Design Code) |

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1 INTRODUCTION

- 1. This chapter of the DCP outlines the development standards which specifically apply to mixed use development. This chapter relates to mixed use development to lands outside the Wollongong City Centre. Where mixed use development is proposed within the Wollongong City Centre reference should be made to the Part D of the DCP which provides the specific controls for mixed use development within the Wollongong City Centre.
- 2. This chapter must be read in conjunction with Part A (Introduction), Part D (Locality based / Site Specific Precinct Planning DCPs) and Part E (General City Wide Controls). In the event that the subject site is affected by Part D Locality or Site Specific Precinct based DCP controls and there is any in consistency between this part of the DCP and Part D of the DCP, Part D of the DCP will prevail.
- Additionally, this chapter should also be read in conjunction with the relevant LEP applying to the 3. site as the first step to determine whether a proposed mixed use development is permitted upon a particular zoned parcel of land.
- Under Wollongong LEP 2009, "Mixed use development" means a building or place comprising 2 4. or more different land uses.
- 5. For the purposes of this chapter, mixed use development is development which includes residential uses (ie shop top housing, residential flat buildings etc) in conjunction with one or more non-residential uses such as: XIO'
 - Business premises. (a)
 - (b) Commercial offices.
 - Retail shops. (c)
 - (d) Community facilities
 - (e) Hotels.
 - Serviced apartments. (f)
 - Seniors housing. (g)
- 6. Typical mixed use developments involve ground floor retail shops, commercial offices / business premises and upper level residential apartments. Other mixed use developments may include ground floor retail, serviced apartments / hotel and residential apartments (provided the serviced apartments are on separate floors / levels to the residential apartment component).

2 **OBJECTIVES**

- 1. The objectives of this chapter are:
 - To ensure new mixed use developments are of a high architectural standard through (a) design and appropriate selection of external building materials and finishes.
 - To promote mixed used development that achieves the principles of ecologically (b) sustainable development.
 - (b) To discourage any development which is, in the opinion of Council, unreasonably detrimental to the surrounding locality in regard to its proposed use, design, height, bulk /form, external appearance and streetscape character.

- (c) To minimise any potential adverse impact upon neighbouring land uses in term of amenity, noise, overlooking or loss of privacy.
- (d) To ensure that mixed use developments can satisfactorily function totally within their designated site, in terms of on-site car parking, off-street loading/unloading areas and manoeuvring areas and waste disposal.
- (e) To ensure that design, placement and height of buildings takes into account any site constraints.
- (f) To optimise, balance and/or retain a minimum mix of uses in all business/ commercial centres so that they provide an efficient local service role to their communities, in addition to any specialised role they may have.
- (g) In order that a broad range of business functions are attracted to commercial zones, the non-residential component of mixed use developments are to be designed and located so that both retail and commercial/office functions may be catered for.
- (h) To ensure all mixed use developments make provision for a high standard of landscaping.
- (i) To ensure that mixed use developments have particular regard to whether any trees or other vegetation on the land should be preserved.

3 **DEFINITIONS**

Business premises means a building or place at or on which:

- (a) An occupation, profession or trade (other than an industry) is carried on for the provision of services directly to members of the public on a regular basis, or
- (b) A service is provided directly to members of the public on a regular basis.

Hotel or motel accommodation means tourist and visitor accommodation (whether or not licenced premises under the Liquor Act 1982):

- (a) Comprising rooms or self-contained suites, and
- (b) That may provide meals to guests or the general public and facilities for the parking of guest's vehicles,

but does not include backpacker's accommodation, a boarding-house, bed and breakfast accommodation or farm stay accommodation.

Residential flat building means a building containing 3 or more dwellings, but does not include an attached dwelling or multi-dwelling development.

Restaurant means a building or place the principal purpose of which is the provision of food or beverages to people for consumption on the premises and that may also provide takeaway meals and beverages.

Retail premises means a building or place used for the purpose of selling items by retail, or for hiring or displaying items for the purposes of selling them by retail or hiring them out, whether the items are goods or materials (or whether also sold by wholesale).

Seniors housing means residential accommodation that consists of:

- (a) A residential care facility, or
- (b) A hostel, or

- (c) A group of self-contained dwellings, or
- (d) A combination of these and that is or is intended to be used permanently for:
- (e) Seniors or people who have a disability, or
- (f) People who live in the same household with seniors or people who have a disability, or
- (g) Staff employed to assist in the administration of the residential accommodation or in the provision of services to persons living in the accommodation,

But does not include a hospital.

Serviced apartment means a building or part of a building providing self-contained tourist and visitor accommodation that is regularly serviced or cleaned by the owner or manager of the building or part of the building or the owner's or manager's agents.

Shop top housing means one or more dwellings located above (or otherwise attached to) ground floor retail premises or restricted premises.

4 DESIGN REQUIREMENTS - MIXED USE BUILDINGS

4.1 Minimum Site Width

4.1.1 Objectives

- (a) To allow for development of sites which are of sufficient width to accommodate the required building envelope, car parking and landscaping requirements.
- (b) To allow for development of sites only where the land is not significantly constrained by flood, geotechnical or other environmental hazards.
- (c) To promote the efficient utilisation of land.
- (d) To encourage amalgamation of allotments to provide for improved design outcomes including greater solar access and amenity.

4.1.2 **Development Controls**

- 1. A minimum site width of 24 metres is required for mixed use developments. The site width must be measured for the full length of the building envelope and perpendicular to the side boundary. Exceptions will only be considered for social housing developments. Sites may be amalgamated, where required, to achieve the frontage requirements.
- 2. Within business centres, mixed use development must not result in the creation of an isolated allotment. An isolated allotment is 'a lot which is bounded on both sides by properties (or a property and a second street frontage) which comprise existing development other than a single dwelling house'. Amalgamation of allotments will be required in the circumstance where an isolated allotment would otherwise be created.
- 3. Council will only allow development which would result in the creation of an isolated allotment, where it is demonstrated that:

- (a) Written negotiations to purchase the isolated allotment have been entered into but have been unsuccessful; and
- (b) The isolated allotment has a site width of greater than 20m and is capable of accommodating a similar mixed use development.

4.2 Maximum Floor Space Ratio / Density

4.2.1 Objectives

- (a) To ensure that the bulk and scale of the building is compatible with surrounding built form and the desired future character of commercial precincts.
- (b) To ensure the density is appropriate for the site and its context.
- (c) To ensure that density is sustainable in the regional servicing context.

4.2.2 Development Controls

1. The maximum floor space ratio (FSR) for a mixed used development upon a particular parcel of land will be determined by the relevant LEP and the relevant Floor Space Ratio Map applying to the subject site.

4.3 Building Height

4.3.1 Objectives

- (a) To encourage buildings which integrate within the existing streetscape or the desired future character in an area which is undergoing transition.
- (b) To minimise the potential impacts of overshadowing and overlooking on adjacent dwellings and open space areas.

4.3.2 Development Controls

1. The maximum permissible building height for a mixed use development upon a particular parcel of land is shown on the relevant Heights Map applying to the subject site as contained in the relevant LEP.

4.4 Front Setbacks

4.4.1 Objectives

- (a) To reinforce the existing character of the street by acknowledging building setbacks.
- (b) To provide a continuous façade along main commercial streets.
- (c) To define the spatial proportions of the street and define the street edge.
- (d) To provide a transition between the public and private domain.

4.4.2 Development Controls

Within the B2 Local Centre zone:

1. The building should be located on the front property boundary, where a continuous façade along main commercial streets is desired.

Within the B1 Neighbourhood Centre zone and B6 Enterprise Corridor zone:

- 2. The following setback requirements apply from the front property boundary to the front façade of the building:
 - (a) The same distance as one or other of the adjoining buildings, provided the difference between the setbacks of the two adjoining dwellings is less than 2.0m; or
 - (b) The average of the setbacks of the two adjoining buildings, if the difference between the setbacks of the buildings is greater than 2.0m; unless Council considers that a reduced setback is appropriate in the local context.



Figure 1: Provides a continuous facade along main commercial streets at the lower levels (Ref: Residential Flat Design Code

4.5 Side and Rear Setbacks / Building Separation

4.5.1 Objectives

- (a) To provide adequate setbacks from boundaries and adjoining dwellings to retain privacy levels, views, sunlight and daylight access and to minimise overlooking.
- (b) To optimise surveillance of the street at the front of the property.
- (c) To control overshadowing of adjacent residential properties and private or shared open space.
- (d) To ensure that new development is scaled to support the desired area character with appropriate massing and space between buildings.

4.5.2 Development Controls

Within the B2 Local Centre:

1. A continuous street line / zero side setback is required for the majority of mixed use developments within a B2 Local Centre ,except in cases where a subject site directly abuts

residentially zoned land, in which case the minimum side setback shall be in accordance with Table 1 below.

4. Cide Cath

| Lt. | able 1: Side Setbacks | | |
|--|---|--|--|
| Mixed Use Buildings | | | |
| Building Height | Minimum Side Setback | | |
| Buildings up to 4 storeys (12 metres) | 6 metres where a habitable room/balcony faces an adjacent property | | |
| | 3.5 metres where a non-habitable room/blank wall faces an adjacent property | | |
| Buildings of 5 to 8 storeys (up to 25 metres) | 9 metres where a habitable room/balcony faces an adjacent property | | |
| | 4.5 metres where a non-habitable room/blank wall faces an adjacent property | | |
| <u>ote</u> : The setback is measure djacent boundary. | d from the side or rear wall of the building or ba | | |
| he minimum rear setback for ccordance with Table 2 below: | any mixed use / shop top housing development | | |
| Tabl | e 2: Side Rear Setbacks | | |
| | Nixed Use Buildings | | |
| Building Height | Minimum Rear Setback | | |
| Buildings up to 4 storeys (12 metres) | 6 metres from the common property bopundary with any directly abutting residentially zoned property | | |
| | 6 metres where a habitable room/balcony faces an adjacent property | | |
| 1 tel | 3.5 metres where a non-habitable room/blank wall faces an adjacent non-residentially zoned property | | |
| Buildings of 5 to 8 storeys (up to 25 metres) | 9 metres from the common property boundary with any directly abutting residentially zoned property | | |
| | 9 metres where a habitable room/balcony faces | | |
| | an adjacent property | | |
| | an adjacent property 4.5 metres where a non-habitable room/blank wall faces an adjacent property | | |

<u>Note</u>: The setback is measured from the rear wall of the building or balcony to the adjacent property boundary.

- 4. Council will only consider granting a variation to the setback requirements where the following can be demonstrated:
 - (a) The development site comprises a narrow infill site, where zero lot lines are appropriate at all levels; and

2.

- (b) The development predominantly contains commercial functions and the increased residential setback requirements are inappropriate; and
- (c) The recommendations of this DCP have been varied in response to site and context constraints; and
- (d) The requirements of daylight access, urban form and visual/acoustic privacy have been satisfactorily achieved; and
- (e) The daylight access requirements of this DCP and the Apartment Design Guide 2015 Residential Flat Design Code will be available to buildings and open spaces.

Within the B1 Neighbourhood Centre:

5. The side and rear building setbacks for any mixed use development upon land zoned B1 Neighbourhood Centre shall be in accordance with the side and rear setback requirements contained in Table 1 in clause 4.5.2.1 and Table 2 in clause 4.5.2.2 above.

For mixed use developments on any site which adjoin a residential zone:

6. The side and rear setbacks for any mixed use development on any site adjoining residentially zoned land shall be in accordance with the side and rear setback requirements contained in Table 1 in clause 4.5.2.1 and Table 2 in clause 4.5.2.2 above.

4.6 Built Form

4.6.1 **Objectives**

- (a) To support the integration of appropriate retail and commercial uses with housing.
- (b) To provide an identifiable and desirable street address to each building and dwelling.
- (c) To create safe and more active lively streets and urban areas, which encourage pedestrian movement, and services to meet the needs of residents.
- (d) To ensure that the design of mixed-use developments maintains residential amenity and preserves compatibility between uses.
- (e) To allow for outlook and surveillance towards the street and the public domain.
- (f) To encourage mixed used development that achieves the principles of ecologically sustainable development.

4.6.2 **Development Controls**

- 1. A mixed use or shop top housing development involving three (3) or more storeys and four (4) or more dwellings must be designed by a qualified designer in accordance with State Environmental Planning Policy No. 65 Design Quality of Residential Flat Development.
- 2. The appearance of new development must be in harmony with the buildings around it and the streetscape character of the locality. New development must contain or respond to the essential elements that make up the character of the surrounding urban environment. This character is created by elements such as building height, setbacks, architectural style, window treatment and placement, materials and landscaping.
- 3. The siting, form, height and external appearance of any new building should be sympathetic with adjoining buildings in the surrounding retail and business precinct in addition to any abutting or nearby residential dwellings.

- 4. Any mixed use or shop top housing building should feature highly articulated facades, particularly any facades facing road frontages and any abutting residential area, in order to add visual interest to the building.
- 5. Any mixed use or shop top housing building must be designed to provide active street frontages on the ground floor level of the building to all street frontages and in some cases, Council may require appropriate pedestrian thoroughfare links.
- 6. Within the B1 Neighbourhood Centre and B2 Local Centre zones, commercial office / retail development is required at the ground floor level, as a minimum, within a mixed use or shop top housing building. However, any such use must be designed to minimise any potential adverse noise or amenity impacts upon the upper level residential apartments in the building.
- 7. Where residential development is located at the ground floor level, the development must maximise the number of ground floor units which have separate entrances and are accessible from the street. Ground floor apartments must incorporate an internal layout which provides opportunity for home employment. Only in exceptional circumstances will ground level dwellings and residential apartments be permitted, such as where it can be clearly demonstrated that the proposal will not detrimentally impact the commercial area and where there is no demand for commercial frontage development.
- 8. In B2 Local Centre, B1 Neighbourhood Centre and B4 Mixed Use zones, the ground floor and first floor levels of a building must provide for minimum 3.3 metre floor to ceiling height clearances, to maximise the flexibility of in the future use of the buildings.



Figure 2: Ground floor residential units with residential entrances directly accessed from the street (Ref: Residential Flat Design Code)

- 9. Separate entrances must be provided for retail. The floor layouts of residential apartments and the ceiling heights which are provided within mixed use developments must allow for future adaptive use of the upper residential floors.
- 10. The following elements must be incorporated into the building design to define the commercial and retail components of the development:
 - (a) Servicing of retail and commercial uses must be separated from the servicing of the residential component. Commercial and residential uses.
 - (b) Residential entrances must directly address the street. The main pedestrian entrance or a foyer must provide for continuous and safe access for all people, including people with a disability.

- (c) For those dwellings adjacent to the street frontage, the habitable rooms must face the street.
- (d) Active uses are encouraged on the street level and first floor.
- (e) Where ground floor residential units are provided they must have separate entrances and be accessible from the street.
- (f) Maximise glazing for retail uses but break glazing into sections to avoid large expanses of glass. Wrap shopfronts around corners.
- (g) Orientate commercial and residential uses to the street to provide casual surveillance.
- (h) All buildings must express their internal functions in their facades.
- (i) Entrances must be visible at eye level from the street and well-lit.
- (k) Ensure entrances can accommodate the movement of furniture
- (I) Solid roller shutters are not permitted as security devices on shop fronts (windows and doors). Open grille security devices may be used on shop fronts if such devices are necessary but should be unobtrusive and sympathetic to the character of the building and the streetscape, with minimum transparency of 65% to provide light spill to the pavement and create a sense of openness to the street.
- (m) Place services such as Automatic Teller Machines (ATMs) and public telephones in highly visible locations to be accessible and well lit at night.
- (n) Where developments have a car park or access laneway to a car park, provide windows, lighting or secondary access doors that address the car park.
- (o) Avoid building recess, alcoves or dense landscaping in places where concealment is possible.
- 11. The horizontal form of any building should also be broken up vertically, in order to provide visual relief and interest to the development. The horizontal and vertical emphasis is especially critical for the middle and upper levels of a building.
- 12. The following elements must be considered in the building design:
 - (a) Define a base, middle and top related to the overall proportion of the building.
 - (b) Articulate and fragment building walls that address the street and add visual interest.
 - (c) Highly reflective finishes and curtain wall glazing are not permitted above ground level.
 - (d) Large areas of flat facade are to be avoided. Facades should be articulated into separate sections, using steps in the facade, expressed entries, panels, bay windows, balconies, pergolas and other architectural elements.
 - (e) Avoid expanses of any single material.
 - (f) Provide a balance of horizontal and vertical facade elements to relate to adjacent facades in the streetscape. Avoid simple facade designs containing only horizontal or vertical elements.
 - (g) Utilise high quality and durable materials and finishes.
 - (h) The façade of ground floor retail development must be compatible with surrounding facades.

- (i) Air conditioning units must not be visible from the street.
- (j) Avoid blank or solid walls and the use of dark or obscured glass on street frontages.
- 13. The design of roof forms must address the following:
 - (a) Create a richly patterned skyline and roof scapes when viewed from the street or from the upper levels of other buildings.
 - (b) The profile of parapets and roof top elements should be integrated in the overall roof design of the building.
 - (c) The angle of any pitched roof shall be compatible with existing development.
 - (d) Create interesting and harmonious roof scapes and skylines through the design of roofs.
 - (e) Lift over runs and service plants must be concealed within the roof, the building or relate to adjacent roof top rooms or open space.
 - (f) Where flat roofs are proposed, lift overruns and rooftop plant and machinery are to be obscured from view by parapets or designed to be incorporated with rooftop activities/features.
 - (g) All roof forms and roof top elements are not to exceed the maximum ridge height limit for the site. This does not include any vent, chimney, flue, antennae or the like.
 - (h) Landscaped and shaded areas on the roofs of mixed use buildings for private use by residents will be considered, where residential amenity is not unreasonably affected.
 - The incorporation of green roofs is encouraged however such features must not exceed the maximum height limit for the site.
- 14. Mixed use buildings which are located on corner sites must address the following:
 - (a) Ensure that corner buildings, which by their location are often highly visible, are well designed and respond to the different characteristics of the street which they address.
 - (b) Emphasise verticality at corners, where possible, by concentrating the tallest portion of the building on the corner itself. Utilise design devices such as increased wall heights, splayed corner details, increased heights, expression of junction of building planes and other architectural features to reinforce the way finding attributes of street corners.
 - (c) Design corners to add variety and interest to the street and clarify the street hierarchy.
 - (d) Present each frontage of a corner building as a main street frontage.
 - (e) Design building frontages and entries so that they are readily apparent from the street and are well lit.
 - (f) Avoid blank or solid walls on street frontages.



Figures 3 & 4: Mixed use development containing ground floor retail shops and upper residential apartments



Figure 5: Mixed use development containing active ground floor retail shops and café / restaurants with upper level residential apartments

- 15. The street corners of any new corner building should be strengthened by massing and building articulation to both street frontages. In this regard, Council may permit a variation to the height limits contained in this DCP (but no greater than the building height limit in the LEP) by permitting an additional 1 2 storeys for the corner element of a building where, in the opinion of Council, a strong corner element is necessary for the building. Any such variation to the height limit will only be supported by Council in circumstances where Council is of the opinion that the proposed development will exhibit design excellence, through the provision a strong corner element in the proposed building.
- 15. New mixed use buildings should continue the predominant built form character of the locality, including parapets, floor to ceiling heights and roof pitches.
- 16. For large multi-storey mixed use buildings, the treatment of the facades should be designed to provide character, visual legibility and human scale and to delineate the distinct uses.
- 17. New mixed use buildings should maintain the balance of horizontal and vertical proportions of other existing buildings in the locality.
- 18. Any development involving the re-use of existing buildings should reinstate any missing façade elements or other decorative details, wherever practicable.
- 19. The external building materials and finishes of any mixed use building should be sympathetic to the existing fabric and character of buildings within that retail and business precinct.

- 20. External walls should be constructed of high quality and durable materials and finishes with low maintenance costs.
- 21. Highly reflective finishes, reflective glass and curtain wall glazing are not permitted above ground floor level.
- 22. The reflectivity of glazing shall be restricted to less than 20%. A reflectivity diagram may be required where in the opinion of Council has the potential to pose future glare impacts upon pedestrians within public domain areas or motorists travelling past the site.
- 23. All Development Applications for new buildings or external alterations and additions to existing premises must be accompanied by a schedule of proposed external building materials and finishes (colours) board which shows the proposed building materials and finishes (colours) to be used on the external facades of the building. An A4 sized photograph of the schedule of external building materials and finishes (colours) board is also required.

4.7 Active Street Frontages

4.7.1 Objectives

- (a) To provide active street frontages to all mixed use buildings, in order to maintain or enhance the vibrancy of local business centres.
- (b) To ensure ground floor level retail or business premises provide direct pedestrian access to / from the street with direct visual inspection into each premise.

4.7.2 Development Controls

- 1. All new retail, business or mixed use buildings are required to provide ground level active street frontages.
- 2. Buildings should contain no more than 5 metres of ground floor wall without a door or window. Windows should make up at least 50% of the ground floor front wall.
- 3. Buildings with frontages to retail streets are to contribute to the liveliness and vitality of those streets by:
 - (a) Providing product retailing and / or food and drink premises within all enclosed shop fronts;
 - (b) Minimising the extent and visual impact of building entrances, office lobbies, foyers, vehicle entrances and other entries not associated with retail, service areas and fire escapes;
 - (c) Locating activities that may involve queuing (e.g. automatic teller machines) behind building frontages so that footpaths remain free for pedestrian movement; and
 - (d) Providing a high standard of finish to retail shopfronts.
- 4. All street frontage windows at ground level are to have clear glazing.
- 5. Display windows with clear glazing to ground floor retail and business premises are required with a maximum window sill height of 0.7 metres above finished ground level.
- 6. Security grilles are to be fitted only within the retail shopfront. Such grilles are to be transparent and not of any roller door type.
- 7. Direct pedestrian access and visual inspection should be provided from the front of the building, to encourage active street frontage to retail shops and business premises.

4.8 Awnings

4.8.1 Objectives

- (a) To provide all weather protection for pedestrians.
- (b) To address the streetscape by providing a consistent street frontage within commercial areas.

4.8.2 Development Controls

- 1. Provide continuous street front awnings, where required to provide a continuation of existing awnings.
- 2. Awning designs should match building frontages.
- 3. Wrap awnings around corners where a building is sited on a street corner. Corner awnings must be wrapped for a minimum distance of 6m.
- 4. Awnings must have a minimum width of 2.5m.
- 5. Cantilever awnings from buildings should be a maximum eave height of 3.3m.
- 6. Awnings should be setback from the kerb a minimum of 600 mm.
- 7. Awnings should be complimentary to other existing awnings.
- 8. Provide under awning lighting to facilitate night use and to improve public safety.

4.9 Car Parking

4.9.1 Objectives

- (a) To provide an adequate level of on site carparking based upon the anticipated building use.
- (b) To ensure that mixed use buildings are designed to be accessible for pedestrians, cyclists and motorists.
- (c) To ensure integrated design of car parking facilities to minimise visual impacts.
- (d) To provide underground parking, wherever feasible.
- (e) To ensure the provision of facilities such as bike racks, which encourage the use of alternative methods of transport.

4.9.2 **Development Controls**

- 1. Parking for cars, motorcycles and bicycles shall be provided in accordance with the requirements contained in the Traffic, Parking, Access and Servicing chapter in Part E of this DCP.
- 2. Access driveways to car parking areas must be positioned to minimise impacts on the streetscape. Access driveways to car parking areas must be positioned to minimise impacts on the streetscape.
- 3. Car parking for mixed use developments must be provided within one or more basement levels. For mixed use developments within B1 Neighbourhood Centre zones, Council may require the provision of a number of at grade parking spaces for customers to minimise on street parking.
- 4. Car parking areas should be designed to conveniently, efficiently and appropriately serve residents and visitors of the site. This can be achieved in the following ways:

- (a) Ensuring that visitor car parking areas are located close to entrances and access driveways.
- (b) Have clearly defined areas for staff, resident, visitor, customer and disabled parking. Where customer and visitor car parking is located in a secure basement, an intercom system shall be provided to allow for visitor access. A turning bay must also be provided for customer/visitor use to prevent vehicles reversing onto the street in the event that a car parking space is not available.
- 5. Car parking spaces must comply with the minimum size requirements:

| Carparking Dimensions | | | |
|------------------------------------|-----------------------------|--|--|
| Car space type | Minimum car space dimension | | |
| Unencumbered open space | 2.6m x 5.5m | | |
| Open space – restricted one side | 2.7m x 5.5m | | |
| Open space – restricted both sides | 2.9m x 5.5m | | |
| Single garages | 3.0m x 6.0m | | |
| Garage door openings | 2.7m | | |
| Double garages | 6.0m x 6.0m | | |
| Garage door openings | 5.4m | | |
| Disabled Parking | 3.2m x 5.5m | | |

- 6. Integrate ventilation grills or screening devices of carpark openings into the façade design and landscape design.
- 7. Car parking entry doors or façade elements must be setback a minimum of 600mm from the line of the front façade.
- 8. Tandem or stacked car parking (one space immediately behind the other) is permitted for resident parking provisions providing both spaces are utilised by the same dwelling and such spaces do not interfere with common manoeuvring areas. Tandem or stacked parking is not permitted for adaptable housing.
- 9. For developments having greater than 10 dwellings, one bicycle rail per ten dwellings must be provided for visitors.

4.9.3 Mechanical Parking Systems

- 1. Mechanical parking systems may provide for more space-efficient storage of vehicles than can be achieved with traditional at-grade parking. These systems can be considered for use in residential developments.
- 2. Where it is proposed to incorporate a mechanical parking system within a residential development, the developer shall provide the following information as part of a Traffic Report and suitably scaled plan and sectional drawings submitted with the Development Application documentation:
 - (a) The make and model of the system.
 - (b) A demonstrated need for the need for the system, including reasons why parking cannot be satisfactorily provided in an at-grade parking arrangement.
 - (c) Demonstrated compliance with all relevant clauses of AS2890.1

- (d) A demonstrated minimum internal headroom clearance of 1.90m in the entry level of the system.
- (e) A demonstrated minimum internal vertical clearance of 1.55m on all other levels within the parking system.
- (f) Details of security measures restricting the use of the system to permanent residents of the building.
- (g) Details of noise and vibration associated with the use of the system.
- (h) Details of a waiting bay, demonstrating that vehicles can safely and conveniently wait at the entry level for other vehicles to manoeuvre to or from the parking system. Waiting bays must be designed so as to not obstruct traffic flow within the parking level. Waiting bays would typically have identical dimensions to parking spaces as per AS2890.1 and are additional to the parking requirement of the development.
- (i) An assessment of the likely vehicle queuing impacts associated with system, with reference to the operating times of the system, peak vehicle movements and available queue lengths within the parking area.
- (j) Swept path turning templates demonstrating the ability of vehicles to turn into and out of the system in a single movement.
- 3. All visitor parking spaces and those spaces associated with adaptable housing must be provided in at-grade positions and;
 - (a) The system and all associated infrastructure such as pits and ceiling indentations must be clearly shown in the drawings of the car parking area, at development application stage.

4.10 Basement Car Parking

4.10.1 Objective

(a) To integrate the siting, scale and design of basement parking into the site and building design.

4.10.2 Development Controls

- 1. The scale and siting of the basement carpark must not impact upon the ability of the development to satisfy minimum landscaping requirements.
- 2. The roof of any basement podium, measured to the top of any solid wall located on the podium, must not be greater than 1.2 metres above natural or finished ground level, when measured at any point on the outside walls of the building. On sites with a greater slope, a change in level in the basement must be provided to achieve this maximum 1.2 metre height.
- 3. Generally variation to this 1.2 metre height will not be supported however Council recognises that there may be occasions where this standard cannot be achieved. Should such a circumstance arise, the additional portion of the basement podium above 1.2 metre height must be included in the total gross floor area calculation for the development. In addition, the following must be satisfied:
 - (a) Landscaped terraces are provided in front of the basement podium to reduce the overall visual impact;

- (b) The height of the basement does not result in the building having a bulk and scale which dominates the streetscape; and
- (c) The main pedestrian entry to the building is identifiable and readily accessible from the street frontage.

Within the B2 Local Centre zone:

1. Where a continuous street line is required, the basement must be constructed on the side property boundaries (ie zero setbacks).

Within the B1 Neighbourhood Centre and B6 Enterprise Corridor zones:

1. The basement setbacks for residential apartment buildings in Chapter B1: Residential Development shall apply to that boundary which adjoins the residential zone.

For mixed use developments on any site which adjoin a residential zone:

- 1. The setbacks for residential apartment buildings in Chapter B1: Residential Development shall apply to that boundary which adjoins the residential zone.
- 2. Where parking is provided in a basement, ventilation structures for the basement parking and airconditioning units must be orientated away from windows of habitable rooms and private open space areas. Ventilation grills must be integrated into the design of the façade of the building to minimise their visual impact.
- 3. The visual impact of all basement walls must be minimised through the use of various design techniques including well proportioned ground level articulation and relief, mixed finishes and materials, terracing and/or dense landscaping.
- 4. Basements must be protected from inundation from the 100-year flood levels (or greater).

4.11 Driveways

4.11.1 Objectives

- (a) To provide adequate and safe vehicular access to basement carparking areas.
- (b) To ensure that all carparking areas have satisfactory manoeuvring areas to enable vehicles to leave the site in a forward direction.

4.11.2 Development Controls

- 1. Provide driveways to parking areas from lanes and secondary streets rather than the primary street, wherever practical.
- 2. Locate driveways taking into account any services within the road reserve, such as power poles, drainage inlet pits and existing street trees.
- 3. All driveways must be located a minimum of 6 metres from the perpendicular of any intersection of any two roads.
- 4. Any driveway servicing a residential development is to be setback a minimum of 1.5m from any side property boundary.
- 5. The design of driveway and crossovers must be in accordance with Council's standard vehicle entrance designs.
- 6. All vehicles within a mixed use development building must provide vehicular manoeuvring areas to all parking spaces so vehicles do not need to make more than a single point turn to leave the site in a forward direction.

7. Driveway grades, vehicular ramp width/grades and passing bays must be in accordance with the relevant Australian Standard, being AS 2890.1. Crossover and driveway widths relating to the erection of one or more dwellings must comply with the following:

| No. Units | Crossover Width | Driveway Width |
|-----------|---|---|
| 1 to 2 | Minimum 2.75m | Minimum 2.75m |
| 3 to 5 | 3 –4m combined | Minimum 3m |
| 6 to 20 | 4 –6m combined to within 6m internally of the front property boundary | Minimum 3m |
| 21 to 50 | 6 –8m combined | 6m |
| > 50 | 3-4m each, separated | Minimum 3m each or 6m when combined |

4.12 Landscaping

4.12.1 Objectives

- (a) To use landscaping features to define spaces and their intended functions.
- (b) To enhance the appearance and amenity through integrated landscape design.
- (c) To encourage the use of green roofs and walls in communal open space to enhance the environmental performance of the development.

4.12.2 Development Controls

- 1. Landscaping within mixed use developments must be provided on terraces or balconies where required for screening purposes, to minimise overlooking between commercial and residential functions. Landscaping, including deep soil planting, must be provided where mixed use developments are located adjacent residential zones.
- Green roofs and walls, landscaping on podiums and on planters must provide sufficient soil depth and area to allow for plant establishment and growth. The following minimum standards are required:

| Plant type | Definition | <mark>Soil volume</mark> | Soil Depth | Soil area |
|--------------|--|--|----------------------|--|
| Large trees | <mark>12-18m high, up to</mark> 16m crown spread at maturity | <mark>150m³</mark> | <mark>1,200mm</mark> | <mark>10m x 10m or</mark> equivalent |
| Medium trees | <mark>8-12m high, up to 16m</mark> crown spread at maturity | <mark>36m³ 35m2</mark> | <mark>1,000mm</mark> | <mark>6 x 6m or equivalent</mark> |
| Small trees | <mark>6-8m high, up to 16m crown spread at maturity</mark> | <mark>16m³</mark> 9m2 | <mark>800mm</mark> | <mark>4 x 4m-3.5m x 3.5m or equivalent</mark> |

Minimum soil standards for planting on structures or podiums

| Plant type | Definition | <mark>Soil volume</mark> | Soil Depth | Soil area |
|--|-------------------|--------------------------|--------------------------------------|-----------|
| Shrubs | | | 500-600mm | |
| Ground cover | | | <mark>300-450mm</mark> | |
| Turf | | | <mark>300 <mark>200</mark> mm</mark> | |
| *Sub-surface drainage requirements are in addition to the above minimum soil depths. | | | | |

Source: adapted from Apartment Design Guide (July 2015)

Landscaping on podiums must provide sufficient soil depth and area to allow for plant establishment and growth. The following minimum standards are recommended (*Ref: Residential Flat Design Code*):

| Plant Type | Soil Depth | |
|--------------|----------------------|----|
| Medium trees | 1.0m | X |
| Small trees | 800mm | O, |
| Shrubs | 500-600mm | |

- 3. Where a mixed use development is sited on the boundary of a business area and / or is adjacent residential buildings, the residential component of the development must adopt the respective landscape requirements of a residential apartment building.
- 4. Within a B1 Neighbourhood Centre zone, the landscaping requirements for a residential flat building or multi dwelling housing also apply, to ensure that the development will integrate within the residential neighbourhood.
- 5. The following matters shall be addressed within the submitted landscape plan:
 - (a) Site landscaping must be integrated with the stormwater management controls. Select appropriate species that are likely to survive in the specific environmental conditions of the site, orientation and microclimate.
 - (b) Identify and retain where possible existing mature trees.
- 6. Public domain improvements must be provided, where required, in accordance with the relevant Public Domain Master plan.
- 7. The use of green walls is encouraged as an avenue to enliven blank facades.
- 8. The developer is to provide street trees to street frontages of the development site. Trees to be minimum container size 100L and must be true to type, of good health and vigour, free from pests and disease, free from injury, be self supporting (tree must not be tied to stakes) and meet the following NATSPEC criteria:
- 9. Trees must be planted and adequately established (minimum 12 months) to the satisfaction of WCC Manager of City Works.
- 10. The preparation of a landscape plan and accompanying supporting documentation should be in accordance with the Landscaping chapter in Part E of the DCP.

4.13 Communal Open Space

4.13.1 Objectives

- (a) To ensure that communal open spaces are of adequate size to be functional.
- (b) To provide communal open space which is accessible by all residents.

4.13.2 Development Controls

1. Mixed use developments with more than 10 dwellings must incorporate communal open space. The minimum size of this open space is to be calculated at the rate of 5m² per dwelling. Any area to be included in the open space calculations must have a minimum width of 5 metres.

Variation to this requirement will only be considered where it can be demonstrated that the development has access to a range of recreational opportunities in the immediate vicinity.

- 2. Within mixed use developments the communal open space area may be provided as either an internal or external space. Roof top terraces will not be accepted as communal open space.
- 3. The communal open space must be easily accessible and be integrated with landscaping.

4.14 Private Open Space

4.14.1 Objectives

- (a) To ensure that private open spaces are large enough to accommodate a range of uses and are accessible and connected to indoor spaces where appropriate.
- (b) To ensure functionality of private open space by reducing overlooking and overshadowing of such spaces.

4.14.2 Development Controls

- 1. Private open space must be provided for each residential dwelling within the development in the form of a balcony, courtyard, terrace and/or roof garden.
- 2. Private open space for each dwelling within a residential apartment building must comply with the following:
 - (a) The courtyard/terrace for the ground level dwellings must have a minimum area of 8m² and depth of 2m². Design private open spaces so that they act as direct extensions of the living areas of the dwellings they serve.
 - (b) Screen private open space where appropriate to ensure privacy.
 - (c) Provide balconies with operable screens or similar in locations where noise or high winds would otherwise prohibit reasonable outdoor use (ie. next to rail corridors, busy roads and tall towers).
- 3. Where private open space is provided in the form of a balcony, the following requirements must also be met:
 - (a) Avoid locating primary balconies towards side setbacks.
 - (b) The balcony must have a minimum area of 12m² open space and a minimum width of 2.4 metres.

- (c) The primary balcony of at least 70% of the residential dwellings within a mixed use housing development shall receive a minimum of three hours of direct sunlight between 9.00am and 3.00pm on June 21.
- (d) Balconies must be designed and positioned to ensure sufficient light can penetrate into the building at lower levels.
- (e) Individual balcony enclosures are not supported since such enclosure would compromise the functionality of a balcony as a private open space area and adversely affect the streetscape/ visual character of the building.

4.15 Solar Access

4.15.1 Objectives

- (a) To minimise the extent of loss of sunlight to living areas and private open space areas of adjacent dwellings.
- (b) To maximise solar access into the habitable areas and private balconies of residential apartments within the mixed used development.
- (c) To maximise solar access into any ground floor communal open space area or outdoor restaurant.
- (d) To provide appropriate shading devices to windows of habitable rooms on the western façade of buildings.

4.15.2 Development Controls

- 1. The design of the development must have regard to the existing and proposed level of sunlight which is received by living areas and private open space areas of adjacent dwellings. Sensitive design must aim to retain the maximum amount of sunlight for adjacent residents. Council will place greatest emphasis on the retention of sunlight within the lower density residential areas.
- 2. Living rooms and private courtyards of adjacent residential buildings must receive at least 3 hours of direct sunlight between 9.00am and 3.00pm on June 21.

In determining access to sunlight, overshadowing by fences, roof overhangs and changes in level must be taken into consideration. Overshadowing by vegetation should also be considered, where dense vegetation appears as a solid fence.

- 3. In areas undergoing change, the impact of overshadowing on development likely to be built on adjoining sites must be considered, in addition to the impacts on existing development.
- 4. Mixed use developments must aim to maximise the number of dwellings having a northern aspect. Where a northern aspect is available, the living spaces and balconies of such apartments must typically be orientated towards the north.
- 5. The development must maximise the number of apartments with a dual orientation. Single aspect, single storey apartments should preferably have a northerly or easterly aspect and a reduced depth to allow for access of natural light to all habitable spaces.
- 6. Shading devices should be utilised where necessary, particularly where windows of habitable rooms are located on the western elevation.

- 7. The living rooms and private open space of at least 70% of apartments within the subject development must receive a minimum of three (3) hours direct sunlight between 9.00am and 3.00pm on 21 June.
- 8. The number of single aspect apartments with a southerly (south-westerly to south-easterly) aspect shall be limited to a maximum of 10% of the total number of apartments proposed in the development.
- 9. Provide vertical shading to eastern and western windows. Shading can take the form of eaves, awnings, colonnades, balconies, pergolas, external louvres and planting.

4.16 Visual privacy

4.16.1 General

1. Visual privacy measures are designed to protect the privacy and amenity of occupants within a residential apartment or serviced apartment. Visual privacy measures allow occupants to carry out private functions within all rooms in the apartment as well as private balconies or open space courtyards, through limiting direct views or overlooking issues from adjoining buildings.

4.16.2 Objectives

- (a) To provide reasonable levels of visual privacy externally and internally, during the day and at night.
- (b) To maximise outlook and views from principal rooms and private open space without comprosing visual privacy.

4.16.3 Development controls

- 1. New buildings should be sited and oriented to maximise visual privacy between buildings through compliance with minimum front, side and rear setback / building separation requirements.
- 2. The internal layout of buildings should be designed to minimise any direct overlooking impacts occurring upon habitable rooms and private balcony / open space courtyards, wherever possible by separating communal open space and public domain areas from windows of rooms, particularly sleeping room and living room areas.
- 3. Buildings are to be designed to increase privacy without compromising access to sunlight and natural ventilation through the following measures:
 - (a) Off-setting of windows in new buildings from windows in existing adjoining building(s).
 - (b) Recessed balconies and / or vertical fin elements between adjoining balconies to improve visual privacy.
 - (c) Provision of solid, semi-solid or dark tinted glazed balustrading to balconies.
 - (d) Provision of louvers or screen panels to windows and / or balconies.
 - (e) Provision of perimeter landscaped screen / deep soil planting.
 - (f) Incorporating planter boxes onto apartment balconies to improve visual separation between apartments within the development and adjoining buildings.
 - (g) Provision of pergolas or shading devices to limit overlooking of lower apartments or private open space courtyards / balconies.

4.17 Acoustic privacy

4.17.1 General

1. Acoustic privacy is a measure of sound insulation between residential apartments and between external and internal spaces.

4.17.2 Objective

(a) To ensure a high level of amenity for occupants within residential apartments and / or serviced apartments in the development.

4.17.3 Development Controls

- 1. Residential apartments and / or serviced apartments should be arranged in a mixed use building, to minimise noise transition between apartments by:
 - (a) Locating busy, noisy areas next to each other and quieter areas, next to other quieter areas (eg living rooms with living rooms and bedrooms with bedrooms);
 - (b) Using storage or circulation zones within an apartment to buffer noise from adjacent apartments, mechanical services or corridors and lobby areas; and
 - (c) Minimising the amount of party (shared) walls with other apartments.
- 2. All residential apartments and / or serviced apartments within a mixed use development should be designed and constructed with double-glazed windows and / or laminated windows, solid walls, sealing of air gaps around doors and windows as well as appropriate insulating building elements for doors, walls, roofs and ceilings etc; to provide satisfactory acoustic privacy and amenity levels for occupants within the residential and / or serviced apartment(s).
- 3. Appropriate sound attenuation measures should be considered between for each floor in the development, to minimise potential sound transmission into any residential apartment below.
- 4. Any residential apartment which faces towards a major (busy) road must be designed in accordance with the requirements contained in Chapter E4: Development near Railway Corridors and Major (Busy) Roads in this DCP.
- 5. The Statement of Environmental Effects (SEE) accompanying the development must demonstrate what acoustic measures will be provided to windows of sleeping areas and living areas for each residential apartment or serviced apartment in the development. The proposed acoustic measures must also be shown on the required architectural floor layout and elevation plans for the development.

Alternatively, the Statement of Environmental Effects (SEE) may include an acoustical impact assessment study which outlines alternative acoustic treatment measures for residential apartment(s) and / or serviced apartment(s) in the development. The acoustic impact assessment study must be carried out by a suitably qualified and experienced acoustic consultant (ie a person who is a Member of the Australian Acoustical Society, the Institution of Engineers or the Association of Australian Acoustical Consultants).

4.18 Adaptable and Universally Designed Housing

4.18.1 Objectives

(a) To ensure that dwelling layout is sufficiently flexible for resident's changing needs over time.

- (b) To ensure a sufficient proportion of dwellings include accessible layouts and universally designed features to accommodate changing requirements of residents.
- (c) To ensure the provision of housing that will, in its adaptable features, meet the access and mobility needs of any occupant.

4.18.2 Development Controls

- 1. Within a mixed use development incorporating more than six (6) dwellings, 10% of all dwellings (or a minimum of 1 dwelling) must be designed to be capable of adaptation for disabled or elderly residents. Dwellings must be designed in accordance with the Australian Adaptable Housing Standard (AS 4299-1995), which includes "pre-adaptation" design details to ensure that visitability is achieved.
- 2. Lift access to all adaptable dwellings must be provided. The lift must provide access from the basement to allow access for people with disabilities. Disabled access to the commercial component of the development must also be provided from the footpath level.
- 3. Any Development Application for mixed use development must be accompanied by certification from a suitably qualified and experienced Access Consultant confirming that the adaptable dwellings are capable of being modified, when required by the occupant, to comply with the Australian Adaptable Housing Standard (AS 4299-1995).
- 4. Car parking and garages allocated to adaptable dwellings must comply with the following requirements:

| Adaptable Dwellings – Car parking Dimensions | | | |
|--|----------------------------------|--|--|
| Car space type | Minimum car space dimension | | |
| Open space | 3.2m x 5.5 m | | |
| Single garage | 3.5m x 6.0m - min. 2.5m headroom | | |
| Double garage | 6.5 x 6.0m - min. 2.5m headroom | | |
| | | | |

5. Within a mixed use development incorporating more than six (6) dwellings, 10% of all dwellings (or at least 1 dwelling) must be designed to achieve the Silver Standards of the Livable Housing Design Guideline (Livable Housing Australia 2015). All proposed livable dwellings must be clearly identified on the submitted DA plans.

4.19 Residential Component - Apartment Mix and Layout

4.19.1 Objectives

- (a) To provide variety in apartment sizes and layouts to cater for a range of household types.
- (b) To provide flexible living/work relationships within dwellings design.
- (c) To ensure that building design is sufficiently robust to accommodate mixed use and potential changes in use such as accommodating an office.

4.19.2 Development Controls

- 1. Provide a mix of apartment sizes and layouts within larger mixed use developments of ten (10) or more dwellings. This could include both variation in the gross floor areas of apartments, variety in the internal design, together with single or two level apartments to accommodate various resident requirements.
- 2. The selection of the number of bedrooms within developments shall be determined having regard to the site context, geographic location and demographic characteristics. For mixed use

developments having ten (10) or more dwellings, a minimum of 10% of the apartments must be one bedroom and/or studio apartments, to provide affordable housing opportunities.

- 3. Consideration should be given to the design of apartments to encourage future flexibility. This may include opportunities to combine smaller apartments with adjacent dwellings should resident's lifestyle change or may include the ability to accommodate home office opportunities, if required. Consideration should also be given to the location of one and three bedroom apartments on the ground level where accessibility is more easily achieved for disabled, elderly people or families with children.
- 4. Apartments should be designed with internal space, which is flexible and adaptable to resident's requirements. This should involve the efficient utilisation of available floor space to maximise useable room areas. Apartment layouts should also respond to the site opportunities, including views and aspect.
- 5. Mixed use buildings shall be designed to permit adaptation of residential floors for commercial uses, if appropriate at a future time.
- 6. Provide apartments with the following minimum dimensions;
 - (a) Studio and 1 bedroom apartment
 - (b) 2 bedroom apartment
 - (c) 3 bedroom apartment

Unless it can be demonstrated that efficient design and room configuration will provide an appropriate level of residential amenity.

50m²

70m²

95m²

- 7. Ceiling heights of apartments must be selected to encourage the penetration of natural sunlight into all areas of the dwelling.
- 8. Provide the following minimum floor to ceiling heights, as required by the Apartment Design Guide. Residential Flat Design Code
 - (a) Minimum 3.3m for both ground floor retail or commercial and first floor levels of the building, in order to enable future flexibility of potential uses.
 - (b) For upper residential floors (above the ground and first floors in a mixed use building / shop top housing development) provide the following minimum floor to ceiling heights:
 - (i) 2.7m minimum for all habitable rooms on all floors.
 - (ii) 2.25 to 2.4m minimum for non-habitable rooms on all floors.
 - (iii) For two storey apartments, 2.4m minimum for the second storey if 50% or more of the apartment has 2.7m minimum ceiling heights.
 - (iv) For 2 storey units with a two storey void space, 2.4m minimum ceiling heights.
 - (v) Attic spaces, 1.5m minimum wall height at edge of room with a 30 degree minimum ceiling slope.

:



4.20 Natural Ventilation

4.20.1 Objectives

- (a) To encourage apartment design which allows for natural ventilation of habitable rooms.
- (b) To provide natural ventilation in non–habitable rooms, where possible.
- (c) To reduce energy consumption by minimising the use of mechanical ventilation.

4.20.2 Development Controls

- 1. The site analysis shall be used to determine the prevailing winds and the optimal building orientation. Dwellings must be orientated to take advantage of natural breezes. The development shall seek to incorporate dual aspect apartments, two storey apartments or apartments with a narrow depth to allow natural airflows to penetrate through habitable rooms.
- 2. Mixed use developments may have varied building depths to accommodate the varied functions of the building. The residential component of mixed use developments shall have a building depth of between 10 and 18m. Residential apartments must be a maximum depth of 21m, as measured from the outside of the balcony. Increased building depths are acceptable for the commercial component of the building.
- 3. Variation to the maximum depth of the residential component of the building will only be considered where it can be demonstrated that apartments will achieve the minimum requirements with regard to solar access and natural ventilation. This may be achieved where apartments have a wider frontage to allow for greater penetration of natural light. The building depth is measured across the shortest access, excluding the depth of any unenclosed balconies.

- 4. A minimum of sixty percent (60%) of all residential apartments must be naturally cross ventilated.
- 5. Twenty five (25%) of kitchens within a development must have access to natural ventilation. Where kitchens do not have direct access to a window, the back of the kitchen must be no more than 8m from a window.
- 6. To maximise natural ventilation and natural daylight opportunities, upper level residential apartments in a building should include corner apartments, cross over or cross through apartments, split-level apartments or shallow, single aspect apartments only.
- 7. Single aspect apartments must be limited in depth to 8 metres from a window.
- 8. Crossover or cross through apartments must be no greater than 15 metres deep (excluding balconies or terraces), to avoid deep narrow apartment layouts.
- 9. The minimum width for residential apartments should be at least 6 metres in order to avoid relatively narrow apartments and to improve natural ventilation and daylight opportunities. However, Council may in some cases, allow a minimum 4 metre width for cross-over or cross through apartments which are below 12 metres in depth,



Figure 4: Good cross ventilation can be achieved with cross over apartments and corner apartments (Ref: Residential Flat Design Code).

4.21 Adaptive Re-use

4.21.1 Objectives

- (a) To provide flexible living/work relationships within dwelling design.
- (b) To encourage the conversion of underutilised office and retail space above street level premises in existing commercial premises to residential uses.
- (c) To consider adaptive reuse opportunities in the design of mixed use buildings.

4.21.2 Development Controls

1. Within appropriately located developments, consider including opportunity for home based employment when designing dwellings. This can be achieved by providing purpose built dwellings at the ground floor level which have separate residential and employment spaces and which have direct access from the adjacent street. Consideration could also be given to the provision of apartment layouts which will allow for future reconfiguration of rooms to allow for home based work opportunities.

- 2. Where residential dwelling units are proposed at ground level within a business zone a report must be provided with the development application demonstrating how future commercial uses can be accommodated within the ground level design. The report must address:
 - (a) Access requirements including access for persons with a disability.
 - (b) Any upgrading works necessary for compliance with the Building Code of Australia.
- 3. Council encourages the adaptive use of underutilised or vacant floor space within the business zones in the City. Shop top housing is encouraged in such situations, to allow adaptive use of such space. To encourage shop top housing the following incentives are offered by Council:
 - (a) No requirement for additional carparking spaces for existing floor space that is converted to residential uses.
 - (b) Where a change of use does not involve an increase in floor space, certain controls may not be applied such as building setback and orientation of windows etc....

4.22 Crime Prevention Through Environmental Design (Safety and Security)

4.22.1 Objectives

- (a) To ensure compliance with relevant legislation in the consideration of security (crime prevention) issues.
- (b) To reduce opportunities for crime through the provision of natural and technical surveillance opportunities.
- (c) To control access through the provisions of physical or implied barriers which can be used to attract, channel or restrict the movement of people.
- (d) To implement territorial reinforcement by encouraging community ownership of public space.
- (e) To promote space management by ensuring that public open space is effectively utilised and maintained.

4.22.2 Development Controls

- 1. Ensure that the building design allows for casual surveillance of accessways, entries and driveways.
- 2. Avoid creating blind corners in pathways, stairwells, hallways and car parks.
- 3. Provide entrances which are in prominent positions and which are easily identifiable, with visible numbering.
- 4. Where private open space is located within the front building alignment any front fencing must be of a design and/or height which allows for passive surveillance of the street.
- 5. The number of dwellings accessible from a single lift or corridor is limited to a maximum of eight (8) per floor.
- 6. Provide adequate lighting of all pedestrian access ways, parking areas and building entries. Such lighting should be on a timer or movement detector to reduce energy consumption.

- 7. Avoid the creation of obscure or dark alcoves, which might conceal intruders. Provide clear lines of sight and well-lit routes throughout the development.
- 8. Where a pedestrian pathway is provided from the street, allow for casual surveillance of the pathway. Ensure that pathways do not provide concealment opportunities.

5 GENERAL REQUIREMENTS FOR ALL MIXED USE DEVELOPMENT

5.1 Floodplain Management

5.1.1 Objectives

- (a) To minimise potential risks to life and property as a result of potential flooding.
- (b) To provide appropriate freeboards for residential development.
- (c) To ensure that development is appropriately sited having regard to potential flood risks.

5.1.2 **Development Controls**

1 The submission of a flood study is required where the land is suspected to be affected by flooding or the proposed development could impact on flood behaviour. All development must comply with Floodplain Management chapter contained in Part E of this DCP, with appropriate freeboards for residential development.

5.2 Land Re-Shaping Works (Cut and Fill Earthworks)

5.2.1 Objectives

- (a) To encourage development which follows the natural contours of the land, to minimise the extent of cut and fill required on a site.
- (b) To ensure that building design is appropriate for site conditions.
- (c) To protect the stability and privacy of adjoining properties.

5.2.2 Development Controls

- 1. All land re-shaping (cut and fill earthworks) shall be minimised.
- 2. A maximum of 600mm of cut and/or 600mm of fill will generally be permitted.
- 3. Excavations in excess of 600mm within the confines of the building may be permitted to allow for basement garages, non-habitable rooms or similar construction.
- 4. Where walls are designed as retaining walls, waterproofing and drainage details, to direct water away from the building, must be submitted to Council.
- 5. Proposed cut or fill must not compromise structures on the subject land or adjacent land or the overall stability of the land.
- 6. Further, any cut or fill must not impede the drainage characteristics of adjoining land and must not interfere with neighbouring properties or existing vegetation which is required to be retained.

- 7. Battered slopes must be graded at no steeper than 1:2 (vertical: horizontal), to the natural ground level, unless the foundation strata of the area permits otherwise and Council is satisfied with the overall stability of the ground. A slope of 1:4 is recommended for mowing purposes.
- 8. All fill applied should be Virgin Excavated Natural Material (VENM) as defined by the NSW Department of Environment and Climate Change.
- 9. Adequate measures must be made to ensure public safety, especially where excavation is located close to a public place or where it exceeds one metre in depth.
- 10. Stormwater must not be redirected or concentrated onto adjoining properties so as to cause a nuisance.
- 11. Within areas of landslip or suspected landslip, Council may require a geotechnical and structural engineer's report relating to the proposed structure. Council will assess the stability of any cut or fill within these areas dependent upon the recommendations contained in these reports.

5.3 Retaining Walls

5.3.1 Objectives

- (a) To ensure that retaining walls are structurally sound and are located to minimise any adverse impact on adjoining properties.
- (b) To guide the design and construction of low height aesthetically pleasing retaining walls.
- (c) To ensure slope stabilisation techniques are implemented to preserve and enhance the natural features and characteristics of the site.

5.3.2 Development Controls

- 1. Schedule 2 of Wollongong LEP 2009 identifies retaining walls that do not require Council approval subject to the requirements of clause 3.1 of the LEP.
- 2. Within areas of landslip and suspected landslip Council may require a report prepared by a suitably qualified geotechnical and structural engineer relating to the proposed retaining wall. Council will assess the suitability of any retaining within these areas dependent upon the recommendations contained in these reports.
- 3. Applications for retaining walls which exceed 1.0 metre in height must be accompanied by certification provided by a suitably qualified practising structural engineer and/or the manufacturer's specification of the design of the wall.
- 4. To limit the overall height impact, terracing of retaining walls is required, to limit the maximum vertical rise of a retaining wall to 1.0m, with a minimum horizontal setback of 1.0m.
- 5. Applicants proposing retaining walls of a vertical height exceeding 1.0m in any one vertical rise must demonstrate compliance with the above objectives.
- 6. Ballustrading will be required in accordance with the *Building Code of Australia*, to ensure the safety of the public, where the retaining wall adjoins a public place and where a person could fall more than one metre.
- 7. The height and design of any proposed fence on top of the retaining wall must be included in the consideration of the height of the retaining wall. Applicants proposing fences on retaining walls must demonstrate compliance with the above objectives.

- 8. Open window face type retaining walls must not be permitted within 1.5 metres of an adjoining property boundary. These include crib block and similar type walls that permit the free flow of solid material through the wall.
- 9. The maximum height of a retaining wall in any one vertical rise and which is located within 3m of the adjoining boundary is 600mm. Additionally:
 - (a) All components, including footings and agricultural lines must be wholly contained within the property.
 - (b) Retaining walls are to be constructed so as not to prevent the natural flow of stormwater runoff.
- 10. Adequate provision must be made for the proper disposal of surface and subsurface drainage associated with the erection of the walls. The method of disposal must be approved by Council and could include:
 - (a) The connection of sub-surface drainage from the retaining wall to the street gutter.
 - (b) Disposal via properly constructed absorption trenches on the property containing the retaining wall in accordance with Council's Fact Sheet on Domestic Stormwater Drainage Systems.
 - (c) Disposal via piped or channelled drainage easement.
 - (d) Other means as determined by Council.
- 11. All surface and sub-surface drainage must not discharge directly onto other adjoining properties unless a drainage easement has been created. Council's Fact Sheet on Retaining Walls provides further information regarding the construction of retaining walls.

5.4 Soil Erosion and Sediment Control

5.4.1 Objectives

- (a) To minimise site disturbance during construction.
- (b) To implement erosion and sediment controls to minimise potential adverse impacts during construction works.

5.4.2 **Development Controls**

1. All soil erosion and sediment control measures shall comply with Soil Erosion and Sediment Control chapter in Part E of the DCP.

5.5 Fences

5.5.1 Objectives

- (a) To allow for the physical separation of properties for resident privacy.
- (b) To ensure that the design, heights and materials of fencing are appropriately selected.
- (c) Fencing design and location should aim to complement the building design and enhance the streetscape.

- (d) To ensure that the design allows for casual surveillance of the lot.
- (e) To ensure that clear lines of sight are maintained for motorists and pedestrians to and from the lot.

5.5.2 **Development Controls**

- 1. All fences are to be constructed to allow the natural flow of stormwater drainage or runoff. Fences must not significantly obstruct the free flow of floodwaters and must be constructed so as to remain safe during floods and not obstruct moving debris. Fences must not be constructed of second hand materials without the consent of Council.
- 2. Fences within the front and secondary building lines should be predominantly constructed in transparent fence materials, allowing visual connection between the dwelling and the street.
- 3. Fences within the front setback area from the primary road frontage are to be a maximum 1.2m in height. Front fences must be of a height and/or design to allow for passive surveillance of the street.
- 4. Side fences on corner blocks shall be a maximum of 1.2m in height within the front setback area from the primary road frontage and shall be a maximum of 1.8m in height for the remainder of the secondary road frontage.
- 5. Dividing fences between the front building line and the rear property boundary must be a maximum of 1.8m in height.
- 6. Fences exceeding maximum permissible heights must be articulated and landscaped to soften their visual impact.
- 7. Fences must be constructed of timber, metal, lightweight materials or masonry.
- 8. The height and design of any proposed fence on top of a retaining wall must be included in the consideration of the height of the retaining wall.
- 9. When trees which are the subject of a tree preservation order are located in the location of a proposed fence, then the fence must be designed around the tree or an application made to Council for the removal of the tree.
- 10. Fences within a floodway or high-risk flood precinct are not permitted except for security/permeable/open style safety fences of a design approved by Council.

5.6 Access for People with a Disability

5.6.1 General

1. Refer to Access for People with a Disability Chapter in Part E of the DCP.

5.7 Services

5.7.1 Objectives

(a) To encourage early consideration of servicing requirements, to ensure that all residential development can be appropriately serviced.

5.7.2 **Development Controls**

- 1. Applicants shall contact service authorities early in the planning stage to determine their requirements regarding conduits, contributions, layout plans, substations and other relevant details.
- 2. Consideration shall be given to the siting of any proposed substation during the design stage, to minimise its visual impact on the streetscape. Any required substation must not be located in a prominent position at the front of the property.
- 3. Water, sewerage, gas, underground electricity and telephone are to be provided to the proposed development by the developer in accordance with Council and servicing authority requirements.
- 4. Developments must be connected to a reticulated sewerage scheme.
- 5. Where a reticulated scheme is not available, an on-site sewage management system will be required in accordance with the On-site Sewage Management System chapter in Part E of the DCP. The full details of the proposed on-site sewage management system must be provided with the Development Application. A section 68 approval will also be required under the Local Government Act 1993 in these instances. me

5.8 **Swimming Pools**

5.8.1 **Objectives**

To ensure that swimming pools meet relevant safety standards and meet user needs whilst not (a) compromising the amenity of the residential neighbourhood.

5.8.2 **Development Controls**

- 1. Swimming pools for private use within a mixed use development must be located on land:
 - That contains an existing dwelling or a dwelling is constructed on the land at the same time a) the swimming pool is constructed; and
 - b) Behind the front building line.
- 2. A swimming pool must not be located:
 - a) Over an easement or restricted building zone;
 - Within a zone of influence of a public sewer main; b)
 - Within a zone of influence of a public drainage pipe; or c)

Without appropriate approval by Council

- 3. The swimming pool water line must have a setback of at least 900mm from a side or rear boundary.
- 4. Decking around a swimming pool must not be more than 600mm above ground level (existing).
- 5. Coping around a swimming pool must not be more than:
 - a) 1.4m above ground level (existing), and
 - b) 300mm wide if the coping is more than 600mm above ground level (existing).
- Water from paved areas must not be discharged to any watercourse. 6.

- 7. Overflow paths must be provided to allow for surface flows of water in paving areas around the pool and shall not be directed or connected at any point onto the adjoining property.
- 8. Discharge and/or overflow pipe(s) from the swimming pool and filtration unit are:
 - a) To be discharged in accordance with an approval under the *Local Government Act 1993* if the lot is not connected to a sewer main.
 - b) Not to discharge water to any watercourse.
- 9. Pool excavations are not to conflict with the position of the household drainage trenches or lines, the position of which must be ascertained and shown on the site plan before pool excavation commences.
- 10. A swimming pool must be surrounded by a child resistant barrier complying with the requirements of the *Swimming Pools Act 1992* (and Regulations) and the appropriate Australian Standard as referenced by the *Building Code of Australia*.
- 11. A minimum of 50% of the perimeter of a pool must be accessible for rescue purposes.
- 12. Structures such as tool sheds, garages, barbeques, clotheslines or other like structures must be located outside the fenced pool enclosure.

5.9 Fire Brigade Servicing

5.9.1 Objectives

(a) To ensure that all mixed use developments can be serviced by fire fighting vehicles.

5.9.2 Development Controls

- 1. All mixed use developments must be located within 60m of a fire hydrant, or the required distance as required by Australian Standard AS2419.1. Provision must be made so that NSW Fire Brigade vehicles can enter and leave the site in a forward direction where:
 - (a) NSW Fire Brigade cannot park their vehicles within the road reserve due to the distance of hydrants from dwellings and/or restricted vehicular access to hydrants; and
 - (b) The site has an access driveway longer than 15m.
- 2. For developments where a fire brigade vehicle is required to access the site, vehicular access, egress and manoeuvring must be provided on the site in accordance with the NSW Fire Brigades Code of Practice Building Construction NSWFB Vehicle Requirements.

5.10 Site Facilities

5.10.1 Objectives

- (a) To ensure that site facilities (such as clothes drying, mail boxes, recycling and garbage disposal units/areas, screens, lighting, storage areas, air conditioning units and communication structures) are effectively integrated into the development and are unobtrusive.
- (b) To design site services and facilities in a manner such that they relate to the development, enable easy access, require minimal maintenance and blend with the development.

5.10.2 Development Controls

1. Provide letterboxes for all mixed use developments in a location, which are accessible.
- 2. Letterboxes should be grouped in one location adjacent to the main entrance to the development. Letterboxes must be secure and large enough to accommodate articles such as newspapers. Letterboxes should be integrated into a wall where possible and be constructed of materials that are aligned with the appearance of the building.
- 3. Locate satellite dish telecommunication antennae, air conditioning units and any ancillary structures:
 - (a) Away from the street frontage;
 - (b) In a position where such facilities will not become a skyline feature at the top of any building; and
 - (c) Adequately setback from the perimeter wall or roof edge of buildings.
- 4. All residential apartments within a mixed use development must be provided with open air clothes drying facilities that are easily accessible and which are screened from the public domain and communal open spaces. Clothes drying areas must have a high degree of solar access. Clothes drying areas must not be located between the building line and a public road or accessway, unless adequately screened.
- 5. Air conditioning units shall be located so that they are not visible from the street or other public places.

5.11 Storage Facilities

5.11.1 Objective

(a) To provide accessible storage for larger household items which cannot be readily accommodated within dwellings.

5.11.2 Development Controls

1. For each dwelling within a mixed use building provide a secure space to be set aside exclusively for storage as part of the basement. The storage area must comply with the following requirements:

| Dwelling | Storage Area | Storage Volume |
|----------------------------------|-----------------|------------------|
| One bedroom apartments | 3m ² | 6m ³ |
| Two bedroom apartments | 4m ² | 8m ³ |
| Three or more bedroom apartments | 5m ² | 10m ³ |

5.12 Waste Management

5.12.1 Objectives

- (a) To minimise the volume of waste generated during relevant demolition and construction phases of development, through reuse and recycling and the efficient selection and use of resources.
- (b) To encourage development which facilitates waste minimisation and complements waste services offered by a private waste and recycling contractors.

- (c) To maximise reuse and recycling of building materials and commercial office / retail waste.
- (d) To provide appropriately located, sized and accessible waste and recycling storage facilities.
- (e) To ensure sustainable waste management practices are implemented through the preparation of a site waste minimisation and management plan at the Development Application stage.

5.12.2 Development Controls

- 1. All mixed use developments shall address all of the requirements contained in Chapter E7:Waste Management in Part E of the DCP.
- 2. All mixed use developments shall provide suitable garbage and waste recycling facilities in accordance with the Chapter E7: Waste Management in the DCP.
- 3. The garbage and recycling facilities shall be designed to be serviced by an appropriate waste contractor as per the design requirements contained in the Waste Management chapter.

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Part B – Land Use Base Controls Chapter B5: Industrial Development

Contents

| 1 | INTRODUCTION | 1 |
|------|---|----|
| 2 | OBJECTIVES | 1 |
| 3 | factory / WAREHOUSE DISTRIBUTION centre BUILDING DESIGN REQUIREMENTS | 2 |
| 3.1 | Building Setbacks | 2 |
| 4 | Building Design / Façade Treatment | 3 |
| 5 | SAFETY AND SECURITY | 5 |
| 5.1 | Objectives | 6 |
| 5.2 | Development Controls | 6 |
| 6 | CARPARKING REQUIREMENTS | 7 |
| 6.1 | Objectives | 7 |
| 6.2 | Development Controls | 7 |
| 7 | LOADING DOCK FACILITIES, VEHICULAR ACCESS | |
| | AND MANOEUVRING REQUIREMENTS | 8 |
| 7.1 | Objectives | 8 |
| 7.2 | Development Controls | 8 |
| 8 | LANDSCAPING REQUIREMENTS | 9 |
| 8.1 | Objectives | 9 |
| 8.2 | Development Controls | 10 |
| 9 | OUTDOOR STORAGE AREAS | 15 |
| 9.1 | Objectives | 15 |
| 9.2 | Development Controls | 15 |
| 10 | SHIPPING CONTAINER STORAGE FACILITIES | 16 |
| 10.1 | Objectives | 16 |
| 10.2 | Development Controls | 16 |

| | 11 | MOTOR VEHICLE REPAIR WORKSHOPS | 17 |
|---|------|------------------------------------|----|
| | 11.1 | Objectives | 17 |
| | 11.2 | Development Controls | 17 |
| | 12 | FENCING | 17 |
| | 12.1 | Objectives | 17 |
| 6 | 12.2 | Development Controls | 17 |
| | 13 | USE OF FACTORY / WAREHOUSE UNITS | 18 |
| | 13.1 | Objective | 18 |
| | 13.2 | Development Control | 18 |
| | 14 | ABRASIVE BLASTING INDUSTRY | 18 |
| | 14.1 | General | 18 |
| | 14.2 | Objectives | 19 |
| | 14.3 | Development Controls | 19 |
| | 15 | INDUSTRIAL DEVELOPMENT ADJOINING A | |
| | | RESIDENTIAL ZONE | 21 |
| | 15.1 | Objectives | 21 |
| | 15.2 | Development Controls | 21 |
| | 16 | RETAILING IN INDUSTRIAL AREAS | 22 |
| | 16.1 | Neighbourhood Shops | 22 |
| | 16.2 | Take –away food and drink premises | 23 |
| | 16.3 | Kiosks | 23 |
| | | YALLAH INDUSTRIAL ESTATE | 24 |
| | 17 | 24 | |
| | 17.1 | Development Controls | 24 |
| | 18 | JARDINE STREET INDUSTRIAL ESTATE | 24 |
| | 18.1 | Development Controls | 24 |

X

| 19 | ADVERTISING STRUCTURES / SIGNS | 25 |
|------|---|----|
| 19.1 | Development Controls | 25 |
| 20 | STORMWATER DRAINAGE REQUIREMENTS & | |
| | FLOOD STUDY REQUIREMENTS | 25 |
| 20.1 | Objectives | 25 |
| 20.2 | Development Controls | 25 |
| 21 | RIPARIAN CORRIDOR MANAGEMENT | 26 |
| 21.1 | Development Controls | 26 |
| 22 | UTILITY INFRASTRUCTURE SERVICES | 26 |
| 22.1 | Development Controls | 26 |
| 23 | SUBDIVISION OF INDUSTRIAL LAND | 27 |
| 23.1 | Development Controls | 27 |
| 24 | ROAD DESIGN & CONSTRUCTION REQUIREMENTS ROAD TYPES AND CHARACTERISTICS FOR PUBLIC | |
| | ROADS | 28 |
| 24.1 | Road infrastructure construction works | 29 |
| 25 | RESTRICTED ACCESS TO ARTERIAL OR SUB- | |
| | ARTERIAL ROADS | 29 |
| 25.1 | General | 29 |
| 25.2 | Creation of legal restrictions prohibiting direct access to designated roads (arterial or sub-arterial roads) | 30 |
| 25.3 | Temporary access to designated roads (arterial or sub- arterial roads) | 30 |
| 26 | STREET LIGHTING | 30 |
| 27 | STRATA SUBDIVISION OF MULTI-UNIT FACTORY / WAREHOUSE DISTRIBUTION CENTRE COMPLEXES | 31 |
| 27.1 | Development Controls | 31 |

| Document Control | | |
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1 INTRODUCTION

- 1. This chapter of the DCP provides the objectives and detailed controls for the subdivision of industrial land and industrial development and should be read in conjunction with the relevant LEP applying to the subject site..
- 2. This chapter of the DCP applies to land zoned either: IN1 General Industry, IN2 Light Industrial, IN3 Heavy Industrial and IN4 Working Waterfront under the relevant LEP.
- 3. This chapter of the DCP also applies to any light industry or warehouse or distribution centre proposed upon land zoned B6 Enterprise Corridor.
- 4. It is also recommended that prospective applicant's also refer to the Subdivision Code which provides the detailed design and construction requirements for roads, stormwater drainage and other infrastructure works.

2 **OBJECTIVES**

- 1. The objectives of this chapter of the DCP are:
 - (a) To preserve core industrial lands to meet the current and future needs of the Illawarra Region.
 - (b) To minimise the fragmentation of land in industrial areas, particularly the Port Kembla heavy industrial area and the Unanderra industrial area to enable the future establishment of port related industries and large-scale warehouse distribution facilities.
 - (c) To accommodate industrial development which produces a range of goods and provides employment without adversely affecting the amenity, health or safety of any adjoining residential area.
 - (d) To encourage a high standard of aesthetically pleasing and functional industrial developments that sympathetically relate to adjoining and nearby developments.
 - (e) To encourage modern forms of general industrial, light industrial, warehousing, high technology and research and the like development within industrial areas of the City.
 - (f) To reduce the visual impact of industrial development on the streetscape and surrounding areas.
 - (g) To ensure open storage areas are properly screened to minimise any adverse visual effects of the development.
 - (h) To ensure that fencing and walls for security purposes have positive impacts on the streetscape and public domain areas.
 - (i) To encourage water sensitive urban design measures, wherever practicable and to ensure stormwater run-off is satisfactorily catered for.
 - (j) To ensure that employment premises incorporate the principles of Ecologically Sustainable Development.

3 FACTORY / WAREHOUSE DISTRIBUTION CENTRE BUILDING DESIGN REQUIREMENTS

3.1 Building Setbacks

3.1.1 Objectives

- (a) To enhance the visual quality of industrial development through appropriate setbacks together with appropriate building and landscape design, particularly when viewed from public roads and other public domain areas.
- (b) To minimise the visual impact of factory / warehouse distribution centre buildings upon the streetscape of the surrounding locality.
- (c) To create a pleasant environment within and external to the site.
- (d) To ensure satisfactory amenity and privacy levels are maintained for any adjoining sensitive land uses such as a residential land use.

3.1.2 **Development Controls**

1. The minimum front building line setback for all buildings fronting a public road shall be in accordance with the following table:

Table 1: Minimum Front Building Line Setbacks for Factory/ Warehouse Distribution Centre Buildings

| Road Classification | Minimum Front Building Line Setback (Primary Road Frontage) |
|---------------------|--|
| Arterial Road | 20 metres |
| Sub-Arterial Road | 15 metres |
| Collector Road | 10 metres |
| Local Road | 7.5 metres |

2. The minimum secondary road building line setback for all buildings on corner or dual frontage sites shall be in accordance with the following table:

Table 2: Minimum Secondary Road Setbacks for Buildings on Corner or Dual Frontage Sites

| Road Classification | Minimum Building Line Setback for Secondary Road Frontage (Corner Lot or Dual Frontage Lot) |
|---------------------|---|
| Arterial Road | 7.5 metres |
| Sub-Arterial Road | 5 metres |
| Collector Road | 5 metres |

Local Road

5 metres

4 BUILDING DESIGN / FAÇADE TREATMENT

4.1.1 Objectives

- (a) To achieve a high standard of industrial development by promoting visually attractive buildings and through the use of high quality external finishes.
- (b) To encourage a range of architectural design elements and innovative roof forms for industrial buildings, in order to improve the visual interest and attractiveness of such buildings.
- (c) To promote functional, safe and environmentally friendly industrial development.

4.1.2 Development Controls

- 1. The external front façade of all buildings fronting public roads shall be of a high quality glass, decorative finished concrete or face brick construction. This external façade treatment shall incorporate a minimum 6 metre return around the sides of the building. Alternatively, colorbond wall materials may be used for up 50% of the total front façade of the building with the remaining 50% of the façade being of a glass, decorative finished concrete or face brick construction.
- 2. The maximum reflectivity of any glazing shall not exceed 20%, in order to minimise any potential glare impacts.
- 3. The submission of a schedule of proposed external building materials and finishes is required with the Development Application.
- 4. Large unrelieved expanses of walls or building mass are required to be broken up through building articulation, vertical and horizontal modulation and / or alternative architectural enhancements, in order to provide visual interest to the building.
- 5. Other architectural elements or treatments may include (but are not limited to) the following:
 - (a) Varied building materials and external finishes on the building façade;
 - (b) Roof forms and parapets to create an interesting skyline;
 - (c) Vertical fin walls;
 - (d) Sun shading devices; and
 - (e) Public art works on the building and in front of the building.
- 6. Any proposed building on a dual road frontage lot will be required to be designed to incorporate varied architectural features for both road frontages with the building being orientated towards the major road frontage.
- 7. Buildings located on corner allotments shall be designed to address both street frontages in terms of façade treatment and articulation of the building and the roofline form. Any building on a corner lot must incorporate architectural corner features to add visual interest to the building.
- 8. Where blank walls on street frontages are unavoidable for new buildings, the building shall feature decorative wall elements and / or vertical fin elements to provide visual interest.

- 9. The placement of roller shutters, loading docks and other building openings shall wherever possible be provided at the rear or side of the building.
- 10. Showroom display areas, ancillary offices and other low scale elements should be, wherever practicable, located at the front of the building and constructed of glass, decorative finished concrete or face brick materials.
- 11. The main entry to the building shall be easily identifiable from the road and directly accessible from the front of the building or driveway in the case of a multi-unit complex.
- 12. Large floor plate buildings must provide an open face to the public domain, especially at road level.
- 13. Buildings should incorporative decorative roof elements and avoid bulky roof forms.
- 14. Roofing materials should be constructed of low reflective materials and / or finishes wherever possible.
- 15. All roofing shall be provided with adequate guttering and downpipes which discharge to an open grated surface inlet pit for subsequent discharge to Council's stormwater drainage system or as parted of a Water Sensitive Urban Design solution.
- 16. All rooftop or exposed structures including plant rooms, air conditioning, ventilation and exhaust systems are to be suitably screened and integrated with the building in order to guarantee an integrated appearance.
- 17. All building construction shall comply with the requirements of the Building Code of Australia and in particular, fire egress and fire safety requirements.
- 18. Natural lighting must be incorporated into the design for large-scale factory or warehouse distribution buildings.



Figure 1: (Top Left: Warehouse distribution building with varied architectural elements, varied external finishes and ancillary offices located on the front façade of the building)

Figure 2: (Top Right: Factory / Warehouse distribution building with ancillary offices to the side of the building, providing strong vertical modulation and visual interest to the building)



Figure 3: (Top Left: Two storey ancillary offices with strong vertical fin wall projections in front of a factory / warehouse building)

Figure 4: Top Right: Two storey ancillary offices on the front façade of a warehouse distribution building and vertical architectural elements along the building)



Figure 5: (Top Left: Factory / warehouse distribution building with horizontal colour banding on the building elevations with advertising signage matching the key vertical front façade element)

Figure 6: (Top Right: Warehouse distribution building with two-storey ancillary offices on the front facade)

5 ENERGY AND WATER EFFICIENCY

5.1.1 Objectives

- (a) Encourage development that achieves the principles of ecological sustainable development.
- (b) Ensure development incorporates passive solar design principles, energy and water efficiency and conservation and opportunities for natural ventilation.
- 5.1.2 Development Controls
- The following energy efficiency measures are to be employed as a minimum as part of any development application.
 - (a) designing heating/cooling systems to target only those spaces which require heating or cooling, not the whole building.
 - (b) Reduce reliance on artificial lighting by incorporating natural light. This may include designing the development to provide direct daylight access to office spaces, providing skylights whenever possible and/ or sectioning lighting throughout the development to cater for current and future business needs.

(c) appliances and products (e.g. fridges, computers, dishwashers) achieve a minimum 4 stars on the energy rating label.

- 2. The following water saving measures shall be incorporated in all industrial developments.
 - (a) A rainwater tank is to be installed onsite and sited to enable easy maintenance and cleaning. The rainwater tank is to be fitted with a first flush device and may be used for watering landscaped areas. Where possible, rainwater should supply toilets in the development.
 - (b) Water fixtures and appliances (dishwashers, shower heads, taps, toilets, urinals etc) are to be 3.5 stars or better rated.
 - (c) Select water efficient plants and/or, indigenous vegetation for use in landscaped areas.

Alternatives to the above water savings methods can be presented to Council and they will be assessed on merit.

6 SAFETY AND SECURITY

6.1 **Objectives**

- (a) To encourage appropriate natural survelliance and sightlines, in order to minimise potential crime risks within sites and the surrounding industrial areas.
- (b) To provide unimpeded sight lines, particularly along pedestrian pathways from public roads and car parking areas within the site.
- (c) To provide adequate lighting throughout the development site including lighting between building entrance points and car parking areas in accordance with Crime Prevention through Environmental Design (CPTED) principles.

6.2 Development Controls

6.2.1 Entrances and natural surveillance

- 1. The front door to a building should face the road, wherever possible.
- 2. Any administration offices or showrooms must be located at the front of the building with windows facing the public road.
- 3. The street number of the building must be visible from the road to allow visitors and emergency service vehicles to easily identify the building.
- 4. Lighting (including bollard lighting) should be provided to the external entry path and the car parking area using vandal resistant light fixtures.
- 5. Lighting design should address the principles of Crime Prevention through Environmental Design (CPTED).
- 6. Compliance with the requirements of Chapter E2: Crime Prevention through Environmental Design (CPTED) in this DCP.

7 CARPARKING REQUIREMENTS

7.1 **Objectives**

- (a) To ensure adequate provision is made for on-site car parking for employee's and visitor's vehicles.
- (b) To encourage the provision of car parking areas that are integrated with the form and arrangement of buildings on-site.
- (c) To provide disabled car parking in accordance with the Access part of this DCP and the relevant Australian Standard.
- (d) To ensure car parking areas are attractive by requiring landscaping of all car parking areas.
- (e) To ensure opportunities for cycling to work are provided by encouraging the provision of bicycle parking areas and associated facilities within industrial developments.
- (f) To ensure car parking areas are integrated with the landscape design of the development site, in order to screen the car parking from the public road frontage as much as possible.

7.2 Development Controls

- 1. Car parking is to be provided in accordance with the requirements of the Car Parking, Access, Servicing / Loading Facilities and Traffic Management chapter in Part E of this DCP.
- 2. All car parking required by Council shall be provided 100% on-site.
- 3. The use of stacked car parking spaces is generally not permitted, except where the development is for a purpose built facility and the proponent can provide appropriate evidence that any stacked car parking spaces will be used only by employees and that appropriate documentary evidence is provided which outlines the management procedures that will be put in place by the specific organisation to guarantee the effective use of any stacked parking arrangement.
- 4. All developments shall provide a minimum of one (1) disabled car parking space which is clearly marked and located in close proximity to the main entrance to the building. For developments involving 50 or more car parking spaces, at least 2% or part thereof of these spaces shall be dedicated as disabled car parking spaces and located in close proximity to the main entrance to the building.
- 5. All car parking areas including access roadways shall be constructed of hard-standing, all weather-material with parking bays and manoeuvring areas clearly line marked.
- 6. The provision of bicycles is required in accordance with requirements of the Car Parking, Access, Servicing / Loading Facilities and Traffic Management chapter in Part E of this DCP and should be designed to encourage increased use of bicycles as a means of transportation to the workplace. The provision of bicycle storage facilities and showering / change rooms for staff is required to be shown on the architectural plans submitted with the Development Application.



Figure 7: Landscaping within car park providing shading for vehicles and visual relief of car parking areas.

8 LOADING DOCK FACILITIES, VEHICULAR ACCESS AND MANOEUVRING REQUIREMENTS

8.1 **Objectives**

- (a) To ensure that loading facilities required in association with factory or warehouse distribution centre developments do not detract from the amenity of adjoining land uses or public open space areas.
- (b) To ensure that adequate areas are set aside on the site to allow for the safe and efficient manoeuvring of delivery and service vehicles.
- (c) To ensure truck access and manoeuvring on site is safe and efficient and minimises any potential vehicular and / or pedestrian conflicts.
- (d) To ensure traffic circulation arrangements within the site are compatible with the local road system by implementing appropriate controls on the ingress and egress to / from sites.

8.2 Development Controls

- 1. Servicing and loading dock facilities shall be provided in accordance with the Car Parking, Access, Servicing / Loading Facilities and Traffic Management chapter in Part E of the DCP.
- 2. Each factory building / unit shall provide a suitable loading bay facility which is designed to accommodate a large rigid truck. However, buildings with a gross floor area of greater than 3,000 square metres shall provide loading dock facilities and manoeuvring areas capable of accommodating both semi-trailers and large rigid trucks.
- 3. Each factory / warehouse distribution centre unit shall be provided with a suitable loading bay external to the factory / warehouse building.
- 4. All loading and unloading activities shall take place wholly within the loading bay, at all times. No loading or unloading activity shall take place within any car parking area, landscaping area, pedestrian footway or any road reserve.
- 5. Loading docks shall be located so they are not visible from any adjoining residential area and do not transmit excessive noise onto any adjoining residential area.

- 6. Loading docks shall be positioned wherever possible, away from the public road frontage. Where such facilities can only be provided to the public frontage, appropriate landscaping will be required in front of the loading facility to adequately screen the development.
- 7. All loading dock facilities must guarantee satisfactory on-site manoeuvring areas for trucks in accordance with the Australian Standard AS 2890.2 Design Vehicular and Turning templates.

<u>Note</u>: Council will assess the adequacy of proposed manoeuvring areas provided for on-site truck manoeuvring with reference to the standard vehicle turning templates as per the Australian Standard AS 2890.2 Design Vehicular and Turning templates.

- 8. All developments must be designed to ensure that the standard truck for each building / unit is able to complete a semi-circular turn on the site, in order to guarantee that all truck movements into / from the site are in a forward direction.
- 9. Truck turning circles shall not encroach upon any building, car parking space or landscaped area.
- 10. Access arrangements should be designed in accordance with the NSW Roads & Traffic Authority's Traffic Generating Guidelines and Australian Standard AS 2890.1 (2004). However, it is desirable that separate access arrangements be made available for standard passenger vehicles and trucks upon the development site, in order to minimise potential vehicular conflicts.
- 11. All internal two-way access roads shall have a minimum width of 7 metres. Lesser widths may be provided if the internal road system is designed to a single one-way circulation arrangement within the site including any loading dock facilities. Directional signage shall be shown on all internal roadways (where required) to facilitate the orderly movement of trucks and other vehicles within the site.
- 12. As per the provisions of C2.4 of the Building Code of Australia, emergency vehicular access must be provided from a public road. In this respect, the internal access road must have an unobstructed 6 metre width with no part of the building being more than 18 metres away from the access road. The minimum 6 metre wide access road shall be reserved for vehicular and pedestrian access only and not built upon or used for any other purpose.
- 13. All car parking areas, manoeuvring areas and internal roadways must be provided with a drainage system comprising surface inlet pits. Therefore, Council will require the lodgement of appropriate stormwater drainage layout plans and calculations for the proposed stormwater drainage system. The proposed stormwater drainage system must be designed in accordance with Council's requirements for stormwater drainage and on-site detention as per the Stormwater Management Chapter in Part E of this DCP.

9 LANDSCAPING REQUIREMENTS

9.1 **Objectives**

- (a) To use landscaping to improve the appearance of industrial developments.
- (b) To ensure that landscaping is provided to enhance the streetscape environment and amenity of industrial areas.
- (c) To screen unsightly land uses and outdoor storage areas.

9.2 **Development Controls**

- 1. Landscaping is required to be integrated with the overall development and should be used to improve the streetscape appearance of industrial development and associated car parking and loading areas.
- 2. A minimum 10% of the site area is required to be landscaped. The majority of such landscaping should be provided within the front property building line setback area and the side property boundaries.
- 3. Where an existing site has less than 10% landscaping for the total site area, Council will seek to achieve the provision of 10% landscaping on any unused portion of the land or within surplus car parking areas.
- 4. The provision of dense landscaping within the front property boundary to public roads is required in order to visually soften the bulk of large developments when viewed from the public road.
- 5. A minimum 5 metre set back from the front boundary is to be provided for landscaping along the full length of the property with frontage to an arterial or sub- arterial road. A 3 metre minimum deep dense landscaped area is required along the full length of the property frontage to a collector or local road. This area is to be a mulched planted area and must include trees planted at a minimum rate of one tree per 25m².
- 6. Trees are to be planted at a rate of 1 tree per 10 car spaces. Tree species shall be selected top provide at least a 4 6 metre canopy spread at maturity. A minimum 1.5 metre wide landscape strip is required to be provided after every fifth parking space. Trees shall be a minimum 100 Litre size and shall be planted in minimum two (2) cubic metres of planting medium. Trees are to be protected by the use of such devices as bollards, kerbs and/or tree guards.
- 7. No structures, basement car parks, driveways, hard paving, are permitted within the landscaped setbacks.
- 8. Car parking areas which adjoin public roads or adjoining non industrial land uses are to be visually screened by dense landscaping.
- 9. The planting of low shrubs to a maximum mature height of 1 metre is recommended along any pedestrian footpath area, in order to provide adequate pedestrian safety, particularly at night-time.
- 10. Parking and circulation areas are to be delineated by planter beds at the ends of parking bays.
- 11. Planter beds shall be a minimum width of 1.5 metres and shall be contained by a 150mm concrete kerb.
- 12. All car parking spaces shall contain concrete wheel stops.
- 13. Retaining wall heights are to be generally restricted up to a maximum height of 2.5m. Where walls exceed 2.5metres, the wall is to be terraced with a minimum 1.5m mulched planted area, which is to be planted with tall shrubs to provide adequate visual screening.
- 14. Pedestrian and vehicular movement is to be clearly separated by use of design devices such as change in paving, kerb, bollards, line marking. Pedestrian paths are to be minimum 1.5 metres in width.
- 15. Fencing forward of the front building alignment to be palisade type maximum height 1.8m. Gates where possible are to be sliding type gates, to prevent conflicts with access to and within the site.
- 16. An external shaded seating area for meal breaks is to be provided.

- 17. Contrasting paving is required at driveway thresholds. Large expanses of car parking are to be broken up by the use of contrasting paving.
- 18. Fire hydrants, electricity substations, sprinkler tanks and / or waste collection and storage facilities must not be located within the front landscaped area.
- 19. A fully automatic irrigation system is required in all car park planter beds. Tree root barriers should be installed around the edge of planter beds to reduce future maintenance.

9.2.1 Landscape Plan

- 1. The submission of a scaled and dimensioned Landscape Plan is required for all applications. This Landscape Plan must be prepared by a Landscape Architect or Designer with appropriate qualifications. A Landscape Architect is a person eligible for corporate membership of the Australian Institute of Landscape Architects. A Landscape Designer must be eligible for membership of the Australian Institute of Landscape Design and Management. The Landscape Plan, which is to be scaled at 1:100 or 1:200 must indicate:
 - (a) Existing site information, north point, site boundaries, dimensions, trees and vegetation, including trees on neighbouring properties that will be effected by the development.
 - (b) Proposed buildings/structures, underground/overhead services, easements, right-ofways, roadways, car parks, footpaths.
 - (c) Location of external building structures i.e. Retaining walls including levels on the top and bottom of the walls, fences, materials, heights and finishes.
 - (d) Basic design levels to AHD of both hard and soft landscape areas including existing and proposed contours, spot heights, areas of cut and fill and finished levels.
 - (e) Proposed surface treatment of all landscape areas (eg paving, driveways, mulched planted areas, edging, turf, water).
 - (f) Each plant identified and catalogued in a plant schedule describing mature height and spread, quantity, proposed container size and staking. The plant schedule should be divided into trees, shrubs and ground covers.
 - (g) Construction or detail drawings, sections and elevations for outdoor structures, garden beds and planting, paving, edging, tree protection and retaining walls.
 - (h) Design details for special situations e.g. erosion, creek bank stabilisation.
 - (i) Location and details of lighting.
 - (j) Location of proposed drainage (both surface and sub-surface). The landscape and drainage plans must be compatible.
 - (k) Specification notes for soil preparation, plant material, tree protection etc.
 - (I) Details of minimum 12 months maintenance schedule.
 - (m) Provide taps or an irrigation system to ensure that all landscape works are adequately watered, the location of which is to be included on the landscape plan.
 - (n) Design measures to minimise crime risk including but not limited to: provision of external lighting to pathways, driveways and outdoor areas; shrubs higher than 1m to be setback from the edge of pathways; types of trees that have sufficiently high canopy when fully grown so that pedestrian vision is not impeded.

9.2.2 Arborist Report

- 1. An Arborist Report is required in relation to any significant tree on the subject site (other than an exempt tree) and trees on neighbouring properties that will be affected by the development, if it is 3 metres or more in height, or has a trunk diameter of 200mm or more at a height of 1 metre from the ground, or has a branch spread of 3 metres or more.
- 2. The Arborist Report is to be prepared by a qualified Arborist, which is a person who is eligible for membership as a 'Consulting Arborist' with the National Arborist Association of Australia or the Institute of Australian Consulting Arboriculturists, and who has attained a Level 5 Certificate of Horticulture / Arboriculture or equivalent. The report must identify trees on the site survey plan by number and provide details of the following:
 - (a) Genus and species of each tree;
 - (b) Health, amenity value and S.U.L.E. (Safe Useful Life Expectancy) rating of each tree;
 - (c) Impact of the development on each tree;
 - (d) Impact of retaining trees on the proposed development;
 - (e) The Tree Protection Zone (TPZ) required for each tree proposed to be retained;
 - (f) Any root barriers necessary, type and their location; and
 - (g) Any branch or root pruning which may be required for the trees.
- 3. The following table, from British Standard BS5837 (1991), is provided as a guide to developers of suitable development setbacks from existing trees.

Table 3: Protection of trees: minimum distances for protective fencing around trees

| Tree age | Tree vigour | Trunk dia. Mm | Min. distance m |
|-------------------------|-------------|---------------|-----------------|
| Young | Normal | <200 | 2.0 |
| (age less than 1/3 life | | 200 to 400 | 3.0 |
| | , | >400 | 4.0 |
| Young | Low | <20 | 3.0 |
| | | 200 to 400 | 4.5 |
| | | >400 | 6.0 |
| Middle age | Normal | <250 | 3.0 |
| (1/3 to 2/3's life | | 250 to 500 | 4.5 |
| expectancy) | | >500 | 6.0 |
| Middle age | Low | <250 | 5.0 |
| | | 250 to 500 | 7.5 |
| | | >500 | 10.0 |

| Tree age | Tree vigour | Trunk dia. Mm | Min. distance m |
|-----------------|-------------|---------------|-----------------|
| Mature | Normal | <350 | 4.0 |
| | | 350 to 750 | 6.0 |
| | | >750 | 8.0 |
| Mature and over | Low | <350 | 6.0 |
| mature | | 350 to 750 | 9.0 |
| | | >750 | 12.0 |

Note 1: It should be emphasised that this table relates to distances from the centre of tree to protective fencing. Other considerations, particularly the need to provide adequate space around the tree including allowances for future growth and also working space around the tree will usually indicate that the structure should be further away.

Note 2: With appropriate precautions, temporary site works can occur within the protected area e.g. for access or scaffolding.

- 4. Trees proposed for industrial sites are to be suitable species that fulfil the following criteria: medium sized, hardy, long lived, pollution resistant, drought resistant, not prone to failing or dropping limbs. In addition trees must be true to type, of good health and vigour, free from pests and disease, free from injury, be self supporting (tree must not be tied to stakes) and meet the NATSPEC criteria. Refer to Table 4. for NATSPEC criteria. and Table 5. for the schedule of suitable species for industrial zones.
- 5. Site landscaping must be integrated with the stormwater management controls. In particular, the location and nature of on site stormwater detention basins should not conflict with landscaping areas and objectives.
- 6. Existing trees on site and on adjacent properties are to be surveyed and accurately plotted with levels and extent of canopy. This information is to be indicated on the Landscape Plan and clearly show whether the trees are to be retained or removed. If the proposed development impacts on significant trees an Arborist Report must be submitted that has been completed by a qualified Arborist.
- 7. The developer is to provide street trees to street frontages of the development site. Trees to be minimum container size 100L and must be true to type, of good health and vigour, free from pests and disease, free from injury, be self supporting (tree must not be tied to stakes) and meet the following NATSPEC criteria in Table 4:

Table 4: NATSPEC Criteria

| | Height (m) | Calliper (mm) 300mm above ground level | Minimum Rootball Diameter (mm) |
|-------------------|------------|---|-----------------------------------|
| Thin Stemmed 100L | 3 | 40 | 500 |

| Tree | | | |
|----------------------------|-----|----|-----|
| Thick Stemmed 100L Tree | 2.5 | 50 | 500 |

- 8. Street trees to be planted in mulched, edged areas minimum dimensions 1.2m x 1.2m, including root control barriers to back of kerb and to foot path alignment, and a robust timber tree guard to protect tree from damage, or as per conditions of consent.
- 9. Suitable street trees for industrial areas in the Wollongong Local Government area can be obtained from Chapter E6 Landscaping in the DCP.



10. Trees must be planted and adequately established (minimum 12 months) to the satisfaction of WCC Manager of City Works.

Definitions

Landscape area - Is any part of the site which is not occupied by any building, basement or hard surface such as driveways, parking areas or paved areas.

S.U.L.E. – **Safe Useful Life Expectancy** - The S.U.L.E. rating system, based on Barrell 2001, rates existing trees on their safe useful life expectancy, and are determined in view of both the current state of health and age of the tree.

Tree - Is a perennial plant with a self-supporting stem or trunk, when mature, and for the purpose of this DCP means any tree (other than an exempt tree) including the roots of that tree, if it is 3 metres or more in height, or has a trunk diameter of 200mm or more at a height of 1 metre from the ground, or has a branch spread of 3 metres or more.

Tree Protection Zone - The Tree Protection Zone (TPZ) defines the optimal distance from the trunk of a tree that should be maintained free of development and construction activity.

10 OUTDOOR STORAGE AREAS

10.1 Objectives

- (a) To ensure outdoor storage areas are appropriately accommodated on-site.
- (b) To minimise the visual impact of outdoor storage area on the streetscape of the locality.
- (c) To ensure open storage areas are properly screened to minimise any adverse visual effects of the development.

10.2 Development Controls

- 1. Where any storage area for raw materials or finished goods is proposed to be provided outside the confines of the building, full details of the storage area will require formal development consent.
- 2. All outdoor storage areas are to be positioned at the rear or side of buildings with no storage areas being permitted within the front setback area of either the primary street frontage or any secondary street frontage.
- 3. Outdoor storage areas shall be adequately screened from public view by a minimum 2 metre high masonry fence.
- 4. The maximum height of goods and materials stored within the storage area shall be restricted to no more than the height of the screening structure. However, Council may permit a variation from this requirement where Council is of the opinion, that: (i) the location and overall height of the goods and materials will not pose any adverse overshadowing, amenity or visual impact upon any adjoining sensitive land use such as residential development or (ii) the siting and overall height of the goods and materials will not pose any adverse amenity impact upon the public domain or upon streetscape in the immediate locality.

11 SHIPPING CONTAINER STORAGE FACILITIES

11.1 Objectives

- (a) To ensure that the storage of shipping containers does not cause any adverse visual impact upon the streetscape or amenity of the surrounding locality.
- (b) To ensure the storage of shipping containers is restricted to specific designated storage areas only within a site and that the storage areas are well screened from view from any road frontage or any abutting or nearby residential area.
- (c) To ensure all semi-trailer trucks and trailers carrying shipping containers are contained wholly within the confines of the subject site and not on any public road.

11.2 Development Controls

- 1. The storage of shipping containers shall take place within a designated storage area behind the front building line setback. The storage of shipping containers within the front setback area of a development is not permitted.
- 2. All shipping container storage areas shall be screened from view from any road frontage and from any adjoining residential area by landscaping or other form of screening to the satisfaction of Council.
- 3. All storage areas for shipping containers shall provide sufficient on-site truck manoeuvring areas, in order to ensure all trucks can enter and leave the site in a forward direction.
- 4. All shipping container storage areas shall be separate from truck manoeuvring / parking areas and employee car parking areas.
- 5. All trailers used for the carrying of shipping containers to / from the site (whether with or without prime movers) shall be prohibited from standing on any public road.
- 6. The stacking of shipping containers may be acceptable where it can be demonstrated that the overall height of the stacked shipping containers will not result in any adverse visual or amenity impact upon any adjoining land use. However, the stacking of shipping containers on sites adjoining residential areas will not be supported, except where such containers are situated a minimum distance of 20 metres from the common property boundary with the residential area and any such stacking of containers does not pose any adverse overshadowing, amenity or visual impact upon the adjoining residential property(s).
- 7. Any refrigerated shipping containers shall be located within a central part of the site, if the site abuts a residential area or is adjacent to a dwelling not associated with the development in which the refrigerated shipping container is stored.
- 8. Any weighbridge or control device shall be sited at least 30 metres from the site entrance, in order to prevent any queuing of container freight trucks on any public road.
- 9. All trucks carrying shipping containers shall travel along specified roads, at all times. Documentary evidence will be required to be provided in support of any Development Application outlining the proposed routes to / from the subject site.

12 MOTOR VEHICLE REPAIR WORKSHOPS

12.1 Objectives

- (a) To ensure that motor vehicle repair workshops provide satisfactory vehicle storage areas and parking facilities on-site; and
- (b) To minimise any environmental problems through the emission of odours, noise, material storage, overspray and liquid spillage.

12.2 Development Controls

- 1. All vehicles awaiting servicing, repair and / or collection are to be stored on approved parking bays only and are prohibited from standing or being stored on any designated visitor parking area, public open space area or the public road carriageway or footpath.
- 2. All work shall be confined wholly within the building. No work is to carried out on motor vehicles in any car parking area or any public road.
- 3. Where spray painting is proposed, spray painting booths shall be provided to the requirements of Australian Standard AS 4114.
- 4. Spray painting shall be exhaust ventilated so that no odour is noticeable in any adjoining residential area.
- 5. A Trade Waste agreement is to be obtained from Sydney Water prior to the commencement of works for any waste water generated and to be discharged into Sydney Water's wastewater system.
- 6. Storage bins for scrap body panels and motor parts are to be provided. These bins are to be fully screened from any public road frontage and car parking area and must be emptied on a regular basis. The proposed location of storage bins shall be shown on the site plan accompanying a Development Application.
- 7. The car parking requirements for a motor vehicle repair operation shall be commensurate with the car parking requirements contained in this part of the DCP.
- 8. All vehicles including tow trucks are to enter and leave the site in a forward direction, at all times.

13 FENCING

13.1 Objectives

- (a) To ensure that fencing does not detract from the overall streetscape and visual amenity of the surrounding locality.
- (b) To provide appropriate security for the development and any outdoor storage areas.

13.2 Development Controls

1. All fencing in industrial developments shall be constructed of palisade or decorative open style metal type fencing with a maximum 2.4 metre height.

- 2. The use of sheet metal fencing or chain wire fencing on the front property boundary is not permitted.
- 3. In cases where residential land uses abut the common side or rear property boundary, timber paling, colorbond or decorative masonry fencing may be permitted in order to provide appropriate visual relief to the residential property. A maximum 2.2 metre fence height (ie at any point) will be permitted along the common property boundary between an industrial site and an abutting residential property.
- 4. All front entry gates shall be constructed to swing inwards into the site or slide across the frontage, at all times.
- 5. Masonry retaining walls along the street frontage shall be restricted to 600mm in height. Palisade or other decorative open metal type fencing may be erected on top of the masonry wall provided the total height of the masonry wall and fence is a maximum 2.4 metres in height.



Figure 9: Palisade fencing

14 USE OF FACTORY / WAREHOUSE UNITS

14.1 Objective

(a) To ensure that appropriate assessment is made upfront to ensure the proposed fit-out and use of the relevant factory unit or warehouse unit takes into account relevant fire safety and Building Code of Australia (BCA) requirements.

14.2 Development Control

1. Under certain circumstances, separate development consent may be required for the initial occupancy or change of use of a factory unit or warehouse unit. Applicants are recommended to contact the Duty Building Surveyor in the Customer Service Centre, to provide advice as to whether formal development consent is required for their intended use and / or whether an upgrading of the building is likely to be necessary to ensure BCA and fire safety compliance.

15 ABRASIVE BLASTING INDUSTRY

15.1 General

1. Abrasive blasting is used in a wide range of industries for many different purposes including the removal of rust, scale, paint, graffiti, mildew, and various forms of surface preparation. Abrasive

material is propelled on to the surface at high speed, using air pressure, water pressure, or centrifugal force.

2. The most common method of abrasive blasting uses compressed air to propel abrasive material from a blast pot, through a blasting hose to a nozzle that is manually controlled by the operator. Blasting is done in commercially built blast rooms, blasting yards, or inside temporary enclosures erected on-site. Other methods use wet abrasive blasting or water jetting with or without an abrasive. Automated abrasive blasting machines such as centrifugal wheel systems and tumblers are also occasionally used.

15.2 **Objectives**

- To encourage abrasive blasting within fully enclosed booths with venting to the atmosphere via (a) an appropriate dust collector filter, wherever possible.
- (b) To ensure all waste material collected from the site must be either gathered for reconstitution or disposed of at a site approved by the DECCW.
- To ensure wet abrasive blasting activities are carried out at least 30 metres distance away from (c) any other adjoining land use activity. mei

15.3 Development Controls

15.3.1 Abrasive Blasting Booth

- Where possible all abrasive blast cleaning should be carried out in a totally enclosed booth 1. vented to the atmosphere via a dust collector, preferably a fabric filter.
- For an abrasive blast cleaning booth the following criteria should be complied with:-2.
 - (a) The fabric filter or dust collector should be properly designed and maintained. The Department of Environment, Climate Change and Water (DECCW) advises that the appropriate air to cloth ratio is 0.01 to 0.03 metres per second. However, different types of filters are available having variable air to cloth ratios. The most efficient filter for the particular application should be the goal.
 - All particulate wastes generated by the blast cleaning should be removed from the booth (b) and either re-used or transported from the site without causing any visible emissions;
 - (c) Spent filters should be bagged or contained before disposal;
 - The condition of the fabric filters should be monitored by assessing emission levels so (d) that they are replaced before their efficiency is reduced.
 - The booth should be designed to enable continuous or frequent recovery of spent (e) abrasive agent.
 - (f) Immediate action should be taken to rectify any problems causing any visible emissions from the abrasive blast cleaning work area or associated operations;
 - The residual concentration limits of particulate material in the air discharged to (g) atmosphere from the booth after passing through the filter should not exceed 150 milligrams per cubic metre.

Note:- An emission level for particulate material has been proposed for the National Guidelines which is 100 milligrams per cubic metre using Best Practicable Technology (BPT).

3. All waste material collected from the site must be either gathered for reconstitution or disposed of at a site approved by the DECCW. (Whytes Gully Waste Disposal Depot has been approved for this purpose subject to the waste being properly contained and placed at the disposal site in a manner that controls dust emissions).

15.3.2 Metal Plate and Sections Abrasive Blasting

1. Commercial units for the abrasive blast cleaning of metal plate or other solid sections are available with a plate or section cleaning machine. The cleaning machine should discharge to the atmosphere via a suitable fabric filter dust collector.

15.3.3 Wet Abrasive Cleaning

- 1. When it is impracticable to use a suction system, wet abrasive cleaning can be carried out provided that:-
 - (a) A buffer distance of 30 metres or twice the height of the work platform, whichever is the greater, exists around the blast cleaning operation. A buffer distance of less than the above may be permitted if effective screens are used to prevent particulate emissions escaping from the site.
 - (b) The blasting agent is thoroughly wetted to prevent a visible emission;
 - (c) The waste material is removed before it is able to dry out and become airborne or can be washed away causing sedimentation in drains and watercourses or harm to the environment.
 - (d) Special collection and treatment facilities will be required to be designed for wastes such as sodium chromate, sodium dichromate, potassium dichromate, sodium nitrate, chromic acid, hydrochloric acid or sodium bicarbonate solids.
 - (e) All waste material must be disposed to an appropriate disposal site approved by the DECC. (Whytes Gully Waste Disposal Depot has been approved for this purpose subject to the waste being properly contained and placed at the disposal site in a manner that controls dust emissions).

15.3.4 Outdoors Blast Cleaning

- 1. Outdoors blast cleaning operations should only be conducted where it is impractical to clean items in a booth or with a plate or section cleaning machine, e.g. items which are too large or too heavy to fit into a booth or which are existing fixed structures. In such cases all plant and equipment associated with the outdoor blasting operation should be located within a regulated area on site and appropriately sign posted.
- 2. Outdoors blast cleaning should preferably be carried out using a blasting gun or an airless applicator which extracts excess blasting agent together with any dust generated.
- 3. All outdoor blasting involving structures such as bridges or buildings should be totally enclosed or sections enclosed progressively such that no visible emissions escape to the environment. The air supply for the operator should be supplied via a hose from outside the enclosure and all waste material should be collected and disposed of appropriately. No waste material should be allowed to fall into rivers, creeks or storm water drains.
- 4. If the material being removed during blast cleaning contains toxic concentrations of substances such as lead, arsenic, chromium, etc., then advice should be sought about collection and disposal of the contaminated abrasive. If there is an inability to confirm that the material does not contain these substances, the material should be considered toxic and compliance with AS 1361.1-1995 is necessary.

15.3.5 Surface Run-off Control

- 1. Pollution control devices should be provided on the site to control surface run-off whenever abrasive blasting operations are carried out external to an abrasive blasting booth.
- 2. The control may include site bunding that surrounds the area where particulate fallout is likely to occur. This bund should be graded towards a point that is directly attached to a pollution control pit/sedimentation pond.
- 3. This pollution control pit requires regular monitoring and regular maintenance to remove accumulated sludge.
- 4. All sludge must be disposed of at an appropriate disposal site approved by the DECCW.

16 INDUSTRIAL DEVELOPMENT ADJOINING A RESIDENTIAL ZONE

16.1 Objectives

- (a) To ensure any new industrial development is sympathetic with the streetscape character and amenity of an adjoining residential precinct.
- (b) To ameriolate any potential adverse amenity, noise, privacy or overshadowing impacts upon any adjoining or neighbouring residential development from any proposed new industrial building or proposed alterations and additions to an existing industrial building.

16.2 Development Controls

- 1. Where a new factory / warehouse distribution building abuts a residential zone, the front building line setback shall be in accordance with the minimum front setback requirements as listed in Table 1 of clause 3.1.2 in this chapter or the front building line setback of the adjoining residential development, whichever is the greater.
- 2. As per sub-clause 3.1.2(6), a minimum 3 metre side or rear building line sebtback is required for any industrial building abutting a residential zone. The setback distance for an industrial building shall be further increased by an additional one (1) metre for every additional metre, above 5 metres in building height. The setback area between the building and the common property boundary is to be densely planted with evergreen trees and shrubs which, at maturity, help screen the development from the adjoining residential precinct. The details of the proposed trees and shrub planting shall be reflected on the required Landscaping Plan and must be consistent with the Landscaping Chapter in Part E of this DCP.
- 3. The submission of shadow diagrams for hourly intervals between 9.00 am and 3.00 pm for the 21st June winter solstice period will be required for any new industrial building or alterations and additions to an existing industrial building abutting a residential zone or a dwelling not associated with the subject site which prove that at least all habitable living room windows in an adjoining dwelling and at least 50% of the rear private courtyard area of an adjoining residential property receive at least 3 hours of direct sunlight between 9.00 am and 3.00 pm on the 21st June winter solstice period.
- 4. Sources of noise such as garbage collection, deliveries, plant and machinery, parking areas and air conditioning plants should be sited away from adjoining residential properties, wherever practicable or where necessary, screened by walls or other acoustical treatment.
- 5. Loading/ unloading areas should be located so they are not visible from any adjoining residential area and do not transmit any excessive noise onto any abutting residential development. The

submission of a noise impact assessment report may be required with the Development Application where loading / unloading facilities are proposed to be positioned in proximity to any adjoining noise sensitive land use such as residential dwellings and educational establishments.

6. Noise emissions from the operation of an industrial premises must not exceed an LA10,^{T(15 minute)} noise emissions criteria of 45dB(A) during the day (7.00 am and 6.00 pm), when measured at the common boundary property boundary with the nearest residential property.

Note

LA10 ^{T(15 minute)} is the sound pressure level that is exceeded for 10% of the time when measured over a 15 minute period.

For the purpose of noise measures required the LA10 noise level must be measured or computed at any point described above over a period of 15 minutes using "FAST" response on the sound level meter.

For the purpose of the noise criteria for this section, 5dB(A) must be added to the measured level if the noise is substantially tonal or impulsive in character. The location or point of impact can be different for each development, for example, at the closest residential receiver or at the closest boundary of the development.

The noise emission limits identified apply for prevailing meteorological conditions (winds up to 3m/s), except under conditions of temperature inversions. Noise impacts that may be enhanced by temperature inversions must be addressed by:

- (a) Documenting noise complaints received to identify any higher level of impacts or patterns of temperature inversions;
- (b) Where levels of noise complaints indicate a higher level of impact then actions to quantify and ameliorate any enhanced impacts under temperature inversion conditions should be developed and implemented.
- 7. The hours of operation for any industrial development adjoining a residential zone will generally be restricted to between 7.00 am and 6.00 pm Mondays to Fridays and 7.00 am to 1.00 pm Saturdays with no activities or work permitted on Sundays and / or Public Holidays.
- 8. Council may consider a variation to the general hours of operation referred to in sub-clause 6 where a Development Application is supported by a Noise Impact Assessment report. The report shall be prepared by a suitably qualified and experienced consultant who is a member of the Australian Acoustical Society (AAS) or the Australian Association of Acoustical Consultants (AAAC). The report should identify all potential noise sources / activities including plant and equipment, gabage collection, loading / unloading deliveries etc.

For Council to consider any variation to the standard hours of the operation, the report must prove that the LA10 ^{T(15 minute)} maximum average noise emission level for the development (inclusive of all potential noise generating sources / activities) will be no more than 5dB(A) above the LA90 background noise emission level throughout the evening and night-time periods, when measured at the common property boundary with the nearest residential property.

17 RETAILING IN INDUSTRIAL AREAS

17.1 Neighbourhood Shops

17.1.1 Objectives

(a) To encourage small neighbourhood shops which provide for the daily convenience needs of people who live or work in the surrounding industrial estate.

(b) To limit the location, number and size of small neighbourhood shops within an industrial estate to maintain the role and character of the industrial area by primarily catering for industrial development and to maintain the viability of any existing or approved neighbourhood shop in the industrial area.

17.1.2 Development Controls

- 1. Any proposed neighbourhood shop must be limited to the retail sale of small daily convenience goods such as foodstuffs, drinks, personal care products, newspapers and the like <u>which provide</u> for the daily needs of people who live or work in the local industrial estate.
- 2. A neighbourhood shop must be restricted to a maximum gross floor area (GFA) of 100m², to ensure that the shop primarily caters for the daily convenience needs of people who live or work in the subject local industrial estate and to ensure that the development does not cause any potential significant adverse effect upon the viability of a nearby business zone identified as per Council's adopted retail hierarchy strategy in Chapter B4 in this DCP.
- 3. A minimum 400 metre straight line separation distance is required between a proposed neighbourhood shop and any existing or approved neighbourhood shop or any neighbouring business zoned land.

17.2 Take –away food and drink premises

17.2.1 Objectives

- (a) To encourage small take away food and drink premises which primarily provide for the sale of food and / or drinks for immediate consumption away from the premises by people who live or work in the surrounding industrial estate.
- (b) To limit the location, number and size of take away food and drink premises within an industrial estate to maintain the role and character of the industrial area by primarily catering for industrial development and to maintain the viability of an existing or approved take away food and drink premises or kiosk in the industrial area or within a nearby business zone.

17.2.2 Development Controls

- 1. Any proposed take away food and drink premises shall primarily provide for the retail sale of food and / or drinks for the immediate consumption away from the premises.
- 2. Any take away food and drink premises within an industrial area shall be restricted to a maximum gross floor area of 100m².
- 3. A minimum 400 metre straight line separation distance is required between a proposed take away food and drink premises and any existing or approved take away food and drink premises or any neighbouring business zoned land.

17.3 Kiosks

17.3.1 Objectives

- (a) To encourage the establishment of kiosks which provide for the retail sale of food, light refreshments and other small convenience items to meet the daily convenience needs of people who live or work in a local industrial area.
- (b) To limit the location, number and size of kiosks within an industrial estate to maintain the role and character of the industrial area by primarily catering for industrial development and to maintain the viability of an existing or approved kiosk or takeaway food and drink premises.

17.3.2 Development Controls

- 1. Any kiosk shall be restricted to the retail sale of food, light refreshments and other small daily convenience items such as newspapers and the like.
- 2. Any kiosk shall be restricted to a maximum gross floor area (GFA) of 30m².
- 3. A minimum 400 metre straight line separation distance is required between a proposed kiosk and any existing or approved kiosk or takeaway food and drink premises or any nearby business zoned land.

18 YALLAH INDUSTRIAL ESTATE

18.1 Development Controls

18.1.1 Building height

1. The Yallah Industrial Estate is within the flight path of the Illawarra Regional Airport. Therefore, no development is permitted to penetrate the Obstacle Limitation Surfaces for the Illawarra Regional Airport. Further information regarding the specific height restriction for development upon land within the Yallah Industrial estate should be obtained from Council.

18.1.2 Floodlighting restrictions within flight path

1. Given that the majority of lands within the Yallah Industrial Estate are within the flight path of the Illawarra Regional Airport, the provision of floodlighting to industrial premises within the Yallah Industrial Estate is not permitted.

18.1.3 Use of non-reflective building materials

- 1. Since the majority of lands within the Yallah Industrial Estate are within the flight path of the Illawarra Regional Airport, all building materials must be of a low-reflective finish. All external building materials / finishes must have a low level of reflectivity and hence, zincalume external materials and finishes will not be permitted.
- 2. The glass reflectivity of any building shall not exceed 20%.
- 3. The submission of a schedule of proposed external materials and finishes board and A4 sized colour photograph of the schedule of proposed external materials and finishes board is required to be submitted with any Development Application.

19 JARDINE STREET INDUSTRIAL ESTATE

19.1 Development Controls

- 1. Any proposed building on a lot adjoining residential properties shall be setback a distance equal to the height of the building, in order to avoid any potential overlooking or overshadowing problems. An absolute 3 metre minimum setback distance is required for the provision of a dense landscaping buffer screen and / or drainage purposes.
- 2. The provision of two (2) street trees per development site will be required to be planted within Council's footpath. The street trees shall be either:
 - (i) Syzygium paniculatum (where there are no electricity wires);

- (ii) Acmena smithii var minor (where there are electricity wires); or
- (iii) Native trees as listed in the Landscaping Section of this DCP and endorsed by Council's Infrastructure Division (Design & Technical Services Section).

Accordingly, applicants may wish to liaise with Council's Infrastructure Division (Design & Technical Services Section) to determine what street tree species should be planted within the footpath area.

20 ADVERTISING STRUCTURES / SIGNS

20.1 Development Controls

 All advertising signage or structures for industrial developments shall be in accordance with the requirements of State Environmental Planning Policy No. 64 – Advertising and Signage (SEPP 64) and Chapter C1 Advertising Signage and Structures of this DCP.

21 STORMWATER DRAINAGE REQUIREMENTS & FLOOD STUDY REQUIREMENTS

21.1 Objectives

- (a) To provide for the effective and efficient disposal of stormwater run-off.
- (b) To minimise stormwater run-off from development sites, wherever possible.
- (c) To improve water quality of stormwater run-off from all industrial developments.
- (d) To ensure Water Sensitive Urban Design (WSUD) measures are incorporated into the design and construction of industrial developments.
- (e) To encourage the re-use and recycling of stormwater run-off and reduce the reliance on potable water by incorporating WSUD principles.
- (f) To ensure appropriate flood impact assessment is undertaken for sites subject to flood inundation.

21.2 **Development Controls**

21.2.1 Stormwater drainage & stormwater quality controls

- 1. Water sensitive urban design treatment measures should be incorporated into the following developments:
 - (a) Industrial developments (including major alterations and additions to existing industrial buildings) involving a gross floor area of 4,000 square metres;
 - (b) Industrial subdivisions involving 5 or more proposed allotments or a site area of 4,000 square metres or more (whichever is the lesser);
 - (c) Warehouse distribution centre developments involving a gross floor area of 5,000 square metres or more.

- 2. Water sensitive urban design treatment measures shall be designed in accordance with the Water Sensitive Urban Design chapter in Part E of the DCP.
- 3. Stormwater including overland flows entering and discharging from the site must be satisfactorily managed. The site drainage network must provide the capacity to safely convey stormwater run-off resulting from design storm events.
- 4. All developments must provide for stormwater drainage and on-site detention in accordance with the requirements of Stormwater Management chapter in Part E of this DCP.
- 5. For sites which slope downwards away from the public road, the submission of documentary evidence is required from all relevant downstream property owners, which confirms that each property owner raises no objection to the discharge of stormwater by way of drainage pipelines through their properties to connect up with Council's stormwater drainage system. This documentary evidence must also confirm that each property owner has no objection to the creation of an easement covering the width of the drainage pipeline(s) on their respective property title(s).

21.2.2 Flood impact assessment

1. Any development upon a site which is identified as "flood hazard – affected" on Council's Property system must also comply with the requirements of the Floodplain Management Chapter in Part E of the DCP and the NSW State Government's Floodplain Development Manual. In this respect, a flood study is likely to be required to be prepared and hence, applicants should consult with Council's Infrastructure Division to determine whether a flood study is required and the necessary content of any such study

22 RIPARIAN CORRIDOR MANAGEMENT

22.1 Development Controls

1. Any proposed industrial subdivision or factory / warehouse development involving waterfront land on, in or within 40 metres of any bed of a river, creek or intermittent watercourse, lake or estuary must comply with the requirements of Chapter E23 Riparian Corridor Management in this DCP.

23 UTILITY INFRASTRUCTURE SERVICES

23.1 Development Controls

- 1. Satisfactory arrangements are required for:
 - (a) The provision of reticulated water and sewerage;
 - (b) The provision of underground electricity; and
 - (c) The provision of underground telecommunications.
- 2. Applicants are encouraged to consult with Sydney Water, in order to ensure that all industrial allotments can be satisfactorily serviced with reticulated water and sewerage.

Additionally, applicants should liaise with Sydney Water to determine what water pressure will be available in the reticulated water supply system. In the event that a sprinkler tank is required to be provided by the applicant / developer the water pressure from a sprinkler tank shall be in accordance with the Australian Standard AS 2118.1 – 1999 – Automatic Fire Sprinkler Systems.

Any sprinkler tank will be required to be positioned behind the front building line and not within any landscaped area.

- 3. Applicants are also recommended to liaise with Integral Energy or another electricity provider prior to the lodgement of the Development Application, in order to ascertain the exact requirements for the provision of electricity supplies to the development. As part of this consultation, the applicant will be required to ascertain whether an electricity sub-station is required. In the event that an electricity sub-station is required, the sub-station must be located behind the front building line of the building and not within any landscaping area.
- 4. Applicants should also liaise with a telecommunications carrier to ascertain the requirements for the provision of telecommunications to the site.

Any consent issued for the industrial land subdivision will require the submission of documentary evidence that satisfactory arrangements have been made with Sydney Water, the electricity provider and the telecommunications provider to service each lot in the subdivision.

24 SUBDIVISION OF INDUSTRIAL LAND

24.1 **Development Controls**

24.1.1 Minimum Lot Size & Width Requirements

- 1. The minimum subdivision lot size requirement for lands within the IN1 General Industrial, IN2 Light Industrial and IN3 Heavy Industrial zones shall be in accordance with the relevant Lot Size map as controlled in Wollongong Local Environmental Plan 2009.
- 2. The minimum lot width requirement for lands zoned either IN1 General Industrial, IN2 Light Industrial and IN3 Heavy Industrial zones shall be in accordance with the Table below.

Table 6 Minimum Lot Width Requirements

| Industrial Zone | Minimum Lot Width Requirement |
|-----------------------------|-------------------------------|
| IN1 General Industrial Zone | 50 metres |
| IN2 Light Industrial Zone | 30 metres |
| IN3 Heavy Industrial Zone | 100 metres |

- 3. Battle-axe shaped allotments shall comply with the minimum lot width requirements at the building line as referred to in the Table above. For the purposes of this clause, the building line for battle-axe shaped allotments is 10 metres from the battle-axe handle.
- 4. Where battle-axe shaped lots are proposed, the access handle must be a minimum width of 8 metres for the servicing of up to two(2) allotments.
- 5. A maximum of two (2) battle-axe allotments are permitted to share a common battle-axe handle. Where two(2) battle-axed shaped lots share a common battle-axe handle, the creation of reciprocal rights of carriageway benefiting and burdening each of the affected allotments will be required as part of the subdivision.
- 6. All battle-axed shaped allotments shall provide fire hydrant servicing in accordance with the requirements of the New South Wales Fire Brigade, New South Wales Rural Fire Service and any relevant Australian Standard.

7. Corner allotments are to be provided with a 3 metre x 3 metre splay corner.

25 ROAD DESIGN & CONSTRUCTION REQUIREMENTS - ROAD TYPES AND CHARACTERISTICS FOR PUBLIC ROADS

1. The design of any road as part of a subdivision shall be in accordance with the following Table 7 for each specific road type.

| ROAD TYPE | MAXIMUM TRAFFIC VOLUME | DESIGN SPEED (Km/hr) | MINIMUM ROAD CARRIAGEWAY WIDTH (m) | MINIMUM VERGE WIDTH EACH SIDE (m) | MINIMUM TOTAL ROAD RESERVE WIDTH(m) |
|---|---|----------------------------|---|---|---|
| Arterial Roads* | >10,000 vehicles / day | 80 | Min.18.5m (including 4m wide central median)* | Min.4.25m with upright kerbing* | Min.27m* |
| Sub-Arterial / Major Collector Roads* | >5,000 up to 10,000 vehicles per day | 60 / 70 | Min.16m (including 4m wide central median)* | 4.25m with upright kerbing* | Min.24.5m* |
| Other Industrial Roads | Up to 5,000 vehicles / day | 50 /60 | Min.12m | 4m with upright kerbing | Min. 20 m |
| Cul-de-sacs | Up to 2,000 vehicles | 50 | Min. 12m | 4m with upright kerbing | Min.20m Min. 28m diameter turning head |

Table 7: Road Type Characteristics & Construction Requirements

Additional Requirements:

- (1) The design and construction for each road type as indicated in the Table above shall also be in accordance with the design requirements contained in Wollongong City Council's "Wollongong Subdivision Code" dated 24 February 2003. Also refer to Council's Subdivision Code for general subdivision design and the construction requirements for roads, stormwater drainage, utility services etc.
- (2) Road carriageways must be widened at bends to allow for wider vehicular travel paths (Austroads Turning Templates)
- (3) The road design should be compatible with the existing road pattern in the locality.
- (4) The minimum spacing of staggered intersections in a local road network should be 20 metres.
- (5) Any subdivision proposal adjoining a rear lane shall be designed so as to provide both vehicular and pedestrian access to the front road.

- (*) Early upfront consultation is recommended with both the NSW Roads & Traffic Authority and Council's Infrastructure Division, in order to determine the exact total road reserve and road carriageway width requirements for arterial and sub-arterial roads.
- 2. A deceleration lane may also be required for development sites fronting a main arterial or subarterial road. This requirement may in certain cases, be based upon advice received from the NSW Roads & Traffic Authority in accordance with provisions of SEPP (Infrastructure) 2007 relating to traffic generating development and / or Council's own traffic generation impact and access arrangement assessments of the proposed development.

Accordingly, applicants are recommended to discuss any proposal for industrial development on an arterial road or sub-arterial road with Council's Infrastructure Division (Traffic & Transport Section) for appropriate advice as to whether a deceleration lane may be required for a particular development.

- 3. Notwithstanding Table 7, Council may permit the provision of car parking areas within the front building line setback area provided to a minimum 5 metre deep dense landscaped area being provided along the front property boundary line for properties abutting an arterial or sub-arterial road, or a minimum 3 metre deep dense landscaped area being provided from the front property boundary line for properties abutting a collector or local road.
- 4. Portico or special entrance features which are integrated into the building and which provide visual interest, may encroach into the front setback by a maximum of 2 metres.
- 5. Side and rear setbacks may be required depending upon the nature of adjoining development and whether the subject site is adjacent to a stormwater drainage system or additional setbacks are required for the provision of satisfactory fire truck access as per the Building Code of Australia and / or the specific requirements of the NSW Fire Brigades including the NSW Fire Brigades Code of Practice – Building Construction – NSWFB Vehicle Requirements. Therefore, applicants are encouraged to discuss this aspect with Council staff, prior to the lodgement of the Development Application.
- 6. A minimum 3 metre side or rear building line sebtback is required for any industrial building abutting a residential zone. The setback distance for an industrial building shall be further increased by an additional one (1) metre for every additional one (1) metre, above 5 metres in the building height. The setback area between the building and the common property boundary is to be appropriately planted with suitable evergreen trees and shrubs which, at maturity, help screen the development from the adjoining residential development. The details of the proposed trees and shrub planting shall be reflected on the required Landscaping Plan and must be consistent with the Landscaping Chapter in Part E of this DCP.

25.1 Road infrastructure construction works

1. Where a subdivision of land fronts an existing public road in poor condition the developer will be required to provide and / or reconstruct kerb and gutter or fully construct the road structure and pavement for the full length of the existing road frontage at full cost to the applicant as per the requirements of Council's Subdivision Code.

26 RESTRICTED ACCESS TO ARTERIAL OR SUB-ARTERIAL ROADS

26.1 General

1. Direct access to any arterial or sub-arterial road will not be permitted where alternate public road access is available. However, direct property access to / from an arterial or sub-arterial road will not be restricted until such time as alternate public road access is available.

26.2 Creation of legal restrictions prohibiting direct access to designated roads (arterial or sub-arterial roads)

1. Council may require as a condition of consent as part of any subdivision or development that a suitable restriction on the use of land be created pursuant to the provisions of Section 88B of the Conveyancing Act 1919, in order to legally prohibit direct access to / from any adjoining Arterial or Sub-Arterial Road where alternative direct public road access is available to / from the subject site.

26.3 Temporary access to designated roads (arterial or sub-arterial roads)

1. Temporary access may be granted to a designated road (arterial or sub-arterial road) where alternate public access has not yet been completed. However, this temporary access arrangement will be dependent upon the nature of the access arrangement in relation to the arterial or sub-arterial road. Additionally, the formal concurrence of the NSW Roads & Traffic Authority may be required.

27 STREET LIGHTING

1. Electric street lighting systems are to be provided for roads and intersections as well as pedestrian crossing and traffic calming device locations in accordance with AS / NZS 1158 Road Lighting as indicated in the following Table 8.

| Road Type | Street Lighting Category (AS 1158) |
|---|--|
| Arterial Roads | V4 |
| Connector Road (>7000 vehicles / day) | P3 |
| Connector Road (<7000 vehicles / day) | P4 |
| Access Road in Business Areas | P3 |
| Access Road | P4 |
| Laneway | P5 |
| Public Pathways & Cycleways | P4 |
| Car parks | P11 |
| Traffic Calming Device (including roundabout) | Horizontal illuminance min. of 3.5 lux |
| Pedestrian Refuge | Horizontal illuminance min. of 3.5 lux |

Table 8: Road Type - Street Lighting Requirements

Note: Category of illumination is defined in AS 1158 Part 1.1 and Part 3.1. All lighting designs are to be prepared in accordance with AS / NZS 1158 for the above specified categories.

28 STRATA SUBDIVISION OF MULTI-UNIT FACTORY / WAREHOUSE DISTRIBUTION CENTRE COMPLEXES

28.1 Development Controls

1. Any strata subdivision of a multi-unit factory or warehouse distribution centre complex shall guarantee that each unit is provided with the appropriate level of car parking as per the car parking requirements contained in this DCP. Any visitor car parking, visitor bicycle parking and / visitor motorcycle parking shall be incorporated in the common area of any strata plan.

tem Attachment

Part D - Locality Based DCPs / Precinct Plans Chapter D13: Wollongong City Centre

Contents

| Contents | | | | | | | | | |
|-----------|---|----------|------|---|-------|--|--|--|--|
| 1 | | 1 | 4.3 | Vehicular driveways and manoeuvring areas | 45 | | | | |
| | City Centre Character Areas | 1 | 4.4 | On-site parking | 46 | | | | |
| | | | 4.5 | Site facilities and services | 47 | | | | |
| 2 | BUILDING FORM | 5 | 5 | ENVIRONMENTAL MANAGEMENT | 49 | | | | |
| 2.1 | General | 5 | 51 | General | 49 | | | | |
| 2.2 | Building to street alignment and street setbacks | 5 | 5.2 | Energy efficiency and conservation | 50 | | | | |
| 2.3 | Street frontage heights in commercial core | | 5.3 | Water conservation | 51 | | | | |
| 2.4 | Building depth and bulk | | 54 | Reflectivity | 52 | | | | |
| 2.5 | Side and rear building setbacks and building separation | 12 | 5.5 | Wind mitigation | 52 | | | | |
| 2.6 | Mixed used buildings | 15 | 5.6 | Waste and recycling | 53 | | | | |
| 2.7 | Deep soil zone | 18 | 0.0 | naoto una rooyonng | 00 | | | | |
| 2.8 | Landscape design | 19 | 6 | GENERAL RESIDENTIAL DEVELOPMENT CONTRO | LS 54 | | | | |
| 2.9 | Green roofs, green walls and planting on structures | 19 | 6.1 | SEPP 65 and Apartment Design Guide | 54 | | | | |
| 2.10 | Sun access planes | 22 | 6.2 | Housing choice and mix | 55 | | | | |
| 2.11 | Development on classified roads | 27 | 6.3 | Dwelling houses | 56 | | | | |
| 3 | PEDESTRIAN AMENITY | 27 | 6.4 | Multi dwelling housing | 56 | | | | |
| 3.1 | General | 27 | 6.5 | Dual occupancy | 57 | | | | |
| 3.2 | Permeability | 28 | 6.6 | Basement Car parks | 57 | | | | |
| 3.3 | Active street frontages | 30 | 6.7 | Communal open space | 58 | | | | |
| 3.4 | Safety and security | 32 | 6.8 | Private open space | 58 | | | | |
| 3.5 | Awnings | 33 | 6.9 | Overshadowing | 59 | | | | |
| 3.6 | Vehicular footpath crossings | 35 | 6.10 | Solar access | 59 | | | | |
| 3.7 | Pedestrian overpasses, underpasses and encroachments | 38 | 6.11 | Natural ventilation | 60 | | | | |
| 3.8 | Building exteriors | 38 | 6.12 | Visual privacy | 61 | | | | |
| 3.9 | Advertising and signage | 40 | 6.13 | Acoustic Privacy | 62 | | | | |
| 3.10 | Views and view corridors | 42 | 6.14 | Storage | 64 | | | | |
| | | | 7 | PLANNING CONTROLS FOR SPECIAL AREAS | 64 | | | | |
| 44 / 1 | AUGESS, FARNING AND SERVICING | 44 | 7.1 | Special areas with heritage items | 65 | | | | |
| 4.1 | Pedestrian access and mobility | 44 45 | 7.2 | Special areas and Development Standards | 68 | | | | |
| 7.3 | Non-residential development in the enterprise corridor zone |
|-----|--|
| 7.4 | Special area design guidelines |
| 7.5 | Design excellence |
| 8 | WORKS IN THE PUBLIC DOMAIN |
| 9 | GLOSSARY / DEFINITIONS |

Figures

| Figure 1.2: Land Zoning Map 4 Figure 2.1: Building lines and street setbacks 7 Figure 2.2: Specific street alignment and street setbacks 8 Figure 2.3: Permissible street frontage heights 9 Figure 2.4: In the Commercial Core buildings are to be built to street alignment with upper level set back 10 Figure 2.5: In residential locations buildings to have landscaped setbacks 11 Figure 2.6: Building bulk controls 12 Figure 2.7: Building depth controls 12 Figure 2.8 (left): Side setbacks for all development in the Commercial Core 15 Figure 2.9: Side setbacks for all development in all zones except in the Commercial Core 16 Figure 2.10: Rear setback for all development in all zones except in the Commercial Core and Mixed Use (city edge) zones 16 Figure 2.13: Communal Public Space with deep soil allows for tree planting and high quality landscape 20 Figure 2.14: Encourage high quality landscape on structures and in internal communal courtyards 20 Figure 2.16: Special building envelope control locations 23 Figure 2.17 (top): Sun access diagram heights contours showing maximum building height above ground 24 Figure 2.18 (bottom) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.19 | Figure 1.1: Map of DCP Area 1 |
|---|--|
| Figure 2.1: Building lines and street setbacks 7 Figure 2.2: Specific street alignment and street setbacks 8 Figure 2.3: Permissible street frontage heights 9 Figure 2.4: In the Commercial Core buildings are to be built to street alignment with upper level set back 10 Figure 2.5: In residential locations buildings to have landscaped setbacks 11 Figure 2.6: Building bulk controls 12 Figure 2.7: Building depth controls 12 Figure 2.8 (left): Side setbacks for all development in the Commercial Core 15 Figure 2.9: Side setbacks for all development in all zones except in the Commercial Core 16 Figure 2.10: Rear setback for all development in all zones except in the Commercial Core 16 Figure 2.11: Separation for multiple buildings on a single site in the Commercial Core and Mixed Use (city edge) zones 17 Figure 2.13: Communal Public Space with deep soil allows for tree planting and high quality landscape 20 Figure 2.15: Planting on root structures and in internal communal courtyards 20 Figure 2.16: Special building envelope control locations 23 Figure 2.17 (top): Sun access diagram heights contours showing maximum building height above ground 24 Figure 2.18 (bottom) Sun access diagram height contours showing maximum building height above ground 25 | Figure 1.2: Land Zoning Map 4 |
| Figure 2.2: Specific street alignment and street setbacks 8 Figure 2.3: Permissible street frontage heights 9 Figure 2.4: In the Commercial Core buildings are to be built to street alignment with upper level set back 10 Figure 2.5: In residential locations buildings to have landscaped setbacks 11 Figure 2.6: Building bulk controls 12 Figure 2.7: Building depth controls 12 Figure 2.8: (left): Side setbacks for all development in the Commercial Core 15 Figure 2.9: Side setbacks for all development in all zones except in the Commercial Core 16 Figure 2.10: Rear setback for all development in all zones except in the Commercial Core 16 Figure 2.11: Separation for multiple buildings on a single site in the Commercial Core and Mixed Use (city edge) zones 17 Figure 2.12: Mixed use buildings 17 Figure 2.13: Communal Public Space with deep soil allows for tree planting and high quality landscape 18 Figure 2.14: Encourage high quality landscape on structures and in internal communal courtyards 20 Figure 2.15: Planting on root structures and terraces creates an interesting outlook from adjacent adjoining buildings 23 Figure 2.17 (top): Sun access diagram heights contours showing maximum building height above ground 24 Figure 2.19: (top) Sun access diagram height contours | Figure 2.1: Building lines and street setbacks7 |
| Figure 2.3: Permissible street frontage heights 9 Figure 2.4: In the Commercial Core buildings are to be built to street alignment with upper level set back 10 Figure 2.5: In residential locations buildings to have landscaped setbacks 11 Figure 2.6: Building bulk controls 12 Figure 2.7: Building depth controls 12 Figure 2.8 (left): Side setbacks for all development in the Commercial Core 15 Figure 2.9: Side setbacks for all development in all zones except in the Commercial Core 16 Figure 2.10: Rear setback for all development in all zones except in the Commercial Core and Mixed Use (city edge) zones 16 Figure 2.12: Mixed use buildings 17 Figure 2.13: Communal Public Space with deep soil allows for tree planting and high quality landscape 17 Figure 2.14: Encourage high quality landscape on structures and in internal communal courtyards 20 Figure 2.15: Planting on root structures and terraces creates an interesting outlook from adjacent adjoining buildings 23 Figure 2.17 (top): Sun access diagram heights contours showing maximum building height above ground 24 Figure 2.19: (top) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.20: (middle) Sun access diagram height contours showing maximum building height above ground 25 <t< td=""><td>Figure 2.2: Specific street alignment and street setbacks 8</td></t<> | Figure 2.2: Specific street alignment and street setbacks 8 |
| Figure 2.4: In the Commercial Core buildings are to be built to street alignment with upper level set back 10 Figure 2.5: In residential locations buildings to have landscaped setbacks 11 Figure 2.6: Building bulk controls 12 Figure 2.7: Building depth controls 12 Figure 2.8: (left): Side setbacks for all development in the Commercial Core 15 Figure 2.9: Side setbacks for all development in all zones except in the Commercial Core 16 Figure 2.10: Rear setback for all development in all zones except in the Commercial Core 16 Figure 2.11: Separation for multiple buildings on a single site in the Commercial Core and Mixed Use (city edge) zones 16 Figure 2.12: Mixed use buildings 17 Figure 2.13: Communal Public Space with deep soil allows for tree planting and high quality landscape 18 Figure 2.14: Encourage high quality landscape on structures and in internal communal courtyards 20 Figure 2.15: Planting on root structures and terraces creates an interesting outlook from adjacent adjoining buildings 24 Figure 2.18 (bottom) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.20: (middle) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.21: (bottom) Sun access diagram height contours showing maximum building height above ground | Figure 2.3: Permissible street frontage heights |
| Figure 2.5: In residential locations buildings to have landscaped setbacks 11 Figure 2.6: Building bulk controls 12 Figure 2.6: Building depth controls 12 Figure 2.7: Building depth controls 12 Figure 2.8: (left): Side setbacks for all development in the Commercial Core 15 Figure 2.9: Side setbacks for all development in all zones except in the Commercial Core 16 Figure 2.10: Rear setback for all development in all zones except in the Commercial Core 16 Figure 2.11: Separation for multiple buildings on a single site in the Commercial Core and Mixed Use (city edge) zones 16 Figure 2.12: Mixed use buildings 17 Figure 2.13: Communal Public Space with deep soil allows for tree planting and high quality landscape 18 Figure 2.14: Encourage high quality landscape on structures and in internal communal courtyards 20 Figure 2.15: Planting on root structures and terraces creates an interesting outlook from adjacent adjoining buildings 23 Figure 2.16: Special building envelope control locations 24 Figure 2.18 (bottom) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.20: (middle) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.21: (bottom) Sun access diagram height contours showing maxi | Figure 2.4: In the Commercial Core buildings are to be built to street alignment with upper level set back |
| Figure 2.6: Building bulk controls 12 Figure 2.7: Building depth controls 12 Figure 2.7: Building depth controls 12 Figure 2.8 (left): Side setbacks for all development in the Commercial Core 15 Figure 2.9: Side setbacks for all development in all zones except in the Commercial Core 16 Figure 2.10: Rear setback for all development in all zones except in the Commercial Core 16 Figure 2.11: Separation for multiple buildings on a single site in the Commercial Core and Mixed Use (city edge) zones 16 Figure 2.12: Mixed use buildings 17 Figure 2.13: Communal Public Space with deep soil allows for tree planting and high quality landscape 18 Figure 2.14: Encourage high quality landscape on structures and in internal communal courtyards 20 Figure 2.15: Planting on root structures and terraces creates an interesting outlook from adjacent adjoining buildings 23 Figure 2.16: Special building envelope control locations 24 Figure 2.18 (bottom) Sun access diagram height contours showing maximum building height above ground 24 Figure 2.20: (middle) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.21: (bottom) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.21: (bottom) Sun access diagram he | Figure 2.5: In residential locations buildings to have landscaped setbacks |
| Figure 2.7: Building depth controls 12 Figure 2.8 (left): Side setbacks for all development in the Commercial Core 15 Figure 2.9: Side setbacks for all development in all zones except in the Commercial Core 16 Figure 2.10: Rear setback for all development in all zones except in the Commercial Core 16 Figure 2.11: Separation for multiple buildings on a single site in the Commercial Core and Mixed Use (city edge) zones 16 Figure 2.12: Mixed use buildings 17 Figure 2.13: Communal Public Space with deep soil allows for tree planting and high quality landscape 18 Figure 2.14: Encourage high quality landscape on structures and in internal communal courtyards 20 Figure 2.15: Planting on root structures and terraces creates an interesting outlook from adjacent adjoining buildings 20 Figure 2.16: Special building envelope control locations 23 Figure 2.17 (top): Sun access diagram heights contours showing maximum building height above ground 24 Figure 2.18 (bottom) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.20: (middle) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.21: (bottom) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.21: (bottom) Sun access diagram height contours showing m | Figure 2.6: Building bulk controls 12 |
| Figure 2.8 (left): Side setbacks for all development in the Commercial Core 15 Figure 2.9: Side setbacks for all development in all zones except in the Commercial Core 16 Figure 2.10: Rear setback for all development in all zones except in the Commercial Core 16 Figure 2.10: Rear setback for all development in all zones except in the Commercial Core 16 Figure 2.11: Separation for multiple buildings on a single site in the Commercial Core and Mixed Use (city edge) zones 16 Figure 2.12: Mixed use buildings 17 Figure 2.13: Communal Public Space with deep soil allows for tree planting and high quality landscape 18 Figure 2.14: Encourage high quality landscape on structures and in internal communal courtyards 20 Figure 2.15: Planting on root structures and terraces creates an interesting outlook from adjacent adjoining buildings 20 Figure 2.17 (top): Sun access diagram heights contours showing maximum heights above ground 24 Figure 2.18 (bottom) Sun access diagram heights contours showing maximum building height above ground 25 Figure 2.20: (middle) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.21: (bottom) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.21: (bottom) Sun access diagram height contours showing maximum building height above ground 25 | Figure 2.7: Building depth controls 12 |
| Figure 2.9: Side setbacks for all development in all zones except in the Commercial Core | Figure 2.8 (left): Side setbacks for all development in the Commercial Core |
| Figure 2.10: Rear setback for all development in all zones except in the Commercial Core 16 Figure 2.11: Separation for multiple buildings on a single site in the Commercial Core and Mixed Use (city edge) zones 16 Figure 2.12: Mixed use buildings 16 Figure 2.12: Mixed use buildings 17 Figure 2.13: Communal Public Space with deep soil allows for tree planting and high quality landscape 17 Figure 2.14: Encourage high quality landscape on structures and in internal communal courtyards 20 Figure 2.15: Planting on root structures and terraces creates an interesting outlook from adjacent adjoining buildings 20 Figure 2.16: Special building envelope control locations 23 Figure 2.17 (top): Sun access diagram heights contours showing maximum heights above ground 24 Figure 2.18 (bottom) Sun access diagram, height contours showing maximum building height above ground 25 Figure 2.20: (middle) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.21: (bottom) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.21: (bottom) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.21: (bottom) Sun access diagram height contours showing maximum building height above ground 25 | Figure 2.9: Side setbacks for all development in all zones except in the Commercial Core |
| Figure 2.11: Separation for multiple buildings on a single site in the Commercial Core and Mixed Use (city edge) zones | Figure 2.10: Rear setback for all development in all zones except in the Commercial Core |
| Figure 2.12: Mixed use buildings | Figure 2.11: Separation for multiple buildings on a single site in the Commercial Core and Mixed Use (city edge) zones |
| Figure 2.13: Communal Public Space with deep soil allows for tree planting and high quality landscape Figure 2.14: Encourage high quality landscape on structures and in internal communal courtyards 20 Figure 2.15: Planting on root structures and terraces creates an interesting outlook from adjacent adjoining buildings 20 Figure 2.16: Special building envelope control locations 21 Figure 2.17 (top): Sun access diagram heights contours showing maximum heights above ground 24 Figure 2.18 (bottom) Sun access diagram height contours 24 Figure 2.19: (top) Sun access diagram heights contours showing maximum building height above ground 25 Figure 2.20: (middle) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.20: (middle) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.21: (bottom) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.21: (bottom) Sun access diagram height contours showing maximum building height above ground | Figure 2.12: Mixed use buildings 17 |
| Figure 2.14: Encourage high quality landscape on structures and in internal communal courtyards 20 Figure 2.15: Planting on root structures and terraces creates an 20 Figure 2.15: Special building envelope control locations 20 Figure 2.16: Special building envelope control locations 23 Figure 2.17 (top): Sun access diagram heights contours showing 24 Figure 2.18 (bottom) Sun access diagram, height contours 24 Figure 2.19: (top) Sun access diagram heights contours showing 24 Figure 2.19: (top) Sun access diagram height contours 24 Figure 2.19: (top) Sun access diagram height contours 24 Figure 2.20: (middle) Sun access diagram height contours 25 Figure 2.20: (middle) Sun access diagram height contours 25 Figure 2.21: (bottom) Sun access diagram height contours 25 Figure 2.22: (middle) Sun access diagram height contours 25 Figure 2.21: (bottom) Sun access diagram height contours 25 Figure 2.21: (bottom) Sun access diagram height contours 25 Figure 2.21: (bottom) Sun access diagram height contours 26 Figure 2.21: (bottom) Sun access diagram height contours 26 Figure 2.21: (bottom) Sun access diagram height contours 26< | Figure 2.13: Communal Public Space with deep soil allows for tree planting and high quality landscape |
| Figure 2.15: Planting on root structures and terraces creates an interesting outlook from adjacent adjoining buildings 20 Figure 2.16: Special building envelope control locations 23 Figure 2.17 (top): Sun access diagram heights contours showing maximum heights above ground 24 Figure 2.18 (bottom) Sun access diagram, height contours showing maximum building heights above ground 24 Figure 2.19 (top) Sun access diagram heights contours showing maximum building height above ground 25 Figure 2.20: (middle) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.21: (bottom) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.21: (bottom) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.21: (bottom) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.21: (bottom) Sun access diagram height contours showing maximum building height above ground 25 Figure 2.21: (bottom) Sun access diagram height contours showing maximum building height above ground 25 | Figure 2.14: Encourage high quality landscape on structures and in internal communal courtyards |
| Figure 2.16: Special building envelope control locations 23 Figure 2.17 (top): Sun access diagram heights contours showing maximum heights above ground | Figure 2.15: Planting on root structures and terraces creates an interesting outlook from adjacent adjoining buildings |
| Figure 2.17 (top): Sun access diagram heights contours showing maximum heights above ground | Figure 2.16: Special building envelope control locations 23 |
| Figure 2.18 (bottom) Sun access diagram, height contours showing maximum building heights above ground | Figure 2.17 (top): Sun access diagram heights contours showing maximum heights above ground |
| Figure 2.19: (top) Sun access diagram heights contours showing maximum building height above ground | Figure 2.18 (bottom) Sun access diagram, height contours showing maximum building heights above ground |
| Figure 2.20: (middle) Sun access diagram height contours showing maximum building height above ground | Figure 2.19: (top) Sun access diagram heights contours showing maximum building height above ground |
| Figure 2.21: (bottom) Sun access diagram height contours showing maximum building height above ground | Figure 2.20: (middle) Sun access diagram height contours showing maximum building height above ground |
| | Figure 2.21: (bottom) Sun access diagram height contours showing maximum building height above ground |

| Figure 2.22: The sun access plane formula diagram |
|---|
| Figure 3.1: Permeability |
| Figure 3.2: Lanes and arcades add to the richness of a city 30 |
| Figure 3.3: Active street frontages promote safe pedestrian environment |
| Figure 3.4: Active street frontages |
| Figure 3.5: Continuous street awnings offer good pedestrian amenity |
| Figure 3.6: Awnings |
| Figure 3.7: Restrictions on vehicular entries |
| Figure 3.8: Driveway crossing dimensions |
| Figure 3.9: Select high quality masonry finishes with accent colours |
| Figure 3.10: Under awning signage |
| Figure 3.11: Signage Zones |
| Figure 3.12: Significant views |
| Figure 6.1: Natural ventilation |
| Figure 7.1: Areas with special control/ principles |
| Figure 7.2: St Michael's Cathedral and square |
| Figure 7.3: West Crown Street shops |
| Figure 7.4: View looking along Market Street to St. Michal's Cathedral |
| Figure 7.5: East Crown Street Shops71 |
| Figure 7.6: Market Square |
| Figure 7.7: Natural Mutual Life Association Building, 1938 in Keira Street |
| Figure 7.8: Enterprise Corridor |

| Document Control Document ID: Wollongong DCP 2009 – D13 Wollongong City Centre | | | | |
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1 INTRODUCTION

The Wollongong City Centre precinct applies to all lands contained within the Wollongong City Centre as shown in Figure 1.1.

This part of the DCP provides the site specific planning requirements for development within the Wollongong City Centre precinct. In the event of any inconsistency between this part of the DCP and any other part of the DCP, the site specific planning requirements in this part of the DCP will prevail.



Figure 1.1: Map of DCP Area

1.1 City Centre Character Areas

- 1. The future character of the Wollongong city centre is set out within the Wollongong City Centre Plan that includes the Vision, Local Environmental Plan, Civic Improvements Plan and this Development Control Plan.
- 2. The character objectives for these land use zones are described below, and the development controls within this DCP aim to develop and reinforce the characteristics of each area, enhance

the vibrancy and activity along streets and provide for sustainable growth within the city centre. See Figure 1.2.

- 3. Commercial Core provides for a wide range of retail, business, office, civic and cultural entertainment and community uses, including tourism and leisure uses, and residential uses within mixed use developments.
- 4. The commercial core is the 'heart of the city', where the focus is on high quality buildings, streetscapes, public art, outdoor eating and a collection of attractive public spaces such as a new forecourt to the railway station, rejuvenated MacCabe Park and Crown Street Mall, new civic square on Crown Street and an attractive collection of laneways and arcades. The primary retail focus is Crown Street Mall. The core retail area along Crown Street is generally characterised by street enclosing buildings forming continuous building facades that provide for an active street frontage to all commercial core streets. Streets are to have continuous awnings to give weather protection to concentrated pedestrian street activity.
- 5. Mixed Use (City Edge) west of the railway station, this area provides for a mixture of compatible land uses to the commercial core, including commercial, retail, cultural, entertainment, tourism, leisure, recreation, social, educational, health and high density residential development.
- 6. The upgrading of the railway station will offer a safe and attractive street environment and railway/bus interchange facility. The scale of new development is to have a transition in scale between the high form at the station to a medium rise to the north and south of Crown Street. Pedestrian activity will focus around the railway station, in Crown Street and along Gladstone Avenue towards the TAFE campus. New development is to have active frontages and continuous awnings to protect pedestrian activity.
- 7. East of Corrinal Street, the Mixed Use (City Edge) provides for a mixture of compatible land uses to the commercial core, including commercial and retail, cultural and entertainment, tourism, leisure and recreation, social, educational, health and higher density residential development. The area is characterised by the relaxed beach character with residential buildings sitting in the landscape with more generous street setbacks. Buildings along Corrinal Street (between Market and Stewart Streets) and Crown Street (nb. northern side, east of Corrinal Street) are to be built to street alignment and have awnings and active street frontages.
- 8. North of Market Street and south of Stewart Street is a transition area between the commercial core and predominately residential areas to the north and south. It allows for high density residential development that can take advantage of views towards the escarpment and the foreshore, with retail and business uses encouraged at ground level along major streets. Building heights allow for view sharing and retention of significant views, with higher buildings located on the lower lying land along Burelli Street.
- 9. Special Activities Hospitals and Medical Research and Development is an area clustered around the Wollongong Hospital and along Crown Street, west of the railway station.
- 10. This area has an excellent potential to become a hub of innovation, education and research in the city centre. The area can be supported by student and nursing staff accommodation, medical centres, doctors' surgeries, specialise rooms and associated uses. The upgrading of the railway station will offer a safe and attractive street environment and railway/bus interchange facility. The scale of new development is to be of a transition scale between the high buildings at the station to medium rise buildings to the north and south of Crown Street.
- 11. Enterprise Corridor will promote business activity along Flinders Street, particularly business uses requiring larger footprint buildings and good vehicular access and exposure. The area will cater also for the complementary business, office, retail and light industrial uses. The importance of Flinders Street (the Princes Highway) as a business address is reinforced by increasing the scale and activation of buildings along the street, with service uses such as parking and goods storage away from street frontages. Residential development incorporated in mixed use developments, is encouraged within walking distance of the North Wollongong rail station and in

areas abutting the general residential zone to the east. The character of the area will be of an attractive city boulevard lined with trees and high quality buildings of medium scale with large showroom windows fronting the street with landscaped setbacks.

- 12. Tourist and Private Recreation this area is largely occupied by existing entertainment and sporting uses (WIN Stadium). The precinct is to be activated by complementary uses that address the street and promote extended use of the area during non-event times. Complementary uses include tourist development, tourist facilities (restaurants, gyms) and convention centres. Improved integration of the area with the city is envisaged, with specific requirements for improved pedestrian linkages between the foreshore and the Mixed Use (City Edge) along Burelli, Stewart and Bank Streets and activation of Crown and Harbour Streets. The future vision for the area will be focusing on the 'city beach' character along the eastern edge of the city centre with alfresco dining and tourist uses facing the beach frontage.
- **13. General Residential** the general residential zone in Wollongong city centre is ideally located within easy walking distance to both the commercial core and the major recreational areas along the foreshore. The topography of the area allows for good view opportunities towards the escarpment and foreshore. Scale and form of new residential development should be compatible with the character of the locality, providing for higher density residential use, local convenience shops and longer stay tourist accommodation in serviced apartments.
- 14. Development controls aim to promote high levels of residential amenity, high quality landscaping and onsite open space provisions, combined with setbacks and building depth controls to ensure that building bulk and scale is compatible with good residential amenity, view sharing and a sustainable living environment.
- **15.** Working Waterfront and Public Recreation the waterfront area encompasses the working waterfront land use zone and those parts of the public recreation zone fronting the foreshore. The area offers recreational activities to the city, neighbouring residential areas and the wider Illawarra community. The natural and historic attributes of the area, including the State significant Belmore Basin Heritage Conservation Area, lighthouse, North Beach and natural features of the foreshore are to be protected commensurate with an increase in tourist and visitor use.
- 16. Scale and bulk of development is to consider the natural topography of the setting, with buildings of small scale, sympathetic to the setting.
- 17. Foreshore improvement works and enhanced community facilities and buildings are planned to improve visitor amenity and provide for a vibrant beachside and maritime environment. Boating and marine activities within the working waterfront zone combined with specialist shops and food outlets are encouraged in this area.





Figure 1.2: Land Zoning Map

2 BUILDING FORM

2.1 General

- 1. Building form and character refers to the individual elements of building design that collectively contribute to the character and appearance of the built environment. The Wollongong City Centre LEP includes provisions for land use, building heights and sun access planes, floor space ratio and design excellence. The development provisions in this section of the DCP on building form are intended to encourage high quality design for new buildings, balancing character of Wollongong with innovation and creativity. The resulting built form and character of new development should contribute to an attractive public domain in central Wollongong and produce a desirable setting for its intended uses.
- 2. The controls in this section aim to:
- a) Establish the scale, dimensions, form and separation of buildings appropriate for the setting in the city centre;
- b) Achieve attractive and sustainable Wollongong city form within the city context;
- c) Provide a strong definition of the public domain;
- Achieve active street frontages with good physical and visual connections between buildings and the street;
- e) Ensure there is consistency in the main street frontages of buildings having a common alignment;
- f) Provide for pedestrian comfort and protection from weather conditions;
- g) Define the public street to provide spaces that are clear in terms of public accessibility and safety, and are easy to maintain;
- Ensure building depth and bulk is appropriate to the environmental setting and landform, allows for view sharing and provides good internal building amenity;
- i) Ensure building separation is adequate to protect amenity, daylight penetration and privacy between adjoining developments;
- j) Encourage mixed use development with residential components that achieve active street fronts and maintain good residential amenity;
- Achieve an articulation and finish of building exteriors that contributes to a high quality and sustainable urban environment; and
- I) Provide for high quality landscape to contribute to the amenity of the city centre and a sustainable urban environment.

2.2 Building to street alignment and street setbacks

2.2.1 General

- Street setbacks and building alignments establish the front building line. They help to create the proportions of the street and can contribute to the public domain by enhancing streetscape character and the continuity of street facades. Street setbacks can also be used to enhance the setting and address for the building. They provide for landscape areas, entries to ground floor apartments and deep soil zones. Street setbacks are measured from the street boundary to the outside face of the external wall of the building.
- 2. In the commercial core, buildings are to be built up to the street alignment to reinforce the urban character and improve pedestrian amenity and activity at street level. Above street frontage height, tall buildings are to be set back to provide for sunlight to streets, and daylight to pedestrian areas and lower levels of other buildings. They offer comfortable wind conditions,

view corridors, an appropriate building scale for pedestrians, and good growing conditions for street trees. In the residential locations and some Mixed Use (City Edge) locations, buildings are to be setback to a consistent building line.

3. The definition of "building line or setback" is provided in the Wollongong City Centre LEP 2007.

2.2.2 **Objectives**

- To provide a hierarchy of street edges from commercial core with no street setbacks to residential a) locations with landscaped setbacks.
- To establish the desired spatial proportions of the street and define the street edge. b)
- c) To increase a clear transition between public and private space.
- d) To locate active uses, such as shopfronts, closer to pedestrian activity areas.
- To assist in achieving visual privacy to apartments from the street. e)
- ment f) To create good quality entry spaces to lobbies, foyers or individual dwelling entrances.
- To allow an outlook to, and surveillance of, the street. g)
- h) To allow for street landscape character, where appropriate.
- i) To maintain shared views to the ocean.
- To maintain sun access to the public domain. i)

2.2.3 **Development Controls**

Street building alignment and setbacks are specified in Figure 2.1 and Figure 2.2 and, in the following table. These street building lines and setbacks also apply to basement portions of buildings. a) buildings.

Table 2.1: Street building alignments and setbacks

| Zone | Building line or setback from street alignment | |
|-----------------------|--|--|
| | | |
| Commercial Core | Build to the street alignment or specified setback with 4m minimum further setback above street frontage height. | |
| Mixed Use (City Edge) | Build to 3m from the street alignment. Except in Crown Street (nb. northern side only east of Corrimal Street) and Corrimal Street (between Market and Stewart Streets), where building frontage is to be built to street alignment. A 10.36m setback applies in Corrimal Street between Market and Smith Streets. | |
| General Residential | 4m minimum setback. Except in Bourke Street between Kembla and Cliff Road where building frontage is to be built to street alignment. Except in Corrimal Street north of Market Street, and Kembla Street north of Corrimal Street to George Hanley Drive, where a 10.36m setback applies. | |
| Enterprise Corridor | 4m minimum setback in Flinders Street. Except in Station Street where building frontage is to be built to street alignment. | |

Special Activities:

4m minimum setback for development.

Hospitals & Medical

Research & Development

- b) Notwithstanding the above, development is to meet the street building line and setback for specific streets as shown in Figure 2.2.
- c) Balconies may project up to 600 mm into front building setbacks, provided the cumulative width of all balconies at that particular level totals no more than 50% of the horizontal width of the building façade, measured at that level. Balconies are not permitted to encroach above the public road reserve.
- d) Minor projections into front building lines and setbacks for sun shading devices, entry awnings and cornices are permissible (see also Building Exteriors at 3.7)
- e) The Commercial Core, Mixed Use (city edge) and Enterprise Corridor zones are subject to a requirement for corner properties to provide a 6m x 6m corner splay.





Figure 2.2: Specific street alignment and street setbacks

2.3 Street frontage heights in commercial core

2.3.1 General

- 1. Buildings built to the street alignment and with a height to street width ratio of approximately 1:1 give a sense of enclosure to the street that is appropriate for a city centre. In Wollongong, streets in the Commercial Core are generally 20 metres wide, generating a preferred street front height of between 12m and 24m, subject to context and sun access requirements.
- 2. Controls setting street front heights apply within the commercial core where buildings are to be built to the street alignment.

2.3.2 Objectives

8

- a) To achieve comfortable street environments for pedestrians in terms of daylight, scale, sense of enclosure and wind mitigation as well as a healthy environment for street trees.
- b) To reinforce the intrinsic character of Wollongong City Centre while enabling flexibility in building design.
- c) To enhance the distinctive character of Special Areas with compatible development.

d) To protect solar access to key streets and public spaces.

2.3.3 Development Controls

The street frontage height of buildings in the Commercial Core are not to be less than 12m or greater than 24m above mean ground level on the street front as shown in Figure 2.3.

Notwithstanding the above, the street front height of new buildings are to be consistent with the sun access controls in Clause 2.9.



2.4 Building depth and bulk

2.4.1 General

- Wollongong features a temperate climate and pleasant outdoor conditions for much of the year. Controlling the size of upper level floor plates in new buildings allows for good internal amenity access to natural light and ventilation and mitigates potential adverse effects that tall and bulky buildings may have on the public domain.
- 2. Building depth is related to building use. Typically, mixed use buildings have larger commercial floor plates combined with smaller residential floors. The following controls are therefore classified into residential or commercial at the detail level.



Figure 2.4: In the Commercial Core buildings are to be built to street alignment with upper level set back

2.4.2 Objectives

- a) To promote the design and development of sustainable buildings.
- b) To achieve the development of living and working environments with good internal amenity and minimise the need for artificial heating, cooling and lighting.
- c) To provide viable and useable commercial floor space.
- d) To achieve usable and pleasant streets and public domain at ground level by controlling the size of upper level floor plates of buildings.
- e) To achieve a city skyline sympathetic to the topography and context.
- f) To allow for view sharing and view corridors.
- g) To reduce the apparent bulk and scale of buildings by breaking up expanses of building wall with modulation of form and articulation of facades.

-shment 1



Figure 2.5: In residential locations buildings to have landscaped setbacks

2.4.3 Development Controls

 a) The maximum floorplate sizes and depth of buildings are specified in Figures 2.6 and 2.7, and in the following table (which does not apply to building frontages up to the street front height in the commercial core):

| Building use | Maximum floor | Maximum |
|---|---------------------------------------|----------------------|
| | plate size | building depth |
| | (gross floor area) | (excludes balconies) |
| Non-residential | 1,200m ² | |
| Commercial Core | above 24m height | 25m |
| Residential and serviced apartments in Commercial Core | 900m ² above 24m height | 18m |
| Residential and serviced apartments outside the Commercial Core | 900m ² above 12m height | 18m |

b) At street frontage height levels, and where development is built from street edge to street edge, articulate buildings using atria, light wells and courtyards to improve internal building amenity and achieve substantial daylighting at every level, and cross ventilation and/or stack effect ventilation.

c) All points on an office floor should be no more than 10m from a source of daylight (eg. window, lightwell or skylight) in buildings less than 24m in height, and no more than 12.5m from a window in buildings over 24m in height.



2.5 Side and rear building setbacks and building separation

2.5.1 General

- 1. Side and rear setbacks, where provided, allow ventilation, daylight access and view sharing, increase privacy, and reduce adverse wind effects. Building separation increases in proportion to building height to ensure appropriate urban form, amenity and privacy for building occupants. In residential buildings and serviced apartments, separation between windows on side and rear facades and other buildings is particularly important for privacy, acoustic amenity and view sharing. Setbacks for residential development in the Commercial Core are different to other zones to reflect the different settings and forms of buildings in the different zones.
- 2. For commercial buildings, separation distances are smaller due to the reduced requirement for privacy, noise and daylight access.
- 3. Separation for Mixed Use buildings containing residential and commercial uses is to be in accordance with specified distances for each component use.

4. The definition of "building line or setback" is provided in the Wollongong City Centre LEP 2009.

2.5.2 Objectives

- a) To ensure an appropriate level of amenity for building occupants in terms of daylight, outlook, view sharing, ventilation, wind mitigation, and privacy.
- b) To achieve usable and pleasant streets and public domain areas in terms of wind mitigation and daylight access.

2.5.3 **Development Controls**

Note: For the purpose of this section, **commercial buildings** means all non-residential buildings (including hotel accommodation, but not serviced apartments). **Principal windows and balconies** means the main window of a living room or main bedroom, or the edge of primary balcony of a dwelling.

- a) The minimum building setbacks from the side and rear property boundaries are specified in Figures 2.8 to 2.11, and in the following table:
- b) For multiple buildings on the same site in the Commercial Core and Mixed Use (city edge) zones, minimum separation distances are shown in Figure 2.12.
- c) In mixed use buildings, setbacks for the residential component are to be the distances specified above for residential development in the specified zone.
- d) If the specified setback distances cannot be achieved when an existing building is being refurbished or converted to another use, appropriate visual privacy levels are to be achieved through other means, for example, the construction of screens. These will be assessed on merit by the consent authority.
- e) In certain circumstances, Council may consider a variation to the side and rear setback requirements through appropriate architectural features (eg splayed windows which achieve oblique outlooks) provided that:
 - i) A minimum separation between the main walls of 6 metres is maintained,
 - ii) Separation is between sections of building walls that include only service room windows,
 - iii) Views are available obliquely to site boundaries; and
 - iv) Privacy screens are provided to all balconies and windows for all units / suites along the building facade.

| Zone | Building condition | Minimum | Minimum |
|--------------------|---|--------------|--------------|
| | | side setback | rear setback |
| Commercial Core | Up to street frontage heights | 0m | 0m |
| | Residential uses (habitable rooms) between street frontage height and 45m | 12m | 12m |
| | All uses (including non-habitable residential) between street frontage height and 45m | 6m | 6m |
| | All uses above 45m | 14m | 14m |
| All other zones | Residential uses up to 12m in height | | |
| | - habitable rooms with openings and balconies | 6m | 6m |
| | - non-habitable rooms and habitable rooms | 3m | 4.5m |
| | without openings | 2 | • |
| | Residential uses between 12m & 24m | ^C | |
| | - habitable rooms with openings and balconies | 9m | 9m |
| | -non-habitable rooms and habitable rooms without openings | 4.5m | 4.5m |
| | Residential uses above 24m | | |
| | - habitable rooms with openings and balconies and up to 45m | 12m | 12m |
| | - non-habitable rooms and habitable rooms without openings | 6m | 6m |
| | All residential uses above 45m | 14m | 14m |
| | Commercial uses up to 24m | 3m | 9m |
| | Commercial uses above 24m | 6m | 12m |

Wollongong Development Control Plan 2009



2.6.1 General

- 1. Mixed-use developments provide for a variety of uses and activities within city centres, encouraging use of the city outside the working day, adding vibrancy and life to the city streets. Different uses within the same building are best located to a pattern and layout suitable to the mix of uses, with retail and business activity at ground level to assist street activation and residential uses, requiring privacy and noise mitigation, located above street level (see Figure 2.13).
- 2. Mixed use development within the city centre is preferred in sustainable locations, close to transport (rail station), and recreational areas (foreshore).

2.6.2 Objectives

- a) To encourage a variety of mixed-use developments in the city centre.
- b) To create lively streets and public spaces in the city centre
- c) To increase the diversity and range of shopping and recreational activities for workers, residents and visitors.
- d) To enhance public safety by increasing activity in the public domain on week nights and on weekends.
- e) To minimise potential conflicts and achieve compatibility between different uses.
- f) To minimise conflicts between permitted land use and heritage buildings.
- g) To ensure that the design of mixed-use buildings addresses residential amenity.
- h) To create separate, legible and safe access and circulation in mixed use buildings.
- i) To ensure that mixed use buildings address the public domain and the street.



Figure 2.10: Rear setback for all development in all zones except in the Commercial Core



Figure 2.11: Separation for multiple buildings on a single site in the Commercial Core and Mixed Use (city edge) zones

2.6.3 **Development Controls**

- a) Provide flexible building layouts which allow variable tenancies or uses on the first two floors of a building above the ground floor.
- b) Minimum floor to ceiling heights are 3.3 metres for commercial office and 3.6 metres for active public uses, such as retail and restaurants in the B3 Commercial Core zone. In the B4 Mixed Use zone, the ground floor and first levels of a building shall incorporate a minimum 3 metre floor to ceiling height clearance, to maximise the flexibility in the future use of the building.
- c) Separate commercial service requirements, such as loading docks, from residential access, servicing needs and primary outlook.
- d) Locate clearly demarcated residential entries directly from the public street.
- e) Clearly separate and distinguish commercial and residential entries and vertical circulation.
- f) Provide security access controls to all entrances into private areas, including car parks and internal courtyards.
- g) Provide safe pedestrian routes through the site, where required.
- h) Front buildings onto major streets with active uses.
- i) Avoid the use of blank building walls at the ground level.
- j) For mixed use buildings that include food and drink premises uses, the location of kitchen ventilation systems shall be indicated on plans and situated to avoid amenity impacts to residents.



Figure 2.12: Mixed use buildings

2.7 Deep soil zone

2.7.1 General

- 1. Deep soil zones are areas of natural ground retained within a development, uninhibited by artificial structures and with relatively natural soil profiles. Deep soil zones have important environmental benefits, including:
- (a) Promoting healthy growth of large trees with large canopies,
- (b) Protecting existing mature trees, and
- (c) Allowing infiltration of rainwater to the water table and reduction of stormwater runoff.

2.7.2 Objectives

- a) To provide an area on sites that enables soft landscaping and deep soil planting, permitting the retention and/or planting of trees that will grow to a large or medium size.
- b) To limit building bulk on a site and improve the amenity of developments, allowing for good daylight access, ventilation, and improved visual privacy.
- c) To provide passive and active recreational opportunities.

2.7.3 Development Controls

- a) All residential developments must include a deep soil zone (See Figure 2.14).
- b) The deep soil zone shall comprise no less than 15% of the total site area preferably provided in one continuous block and shall have a minimum dimension (width or length) of 6 metres.
- c) For residential components in mixed use developments in the Commercial Core, Mixed Use (city edge) and Enterprise zones, the amount of deep soil zone may be reduced commensurate with the extent of non-residential uses. Where non-residential components result in full site coverage and there is no capacity for water infiltration, the deep soil component must be provided on structure, in accordance with the provisions of Section 2.8 and 2.9. In such cases, compensatory stormwater management measures must be integrated within the development to minimise stormwater runoff.
- d) Where deep soil zones are provided, they must accommodate existing mature trees as well as allowing for the planting of trees/shrubs that will grow to be mature trees.
- e) No structures, works or excavations that may restrict vegetation growth are permitted in this zone (including but not limited to basements, car parking, hard paving, patios, decks and drying areas).



Figure 2.13: Communal Public Space with deep soil allows for tree planting and high quality landscape

Comment [RC1]: Add tree planting clause

2.8 Landscape design

2.8.1 General

 Landscape design includes the planning, design, construction and maintenance of all utility, open space and garden areas. Good landscaping provides breathing space, passive and active recreational opportunities and enhances air quality in city centres. It is fundamental to the amenity and quality of outside space for residential flats and multi-dwelling housing.

2.8.2 Objectives

- a) To ensure landscaping is integrated into the design of development.
- b) To add value and quality of life for residents and occupants within a development in terms of privacy, outlook, views and recreational opportunities.
- c) To improve stormwater quality and control run-off.
- d) To improve the microclimate and solar performance within the development.
- e) To improve urban air quality and contribute to biodiversity.

2.8.3 **Development Controls**

- a) The following documents must be considered for site planning and landscape design:
 - i) Chapter E6 Landscaping in the DCP.
 - ii) Wollongong City Centre Public Domain Technical Manual. (Appendix 2 to this DCP).
- b) Remnant vegetation must be maintained throughout the site wherever practicable, particularly significant trees.
- c) A long-term landscape management plan must be provided for all landscaped areas, in particular the deep soil landscape zone.
- d) The plan must outline how landscaped areas are to be maintained for the life of the development.
- e) Chapter E17 Preservation and Management of Trees and Other Vegetation in this DCP provides for the protection of all trees with a girth greater than 200mm or a height over three metres, or a spread over three metres.

2.9 **Green roofs, green walls and planting on structures**

2.9.1 General

 The following controls apply in the Commercial Core, Mixed Use (city edge) and Enterprise zones for planting on roof tops or over car park structures, particularly for communal open space required as a component of mixed use residential development, and in non-residential developments where the landscaping proposed is not on natural ground e.g. green roofs and walls, podiums, rooftop gardens (Figures 2.15 and 2.16).

2.9.2 Objectives

- a) To contribute to the quality and amenity of open space on roof tops and internal courtyards.
- b) To encourage the establishment and healthy growth of trees in urban areas.
- c) To encourage the use of green walls and roofs in communal open space, and to enhance the environmental performance of the development.



Figure 2.14: Encourage high quality landscape on structures and in internal communal courtyards



Figure 2.15: Planting on root structures and terraces creates an interesting outlook from adjacent adjoining buildings

2.9.3 Development Controls

- a) Design for optimum conditions for plant growth by:
 - i) Providing soil depth, soil volume and soil area appropriate to the size of the plants to be established,
 - ii) Providing appropriate soil conditions and irrigation methods, and
 - iii) Providing appropriate drainage.
- b) Design planters to support the appropriate soil depth and plant selection by:
 - i) Ensuring planter proportions accommodate the largest volume of soil possible and soil depths to ensure tree growth, and
 - ii) Providing square or rectangular planting areas rather than narrow linear areas.
- c) Increase minimum soil depths in accordance with:

- i) The mix of plants in a planter for example where trees are planted in association with shrubs, groundcovers and grass,
- ii) The level of landscape management, particularly the frequency of irrigation,
- iii) Anchorage requirements of large and medium trees, and
- iv) Soil type and quality.
- d) Provide sufficient soil depth and area to allow for plant establishment and growth. The following minimum standards are recommended:

| Plant type | Definition | Soil volume | Soil Depth | Soil area |
|--------------|--|-------------------------------------|--------------------------------------|--|
| Large trees | 12-18m high, up to 16m crown spread at maturity | <mark>150m³</mark> | 1,200mm | 10m x 10m or equivalent |
| Medium trees | 8-12m high, up to 16m crown spread at maturity | 36m ³ 35m2 | 1,000mm | 6 x 6m or equivalent |
| Small trees | <mark>6-8m high, up to 16m crown spread at maturity</mark> | 16m³ 9m2 | 800mm | <mark>4 x 4m-3.5m x 3.5m or equivalent</mark> |
| Shrubs | | | 500-600mm | |
| Ground cover | | X | <mark>300-450mm</mark> | |
| Turf | | | <mark>300 <mark>200</mark> mm</mark> | |

/inimum soil standards for planting on structures or podiums

*Sub-surface drainage requirements are in addition to the above minimum soil depths

| Plant type | Min soil depth | Min soil volume | |
|----------------------------|------------------|---------------------|--|
| | | | |
| Large trees | .0, | | |
| (over 8m high) | 1.3m | 150 cu m | |
| Medium trees | • | | |
| (2m to 8m high) | 1.0m | 35 cu m | |
| Small trees | | | |
| (up to 2m high) | 800mm | 9 cu m | |
| Shrubs and | | | |
| ground cover | 500mm | n/a | |

2.10 Sun access planes

Sun access planes establish building heights around the following parks and community places:

MacCabe Park on 21 June from 12 noon to 2pm.

Civic Square on 21 June from 11am to 3pm.

Market Square on 21 June from 12 noon to 2pm.

Pioneer Park on 21 June from 12 noon to 2pm.

2.10.1 Sun Access Diagrams

The sun access diagrams show building height contours that will achieve well scaled buildings enclosing these key public spaces with building frontage heights and setbacks required to protect sun access.

The sun access diagrams also provide controls for an appropriate transition of building heights from the street frontage height to the maximum development height permissible in the LEP by controlling the number of setbacks.

2.10.2 Objectives

- a) To allow sunlight access to significant public spaces in the city centre.
- b) To provide for an appropriate transition in building heights from key public spaces
- c) To provide well scaled enclosure to the significant public spaces.

2.10.3 Development Controls

a) Refer to Figure 2.17 and sun access diagrams in Figures 2.18 to 2.22 for relevant height and setback controls for development adjacent to key public spaces.

2.10.4 Sun Access Planes

The height contours are based on sun access planes for mid winter.

A sun access plane projects above land shown as affected by the plan on the Sun Plane Protection Map and is located by applying the following formula:

 $H = V + (D x \tan a)$

Where:

'H' is the height, measured in metres, of a point in a sun access plan.

'V' is the height, specified for this factor in the sun access planes table and measured in metres above ground level, at the part of the street alignment specified in the sun access planes table for the relevant sun access plane.

'D' is the horizontal distance, from that part of the street alignment to the point in the sun access plane, measured in metres away from the relevant park or community place along the horizontal bearing measured from true north, specified in the sun access planes table for the relevant sun access plane.

'a' is the vertical angle in degrees, specified for this factor in the sun access planes table, corresponding to the horizontal bearing for the relevant sun access plane.





Figure 2.16: Special building envelope control locations



Figure 2.17 (top): Sun access diagram heights contours showing maximum heights above ground

Figure 2.18 (bottom) Sun access diagram, height contours showing maximum building heights above ground

Part D –Locality Based DCPs / Precinct Plans Chapter D13: Wollongong City Centre



Figure 2.19: (top) Sun access diagram heights contours showing maximum building height above ground Figure 2.20: (middle) Sun access diagram height contours showing maximum building height above ground Figure 2.21: (bottom) Sun access diagram height contours showing maximum building height above ground

Table 2.2: Sun access planes

| Park or | Time | Horizontal | Vertical angle Vertical height above | Vertical height above ground |
|------------------|-----------|--|--------------------------------------|---|
| place | (21 June) | Bearing | (degrees) (a) | alignment |
| | | (degrees) | (metres) (v) | |
| MacCabe | 12 noon | 359.30 | 32.08 | 16m on the northern alignment |
| | 2pm | 329.02 | 25.18 | Street and Church Street 20m on the western alignment of Keira Street between Ellen Street and Burelli Street. |
| Civic Square | 11am | 15.30 | 30.30 | 12m on the northern alignment of Crown Street. |
| | 3pm | 316.37 | 17.49 | |
| Market Square | 12 noon | 359.30 | 30.08 | 12m on the northern and western alignment of Market |
| | 2pm | 329.02 | 25.18 | Place. |
| Pioneer Park | 12 noon | 359.30 | 32.08 | 16m on the northern boundary of the park. |
| | 2pm | 329.02 | 25.18 | |
| | | The following diagrams illust Formula H = V +(D × Tan a) Horizontal line measured in degrees from True North Horizontal bearing (degrees). Plan | trate how the formula applies: | At C |

Vertical height (in metres) above ground level (Australian Height Daturn) and for the alignment spin of the rest site in table (V)

Note: The sun access plane formula calculates the height to a point on the sun access plane from a point horizontal with ground level at the street alignment. For sites with ground levels different to the street alignment, the difference should be taken into account by the user to determine the height of a point in the sun access plane vertically above ground. Refer to DCP sun access diagrams in Clause 2.9 for confirmation of building heights at the street or park edge and for appropriate setbacks.

Figure 2.22: The sun access plane formula diagram

2.11 Development on classified roads

2.11.1 Objectives

- a) To ensure that new development does not compromise the effective and ongoing operation and function of classified roads; and
- b) To prevent or reduce the potential impact of traffic noise and vehicle emission on development adjacent to classified roads.

2.11.2 Development Controls

- a) Consent must not be granted to the development of land that has a frontage to a classified road unless the consent authority is satisfied that:
- b) Where practicable, vehicular access to the land is provided by a road other than the classified road; and
- c) The safety, efficiency and ongoing operation of the classified road will not be adversely affected by the proposed development as a result of:
 - i) The design of the vehicular access to the land, or
 - ii) The emission of smoke or dust from the proposed development, or
 - iii) The nature, volume or frequency of vehicles using the classified road to gain access to the land, and
- d) The development is of a type that is not sensitive to traffic noise or vehicle emissions, or is appropriately located and designed, or includes measures, to ameliorate potential traffic noise or vehicle emissions within the site of the proposed development.

3 PEDESTRIAN AMENITY

3.1 General

Pedestrian amenity incorporates all those elements of individual developments that directly affect the quality and character of the public domain. The pedestrian amenity provisions are intended to achieve a high quality of urban design and pedestrian comfort in the public spaces of the city centre. The pedestrian environment provides people with their primary experience of and interface with the city. This environment needs to be safe, functional and accessible to all. It should provide a wide variety of opportunities for social and cultural activities. The pedestrian environment is to be characterised by excellence of design, high quality materials and a standard of finish appropriate to a regional city centre. The city's lanes, arcades and through site links should form an integrated pedestrian network providing choice of routes at ground level for pedestrians.

The controls in this section aim to increase the vitality, safety, security and amenity of streets, laneways, arcades and through site links by:

Encouraging future through site links,

Ensuring provision of awnings along the Commercial Core street frontages and Crown Street in Mixed Use (city edge),

Protecting significant views and vistas along streets, and

Mitigating adverse impacts on the street arising from driveway access crossings, advertising signage and selection of building finishes and materials.

3.2 Permeability

Through site links provide access connections between the long sides of street blocks for pedestrian and vehicular access at street level. These links provide an important function in the form of lanes, shared zones, arcades and pedestrian ways.

3.2.1 Objectives

- a) To improve access in the city centre by providing through site links as redevelopment occurs.
- b) To ensure that through site links have active frontages along their length where possible.
- c) To provide for pedestrian amenity and safety.
- d) To encourage removal of vehicular entries from primary street frontages.
- e) To retain and develop lanes as useful and interesting pedestrian connections as well as for service access.

3.2.2 Development Controls

- a) Through site links, arcades, shared ways and laneways are to be provided as shown in Figure 3.1.
- b) Where possible, existing dead end lanes are to be extended through to the next street as redevelopment occurs.
- c) New through site links should be connected with existing and proposed through block lanes, shared zones, arcades and pedestrian ways and opposite other through site links.
- d) Existing publicly and privately owned lanes are to be retained.
- e) The design and finish of new through site links need to be provided in accordance with Council's City Centre Public Domain Manual.

3.2.3 Pedestrian Links

Through site links (arcades) for pedestrians are to be provided as shown in Figure 3.1, and:

- a) Have active frontages,
- b) Be clear and direct throughways for pedestrians,
- c) Provide public access at all business trading times or as otherwise stipulated by Council's conditions of approval,
- d) Have a minimum width of 4m non-leasable space clear of all obstructions (including columns, stairs and escalators),
- e) Where practicable, have access to natural light for at least 30% of their length,
- f) Where air conditioned, have clear glazed entry doors comprising at least 50% of the entrance, and
- g) Have signage at street entries indicating public accessibility and the street to which the through site link connects.



Internal arcades will not be approved in preference to activation of an existing or required lane. Where developments front a lane that is also a pedestrian route, provide an active frontage and design details that create visual interest such as landscaping, awnings, paved finishes and good lighting.

3.2.4 Lanes

- a) New through site laneways for pedestrians and vehicles are to be provided as indicated in Figure 3.1.
- b) Lanes are to:
 - i) have active frontages,

- ii) be clear and direct throughways for pedestrians,
- iii) provide public access at all times or as otherwise stipulated by Council's conditions of approval,
- iv) have a minimum width of 6m clear of all obstructions, and
- v) have signage indicating public accessibility and the street to which the lane connects.
- c) Where lanes are primarily used for building access and servicing, 'safer by design' principles must be demonstrated (refer to Section 3.3).



Figure 3.2: Lanes and arcades add to the richness of a city

3.3 Active street frontages

Active street frontages promote an interesting and safe pedestrian environment. Busy pedestrian areas and non-residential uses such as shops, studios, offices, cafes, recreation and promenade opportunities promote the most active street fronts (Figure 3.3).

Residential buildings can also activate the street by providing a clear street address, direct access from the street and direct outlook over the street.

3.3.1 Objectives

- a) To promote pedestrian activity and safety in the public domain.
- b) To maximise active street fronts in Wollongong city centre.
- c) To define areas where active streets are required or are desirable.

Active frontage uses are defined as one or a combination of the following at street level:

Entrance to retail.

Shop front.

Glazed entries to commercial and residential lobbies occupying less than 50% of the street frontage, to a maximum of 12 metres frontage.

Café or restaurant if accompanied by an entry from the street.

Active office uses, such as reception, if visible from the street.

Public building if accompanied by an entry.



Figure 3.3: Active street frontages promote safe pedestrian environment

3.3.2 Development Controls

- a) In commercial and mixed use development, active street fronts are encouraged in the form of nonresidential uses on ground level.
- b) Active street fronts in the form of non-residential uses on ground level are required along streets, lanes and through site links shown in Figure 3.4 for all buildings in the Commercial Core and Tourist zones, and for mixed use buildings in the Mixed Use (city edge) and Enterprise zones.
- c) Active ground floor uses are to be at the same general level as the footpath and be accessible directly from the street.
- d) For all non-residential ground floor frontages outside the streets shown in Figure 3.4, provide clear glazing where ever possible to promote passive surveillance and contribute to street activity.
- e) Restaurants, cafes and the like are to consider providing openable shop fronts.
- f) Residential developments are to provide a clear street address and direct pedestrian access off the primary street front, and allow for residents to overlook all surrounding streets.
- g) Provide multiple entrances for large developments including an entrance on each street frontage.



A safe and secure environment encourages activity, vitality and viability, enabling a greater level of security. Planning and design can identify and address safety and security issues through the use of environmental and technical measures.

3.4.1 Objectives

3.4

- Address safety, security and crime prevention requirements in the planning and design of development (including the NSW Police 'Safer by Design' crime prevention through environmental design (CPTED) principles).
- b) Reduce opportunities for crime through environmental design and the provision of natural and technical surveillance opportunities.
- c) Control access through the provision of physical or implied barriers which can be used to attract, channel or restrict the movement of people.
- d) Implement territorial reinforcement by encouraging community ownership of public space.
- e) Promote space management by ensuring that public open space is effectively utilised and maintained.

3.4.2 Development Controls

- a) Ensure that the building design allows for casual surveillance of accessways, entries and driveways.
- b) Avoid creating blind corners and dark alcoves that provide concealment opportunities in pathways, stairwells, hallways and carparks.
- c) Provide entrances which are in visually prominent positions and which are easily identifiable, with visible numbering.
- d) Where private open space is located within the front building alignment any front fencing must be of a design and/or height which allows for passive surveillance of the street.
- Provide adequate lighting of all pedestrian access ways, parking areas and building entries. Such lighting should be on a timer or movement detector to reduce energy consumption and glare nuisance.
- f) Provide clear lines of sight and well-lit routes throughout the development.
- g) Where a pedestrian pathway is provided from the street, allow for casual surveillance of the pathway.
- For large scale retail and commercial development with a GFA of over 5,000m², provide a safety by design' assessment in accordance with the CPTED principles.
- i) Provide security access controls where appropriate.
- j) Ensure building entrance(s) including pathways, lanes and arcades for larger scale retail and commercial developments are directed to signalised intersections rather than mid-block in the Commercial zone, Mixed Use (city edge) and Enterprise Corridor zones.



Figure 3.5: Continuous street awnings offer good pedestrian amenity



3.5 Awnings

Awnings increase the useability and amenity of public footpaths by protecting pedestrians from sun and rain. They encourage pedestrian activity along streets and in conjunction with active edges such as retail frontages, support and enhance the vitality of the local area. Awnings, like building entries, provide a public presence and interface within the public domain and contribute to the identity of a development.

3.5.1 Objectives

- a) To provide shelter for public streets where most pedestrian activity occurs.
- b) To address the streetscape by providing a consistent street frontage in the city centre.

3.5.2 Development Controls

- a) Continuous street frontage awnings are to be provided for all new developments as indicated in Figure 3.6.
- b) Awning design must match building facades and be complementary to those of adjoining buildings.
- c) Wrap awnings around corners for a minimum six metres from where a building is sited on a street corner.
- d) Awnings dimensions should generally be:
 - i) Minimum soffit height of 3.3 metres,
 - ii) Low profile, with slim vertical facias or eaves (generally not to exceed 300mm height),
 - iii) Setback a minimum of 1.2 metres from the kerb, and
 - iv) Generally minimum 2.4 metres deep.
- e) To control sun access/protection, canvas blinds along the street edge may be permitted, subject to design merit and assessment.
- f) Signage on blinds is not permitted.
- g) Provide under awning lighting to facilitate night use and to improve public safety



Figure 3.6: Awnings

3.6 Vehicular footpath crossings

Vehicle crossings over footpaths disrupt pedestrian movement and threaten safety. The design of vehicle access to buildings also influences the quality of the public domain. Overly wide and high vehicle access points detract from the streetscape and the active use of street frontages.

The design and location of vehicle access to developments should minimise both conflicts between pedestrians and vehicles on footpaths, particularly along pedestrian priority places, and visual intrusion and disruption of streetscape continuity.

Design of driveways and vehicle access is to be in accordance with the provision of section 4.2.

3.6.1 Objectives

- a) To make vehicle access to buildings more compatible with pedestrian movements and the public domain.
- b) To ensure vehicle entry points are integrated into building design and contribute to high quality architecture.
3.6.2 Development Controls

Location of Vehicle Access

- a) No additional vehicle entry points will be permitted into the parking or service areas of development along those streets identified as significant pedestrian circulation routes in Figure 3.7.
- b) In all other areas, one vehicle access point only (including the access for service vehicles and parking for non-residential uses within mixed use developments) will be generally permitted.
- c) Where practicable, vehicle access is to be from lanes and minor streets rather than primary street fronts or streets with major pedestrian and cyclist activity.
- d) Where practicable, adjoining buildings are to share or amalgamate vehicle access points. Internal on-site signal equipment is to be used to allow shared access. Where appropriate, new buildings should provide vehicle access points so that they are capable of shared access at a later date.
- e) Vehicle access may not be required or may be denied to some heritage buildings.



Figure 3.7: Restrictions on vehicular entries

Design of Vehicle Access

- a) Wherever practicable, vehicle access is to be a single lane crossing with a maximum width of 2.7 metres over the footpath, and perpendicular to the kerb alignment. In exceptional circumstances, a double lane crossing with a maximum width of 5.4 metres may be permitted for safety reasons (refer Figure 3.8).
- b) Vehicle access ramps parallel to the street frontage will not be permitted.
- c) Doors to vehicle access points are to be roller shutters or tilting doors fitted behind the building façade.
- d) Vehicle entries are to have high quality finishes to walls and ceilings as well as high standard detailing. No service ducts or pipes are to be visible from the street.



Porte Cocheres

Porte cocheres disrupt pedestrian movement and do not contribute to active street frontage. They may only be permitted in exceptional circumstances for hotels and major tourist venues subject to a high quality urban design, streetscape, heritage and pedestrian amenity considerations. They are not permitted in those streets shown with significant pedestrian circulation at Figure 3.7.

If justified, porte cocheres should preferably be internal to the building with one combined vehicle entry and exit point, or one entry and one exit point on two different street fronts of the development.

In exceptional circumstances for the buildings with one street frontage only, an indented porte cochere with separate entry and exit points across the footpath may be permitted, as long as it:

Is constructed entirely at the footpath level,

Provides active street frontage uses in addition to any hotel entry or lobby at its perimeter,

Is of high quality design and finish, and

Provides for safe and clear pedestrian movement along the street.

Wollongong Development Control Plan 2009

3.7 Pedestrian overpasses, underpasses and encroachments

Streets represent important components of the public domain and provide the best potential amenity and safety when activated by pedestrians. Streets offer sky exposure, sunlight and air, a sense of orientation and direct access to the main frontages of buildings. A successful city street provides a comfortable interface between pedestrians and exposure for business. Generally, pedestrians should be encouraged to use the street level to enhance and contribute to street life, to promote activity and interest, and to maximise safety and security of the public domain. Wollongong's climate does not warrant pedestrian isolation from the street, and any conflicts between pedestrians and vehicles are to be resolved at the street level.

Pedestrian overpasses are discouraged as they have a negative impact on the streetscape quality and on views and vistas along streets. New pedestrian underpasses will only be considered where they would directly connect to major transport nodes such as railway stations and substantially improve pedestrian safety and access.

3.7.1 Objectives

- a) To promote pedestrian activation of streets and public places.
- b) To promote 'safer by design' and crime prevention principles.
- c) To encourage pedestrian circulation at street level.
- d) To protect views and vistas along streets.

3.7.2 Development Controls

- a) New overpasses over streets will generally not be approved. In exceptional circumstances, new overpasses over service lanes may be considered by the consent authority subject to assessment of impacts on safety and crime prevention, streetscape amenity and activation of the public domain. In such circumstances, overpasses are to be fully glazed, not greater than 6 metres wide or more than one level high. Refer to AS 5100.1 2004.
- b) Longitudinal development under the road reserve is not permitted. The siting of basement carparks beneath the road reserve is not permitted for private developments. Stratum road closures for this purpose will not be permitted.
- c) Underpasses may be considered by the consent authority for direct connection under adjacent streets to railway stations:
 - i) Where they would substantially improve pedestrian safety and accessibility, and
 - ii) Incorporate active uses, particularly at entry and exit points.
- d) Access to underpasses should be provided directly from a public footpath at the street alignment (rather than reducing the space of the footpath). This will ensure public access at all times and enhance the use and activities of the public domain.
- e) All underpasses are to have a minimum width of 4.5 metres clear of all fixed obstructions, a minimum ceiling height of 4 metres and a minimum depth of 3 metres.

3.8 Building exteriors

Wollongong's cityscape and public domain is defined by its buildings, streets and public places. The maintenance and improvement of the public domain is dependent on a consistent approach to the design of new development including the articulation and finish of building exteriors.

3.8.1 Objectives

To ensure that new buildings in Wollongong:

a) Contribute positively to the streetscape and public domain by means of high quality architecture and robust selection of materials and finishes.

men

- b) Provide richness of detail and architectural interest especially at visually prominent parts of buildings such as lower levels and roof tops.
- c) Present appropriate design responses to nearby development that complement the streetscape.
- d) Clearly define the adjoining streets, street corners and public spaces and avoid ambiguous external spaces with poor pedestrian amenity and security.
- e) Maintain a pedestrian scale in the articulation and detailing of the lower levels of the building.
- f) Contribute to a visually interesting skyline.

3.8.2 Development Controls

- a) Adjoining buildings (particularly heritage buildings) are to be considered in the design of new buildings in terms of:
 - i) Appropriate alignment and street frontage heights.
 - ii) Setbacks above street frontage heights.
 - iii) Appropriate materials and finishes selection.
 - iv) Façade proportions including horizontal or vertical emphasis.
 - v) The provision of enclosed corners at street intersections.
- b) Balconies and terraces should be provided, particularly where buildings overlook parks and on low rise parts of buildings. Gardens on the top of setback areas of buildings are encouraged.
- c) Articulate facades so that they address the street and add visual interest.
- External walls should be constructed of high quality and durable materials and finishes with 'selfcleaning' attributes, such as face brickwork, rendered brickwork, stone, concrete and glass.
- e) Finishes with high maintenance costs, those susceptible to degradation or corrosion from a coastal or industrial environment or finishes that result in unacceptable amenity impacts, such as reflective glass, are to be avoided.
- f) To assist articulation and visual interest, avoid expanses of any single material.
- g) Limit opaque or blank walls for ground floor uses to 30% of the street frontage.
- h) Maximise glazing for retail uses, but break glazing into sections to avoid large expanses of glass.
- i) Highly reflective finishes and curtain wall glazing are not permitted above ground floor level (see Section 5.3).
- j) A materials sample board and schedule is required to be submitted with applications for development over \$1 million or for that part of any development built to the street edge.
- k) Minor projections up to 450mm from building walls in accordance with those permitted by the Building Code of Australia may extend into the public space providing it does not fall within the definition of gross floor area and there is a public benefit, such as:
 - i) Expressed cornice lines that assist in enhancing the streetscape,
 - ii) Projections such as entry canopies that add visual interest and amenity, and
 - iii) Provided that the projections do not detract from significant views and vistas (see Figure 3.12).
- The design of roof plant rooms and lift overruns is to be integrated into the overall architecture of the building.



Figure 3.9: Select high quality masonry finishes with accent colours

3.9 Advertising and signage

Advertisements and advertising structures are an important element of the built environment. These provisions are intended to protect the significant characteristics of buildings, streetscapes, vistas and the city skyline and to encourage well designed and well positioned signs which contribute to the vitality and legibility of Wollongong city centre and which respect the amenity of residents and pedestrians and the safety of motorists. (Figures 3.10 and 3.11).



Figure 3.10: Under awning signage



Figure 3.11: Signage Zones

In considering innovative design proposals for signs not envisaged by these provisions or where there are issues of interpretation, the consent authority will consider the design excellence of the proposed design and the degree to which it meets the objectives of this section.

3.9.1 Objectives

- a) To ensure that all advertising achieves a very high level of design quality in terms of graphic design, its relationship to the architectural design of buildings and the character of streetscapes.
- b) To limit the overall amount of advertising through the provision of fewer, more effective signs, to avoid the creation of visual clutter on buildings and streetscapes.
- c) To promote signs that add character to the streetscape and assist with way finding and the pedestrian useability of the city.
- d) To promote signs that complement the architectural style and use of buildings.
- e) To consider the amenity of residential development and the visual quality of the public domain.
- f) To encourage corporate logos and colours in signs that achieve a high degree of compatibility with the architecture of the building.
- g) To ensure that the location and design of signs are consistent with road safety principles.

3.9.2 Development Controls

General location and design of signs.

- a) Signs are to be designed and located to:
 - i) Relate to the use of the building,
 - ii) Be visually interesting and exhibit a high level of design quality,
 - iii) Be integrated and achieve a high degree of compatibility with the architectural design of the supporting building having regard to its composition, fenestration, materials, finishes, and colours, and ensure that architectural features of the building are not obscured,
 - iv) Have regard to the view of the sign and any supporting structure, cabling and conduit from all angles, including visibility from the street level and nearby higher buildings and against the skyline, and
 - v) Have only a minimal projection from the building.
- b) Signs that contain additional advertising promoting products or services not related to the approved use of the premises or site (such as the logos or brands of products eg soft drinks, brewers, photographic film, etc) are not permitted.
- c) Signs painted on or applied on the roof are prohibited.

- d) Corporate colours, logos and other graphics are encouraged to achieve a very high degree of compatibility with the architecture, materials, finishes and colours of the building and the streetscape.
- e) In considering applications for new signs the consent authority must have regard to the number of existing signs on the site and in its vicinity and whether that signage is consistent with the provisions of this section and whether the cumulative impact gives rise to visual clutter.
- f) A signage strategy shall be submitted with a development application for a building where the signage details are not known for future uses within the building. The strategy shall include elevations that indicate signage zones on the building into which future signs will be located and details of other controls relating to theme, illumination and size, where appropriate.

3.9.3 Illuminated signs

- a) Illuminated signs are not to detract from the architecture of the supporting building during daylight.
- b) Illumination (including cabling) of signs is to be:
 - i) Concealed, or
 - ii) Integral with the sign, or
 - iii) Provided by means of carefully designed and located remote or spot lighting.
- c) The ability to adjust the light intensity of illuminated signs is to be installed where the consent authority considers necessary.
- d) A curfew may be imposed on the operation of illuminated signs where continuous illumination may impact adversely on the amenity of residential buildings, serviced apartments or other visitor accommodation, or have other adverse environmental effects.
- e) Up-lighting of signs is prohibited. Any external lighting of signs is to be downward pointing and focused directly on the sign and is to prevent or minimise the escape of light beyond the sign.

3.9.4 Signs and Road Safety

- a) Signs are regarded as prejudicial to the safety of the travelling public if they:
 - i) Obscure or interfere with road traffic signs and signals or with the view of a road hazard, oncoming vehicles, or any other vehicle or person, or an obstruction which should be visible to drivers or other road users,
 - ii) Give instructions to traffic by use of the word stop' or other directions, which could be confused with traffic signs,
 - Are of such a design or arrangement that any variable messages or intensity or lighting impair drivers' vision or distract drivers' attention, and
 - iv) Are situated at locations where the demand on drivers' concentration due to road conditions are high such as at major intersection or merging and diverging lanes.

3.10 Views and view corridors

Views contribute to the character and amenity of a city, enhancing the sense of place and identity. The physical setting of the Wollongong city centre between the coast and escarpment provides for special views of this natural setting and associated elements.

It is important that views to the ocean and the escarpment be maintained from as many points as possible at street level. In the redevelopment of some sites consideration should be given to opening up new significant views. Views are regarded as significant when they terminate at places of architectural, landscape, or cultural significance. This may include views of the foreshore, major parks or publicly significant objects or heritage buildings.

A silhouette is the outline of a building against the sky. The silhouettes of many buildings are significant and contribute to the identity of the commercial core of the city and its skyline. The massing and

arrangement of the skyline and existing building silhouettes should be carefully considered and proposed development should be carefully designed so that its appearance complements the city skyline.

3.10.1 Objectives

- a) To maintain and enhance views from the city centre to the foreshore, escarpment and significant objects (such as the lighthouse) wherever possible.
- To enhance views along city streets. b)
- To protect silhouettes of the tops of major buildings or structures as seen against the sky or c) backdrop of the escarpment or foreshore.

3.10.2 Development Controls

- Existing views shown in Figure 3.12 are to be protected to the extent that is practical in the planning a) and design of development.
- The redevelopment of sites with potential to open a blocked view shown in Figure 3.12 must take b) into account the restoration of that view.
- C) Align buildings to maximise view corridors between buildings.
- d) Remove or avoid installation of built elements that obstruct significant views.
- Carefully consider tree selection to provide views along streets in Figure 3.12 and keep under storey e) planting low where possible.
- sign of bu poment. Site analysis must address views with the planning and design of building forms taking into account f) existing topography, vegetation and surrounding development.



4 ACCESS, PARKING AND SERVICING

4.1 General

This section contains detailed objectives and controls on pedestrian access, vehicular access, on-site parking and site facilities, including refuse collection and removal.

To satisfy the aims and zoning objectives of the Wollongong LEP 2009, controls in this section aim to:

- a) Facilitate the development of building design excellence appropriate to a regional city;
- b) Require parking and servicing provisions to be contained within development sites to an amount and rate adequate for the economic and sustainable growth of the city centre;
- c) Provide for safe and secure access;
- d) Minimise impacts on city amenity, the public domain and streetscape, and
- e) Ensure that access is provided for the disabled and mobility impaired.

4.2 Pedestrian access and mobility

Any new development must be designed to ensure that safe and equitable access is provided to all, including people with a disability.

4.2.1 Objectives

- a) To provide safe and easy access to buildings to enable better use and enjoyment by people regardless of age and physical condition, whilst also contributing to the vitality and vibrancy of the public domain.
- b) To ensure buildings and places are accessible to people with a disability.

4.2.2 Development Controls

- a) Main building entry points should be clearly visible from primary street frontages and enhanced as appropriate with awnings, building signage or high quality architectural features that improve clarity of building address and contribute to visitor and occupant amenity.
- b) The design of facilities (including car parking requirements) for disabled persons must comply with the relevant Australian Standard (AS 1428 Pt 1 and 2, AS 2890 Pt 1, or as amended) and the Disability Discrimination Act 1992 (as amended).
- c) The development must provide at least one main pedestrian entrance with convenient barrier free access in all developments to at least the ground floor.
- d) The development must provide continuous access paths of travel from all public roads and spaces as well as unimpeded internal access.
- e) Pedestrian access ways, entry paths and lobbies must use durable materials commensurate with the standard of the adjoining public domain (street) with appropriate slip resistant materials, tactile surfaces and contrasting colours in accordance with Council's Public Domain Technical Manual.
- f) Building entrance levels and footpaths must comply with the longitudinal and cross grades specified in AS 1428.1:2001, AS/NZS 2890.1:2004 and the Disability Discrimination Act.

4.3 Vehicular driveways and manoeuvring areas

4.3.1 Objectives

- a) To minimise the impact of vehicle access points and driveway crossovers on streetscape amenity, pedestrian safety and the quality of the public domain by:
 - i) Designing vehicle access to required safety and traffic management standards;
 - ii) Integrating vehicle access with site planning, streetscape requirements, traffic patterns; and
 - iii) Minimising potential conflict with pedestrians.

4.3.2 Development Controls

- a) Driveways should be:
 - i) Provided from lanes and secondary streets rather than the primary street, wherever practical.
 - ii) Located taking into account any services within the road reserve, such as power poles, drainage pits and existing street trees.
 - iii) Located a minimum of 6 metres from the perpendicular of any intersection of any two roads.
 - iv) If adjacent to a residential development setback a minimum of 1.5m from the relevant side property boundary.
- b) Vehicle access is to be designed to:
 - i) Minimise the impact on the street, site layout and the building façade design; and
 - ii) If located off a primary street frontage, integrated into the building design.

- c) All vehicles must be able to enter and leave the site in a forward direction without the need to make more than a three point turn.
- d) Design of driveway crossings must be in accordance with Council's standard Vehicle Entrance Designs, with any works within the footpath and road reserve subject to a s138 Roads Act approval.
- e) Driveway widths must comply with the relevant Australian Standards.
- f) Car space dimensions must comply with the relevant Australian Standards.
- g) Driveway grades, vehicular ramp width/grades and passing bays must be in accordance with the relevant Australian Standard, (AS 2990.1).
- h) Vehicular ramps less than 20m long within developments and parking stations must have a maximum grade of 1 in 5 (20%). Ramp widths and design must be in accordance with AS 2890.1.
- Access ways to underground parking should not be located adjacent to doors or windows of the habitable rooms of any residential development.
- j) For residential development in the General Residential zone, use semi-pervious materials for all uncovered parts of driveways/spaces to provide for some stormwater infiltration.

4.4 On-site parking

On-site parking includes underground (basement), surface (at-grade) and above ground parking, including parking stations.

Parking rates for commercial and retail development are specified within Part E of this DCP.

4.4.1 Objectives

- a) Facilitate an appropriate level of on-site parking provision in the city to cater for a mix of development types.
- b) Minimise the visual impact of on-site parking.
- c) Provide adequate space for parking and manoeuvring of vehicles (including service vehicles and bicycles).
- d) To promote Wollongong city centre as a more lively and vibrant place by providing parking incentives for certain developments in the city centre.
- e) To encourage economic growth in the city centre.
- f) To recognise the complementary use and benefit of public transport and non-motorised modes of transport such as bicycles and walking.

4.4.2 Development Controls

General (all development)

- a) On-site parking must meet the relevant Australian Standard (AS2890.1 2004 Parking facilities, or as amended).
- b) Council may require the provision of a supporting geotechnical report prepared by an appropriately qualified professional as information to accompany a development application to Council.
- c) Car parking and associated internal manoeuvring areas which are surplus to Council's specified parking requirements will count towards the gross floor area, but not for the purpose of determining the necessary parking.
- d) Any car parking provided in a building above ground level is to have a minimum floor to ceiling height of 2.8m so it can be adapted to another use in the future.
- e) On-site vehicle, motorcycle and bicycle parking is to be provided in accordance with Part E of this DCP.

f) To accommodate people with disabilities, provide a minimum of 1% of the required parking spaces, or minimum of 1 space per development, (whichever is the greater) as an appropriately designated and signed disabled parking space.

Residential flat buildings

a) On-site parking is to be accommodated underground, or otherwise integrated into the design of the building.

Commercial developments within the commercial core and city edge zones

a) On-site parking is to be accommodated underground, or otherwise integrated into the design of the building.

Commercial developments and mixed use developments in all other zones

- a) The impact of any on-grade car parking must be minimised by:
 - i) Locating parking on the side or rear of the lot away from the street frontage;
 - ii) Provision of fencing or landscape to screen the view of cars from adjacent streets and buildings;
 - iii) Allowing for safe and direct access to building entry points; or
 - iv) Incorporating car parking into landscape design of the site (such as plantings between parking bays to improve views, selection of paving material and screening from communal and open space areas).
- Natural ventilation should be provided to underground parking areas where possible, with ventilation grilles and structures;
 - i) integrated into the overall façade and landscape design of the development,
 - ii) not located on the primary street façade, and
 - iii) oriented away from windows of habitable rooms and private opens space areas.

4.5 Site facilities and services

4.5.1 Objectives

- a) To ensure that site facilities (such as clothes drying areas, mail boxes, recycling and garbage disposal units/areas, screens, lighting, storage areas, air conditioning units and communication structures) are effectively integrated into the development and are unobtrusive.
- b) To ensure that site services and facilities are adequate for the nature and quantum of development.
- c) To establish appropriate access and location requirements for servicing.
- d) To ensure service requirements do not have adverse amenity impacts.

4.5.2 Development Controls

Mail boxes

- a) Provide letterboxes for residential building and/or commercial tenancies in one accessible location adjacent to the main entrance to the development.
- b) They should be integrated into a wall where possible and be constructed of materials consistent with the appearance of the building.
- c) Letterboxes shall be secure and large enough to accommodate articles such as newspapers.

Communication structures, air conditioners and service vents

a) Locate satellite dish and telecommunication antennae, air conditioning units, ventilation stacks and any ancillary structures:

- i) Away from the street frontage,
- ii) Integrated into the roof scape design and in a position where such facilities will not become a skyline feature at the top of any building, and
- iii) Adequately setback from the perimeter wall or roof edge of buildings.
- b) A master antennae must be provided for residential apartment buildings. This antenna shall be sited to minimise its visibility from surrounding public areas.

Waste (garbage) storage and collection

General (all development)

- a) All development is to adequately accommodate waste handing and storage on-site. The size, location and handling procedures for all waste, including recyclables, is to be determined in accordance with Council waste policies and advice from relevant waste handling contractors.
- b) Access for waste collection and storage is preferred from rear lanes, side streets or rights of ways.
- c) Waste storage areas are to be designed to:
 - i) Ensure adequate driveway access and manoeuvrability for any required service vehicles,
 - ii) Located so as not to create any adverse noise impacts on the existing developments or sensitive noise receptors such as habitable rooms of residential developments, and
 - iii) Screened from the public way and adjacent development that may overlook the area.
- d) The storage facility must be well lit, easily accessible on grade for movement of bins, free of obstructions that may restrict movement and servicing of bins or containers and designed to minimise noise impacts.

Location requirements for Waste Storage Areas and Access

- a) Where waste volumes require a common collection, storage and handling area, this is to be located:
 - i) For residential flat buildings, enclosed within a basement or enclosed carpark,
 - ii) For multi-housing, at ground behind the main building setback and façade, or within a basement or enclosed carpark,
 - iii) For commercial, retail and other development, on-site in basements or at ground within discrete service areas not visible from main street frontages.
- b) Where above ground garbage collection is prohibitive or impractical due to limited street frontage, or would create an unsafe environment, an on-site basement storage area must be provided.
- c) Where a mobile compaction vehicle is required to enter the site, the access and circulation area shall be designed to accommodate a vehicle with the following dimensions:

| Position | Dimension |
|--|-------------------------|
| Vehicle length | 12300mm |
| Vehicle width | 3500mm |
| Vehicle height - travel | |
| (Safe height in confined areas – top forks down) | o door closed an 3800mm |
| Vehicle height – operation | |
| (Top door open with a bin at full tip | ping position) 6000mm |

Service docks and loading/unloading areas

- a) Provide adequate space within any new development for the loading and unloading of service/delivery vehicles.
- b) Preferably locate service access off rear lanes, side streets or rights of way.
- c) Screen all service doors and loading docks from street frontages and from active overlooking from existing developments.
- d) Design circulation and access in accordance with AS2890.1.

Fire service and emergency vehicles

- a) For developments where a fire brigade vehicle is required to enter the site, vehicular access, egress and manoeuvring must be provided to, from and on the site in accordance with the NSW Fire Brigades Code of Practice – Building Construction – NSWFB Vehicle Requirements.
- b) Generally, provision must be made for NSW Fire Brigade vehicles to enter and leave the site in a forward direction where:
 - i) NSW Fire Brigade cannot park their vehicles within the road reserve due to the distance of hydrants from the building or restricted vehicular access to hydrants; or
 - ii) The site has an access driveway longer than 15m.

Utility Services

The provision of utility services and access for regular servicing and maintenance must be considered at the concept stage of site development.

- a) Development must ensure that adequate provision has been made for all essential services including water, sewerage, electricity and telecommunications and stormwater drainage to the satisfaction of all relevant authorities.
- b) The applicant must liaise with the relevant power authority with regard to the need for a conduit to be installed within the foot way area for the future provision of an underground power supply and extension of the conduit up to the wall of the existing or proposed building.
- c) The development must ensure that ready connection of the building(s) can be made in future when underground power is installed and the overhead connection is replaced with a connection to the underground line.
- d) The applicant must liaise with the power authority with regard to the retention, relocation, or removal of any existing power pole.

5 ENVIRONMENTAL MANAGEMENT

5.1 General

This section deals with energy efficiency requirements of buildings, water use and conservation, wind and solar impacts and waste management.

5.1.1 Strategy

To satisfy the aims and zoning objectives of the Wollongong City Centre LEP 2007, controls in this section aim to;

- (a) Facilitate the development of building design excellence appropriate to a regional city,
- (b) Ensure environmental impacts of new development are managed in a sustainable and economical way,

- (c) Ensure a healthy environment,
- (d) Provide an adequate and renewable supply of resources, and
- (e) Ensure application, where appropriate, of the BASIX or National Built Environment Rating System (NABERS), Australian Greenhouse Ratings (AGR) certification systems.

5.2 Energy efficiency and conservation

The ability of development to optimise thermal performance, thermal comfort and day lighting will contribute to the energy efficiency of the buildings, provide increased amenity to occupants and reduce greenhouse emissions and, with them, the cost of supplying energy.

5.2.1 Objectives

- a) To reduce the necessity for mechanical heating and cooling.
- b) To minimise greenhouse gas omissions emissions.
- c) To use natural climatic advantages of the coastal location such as cooling summer breezes, and exposure to unobstructed winter sun.

5.2.2 Development Controls

Residential

New dwellings, including multi-unit development within a mixed use building and serviced apartments intended or capable of being strata titled, are to demonstrate compliance with State Environmental Planning Policy – Building Sustainability Index (BASIX). Council encourages all applicants to go beyond minimum BASIX requirements incorporating passive solar design and energy efficiency measures for residential development.

Non-Residential

For all non-residential development:

- a) Improve the control of mechanical space heating and cooling by:
 - i) Designing heating/cooling systems to target only those spaces which require heating or cooling, not the whole building.
- b) Improve the efficiency of hot water systems by:
 - i) Insulating hot water systems, and
 - Installing water saving devices, such as flow regulators, 3 stars 3.5 stars rated shower heads, dual flush toilets and tap aerators.
- c) Reduce reliance on artificial lighting and designing lighting systems to target only those spaces which require lighting at any particular 'off peak' time, not the whole building.

For all commercial development over \$5 million:

Provide an Energy Efficiency Report from a suitably qualified consultant to accompany any development application for new commercial office development with a construction cost of \$5 million or more that demonstrates a commitment to achieve no less than a 4 star rating under the Australian Building Greenhouse Rating Scheme.

An energy efficiency report from a suitably qualified consultant is to accompany any development application for non-residential development with a construction cost of \$1million or greater. This report must demonstrate commitment to achieving a minimum of 4 stars Green Star rating (design and as built tool) or 4 stars NABERS rating (energy tool) for the development.

P.Mi

From 1st November 2006 all non-residential development Class 5-9 will need to comply with the Building Code of Australia energy efficiency provisions.

5.3 Water conservation

Building design can contribute to environmental sustainability by integrating measures for improved water quality and efficiency of use. Water can be conserved in two ways; by reducing water demand from the mains and re-using water, which would otherwise be lost, as run off or waste water. By integrating water use efficiency; water collection and water reuse measures into building associated infrastructure design development can contribute to environmentally sustainable outcomes.

5.3.1 Objectives

- a) To reduce per-capita mains consumption of potable water.
- b) To harvest rainwater and urban stormwater runoff for use.
- c) To reduce wastewater discharge.
- d) To capture, treat and reuse wastewater where appropriate.
- e) To safeguard the environment by improving the quality of water run-off.
- f) To ensure infrastructure design is complementary to current and future water use

5.3.2 Development Controls

Residential

New dwellings, including a residential component within a mixed use building and serviced apartments intended or capable of being strata titled, are to demonstrate compliance with State Environmental Planning Policy – Building Sustainability Index (BASIX). Council encourages all residential development to go beyond the minimum BASIX requirements and enhance the water efficiency for their development.

Non-residential

- a) The following water saving measures are to be incorporated into non-residential building. Water fixtures (shower heads, taps, toilets, urinals etc) are to be 3 stars 3.5 stars or better rated.
 - Appliances (dishwashers, clothes washers etc) are to be 3 stars 3.5 stars or better rated with respect to water use efficiency. Demonstrate, if necessary, how these requirements will be achieved for replacement appliances, appliances not installed at construction or bought in by occupants following construction,
 - ii) Stormwater runoff control, capture and reuse, including water quality management in accordance with Council's guidelines,
 - iii) Select water efficient plants and/or, indigenous vegetation for landscape in accordance with Council's recommendations,
 - iv) Use non-potable water for watering gardens and landscape features, and
 - V) Operating details for swimming pools and water features including filling, draining and maintenance activities. Covers are to be included in the design and operational aspects of swimming pool installations.
- b) Alternatives to the above water savings methods can be presented to Council and they will be assessed on merit.

5.4 Reflectivity

Reflective materials used on the exterior of buildings can result in undesirable glare for pedestrians and potentially hazardous glare for motorists. Reflective materials can also impose additional heat load on other buildings. The excessive use of highly reflective glass should be discouraged. Buildings with a glazed roof, façade or awning should be designed to minimise hazardous or uncomfortable glare arising from reflected sunlight.

5.4.1 Objective

a) To restrict the reflection of sunlight from buildings to surrounding areas and buildings.

5.4.2 Development Controls

- a) New buildings and facades should not result in glare that causes discomfort or threatens safety of pedestrians or drivers.
- b) Visible light reflectivity from building materials used on facades of new buildings should not exceed 20%.
- c) Subject to the extent and nature of glazing and reflective materials used, a Reflectivity Report that analyses potential solar glare from the proposed development on pedestrians or motorists may be required.

5.5 Wind mitigation

Windy conditions can cause discomfort and danger to pedestrians, and downdrafts from buildings can inhibit the growth of street trees. Conversely, moderate breezes that penetrate the streets can enhance pedestrian comfort and disperse vehicle emissions and air conditioning plant exhausts.

5.5.1 Objectives

- a) To ensure that new developments satisfy nominated wind standards and maintain comfortable conditions for pedestrians.
- b) To ensure that the moderate breezes are able to penetrate the streets of Wollongong city centre.

5.5.2 Development Controls

- a) To ensure public safety and comfort the following maximum wind criteria are to be met by new buildings:
 - i) 10 metres/second in retail streets,
 - ii) 13 metres/second along major pedestrian streets, parks and public places, and
 - iii) 16 metres/second in all other streets.
- b) Site design for tall buildings (towers) should:
 - Set tower buildings back from lower structures built at the street frontage to protect pedestrians from strong wind downdrafts at the base of the tower,
 - ii) Ensure that tower buildings are well spaced from each other to allow breezes to penetrate city centre,
 - iii) Consider the shape, location and height of buildings to satisfy wind criteria for public safety and comfort at ground level, and
 - iv) Ensure usability of open terraces and balconies.
- c) A Wind Effects Report is to be submitted with the DA for all buildings greater than 32m in height,
- d) For buildings over 50m in height, results of a wind tunnel test are to be included in the report.

5.6 Waste and recycling

The minimisation of waste from development can reduce impacts on the public domain, contribute to the amenity of the building and limit the potential harmful impacts to the environment. Waste management refers to all stages of development from construction and use through to demolition. It also includes the way in which waste is stored and collected.

5.6.1 Objectives

- a) To minimise waste generation and disposal to landfill with careful source separation, reuse and recycling.
- b) To avoid the generation of waste through design, material selection and building practices.
- c) To plan for the types, amount and disposal of waste to be generated during demolition, excavation and construction of the development.
- d) To ensure efficient storage and collection of waste and quality design of facilities.

5.6.2 Development Controls

a) All development must comply with Council's Technical Policy for the Management of all Wastes Associated with Building Sites.

Non-residential development

- a) Development applications for all non-residential development must be accompanied by a waste management plan that addresses:
 - i) Best practice recycling and reuse of construction and demolition materials,
 - ii) Use of sustainable building materials that can be reused or recycled at the end of their life,
 - iii) Handling methods and location of waste storage areas in accordance with the provisions of Section 4.4.3 of this DCP, such that handling and storage has no negative impact on the streetscape, building presentation or amenity of occupants and pedestrians, and
 - iv) Procedures for the on-going sustainable management of green and putrescible waste, garbage, glass, containers and paper, including estimated volumes, required bin capacity and on-site storage requirements.

The waste management plan is to be prepared by a specialist waste consultant and is subject to approval by Council.

Residential development

Provision must be made for the following waste generation:

- a) In developments not exceeding six dwellings, individual waste storage facilities may be permitted.
- b) In development of more than six units or dwellings, or where the topography or distance to the street collection point makes access difficult for individual occupants, a collection and storage area is required. The storage area must be located in a position which is;
 - i) Not visible from the street,
 - ii) Easily accessible to dwelling occupants,
 - iii) Accessible by collection vehicles (or adequately managed by the body corporate to permit relocation of bins to the approved collection point),
 - iv) Has water and drainage facilities for cleaning and maintenance, and
 - v) Does not immediately adjoin private open space, windows or clothes drying areas.

Subject to Council collection policy, common garbage storage areas must be sized to either C) accommodate the number of individual bins required or to accommodate sufficient larger bins with the following minimum dimensions:

| Bin size | Dimensions |
|------------|--------------------|
| 660 litres | 1070 x 910 x 635mm |
| 240 litres | 1180 x 740 x 570mm |

The size and number of the waste bins shall be determined having regard to the need for either on-site access by collection vehicles or the requirement for bins to be wheeled to the street for collection by a contractor. If transferred to the street for collection, the body corporate or a caretaker must be responsible for the movement of bins to their collection point.

| Residential Flats | Multi Unit Housing |
|---|-----------------------------------|
| Waste | |
| 80 litres per week/flat | 120 litres per week/dwelling |
| Recycling | |
| 80 litres per week/flat | 120 litres per week/dwelling |
| Green waste | |
| A communal waste bin of sufficient capacity to accept waste from any landscaped areas | 120 litres per fortnight/dwelling |

GENERAL RESIDENTIAL DEVELOPMENT 6 **CONTROLS**

6.1 SEPP 65 and Apartment Design Guide Residential flat design code

In addition to other controls in this DCP, the provisions in the Residential Flat Design Code associated with State Environmental Planning Policy No.65 – Design Quality of Residential Apartment Flat Development (SEPP 65) and associated Apartment Design Guide 2015 apply to residential flat buildings, shop top housing, and the residential component of mixed use developments. These provisions apply to buildings that are more than three storeys and have four or more dwellings, where the development consists of the:

- erection of a new building
- substantial redevelopment or refurbishment of an existing building
- conversion of an existing building to a residential flat building.

The objectives, design criteria and design guidance relating to any of the following points (as detailed in Part 3 and Part 4 of the Apartment Design Guide) prevail over any inconsistent objective or control in this DCP.

- Visual privacy Solar and daylight access (b)
- Natural ventilation
- Ceiling heights
- Apartment size and layout (e)
- Private open space and balconie
- Common circulation and spaces

(h) Storage

are adopted in this DCP to apply to residential development in the Wollongong City Centre including flats, multi dwelling housing, any residential component of a mixed use development, and serviced apartments that are strata titled. In particular, Parts 2 and 3 of the code are to apply to the city centre and include provisions for the following:

Site configuration including deep soil zones, fences and walls, landscape design, open space, orientation, planting on structures, and stormwater management;

Site amenity including safety and visual privacy;

Site access including building entries, parking, pedestrian and vehicle access;

Building configuration including apartment layout, balconies, ceiling heights, flexibility, ground floor apartments, internal circulation, mixed use and storage;

Building amenity including acoustic privacy, daylight access and natural ventilation;

Building form including awnings and signage, facades and roof design; and

Building performance including energy efficiency, maintenance, waste management and water concervation.

Where there is an inconsistency between other provisions in this DCP and the Residential Flat Design Code, this DCP prevails to the extent of the inconsistency.

6.2 Housing choice and mix

A choice of apartment types and mix of sizes in the city centre caters for a variety of socio-economic groups.

In addition to the provisions for apartment mix at Part 03 of the Residential Flat Design Code, the following additional controls apply.

(These controls do not apply to single dwellings),

6.2.1 Objectives

- a) Ensure that residential development provides a mix of dwelling types and sizes to cater for a range of household types.
- b) Ensure that dwelling layout is sufficiently flexible for residents' changing needs over time.
- c) Ensure a sufficient proportion of dwellings include accessible layouts and universally designed features to accommodate changing requirements of residents.
- d) Ensure the provision of housing that will, in its adaptable features, meet the access and mobility needs of any occupant.

6.2.2 Development Controls

- a) Where residential units are proposed at ground level within the Mixed Use (City Edge) and Special Activities zone, a report must be provided with the development application demonstrating how future commercial uses can be accommodated within the ground level design. The report must address:
 - Access requirements including access for persons with a disability (Compliance with Disability Discrimination Act 1992),
 - ii) Any upgrading works necessary for compliance with the Building Code of Australia, and

- iii) Appropriate floor to ceiling heights.
- b) To achieve a mix of living styles, sizes and layouts within each residential development, comply with the following mix and size:
 - i) Studio and one bedroom units must not be less than 10% of the total mix of units within each development,
 - ii) Three or more bedroom units must not be less than 10% of the total mix of units within each development, and
 - iii) For smaller developments (less than six dwellings) achieve a mix appropriate to locality.
- c) For development built by (or on behalf of) the Department of Housing, an alternative mix of unit types may be approved, subject to housing needs being demonstrated by the Department.
- d) For residential apartment buildings and multi-unit housing, 10% of all dwellings (or at least one dwelling) must be designed to be capable of adaptation for disabled or elderly residents. Dwellings must be designed in accordance with the Australian Adaptable Housing Standard (AS 4299-1995), which includes "pre-adaptation" design details to ensure visitability is achieved.
- e) Where possible, adaptable dwellings shall be located on the ground floor, for ease of access. Dwellings located above the ground level of a building may only be provided as adaptable dwellings where lift access is available within the building. The lift access must provide access from the basement to allow access for people with disabilities.
- f) The development application must be accompanied by certification from an accredited Access Consultant confirming that the adaptable dwellings are capable of being modified, when required by the occupant, to comply with the Australian Adaptable Housing Standard (AS 4299-1995).
- g) Car parking and garages allocated to adaptable dwellings must comply with the requirements of the relevant Australian Standard for disabled parking spaces.
- h) For all residential apartment / flat buildings, 10% of all dwellings (or at least 1 dwelling) must be designed to achieve the Silver Standards of the Livable Housing Design Guideline (Livable Housing Australia 2015). All proposed livable dwellings must be clearly identified on the submitted DA plans.
- Ceiling heights of apartments must be selected to encourage the penetration of natural sunlight into all areas of the building. Provide the following minimum floor to ceiling heights, for residential zones, as required by the Residential Flat Design Code:
 - i) 2.7m minimum for all habitable rooms on all floors;
 - ii) 2.25m to 2.4m minimum for non-habitable rooms on all floors;
 - iii) for two storey apartments, 2.4m minimum for the second storey if 50% or more of the apartment has 2.7m minimum ceiling heights;
 - iv) for two storey units with a two storey void space, 2.4m minimum ceiling heights;
 - v) attic spaces, 1.5 minimum wall heights at edge of room with a 30 degree minimum ceiling slope.

6.3 Dwelling houses

Where there is an inconsistency between the provisions of this part of the DCP and other parts of the DCP, this part of the DCP will prevail to the extent of the inconsistency.

6.4 Multi dwelling housing

Where there is an inconsistency between the provisions of this part of the DCP and other parts of the DCP, this part of the DCP will prevail to the extent of the inconsistency.

6.5 Dual occupancy

Where there is an inconsistency between the provisions of this part of the DCP and other parts of the DCP, this part of the DCP will prevail to the extent of the inconsistency.

6.6 Basement Car parks

6.6.1 Objective

a) Integrate the siting, scale and design of basement parking into the site and building design.

6.6.2 Development Controls

- a) The scale and siting of the basement car park must not impact upon the ability of the development to satisfy minimum landscaping and deep soil zone requirements.
- b) The roof of any basement podium, measured to the top of any solid wall located on the podium, must not be greater than 1.2m above natural or finished ground level, when measured at any point on the outside walls of the building. On sloping sites, a change in level in the basement must be provided to achieve this maximum 1.2m height.

Generally variation to this 1.2m height will not be supported however Council recognises that there may be occasions where this standard cannot be achieved. Should such a circumstance arise, the additional portion of the basement podium above 1.2m height must be included in the total gross floor area calculation for the development.

- c) In addition, the following must be satisfied:
 - Landscaped terraces are provided in front of the basement podium to reduce the overall visual impact;
 - ii) The height of the basement does not result in the building having a bulk and scale which dominates the streetscape; and
 - iii) The main pedestrian entry to the building is identifiable and readily accessible from the street frontage.
- d) The following setbacks from front, side and rear boundaries apply to basement podiums:
 - i) Where the height of the basement podium (measured to the top of any solid wall located on the podium) is less than 1.2m above natural or finished ground level (whichever distance is greater), the basement podium may extend to the property boundary. A minimum 1.5m wide landscaped planter must be provided on the perimeter of any section of the basement podium which is located on a side or rear property boundary. Such planter must prevent direct access to the outer edge of the podium, to minimise direct overlooking of adjacent dwellings and open space areas.
 - ii) Any portion of the basement which exceeds 1.2m above natural or finished ground level (whichever distance is greater) must be setback from the property boundaries by a ratio 1:1 (height: setback). A minimum setback of 1.5m applies in this instance, with this area to be landscaped. For the purpose of determining the height of the basement, any solid walls located on the podium shall be included in the overall height calculation.
- e) Where parking is provided in a basement, ventilation structures for the basement parking and air conditioning units must be orientated away from windows of habitable rooms and private open space areas. Ventilation grills must be integrated into the design of the façade of the building to minimise their visual impact.
- f) The visual impact of all basement walls must be minimised through the use of various design techniques including well proportioned ground level articulation and relief, mixed finishes and materials, terracing and/or dense landscaping.
- g) Basements must be protected from inundation from 100-year ARI flood levels (or greater).

6.7 Communal open space

6.7.1 Objectives

- a) Ensure that communal open spaces are of adequate size to be functional.
- b) Provide communal open space which is accessible by all residents.

6.7.2 Development Controls

- a) Developments with more than 10 dwellings must incorporate communal open space. The minimum size of this open space is to be calculated at 5m2 per dwelling. Any area to be included in the communal open space calculations must have a minimum dimension of 5m.
- b) The communal open space must be easily accessible and within a reasonable distance from apartments, be integrated with site landscaping, allow for casual social interaction and be capable of accommodating recreational activities.
- c) Where a minimum of 15% of the site is provided as a deep soil zone, combined use of part of the deep soil zone as communal open space may occur. The combined communal open space/deep soil area may be grassed but must not contain significant shade trees. A maximum of 1/3 of the required communal open space area may be combined with the deep soil zone.
- d) Areas of the communal open space which are to be paved or which will contain shade structures, swimming pools or the like cannot be located within the deep soil zone.
- e) The communal open space area must receive at least 3 hours of direct sunlight between 9.00am and 3.00pm on June 21.

6.8 Private open space

6.8.1 Objectives

- a) Ensure that private open spaces are of sufficient size to accommodate a range of uses and are accessible and connected to indoor spaces where appropriate.
- b) Ensure functionality of private open space by reducing overlooking and overshadowing of such spaces.
- c) Reduce the dominance of balconies in determining building form.

6.8.2 Development Controls

- a) Private open space must be provided for each dwelling within a residential apartment building in the form of a balcony, courtyard, terrace and/or roof garden.
- b) Private open space for each dwelling within a residential apartment building must comply with the following:
 - i) The courtyard/terrace for the ground level dwellings must have a minimum area of 25m2 and a width of 2 metres. This area must be separated from boundaries by at least 1.5m with a vegetated landscaping bed and must not encroach upon deep soil zone landscaping areas.
 - The primary private open area of at least 70% of the dwellings within a residential apartment building must receive a minimum of three hours of direct sunlight between 9.00am and 3.00pm on June 21.
 - iii) Private open space areas (courtyards) must not extend forward to the front building setback by greater than 900mm.
 - iv) Private open space should be sited in a location which provides privacy, solar access, and pleasing outlook and has a limited impact on neighbours.
 - v) Design private open spaces so that they act as direct extensions of the living areas of the dwellings they serve.
 - vi) Clearly define private open space through use of planting, fencing or landscaping features.

- vii) Screen private open space where appropriate to ensure privacy.
- viii) Provide balconies with operable screens or similar in locations where noise or high winds prohibit reasonable outdoor use (i.e. next to rail corridors, busy roads and tall towers).
- c) Where private open space is provided in the form of a balcony, the following requirements must also be met:
 - i) Avoid locating the primary balconies where they address side setbacks.
 - ii) The balcony must have a minimum area of 12m2 open space a minimum depth of 2.4 metres.
 - iii) The primary balcony of at least 70% of the dwellings within a multi dwelling housing development shall receive a minimum of three hours of direct sunlight between 9.00am and 3.00pm on June 21.
 - iv) Balconies must be designed and positioned to ensure sufficient light can penetrate into the building at lower levels.
 - Individual balcony enclosures are not supported. Balcony enclosures must form part of an overall building façade design treatment and should not compromise the functionality of a balcony as a private open space area.

6.9 Overshadowing

6.9.1 Objective

a) Minimise the extent of loss of sunlight to living areas and private open space areas of adjacent dwellings.

6.9.2 Development Controls

- a) The design of the development must have regard to the existing and proposed level of sunlight which is received by living areas and private open space areas of adjacent dwellings. Sensitive design must aim to retain the maximum amount of sunlight for adjacent residents. Council will place greatest emphasis on the retention of sunlight within the lower density residential areas.
- b) Adjacent residential buildings and their public spaces must receive at least 3 hours of direct sunlight between 9.00am and 3.00pm on 21 June
- c) In determining access to sunlight, overshadowing by fences, roof overhangs and changes in level must be taken into consideration. Overshadowing by vegetation should also be considered, where dense vegetation appears as a solid fence. Refer to Land and Environment Court Planning Principles – Parsonage vs Ku-Rin-Gai Council (2004).
- d) In areas undergoing change, the impact of overshadowing on development likely to be built on adjoining sites must be considered, in addition to the impacts on existing development.

6.10 Solar access

6.10.1 Objective

a) Provide an appropriate level of natural sunlight to living spaces to improve residential amenity and minimise the use of artificial light.

6.10.2 Development Controls

- a) Residential apartment buildings must aim to maximise their level of northern exposure to optimise the number of dwellings having a northern aspect. Where a northern aspect is available, the living spaces and balconies of such apartments must typically be orientated towards the north.
- b) The development must maximise the number of apartments with a dual orientation. Single aspect, single storey apartments should preferably have a northerly or easterly aspect and a reduced depth to allow for access of natural light to all habitable spaces.

- c) Shading devices should be utilised where necessary, particularly where windows of habitable rooms are located on the western elevation.
- d) The living rooms and private open space of at least 70% of apartments should receive a minimum of three hours of direct sunlight between 9.00am and 3.00pm.
- e) The number of single aspect apartments with a southerly aspect (south-westerly to south-easterly) is limited to a maximum of 10% of the total number of apartments proposed.
- f) Provide vertical shading to eastern and western windows. Shading can take the form of eaves, awnings, colonnades, balconies, pergolas, external louvres and planting.

6.11 Natural ventilation

6.11.1 Objective

- a) Encourage apartment design which allows for natural ventilation of habitable rooms.
- b) Provide natural ventilation in non-habitable rooms, where possible.
- c) Reduce energy consumption by minimising the use of mechanical ventilation.

6.11.2 Development Controls

- a) Provide residential apartment buildings with a building depth of between 10 and 18m. The depth is measured across the shortest dimension of the building. Dwellings should be a maximum depth of 21m measured from the outside of the balcony.
- b) Variation to this standard will only be considered where it can be demonstrated that apartments will achieve the minimum requirements with regard to natural ventilation. This may be achieved where apartments have a wider frontage, or increased ceiling and window height to allow for greater penetration of natural light. The building depth is measured across the shortest access, excluding the depth of any unenclosed balconies.
- c) A minimum of sixty percent (60%) of all residential apartments shall be naturally cross ventilated.

Hems



Natural Ventilation Corner apartments encourage natural ventilation flows (Ref: Residential Flat Design Code)



Figure 6.1: Natural ventilation

- d) Twenty five percent (25%) of kitchens within a development must have access to natural ventilation. Where kitchens do not have direct access to a window, the back of the kitchen must be no more than 8m from a window.
- e) Single aspect apartments must be limited in depth to 8m from a window.

6.12 Visual privacy

6.12.1 General

Visual privacy measures are designed to protect the privacy and amenity of occupants within a residential apartment or serviced apartment. Visual privacy measures allow occupants to carry out private functions within all rooms in the apartment as well as private balconies or open space courtyards, through limiting direct views or overlooking issues from adjoining buildings.

6.12.2 Objectives

The key objectives for visual privacy are:

- (a) To provide reasonable levels of visual privacy externally and internally, during the day and at night.
- (b) To maximise outlook and views from principal rooms and private open space without comprosing visual privacy.

6.12.3 Development controls

1. New buildings should be sited and oriented to maximise visual privacy between buildings through compliance with minimum front, side and rear setback / building separation requirements.

- 2. The internal layout of buildings should be designed to minimise any direct overlooking impacts occurring upon habitable rooms and private balcony / open space courtyards, wherever possible by separating communal open space and public domain areas from windows of rooms, particularly sleeping room and living room areas.
- 3. Buildings are to be designed to increase privacy without compromising access to sunlight and natural ventilation through the following measures:
 - (a) Off-setting of windows in new buildings from windows in existing adjoining building(s).
 - (b) Recessed balconies and / or vertical fin elements between adjoining balconies to improve visual privacy.
 - (c) Provision of solid, semi-solid or dark tinted glazed balustrading to balconies.
 - (d) Provision of louvers or screen panels to windows and / or balconies.
 - (e) Provision of perimeter landscaped screen / deep soil planting.
 - (f) Incorporating planter boxes onto apartment balconies to improve visual separation between apartments within the development and adjoining buildings.
 - (g) Provision of pergolas or shading devices to limit overlooking of lower apartments or private open space courtyards / balconies.

6.13 Acoustic Privacy

Acoustic privacy is a measure of sound insulation between residential apartments and between external and internal spaces.

6.13.1 Objective

The main objective of acoustic privacy is to ensure a high level of amenity for occupants within residential apartments and / or serviced apartments in the development.

6.13.2 Development Controls

- 1. Residential apartments should be arranged in a mixed use building, to minimise noise transition between apartments by:
 - Locating busy, noisy areas next to each other and quieter areas, next to other quieter areas (eg living rooms with living rooms and bedrooms with bedrooms);
 - (b) Using storage or circulation zones within an apartment to buffer noise from adjacent apartments, mechanical services or corridors and lobby areas; and
 - (c) Minimising the amount of party (shared) walls with other apartments.
- 2. All residential apartments within a mixed use development should be designed and constructed with double-glazed windows and / or laminated windows, solid walls, sealing of air gaps around doors and windows as well as insulating building elements for doors, walls, roofs and ceilings etc; to provide satisfactory acoustic privacy and amenity levels for occupants within the residential and / or serviced apartment(s).
- 3. Noise transmission from common corridors or outside the building is to be minimised by providing seals at entry doors.
- 4. In order to assist acoustic control of impact noise between units:

- (a) A common wall shall have a Field Sound Transmission Class (FSTC) of not less than 50 if it separates;
 - (i) Sole occupancy units,
 - (ii) A sole occupancy unit from a plant room, stairway, public corridor, hallway or the like.
- (b) A wall separating a bathroom, sanitary compartment, laundry or kitchen in one sole occupancy unit from a habitable room (other than a kitchen) in an adjoining unit, shall have an FSTC of not less than 55.
- (c) A floor separating sole occupancy units must not have an FSTC less than 50.
- 5. In order to assist acoustic control of impact noise between units:
 - (a) A floor shall have an Impact Isolation Class (IIC) of not less than 50 if it separates;
 - (i) Habitable rooms of sole occupancy units
 - (ii) A sole occupancy unit from a plant room, stairway, public corridor, hallway or the like.
 - (b) A floor separating a bathroom, sanitary compartment, laundry or kitchen in one sole occupancy unit from a habitable room (other than a kitchen) in an adjoining unit, shall have an FSTC of not less than 55.
 - (c) Walls between sole occupancy units shall comply with the impact sound resistance standards specified in the BCA.
- All residential buildings and serviced apartments are to be constructed so that the repeatable maximum L Aeq (1 hour) level not does exceed the following levels:
 - (a) In a naturally ventilated windows closed condition:
 - (i) Sleeping areas (night time only: Hours 2200-0700) 35dB
 - (ii) Living areas (24 hours) 45dB
 - (b) In a naturally ventilated windows open condition, (ie, windows open up to 5% of the floor area, or attenuated natural ventilation open to 5% of the floor area):
 - (i) Sleeping areas (night time only: Hours 2200-0700) 45dB
 - (ii) Living areas (24 hours) 55dB
 - (c) Where a naturally ventilated windows open condition cannot be achieved, it is necessary to incorporate mechanical ventilation or air conditioning.
 - (d) The following repeatable maximum L Aeq (1 hour) levels shall not be exceeded when doors and windows are shut and mechanical ventilation or air conditioning is operating:
 - (i) Sleeping areas (night time only: Hours 2200-0700) 38dB
 - (ii) Living areas (24 hours) 46dB

Note: These levels correspond to the combined measured level of external sources and the ventilation system operating normally.

7. The Statement of Environmental Effects (SEE) accompanying the development must demonstrate that the abovementioned noise criteria for windows to sleeping areas and living areas and Field Sound Transmission Class (FSTC) criteria for walls and floors have been met for each residential apartment or serviced apartment in the development through the provision of appropriate acoustic treatment measures. The proposed acoustic measures must also be shown on the required architectural floor layout and elevation plans for the development.

Alternatively, the Statement of Environmental Effects (SEE) may include an acoustical impact assessment study which outlines alternative acoustic treatment measures for any residential apartments and / or serviced apartments in the development. The acoustic impact assessment study must be carried out by a suitably qualified and experienced acoustic consultant (ie a person who is a Member of the Australian Acoustical Society, the Institution of Engineers or the Association of Australian Acoustical Consultants).

6.14 Storage

6.14.1 Objective

 a) Provide accessible storage for larger household items which cannot be readily accommodated within dwellings.

6.14.2 Development Controls

a) For residential apartment buildings provide a secure space to be set aside exclusively for storage as part of the basement. The storage area must comply with the following requirements:

| Dwelling | Storage | Storage |
|----------------------------------|-----------------|------------------|
| | Area | Volume |
| One bedroom apartments | 3m ² | 3m ³ |
| Two bedroom apartments | 4m ² | 8m ³ |
| Three or more bedroom apartments | 5m ² | 10m ³ |

7 PLANNING CONTROLS FOR SPECIAL AREAS

The following controls are in addition to the general controls elsewhere in this part of the DCP. Controls for special areas apply to Heritage Conservation Areas and to special areas, including the Enterprise Corridor Zone, the Railway Precinct and the Civic and Cultural Precinct as identified in Figure 7.1.



Figure 7.1: Areas with special control/ principles

7.1 Special areas with heritage items

7.1.1 Development of Heritage Items Generally

Heritage items are identified in Schedule 5 of the Wollongong Local Environmental Plan 2009 (LEP). Works to listed heritage items, or development on listed heritage sites, or within Heritage Conservation Areas, are subject to the provisions of Clause 35 of the LEP 2009. As part of the assessment process, the consent authority must have regard to:

Heritage provisions in the City Centre LEP,

Wollongong Heritage DCP,

Heritage objectives as listed below,

The relevant Statement of Significance for each item,

The development principles and controls contained in this section,

Any conservation management plan, heritage impact statement or study required by the consent authority in response to proposed development of these areas, and

For development that affects a heritage item, information addressing relevant issues must be included in a Statement of Heritage Impact submitted with the development application (DA).

Development within the curtilage of a listed item, or a Heritage Conservation Area, or which will impact upon the setting of a heritage item or Heritage Conservation Area is also subject to the following provisions. Where there is a discrepancy with general controls elsewhere in the DCP the following objectives and controls are to apply.

Objectives

- a) To facilitate the conservation and protection of heritage items and Heritage Conservation Areas and their settings.
- b) To reinforce the special attributes and qualities of heritage items by ensuring that development has regard to the fabric and prevailing character of the item or special area e.g., scale, proportions, materials and finishes.
- c) To conserve, maintain and enhance existing views and vistas to buildings and places of historic and aesthetic significance.



Figure 7.2: St Michael's Cathedral and square

Conservation Criteria

As new development within the study area must ensure that the significance of heritage items and their setting are retained and enhanced. Development applications relating to heritage listed sites or sites within Heritage Conservation Areas must demonstrate how the proposed work will not adversely affect the heritage significance of the site and the area around it.

For sites in the vicinity of heritage items or Heritage Conservation Areas, an assessment of the impact of the proposal on the setting of nearby heritage items or Heritage Conservation Areas is to be undertaken.

Relevant criteria to be considered will vary for each proposal depending on the nature of development, the proximity of the development to surrounding heritage items and conservation areas as well as other factors. For this reason, each proposal will need to be considered on a case by case basis using the following general principles:

- a) Scale. The scale and bulk of any new building or work must be in scale with the original building and new development must not obstruct important views or vistas of the item. In the case of infill work in a conservation area, the scale of the new building must be similar to those around it. Where this is not feasible, sufficient curtilage around the heritage item must be included to assist interpretation of its heritage significance. In some circumstances, where site depth would allow, a higher building could be erected behind a heritage shopfront.
- b) **Siting.** If the existing street façade of the building is sympathetic to the character of the street, then alteration must be avoided. New work is best located to the rear or side of the building.
- c) Architectural form. The basic architectural form of any new work needs to respect what exists. Issues to consider are the roof form, proportion and location of windows and doors.
- d) Architectural detailing. It is important to be aware of the particular era and architectural style of the building or buildings and make sure that any proposed changes are contextual to the period. For example, it is not appropriate to mix Victorian features with a California Bungalow. Overuse of historical architectural features on new work should be avoided, with preference given to uncomplicated interpretive forms and detailing.
- e) Materials and finishes. Reuse existing materials where possible. New materials and detailing must be compatible with the original and consideration must be given to the colour, texture and type of materials and finishes.
- f) Use. The best use for a building is usually the one for which it is built. Where this is not possible, a use sympathetic to the layout of the building and requiring minimal alterations will be more compatible.
- g) **Original fabric.** It is important to minimise alterations to the original fabric and where possible, repair rather than replace individual elements, such as windows and doors.
- h) The aging process. The patina of age on a building adds much to its character and significance. A worn step for example demonstrates the many years of feet crossing a threshold. Such features add to the uniqueness and character of a place and must be retained wherever this does not present a public safety risk.
- i) **Curtilage.** There are three types of heritage curtilage:
 - Lot boundary. The lot boundary is the most common type of curtilage. It may contain associated buildings, gardens, walls, fences and the like which contribute to the significance of the property. The majority of built items in Wollongong are listed within their lot boundary curtilage.
 - ii) Reduced curtilage. This curtilage is less than the lot boundary of the property and it arises where the significance of the item and its interpretation is not dependant on having a large curtilage extending to a lot boundary. Examples are a large estate with sufficient land on the lot that can be subdivided independent of the heritage significance of any item on that land, or a new dwelling adjacent but not impacting on the existing heritage item on that land. In such cases, it is necessary to identify a curtilage that enables the heritage significance of the item to be retained, and
 - iii) Expanded curtilage. This curtilage is greater than the property boundary. An expanded curtilage may be required to protect that landscape setting or visual catchment of an item. For example, the significance of some properties includes a visual link between the property itself and a harbour, river or topographical feature.
- j) Infill development. The key to successful infill development adjacent to a heritage item is reflected in design where the infill is of similar mass and character to the adjacent heritage building/s. This may comprise use of the vertical (versus square) windows, verandas, balconies, positive roof pitches (i.e. 25 to 35 degrees) and general façade detailing. Buildings and landscaping may establish a character of an area and provide a sense of continuity and recognised community value. Unsympathetic infill will disrupt the unity of a group of buildings and may spoil the existing character. Architectural 'good manners' are important in areas of special character. An infill building must not precisely imitate its neighbour but use recognisable tools such as massing, scale, setback and orientation, detailing and materials, roof forms and coursing lines to complement adjacent heritage items.

Refer to the joint NSW Heritage Office and RAIA publication "Designing in Context: Guidelines for infill Development in the Historic Environment" (2005) for further guidance.

7.2 Special areas and Development Standards

These special areas are parts of the city centre that encompass one or more of the following:

A cluster of heritage items,

An important public domain area, or

A place that has strong community recognition as being linked to the origins of the city, its first plan and settlement.

These are identified in figure 7.1. Each area has its own set of objectives linked to the relevant development controls. These controls must be considered in addition to the other requirements of this section.

For the purposes of applying appropriate development controls, the North Beach Precinct and Belmore Basin Heritage Conservation Area which is listed as a State significant item in the WLEP 2009 and the North Beach Heritage Precinct which is listed on the State Heritage Register are considered under the controls established in the Conservation Management Plans.

7.2.1 Area 1: West Crown Street Shops

Objectives

- a) Promote conservation of early federation row of two-storey shops.
- b) Preserve the curvature of Crown Street to the point where it connects to West Crown Street.
- c) Preserve existing narrow lot layout as a reflection of early city subdivision patterns.
- d) Reduce number of over-scaled and inappropriate advertising signs.
- e) Encourage conservation of shop façade (including paintwork and possible restoration of classical detailing below awning level).
- f) Alleviate overshadowing and wind impacts on the streetscape.
- g) Promote consistency of street treatments such as awnings and lighting.

Development Standards

- a) Development in Area 1 must comply with the conservation criteria and development controls provided under Section 7.1.
- b) New development must retain and interpret the existing shopfront facades as part of the building design.
- c) New development and renovation of buildings must be designed by a suitably qualified registered architect.
- d) Shopfronts must be a maximum of six metres wide to retain fine grain of built form.
- e) Any other heritage conservation requirements of Council must be addressed.

Height

- i) A two-storey street wall must be retained with a minimum setback of four metres at the third storey.
- ii) Maximum building height to comply with the LEP 2007 and the sun access requirements.

Signage (refer also section 3.8 Advertising and Signage)

- i) Outdoor advertising signs and lighting must complement and be compatible with the building design in scale, style and colour.
- ii) Late 19th/early 20th Century style of outdoor advertising signs is required.
- iii) No signage is permitted on the roof of awnings or on structures extending above the awning.
- iv) Signs relating to products are not permissible over street awnings.



Figure 7.3: West Crown Street shops

7.2.2 Area 2: St Michael's Square/Law Courts/Market St West

Objectives

- a) To maintain the established moderate scale and civic nature of the square and civic buildings.
- b) To preserve the significant view looking West along Market Street to St Michael's Cathedral and east along Market Street towards the coast.
- c) To maintain the view of the square from Church Street and the mall looking north.
- d) To maintain the courthouse clock tower and Cathedral steeples as the highest structures on the hill.

Development Controls

- a) Development in Area 2 must comply with the conservation criteria and development controls provided under section 7.1.
- b) The view of the cathedral against the skyline looking west along Market Street must be maintained. Future developments that propose to penetrate this view will not be permitted.
- c) The height of new developments immediately west of St Michael's must not exceed the existing ridgeline of the cathedral (R.L 43.45 AHD).
- d) Development surrounding St Michael's Square must be designed so as not to compromise the existing views to be appreciated to and from the site in other directions.
- e) Building lines for any future development within and surrounding this site (such as land to the north of St Michael's Square) must align with the existing zero front setback of the cathedral and its associated buildings.

- f) Four metre front setback to all new development fronting Market Street east of St Michael's Church.
- g) New development and renovation of buildings must be designed by a suitability qualified registered architect.
- h) Shopfronts must be a maximum of six metres wide to retain fine grain of built form.

7.2.3 Area 3: MacCabe Park

Objectives

- a) To enhance the spatial definition of the edges of MacCabe Park.
- b) To encourage a high level of daylight access to the public domain.
- c) To promote passive surveillance and greater utilisation of the park.
- d) To promote active and passive recreation opportunities.

Development Controls

- a) Development in Area 3 must comply with the conservation criteria and development controls provided under section 7.1
- b) Any development surrounding the park must comply with the street edge height requirements shown in sun access diagrams in Figure 2.17 of this DCP.
- c) Any development of MacCabe Park must be in accordance with a plan of management for the park.



Figure 7.4: View looking along Market Street to St. Michal's Cathedral

7.2.4 Area 4: East Crown Street

Objectives

- a) To consolidate the remaining heritage character along east Crown Street between Kembla and Corrimal Streets.
- b) To promote appropriate and pleasant spatial links between the railway station and the foreshore.
- c) To alleviate overshadowing and undesirable wind action on prominent public and private open spaces.

d) To encourage tourism, recreational and cultural uses and activities in appropriate locations, especially east of Corrimal Street.

Development Controls

- a) Development in Area 4 must comply with the conservation criteria and development controls provided under Section 7.1.
- b) New Development and renovation of buildings must be designed by a suitably qualified registered architect.
- c) Residential development is only permitted in the form of mixed use development with at least the ground floor providing for shops, restaurant or commercial premises.

Building Height

- a) A 9m high street wall must be retained with a minimum setback of at least 10 metres at the third storey and above on the northern side of the street (to maintain winter sunlight to the street).
- b) Maximum building height must not exceed the height specified in the LEP 2007.



Figure 7.5: East Crown Street Shops

Façade

- a) Ground and first floor frontages of new buildings along East Crown Street from Kembla Street to Corrinal Street must be sympathetic to the late 19th Century Victorian and Italianate shop front styles without creating repetition of such styles.
- b) The appearance of building external finishes and colour must promote a sense of unity and character that consolidates the heritage environment.

Signage (refer also section 3.8 Advertising and Signage)

- a) Outdoor advertising signs and lighting must complement and be compatible with the building design in scale, style and colour.
- b) 19th Century styles of outdoor advertising signs may be considered along Crown Street between Kembla and Corrimal Streets.
- c) Signs relating to products are not permissible over street awnings.
- d) No signage is permitted on the roof of awnings or on structures extending above the awning.


Figure 7.6: Market Square

7.2.5 Area 5: Market Square

Objectives

- a) To retain the established residential character and moderate scale of development on land surrounding Market Square.
- b) To maintain a high level of daylight access to the public domain.

Development Controls

- a) Development in Area 5 must comply with the conservation criteria and development controls provided under section 7.1.
- b) The maximum height of all development must not exceed heights defined in the LEP 2007.
- c) A minimum front setback of four metres for new development is required to enhance the spatial definition of the edges of Market Square.

7.2.6 Area 6: Keira Street

Objectives

- a) Reinforce and emphasise the historical street proportions and street wall of main street shop typologies along Keira Street
- b) Retain the fine grain of shop front facades.
- c) Encourage further agglomeration of active uses (day and night) such as boutique restaurants, speciality shops, grocery stores, clubs and pubs (that characterise land north and south of Victoria Street).
- d) New development is to complement and not compete with the existing landmark on the northeast corner of Market and Keira Streets (formerly the National Mutual Life Association Building).

Development Controls

a) Development in Area 6 must comply with the conservation criteria and development controls provided under Section 7.1.

Building Height

a) Maximum building height must not exceed 24 metres.

Setbacks

- b) Front setback for two-storeys to be zero metres. Zero setback on the ground floor is to be strictly enforced for 100% of the street frontage.
- c) Front setback for third storey to be minimum four metres. New development on corner sites must maintain zero metres setback for 8m to 12m from the corner on the third storey.
- d) Side setbacks to be zero metres for a depth of 18m from the front boundary.

Façade

- a) Finished floor level of ground to be no greater than 500m above the footpath level at any point on the street façade.
- b) Non-structural verandah posts located minimum 500mm from the road are encouraged.
- c) The top of the three-storey base to Keira Street is to finish with a parapet wall. If the building is only three storeys high a pitched roof of 25 to 35 degrees is also allowable.
- d) External materials are to be rendered brickwork painted with at least two colours, face brickwork or tiles. If face brickwork is used it is to match the colour of the bricks used at the Illawarra Hotel or upper floors of 135-145 Keira Street. The principal colour of any paintwork is to be in the heritage colour palette of brown or cream.
- e) The ground floor façade is to include fenestration detailing to emulate the five metres grain of shop fronts existing on Keira Street.

Signage (refer also Section 3.8 Advertising and Signage)

- a) No signage permitted on the roof of awnings or on structures extending above the awning.
- b) Signs relating to products are not permissible over street awnings.
- c) Outdoor advertising signs and lighting must be compatible with the building design, style and colour.



Figure 7.7: Natural Mutual Life Association Building, 1938 in Keira Street

7.3 Non-residential development in the enterprise corridor zone

The Enterprise Corridor zone is identified as Area 7 in Figure 7.3. It allows for a range of commercial uses including industrial/warehouse uses, commercial offices and retailing as well as residential uses. The following controls seek to ensure that new development is compatible with existing land uses, and provide for a mix of business and employment uses and retail development as well as individual/warehouse development appropriate to its setting along a major approach to the city's commercial core.

The following controls apply to all non-residential development and are in addition to controls elsewhere in this part of the DCP. Where the controls in this section differ (except in relation to residential development), they shall override the requirement elsewhere in this part of the DCP.

7.3.1 Objectives

- a) To ensure that new development is compatible with surrounding land uses.
- b) To promote streets with pedestrian activity, amenity and safety.
- c) To promote high quality well designed buildings.
- d) To provide for buildings fronting the street and legible street addresses and access.
- e) To ensure that high quality materials and finishes are used for buildings and the public domain.
- f) To provide for infiltration of stormwater below the ground surface and reduce stormwater runoff.
- g) To improve pedestrian and vehicle access and connections within the zone and with the city centre.
- h) To minimise and control vehicle access off Flinders Street (Princes Highway).
- i) To promote Flinders Street as a 'boulevard' providing a gateway entrance to the commercial core.
- j) To ensure that new development has appropriate access.
- k) To discourage subdivisions of land into small lots without a detailed plan.

7.3.2 Development Controls

Land use

- a) In determining a development application, Council is to consider the suitability of proposed development in terms of its compatibility with existing development and impact on the amenity of surrounding properties relating to noise, vibration, odour, fumes, smoke, dust, waste and light spillage.
- b) Preferred areas for residential and mixed development are in 400m radius of North Wollongong Railway Station, to the eastern side of the area, abutting the general residential zone, and near open space areas (refer figure 7A).
- c) Preferred areas for commercial, retail and enterprise uses are fronting Flinders Street and on the southern part of the zone away from open space.
- d) Commercial office uses and retail uses in new mixed use development are to be located at ground level addressing the street frontage.

Building form

- a) Buildings are to front the street and provide a clear street address.
- b) Buildings are to present legible vehicle and pedestrian access points.
- c) Servicing areas and mechanical/electrical plants are to be screened from view from the public domain.
- d) A maximum of two advertising signs is allowed per building. Each sign is to relate to the use of the building. Refer to Section 3.7 of this part of the DCP for further controls and guidelines for signs.

Landscaping

- a) Front building setbacks, including any car parking areas, are to include landscaping.
- b) Use existing and new drainage lines and channels for landscaped open space and stormwater management measures such as detention.
- c) No fences are to be provided on street frontages.

Part D –Locality Based DCPs / Precinct Plans Chapter D13: Wollongong City Centre

Access, road connections and parking

- a) Vehicle and pedestrian access points are to be clear and legible.
- b) Driveways should be located more than 6m from an intersection or break in median strip, 25m from traffic lights and 1.5m to side boundaries.
- Car parking for commercial office and retail buildings, service areas and storage yards are to be c) located to the rear of buildings in basements - not on the street frontage.
- Industrial/warehouse buildings may have some car parking located in the front street setback subject d) to being integrated with approved landscaping.

Subdivision

a) The minimum site area for subdivision that is not part of a development application for building envelopes is 1,000 square metres.

http://www.informerica.com/



Figure 7.8: Enterprise Corridor

7.4 Special area design guidelines

More detailed design guidelines will be developed by Council for special areas and for key sites scheduled for architectural competitions.

Part D –Locality Based DCPs / Precinct Plans Chapter D13: Wollongong City Centre

7.5 Design excellence

7.5.1 Design Review Panel

- Any Development Application for land within the Wollongong City Centre for a development proposal involving a height of 35 metres or more and / or having a capital value of more than \$1,000,000 on a key site (ie being a site shown edged heavy black and distinctively coloured on the Key Sites Map in Wollongong Local Environmental Plan 2009) will be referred to the Design Review Panel for appropriate assessment, prior to determination of the application.
- The Design Review Panel will also consider any Development Application for land within the Wollongong City Centre, where an applicant wishes architectural design advice on their development proposal, prior to determination of the application.
- 3. The Design Review Panel will consider applications at the pre-lodgement stage, in order to provide upfront design advice prior to the formal lodgement of the Development Application.
- 4. The Design Review Panel will consider whether the development exhibits design excellence and will have regard to the following matters:
 - (a) Whether a high standard of architectural design, materials and detailing appropriate to the building type and location will be achieved,
 - (b) Whether the form and external appearance of the proposed development will improve the quality and amenity of the public domain,
 - (c) Whether the proposed development detrimentally impacts on view corridors,
 - (d) Whether the proposed development detrimentally overshadows an area shown on the Sun Plane Protection Map in Wollongong Local Environmental Plan 2009 and taking into account the sun access diagram requirements under clause 2.10 in this chapter of the DCP,
 - (e) How the proposed development addresses the following matters:
 - (i) The suitability of the land for development,
 - (ii) Existing and proposed uses and use mix,
 - (iii) Heritage issues and streetscape constraints,
 - (iv) The location of any tower proposed, having regard to the need to achieve an acceptable relationship with other towers (existing or proposed) on the same site or on neighbouring sites in terms of separation, setbacks, amenity and urban form,
 - (v) Bulk, massing and modulation of buildings,
 - (vi) Street frontage heights,
 - (vii) Environmental impacts such as sustainable design, overshadowing, wind and reflectivity,
 - (viii) The achievement of the principles of ecologically sustainable development,
 - (ix) Pedestrian, cycle, vehicular and service access, circulation and requirements,
 - (x) Impact on, and any proposed improvements to the public domain.

8 WORKS IN THE PUBLIC DOMAIN

Any development requiring works to be carried out within the public domain in the Wollongong City Centre will be subject to compliance with the requirements of the Wollongong City Centre Public Domain Technical Manual at Appendix 2 to this DCP and any other specific Council requirements.

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Part D –Locality Based DCPs / Precinct Plans Chapter D13: Wollongong City Centre

9 GLOSSARY / DEFINITIONS

Above awning sign

A projecting sign on top of an awning.

Awning

An awning is a predominantly horizontal structure that projects over a footpath from the host building to provide weather protection for pedestrians.

Awning fascia sign

A sign on the fascia of an awning or verandah.

Fascia sign

A sign on the fascia of an existing awning or verandah.

Habitable room

Any room or area used for normal domestic activities, including living, dining, family, lounge, bedrooms, study, kitchen, sun room and play room.

Identification sign

A sign used to identify a site, building, building use or tenant.

Illuminated sign

A sign which is internally or externally lit by artificial lighting whether that lighting is integral to or separate from the sign, including signs that have flashing or sequenced lighting, spotlighting, directional, projected or laser lighting.

Lane

An external space which is uncovered and open to the sky and which provides permanent pedestrian and/or vehicle connections through the city fabric at all hours.

Through site link

An enclosed or partly enclosed arcade within a development that has a public character, provides right of way and is open and accessible at each end.

Non-habitable room

Spaces of a specialised nature not occupied frequently or for extended periods, including bathrooms, toilets, pantries, walk-in wardrobes, corridors, lobbies, photographic darkrooms and clothes drying rooms.

Porte cochere

A porch, often used in hotel development, large enough for vehicles such as tourist coaches to pass through.

Projecting wall sign

A sign projecting in either a horizontal or vertical direction from the wall of a building.

Part D –Locality Based DCPs / Precinct Plans Chapter D13: Wollongong City Centre

Promotional sign

A sign on land or a building that advertises either:

Goods or services not provided by an occupier of a significant portion of the premises on which the sign is attached, or

An event or activity not conducted on the land or in the building.

Roof sign

A sign above parapet level of a building on the uppermost structural elements and attached to lift motor and plant rooms.

Silhouette

A building outline viewed against the sky.

Street alignment

The boundary between land allotments and a street or lane.

Street frontage height

The vertical distance measured in metres at the centre of the street frontage from the average of the street levels at each end of the frontage to the parapet level of the frontage. The parapet level is the horizontal plane in which at least two thirds of the length of the top of the façade is situated. No part of the façade is to be less than 80 per cent of the height.

Under awning sign

A sign located below or otherwise supported from the underside of an awning.

View

An extensive or long range prospect of particular objects or geographic features.

Vista

A view along a street terminated by a building or structure such as an obelisk.

Wollongong Development Control Plan 2009

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eneral Controls – Design Controls Car Parking, Access, Servicing/ 3. ante oading Facilities and Traffic Management

Contents

| 1 | INTRODUCTION | 3 | 7.8 | Basement Cal Parking | 12 |
|-----|---|-----|------|---|---------|
| • | | Ū | 7.9 | Mechanical Parking Systems | 13 |
| 2 | OBJECTIVES | 3 | 7.10 | Allocation of Car Parking within a Strata titled | |
| 3 | DEFINITIONS | 4 | | Development | 14 |
| Ū | | • | 7.11 | Public Car Parks | 14 |
| 4 | STATUTORY FRAMEWORK | 4 | 7.12 | Electronic Parking Vacancy Signs | 15 |
| 4.1 | Integrated Development – Section 91 of the | X'C | 7.13 | Car Parking & Access Construction Requirements | 15 |
| | Environmental Planning and Assessment Act 1979 & | | 7.14 | Directional Signage for Car Parking Areas | 15 |
| 4.2 | State Environmental Planning Policy (Infrastructure) 2007 | 74 | 7.15 | Green Travel Plans | 16 |
| E | | | 8 | VEHICULAR ACCESS | 16 |
| 9 | GUIDELINES | 4 | 8.1 | General | 16 |
| 6 | TRAFFIC IMPACT ASSESSMENT AND PUBLIC TRANSPORT STUDIES | 5 | 9 | LOADING / UNLOADING FACILITIES AND SERVICE VEHICLE MANOEUVRING | 17 |
| 6.1 | Car Parking and Traffic Impact Assessment Study | 5 | 9.1 | Loading / Unloading and Manoeuvring Area Requirements | 18 |
| 6.2 | Preliminary Construction Traffic Management Plan | 6 | 9.2 | Noise Impact Assessment associated with Loading / | |
| 6.3 | Public Transport Study | 7 | | Unloading Facilities | 19 |
| 7 | PARKING DEMAND AND SERVICING REQUIREMENT | S 8 | 10 | PEDESTRIAN ACCESS | 20 |
| 7.1 | Car Parking, Motor Cycle, Bicycle Requirements and Delivery / Servicing Vehicle Requirements | 8 | 11 | SAFETY & SECURITY (CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN) MEASURES | |
| 7.2 | Disabled Access and Parking | 8 | | FOR CAR PARKING AREAS | 20 |
| 7.3 | Bicycle Parking / Storage Facilities and Shower and Change Facilities | 9 | 12 | LANDSCAPING REQUIREMENTS FOR AT-GRADE CAN Parking Areas | R 20 |
| 7.4 | Waiver or Reduction of Parking Spaces | 10 | | | |
| 7.5 | Car Parking Credits for Existing Development | 11 | 13 | STUKMWATER DRAINAGE / WATER SENSITIVE | 21 |
| 7.6 | Monetary Contributions for Off Site Car Parking Provision | n11 | | UIDAN DESIGN | 21 |
| 7.7 | Car Parking Layout and Design | 11 | | | |

| Wollongong Development Control Plan 2009 - Draft | |
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1 INTRODUCTION

- 1. This chapter of the DCP provides general requirements for the assessment and management of traffic impacts associated with development. This chapter also outlines Council's general requirements for the design and provision of car parking, motorcycle parking, bicycle parking and storage facilities in addition to access and loading facility requirements for specific developments.
- 2. This chapter includes specific reference to recognised design standards such as Australian Standard AS2890 Parts 1 6 and AUSTROADS, where appropriate.
- 3. This chapter should be read in conjunction with other parts of the DCP, especially Part B (Land use Based Controls), Part C (City Wide Land uses) and Part D (Site Specific / Locality Based Controls) in relation to any other specific traffic, access, parking and servicing requirements for a specific development in particular zone or locality. This chapter should also be read in conjunction with Part E, Waste Management, in respect to the provision of suitable waste and recycling storage facilities, access and manoeuvring arrangements for waste recycling truck management.
- 4. In the event of any inconsistency between the requirements of this chapter of the DCP and other Parts of this DCP, the other Parts of the DCP shall prevail to the extent of the inconsistency.

2 **OBJECTIVES**

- 1. The key objectives of this part of the DCP are to
 - (a) Ensure that transport networks are able to support the proposed development in a manner that maintains safe levels of service.
 - (b) Provide adequate and safe vehicular access to sites without compromising streetscape qualities.
 - (c) Incorporate provisions that manage the demand for parking rather than seeking to accommodate peak demand.
 - (d) Recognise variable accessibility to public transport in parking rates for different parts of the city.
 - (e) Support an increase in bicycle and motorcycle usage by requiring provision of bicycle and motorcycle parking, storage and end-of-trip facilities for certain developments.
 - (f) Ensure that the design of access and parking areas meets relevant Australian Standards.
 - (g) Ensure that developments are designed to be accessible for pedestrians, cyclists and motorists.
 - (h) Provide adequate access, loading facilities and on-site manoeuvring for service and waste collection vehicles.
 - (i) Ensure that parking facilities are integrated into the design of developments and minimise visual impacts.
 - (j) Ensure safe access for pedestrians and people with a disability.

3 DEFINITIONS

AUSTROADS means AUSTROADS: "Guide to Traffic Management".

GFA is "Gross floor area" and is defined in the LEP.

4 STATUTORY FRAMEWORK

4.1 Integrated Development – Section 91 of the Environmental Planning and Assessment Act 1979 & Roads Act 1993 (section 138)

- 1. Under Section 91 of the Environmental Planning and Assessment Act 1979, an Integrated Development Application is required to be lodged where the concurrence of the NSW Roads and Traffic Authority is required under section 138 of the Roads Act 1993.
- 2. Under section 138 of the *Roads Act 1993* consent is required from the RTA (ie classified roads) and usually Council in other instances for the following:
 - (a) Erect a structure or carry out a work in, on or over a public road
 - (b) Dig up or disturb the surface of a public road
 - (c) Remove or interfere with a structure, work or tree on a public road
 - (d) Pump water into a public road from any land adjoining the road
 - (e) Connect a road (whether public or private) to a classified road
- 3. In regards to development affecting Classified Roads, concurrence will be required from the RTA prior to Development Consent being issued by Council.
- 4. However, an Integrated Development Application is not required to be lodged where Council is the consent authority and the approval authority under section 138 of the Roads Act. In such cases a Development Application for the proposed development is only required.

4.2 State Environmental Planning Policy (Infrastructure) 2007

1. Under State Environmental Planning Policy (Infrastructure) 2007, Council is required to formally forward a Development Application to the NSW Roads and Traffic Authority (RTA) for certain developments listed in Columns 2 & 3 of Schedule 3 of the policy and to consider any representations made by the RTA.

5 ADOPTION OF OTHER STANDARDS AND GUIDELINES

- 1. For the purposes of this chapter of the DCP, the provisions of the most current version of the following Australian Standards are adopted (except where amended by specific development controls):
 - (a) AS 2890.1 Part 1: "Parking Facilities: Off-street Car Parking";
 - (b) AS 2890.2 Part 2: "Parking Facilities: Off-street Commercial Vehicle Facilities";

- (c) AS 2890.3 Part 3: "Bicycle Parking Facilities";
- (d) AS 2890.5 Part 5: "On-street parking"; and
- (e) AS 2890.6 Part 6: "Off Street Parking for People with Disabilities".
- 2. The following documents may also be used as best practice guidelines where specific development controls are not contained in this DCP or the relevant Australian Standard.
 - (i) RTA: "Guide to Traffic Generating Developments" December 2002, Issue 2.2;
 - (ii) AUSTROADS: "Guide to Traffic Management; and
 - (iii) Building Code of Australia.
- <u>Note</u>: Where the above mentioned standards and guidelines are superseded by updated versions, the version current at the date of lodgement of the Development Application shall apply to the development.

6 TRAFFIC IMPACT ASSESSMENT AND PUBLIC TRANSPORT STUDIES

6.1 Car Parking and Traffic Impact Assessment Study

- 1. A Car Parking / Traffic Impact Assessment Study shall be submitted in support of the following Development Applications:
 - (a) All Development Applications required to be referred to the NSW Roads and Traffic Authority under Schedule 3 of State Environmental Planning Policy (Infrastructure) 2007; and
 - (b) Other Development Applications where in the opinion of Council may cause a potential significant adverse traffic generation or traffic management impact upon the surrounding road network.
- 2. The Car Parking / Traffic Impact Assessment Study must be prepared by a suitably qualified and experienced traffic engineering consultant.
- 3. The Car Parking / Traffic Impact Assessment Study shall be prepared in accordance with table 2.1 of the RTA Guide to Traffic Generating Developments 2002 (contact Council or the RTA for a copy of the guide).
- 4. Certain traffic generating developments will require intersection and / or network modelling to analyse the potential traffic impacts of the proposed development upon the surrounding road network and key intersections in the locality.
- 5. Accordingly, intersection modelling (eg SIDRA) will be required for any proposed traffic generating development as prescribed in Columns 1, 2 & 3 in Schedule 3 of SEPP (Infrastructure) 2007.
- Network modelling may be required for traffic generating development as prescribed in Columns 1 & 2 in Schedule 3 of SEPP (Infrastructure) 2007. The need for such modelling will be determined by Council at the pre-lodgement stage.

- 7. The findings of the modelling analysis are to be addressed in the Car Parking / Traffic Impact Assessment Study with appropriate recommendations as to whether road upgrading, signalisation and / or other traffic management works are necessary to enable the proposed development.
- 8. Electronic modelling files generated as part of the modelling analysis are to be submitted to Council and the RTA in conjunction with the Car Parking / Traffic Impact Assessment Study.

6.2 **Preliminary Construction Traffic Management Plan**

- 1. A preliminary Construction Traffic Management Plan may be required where it is likely that the construction phase of a development may pose a significant impact upon traffic movement, on-street car parking availability and / or pedestrian safety.
- 2. The preliminary Construction Traffic Management plan is required to address the following matters / aspects:
 - (a) Assessment of the existing traffic conditions within the road network and key intersections in the locality;
 - (b) Assessment of the existing public domain and pedestrian areas in proximity to the proposed development;
 - (c) Assessment of the anticipated traffic generation associated with the construction of the proposed development;
 - (d) Proposed heavy vehicle routes for raw material delivery vehicles, demolition / construction heavy vehicles and other service vehicles;
 - (e) Assessment of the proposed construction impact of the proposed development upon the surrounding road network, on-street car parking and / or pedestrian areas;
 - (f) Proposed traffic control measures required for each phase of the demolition and construction program for the development;
 - (g) Proposed hours of the development during both the demolition and construction phases of the development;
 - (h) Proposed temporary parking or storage arrangements for heavy vehicles awaiting their turn to service the site, especially demolition and raw material heavy vehicles;
 - (i) Proposed car parking arrangements for construction workers, including demand management measures;
 - (j) Sight line distances and other safety issues;
 - (k) Proposed location, frequency and duration of any road closures required (i.e. during the demolition and / or construction phases of the development), in order to ensure vehicular, pedestrian and construction worker safety; and
 - (I) Other relevant matters (ie depending upon the circumstances of the site and the nature of the proposed development).
- 3. In certain cases, Council may elect to forward the preliminary Construction Traffic Management Plan to the NSW Roads and Traffic Authority for appropriate comment.

4. Should Council ultimately grant consent to the development, Council may also require the preparation of a Final Construction Traffic Management Plan, prior to the release of the Construction Certificate.

6.3 Public Transport Study

- 1. Large-scale residential subdivision residential apartment buildings, mixed use developments, retail shopping centres, business / commercial office developments, community facilities, educational establishments and entertainment facilities etc should be sited in proximity to public transport nodes such as regular bus routes and railway stations, in order to maximise user access to public transport.
- 2. A Public Transport Study will be required for the following developments:
 - (a) New or major extensions to educational establishments such as Universities and Colleges which provide facilities for 2,000 or more students and which are located outside the boundaries of the Wollongong City Centre.
 - (b) Business Parks or new large industrial developments involving a total gross floor area of 20,000m² or greater and which are outside the boundaries of the Wollongong City Centre.
 - (c) Other development (as determined by Council, at the pre-lodgement stage).
- 3. The Public Transport Study should be prepared by a suitably qualified and experienced traffic engineering consultant.
- 4. The Public Transport Study is required to address a range of issues, including (but not necessarily limited to) the following:
 - (a) Locality plan showing the proposed development site in relation to nearest practical public transport route, bus stops and / or railway station;
 - (b) Assessment of the condition of any existing pedestrian footway between nearest bus stop or railway station and the development site;
 - (c) Where the development site is more than 400 metres from the nearest bus stop, written evidence is required which proves that appropriate negotiations have taken place with the public transport operator and the NSW Ministry of Transport to obtain a bus route and bus stop, in close proximity to the development;
 - (d) Full details as to the proposed location and seating arrangements for the bus stop;
 - (e) Recommendations as to the provision of a shuttle bus service, to operate between the specific land use and the closest railway station, in order to improve public transport accessibility; and
 - (f) Recommendations as to the provision of new pedestrian facilities such as pedestrian footways, pedestrian refuges and / or necessary upgrading of any existing footway, in order to encourage pedestrian access to public transport.

7 PARKING DEMAND AND SERVICING REQUIREMENTS

7.1 Car Parking, Motor Cycle, Bicycle Requirements and Delivery / Servicing Vehicle Requirements

- 1. The car parking, motorcycle and bicycle requirements for specific land uses / developments are contained in Schedule 1 to this chapter of the DCP.
- 2. Where development proposals contain uses that fall into a number of different land use categories the parking requirements will be calculated by adding up the quantum of car parking, motorcycle and bicycle required for each land use component. Where a formula in the table results in fractions, numbers are to be rounded up to the nearest whole number. If a number of uses are present on the same development site the rounding off is to take place after the requirements for all uses have been summed together.
- 3. Requirements relating to staff parking refer to the maximum number of staff concurrently present on the site at any time.
- 4. In the circumstances where the car parking and / or other requirements are not defined by this chapter in the DCP for a particular land use or in the RTA Guide to Traffic Generating Developments, a detailed Car Parking and Traffic Impact Assessment Study will be required to be prepared for the proposed development.
- 5. The car parking component of the study must include:
 - (a) A detailed car parking survey of similar development located in localities which demonstrate similar traffic and parking demand characteristics;
 - (b) Assessment of the current traffic flow conditions in the local road network and performance of key intersections in the locality;
 - (c) Assessment of existing on-street car parking and whether the locality is experiencing traffic and on-street parking congestion issues;
 - (d) Anticipated traffic generation rate for the development;
 - (e) Assessment as to likely impact of the development on traffic flows and traffic safety within the local road network and the demand for on-street parking in the future as a result of the proposed development; and
 - (f) Assessment of the on-site car parking requirements based on the detailed car parking survey of other similar developments and localities.

7.2 Disabled Access and Parking

- 1. Disabled access and parking facilities are to be provided in accordance with AS2890.6 (2009), Building Code of Australia and the Commonwealth Disability Discrimination Act 1992. The car parking rates for accessible car parking spaces are contained in Schedule 2 below (Table D3.5 of the BCA).
- 2. Each disabled person's parking space must be designed in accordance with the minimum dimensions as contained in the *AS2890.6 (2009)*. This shall be reflected on the relevant DA car parking layout plans. The disabled car parking spaces shall be clearly marked and signposted and located adjacent to the entrance exit with a minimum 2.5 metre head clearance in accordance with *AS2890.6 (2009)*.

- 3. The designated car parking spaces for people with a disability must be positioned directly adjacent to main lift lobby or access points servicing the development. In this regard, a continuous accessible path of travel must be provided to all levels within the subject building and all facilities in accordance with AS 1428.1 and the Access for People with a Disability chapter contained in Part E of this DCP.
- 4. The continuous accessible path of travel must be:
 - (a) From accessible parking spaces and passenger drop off points to entrances of buildings;
 - (b) To connect buildings, facilities and spaces that are on the same block or part of the same, complex, where topographically possible;
 - (c) To connect accessible entrances of a building to all accessible spaces and facilities within the building;
 - (d) To minimise distances travelled between accessible elements of buildings and facilities; and
 - (e) Provided between public domain areas to building entrances.
- 5. A continuous path of travel should be the most commonly used and direct path of travel. If for any reason this is not possible, clear signage indicating an alternative route must be provided.
- 6. The designated car parking spaces for people with a disability must be appropriately signposted and line marked. The details of such car parking spaces for people with a disability shall be reflected on the architectural plans submitted with the Development Application.
- 7. The main entry point to the building shall be in accordance with the current relevant Australian Standard 1428.1 2001 Design for Access and Mobility Part 1 General Requirements for Access Buildings. The proposed pedestrian ramps within the car parking areas shall incorporate gradients (with suitable landing intervals) in accordance with the current Australian Standard.

7.3 Bicycle Parking / Storage Facilities and Shower and Change Facilities

- 1. Developments are to be designed to provide suitable bicycle parking facilities. The provision of bicycle parking for a particular land use / development shall be in accordance with Schedule 1.
- 2. For commercial office / business premises and retail centres, suitable bicycle parking facilities should be provided for both tenants / workers as well as bicycle couriers.
- 3. Provision for access by vehicles and vehicle parking is not to compromise the equity and amenity of bicycle access and parking.
- 4. Bicycle parking is to be designed and constructed in accordance with AS 2890.3, Parking Facilities Part 3: Bicycle Parking Facilities OR Austroads: "Guide to Traffic Management, Part 14: Bicycles (1995)".
- 5. Bicycle parking facilities are to be provided in accordance with *AS 2890.3*, Table 1.1 for all user classes exempting class 4.
- 6. Shower, change facilities and personal lockers shall be provided in accordance with Table 1 below.

- 7. Bicycle parking devices should be designed to enable the wheels and frame to be locked to the device without damaging the bicycle. The parking device should be easily accessible to / from a public road. The bicycle parking device should not encroach into any pedestrian thoroughfare but should be positioned in full public view, wherever practicable.
- 8. The bicycle parking area should be designed to be protected from damage arising from the manoeuvring of motor vehicles and the opening of vehicle doors.
- 9. The bicycle parking area is to be well lit by appropriate existing or new lighting as per AS 1680.2 Table E1 or higher, if required for monitoring of the car park and access points by closed circuit television (CCTV).
- 10. The bicycle parking area should also be protected from the weather, as far as practicable.

| Table 1: Bicycle End-of-trip Facilities | | 8 |
|--|---|---------------------|
| Required Bicycle Parking Spaces (refer to Schedule 1) | Shower & Change Cubicle | Personal Lockers |
| < 5 bicycle spaces | n/a | n/a |
| 5 - 11 bicycle spaces | 1 | 1 per bicycle space |
| 11 – 20 bicycle spaces | 2 | 1 per bicycle space |
| > 20 bicycle spaces | 2 + 1 additional shower and change cubicle for every additional 10 bicycle spaces, or part thereof | 1 per bicycle space |

Note: Shower and change facilities may be provided in the form of shower/change cubicles in a unisex area or showers in both female and male change rooms.

7.4 Waiver or Reduction of Parking Spaces

- 1. Council has the discretion to waive or reduce the minimum number of car spaces required for a particular site if the reduced provision can be justified in the accompanying Car Parking and Traffic Impact Assessment study, in terms of:
 - (a) The amount of public car spaces in the locality;
 - (b) Proximity to public transport nodes;
 - (c) Opportunity for cross utilisation with another use; and
 - (d) An empirical assessment of car parking.

Note: The following car parking reductions can be applied in relation to public parking availability and public transport accessibility.

City Centre B3 Commercial Core and B4 Mixed Use Zones (excluding residential, office premises, retail and business premises uses):

• 30% reduction due to increased access to public parking and public transport

City Wide:

- 10% reduction* if bus stop within 400m of site (measured along an existing footpath)
- 20% reduction* if railway station within 800m of site (measured along an existing footpath)
- 10% reduction* if public car park with greater than 50 car spaces within 400m of site (measured along an existing footpath)

*Reductions are cumulative with a maximum final reduction of 30%

7.5 Car Parking Credits for Existing Development

- 1. Car parking credits for existing land uses / development will only be supported where written evidence is provided which proves that the existing development is operating lawfully in accordance with development consent.
- 2. For Development Applications involving a change of use* or redevelopment which do not cause any net increase in the demand for car parking, Council may determine that the provision of any additional car parking is not required. In the majority of cases, a Car Parking Impact Assessment study will be required to demonstrate that the proposal will not necessitate any demand for additional parking and hence, to justify this car parking variation request.
- 3. The necessity of a Car Parking Impact Assessment study will be determined by Council at the formal pre-lodgement meeting for the proposed development.

*For development applications involving a change of use within the B3 Commercial Core and B4 Mixed Use zones in the Wollongong City Centre, the provision of additional car parking is not required.

7.6 Monetary Contributions for Off Site Car Parking Provision

- 1. The provision of car parking on site in accordance with Schedule 1 (subject to Clause 7.4) may be found to be impractical or undesirable due to a number of factors. Some or all of the required parking may be provided as public parking through a monetary contribution to Council, in addition to Section 94A levies, via a Voluntary Planning Agreement (VPA).
- 2. Council may refuse to enter into such a VPA if there are no Council owned public parking facilities to be constructed near the development.

7.7 Car Parking Layout and Design

- 1. The parking dimensions, internal circulation, aisle widths, kerb splay corners, head clearance heights, ramp widths and grades of the car parking areas are to be in conformity with the current relevant Australian Standard AS2890.1 (2004). No sprinklers or other services shall encroach within the clear head clearance height requirement.
- 2. The layout of all car parking areas shall be in strictly accordance with Australian Standard AS 2890 and the following additional requirements:
 - (a) Parking areas must be designed so any vehicle which uses the area will be able to enter and leave the site in a forward direction without the need to make more than a three point turn.
 - (b) Stacked parking may be permitted in the following circumstances:

- (i) The applicant must demonstrate that there is a need for stacked parking and that the provision of stacked parking will not adversely affect the safe, efficient and effective use of the site;
- (ii) No more than two cars are parked in a stacked arrangement, so that no more than one vehicle has to move to allow egress of another;
- (iii) Provision shall be made on site for shifting cars without the movement of vehicles onto public streets;
- (iv) Residential: only permitted where both spaces are utilised by the same dwelling and such spaces do not interfere with common manoeuvring areas; and
- (v) Business or Industrial: only permitted for staff spaces, provided the spaces are used by the occupants of one tenancy.
- 3. Small car spaces will only be permitted where the total quantum of required standard sized car parking spaces has already been provided. Small car parking spaces must be designed in accordance with *AS 2890.1*, Clause 2.4 Design of Parking Modules.
- 4. Car parking areas should be designed to ensure that through traffic is excluded or appropriately managed.
- 5. Pedestrian entrances / exits are to be separated from vehicular entry exit points.
- 6. Developments with high pedestrian movements throughout the car parking area(s) such as major retail shopping centres, commercial offices and major entertainment / recreational facilities must incorporate clear and convenient pedestrian routes. The pedestrian routes within the car parking areas must take into account pedestrian desire lines and minimise potential vehicular / pedestrian conflict points. Pedestrian routes must be well lit and sited to maximise pedestrian visibility.
- 7. Car parking areas should incorporate traffic calming and pedestrian crossing facilities such as speed humps, raised thresholds, marked pedestrian crossing points and clear directional signage to pedestrian access points within the development. These must be provided within the car park in order to reduce speed and enhance pedestrian safety and accessibility in accordance with AS2890.1.
- 8. Gradients of ramps and access driveways shall be provided in accordance with Australian Standard AS2890.1 (2004) Off Street Car Parking.
- 9. Wheel stops must be designed and installed in accordance with AS2890.1.
- 10. The provision of suitable barriers, line-marking and painted signage delineating vehicular flow movements within the car parking areas is also required, in order to improve traffic circulation within the car parking area.

7.8 Basement Car Parking

- 1. A minimum 2.4 metre headroom height shall be provided throughout any basement car parking and traffic circulation area.
- 2. A geotechnical and hydro-geological report (i.e. prepared by a suitably qualified engineer) may be required to be provided to Council, in order to address the issues of construction methodology and groundwater management for any proposed basement or sub-basement car parking area. The purpose of this report is to ensure that there is no ground settlement or movement, changes to groundwater level and / or adverse vibration impacts during construction which may result in an adverse impact upon any adjoining property or service infrastructure. The determination as to whether a geotechnical or hydro-geological report is necessary will be determined by Council at the pre-lodgement meeting or via written correspondence to Council requesting Council's written reply response (ie where a formal pre-lodgement meeting is not normally required for the development proposal as per the pre-lodgement meeting requirements in Part A of the DCP).

- 3. Additionally, full details showing how flood-proofing of the vehicular access, fire escape and any ventilation openings will be achieved.
- 4. Waste collection vehicles may enter building basements to collect waste and/or recyclables subject to the following requirements:
 - (a) Compliance with Australian Standard AS 2890.2 Parking Facilities: Off-Street Commercial Vehicle Facilities;
 - (b) The height to the structural members and upper floor ceiling should allow for collection vehicle travel height/operational height, consistent with the type of vehicle nominated as the waste collection vehicle;
 - (c) Adequate provision of space clear of structural members or vehicle parking spaces to allow a typical three-point turn of collection vehicles or alternatively, provision should be made for a truck turn table within the basement car parking area; and
 - (d) The basement floor should be of industrial-type strength pavement and designed for a maximum wheel loading of seven tonnes per axle to accommodate garbage and recycling collection vehicles.
- 5. Wheel stops are to be provided to all car parking spaces, in order to minimise vehicle accidents / damage and to prevent vehicle encroachment into public domain areas or landscaping.

7.9 Mechanical Parking Systems

- 1. The use of mechanical parking systems will only be considered in cases where it can be demonstrated to the satisfaction of Council that the provision of conventional car parking (ie either at-grade or basement car parking) is not appropriate given inherent site constraints and the proposed mechanical parking system is not a result of an overdevelopment of the site.
- 2. Mechanical parking systems may provide for more space-efficient storage of vehicles than can be achieved with traditional at-grade parking. However, mechanical stacked car parking systems will only be considered to meet the car parking needs of owners / tenants only. Mechanical stacked car parking will not be supported for shared use or for visitor parking.
- 3. Where it is proposed to incorporate a mechanical parking system within a development, the following information is required, as part of a Car Parking / Traffic Impact Assessment Study:
 - (a) The company make and model of the proposed mechanical car parking stacking system;
 - (b) A demonstrated need for the system, including reasons why parking cannot be satisfactorily provided in an at-grade parking arrangement;
 - (c) Demonstrated compliance with all relevant clauses of AS2890.1;
 - (d) A demonstrated minimum internal headroom clearance of 1.90m in the entry level of the system;
 - (e) A demonstrated minimum internal vertical clearance of 1.55m on all other levels within the parking system;
 - (f) Details of security measures restricting the use of the system to owners / permanent residents of the building only (e.g. security key pads);
 - (g) Details of noise and vibration associated with the use of the system;

- (h) Details of a waiting bay, demonstrating that vehicles can safely and conveniently wait at the entry level for other vehicles to manoeuvre to or from the parking system. Waiting bays must be designed so as to not obstruct traffic flow within the parking level and to prevent any on-site queuing. Waiting bays would typically have identical dimensions to parking spaces as per AS2890.1 and are additional to the parking requirement of the development;
- An assessment of the likely vehicle queuing impacts associated with system, with reference to the operating times of the system, peak vehicle movements and available queue lengths within the parking area;
- (j) Swept path turning templates demonstrating the ability of vehicles to turn into and out of the system in a single movement;
- (k) Assessment of the adequacy of the facility to cater for a range of vehicles from small sports cars up to large 4WDs (ie the facility is capable of storing the 100th percentile vehicle);
- (I) Proposed management procedures to be implemented in the running of the facility, including emergency response procedures.

Note:

- 1. All visitor and customer parking spaces and those spaces associated with adaptable housing must be provided in at-grade positions (i.e. separate to any mechanical parking system), and
- 2. The mechanical car parking stacker system and all associated infrastructure such as pits and ceiling indentations must be clearly shown on the architectural drawings of the car parking area, at the time of lodgement of the Development Application.

7.10 Allocation of Car Parking within a Strata titled Development

- 1. Where strata subdivision of a development is proposed, car parking spaces shall be allocated to strata lots or common property within the strata plan in accordance with the development consent conditions and approved plans issued for the development.
- 2. In some instances the identification of car parking spaces for specific uses and/or tenancies/ units within developments may be appropriate.

7.11 Public Car Parks

- 1. The establishment and operation of a public carpark requires formal Council consent and may also require concurrence from the NSW Roads & Traffic Authority, if the carpark triggers the threshold levels contained in Columns 2 or 3 in Schedule 3 of SEPP (Infrastructure) 2007. Additionally, the proposed operation of a public carpark also requires an Activity approval under Section 68 of the Local Government Act 1993. Therefore, a combined Development Application / Section 68 Activity Application may be lodged pursuant to the provisions of Section 78A (subsections 78A(2) & (3)) of the Environmental Planning and Assessment Act 1979.
- 2. The exact location of boom gates in a proposed public carpark is an important consideration to ensure adequate queuing lengths are available on-site, in order to minimise potential adverse queuing problems upon any public road.
- 3. The actual design queue length for a particular carpark must be determined by the nature and size of the proposed land use serviced by the subject carpark and the likely parking demand and access requirements, during peak periods. The design of any boom gate and the minimum queue length required within the site must be in accordance with the requirements of Australian Standard AS2890.1 (2004).

4. For developments which require the lodgement of a formal Car Parking and Traffic Impact Study, the study should help determine the desired location of any proposed boom gates / ticket booths and the minimum queue length required to satisfactorily service the development.

7.12 Electronic Parking Vacancy Signs

1. For large retail shopping centres and major entertainment / recreation facility developments with separate or multi-level car parking areas, Council may require the provision of electronic parking vacancy signage at each entry to the car parking area or each carpark level, in order to minimise potential additional traffic flow movement impacts within the development and upon the surrounding road network arising from patrons having to access different car parking areas in the development, in endeavour to find a vacant car parking space.

7.13 Car Parking & Access Construction Requirements

General

- 1. All car parking areas and internal roads must be constructed of a hard-standing all-weather material (ie concrete or asphalt bitumen), which must be maintained to the satisfaction of Council, at all times.
- 2. The pavement construction shall be in accordance with the Subdivision Code and Council's Development Design and Construction Specifications requirements.
- 3. For large industrial or commercial office developments or major retail shopping centres, car parking areas should be designed to include water sensitive urban design treatment measures, in order to encourage infiltration of stormwater run-off rather than direct discharge of stormwater run-off into the piped drainage system.
- 4, Alternatively car parking areas may be sealed with an all-weather surface and high flows managed by detention storage and pollutants removed by suitably designed, installed and maintained devices (GPT, grass swales etc). Minimum trafficked area surface standards in this case are:
- 5. Low parking turnover (<50 movements) flush seal (ie. two coat bitumen spray).
- 6. High parking turnover (>50 movements) asphalt concrete.

Certification of Construction

7. All parking area surfaces will be certified by a suitably qualified Engineer prior to occupation or use.

Line Marking of Car Parking Spaces

8. All car parking areas shall be permanently line marked as detailed in AS 2890.

7.14 Directional Signage for Car Parking Areas

1. All car parking areas shall be provided with appropriate entry and exit advisory signage to direct vehicles into / from the carpark and to minimise potential vehicular conflicts. The details of the proposed entry / exit signage shall be reflected on the architectural plans submitted with the Development Application.

- 2. Where a one-way traffic circulation flow is proposed, all internal roads within car parking area shall be appropriately line marked with directional (arrow) signage to clearly indicate the direction of traffic circulation and to minimise potential vehicular conflicts. This requirement shall be reflected on the architectural plans (ie car parking layout plans) to be submitted with the Development Application.
- 3. All advisory signage and pavement marking is to be provided in accordance with *AS 2890.1*, Section 4.

7.15 Green Travel Plans

Council encourages the use of green travel plans throughout Wollongong, particularly for larger residential developments, offices, recreation facilities, business and retail premises in the Wollongong City Centre. A green travel plan is a tool to minimise the negative impacts of travel on the environment. It describes ways in which the use of sustainable transport may be encouraged for users of the development. Components/strategies of a Green Travel Plan will likely vary according to the nature of the development, but may include:

- a) identification and promotion of public transport options for customers accessing the site e.g. via website, business cards.
- b) encouragement of a car pool system for employees.
- encouragement of cycling and walking to the workplace through provision of bicycle parking, showers and lockers
- d) incentive schemes to encourage employees to commute using sustainable transport modes (such as provision of public transport vouchers/subsidised public transport tickets)
- e) allocation of designated parking spaces for a car sharing scheme, and/or
- f) prominent display of a large map of cycling routes for customers and residents (for example, in the foyer of a residential complex).

8 VEHICULAR ACCESS

8.1 General

- 1. Access to off-street parking areas must comply with Council's Standard Vehicle Entrance Designs, with any works within the footpath and road reserve subject to a section 138 *Roads Act 1993* approval.
- 2. Sight distances to be used for assessment and determination of a suitable driveway location shall be obtained from Australian Standard AS2890.1 (2004) for car use and Australian Standard AS2890.2 (2002) for any access to be used by a commercial vehicle.
- 3. Driveway grades, vehicular ramp width/grades and passing bays must be in accordance with *AS* 2890.1.
- 4. Generally, direct access to arterial or sub-arterial roads will not be permitted, except where no legal alternative access is available.
- 5. Where a development site has dual frontage to a classified road and a secondary road, all driveway crossings (ie entry and exit points) are to be provided via the secondary road unless it

can be demonstrated that this arrangement will have an unacceptable impact on road safety and traffic efficiency. This must be justified with suitable studies or modelling.

- In cases where an access to a classified road is permitted, a deceleration lane may be required, 6. in order to maintain traffic flow movements along the classified road and to minimise potential rear end vehicular accidents which may otherwise occur where vehicles turn into the site from a trafficable lane.
- 7. The area required for any deceleration lane must be provided within the development site itself with this portion of the land being dedicated as public road at no cost to the RTA or Council. Any necessary relocation of public infrastructure required due to a deceleration lane must be detailed in the architectural / section plans lodged with the Development Application with the costs of any such relocation, being fully borne by the developer.

LOADING / UNLOADING FACILITIES AND SERVICE VEHICLE 9 MANOEUVRING

- Site design must allocate adequate space for the loading, unloading, parking and manoeuvring of 1. delivery and service vehicles within the subject property. Design of these areas shall comply with AS 2890.2.
- Loading /unloading facilities shall be provided for the following land uses: 2.
 - (a) Retail shopping centres / specialty retail shops.
 - (b) Commercial Offices / Business Development,
 - (c) Bulky good premises,
 - (d) Factory,
 - (e) Warehouse distribution centre,
 - (f) Light industrial retail outlets,
 - (g) Landscape supplies establishment

 - (h) Retail or Wholesale Nursery,(i) Residential flat building/Multi-dwelling housing/Shop top housing,
 - (i) Seniors housing (including housing for people with a disability),
 - (k) Take away food premises,
 - (I) Food and drink premises,
 - (m) Kiosk,

 - (n) Function,(o) Function centre,
 - (p) Medical centre /health consulting room,
 - (q) Pub / Registered Club,
 - (r) Funeral home / Funeral chapel
 - (s) Other developed requiring loading or unloading facilities.
- 3. Schedule 1 identifies the various types of service vehicles to be catered for within the various development types. Special vehicles such as buses, garbage trucks and ambulances may have particular access, manoeuvring and operating conditions. The designer or applicant should refer to AS 2890.2 Off-street parking (Part 2: Commercial vehicle facilities) and Roads and Traffic Authority, 1993: "Guide to Traffic Generating Developments".
- Table 3 provides the minimum parking / service bay and manoeuvring requirements for delivery 4. and service trucks

 Table 2: Minimum Parking / Service Bay and Manoeuvring Design Requirements for Service and Delivery

 Trucks

| Truck Type | Design Dimensions | Design Turning Template |
|----------------------------|---------------------------------|----------------------------|
| Small Rigid Vehicle | Minimum length – 6.4m | As per <i>AS 2890.2</i> |
| | Minimum height clearance – 3.5m | |
| Medium Rigid Vehicle | Minimum length – 8.8m | As per <i>AS 2890.2</i> |
| | Minimum height clearance – 4.5m | |
| Large Rigid Vehicle | Minimum length – 12.5m | As per <i>AS 2890.2</i> |
| | Minimum height clearance – 4.5m | 8 |
| Articulated Vehicle (Semi- | Minimum length – 19.0m | As per <i>AS 2890.2</i> |
| railer) | Minimum height clearance – 4.5m | 0 |

9.1 Loading / Unloading and Manoeuvring Area Requirements

- 1. All small rigid trucks through to large rigid trucks and articulated heavy vehicles (semi-trailers) must be able to manoeuvre entirely on-site and enter and leave the site in a forward direction. All truck turning or manoeuvring areas must be separate from areas of normal pedestrian or vehicular traffic.
- 2. All loading and unloading activities shall take place wholly within the loading bay, at all times. No loading or unloading activity shall take place within any car parking area, landscaping area, pedestrian footway or any public road reserve.
- 3. The designated loading / unloading area shall be kept free for that purpose, at all times.
- 4. Loading / unloading facilities shall be located so they are not visible from any adjoining residential area and do not transmit excessive noise onto any adjoining residential area.
- 5. All loading dock facilities must guarantee satisfactory on-site manoeuvring areas for trucks in accordance with the Australian Standard AS 2890.2 Design Vehicular and Turning templates.
- 6. Council will assess the adequacy of proposed manoeuvring areas provided for on-site truck manoeuvring with reference to the standard vehicle turning templates as per the Australian Standard AS 2890.2 Design Vehicular and Turning templates.
- 7. All developments must be designed to ensure that the standard truck for each development as per Table 3 is able to complete a semi-circular turn on the site, in order to guarantee that all truck movements into / from the site are in a forward direction.
- 8. Truck turning circles shall not encroach upon any building, car parking space or landscaped area.
- 9. Access arrangements should be designed in accordance with the NSW Roads & Traffic Authority's Traffic Generating Guidelines and Australian Standard AS 2890.1 (2004). However, it is desirable that separate access arrangements be made available for standard passenger vehicles and trucks upon the development site, in order to minimise potential vehicular conflicts.

- 10. All internal two-way access roads shall have a minimum width of 7 metres. Lesser widths may be provided if the internal road system is designed to a single one-way circulation arrangement within the site including any loading dock facilities. Directional signage shall be shown on all internal roadways (where required) to facilitate the orderly movement of trucks and other vehicles within the site.
- 11. As per the provisions of C2.4 of the Building Code of Australia, emergency vehicular access must be provided from a public road. In this respect, the internal access road must have an unobstructed 6 metre width with no part of the building being more than 18 metres away from the access road. The minimum 6 metre wide access road shall be reserved for vehicular and pedestrian access only and not built upon or used for any other purpose.
- 12. Loading docks should also be positioned wherever possible, away from the street frontage. Where such facilities can only be provided to the street frontage, appropriate landscaping will be required in front of the loading facility to adequately screen the development.
- 13. All loading / unloading and manoeuvring areas should be located as far as practicable away from any abutting residential or other sensitive development. Where these activities are likely to result in loss of amenity in nearby residential areas, visual and acoustic screening approved by Council may be required to minimise the potential loss of amenity to adjoining residential or other sensitive development.
- 14. Queuing associated with the loading dock must not impact the operation of adjacent car parking areas, pedestrian paths, internal circulation roadways or public roads.

9.2 Noise Impact Assessment associated with Loading / Unloading Facilities

- 1. The submission of a noise impact assessment report may be required with a Development Application where loading dock facilities are proposed to be positioned in proximity to any adjoining noise sensitive land uses such as residential dwellings, Senior Living developments and educational establishments etc. This requirement will be at the discretion of Council.
- 2. The NSW Department of Environment and Climate Change's '*Environmental Criteria for Road Traffic Noise*' policy is to be used for the assessment of potential traffic noise impacts from the site.
- 3. The noise impact assessment report will be required to address the existing LA_{90} background & LA_{eq} abient noise levels at the boundary to the nearest residential land uses during the daytime, evening and night-time periods. The noise impact assessment report must also address the predicted L_{A1} (maximum noise level) and L_{A10} average maximum noise level of the development, particularly in respect to the loading and unloading activities conducted within the loading dock facility of the development. The noise impact assessment report should also apply the NSW Department of Environment and Climate Change's *'Industrial Noise Policy'* sleep intrusiveness noise criteria and the amenity criteria in determining the noise impact upon sensitive residential land uses. The policy prescribes a sleep disturbance criterion of $L_{A1(1 \text{ minute})} < L_{A90(15 \text{ minutes})} + 15DB(A)$.
- 4. Any noise impact assessment report shall also provide recommendations on acoustic attenuation measures required to be provided to improve the acoustic performance of the loading dock facility and / or other operational restrictions (i.e. restricted delivery times for delivery trucks), bearing in mind the nature and frequency of proposed truck deliveries to / from the site and the predicted noise impacts arising from loading / unloading activities.

10 PEDESTRIAN ACCESS

- 1. New driveway crossings are required o be constructed at grade to facilitate and support access for pedestrians and disabled persons to and within the site.
- 2. Footpaths are to be provided for pedestrians to move from adjacent streets and footpaths onto the site and to destinations within the site. Particular attention is to be given to the movement of pedestrians to and from public transport stops, bicycle parking areas and disabled parking areas. Depending on the expected volumes of pedestrian traffic, weather protection for key pedestrian movement corridors should be integrated into the building design.
- 3. Provision for access by vehicles and vehicle parking is not to compromise the equity and amenity of pedestrian access.
- 4. Pedestrian facilities are to be designed in accordance with AUSTROADS "Guide to Road Design Part 6A: Pedestrians AND Cyclist Paths (2009)".

11 SAFETY & SECURITY (CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN) MEASURES FOR CAR PARKING AREAS

- 1. The soffit of the roof slab, all walls and all columns of any basement car parking area in addition to the interior of all lift foyer areas, fire exits and other staircases must be painted in a white finish, in order to improve the visibility throughout the car park and to minimise potential 'dark spots'.
- 2. The exit fire stairs should also be wide and open, in order to improve visual surveillance into these areas from the car parking and traffic circulation areas within the facility.
- 3. The car parking area should also be designed to prevent blind corners and to maximise visibility and sightlines for both persons in vehicles and pedestrians.
- 4. All car parking spaces should be visible to approaching vehicles and not 'hidden'.
- 5. All pedestrian areas should follow pedestrian desire lines and be well lit.
- 6. The lighting of car parking areas must be in accordance with AS 1680 and lighting levels must be in accordance with AS 1680.2 Table E1 or higher if required for monitoring of the car park and access points by closed circuit television (CCTV).
- 7. All emergency lighting and exit lights are to be provided with "vandal resistant" fittings suitable for use in an unsupervised car park.

12 LANDSCAPING REQUIREMENTS FOR AT-GRADE CAR PARKING AREAS

- 1. The provision of landscaping to car parking areas is designed to provide visual relief to the development site and to help screen the car parking area from adjoining properties and public road frontages.
- 2. Landscaping is required to be an integral part of all car parking areas and internal roads within a development.
- 3. Landscaping should be used throughout the car parking areas at regular intervals and around the perimeter of the car parking areas.

- 4. A minimum 3 metre deep front landscaped setback is required for car parking areas fronting a public road (excluding industrial developments where a 5 metre 10 metre landscaped buffer screen may be required, depending upon the scale and height of the development).
- 5. A minimum 2 metre wide side landscaped buffer screen is required for all car parking areas.
- 6. A dense rear landscaped buffer screen setback may also be required, particularly where the zoning or land use of the rear abutting properties is different to the subject site. This requirement should be raised by the applicant at the formal pre-lodgement meeting of the proposed development with Council.
- 7. The provision of shade trees throughout the car parking area is also required. In this regard, the provision of 1.5 metre wide landscaped islands will be required for every 10 car parking spaces within each aisle of the car park.
- 8. The planting of trees and larger shrubs should occur in the centre of the landscape planter beds with small shrubs and groundcovers positioned at the edge of the planter boxes.
- 9. The selection of appropriate trees and shrubs within car parking areas is critical given that trees or shrubs which drop branches, gum or fruit or trees / shrubs which interfere with underground stormwater drainage pipes are not considered suitable for car parks.
- 10. Any existing trees with a satisfactory Safe Useable Life Expectancy (SULE) rating should be retained within the car parking area, wherever practicable.
- 11. Wheel stops or 150mm concrete kerbs or edge treatments must be used to prevent vehicles encroaching upon the landscaped areas. The use of bollards may also be appropriate in certain circumstances.
- 12. All proposed landscaping shall be in accordance with the Landscaping chapter contained in Part E of this DCP.
- 13. The Landscape concept plan is to be submitted with the Development Application.

13 STORMWATER DRAINAGE / WATER SENSITIVE URBAN DESIGN

- 1. Refer to the Stormwater Management chapter contained in Part E of this DCP for stormwater drainage and on-site stormwater detention requirements for off-street car parking and access areas.
- 2. For certain developments, the Water Sensitive Urban Design treatment measures may also be required for car parking and access areas in accordance with the requirements of the Water Sensitive Urban Design chapter in Part E of the DCP.

Schedule 1 – Car Parking, Bicycle, Motorcycle and Delivery Vehicle Parking Requirements

Note: Variations to controls is Schedule 1 may be considered if supporting information is submitted in accordance with Cl 7.4 of this Chapter.

| Land Use | Car Parking Requirements | Bicycle Parking Requirements | Motorcycle Parking Requirement | Delivery / Service Truck Requirement |
|----------|--------------------------|------------------------------------|--------------------------------------|--|
|----------|--------------------------|------------------------------------|--------------------------------------|--|

| Land Use | Car Parking Requirements | Bicycle Parking Requirements | Motorcycle Parking Requirement | Delivery / Service Truck Requirement |
|--|---|--|---|---|
| Boarding house | <i>City wide:</i> 0.5 car parking space per staff plus 1 car parking space per 5 beds | 1 bicycle space per bed | | NA |
| Dwelling house | <i>City wide:</i> 1 space per dwelling with a gross floor area of less than 125m2; or 2 spaces per dwelling with a gross floor area of 125m2 or greater <i>Wollongong city centre:</i> 1 car parking space per dwelling | NA | NA | NA |
| Dual occupancy | <i>City wide:</i> 1 car parking space per dwelling (<125m ²) or 2 car parking spaces per dwelling (125m ² or greater) | NA | NA | NA |
| Residential flat building / Multi- dwelling housing / Shop top housing / Attached Dwelling | City wide: 1 car parking space per dwelling (<70m ²) or 1.5 car parking spaces per dwelling (70-110m ²) or 2 car parking spaces per dwelling (>110m ²), plus 0.2 car parking spaces per dwelling for visitors Wollongong City Centre or within 400m of railway station (measured along existing footpath): 0.75 car parking space per dwelling (<70m ²) or 1 car parking space per dwelling (70-110m ²) or 1.25 car parking spaces per dwelling (>110m ²), plus 0.2 car parking spaces per dwelling for visitors | 1 bicycle space per 3 dwellings (residents) and 1 bicycle space per 12 dwellings (visitors) | 1 motorcycle space per 15 dwellings | Large Rigid Vehicle (Waste Contractor) >10 dwellings – side loading waste collection vehicle (refer to Chapter E7: Waste Management) |
| Seniors housing (including housing for people with a disability) | Residential care facilities: 1 car parking space per 10 beds (or 1 car parking space per 15 beds if the facility provides care for dementia patients only) plus 1 car parking space per 2 employees plus 1 ambulance space. | NA | NA | Large Rigid Vehicle |

| Land Use | Car Parking Requirements | Bicycle Parking Requirements | Motorcycle Parking Requirement | Delivery / Service Truck Requirement |
|---------------------------------------|---|--|--|--|
| | <i>Hostels:</i> 1 car parking space per 5 dwellings plus 1 car parking space per 2 employees plus 1 ambulance space <i>Self contained dwellings:</i> 0.5 car parking space per bedroom or 1 car parking space per 5 dwellings where social housing <u>Note</u>: The parking rates are based on the maximum rates indicated in SEPP (Housing for Seniors or People with a Disability) 2004 | | ×8 | |
| Hospitals | <i>City wide:</i> I car parking space per medical practitioner plus 1 car parking space plus 2 employee plus 1 car parking space per 2 beds. | 1 bicycle space per 5 car spaces | 1 motor cycle space per 25 car spaces | Large Rigid Vehicle |
| Backpackers accommodation | <i>City wide:</i> 1 car parking space per 2 staff plus 1 car parking space per 5 beds | 1 bicycle space per 5 beds plus 1 car parking space per staff member | 1 motor cycle space per 25 car parking spaces | NA |
| Bed and breakfast accommodation | <i>City wide:</i> As per dwelling house plus 1 car parking space per guest bedroom | NA | 1 motor cycle space per 10 guest bedrooms | NA |
| Tourist and visitor accommodation | <i>City wide:</i> 1 car parking space per 2 staff members plus 1 car parking space per apartment / unit | NA | 1 motor cycle space per 10 apartments / units | Small Rigid Vehicle |
| Office premises | City wide (excluding the B3 Commercial Core and B4 Mixed Use zones in Wollongong City Centre): 1 car parking space per 40m ² of GFA Zones B3 Commercial Core and B4 Mixed Use in Wollongong City centre (as per WLEP 2009): | 1 bicycle space per 200m ² GFA for staff plus 1 bicycle space per 750m ² GFA for visitors | 1 motorcycle space per 25 car parking spaces | <1,000m ² GFA – Small Rigid Vehicle >1,000m ² GFA 0 Large Rigid Vehicle |

| Land Use | Car Parking Requirements | Bicycle Parking Requirements | Motorcycle Parking Requirement | Delivery / Service Truck Requirement |
|---|---|---|--|--|
| | 1 car parking space per 60m ² of GFA | | | |
| Business premises / Retail premises | City wide (excluding the B3 Commercial Core and B4 Mixed Use zones in the Wollongong City Centre): 1 car parking space per 40m ² of GFA – business premises 1 car parking space per 25m ² of GFA – retail premises Zones B3 Commercial Core and B4Mixed Use in Wollongong City Centre (as per WLEP2009): 1 car parking space per 60m ² of GFA Note 1: Where there is an inconsistency between the parking rates specified for uses within the "Business premises" and "Retail premises" groups, the specific parking rates shall prevail except in Zones B3 and B4 in Wollongong city centre. For example, the specific parking rate for Medical Centre is 4/consulting room plus 1/3 employees. This rate would prevail over the general Business Premises rate of 1/40m ² , except if the development is located in Zones B3 or B4 in Wollongong city centre. | 1 bicycle space per 200m ² GFA for staff plus 1 bicycle space per 750m ² GFA for visitors – business premises. 1 bicycle space per 750m ² GFA for staff plus 1 bicycle space per 1000m ² GFA for shoppers – retail premises. | 1 motorcycle space per 25 car parking spaces | <1,000m ² GFA – Small Rigid Vehicle >1,000m ² GFA – Large Rigid Vehicle, Articulated Vehicle (Semi- Trailer)* |
| Bulky goods premises | <i>City wide</i> : 1 car parking space per 30m ² GFA (<500m ²) or 2 car parking spaces per 100m ² (500-3000m ²) or 2 car parking spaces per 150m ² (>3000m ²) | 1 bicycle space per 200m ² GFA | 1 motor cycle space per 25 car spaces | Large Rigid Vehicle – Articulated Vehicle (Semi- Trailer)* |
| Vehicle sales or hire premises | <i>City wide</i> : 0.75 car parking spaces per 100m ² GFA plus 3 car parking spaces per work bay where servicing is | 1 bicycle space per 200m ² GFA | 1 motor cycle space per 25 car parking spaces | Articulated Vehicle (Semi-Trailer) |

| Land Use | Car Parking Requirements | Bicycle Parking Requirements | Motorcycle Parking Requirement | Delivery / Service Truck Requirement |
|---|--|---|--|--|
| | undertaken | | | |
| Car tyre fitting centres | <i>City wide</i> : 3 car parking spaces per work bay | 1 bicycle space | 1 motor cycle space per 3 work bays | Large Rigid Vehicle |
| Food and drink premises | <i>City wide</i> : 1 car parking space per 25m ² GFA (<i>excluding specific premise types</i> <i>described below</i>) | 1 bicycle space per 200m ² GFA | 1 motor cycle space per 25 car parking spaces | Small Rigid Vehicle |
| o Restaurant | <i>City wide</i> : 1 car parking space per 4 staff, plus 1 car parking space per 6m ² or 1 car parking space per 4 seats whichever is the greater <i>Note:</i> For change of use applications in Town Centres (as defined in Chapter B4 Development in Business Zones), the provision of additional parking will not be required | 1 bicycle space per 200m ² GFA | 1 motor cycle space per 25 car parking spaces | Small Rigid Vehicle |
| Take-away food premises | <i>City wide</i> : 1 car parking space per 25m ² GFA | 1 bicycle space per 200m ² GFA | 1 motor cycle space per 25 car parking spaces | Small Rigid Vehicle >500m ² or drive through facility – Large Rigid Vehicle |
| o Pub | <i>City wide:</i> 1 car parking space per 2 staff plus 1 car parking space per 5m ² GFA or 1 car parking space per 6 seats (whichever is the greater) | 1 bicycle space per 25m ² GFA | 1 motorcycle space per 25 car parking spaces | <500m ² GFA – Small Rigid Vehicle >500m ² GFA – Large Rigid Vehicle, Articulated Vehicle (Semi- Trailer)* |
| Neighbourhood shop | <i>City wide</i> : 1 car parking space per 25m ² GFA | 1 bicycle space per 25m ² GFA | 1 motorcycle space per 25 car parking | Small Rigid Vehicle |

| Land Use | Car Parking Requirements | Bicycle Parking Requirements | Motorcycle Parking Requirement | Delivery / Service Truck Requirement |
|---|--|--|--|--|
| | | | spaces | |
| Kiosk | <i>City wide</i> : 1 car parking space per 25m ² GFA | 1 bicycle space per 25m ² GFA | 1 motorcycle space per 25 car parking spaces | Small Rigid Vehicle |
| Function centre | <i>City wide</i> : 1 car parking space per 2 staff plus 1 car parking space per 5m ² | 1 bicycle space per 25m ² GFA | 1 motor cycle space per 25 car parking spaces | Large Rigid Vehicle |
| Market | <i>City wide</i> : 1 car parking space per 20m ² of each stall area Note: Major retail markets may require additional car parking as well as provision for an emergency vehicle | 1 bicycle space per 10 stalls | 1 motor cycle space per 25 car parking spaces | Small Rigid Vehicle |
| Medical centre / Health consulting room | City wide: 4 car parking spaces per consulting room plus 1 car parking space per 3 employees | bicycle space per medical centre | 1 motorcycle space per 25 car parking spaces | Small Rigid Vehicle |
| Hotel or motel accommodation | <i>City wide:</i> 1 car parking space per 2 staff members plus 1 car parking space per unit / apartment <i>Wollongong City Centre:</i> 1 car parking space per 4 staff plus 1 car parking space per motel unit or 0.5 car parking space per hotel unit / apartment <i>Zones B3 Commercial Core and B4Mixed Use in Wollongong city centre (as per WLEP):</i> 1 car parking space per 40m² GFA, where the hotel or motel accommodation is not strata subdivided If a restaurant is included in the hotel | NA | 1 motor cycle space per 25 car parking spaces | >15 units/ apartments – Large Rigid Vehicle |

| Land Use | Car Parking Requirements | Bicycle Parking Requirements | Motorcycle Parking Requirement | Delivery / Service Truck Requirement |
|---|---|---|--|--|
| | / motel which is available to the general public, then an additional 15 car parking spaces per 100m ² GFA of the restaurant shall be included | | | |
| Registered Club | <i>City wide:</i> 1 car parking space per 2 staff plus 1 car parking space per 5m ² GFA or 1 car parking space per 6 seats (whichever is the greater) | 1 bicycle space per 25m ² GFA | 1 motorcycle space per 25 car parking spaces | <500m ² GFA – Small Rigid Vehicle >500m ² GFA – Large Rigid Vehicle, Articulated Vehicle (Semi- Trailer)* |
| Funeral home / Funeral chapel | <i>City wide:</i> 1 car parking space per 4 seats plus 1 car parking space per funeral service area | NA | 1 motor cycle space per 25 car parking spaces | Small Rigid Vehicle |
| Restricted premises | <i>City wide:</i> 1 car parking space per 40m ² | 1 bicycle space per 200m ² GFA | 1 motor cycle space per 25 car parking spaces | Small Rigid Vehicle |
| Video stores | <i>City wide:</i> 6 car parking spaces per 100m ² GFA | 1 bicycle space per 200m ² GFA | 1 motor cycle space per 25 car parking spaces | Small Rigid Vehicle |
| Service station / convenience store / fast food restaurant | <i>City wide:</i> 1 car parking space per 2 staff plus 3 car parking space per work bay plus 1 car parking space per 25m ² of retail convenience store plus 10 car parking spaces for any ancillary fast food restaurant component | 2 bicycle spaces | 1 motor cycle space per 10 car parking spaces | Articulated Vehicle (Semi-Trailer) |
| Timber and building supplies | <i>City wide:</i> 1 car parking space per 45m ² GFA | 1 bicycle space per 200m ² GFA of factory building | 1 motor cycle space per 25 car parking spaces | Large Rigid Vehicle – Articulated Vehicle (Semi- Trailer)* |
| Veterinary hospital | City wide: | NA | NA | Small Rigid Vehicle plus |
Part E – General Controls – Design Controls Chapter E3: Car Parking, Access, Servicing/ Loading Facilities and Traffic Management

| Land Use | Car Parking Requirements | Bicycle Parking Requirements | Motorcycle Parking Requirement | Delivery / Service Truck Requirement |
|---|---|--|--|---|
| | 3 car parking spaces per consulting room plus a loading / unloading area to cater for horse trailers etc (If the veterinary hospital involves care for larger animals) | | | trailer parking / manoeuvring |
| Industry Warehouse / Distribution centre | <i>City wide:</i> 1 car parking space per 75m ² GFA; or 1 car parking space per 150m ² GFA for buildings greater than 5,000m ² where the facility is purpose built for a particular business and where it can demonstrated that staff car parking is satisfactorily catered for <i>City wide:</i> 1 car parking space per 75m ² GFA; or 1 car parking space per 150m ² GFA for buildings greater than 10,000 square metres of gross floor area where the facility is purpose built for a particular business and where it aparticular business and where it | 1 bicycle space per 200m ² GFA 1 bicycle space per 200m ² GFA | 1 motor cycle space per 25 car parking spaces 1 motor cycle space 25 car parking spaces | <500m ² GFA – Small Rigid Vehicle >500m ² GFA - Large Rigid Vehicle, Articulated Vehicle (Semi- Trailer)* Large Rigid Vehicle – Articulated Vehicle (Semi- Trailer)* |
| | car parking is satisfactorily catered for | | | |
| Light Industrial Retail Outlets | <i>City wide</i> : 1 car parking space per 25m ² GFA of gross floor area | 1 bicycle space per 200m ² GFA | 1 motorcycle space per 25 car spaces or part thereof | <500m ² GFA – Small Rigid Vehicle >500m ² GFA - Large Rigid Vehicle |
| Landscape and garden supplies | <i>City wide:</i> 1 car parking space per 30m ² GFA of any building used for retailing plus 1 car parking space per 45m ² for outdoor areas used for retail display purposes plus 1 car parking space per 200m ² for areas used exclusively for propagation or storage, whether indoor or outdoor. | NA | 1 motorcycle space per 25 car parking spaces | Large Rigid Vehicle – Articulated Vehicle (Semi- Trailer)* |

Part E – General Controls – Design Controls Chapter E3: Car Parking, Access, Servicing/ Loading Facilities and Traffic Management

| Land Use | Car Parking Requirements | Bicycle Parking Requirements | Motorcycle Parking Requirement | Delivery / Service Truck Requirement |
|--|---|---|--|---|
| Retail Plant Nursery | <i>City wide:</i> 10 car parking spaces plus 1 additional car parking space per 100m ² of building GFA or land area used for the retailing of plants | NA | 1 motorcycle space per 25 car parking spaces | Large Rigid Vehicle – Articulated Vehicle (Semi- Trailer)* |
| Vehicle body repair shop / Vehicle repair station | <i>City wide:</i> 1 car parking space per 2 employees plus 3 car parking spaces per work bay | 1 bicycle space per 200m ² GFA | 1 motor cycle space per 25 car parking spaces | Large Rigid Vehicle |
| Manufactured home estate | <i>City wide:</i> Car Parking as per Local Government (Manufactured Home Estates, Caravan Parks, Camping Grounds and Moveable Dwellings) Regulation 2005 | NA | NA | Large Rigid Vehicle |
| Caravan park | <i>City wide:</i> 1 car parking space per site Note: In accordance with Local Government (Manufactured Home Estates, Caravan Parks, Camping Grounds and Moveable Dwellings) Regulation 2005 | NA | NA | Large Rigid Vehicle (Waste collection trucks and Coaches) |
| Educational establishment | 1 car parking space per staff member plus 1 car parking space per 10 Year 12 students. | 1 bicycle space per 10 students above grade 4 | 1 motor cycle space per 25 car parking spaces | Large Rigid Vehicle |
| Child Care Centres | space for each member of staff present at any one time. plus visitor space per 6 children. plus space as per Off Street Parking for People with Disabilities. plus | 1 bicycle space per 200m ² GFA | 1 motor cycle space per 25 car parking spaces | Small Rigid Vehicle - Medium Rigid Vehicle |

Chapter E3: Car Parking, Access, Servicing/ Loading Facilities and Traffic Management

| Land Use | Car Parking Requirements | Bicycle Parking Requirements | Motorcycle Parking Requirement | Delivery / Service Truck Requirement |
|----------------------------|---|--|--|--|
| | 2 large spaces (3.2m x 5.5m) for parents requiring the use of strollers | | | |
| Place of Public Worship | <i>1 space per 20m</i> ² GFA, or 1 space per 10 seats, which ever is the greater | 1 bicycle space per 10 car parking spaces | 1 motor cycle space per 25 car parking spaces | Small Rigid Truck |

<u>Note*</u>: The determination as to the standard truck size for a particular development will be dependent upon the nature and scale of the development and will be determined by Council at the pre-lodgement meeting stage.

Schedule 2 – Car Parking Requirements for People with a Disability

| Building Code of Australia Classification | Car Parking Requirements (Table D3.5 of the BCA) |
|---|--|
| Class 3a | Calculated by multiplying the total number of car parking spaces by the:- |
| Boarding-houses, Guest Houses, Hostels or Backpackers Accommodation | (i) Percentage of accessible sole-occupancy units to the total number of sole-occupancy units; (ii) Percentage of beds to which access for people with a disability is provided to the total number of beds provided. The calculated number shall be taken to the next whole |
| | |
| Class 3b Residential part of a Hotel or Motel | 1 car parking space for every 100 car parking spaces or part thereof. |
| Class 5,7,8 and 9c | 1 car parking space for every 100 car parking spaces |
| Standalone car parks, workshops, industry uses, office premises and aged care premises | |
| Class 6 | XO |
| Retail uses | 1 car parking space for every 50 car parking spaces or part thereof |
| (a) Up to 1000 car parking spaces(b) For each additional 100 car parking spaces or part thereof in excess of 1000 car parking spaces | 1 car parking space |
| Class 9a | |
| (a) Hospital | 1 car parking space for every 100 car parking spaces or part thereof. |
| (b)Hospital (Outpatient Area) | |
| (i) Up to 1000 car parking spaces; and | 1 car parking space for every 50 car parking spaces or part thereof. |
| (ii) For each additional 100 car parking spaces or part thereof in excess of 1000 car parking spaces. | 1 car parking space. |
| (c) Nursing Home | 1 car parking space for every 100 car parking spaces or part thereof. |
| (d) Clinic or day surgery not forming part of a hospital | 1 car parking space for every 100 car parking spaces or part thereof. |

Part E – General Controls – Design Controls Chapter E3: Car Parking, Access, Servicing/ Loading Facilities and Traffic Management

| Building Code of Australia Classification | Car Parking Requirements (Table D3.5 of the BCA) |
|--|---|
| Class 9b | |
| (a) Educational Establishment | 1 car parking space for every 100 car parking spaces or part thereof. |
| (b) Other Assembly Buildings | |
| (i) Up to 1000 car parking spaces; and | 1 car parking space for every 50 car parking spaces or part thereof. |
| (ii) For each additional 100 car parking spaces or part thereof in excess of 1000 car parking spaces | 1 car parking space. |
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Part E – General Controls – Design Controls

Chapter E6: Landscaping

Contents

- 1 INTRODUCTION
- 2 OBJECTIVES
- **3 DEFINITIONS**
- 4 MINIMUM INFORMATION REQUIREMENTS TO ACCOMPANY A DEVELOPMENT APPLICATION
- 4.1 Site and Context Analysis Plan
- 4.2 Landscape Concept Plan
- 5 NEIGHBOURHOOD AMENITY AND CHARACTER
- 5.1 Landscape Character
- 5.2 Streetscape Character
- 5.3 Site Amenity
- 6 GENERAL LANDSCAPING REQUIREMENTS
- 6.1 Planting Requirements
- 6.2 Excavation

Γ

| | 6.3 | Retaining walls | 9 |
|---|-----|---|----|
| | 6.4 | Green walls, green roofs and planting on a slab or podium | 9 |
| | 6.5 | Embankments | 10 |
| | 6.6 | Noxious Weeds | 10 |
| (| 6.7 | Street Trees | 11 |
| | 7 | CAR PARKING AREAS | 13 |
| | 8 | POST DEVELOPMENT CONSENT | 14 |
| | 8.1 | Tree Protection during Construction | 14 |
| | 8.2 | Maintenance | 15 |

| Document Control | | |
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| TO BE INSERTED IF ADOPTED | DATE OF PUBLIC NOTICE | Updates resulting from sustainability review. |
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1 INTRODUCTION

This chapter outlines Council's requirements for the lodgement of landscaping plans and other information in support of a Development Application.

This Chapter should be read in conjunction with (but not limited to) the development controls in the following chapters:

- A1 Introduction;
- B1 Residential Development;
- B2 Residential Subdivision;
- B3 Mixed Use Development;
- B4 Development in Business Zones;
- B5 Industrial Development;
- E2 Crime Prevention Through Environmental Design;
- E11 Heritage Conservation;
- E15 Water Sensitive Urban Design;
- E17 Management of Trees; and
- E22 Riparian Land Management.

2 **OBJECTIVES**

- (a) To define the landscaping provisions necessary for the Development Application process.
- (b) To ensure that landscaping is appropriate to characteristics of its locality, preserving and contributing to its natural, cultural, heritage and visual character.
- (c) Minimise the impacts from development on natural site features in particular retaining existing trees where feasible.
- (d) Facilitate long term improvements to the landscape of the Wollongong LGA.

3 **DEFINITIONS**

| 0 | A second |
|-----------------|---|
| Green root | A root surface that supports the growth of vegetation, comprised of a waterproofing membrane, drainage layer, organic growing medium (soil) and vegetation. Green roofs can be classified as either extensive or intensive, depending on the depth of substrate used and the level of maintenance required. Intensive green roofs are generally greater than 300mm deep and are designed as accessible landscape spaces with pathways and other features. Extensive green roofs are generally less than 300mm deep and are generally not trafficable. |
| Green wall | There are two main types of green walls: green facades and living walls. Green |
| | facades are simple systems where plants are grown directly into soil and trained up a frame or trellis system to cover the wall. Living walls are more complex systems where panels or pockets of vegetation are fixed directly to the wall. This is through the use of a suitable growing medium and a hydroponic system. The use of soil in a living wall is generally minimal and plants are fed primarily through nutrients in the irrigation water. |
| Landscaped Area | Means a part of a site used for growing plants, grasses and trees, which does not include any building, structure or hard paved area and which is no less than 1.5m measured in any direction. The landscaped area consists of any any part of the site which is not occupied by any building, basement or hard surface such as driveways, parking areas or paved areas of courtyards, decks, balconies or |

terraces. The landscaped area may also include s landscaping on the a podium,

where that section of the podium is less or equal to than 1.2 metres in height and the minimum soil standards below of this chapter of DCP (clause 6.4.2) are achieved. Any landscaped area on the site which is less than 1.5 metres in width is not included within the landscaped area calculations.

- Tree Is a perennial plant with a self-supporting stem or trunk, when mature, and for the purpose of this DCP means any tree (other than an exempt tree) including the roots of that tree, if it is 3 metres or more in height, or has a trunk diameter of 200mm or more at a height of 1 metre from the ground, or has a branch spread of 3 metres or more.
- Tree Protection Zone The Tree Protection Zone (TPZ) is defined as the optimal distance from the trunk of a tree that should be maintained free of development and construction activity in accordance with AS4970-2009 in order to protect the tree and keep the tree viable.

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4 MINIMUM INFORMATION REQUIREMENTS TO ACCOMPANY A DEVELOPMENT APPLICATION

1. Table 1 outlines the requirements to accompany a Development Application for different types of development:

| Development Type | Required | | Category | |
|--|--|---|----------|---|
| | | 1 | 2 | 3 |
| Residential Subdivision (Two (2) Lots) | Site and Context Analysis | x | | |
| Residential Subdivision (Up to 10 Lots inclusive) | Landscape Concept Plan | 9 | x | |
| Residential Subdivision (> 10 Lots) | Landscape Concept Plan | | | x |
| Dual Occupancy (Attached or Detached) | Landscape Concept Plan and Site and Context Analysis | ¥ | х | |
| Multi-dwelling Development (Up to 10 dwellings inclusive) | Landscape Concept Plan | | x | |
| Multi-dwelling Development (> 10 dwellings) | Landscape Concept Plan | | | x |
| Residential Flat Building | Landscape Concept Plan | | | x |
| Mixed Use Developments | Landscape Concept Plan | | | х |
| Business or Retail Development (< \$1 million) | Landscape Concept Plan | | x | |
| Business or Retail Development (> \$1 million) | Landscape Concept Plan | | | x |
| Community, educational, health, aged care/housing, tourism, Child Care facilities, Place of Public Worship | Landscape Concept Plan | | | x |
| Industrial Development (excluding minor alterations and additions to existing building) | Landscape Concept Plan | | | х |
| Industrial Development (minor alterations and additions to existing building) | Landscape Concept Plan | | х | |
| Telecommunications and Radiocommunications Facilities | Landscape Concept Plan | | | х |
| Development in the Illawarra Escarpment | Landscape Concept Plan | | | х |
| Rural Development | Landscape Concept Plan | | x | |

Table 1: Landscape Requirements at Development Application Stage

| Category | Qualifications required by Landscape Designer |
|----------|---|
| 1 | No formal qualifications required. |
| 2 | Landscape Architect or Landscape Designer with Landscape Associate Diploma or similar and at least 3 years postgraduate experience in landscape design. |
| 3 | Registered Landscape Architect or eligible for registration with the Australian Institute of Landscape Architects. |

4.1 Site and Context Analysis Plan

- 1. Site and Context Analysis Plan is critical in providing the foundation of landscape design for smaller development types outlined in Table 1.
- 2. Information to be included in the Site and Context Analysis is contained in the following Site and Context Analysis Checklist:

Site and Context Analysis Plan – Landscaping Checklist

Information in the Site and Context Analysis must be prepared accordance with Chapter A1 Clause 9 Site and Context Analysis as well as:

Trees and vegetation

- Tree survey including existing trees on the site and trees on adjacent properties that will be affected by the development,
- All trees must be accurately located by a registered surveyor,
- Show the trunk location and level to AHD,
- Show an accurate portrayal of the canopy spread,
- Inner and outer bushfire protection zone areas and any trees requiring removal as a result,
- Should the land be bushfire prone the landscape plan must be coordinated with the Arborist Report and in accordance with the Planning for Bushfire Protection Guidelines.

Developers are to involve an arborist in the initial stages of planning a development to determine which trees are suitable to be retained. Suitability of a tree should be based on the following:

- Tree's health,
- Amenity value,
- Ability of the tree to cope with changes to the site conditions,
- Significance of the tree,
- The location of the tree on the site, and
- Extent of the protection zone that would be required (an area in which no building, excavation, service lines or level changes must occur)

4.2 Landscape Concept Plan

- 1. The lodgement of a Landscape Concept Plan is required for certain development types as outlined in Table 1.
- 2. The Landscape Concept Plan should outline the overall landscape objectives and the context of the surrounding urban and landscape setting.
- 3. The minimum information requirements for a Landscape Concept Plan are listed below:

Landscape Concept Plan – Checklist

- 1. Drawn to scale,
- 2. Landscape Consultant declaration in relation to the compatibility of the landscape plan with the stormwater and bushfire documentation.
- 3. Existing site information and proposed development as per Chapter A1 Clause 9 Site and Context Analysis
- 4. Drainage/Bushfire/Arborist report must be coordinated where appropriate.
- 5. Proposed Landscape Design:
 - Suggested plant species list suitable with site conditions e.g. acid sulphate soils, overshadowing throughout the day etc;
 - Location of various planting layers including groundcovers, shrubs, trees and palms showing canopy at maturity;
 - Location of proposed drainage including subsurface and surface drainage, stormwater detention basins, and water quality control devices – in concept form only;
 - Landscape areas outside the building envelope, balcony planting, roof gardens and internal courtyards etc, and their proposed treatment (e.g. mass planting beds, paving, lawn, water etc);
 - Design details for special situations in concept form e.g. raised planting bed sections, creeks and watercourse treatment and weed eradication; and
 - Proposed surface treatment of landscaped areas (e.g. paving, driveways, mulched planted areas, edging, turfed)
 - All retaining walls including levels top and bottoms of walls.

* Landscaping maintenance is required to be undertaken for a minimum of 6 months after completion of the development unless otherwise specified by Council.

* For large sites with extensive planting that may or will require regular pruning or maintenance, or for sites including a green roof or wall, a "Maintenance Schedule" should be prepared detailing the types of works that will be required to maintain the Landscape Plan once approved.



Figure 1: Example Only - Landscape Concept Plan

5 NEIGHBOURHOOD AMENITY AND CHARACTER

5.1 Landscape Character

- 1. Landscape design should reinforce the identified natural attributes of the site, including, but not limited to watercourses, landmark elements, views and vistas and significant trees.
- 2. Remnant native vegetation should be retained, managed and incorporated into landscape design, wherever practicable.
- 3. Landscape design should also maintain or improve the amenity and visual quality of the site. Landscaping measures are required to help to screen visually obtrusive land uses or buildings.

5.2 Streetscape Character

- 1. The assessment of the prevailing streetscape character of a locality is required as part of the preparation of the Landscape Concept Plan for a proposed development.
- 2. The Landscape Concept Plan should ensure that all positive streetscape elements are incorporated into the design of proposed landscaping measures. Key features contributing to the streetscape character of the locality may include:

** a

- (a) Street trees.
- (b) Remnant stands of trees.
- (c) Architectural character.
- (d) Prevailing built form, including dwelling types, prevailing front setbacks, building height / form etc.
- (e) Existing uses (eg residential, industrial etc).
- (f) Heritage buildings or heritage conservation areas.
- (g) Car parking, especially the level of on-street parking and off-street parking.
- (h) Linkages with other open space areas in the locality.
- (i) Street furniture, fences, gates etc.
- 3. Landscaping should be used to soften the impact of buildings and to assist in providing visual relief to buildings.
- 4. Landscaping should also be used to soften the impact of car parking areas, when viewed from the public domain.
- 5. The developer is responsible for the construction of footpath paving for the entire frontage of the development for the full width of the verge where Council deems it appropriate.
 - (a) The type of paving is to be in accordance with:
 - 1. The Wollongong City Council Public Domain Technical Manual within the City Centre.
 - 2. Determined by Council according to the location.

- (b) A nominal two percent (2%), minimum one percent (1%), maximum two and a half percent (2.5%) cross fall to be provided from property line to back of kerb.
- (c) The driveway entry threshold finish from the property boundary line to the face of the kerb must match the footpath and be designed to withstand predicted traffic loadings.
- (d) The driveway threshold finish within the property boundary line should contrast with the driveway entry.
- (e) Footpath must be installed to the satisfaction of Wollongong City Council.
- (f) A Landscape Plan is to be submitted to Council **for approval** prior to the issue of the Construction Certificate showing proposed paving and location of all services.
- 6. A change in driveway pavement is required at the entrance threshold within the property boundary to clearly show to motorists they are crossing a pedestrian area. Between the property boundary and the kerb, the developer must construct the driveway pavement in accordance with the conditions, technical specifications and levels to be obtained from the Council's Manager of Works. This requirement shall be reflected on the Construction Certificate plans and any supporting documentation.

5.3 Site Amenity

- 1. The landscape design should maximise the area of the deep soil zone, especially around existing trees to provide sufficient root depth as well as deep soil zones around the perimeter of a site.
- 2. Landscaping should be used to highlight architectural features, define entry points, indicate direction and frame and filter views into the site.
- 3. Small trees or large shrubs should be used to help screen service areas.
- 4. Private open space should be clearly defined and provide satisfactory privacy and amenity to occupants.
- 5. Public open space / communal open space areas must incorporate appropriate landscaping and be designed to maximise natural surveillance opportunities whilst providing adequate shade trees.
- 6. Communal open space for multi-dwelling housing or attached dwellings must be accessible from all dwellings in the development and should incorporate suitable passive surveillance to improve saftey.

6 GENERAL LANDSCAPING REQUIREMENTS

6.1 **Planting Requirements**

- 1. All garden areas are to be prepared to a minimum depth of 300mm and free of weed species. This may comprise imported planting mix or a mixture of site soil and soil conditioner.
- 2. Plants utilised in the landscape works must be those species specified on the approved final Landscape Concept Plan unless approval is obtained in writing from Council. (Examples of recommended plant species for the Wollongong Local Government Area are included in Table 3).
- 3. Plants shall be healthy, of good form and be true to species and size. They must be free from pests and disease, and shall not be root bound.
- 4. All trees (excluding street trees) are to be at least 1 metre height and are to be advanced specimens, free of disease.

- 5. All shrubs are to be in 5 litre containers and at least 500mm in height. These are to be advanced specimens and free of disease.
- 6. All ground covers are to be advanced specimens and free of disease.
- 7. Double staking of trees is permitted and trees are to be loosely tied where required.
- 8. Advanced trees and shrubs are to be planted into good quality soil and humus. The planting hole shall be twice the width and the same depth as the plant container.
- 9. In lawns, tree pits are required to be backfilled with good quality soil (or site soil if good quality), mixed with a suitable soil conditioner.
- 10. Landscaping should comprise a mix of canopy trees, shrubs and groundcovers.
- 11. Trees should be planted well clear of underground services or overhead electricity wires.
- 12. Any sites adjoining any natural areas or creek lines with native vegetation must use locally indigenous species (no cultivars) in the landscape plan and must have regard to any impacts of water flows and flooding.
- 13. Trees should be planted in areas that a capable of supporting the expected size of the mature tree.

6.2 Excavation

- 1. Bulk excavation works shall be limited to those areas approved by Council.
- 2. All areas disturbed as a result of excavation shall be stabilised prior to the carrying out of landscape works.

6.3 Retaining walls

- 1. Retaining walls over 600mm high are to be designed and certified by a qualified and experienced Engineer.
- 2. Retaining walls should to be constructed with materials consistent with the building style and adjacent properties.

6.4 Green walls, green roofs and planting on a slab or podium

Planting on a slab or podium

- The use of green roofs and green walls is encouraged particularly where this forms part of a communal open space arrangement in a mixed use development, and for non-residential development in the Wollongong City Centre.
- 2. An average soil depth and volume of 1000mm, 500mm and 300mm is provided for trees, shrubs, groundcover and lawns is provided in the table below respectively.

| Plant type | Definition | Soil Volume | Soil Depth | Soil Area |
|--------------------|--|-------------------------------------|------------------------|--|
| Large trees | 12-18m high, up to 16m crown spread at maturity | <mark>150m³</mark> | <mark>1,200mm</mark> | <mark>10m x 10m or</mark> equivalent |
| Medium trees | 8-12m high, up to 16m crown spread at maturity | 36m ³ 35m2 | <mark>1,000mm</mark> | <mark>6 x 6m or equivalent</mark> |
| Small trees | <mark>6-8m high, up to 16m crown spread at maturity</mark> | <mark>16m³</mark> 9m2 | <mark>800mm</mark> | <mark>4 x 4m-3.5m x 3.5m or equivalent</mark> |
| Shrubs | | | 500-600mm | |
| Ground cover | | | <mark>300-450mm</mark> | |
| Turf | | | 300 200 mm | |
| *Sub-surface drain | age requirements are in a | ddition to the ab | ove minimum sc | il depths. |

Minimum soil standards for planting on structures or podiums

Source: adapted from Apartment Design Guide (July 2015)

- 3. Square, rectangular and round planter boxes are preferable to linear, narrow planters.
- 4. Planter boxes should be designed and constructed proportionally to accommodate the largest proportion of soil possible.
- 5. Green roofs, green walls, and planter areas on suspended slabs are to be designed by a Structural Engineer to determine and design for loads such as soil saturation.
- 6. Landscaping documentation should include details illustrating water-proofing, soil containment, filter fabric, drainage outlets, subsoil drainage methods, irrigation, and external finishes to the retaining wall / planter box.
- 7. Adequate filtration should be provided with at least two layers of filter fabric to ensure silt does not discharge into the storm water system.

6.5 Embankments

- 1. All landscaped embankments having a slope of 1:3 or greater shall be reinforced using stabilisation techniques to prevent erosion or slumping. Stabilisation techniques may include but are not limited to, the use of dense ground covers, erosion control netting, mesh or rock stabilisation.
- 2. The maximum slope of turfed areas in public open spaces is to be to be 1:6 to ensure the safety of individual carrying out maintenance.

6.6 Noxious Weeds

Noxious weed species are to be eradicated from the development site prior to commencement of landscaping works. Council may also advise of additional species to be removed prior to building approval.

A list of Noxious Weeds in the Wollongong LGA can be obtained from the NSW Industry and Investment website <u>http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/noxweed</u>, or the Illawarra District Noxious Weeds Authority <u>http://www.southerncouncils.nsw.gov.au/index.pl?page=117</u>.

6.7 Street Trees

- 1. Street trees, where appropriate should seek to provide:
 - (a) Shade; and
 - (b) Enhancement of visual quality of the streetscape.
- 2. All street trees should be retained and protected during the construction phase of a development.
- Street trees should be installed at regular intervals (between 5 10 metres apart) to enhance the
 appearance of the locality. The tree species type and required intervals for the street tree planting will
 be determined by Council during the application assessment process, depending upon the nature of
 the development.
- 4. The location of Street Trees should take into account overhead and underground services.
- 5. At the time of planting street trees require the installation of root barriers (maximum depth 600mm) directly adjacent to the kerb to prevent future damage to the kerb, guttering or road. In addition, root barriers should be placed to protect existing adjacent services where needed.
- 6. Where trees are to be planted in areas with hard surfaces, suitable grates are to be laid around the tree to protect the roots and enable water infiltration.
- 7. Minimum plant requirements for Street Trees are 200 litre container size, in accordance with AS 2303: 2015 Tree stock for landscape use.
 - (a) Pot size of 100 litres or greater,
 - (b) Height of 2.5 metres or greater,
 - (c) Calliper 400 millimetres or greater, and
 - (d) Rootball diameter of 500 millimetres or greate
- 8. Street Trees must meet the following NATSPEC criteria:

| | Height (m) | Calliper (mm) 300 mm above ground level | Minimum Rootball Diameter (mm) |
|-------------------------|------------|--|-----------------------------------|
| Thin Stemmed 100L Tree | 30 | 40 | 500 |
| Thick Stemmed 100L Tree | 2.5 | 50 | 500 |

9. All street trees or streetscape landscaping requirements should be included in the Landscape Concept Plan. Refer to Table 2 for suitable Street Tree Species for the Wollongong LGA.

Table 2: Recommended Street Tree Species for the Wollongong LGA.

| | Height (metres) | Local Native Species | Shade tree in car parks | Coastal | 1. Sandstone Plateau | 2. Coastal Escarpment | 3. Coastal Plain | 4. Foothills / Plain | 5. City | 6. Berkeley Hills | 7. Dapto Plain | 8. Lake Side |
|---|-----------------|----------------------|-------------------------|---------|----------------------|-----------------------|------------------|----------------------|---------|-------------------|----------------|--------------|
| Syzygium smithii syn Acmena smithii | 7-10 | Х | | Х | | Х | | | X | | | |
| Lilly Pilly | | | | | | | | | O | | | |
| Syzygium smithii var. minor syn Acmena Smith var Minor Lilly Pilly | 4 | | | | | Х | x | x | x | Х | Х | Х |
| Alphitonia excelsa | 10 | Х | Х | | | x | X | Х | Х | Х | | |
| Red Ash | | | | | | | | | | | | |
| Backhousia myrtifolia | 4-8 | Х | Х | | | X | Х | Х | Х | | | |
| Grey Myrtle | | | | X | 0 | | | | | | | |
| Banksia integrifolia | 6-10 | Х | X | X | Х | | Х | Х | Х | | | Х |
| Coast Banksia | | | | K | | | | | | | | |
| Banksia serrata | 7 | Х | X | Х | Х | | | | | | | |
| Old Man Banksia | | C ' | | | | | | | | | | |
| Brachychiton acerifolius | 10-15 | Х | | | | Х | Х | Х | Х | Х | Х | |
| Illawarra Flame Tree | | | | | | | | | | | | |
| Cupaniopsis anacardioides | 5-8 | Х | Х | Х | | Х | Х | Х | Х | Х | Х | Х |
| Tuckeroo # | * | | | | | | | | | | | |
| <i>Elaeocarpus reticulatus</i> Blueberry Ash | 5-8 | Х | Х | | Х | Х | Х | Х | Х | Х | Х | |
| Fraxinus griffithii | 6-10 | | Х | | | Х | Х | Х | Х | Х | Х | Х |
| Evergreen Ash # | | | | | | | | | | | | |
| Glochidion ferdinandi | 8-10 | Х | Х | | Х | Х | Х | Х | Х | Х | Х | Х |
| Cheese Tree | | | | | | | | | | | | |
| Hymenosporum flavum | 6-10 | | | | Х | Х | Х | Х | Х | Х | Х | |
| Native Frangipani | | | | | | | | | | | | |
| Lagerstroemia indica | 4-6 | | | | Х | | Х | Х | Х | Х | Х | |
| Crepe Myrtle | | | | | | | | | | | | |
| Melaleuca decora | 6-10 | Х | Х | | | Х | Х | | Х | Х | Х | |

| | Height (metres) | Local Native Species | Shade tree in car parks | Coastal | 1. Sandstone Plateau | 2. Coastal Escarpment | 3. Coastal Plain | 4. Foothills / Plain | 5. City | 6. Berkeley Hills | 7. Dapto Plain | 8. Lake Side |
|--|-----------------|----------------------|-------------------------|-----------|----------------------|-----------------------|------------------|----------------------|---------|-------------------|----------------|--------------|
| White Cloud Tree | | | | | | | | | | | | |
| Melaleuca linariifolia | 5-8 | Х | Х | | Х | | Х | Х | Х | Х | Х | Х |
| Snow in Summer | | | | | | | | C | | | | |
| Pittosporum rhombifolium | 6-12 | Х | | | Х | Х | Х | Х | x | Х | Х | |
| White Holly | | | | | | | | | | | | |
| Pyrus ussuriensis Ornamental Pear - | 8-12 | | | | X | × | x | Х | Х | Х | Х | |
| Manchunan | 9.10 | V | V | v | N | v | v | V | V | v | v | V |
| Syzygium australe | 0-10 | ^ | ^ | $\hat{0}$ | | ^ | ^ | ^ | ^ | ^ | ^ | ^ |
| Brush Cherry | | | | \sim | | | | | | | | |
| Syzygium luehmannii | 7-10 | | | | Х | Х | Х | Х | Х | Х | Х | |
| Small Leaf Lilly Pilly | | | | | | | | | | | | |
| Syzygium paniculatum | 8-10 | X | Х | | Х | Х | Х | Х | Х | Х | Х | |
| Magenta Lilly Pilly* | | | | | | | | | | | | |
| Tristaniopsis laurina | 5-10 | Х | Х | Х | Х | Х | Х | Х | Х | Х | Х | |
| Water Gum | | | | | | | | | | | | |
| * Endangered species - r | equires Na | tional | Parks | licenc | e for p | ropag | ation a | and sa | le. | | | |

 * Endangered species > requires National Parks licence for propagation and sa # Invasive: Do not plant near natural vegetation.

7 CAR PARKING AREAS

- 1. Development shall aim to provide car parking that does not dominate the development and to provide shade to a minimum of 50% of parked vehicles.
- 2. Large car park development should break up the extent of paving areas with internal planting beds
- 3. Planting beds must have sufficient deep soil area for the trees to grow.
- 4. Landscaping is to be consistent with the Chapter E2 Crime Prevention through Environmental Design.
- 5. Where the car park adjoins a side or rear boundaries development should provide a 1.5 metre wide planting bed
- 6. Where car parking spaces do not front a planting bed 3 metres wide, every tenth car parking space requires a planting bed for tree planting. The minimum dimension of the planting bed is 2.5 metres by 5.5 metres (one car space).

- 7. Parking spaces fronting planting beds must have wheel stops to protect the planting from damage.
- 8. Trees in car parks should be long-lived species that do not drop branches or soft fruit that may damage vehicles.
- 9. Pedestrian and vehicular movement is to be clearly separated by use of design devices such as change in paving, kerb, bollards, line marking. Dedicated pedestrian paths are to be included in multi-lane car parking areas. Pedestrian paths are to be a minimum 1.2m wide.

8 **POST DEVELOPMENT CONSENT**

- 1. Upon completion of the landscaping work, the developer/ applicant must contact the Principal Certifying Authority (PCA) and arrange for the inspection of the work including all required works within WCC land (e.g. road reserve). A Landscape Completion Certificate is to then be issued to the PCA by a Landscape Architect / Landscape Designer. The individual who prepared the Landscape Concept Plan or Landscape Plan is the desired person to certify the landscape work upon completion.
- 2. The Completion Certificate must state the landscape work has been constructed in accordance with the approved Landscape Concept Plan or Landscape Plan and Landscape conditions.

8.1 Tree Protection during Construction

8.1.1 Objectives

1. To ensure tree protection is undertaken prior to and during construction.

8.1.2 Requirements

- 1. The developer must install tree protection in accordance with the Landscape Concept Plan and/ or Arborists Report and/or Development Consent before any works are commenced on site.
- 2. The developer must engage an arborist to certify that trees to be retained are protected by fencing and other measures, prior to the commencement of any such excavation or land clearing works.
- 3. The developer must ensure that once the tree protection is installed it is not to be removed or altered in anyway without written consent from Council.
- 4. Protective fencing must be practically placed to protect the remaining protection zone where access to a site requires vehicles access across the protection zone of a tree and Council has approved this arrangement.
- 5. A 350mm layer of mulch must be placed on the access way for the duration of the construction period to reduce compaction. This must be inspected and approved before work commences. Weight dispersal materials e.g. 200mm ply wood or thick rubber matting should be placed over mulch when vehicles enter and leave the site.
- 6. The developer may also be required to have an arborist inspect and report on the tree/s at monthly intervals during construction. This report must be submitted to the Principal Certifying Authority within one week after each inspection.
- 7. Changes to the development which may affect trees/ vegetation which have been specified to be retained, will require an amended Development Application. Changes may include:
 - a. Any level changes within the dripline of trees;
 - b. Incorrectly located trees; or

c. Requests to remove trees

8.2 Maintenance

8.2.1 Objectives

- 1. To ensure landscaping will be maintained in good condition at all times.
- 2. To enable larger developments to carry out regular maintenance on trees within the property according to an approved plan and reducing the need for individual Tree Management Permits.

8.2.2 Requirements

- 1. Landscape maintenance schedules where required, should cover a minimum period of <u>6 12</u> months and address the following:
 - (a) Pruning / trimming (frequency, method, plant type requirements),
 - (b) Fertilising (e.g. types and frequency),
 - (c) Weeding,
 - (d) Re-mulching,
 - (e) Watering and irrigation,
 - (f) Pest/ disease control,
 - (g) Lawns (e.g. mowing frequency, method, watering, fertilising),
 - (h) Rubbish, leaf litter, drain clearing,
 - (i) Stakes and ties,
 - (j) Tree maintenance (fertiliser frequency and methods, special tree requirements).
- 2. Watering must be carried out at sufficient intervals to maintain the landscaping and allow for variations depending on the seasonal changes inherent to the site.
- 3. Spraying of herbicide, insecticide and / or fungicides must be carried out in accordance with the manufactures directions and undertaken by a suitably qualified person.
- 4. Plant species that do not survive must be replaced in accordance with the Landscape Concept Plan.
- 5. Hard surfaces and landscape structures are to be maintained in an appropriate manner.

Table 3: Recommended plant species for the Wollongong Local Government Area

Note: This list is does not apply to street trees. Street trees must be selected in consultation with Wollongong City Council.

| Species <u>*</u> Not native to Illawarra | Common Name | Form | Coastal Front Line | Coastal Second Line | Coastal Plain/General Purpose | Floodplains | Rainforest / Escarpment | Plateau - Hawkesbury Sandstone |
|---|--------------------|-------|-----------------------|------------------------|-------------------------------------|-------------|----------------------------|--------------------------------------|
| Acacia binervata | Two Veined Hickory | Tree | | | Y | | Y | Y |
| Acacia binervia* | Coastal Myall | Tree | | | Y | | | |
| Acalypha wilkesiana* | Fijian Fire plant | Shrub | Y | Y | | | | |

| Species <u>*</u> Not native to Illawarra | Common Name | Form | Coastal Front Line | Coastal Second Line | Coastal Plain/General Purpose | Floodplains | Rainforest / Escarpment | Plateau - Hawkesbury Sandstone |
|---|---------------------|-------------------|-----------------------|------------------------|-------------------------------------|-------------|----------------------------|--------------------------------------|
| Acer palmatum* | Japanese Maple | Tree | | | Y | | Y | |
| Acmena smithii (syn, Syzygium smithii) | Lilly Pilly | Tree | | Y | Y | Y | Y | Y |
| Acokanthera oblongifolia* | Bushman's Poison | Shrub | | Y | Y | Y | | |
| Adiantum aethiopicum | Maidenhair Fern | Fern | | | Y | Y | Y | |
| Adiantum formosum | Giant Maidenhair | Fern | | Y | Y | Y | Y | |
| Agathis robusta* | Queensland Kauri | Tree | | | Y | 0 | | |
| Agonis flexuosa* | Willow-myrtle | Small Tree | | Y | Y | | | |
| Alectryon subcinereus | Native quince | Small Tree | | X | Y | | Y | |
| Allocasuarina distyla | | Shrub | く | | | | | Y |
| Allocasuarina littoralis | Black Sheoak | Tree | 5 | Y | Y | | Y | Y |
| Allocasuarina nana | Dwarf Sheoak | Shrub | | | | | | Y |
| Allocasuarina torulosa | Forest Oak | Tree | | | Y | | Y | |
| Allocasuarina verticillata | Drooping Sheoak | Tree | Y | | | | | |
| Alocasia brisbanicum | Cunjevoi | Perennial | | | | Y | Y | |
| Alphitonia excelsa | Red Ash | Tree | | | Y | | Y | Y |
| Alpinia caerulea* | Native Ginger | Perennial | | | Y | | Y | |
| Angophora costata | Smooth Barked Apple | Tree | | | | | | Y |
| Angophora floribunda | Rough Barked Apple | Tree | | Y | Y | Y | | |
| Angophora hispida | Dwarf Apple | Shrub | | | | | | Y |
| Antigonon leptopus* | Coral Vine | Vine / Climber | | | | | | |
| Araucaria cookii* | Cooks Pine | Tree | Y | Y | | | Y | |
| Araucaria cunninghamii* | Hoop Pine | Tree | Y | | Y | | | |
| Araucaria heterophylla* | Norfolk Island Pine | Tree | | | | | Y | |
| Arbutus unedo* | Irish Strawberry | Small tree | | Y | Y | | | |
| Archontophoenix | Bangalow Palm | Tree | | Y | Y | Y | Y | |

| Species <u>*</u> Not native to Illawarra | Common Name | Form | Coastal Front Line | Coastal Second Line | Coastal Plain/General Purpose | Floodplains | Rainforest / Escarpment | Plateau - Hawkesbury Sandstone |
|---|-----------------------|-------------------|-----------------------|------------------------|-------------------------------------|-------------|----------------------------|--------------------------------------|
| cunninghamiana | | | | | | | | |
| Aristolochia elegans* | Dutchman's Pipe | Vine / Climber | | | | | | |
| Asplenium australasicum | Bird's Nest Fern | Fern | | Y | Y | | Y | |
| Austrodanthonia bipartita | Wallaby Grass | Grass | | Y | Y | Y | | |
| Austrodanthonia caespitosa | Common Wallaby Grass | Grass | | Y | Y | Y | | |
| Austrodanthonia racemosa | Striped Wallaby Grass | Grass | | Y | | Y | | |
| Austromyrtus dulcis* | Midginberry | Shrub | | Y | Y | Y | | |
| Austrostipa ramossissima | Speargrass | Grass | | S | Y | Y | | |
| Backhousia citriodora* | Lemon-scented Myrtle | Tree | \mathbf{C} | | Y | Y | Y | |
| Backhousia myrtifolia | Grey Myrtle | Small Tree | | | Y | | Y | Y |
| Banksia ericifolia | Heath Banksia | Shrub | | | | | | Y |
| Banksia integrifolia | Coast Banksia | Small Tree | Y | | | | | Y |
| Banksia marginata | Silver Banksia | Shrub | | | | | | Y |
| Banksia serrata | Old Man Banksia | Small Tree | | Y | | | | Y |
| Banksia spinulosa | Hairpin Banksia | Shrub | | | | | | Y |
| Bauhinia corymbosa* | Climbing Bauhinia | Vine / Climber | | | | | | |
| Bauhinia galpinii* | | Shrub | | Y | Y | Y | | |
| Baumea acuta | Pale Twig-rush | Sedge/ Rush | | Y | Y | Y | | |
| Billardiera scandens | Apple Berry | Vine / Climber | | Y | Y | Y | Y | |
| Blechnum cartilagineum | Gristle Fern | Fern | | Y | Y | Y | Y | |
| Boronia megastigma* | Brown Boronia | Shrub | | Y | Y | Y | | |
| Bothriochloa biloba | Redleg | Grass | | | Y | Y | | |
| Brachychiton acerifolius | Illawarra Flame Tree | Tree | | | Y | | Y | |
| Brachychiton populneus | Kurrajong | Tree | | | Y | | Y | Y |

| Species <u>*</u> Not native to Illawarra | Common Name | Form | Coastal Front Line | Coastal Second Line | Coastal Plain/General Purpose | Floodplains | Rainforest / Escarpment | Plateau - Hawkesbury Sandstone |
|---|-----------------------------------|----------------|-----------------------|------------------------|-------------------------------------|-------------|----------------------------|--------------------------------------|
| Buckinghamia celsissima* | Ivory Curl Tree | Shrub | | | Y | | | |
| Buxus sempervirens* | Box | Shrub | | Y | Y | Y | Y | |
| Caesalpinia ferrea* | Leopard tree | Small tree | | Y | Y | Y | | |
| Callicoma serratifolia | Black Wattle | Shrub | | | Y | | Y | Y |
| Callistemon citrinus | Lemon Scented Bottlebrush | Shrub | | | C | | | Y |
| Callistemon 'Harkness'* | Gawler Hybrid Bottlebrush | Shrub | | | X | 0 | | Y |
| <i>Callistemon</i> 'Kings Park Special'* | Bottlebrush | Shrub | | 8 | Y | | | Υ |
| Callistemon polandii* | Bottlebrush | Shrub | 2 | | Y | | | |
| Callistemon salignus | Willow Bottlebrush | Tree | 5 | | Y | Y | Y | |
| Callistemon viminalis* | Weeping Bottlebrush | Shrub | | | Y | Y | | |
| Callitris rhomboidea | Port Jackson Pine | Tree | | | Y | | | Y |
| Calodendron capense* | Cape Chestnut | Tree | | | | | Y | |
| Camellia japonica* | Japanese Camellia | Shrub | | | Y | | | |
| Camellia sasanqua* | Sasanqua Camellia | Shrub | | | Y | | | |
| Carex appressa | (O) | Sedge/ Rush | | Y | Y | Y | Y | |
| Carex longebrachiata | Bergalia tussock | Sedge/ Rush | | Y | | | | |
| Cassine australis | Red Olive Plum | Small Tree | | Y | Y | | Y | Y |
| Casuarina cunninghamiana | River Oak | Tree | | | Y | Y | | |
| Casuarina glauca | Swamp Oak | Tree | | Y | Y | Y | | |
| Caustis flexuosa | Old Man's Beard | Sedge/ Rush | | | | | | Y |
| Ceratopetalum apetalum | Coachwood | Tree | | | Y | | Y | Y |
| Ceratopetalum gummiferum | New South Wales Christmas Bush | Tree | | | Y | | | Y |
| Choisya ternata* | Mexican Orange- | Shrub | | Y | Y | Y | Y | |

| Species <u>*</u> Not native to Illawarra | Common Name | Form | Coastal Front Line | Coastal Second Line | Coastal Plain/General Purpose | Floodplains | Rainforest / Escarpment | Plateau - Hawkesbury Sandstone |
|--|-------------------------|-------------------|-----------------------|------------------------|-------------------------------------|-------------|----------------------------|--------------------------------------|
| | blossom | | | | | | | |
| Choricarpa leptopetala | Brush Turpentine | Tree | | Υ | Y | | Y | |
| Cissus antarctica | Kangaroo Grape | Vine / Climber | | | | | | |
| Cissus hypoglauca | water vine | Vine / Climber | | | | | | |
| Clematis aristata | Old Man's Beard | Vine / Climber | | Y | 3 | Y | Y | |
| Clematis glycinoides | Old Man's Beard | Vine / Climber | | S | Y | Y | | Y |
| Clerodendrum tomentosum | | Shrub | | 0 | | Y | Y | Y |
| Codiaeum variegatum* | Croton | Shrub | | | Y | | Y | Y |
| Coleonema pulchrum* | Pink Diosma | Shrub | Y | Y | Y | | | |
| Commersonia fraseri | Brown Kurrajong | Shrub | | | Y | | Y | Y |
| Cordyline petiolaris* | Broad Leaved Palm Lilly | Shrub | | | Y | | | |
| Cordyline stricta | Narrow Leaved Palm Lily | Shrub | | | Y | | | |
| Cordyline terminalis* | Palm Lily | Shrub | | | Y | | | |
| Correa alba | White Correa | Shrub | Y | | Y | | | Y |
| Crinum pedunculatum | Crinum Lily | Perennial | Y | | Y | Y | | |
| Cryptomeria japonica* | Japanese Cedar | Tree | | | Y | Y | Y | |
| Cupaniopsis anacardioides | Tuckeroo | Small Tree | Y | Y | Y | | | |
| Cupressus macrocarpa* | Monterey Cypress | Tree | | Y | Y | | | |
| <i>Cupressus sempervirens</i> var. <i>stricta*</i> Lombardy Poplar | Lombardy Cypress | Tree | | | Y | | | |
| Cupressus torulosa* | Bhutan Cypress | Tree | | | Y | | | |
| Cyathea australis | Rough Treefern | Fern | | | Y | Y | Y | |
| Cymbopogon refractus | Barb-wire grass | Grass | | | Y | Y | | |
| Cynodon dactylon | Couch | Grass | Y | Y | Y | Y | | Y |

| Species <u>*</u> Not native to Illawarra | Common Name | Form | Coastal Front Line | Coastal Second Line | Coastal Plain/General Purpose | Floodplains | Rainforest / Escarpment | Plateau - Hawkesbury Sandstone |
|---|----------------------|-------------------|-----------------------|------------------------|-------------------------------------|-------------|----------------------------|--------------------------------------|
| Daphne odora* | Winter Daphne | Shrub | | Y | Y | Y | Y | |
| Davallia pyxidata | Hare's Foot Fern | Fern | | Y | Y | Y | Y | |
| Desmodium varians | | Vine / Climber | | | Y | Y | Y | Y |
| Dichelachne crinita | Longhair Plume Grass | Grass | | | Y | Y | Y | Y |
| Dichelacne rara | Plume Grass | Grass | | | Y | Y | | Y |
| Dicksonia antarctica | Soft Treefern | Fern | | | Y | Y | Y | |
| Digitaria didactyla* | Qld Blue Couch | Grass | | Y | Y | Y | | |
| Dodonaea viscosa | Native Hop | Shrub | | X | Y | Y | Y | |
| Doodia aspera | Rasp Fern | Fern | へ | Y | Y | Y | Y | |
| Doryanthes excelsa | Gymea Lily | Perennial | 5 | Y | Y | Y | Y | Y |
| Duboisia myoporoides | Corkwood | Shrub | | Y | Y | Y | Y | |
| Echinipogon caespitosus | Hedgehog grass | Grass | | Y | Y | Y | | |
| Ehretia acuminata | Koda | Tree | | | Y | | Y | |
| Elaeocarpus grandis* | Giant Qandong | Tree | | | Y | | Y | |
| Elaeocarpus kirtonii | Silver Quandong | Tree | | | Y | | Y | |
| Elaeocarpus reticulatus | Blueberry Ash | Small Tree | | | Y | | Y | Y |
| Emmenosperma alphitonioides | Bonewood | Tree | | | Y | | Y | |
| Entolasia marginata | Bordered Panic | Grass | | Y | Y | Y | Y | |
| Entolasia stricta | Wiry Panic | Grass | | Y | Y | Y | Y | |
| Eragrostis brownii | Brown's love-grass | Grass | | Y | Y | Y | | |
| Eriostemon australasius | Wax Flower | Shrub | | | Y | | | Y |
| Escallonia macrantha* | Common Escallonia | Shrub | | | Y | | | |
| Eucaltptus globoidea | White stringybark | Tree | | | Y | Y | | |
| Eucalyptus (Corymbia) calophylla* | Marri | Small tree | | Y | Y | | | |

| Species <u>*</u> Not native to Illawarra | Common Name | Form | Coastal Front Line | Coastal Second Line | Coastal Plain/General Purpose | Floodplains | Rainforest / Escarpment | Plateau - Hawkesbury Sandstone |
|---|---------------------|------------|-----------------------|------------------------|-------------------------------------|-------------|----------------------------|--------------------------------------|
| Eucalyptus (Corymbia) gummifera | Red Bloodwood | Tree | | | | | | Y |
| Eucalyptus (Corymbia) maculata | Spotted Gum | Tree | | | Y | | | |
| Eucalyptus amplifolia | Cabbage Gum | Tree | | Y | Y | Y | | |
| Eucalyptus bosistoana | Coast Grey Box | Tree | | | Y | Y | | |
| Eucalyptus botryoides | Bangalay Gum | Tree | Y | | Y | | | |
| Eucalyptus caesia* | Gunguru | Small Tree | | Υ | Y | | | |
| Eucalyptus cinerea* | Argyle Apple | Tree | | 0 | Y | Y | | |
| Eucalyptus curtisii* | Plunkett Mallee | Small Tree | Ś | Y | Y | | | |
| Eucalyptus elata | River Peppermint | Tree | | | Y | Y | Y | |
| Eucalyptus eugenioides | Stringybark | Tree | | | Y | | | |
| Eucalyptus haemastoma | Scribbly Gum | Tree | | | | | | Y |
| Eucalyptus longifolia | Woollybutt | Tree | | | Y | Y | | |
| Eucalyptus microcorys* | Tallow Wood | Tree | | | Y | | | |
| Eucalyptus paniculata | Grey Ironbark | Tree | | | Y | | Y | Y |
| Eucalyptus pilularis | Blackbutt | Tree | | | Y | | Y | Y |
| Eucalyptus quadrangulata | White Topped Box | Tree | | | | | Y | |
| Eucalyptus racemosa | Scribbly Gum | Tree | | | | | | Y |
| Eucalyptus robusta | Swamp Mahogany | Tree | | Y | Y | Y | | |
| Eucalyptus saligna | Sydney Blue Gum | Tree | | | Y | | Y | |
| Eucalyptus sideroxylon | Red Ironbark | Tree | | | Y | | | |
| Eucalyptus sieberi | Silvertop Ash | Tree | | | | | | Y |
| Eucalyptus tereticornis | Forest Red Gum | Tree | | Y | Y | | | |
| Eucalyptus viminalis* | Manna Gum | Tree | | | Y | Y | | |
| Eucryphia moorei | Eastern Leatherwood | Small Tree | | | | | Y | |
| Euonymus japonicus* | Spindletree | Shrub | Y | Y | Y | | | |

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|---|--------------------|-------------------|-----------------------|------------------------|-------------------------------------|-------------|----------------------------|--------------------------------------|
| Eustrephus latifolius | Wombat Berry | Vine / Climber | Y | Y | Y | Y | | |
| Feijoa sellowiana* | Feijoa | Small Tree | | | Y | Y | | |
| Ficus coronata | Sandpaper Fig | Small Tree | | | Y | Y | Y | Y |
| Ficus macrophylla | Moreton Bay Fig | Tree | | | Y | | Y | |
| Ficus obliqua | Small Leaved Fig | Tree | | Y | Y | | Y | Y |
| Ficus rubiginosa | Port Jackson Fig | Tree | | Y | × | 5 | Y | Y |
| Ficus superba var. henneana | Deciduous Fig | Tree | | 0 | Y | | Y | |
| Flindersia australis* | Australian Teak | Tree | | 2 | Y | Y | Y | |
| Fortunella japonica* | Cumquat | Shrub | 2 | Y | Y | | | |
| Fraxinus 'Raywood'* | Claret Ash | Tree | | | Y | Y | Y | |
| Gahnia aspera | Saw Sedge | Sedge/ Rush | | Y | | | | |
| Gardenia jasminoides* | Gardenia | Shrub | | | Y | Y | Y | |
| Geijera latifolia | Brush Wilga | Tree | | | Y | | Y | |
| Geitonoplesium cymosum | Scrambling Lily | Vine / Climber | | Y | Y | Y | Y | |
| Gelsemium sempervirens* | Yellow jasmine | Vine / Climber | | Y | Y | Y | | |
| Gleichenia dicarpa | Pouched Coral Fern | Fern | | | Y | Y | Y | |
| Glochidion ferdinandi | Cheese Tree | Small Tree | | | Y | Y | Y | Y |
| Gmelina leichardtii | White Beech | Tree | | | Y | Y | Y | |
| Goodenia ovata | | Shrub | | | Y | | | Y |
| Graptophyllum excelsum* | Scarlet Fuchsia | Shrub | | | Y | | Y | |
| Grevillea banksii* | Banks Grevillea | Shrub | | | Y | | | Y |
| Guioa semiglauca | Guioa | Small Tree | | Y | Y | | | |
| Gymnostachys anceps | Settlers' Flax | Sedge/ Rush | | Y | | | Y | |

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| Hakea dactyloides | | Shrub | | | Y | | | Y |
| Hakea salicifolia | Willow Hakea | Shrub | | | Y | | | Y |
| Hardenbergia violacea | False Sarsparilla | Vine / Climber | | Y | Y | Y | Y | Y |
| Heliotropium arborescens* | Cherry Pie | Shrub | | Y | Y | | | |
| Hibbertia dentata | Twining Guinea Flower | Vine / Climber | | Y | Ŏ | Y | Y | |
| Hibbertia scandens | Golden Guinea Flower | Vine / Climber | | 5. | Y | Y | Y | Y |
| Hibiscus diversifolius | Swamp Hibiscus | Shrub | Y | Y | Y | Y | | |
| Hibiscus heterophyllus | Native Hibiscus | Tree | 0 | • | | | Y | |
| Hibiscus rosa-sinensis* | Hibiscus | Shrub | Y | Y | Y | | | |
| Hibiscus splendens | Pink Hibiscus | Small Tree | | | Y | | Y | |
| Hibiscus syriacus* | Syrian Hibiscus | Shrub | | Y | Y | Y | | |
| Hibiscus tiliaceus* | Coast Cottonwood | Small Tree | | | Y | | Y | |
| Hymenosporum flavum* | Native Frangipani | Small Tree | Y | Y | | | | |
| Hypericum calycinum* | Aaron's beard | Shrub | | Y | Y | Y | | |
| Iboza riparia* | Nutmeg Bush | Shrub | Y | Y | Y | | | |
| Imperata cylindrica | Blady grass | Grass | Y | Y | Y | Y | | Y |
| Indigofera australis | Australian Indigo | Shrub | | Y | Y | Y | Y | |
| Jacksonia scoparia | Dogwood | Shrub | | | Y | | | Y |
| Joycea pallida | Red Anther Wallaby grass | Grass | | | Y | | | Y |
| Juncus usitatus | Common Rush | Sedge/ Rush | | Y | Y | Y | Y | |
| Juniperus conferta* | Shore Juniper | Shrub | Y | Y | Y | Y | Y | |
| Juniperus procera* | East African Juniper | Tree | | | Y | | Y | Y |
| Kennedia prostrata | Running Postman | Vine / Climber | | Y | Y | Y | | Y |

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| Kennedia rubicunda | Dusky Coral Pea | Vine / Climber | | | Y | | Y | |
| Kunzea ambigua | Tick Bush | Shrub | | | Y | | | Y |
| Lagerstroemia indica* | Crepe Myrtle | Tree | | | Y | Y | Y | |
| Lasiopetalum ferrugineum | Rusty Velvet-bush | Shrub | | Y | Y | | Y | Y |
| Lavandula dentata* | French Lavender | Shrub | | Y | Y | | | |
| Lepidosperma laterale | Sword-sedge | Sedge/ Rush | | Y | × | Y | Y | |
| Leptospermum juniperinum | | Shrub | | 0 | Y | Y | | Y |
| Leptospermum laevigatum | Coastal Tea Tree | Shrub | Y | | | | | |
| Leptospermum morrisonii | Morrison's Tea Tree | Shrub | N. | | Y | | | Y |
| Leptospermum polygalifolium | Common Tea Tree | Shrub | | | Y | | | Y |
| Leptospermum rotundifolium* | Shoalhaven Tea-tree | Shrub | | Y | Y | | | Y |
| Leptospermum scoparium | Manuka | Shrub | | | Y | | | Y |
| Liquidambar styraciflua* | Liquidambar | Small Tree | | Y | Y | Y | Y | |
| Livistona australis | Cabbage Tree Palm | Tree | | | | | Y | |
| Lomandra longifolia | Lomandra | Perennial | Y | | Y | | Y | Y |
| Lomandra longifolia | Mat Rush | Sedge/ Rush | Y | Y | Y | Y | Y | |
| Lophostemon confertus* | Brush Box | Tree | | Y | Y | Y | | Y |
| Lophostemon suaveolens* | Swamp Brushbox | Tree | | | Y | | | Y |
| Macadamia tetraphylla* | Macadamia | Tree | | | | Y | | Y |
| Magnolia grandiflora* | Magnolia | Tree | | Y | Y | Y | Y | |
| Melaleuca armillaris | Bracelet Honey Myrtle | Tree | | | Y | | | |
| Melaleuca bracteata* | Black Tea-tree | Small Tree | | Y | Y | | | Y |
| Melaleuca decora | White Cloud Tree | Tree | | | Y | | | |
| Melaleuca diosmifolia* | Green Honey Myrtle | Shrub | | | Y | | | Y |

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|---|-------------------------------|-------------------|-----------------------|------------------------|-------------------------------------|-------------|----------------------------|--------------------------------------|
| Melaleuca ericifolia | Swamp Paperbark | Shrub | | Y | Y | Y | | |
| Melaleuca erubescens* | | Shrub | | | Y | | | Y |
| Melaleuca hypericifolia | | Shrub | Y | | Y | | | Y |
| Melaleuca laterita* | Robin Red Breast | Shrub | | | Y | | | Y |
| Melaleuca leucadendra* | Weeping Paperbark | Tree | | Y | Y | Y | | Y |
| Melaleuca linariifolia | Snow in Summer | Small Tree | | | Y | Y | | |
| Melaleuca nesophila* | | Shrub | | Ś | Y | | | Y |
| Melaleuca quinquenervia* | Paperbark | Small Tree | | Y | Y | Y | | Y |
| Melaleuca styphylioides | Prickly Paperbark | Tree | 5 | Y | Y | | Y | |
| Melastoma affine* | | Shrub | | | Y | Y | | Y |
| Melia azedarch var. australasica | White Cedar | Tree | | | Y | Y | | |
| Melicope micrococca | White Euodia | Tree | | | Y | | Y | |
| Metasequoia glyptostroboides* | Dawn Redwood | Small Tree | | | Y | | Y | |
| Metrosideros collina var villosa* | Lehua | Tree | | | Y | | | |
| Metrosideros excelsa* | New Zealand Christmas Bush | Tree | | | Y | | Y | |
| Microlanea stipoides | Weeping Grass | Grass | | Y | Y | Y | Y | |
| Morinda jasminoides | Jasmine Morinda | Vine / Climber | | | Y | | Y | |
| Morus nigra* | Mulberry | Small Tree | | | Y | | Y | |
| Muehlenbeckia complexa* | Maidenhair Creeper | Vine / Climber | Y | Y | Y | Y | | |
| Mussaenda frondosa* | Mussaenda | Shrub | | Y | Y | | | |
| Myoporum acuminatum | Boobialla | Tree | | Y | Y | Y | | |
| Myoporum acuminatum | Boobialla | Shrub | | Y | Y | Y | Y | |
| Myoporum boninese subsp. australis | Boobialla | Shrub | Y | Y | Y | | | |

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|---|-----------------------|-------------------|-----------------------|------------------------|-------------------------------------|-------------|----------------------------|--------------------------------------|
| Nerium oleander* | Oleander | Shrub | Y | Y | & | | | |
| Notelaea venosa | Veined mock olive | Small Tree | | Y | | Y | | |
| Omalanthus populifolius | Bleeding Heart | Small Tree | | | Y | Y | Y | |
| Oplismenus aemulus | Basket Grass | Grass | | Y | Y | Y | Y | |
| Oplismenus imbeciliis | Basket Grass | Grass | | Y | Y | Y | Y | |
| Pandanus tectorius* | Screw Pine | Shrub | Y | Y | C | 5 | | |
| Pandorea jasminoides* | Bower-of-beauty | Vine / Climber | | Y | Υ. | Y | Y | |
| Pandorea pandorana | Wonga Wonga Vine | Vine / Climber | | X | Y | Y | Y | |
| Panicum pygmaeum | Dwarf Panic | Grass | Ň | | Y | Y | Y | |
| Panicum simile | Two Colour Panic | Grass | | | Y | Y | | |
| Pararchidendron pruinosum | Snowwood | Small Tree | | | Y | Y | Y | Y |
| Paspalum distichum | Water Couch | Grass | Y | Y | Y | Y | | |
| Pellaea falcata | Sickle Fern | Fern | | Y | | | Y | |
| Persoonia linearis | Narrow-leaved Geebung | Shrub | | | | | | Y |
| Persoonnia levis | Broad-leaved Geebung | Shrub | | | | | | Y |
| Philotheca myoporoides | Long-leaf Wax-flower | Shrub | | Y | | | | Y |
| Pimelea ligustrina | Tall Rice-flower | Shrub | | | Y | | Y | |
| Pittosporum multiflorum | Orange thorn | Shrub | | | Y | Y | Y | |
| Pittosporum revolutum | Brisbane Laurel | Shrub | | Y | Y | | Y | Y |
| Pittosporum rhombifolium* | White Holly | Tree | | | Y | | Y | |
| Pittosporum tobira* | Tobera | Shrub | | | Y | | | |
| Pittosporum undulatum | Sweet Pittosporum | Tree | | | Y | | | |
| Planchonella australis | Black apple | Tree | | Y | Y | | Y | Y |
| Platanus x hybrida* | Plane Tree | Small Tree | | | Y | Y | Y | |
| Platycerium bifurcatum | Stag Horn | Fern | | Y | Y | Y | Y | |

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|---|--------------------------|-------------------|-----------------------|------------------------|-------------------------------------|-------------|----------------------------|--------------------------------------|
| Platycerium superbum | Elk Horn | Fern | | | Y | Y | Y | |
| Plectranthus graveolens | Spur-flower | fleshy shrub | | Y | Y | Y | | |
| Plumbago auriculata* | Cape Plumbago | Shrub | | | Y | | | |
| Poa labillardieri var. labillardieri | Tussock Grass | Grass | | Y | Y | Y | | |
| Poa sieberiana | Grey Tussock Grass | Grass | | | Y | Y | | |
| Podocarpus elatus | Plum Pine | Tree | | | Y | | | |
| Polyscias elegans | Celery Wood | Tree | | 7 | Y | | Y | |
| Polyscias murrayi | Pencil Cedar | Tree | Ś | Y | Y | | Y | Y |
| Polyscias sambucifolius | Elderberry Panax | Shrub | | | Y | | Y | Y |
| Pomaderris aspera | Hazel Pomaderris | Shrub | | | Y | | Y | |
| Prostanthera incisa | Mintbush | Shrub | | | | | | |
| Prostanthera lasianthos* | Victorian Christmas bush | Shrub | | | Y | | Y | |
| Protea cynaroides* | King Protea | Shrub | | Y | Y | | | Y |
| Prunus seracifera Nigra'* | Purple-leaf Cherry-plum | Tree | | | Y | | Y | Y |
| Punica granatum* | Pomegranate | Shrub | | Y | Y | Y | | |
| Pyrostegia venusta* | Orange trumpet-creeper | Vine / Climber | | Y | Y | Y | | |
| Quisqualis indica* | Rangoon Creeper | Vine / Climber | | Y | Y | Y | | |
| Radermachera sinica* | Asian Bell | Small Tree | | Y | Y | Y | Y | |
| Rhagodia candolleana | Coastal Saltbush | Shrub | Y | | Y | | | |
| Rhodamnia rubescens | Scrub turpentine | Tree | | | Y | | Y | |
| Ricinocarpos pinifolius | Wedding Bush | Shrub | | Y | | | | Y |
| Rosa banksiae* | Banksia Rose | Vine / Climber | | Y | Y | Y | | |
| Rubus moluccanus var. trilobus | Molucca Bramble | Vine / Climber | | Y | Y | | | Y |

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|---|------------------------|-------------------|-----------------------|------------------------|-------------------------------------|-------------|----------------------------|--------------------------------------|
| Rubus parviflorus | Native Raspberry | Vine / Climber | | Y | Y | Y | Y | |
| Russelia equisetiformis* | Coral Plant | Shrub | Y | Y | Y | | | |
| Scolopia braunii | Flintwood | Tree | | Y | Y | | Y | |
| Scaveola calendulacea | | Shrub | Y | | Y | | | |
| Solandra grandiflora* | Chalice Vine | Vine / Climber | Y | Y | YC | Y | | |
| Sorbus aucuparia* | Rowan | Small Tree | | | Y | Y | Y | |
| Spartium junceum* | Spanish Broom | Shrub | | 3 | Y | Y | | |
| Sporobolus creber | Slender Rat's Tail | Grass | Y | Y | Y | Y | | |
| Stenocarpus salignus | Scrub Beefwood | Small Tree | N. | | | | Y | |
| Stenocarpus sinuatus* | Firewheel Tree | Tree | | | Y | | Y | Y |
| Stephania japonica | Snake Vine | Vine / Climber | | Y | Y | Y | | |
| Stephanotis foribunda* | Chaplet Flower | Vine / Climber | | Y | Y | Y | | |
| Sticherus flabellatus | Umbrella Fern | Fern | | | Y | Y | Y | |
| Streblus brunonianus | Whalebone | Shrub | | | Y | | Y | |
| Strelitzia reginae* | Bird of Paradise | Perennial | | Y | Y | Y | | |
| Syncarpia glomulifera | Turpentine | Tree | | | Y | Y | Y | |
| Syzygium australe | Brush Cherry | Tree | | | Y | | Y | Y |
| Syzygium luehmnannii* | Small Leaf Lilly Pilly | Tree | | | Y | Y | Y | |
| Syzygium oleosum | Blue Lilly Pilly | Tree | | Y | Y | | Y | |
| Syzygium paniculatum | Magenta Lilly Pilly | Tree | | Y | Y | | Y | Y |
| Tasmannia insipida | Brush peperwood | Tree | | Y | Y | | Y | Y |
| Taxodium distichum* | Swamp Cypress | Small Tree | | | Y | Y | Y | |
| Telopea speciosissima | Waratah | Shrub | | | | | | Y |
| Themeda australis | Kangaroo Grass | Grass | Y | Y | Y | Y | | Y |

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|---|-----------------------|-------------------|-----------------------|------------------------|-------------------------------------|-------------|----------------------------|--------------------------------------|
| Thryptomene calycina* | Grampians Thryptomene | Shrub | | Y | | | | Y |
| Tibouchina x 'Alstonville'* | | Tree | | | Y | | | |
| Todea barbara | King Fern | Fern | | | Y | Y | Y | |
| Toona ciliata | Red Cedar | Tree | | Y | Y | | | |
| Trachelospermum jasminoides* | Star-jasmine | Vine / Climber | | Y | Y | Y | | |
| Tristaniopsis collina | Hill Kanuka | Tree | | | Y | | Y | |
| Tristaniopsis laurina | Water Gum | Tree | | Y | Y | | Y | Y |
| Tylophora barbata | | Vine / Climber | 2 | | Y | Y | | Y |
| Ulmus parvifolia* | Chinese Elm | Tree | | | Y | | Y | Y |
| Viburnum x burkwoodii* | | Shrub | | | Y | Y | Y | |
| Viminaria juncea | Native Broom | Shrub | | | Y | Y | | Y |
| Vitex trifolia* | N N | Shrub | Y | | | | | |
| Westringia fruticosa | Coastal Rosemary | Shrub | Y | | | | | |
| Wisteria sinensis* | Wisteria | Vine / Climber | | | Y | Y | | |
| Xylomelum pyriforme | Woody Pear | Shrub | | | | | | Y |
| | P | | | | | | | |
| * Not native to Illawarra | | | | | | | | |
Appendix ppendix 4: Definitions

Contents

1 Definitions tem Attachment

Hem Attachment NO

Aboriginal Object: Means any deposit, object or other material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of an area of New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.

Absorption Trench (Onsite Sewarge Management): Means a trench or trenches excavated into the ground and filled with aggregate and piping or arch fabric, used for the absorption of effluent.

Absorption Trench (Stormwater): An excavation that has been filled with material or prefabricated void units that are conducive to the drainage of stormwater and which are designed to drain vertically or side-ways, into adjacent sub-surface in-situ void or fill material.

Acceptable Risk: Acceptable risk for loss of life is taken as, one order of magnitude, lower than the tolerable risk for the person most at risk, as shown in the risk matrix as published in AGS 2007. Acceptable risk for loss of property is taken as low or very low in the risk matrix as published in AGS 2007 as amended. NOTE: This does not preclude development on sites where the risk has been identified as being moderate provided that measures are taken as described in the above mentioned risk matrix as published in AGS 2007 as amended (refer to clause 5.3.(c)).

Access Handle: Means that portion of land within a battleaxe lot which has a road frontage and may contain the access driveway.

Accredited Auditor: Means a person who is accredited by a professional body approved by the Minister for Planning. Accredited auditors may act as a Principal Certifying Authority (PCA) and may issue:

mer

- Complying Development Certificates;
- Construction Certificates;
- Compliance Certificates;
- Occupation Certificates.

Acid Sulfate Soils: Means naturally occurring sediments and soils containing iron sulfides (principally pyrite) or their precursors or oxidation products, whose exposure to oxygen leads to the generation of sulfuric acid (for example, by drainage or excavation).

Adaptable Housing: Housing that is designed and built to accommodate future changes to suit occupants with mobility impairment or life cycle needs (Australian Standard AS 4299:Adaptable Housing).

Advertising Sign: Means a sign, notice, device or representation in the nature of an advertisement, whether illuminated or not which is: (a) visible from any public road, public place or public reserve and (b) is not a road traffic signal or sign.

Advertisement: Has the same meaning as in the Act defined as a sign, notice, device or representation in the nature of an advertisement visible from any public place or public reserve or from any navigable water.

Advertising Area: Means the entire area of a sign face, including any margin, frame or embellishment which forms an integral part of the sign and in the case of an advertising structure with more than 1 sign face, the maximum surface area of the combined faces.

Advertising Structure: Has the same meaning as in the Act defined as a structure used or to be used principally for the display of an advertisement.

Aerated Wastewater Treatment System: Means a wastewater treatment system typically involving sedimentation, aerobic biological oxidation, aerobic sludge digestion and effluent disinfection with final discharge of effluent to a land application area.

Affordable Housing: Has the same meaning as in the Act defined as housing for very low income households, low income households or moderate income households, being such households as are prescribed by the regulations or as are provided for in an environmental planning instrument.

AGS (2007): Means Australian Geomechanics Society's *Practice Note Guidelines for Landslide Risk Management 2007* (AGS 2007) originally cited in *Australian Geomechanics* Vol 42 No 1 March 2007.

Agriculture: Means any of the following:

- a) Animal boarding or training establishments,
- b) Aquaculture,
- c) Extensive agriculture,
- d) Farm forestry,

- e) Intensive livestock agriculture,
- f) Intensive plant agriculture.

Alluvium: Material eroded, transported and deposited by streams.

Allotment: Is the legal parcel of land which has been created via subdivision and registered with the Land Property Information service normally having a Lot number and a Deposited Plan number.

Alteration: Means the making structural or non-structural changes to the exterior or interior of a heritage item such as to the detail, fabric, finish or appearance. It may involve conservation, maintenance or repair works necessary to ensure the conservation, adaptive reuse or continued upkeep of a heritage building.

Amusement Centre: Means a building or place (not being part of a pub or registered club) used principally for playing:

- a) Billiards, pool or other like games, or
- b) Electronic or mechanical amusement devices, such as pinball machines, computer or video games and the like.

Animal Boarding Or Training Establishment: Means a building or place used for the breeding, boarding, training, keeping or caring of animals for commercial purposes (other than for the agistment of horses), and includes any associated riding school or ancillary veterinary hospital.

Annual Exceedance Probability (AEP): Is the probability that a flood of a given or larger magnitude will occur within a period of one year. Its reciprocal is equivalent to average recurrence interval.

Ancillary Residential Structure: Is a non habitable building ancillary to a dwelling-house and includes a garage, carport, shed, cabana, pergola, deck, swimming pool (inground and above ground), outside spa, Jacuzzi, hot tub, aviary, retaining wall, fence, shade sail, water tank etc.

Antecedent: Pre-existing conditions (eg. wetness of soils).

Application/s: Means an application for the determination of Council for development which includes an Integrated Development Application, Development Application, Section 96 Application or Section 82A Application.

Aquaculture: Has the same meaning as in the Fisheries Management Act 1994 defined as follows: Aquaculture means:

- a) Cultivating fish or marine vegetation for the purposes of harvesting the fish or marine vegetation or their progeny with a view to sale, or
- b) Keeping fish or marine vegetation in a confined area for a commercial purpose (such as a fish-out pond),

but does not include:

- c) Keeping anything in a pet shop for sale or in an aquarium for exhibition (including an aquarium operated commercially), or
- d) Anything done for the purposes of maintaining a collection of fish or marine vegetation otherwise than for a commercial purpose, or
- e) Any other thing prescribed by the regulations (made under the Fisheries Management Act 1994).

Arborist: A qualified Arborist is a person who is eligible for membership as a 'Consulting Arborist' with the National Arborists Association of Australia or the Institute of Australian Consulting Arboriculturalists and who has obtained a Level 5 Certificate of Horticulture / Aboriculture or equivalent.

Areal: Variation over an area of a particular parameter.

Average Recurrence Interval: The expected or average interval of time between exceedences of a rainfall or flood event of given magnitude.

Arterial Road: Means a road shown on the Wollongong Local Environmental Plan 2009 maps being an arterial road or a road declared to be a main road, controlled access road, secondary road or a tollway under the Roads Act 1993.

Asbestos: Means the fibrous form of those mineral silicates that belong to the serpentine or amphibole groups of rock forming minerals, including actinolite, amosite (brown asbestos), anthophyllite, chrysotile (white asbestos), crocidolite (blue asbestos) and tremolite. (OHS Regulations 2001).

Asbestos Removal Work: Means any work, in which bonded or friable asbestos material is removed, repaired or disturbed. (OHS Regulation 2001).

At-grade Car parking: Any car parking provided on the ground level of a building or at ground level outside a building.

Attached Dwelling: Means a building containing 3 or more dwellings, where:

- (a) Each dwelling is attached to another dwelling by a common wall, and
- (b) Each of the dwellings is on its own lot of land (not being an individual lot in a strata plan or community title scheme), and
- (c) None of the dwellings are located above any part of another dwelling.

Australian Height Datum (AHD): A standard datum for expressing vertical information.

Australian Rainfall & Runoff: A technical manual providing guidance on current drainage design practice published by the Institute of Engineers Australia.

Average Recurrence Interval (ARI): Means the long-term average number of years between the occurrence of a flood as big as, or larger than, the selected event. For example, floods with a discharge as great as, or greater than, the 20 year ARI flood event will occur on average once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event.

AUSTROADS: Means AUSTROADS: "Guide to Traffic Engineering Practice".

Average Exceedance Probability (AEP): Means the magnitude of a storm.

Average Recurrence Interval (ARI): The average period between the recurrence of a storm event of at least a given rainfall intensity. The ARI represents a statistical probability. For example, a 10 year ARI indicates an average of 10 events over 100 years. The ARI is not the period between actual events.

Backpackers' Accommodation: Means tourist and visitor accommodation:

- a) That has shared facilities, such as a communal bathroom, kitchen or laundry, and
- b) That will generally provide accommodation on a bed basis (rather than by room)

Backwater Profile: Longitudinal profile of the water surface in a stream where the water surface is raised above its normal level by a natural or artificial obstruction.

Balcony: Means an open area above ground level, not being an enclosed room or area, attached to or integrated with a dwelling for the exclusive enjoyment of the occupant or occupants of a dwelling but does not include a basement podium or roof terrace defined elsewhere within this DCP.

Basement car park: Refers to a car parking area wholly or partly accommodated underground, below a building. The roof of this space, including any solid walls on the podium, must not exceed 1.2m in height above natural ground level or finished ground level, whichever is the greatest distance.

Basement podium: Means the supporting structure over any portion of the basement for support of the structure above. The basement podium may be accessible for use from the dwelling/s it adjoins and does not include a balcony or roof terrace defined elsewhere in this DCP.

Battleaxe lot: Is a lot where only the access handle has direct road frontage.

BCA: Means the Building Code of Australia.

Beach: Refers to the sandy shore of the sea at mean high water mark.

Bed And Breakfast Accommodation: Means tourist and visitor accommodation comprising a dwelling (and any ancillary buildings and parking) where the accommodation is provided by the permanent residents of the dwelling and:

- a) Meals are provided for guests only, and
- b) Cooking facilities for the preparation of meals are not provided within guests' rooms, and
- c) Dormitory-style accommodation is not provided.

Biochemical Oxygen Demand (BOD5): Means the amount of oxygen required for the biological decomposition of organic matter, measured over a period of 5 days.

Blackwater: Means human faeces and urine and wastewater heavily and directly contaminated with human faeces and urine generated from a toilet, urinal, bidette or bidet. Blackwater may also contain contaminated solid material, such as toilet paper. Although not strictly water-based, human faeces and urine entering a waterless composting toilet is considered as "blackwater".

Block: Refers to a group of subdivided lots, the edge of which is bound by public roads, and in some cases, public roads and public open space.

Boarding House: Means a building:

a) That is wholly or partly let in lodgings, and

- b) That provides lodgers with a principal place of residence for 3 months or more, and
- c) That generally has shared facilities, such as a communal bathroom, kitchen or laundry, and
- d) That has rooms that accommodate one or more lodgers,

But does not include backpackers' accommodation, a group home, a serviced apartment, seniors housing or hotel or motel accommodation.

Brothel: Has the same meaning as in the Act.

Buildable land: Means land on which the erection of a building is not constrained by being flood prone, subject to instability, subject to easements or restrictions of access.

Building: Has the same meaning as in the Act defined to include part of a building and any structure or part of a structure, but not including a manufactured home, a moveable dwelling or associated structure (or part of a manufactured home, moveable dwelling or associated structure).

Building envelope: Means the three dimensional shape within which a development must fit. It defines the limits for the siting (including setbacks) and height of any buildings.

Building Footprint: Means the area of land measured at finished ground level that is enclosed by the external walls of a building or any attached balconies or terraces.

Building Height (or Height of Building): Means the vertical distance between ground level (existing) at any point to the highest point of the building, including plant and lift overruns, but excluding communication devices, antennae, satellite dishes, masts, flagpoles, chimneys, flues and the like.

Building Identification Sign: Means a sign that identifies or names a building and that may include the name of a building, the street name and number of a building, and a logo or other symbol, but that does not include general advertising of products, goods or services.

Building Sustainability Index (BASIX): A web-based planning tool for the assessment of the potential performance of new residential development in terms of its energy efficiency and water usage efficiency. A BASIX certificate must be submitted with a Development Application or a Complying Development Certificate for any new residential development. BASIX is implemented under State Environmental Planning Policy (Building Sustainability Index) 2004.

Building Line or Setback: Means the horizontal distance between the property boundary or other stated boundary (measured at 90 degrees from the boundary) and:

- a) A building wall, or
- b) The outside face of any balcony, deck or the like, or
- c) The supporting posts of a carport or verandah roof,
- Whichever distance is the shortest.

Building work: Means any physical activity involved in the erection of a building or alterations and additions to a building or structure.

Bulky Goods Premises: Means a building or place used primarily for the sale by retail, wholesale or auction of (or for the hire or display of) bulky goods, being goods that are of such size or weight as to require:

- a) A large area for handling, display or storage, or
- b) Direct vehicular access to the site of the building or place by members of the public for the purpose of loading or unloading such goods into or from their vehicles after purchase or hire,

But does not include a building or place used for the sale of foodstuffs or clothing unless their sale is ancillary to the sale or hire or display of bulky goods.

Bush Fire Hazard Reduction Work: Has the same meaning as in the Rural Fires Act 1997 defined as follows:

Bush Fire Hazard Reduction Work: Means:

- a) The establishment or maintenance of fire breaks on land, and
- b) The controlled application of appropriate fire regimes or other means for the reduction or modification of available fuels within a predetermined area to mitigate against the spread of a bush fire,
- c) But does not include construction of a track, trail or road.

Bushfire Prone Land: Is land that can support a bush fire or is likely to be subject to bush fire / ember attack. In general, bush fire prone land identifies vegetation types and associated buffer zones.

Business Identification Sign: Means a sign:

a) That indicates:

i)

- The name of the person or business, and
- ii) The nature of the business carried on by the person at the premises or place at which the sign is displayed, and
- b) That may include the address of the premises or place and a logo or other symbol that identifies the business,
- c) But that does not include any advertising relating to a person who does not carry on business at the premises or place.

Business Premises: Means a building or place at or on which:

- a) An occupation, profession or trade (other than an industry) is carried on for the provision of services directly to members of the public on a regular basis, or
- b) A service is provided directly to members of the public on a regular basis, and may include, without limitation, premises such as banks, post offices, hairdressers, dry cleaners, travel agencies, internet access facilities, medical centres, betting agencies and the like, but does not include sex services premises.

Campervan: Means a moveable dwelling that is designed so as to be registrable as a motor vehicle under the Traffic Act 1909 and includes a camper trailer.

Car Park: Means a building or place primarily used for the purpose of parking motor vehicles, including any manoeuvring space and access thereto, whether operated for gain or not.

Caravan: Means a moveable dwelling that is designed so as to be registrable as a trailer under the Traffic Act 1909 but doe not include a campervan /camper trailer.

Caravan Park: Means land (including a camping ground) on which caravans (or caravans and other moveable dwellings) are, or are to be, installed or placed.

Catchment: Area draining into a particular creek system, typically bounded by higher ground around its perimeter.

Category 1 Remediation Work: Contaminated land remediation work that requires formal development consent as per the legislative requirements under State Environmental Planning Policy No. 55 – Remediation of Land.

Category 2 Remediation Work: Contaminated land remediation work that does not require formal development consent as per the legislative requirements under State Environmental Planning Policy No. 55 – Remediation of Land.

Ceiling Height: Means the vertical distance from the ceiling level at the outside wall to natural ground level or finished ground level whichever is lower. For a 'cathedral', raked or curved ceiling, or where the roof structure of the building serves the same purpose as the ceiling of a conventional building, the ceiling height is measured as the vertical distance from the pitching point at the outside wall to natural ground level or finished ground level, whichever is lower.

Character: Has two specific elements, namely:

- a) "Existing character" relates to the current patterns of natural and urban geography which may be observed in an area; and
- b) "Desired or future character" which provides objectives for the future development of a suburb and which emphasizes the important existing features or qualities of the area that should be maintained or enhanced.

Child Care Centre: Means a building or place used for the supervision and care of children that:

- a) Provides long day care, pre-school care, occasional child care or out-of-school-hours care, and
- b) Does not provide overnight accommodation for children other than those related to the owner or operator of the centre,

but does not include:

- c) A building or place used for home-based child care, or
- d) An out-of-home care service provided by an agency or organisation accredited by the NSW Office of the Children's Guardian, or
- e) A baby-sitting, playgroup or child-minding service that is organised informally by the parents of the children concerned, or
- f) A service provided for fewer than 5 children (disregarding any children who are related to the person providing the service) at the premises at which at least one of the children resides, being a service that is not advertised, or
- g) A regular child-minding service that is provided in connection with a recreational or commercial facility (such as a gymnasium), by or on behalf of the person conducting the facility, to care for children while the children's parents are using the facility, or
- h) A service that is concerned primarily with the provision of:

- i) Lessons or coaching in, or providing for participation in, a cultural, recreational, religious or sporting activity, or
- ii) Private tutoring, or
- i) A school, or
- j) A service provided at exempt premises (within the meaning of section 200 of the Children and Young Persons (Care and Protection) Act 1998), such as hospitals, but only if the service is established, registered or licensed as part of the institution operating on those premises.

Civil Design: Means a design where the development includes any road, drain, excavation or fill placement which has been prepared by a civil engineer.

Civil Engineer: Means a civil or structural engineer who is a member or is eligible for membership of a professional engineering institution, is university degree qualified with a minimum of five years relevant professional practice during the last ten years as a civil engineer, and is listed on the National Professional Engineers Register, and either has or is employed by a corporation which has professional indemnity insurance of not less than \$2 million, such insurance being evidenced to Council to be in force, for the year in which any information is submitted to the Council in accordance with this policy. The professional indemnity insurance must have retroactive cover extending back to at least the engineer's first submission to Council.

Clearing Native Vegetation: Has the same meaning as in the Native Vegetation Act 2003 defined meaning any one or more of the following:

- a) Cutting down, felling, thinning, logging or removing native vegetation,
- b) Killing, destroying, poisoning, ringbarking, uprooting or burning native vegetation.

(See Division 3 of Part 3 of the Native Vegetation Act 2003 for the exclusion of routine agricultural management and other farming activities from constituting the clearing of native vegetation if the landholder can establish that any clearing was carried out for the purpose of those activities.)

Cliff-top: On land adjacent to the foreshore, is defined as that position where a change in grade of the land is evident, downwards towards the cliff edge or face.

Coastal Building Line: Is the distance a structure must be setback from the cliff top or foreshore lands.

Collection Well: Means a tank used for the collection and temporary storage of effluent discharged from a septic tank.

Communal Open Space: Means useable shared open space within the proposed development for the recreation and relaxation of all residents of a residential or mixed use development.

Community Facility: Means a building or place:

- a) Owned or controlled by a public authority or non-profit community organisation, and
- b) Used for the physical, social, cultural or intellectual development or welfare of the community,
- c) But does not include an educational establishment, hospital, retail premises, place of public worship or residential accommodation.

Community Sensitive Locations: These may include areas:

- Where occupants are located for long periods of time, for instance residences;
- That are frequented by children, for instance schools, child care centres;
- Where there are people with particular health concerns for instance hospitals, aged care centres; and
- · Considered significant to indigenous communities.

Complying Development Certificate (CDC): A certificate that states a particular proposed development is complying development and (if carried out as specified in the certificate) will comply with all development control applicable to the development. A complying development certificate may be issued either by Council or an accredited certifier.

Consent Authority: Means Wollongong City Council.

Construction Certificate (CC): A certificate stating that construction drawings and specifications are consistent with the development consent and relevant construction standards such as the Building Code of Australia. A construction certificate may be issued either by the Council or an accredited certifier.

Contaminated Land: Land in, on or under which any substance is present at a concentration above that naturally present in, on or under the land and that poses, or is likely to pose, an immediate or long term risk to human health or the environment.

Contaminated Land Planning Guidelines: Guidelines notified in accordance with section 145C of the Environmental Planning and Assessment Act 1979 (Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land).

Conveyance: A measure of the carrying capacity of the channel section. Flow is directly proportional to conveyance for steady flow. From Manning's equation, the proportionality factor is the square root of the energy slope.

Council: Means Wollongong City Council.

Corner Apartment: Is an apartment located in the corner position of a building which has frontage to two elevations.

Corner Lot: Is a lot which has a frontage to two roads on adjacent boundaries.

Covenant: A restriction on the use of land recorded on the property title and binding upon successors in title under the Conveyancing Act 1919. Covenants may be either positive (imposing positive obligations) or negative (imposing restrictions).

CPEng: Means Chartered Professional Engineer.

CPGeo: Means Chartered Professional Geologist.

Crime Prevention thought Environmental Design (CPTED): It aims to reduce the opportunities for crime by increasing the effort and risk for offenders, as well as reducing the rewards. CPTED recognises that any design strategy needs to be part of a holistic approach to crime prevention, incorporating social, environment and community development strategies.

Cross Over Apartments: Apartments with two opposite aspects and with a change in level between one side of the building and the other.

Cross Through Apartments: Apartments on one level with two opposite aspects.

Crematorium: Means a building in which deceased persons or pets are cremated, and includes a funeral chapel.

Critical Depth: If discharge is held constant and the water depth allowed to decrease, as in the case of water approaching a free overfall, velocity head will increase, pressure head will decrease, and total energy will decrease toward a minimum value where the rate of the decrease in the pressure head is just counterbalanced by the rate of increase in velocity head. This is the critical depth. More generally, the critical depth is the depth of flow that would produce the minimum total energy head, and it depends on cross section geometry and water discharge.

Critical Flow: The state of flow where the water depth is at the critical depth and when the inertial and gravitational forces are equal. When Froude $N^0 = 1.0$.

Crown Maintenance Pruning: Is defined as in Australian Standard AS 4373 –2007 "Pruning of Amenity Trees" and generally involves a reduction in tree foliage and branches by up to 10 per cent in any one (1) year with no reduction in the height of the main trunk.

Culvert: An enclosed conduit (typically pipe or box) that conveys stormwater below ground.

Cumulative Impact: The sum of the impacts from a number of different sources or over time.

Curtilage: In relation to a heritage item or conservation area, means the area of land (including land covered by water) surrounding a heritage item, a heritage conservation area, or building, work or place within a heritage conservation area, that contributes to its heritage significance.

dBA: Means the decibels of the 'A-scale' – a set of frequency -weighted scale of noise which allows for lack of sensitivity of the ear to sound at very high and very low frequencies.

DCP: Means Development Control Plan.

Dead tree: Means any tree that is no longer capable of performing any one of the following processes:

- Photosynthesis;
- Take up of water through the root system;
- Hold moisture in its cells; or
- Produce new shoots.

DECC: Department of Environment and Climate Change.

Deep Soil Zone: Refers to an area of the site that is not to be built upon, or underneath, thereby leaving an area of deep, soft soil for substantial deep-rooted vegetation, natural vegetation and natural drainage. This area may be included in private open space but is not included in the minimum private open space area calculations.

Demolish: In relation to a heritage item, or a building, work, relic or tree within a heritage conservation area, means wholly or partly destroy, dismantle or deface the heritage item or the building, work, relic or tree.

Demolition Plan: Means a plan and / written statement which outlines the procedures to be carried out for the demolition of a building or work.

Depot: Means a building or place used for the storage (but not sale or hire) of plant, machinery or other goods (that support the operations of an existing undertaking) when not required for use.

Development: Means the construction, alteration or demolition of buildings, including swimming pools, roads, dams, ponds and drains, and the excavation and/or filling of land or any other works that requires the prior approval of Council.

Drainage: Means any activity that intentionally alters the hydrological regime of any locality by facilitating the removal of surface or ground water. It may include the construction, deepening, extending, opening, installation or laying of any canal, drain or pipe, either on the land or in such a manner as to encourage drainage of adjoining land.

Design Floor Level: A minimum floor level specified to be above standard flood level (eg 0.5 metres above).

Designated Development: Development declared as 'designate development' by Schedule 3 of the Environmental Planning and Assessment Regulation 2000.

Detailed Investigation: An investigation to define the extent and degree of contamination to assess potential risk posed by contaminants to human health and the environment and to obtain sufficient information for the development of a remedial action plan of required.

Development Opportunity Envelope: Identifies a building envelope that ensures that development is not visible from important viewing locations for that section of the escarpment.

Development site: Refers to the lands within which the development (ie the subject of the Development Application) relates.

Domestic Greywater Diversion: Means the installation and operation of a system for diverting greywater generated on sewered residential premises to a garden or lawn on those premises, but does not include the manual collection and re-use of greywater (for example, by means of a bucket or similar receptacle).

Domestic Greywater Treatment System (DGTS): Means a system that collects, treats and disinfects greywater for re-use for toilet and urinal flushing, or for use in surface irrigation in dedicated non-trafficable areas or other land application systems.

Driveway Crossing: Refers to a carriageway extending from the edge of the roadway frontage to the property boundary to connect to the first vehicular ramp or driveway encountered, and carrying one or two-way traffic.

Driveway: Refers to the carriageway contained within the development site, which carries one or two way traffic.

Dual Occupancy: Means 2 dwellings (whether attached or detached) on one lot of land (not being an individual lot in a strata plan or community title scheme), but does not include a secondary dwelling.

Dual Aspect Development: Apartments which have at least two major external walls facing in different directions, including corner, cross over and cross through apartments.

DWE: Department of Water and Energy.

Dwelling: Means a room or suite of rooms occupied or used or so constructed or adapted as to be capable of being occupied or used as a separate domicile.

Dwelling House means a building containing only one dwelling.

Earthworks: means excavation or filling.

Ecologically Sustainable Development has the same meaning as in the Environmental Planning and Assessment Act 1979 and the Protection of the Environment Administration Act 1991.

Educational Establishment means a building or place used for education (including teaching), being:

- a) A school, or
- b) A tertiary institution, including a university or a TAFE establishment, that provides formal education and is constituted by or under an Act.

Effective Warning Time: The time available after receiving advice of an impending flood and before the floodwaters prevent appropriate flood response actions being undertaken.

Effluent Application Field (EAF) area: Means the minimum required disposal field size (ie directly wetted area) that is to be constructed within the ESD (Ecological Sustainable Development) area and has been determined in accordance with AS/NZS 1547 (2000), based on the ability of the site's soils to receive effluent without creating health risks or hydraulic failure.

Electricity Generating Works: Means a building or place used for the purpose of making or generating electricity.

Electromagnetic radiation (EMR) or electromagnetic energy (EME): The radiation in the microwave and radiofrequency band of the electromagnetic spectrum.

Embankment: The low permeability earth fill wall of a dam comprising the crest, batter slopes and foundation.

Engineering Geologist: Means a specialist engineering geologist who is university degree qualified, is a member or is eligible for membership of a professional institution and who has achieved chartered professional status being either CPEng or CPGeo or RPGeo with Landslide Risk Management as a core competence; with a minimum of five years practice during the last ten years as an engineering geologist in regions of the Sydney Basin underlain by Narrabeen or Coal Measures geological strata or who is able to demonstrate relevant experience with similar geology and either has or is employed by a corporation which has professional indemnity insurance of not less than \$2 million, such insurance being evidenced to Council to be in force, for the year in which any information is submitted to the Council in accordance with this policy. The professional indemnity insurance must have retroactive cover extending back to at least the engineer's first submission to Council.

Entertainment Facility means a theatre, cinema, music hall, concert hall, dance hall and the like, but does not include a pub, nightclub or registered club.

Environmental Facility means a building or place that provides for the recreational use or scientific study of natural systems, and includes walking tracks, seating, shelters, board walks, observation decks, bird hides or the like, and associated display structures.

Escarpment: A cliff or steep slope, of some extent, generally separating two level or gently sloping areas.

Evapotranspiration (ET) Bed: Means a system of effluent disposal that uses the loss of water from the soil by evaporation and from plants by transpiration from beds that are essentially shallow trenches.

Excavation: Means the removal of soil or rock, whether moved to another part of the same site or to another site, but does not include garden landscaping that does not significantly alter the shape, natural form or drainage of the land.

Exempt Development: Development that is declared to be 'exempt' under Wollongong Local Environmental Plan 2009.

Exhibition Home: Means a dwelling built for the purposes of the public exhibition and marketing of New Dwellings, whether or not it is intended to be sold as a private dwelling after its use for those purposes is completed, and includes any associated sales or home finance office or place used for displays.

Exhibition Village: Means 2 or more exhibition homes and associated buildings and places used for house and land sales, site offices, advisory services, car parking, food and drink sales and other associated purposes.

Existing Ground Level: Means the ground level in existence immediately prior to the commencement of proposed building or site works.

Extractive Industry means the winning or removal of extractive materials (otherwise than from a mine) by methods such as excavating, dredging, tunnelling or quarrying, including the storing, stockpiling or processing of extractive materials by methods such as recycling, washing, crushing, sawing or separating, but does not include turf farming.

Extractive Material: Means sand, soil, gravel, rock or similar substances that are not minerals within the meaning of the Mining Act 1992.

Extreme Flood: Means an estimate of the probable maximum flood, which is the largest flood likely to ever occur.

Farm Stay Accommodation: Means tourist and visitor accommodation provided to paying guests on a working farm as a secondary business to primary production. "Extractive material" means sand, soil, gravel, rock or similar substances that are not minerals within the meaning of the Mining Act 1992.

Fill: The depositing of soil, rock or other similar extractive material obtained from the same or another site, but does not include:

(a) The depositing of topsoil or feature rock imported to the site that is intended for use in garden landscaping, turf or garden bed establishment or top dressing of lawns and that does not significantly alter the shape, natural form or drainage of the land, or (b) The use of land as a waste disposal facility

Final Geotechnical Certificate: Means a certificate prepared by a geotechnical engineer or engineering geologist in accordance with form M17 of this Plan.

Final Structural Certificate: Means a certificate prepared by a structural engineer in accordance with form M16 of this policy.

Finished Ground Level: Means the level of the finished ground surface.

Flood: Is a relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage as defined by the FMM before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami.

Flood Awareness: An appreciation of the likely effects of flooding and knowledge of the relevant flood warning and evacuation procedures.

Flood Compatible Building Components: A combination of measures incorporated in the design and /or construction of buildings or structures subject to flooding and the use of flood compatible materials for the reduction or elimination of flood damage.

Flood Compatible Materials: Materials used in building which are resistant to damage when inundated.

Flood Evacuation Strategy: The strategy for the evacuation of areas within effective warning time during periods of flood as specified within any policy of Council, the FRMP, the relevant State government disaster plan or advice received from the State Emergency Service (SES) or as determined in the assessment and determination of individual Development Applications.

Flood Hazard: The potential for damage to property or persons due to flooding.

Flood Liable Land: Is the area of land which is subject to inundation by the probable maximum flood (PMF).

Flood Mitigation Work means work designed and constructed for the express purpose of mitigating flood impacts. It involves changing the characteristics of flood behaviour to alter the level, location, volume, speed or timing of flood waters to mitigate flood impacts. Types of works may include excavation, construction or enlargement of any fill, wall, or levee that will alter riverine flood behaviour, local overland flooding, or tidal action so as to mitigate flood impacts.

Flood Storage: Part of the floodplain that is important for the temporary storage of floodwaters during the passage of a flood.

Floodplain: The portion of a river valley, adjacent to the river channel, which is covered with water when the river overflows during flood or inundation periods.

Floodplain Development Manual: Refers to the NSW State Government document dated April 2005 and titled "Floodplain Development Manual: The Management of Flood Liable Land."

Floodplain Management Manual (FMM). Refers to the document dated January 2001, published by the New South Wales Government and entitled *"Floodplain Management Manual: the management of flood liable land"* which has been superceded by the *"Floodplain Development Manual: the management of flood liable land April 2005"*.

Floodplain Risk Management Plan (FRMP): Means a plan prepared for one or more floodplains in accordance with the requirements of the FMM or its predecessor.

Floodplain Risk Management Study (FRMS): Means a study prepared for one or more floodplains in accordance with the requirements of the FMM or its predecessor.

Floodways: Areas of the river channel and floodplain where a significant volume of water flows during flood periods. Floodways are areas which, even if only partially blocked would cause significant redistribution of flood flow, which may in turn adversely affect other areas. These areas are also generally characterised (but not always) by areas of deeper flow or the areas where higher velocities occur.

Floor Space Ratio (FSR): Is the ratio of the gross floor area of a building to the area of the site on which it is situated.

Food and Drink Premises: Means retail premises used for the preparation and retail sale of food or drink for immediate consumption on or off the premises, and includes restaurants, cafes, take away food and drink premises, milk bars and pubs.

Foreshore Area: Means the land between the foreshore building line and the mean high water mark of the nearest Foreshore building line: Is a factor of safety expressed as a height above the design flood level. Freeboard provides a factor of safety to compensate for uncertainties in the estimation of flood levels across the floodplain, such as wave action, localised hydraulic behaviour and impacts that are specific event related, such as levee and embankment settlement, and other effects such as 'greenhouse' and climate change.

Forecast (ANEF) Contour: Means the Australian Noise Exposure Forecast contours surrounding the Illawarra Regional Airport at Albion Park Rail and marked on a ANEF map which highlight the level of noise exposure from aircraft operating out of the Illawarra Regional Airport.

Freeboard: Is a factor of safety expressed as a height above the design flood level. Freeboard provides a factor of safety to compensate for uncertainties in the estimation of flood levels across the floodplain, such as wave action, localised hydraulic behaviour and impacts that are specific event related, such as levee and embankment settlement, and other effects such as 'greenhouse' and climate change.

Frontage: Refers to the street alignment at the front of a lot.

Front Building Line: Is the perpendicular distance a building or structure is set back from the front property boundary at the primary street frontage of a lot.

Froude N^o: A measure of flow instability - below a value of one, flow is tranquil and smooth, above one, flow tends to be rough and undulating (as in rapids).

Funeral Home means premises used to arrange and conduct funerals and memorial services, and includes facilities for the short-term storage, dressing and viewing of bodies of deceased persons and premises with mortuary facilities.

Gate Valve: Means a stop cock used to prevent the flow of effluent at the collection side of the suction line.

Geotechnical: Relating to Engineering and the materials of the earth crust.

Geotechnical Engineer: Means a specialist geotechnical engineer who is university degree qualified, is a member of or is eligible for membership of a professional engineering institution and who has achieved chartered professional status being either CPEng or CPGeo or RPGeo with Landslide Risk Management as a core competence; with a minimum of five years practice during the last 10 years as an geotechnical engineer in regions of the Sydney Basin underlain by Narrabeen or Coal Measures geological strata or who is able to demonstrate relevant experience with similar geology and either has or is employed by a corporation which has professional indemnity insurance of not less than \$2 million, such insurance being evidenced to Council to be in force, for the year in which any information is submitted to the Council in accordance with this policy. The professional indemnity insurance must have retroactive cover extending back to at least the engineer's first submission to Council.

Geotechnical Hazards: Means a condition with the potential for causing the movement of soil, rock or debris which may cause injury or death to persons or damage to, or destruction of property.

Geotechnical report: Means a report prepared by and/or technically verified by a geotechnical engineer or engineering geologist as defined by this DCP, which incorporates each of the elements, where applicable to the type of development, described in section 5.2 'Requirements for the preparation of geotechnical reports' of this policy.

Gradient: Slope or rate of fall of land/pipe/stream.

Granny Flat: Means the smaller of two dwellings, where:

- a) The dwellings are both on the same lot and no other dwelling is on that lot;
- b) At least one of the dwellings is occupied by the owner of the lot on which the dwellings stand.

Green roof: A roof surface that supports the growth of vegetation, comprised of a waterproofing membrane, drainage layer, organic growing medium (soil) and vegetation. Green roofs can be classified as either extensive or intensive, depending on the depth of substrate used and the level of maintenance required. Intensive green roofs are generally greater than 300mm deep and are designed as accessible landscape spaces with pathways and other features. Extensive green roofs are generally less than 300mm deep and are generally not trafficable.

Green wall: There are two main types of green walls: green facades and living walls. Green facades are simple systems where plants are grown directly into soil and trained up a frame or trellis system to cover the wall. Living walls are more complex systems where panels or pockets of vegetation are fixed directly to the wall. This is through the use of a suitable growing medium and a hydroponic system. The use of soil in a living wall is generally minimal and plants are fed primarily through nutrients in the irrigation water.

Greywater (Sullage): Means domestic wastewater excluding toilet waste and may include wastewater arising from a hand basin, shower, bath, spa bath, clothes washing machine, laundry tub, dishwasher and kitchen sink.

Greywater Diversion Device (GDD): Is a device that diverts (or diverts and collects), and directs untreated greywater to a subsurface irrigation area.

Gross Floor Area means the sum of the floor area of each floor of a building measured from the internal face of external walls, or from the internal face of walls separating the building from any other building, measured at a height of 1.4 metres above the floor, and includes:

- a) The area of a mezzanine, and
- b) Habitable rooms in a basement or an attic, and

c) Any shop, auditorium, cinema, and the like, in a basement or attic,

but excludes:

- a) Any area for common vertical circulation, such as lifts and stairs, and
- b) Any basement:
 - i) Storage, and
 - ii) Vehicular access, loading areas, garbage and services, and
- c) Plant rooms, lift towers and other areas used exclusively for mechanical services or ducting, and
- d) Car parking to meet any requirements of the consent authority (including access to that car parking), and
- e) Any space used for the loading or unloading of goods (including access to it), and
- f) Terraces and balconies with outer walls less than 1.4 metres high, and
- g) Voids above a floor at the level of a storey or storey above.

Ground Level (Existing) means the existing level of a site at any point.

Ground Level (Finished) means, for any point on a site, the ground surface after completion of any earthworks (excluding any excavation for a basement, footings or the like) for which consent has been granted or that is exempt development.

Ground Level (Mean) means, for any site on which a building is situated or proposed, one half of the sum of the highest and lowest levels at ground level (finished) of the outer surface of the external walls of the building.

Groundwater: Means the body of water that fills the pore spaces of the soil and subsoil and includes seepage from springs.

Group Home: Means a dwelling that is a permanent group home or a transitional group home.

Gully: Narrow ravine, small valley.

Habitable floor area: Means:

- In a residential situation: a living or working area, such as a lounge room, dining room, rumpus room, kitchen, bedroom or workroom;
- In an industrial or commercial situation: an area used for offices or to store valuable possessions susceptible to flood damage in the event of a flood.

Habitable room: Means a room used for normal domestic activities, and:

- Includes a bedroom, living room, lounge room, music room, television room, kitchen, dining room, sewing room, study, playroom, family room and sunroom; but
- Excludes a bathroom, water closet, pantry, walk-in wardrobe, corridor, hallway, lobby, photographic darkroom, clothes drying room and other spaces of a specialised nature occupied neither frequently nor for extended periods.

Habitable Roof Space: Is space within the roof a building which can be used for residential purposes, where the height of the building does not exceed the ridge height specified in the height table.

Habitat Tree: Means any tree which has developed hollows in the trunk or limbs and which is suitable for nesting birds, arboreal marsupials (possums), micro-bats or which support the growth of locally indigenous epiphytic plants such as orchids.

Hazard: Is a source of potential harm or a situation with a potential to cause loss. In relation to this plan, the hazard is flooding which has the potential to cause harm or loss to the community.

Headwall: Wall constructed around inlet or outlet of a culvert.

Health Consulting Rooms means a medical centre that comprises one or more rooms within (or within the curtilage of) a dwelling house used by not more than 3 health care professionals who practise in partnership (if there is more than one such professional) who provide professional health care services to members of the public.

Health Services Facility means a building or place used as a facility to provide medical or other services relating to the maintenance or improvement of the health, or the restoration to health, of persons or the prevention of disease in or treatment of injury to persons, and includes the following:

- a) Day surgeries and medical centres,
- b) Community health service facilities,
- c) Health consulting rooms,
- d) Facilities for the transport of patients, including helipads and ambulance facilities,
- e) Hospitals.

Heavy Industry: Means an industry that requires separation from other land uses because of the nature of the processes involved, or the materials used, stored or produced. It may consist of or include a hazardous or offensive industry or involve the use of a hazardous or offensive storage establishment.

Height: Means the number of storeys in a building which can be intersected by the same vertical line

Heritage Conservation Area: Means any area listed in Schedule 5 Part 2 of Wollongong Local Environmental Plan 2009.

Heritage Conservation Management Plan means a document prepared in accordance with guidelines prepared by the Department of Planning that documents the heritage significance of an item, place or heritage conservation area and identifies conservation policies and management mechanisms that are appropriate to enable that significance to be retained.

Heritage Impact Statement means a document consisting of:

- a) A statement demonstrating the heritage significance of a heritage item, archaeological site, place of Aboriginal heritage significance or other heritage conservation area, and
- b) An assessment of the impact that proposed development will have on that significance, and
- c) Proposals for measures to minimise that impact.

Heritage Item: Means a building, work, archaeological site or place listed in Schedule 1 of Wollongong Local Environmental Plan 1990 and the site of which is described in Schedule 1 and shown edged heavy black or edged broken heavy black on the heritage map.

Heritage Significance means historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value.

Highway Service Centre means a building or place used as a facility to provide refreshments and vehicle services to highway users, and which may include any one or more of the following:

- a) Restaurants or take away food and drink premises,
- b) Service stations and facilities for emergency vehicle towing and repairs,
- c) Parking for vehicles,
- d) Rest areas and public amenities

Home-Based Child Care means a dwelling used by a resident of the dwelling for the supervision and care of one or more children and that satisfies the following conditions:

- a) The service is appropriately licensed within the meaning of the Children and Young Persons (Care and Protection) Act 1998,
- b) The number of children (including children related to the carer or licensee) does not at any one time exceed 7 children under the age of 12 years, including no more than 5 who do not ordinarily attend school.

Home employment: Means an occupation which is carried on in, or from a dwelling, or within or from the curtilage of a dwellinghouse or residential apartment building, by the permanent residents of the dwelling, and which does not involve any of the following

- a) The employment on the premises of persons other than those residents;
- b) Interference with the amenity of the neighbourhood by reason of the emission of noise, vibration, smell, fumes, smoke, vapour, steam, soot, ash, dust, waste water, waste products or grit, oil or otherwise;
- c) The display of goods, whether in a window or otherwise;
- d) The exhibition of any notice, advertisement or sign (other than a notice, advertisement or sign exhibited to indicate the name and occupation of those residents);
- e) The use of the premises as a brothel or bed and breakfast accommodation.

Home Business: Means a business carried on in a dwelling, or in a building ancillary to a dwelling, by one or more permanent residents of the dwelling that does not involve:

a) The employment of more than 2 persons other than those residents, or

- b) Interference with the amenity of the neighbourhood by reason of the emission of noise, vibration, smell, fumes, smoke, vapour, steam, soot, ash, dust, waste water, waste products, grit or oil, traffic generation or otherwise, or
- c) The exposure to view, from any adjacent premises or from any public place, of any unsightly matter, or
- d) The exhibition of any notice, advertisement or sign (other than a notice, advertisement or sign exhibited on that dwelling to indicate the name of the resident and the business carried on in the dwelling), or
- e) The sale of items (whether goods or materials), or the exposure or offer for sale of items, by retail, except for goods produced at the dwelling or building,

but does not include bed and breakfast accommodation, home occupation (sex services) or sex services premises.

Home Industry: Means a light industry carried on in a dwelling, or in a building ancillary to a dwelling, by one or more permanent residents of the dwelling that does not involve:

- a) The employment of more than 2 persons other than those residents, or
- b) Interference with the amenity of the neighbourhood by reason of the emission of noise, vibration, smell, fumes, smoke, vapour, steam, soot, ash, dust, waste water, waste products, grit or oil, traffic generation or otherwise, or
- c) The exposure to view, from any adjacent premises or from any public place, of any unsightly matter, or
- d) The exhibition of any notice, advertisement or sign (other than a notice, advertisement or sign exhibited on that dwelling to indicate the name of the resident and the light industry carried on in the dwelling), or
- e) The sale of items (whether goods or materials), or the exposure or offer for sale of items, by retail, except for goods produced at the dwelling or building, but does not include bed and breakfast accommodation or sex services premises.

Home Occupation: Means an occupation carried on in a dwelling, or in a building ancillary to a dwelling, by one or more permanent residents of the dwelling that does not involve:

- a) The employment of persons other than those residents, or
- b) Interference with the amenity of the neighbourhood by reason of the emission of noise, vibration, smell, fumes, smoke, vapour, steam, soot, ash, dust, waste water, waste products, grit or oil, traffic generation or otherwise, or
- c) The display of goods, whether in a window or otherwise, or
- d) The exhibition of any notice, advertisement or sign (other than a notice, advertisement or sign exhibited on that dwelling to indicate the name of the resident and the occupation carried on in the dwelling), or
- e) The sale of items (whether goods or materials), or the exposure or offer for sale of items, by retail,

but does not include bed and breakfast accommodation, a brothel or home occupation (sex services).

Home Occupation (Sex Services): Means the provision of sex services in a dwelling that is a brothel, or in a building that is a brothel and is ancillary to such a dwelling, by no more than 2 permanent residents of the dwelling and that does not involve:

- a) The employment of persons other than those residents, or
- b) Interference with the amenity of the neighbourhood by reason of the emission of noise, traffic generation or otherwise, or
- c) The exhibition of any notice, advertisement or sign, or
- d) The sale of items (whether goods or materials), or the exposure or offer for sale of items, by retail, but does not include a home business or sex services premises.

Hoardings: Are structures or fences erected on or adjacent to a property to form barrier between demolition and construction sites and the public domain. Hoarding structures may consist of fencing, scaffolding and / or overhead structures as either individual elements or integrated together to form a uniform hoarding.

- A "Type A Hoarding" is a hoarding comprising of a fence.
- A "Type B Hoarding" is an overhead structure situated over footpaths.
- A "Type C Hoarding" is a full- face scaffold.

Hotel or Motel Accommodation: Means tourist and visitor accommodation (whether or not licensed premises under the Liquor Act 1982):

- a) Comprising rooms or self-contained suites, and
- b) That may provide meals to guests or the general public and facilities for the parking of guests' vehicles,

but does not include backpackers' accommodation, a boarding house, bed and breakfast accommodation or farm stay accommodation.

Industry: Means the manufacturing, production, assembling, altering, formulating, repairing, renovating, ornamenting, finishing, cleaning, washing, dismantling, transforming, processing or adapting, or the research and development of any goods, chemical substances, food, agricultural or beverage products, or articles for commercial purposes, but does not include extractive industry or a mine.

Hydrology: A term given to the study of rainfall and runoff processes as relates to the derivation of flood discharges.

Hydrograph: A graph of flood flow against time.

Hydraulic: A term given to the study of water flow, as relates to the evaluation of flow depths, levels and velocities.

IFD: Intensity - Frequency - Duration Rainfall parameters used to describe rainfall at a particular location.

Infill Development: Refers to new urban development within an existing urban development area.

Infill Residential Subdivision: Is the subdivision of a lot of land which has a residential zoning and which is bounded by existing residential development.

Information and Education Facility: Means a building or place used for providing information or education to visitors, and the exhibition or display of items, and includes an art gallery, museum, library, visitor information centre and the like.

Integrated housing: Means development that consists of:

- The Torrens Title or Community Title subdivision of land into 5 or more lots; and
- The erection of a single dwelling-house on each of the lots created by that subdivision;

Where approval is given concurrently for the subdivision and development of the lots

Investigation area: Land declared to be an 'investigation area' by a declaration under Division 2 of Part 3 of the Contaminated Land Management Act 1997.

Investigation order: An order issued by the NSW Department of Environment & Climate Change under Division 2 of Part 3 of the Contaminated Land Management Act 1997.

Irregular Shaped Allotment: Means an allotment which is not square or rectangular in shape.

Isohyets: Lines joining points of equal rainfall.

Isolated Lot: Means a lot which is bounded on both sides by properties (or a property and second street frontage) which comprises existing or proposed multi unit development other than a single dwelling house.

Land Application Area: Means the area of land intended for the disposal of effluent and includes the ecological sustainable development area.

Land Reshaping: Involves a combination of filling and excavation.

Landscaped Area Means a part of a site used for growing plants, grasses and trees, but does not include any building, structure or hard paved area.

Living Area: Means a principle living space such as a living room, dining room, family room, kitchen, rumpus room or the like which is used for normal domestic activities. It does not include a bedroom, study, bathroom, laundry, utility room or room serving a similar function.

Local Overland Flooding: Means inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam.

Long-Term Site: Means a dwelling site in a caravan park that is designated as being a long-term site (ie for periods in excess of 3 months).

Lot: Refers to an individual parcel of subdivided land.

Low impact facility: Means a telecommunications facility that is exempt from state and council local planning requirements under the Telecommunications (Low – impact Facilities) Determination 1997.

Maintenance: In relation to a heritage item or a building, work, archaeological site, tree or place within a heritage conservation area, means ongoing protective care. It does not include the removal or disturbance of existing fabric, alterations, such as carrying out extensions or additions, or the introduction of new materials or technology.

Major Section: Is defined as a 'single portion of a manufactured home or relocatable home, being a portion:

- (a) That contains a total living space (excluding the living space contained in any associated structure) of at least 20 cubic metres and
- (b) That comprises all the major components of that portion of the home, including the chassis or frame, the external and internal walls, the roof and ceilings, the floors, the windows and doors, the internal plumbing and wiring, the tiling, the kitchen, bathroom and laundry fittings (other than stoves, refrigerators, washing machines and other whitegoods) and the built-in cupboards and cabinets.

Manning's n: A measure of channel or pipe roughness.

Manufactured Home: Means a self-contained dwelling (that is a dwelling that includes at least one kitchen, bathroom, bedroom and living area and that also includes toilet and laundry facilities) being a dwelling:

Manufactured Home Estate: Means land on which manufactured homes are or are to be erected.

Market: Means retail premises comprising an open-air area or an existing building used for the purpose of selling, exposing or offering goods, merchandise or materials for sale by independent stall holders, and includes temporary structures and existing permanent structures used for that purpose on an intermittent or occasional basis.

Mean High Water Mark: Means the position where the plane of the mean high water level of all ordinary local high tides intersects the foreshore, being 1.44m above the zero of Fort Denison Tide Gauge and 0.515m Australian Height Datum.

Medical Centre: Means business premises used for the purpose of providing health services (including preventative care, diagnosis, medical or surgical treatment, counselling or alternative therapies) to out-patients only, where such services are principally provided by health care professionals, and may include the ancillary provision of other health services.

Merit approach: Is an approach, the principles of which are embodied in the FMM which weighs social, economic, ecological and cultural impacts of land use options for different flood prone areas together with flood damage, hazard and behaviour implications, and environmental protection and well being of the State's rivers and floodplains.

Minor Development: Developments discharging less than 55L/S and discharging to kerb.

Mixed use development: Means a development which includes residential uses in conjunction with one or more non residential uses such as:

- Business premises;
- Commercial offices;
- Shops or other retail premises;
- Community facilities;
- Entertainment facilities; or
- Refreshment rooms.

Mound System: Means a raised effluent application system that is used where natural soils are extremely permeable and/or underlying groundwaters are seasonally close to the ground surface.

Moveable Dwelling: Is defined as:

- (a) Any tent or any caravan or other van or portable device (whether on wheels or not) used for human habitation or
- (b) A manufactured home, or
- (c) Any conveyance, structure or thing of a class or description prescribed by the regulations for the purposes of this definition.

Multi Dwelling Housing: Means 3 or more dwellings (whether attached or detached) on one lot of land (not being an individual lot in a strata plan or community title scheme) each with access at ground level, but does not include a residential flat building.

Native Flora: Means any plant-life that is indigenous to New South Wales, whether vascular or non-vascular and in any stage of biological development, and includes fungi and lichens, and marine vegetation within the meaning of Part 7A of the Fisheries Management Act 1994.

Native Vegetation: Has the same meaning as in the Native Vegetation Act 2003 defined as follows:

- a) Native vegetation means any of the following types of indigenous vegetation:
 - i) Trees (including any sapling or shrub, or any scrub),
 - ii) Understorey plants,
 - iii) Groundcover (being any type of herbaceous vegetation),
 - iv) Plants occurring in a wetland.
- b) Vegetation is indigenous if it is of a species of vegetation, or if it comprises species of vegetation, that existed in the State before European settlement.
- c) Native vegetation does not include any mangroves, seagrasses or any other type of marine vegetation to which section 205 of the Fisheries Management Act 1994 applies.

Natural Ground Level: Means the level of the ground surface prior to commencement of any construction work on the site.

Natural Ventilation: A range of techniques that combine natural airflow within building design characteristics to induce fresh air into a building and exhaust stale air. Natural ventilation is also used as a means to reduce the temperature of a building's thermal mass.

Net Floor Area: The whole of the lettable floor area of a building where the area of each floor is taken to be the floor area within the internal faces of the outside walls, excluding staircases, amenities, lifts, corridors and other public areas but including any storage areas.

Normal Depth: The depth that would exist if the flow were uniform.

Noxious Weed: Means a plant declared noxious under the Noxious Weeds Act 1993.

Occupation Certificate: A certificate issued by the Principal Certifying Authority that authorises the occupation and use of a new building or a change of building use for an existing building.

Offensive Industry means any development for the purpose of an industry that would, when the development is in operation and when all measures proposed to reduce or minimise its impact on the locality have been employed (including, for example, measures to isolate the development from existing or likely future development on other land in the locality), emit a polluting discharge (including, for example, noise) in a manner that would have a significant adverse impact in the locality or on the existing or likely future development on other land in the locality.

Office Premises means a building or place used for the purpose of administrative, clerical, technical, professional or similar activities that do not include dealing with members of the public at the building or place on a direct and regular basis, except where such dealing is a minor activity (by appointment) that is ancillary to the main purpose for which the building or place is used.

On-site Sewage Management System (OSSM) or On-site Wastewater Management (OSWM) System: Means an on-site system used for the purpose of holding or processing, or reusing or otherwise disposing of sewage or by-products of human waste.

On-site Stormwater Detention (OSD): A stormwater management practice which limits the rate of discharge from a site using outlet restriction devices. Stormwater flows in excess of the capacity of the outflow control device are temporarily stored either in tanks or surface depressions until the storm event recedes. Stormwater flows are released at a controlled rate into the public drainage system.

On-site Stormwater Retention: A stormwater management practice where on-site stormwater run off is actually captured and retained within the site for re0use or infiltration and is not released to the downstream drainage system.

Orographic: Pertaining to changes in relief, i.e. mountains.

Orthophoto: Aerial photograph with land contours, boundaries or reference grids added.

Outbuilding: A building which is ancillary to a principal residential building and includes sheds, detached garages, car ports and other buildings.

Parapet Height: The parapet level is the horizontal plane in which at least 2/3 of the length of the top of the façade of the building adjacent to the street is situated.

Parking Space: Means a space dedicated for the parking of a motor vehicle, including any manoeuvring space and access to it, but does not include a car park.

Passive Solar Energy Systems: Systems which combine the sun's energy with local climate characteristics, to achieve thermal comfort inside buildings without the use of mechanical devices.

PCA: Means principal certifying authority.

Piezometer: Means a borehole constructed with 100mm PVC perforated piping to a depth below the subsoil horizon or to the top of unweathered rock formation or below the water table, used to monitor groundwater quality.

Place of Public Worship: Means a building or place used for the purpose of religious worship by a congregation or religious group, whether or not the building or place is also used for counselling, social events, instruction or religious training.

Pluyiograph: An instrument which records rainfall collected as a function of time.

PMF: Probable Maximum Flood: Flood calculated to be the maximum ever likely to occur.

PMP: Probable Maximum Precipitation: Rainfall calculated to be the maximum ever likely to occur.

Pond-Based Aquaculture: Means aquaculture undertaken in structures that are constructed by excavating and reshaping earth, which may be earthen or lined, and includes any part of the aquaculture undertaken in tanks, such as during the hatchery or pre-market conditioning phases, but does not include natural water-based aquaculture.

Note. Typical pond-based aquaculture is the pond culture of prawns, yabbies or silver perch.

Private land: Means any land in private ownership by individuals or companies but excludes land owned or in the care, control or management of Council, a Crown Authority, government department or statutory authority.

Private Open Space: Means an area external to a building (including an area of land, terrace, balcony or deck) that is used for private outdoor purposes ancillary to the use of the building.

Preliminary investigation: An investigation to identify any past or present potentially contaminated activities and the preliminary assessment of any contaminants within the soil strata or groundwater table.

Principal Certifying Authority: The certifying authority appointed by the applicant to oversee the construction process. Only the Principal Certifying Authority may issue an Occupation Certificate.

Probable Maximum Flood (PMF): The largest flood that has been calculated to occur at a particular location, usually estimated from the probable maximum precipitation.

Probable Maximum Precipitation (PMP): The greatest depth of precipitation for a given duration meteorologically possible over a given size storm area at a particular location at a particular time of the year with no allowance made for long term climatic trends. PMP is the primary input to the estimation of the probable maximum flood (PMF).

Prostitution: Means the provision of a sexual act or sexual service in return for payment or reward.

Primary Frontage: Means:

- The single frontage where an allotment has a single frontage to a road; a)
- The shortest frontage where an allotment has two or more frontages to the public road; b)
- The two frontages where an allotment (not including a corner allotment) runs between two roads. C)

Prominent Ridgeline or Hilltop Means a ridgeline, hilltop or slope which when viewed from a public place such as an arterial road, is a prominent feature of the natural landscape of a locality.

Pruning: Is defined as all other pruning which is not "crown maintenance pruning" and includes "crown modification" as defined in Australian Standard AS 4373- 1996 "Pruning of Amenity Trees".

Public Domain: Land in public ownership which is utilised by the community at large for footpath, public open space or similar purposes.

Public Land has the same meaning as in the Local Government Act 1993 defined as any land (including a public reserve) vested in or under the control of the council, but does not include:

- a) A public road, or
- b) Land to which the Crown Lands Act 1989 applies, or
- A common, or c)
- d) Land subject to the Trustees of Schools of Arts Enabling Act 1902, or
- e) A regional park under the National Parks and Wildlife Act 1974.

Public Reserve has the same meaning as in the Local Government Act 1993.

Public Road: Has the same meaning as public road under the Roads Act 1993.

RCP: Reinforced Concrete Pipe.

Receiving Waters: A river, lake or the ocean.

Recreation Area means a place used for outdoor recreation that is normally open to the public, and includes:

- a) A children's playground, or
- b) An area used for community sporting activities, or
- c) A public park, reserve or garden or the like, and any ancillary buildings, but does not include a recreation facility (indoor), recreation facility (major) or recreation facility (outdoor).

Recreation Facility (Indoor) means a building or place used predominantly for indoor recreation, whether or not operated for the purposes of gain, including a squash court, indoor swimming pool, gymnasium, table tennis centre, health studio, bowling alley, ice rink or any other building or place of a like character used for indoor recreation, but does not include an entertainment facility, a recreation facility (major) or a registered club.

Recreation Facility (Major) means a building or place used for large-scale sporting or recreation activities that are attended by large numbers of people whether regularly or periodically, and includes sports stadiums, showgrounds, racecourses and motor racing tracks.

Recreation Facility (Outdoor) means a building or place (other than a recreation area) used predominantly for outdoor recreation, whether or not operated for the purposes of gain, including a golf course, golf driving range, mini-golf centre, tennis court, paint-ball centre, lawn bowling green, outdoor swimming pool, equestrian centre, skate board ramp, go-kart track, rifle range, water-ski centre or any other building or place of a like character used for outdoor recreation (including any ancillary buildings), but does not include an entertainment facility or a recreation facility (major).

Regular Shaped Allotment: Means either:

- Allotment which is either square or rectangular in shape; or
- b) Allotment of another shape where a square or rectangular shape equivalent in area to the minimum lot size area for the allotment type could be contained within the boundaries of the allotment and includes a battle-axe shaped allotment and a corner allotment where the only deviation from the above requirements is the access handle (i.e. battle axe lot) or the splay corner (ie corner lot).

Related Land: Means land including roads and thoroughfares that could affect or could be affected by any development proposed on a site.

Reliable Access: During a flood means the ability for people to safely evacuate an area subject to imminent flooding within effective warning time, having regard to the depth and velocity of flood waters, the suitability of the evacuation route, and without a need to travel through areas where water depths increase.

Relocatable Home: Means:

- a) A manufactured home, or
- b) Any other moveable dwelling (whether or not self-contained) that comprises one or more major sections, including any associated structure that forms part of the dwelling.

Remedial Action Plan: A plan which sets the remediation strategies and measures for the remediation of identified contaminated land.

Remediation Order: A Remediation Order is made by the NSW Department of Environment & Climate Change under Division 3 of Part 3 of the Contaminated Land Management Act 1997.

Remnant Vegetation: Is the natural vegetation which still exists or, if the natural vegetation has been altered, is still representative of the structure and floristic characteristics of the natural vegetation.

REP: Regional Environmental Plan

Residential Accommodation: Means a building or place used predominantly as a place of residence, but does not include tourist and visitor accommodation.

Residential Care Facility: Means accommodation for seniors (people aged 55 years or more) or people with a disability that includes:

- a) Meals and cleaning services, and
- b) Personal care or nursing care, or both, and
- c) Appropriate staffing, furniture, furnishings and equipment for the provision of that accommodation and care, not being a dwelling, hospital or psychiatric facility.

Residential Flat Building: Means a building containing 3 or more dwellings, but does not include an attached dwelling or multi dwelling housing.

Restaurant: Means a building or place the principal purpose of which is the provision of food or beverages to people for consumption on the premises and that may also provide takeaway meals and beverages.

Restricted Premises: Means business premises or retail premises that, due to their nature, restrict access to patrons or customers over 18 years of age, and includes sex shops and similar premises but does not include hotel or motel accommodation, a pub, home occupation (sex services) or sex services premises.

Retail Premises: Means a building or place used for the purpose of selling items by retail, or for hiring or displaying items for the purpose of selling them by retail or hiring them out, whether the items are goods or materials (or whether also sold by wholesale).

Run-Off: Stormwater running off a catchment during a storm on the catchment.

Ridge Height: Is the distance measured vertically from any point on the uppermost roof surface (not including a vent, chimney, flue, antennae or the like) to the natural ground level or finished ground level immediately below that point, whichever is lower.

Riparian Corridor: Means the area of the river or creek system that supports or has supported the unique ecosystem.

Risk: Means a measure of the probability and severity of an adverse effect to life and property.

Road means a public road or a private road within the meaning of the Roads Act 1993, and includes a classified road.

Roadside Stall: Means a place or temporary structure used for retail selling of agricultural produce or hand crafted goods (or both) produced from the property on which the stall is situated or from an adjacent property.

Roof Terrace: Means the flat roof over any portion of the building, which is both directly accessible for use from the dwelling/s it adjoins and also open to the sky, except for a pergola or similar sun control devices. A roof terrace may be designated for either private or communal open space purposes but does not include a balcony or basement podium defined elsewhere in this DCP.

Roofwater Tank: A water tank, whether aboveground or below ground, designed to store rainwater harvested from a roof area where the stored water is used to supply plumbing fixtures and appliances in order to reduce the harmful effects of stormwater on the environment and to supplement the water supply to the property.

RPGeo: Registered Professional Geologist.

Rural Industry: Means an industry that involves the handling, treating, production, processing or packing of animal or plant agricultural products, and includes:

- a) Agricultural produce industry, or
- b) Livestock processing industry, or
- c) Use of composting facilities and works (including to produce mushroom substrate), or
- d) Use of sawmill or log processing works, or
- e) Use of stock and sale yards, or
- f) The regular servicing or repairing of plant or equipment used for the purposes of a rural enterprise,
- g) Undertaken for commercial purposes.

Rural Supplies: Means a building or place used for the display, sale (whether by retail or wholesale) or hire of stockfeeds, grains, seed, fertilizers, veterinary supplies and other goods or materials used in farming and primary industry production.

Rural Worker's Dwelling: Means a dwelling, ancillary to a dwelling house on the same landholding, used as the principal place of residence by persons employed for the purpose of agriculture or a rural industry on that land.

School: Means a government school or non-government school within the meaning of the Education Act 1990.

Scour: Erosion of soil in the banks or bed of a creek, typically occurring in areas of high flow velocities and turbulence.

Seaward Building Line: Means the seaward alignment of existing dwellings adjacent to the foreshore, cliff top, beach or coastline. The seaward building line must not encroach upon the coastal building line defined elsewhere in this DCP.

Secondary Building Lines: Is the distance a structure is set back from the property boundary at the secondary street frontage in the case of a corner lot

Secondary Dwelling: Means a self-contained dwelling that:

- a) Is established in conjunction with another dwelling (the principal dwelling), and
- b) Is on the same lot of land (not being an individual lot in a strata plan or community title scheme) as the principal dwelling, and
- c) Is located within, or is attached to, or is separate from, the principal dwelling.

Secondary frontage: Means:

- The longer frontages where an allotment has two or more frontages to a road; or
- The frontage that adjoins a lane where an allotment (not including a corner allotment) runs between a road and a lane. A lane is generally a roadway that is 6 metres wide or less.

Self-Storage Units: Means storage premises that consist of individual enclosed compartments for storing goods or materials (other than hazardous or offensive goods or materials).

Semi-Detached Dwelling: Means a dwelling that is on its own lot of land (not being an individual lot in a strata plan or community title scheme) and is attached to only one other dwelling.

Seniors Housing: Means residential accommodation that consists of:

- a) A residential care facility, or
- b) A hostel, or
- c) A group of self-contained dwellings, or
- d) A combination of these, and that is, or is intended to be, used permanently for:
- e) Seniors or people who have a disability, or
- People who live in the same household with seniors or people who have a disability, or
- g) Staff employed to assist in the administration of the residential accommodation or in the provision of services to persons living in the accommodation,
- h) But does not include a hospital.

Septic Tank: Means a tank used for the storage or primary treatment of sewage comprising sedimentation of settleable solids, flotation of oils and fats, and anaerobic digestion of sludge.

Serviced Apartment: Means a building or part of a building providing self-contained tourist and visitor accommodation that is regularly serviced or cleaned by the owner or manager of the building or part of the building or the owner's or manager's agents.

Setback: The horizontal distance measured from an external enclosing wall (including an above ground deck, balcony and the like), a window or the eaves of a building to the:

- Allotment front boundary; or
- A window to a bedroom or living area of another dwelling.

Sewage: Means a combination of blackwater and greywater.

Sex Services: Means sexual acts or sexual services in exchange for payment.

Sex Services Premises: Means a brothel, but does not include home occupation (sex services).

Shallow Sub-surface Drip/Trickle Irrigation: Means the use of effluent applied directly to plants by drip or trickle to the soil below a 50-100mm layer of bark, wood chip or mulch.

Shop: Means retail premises that sell groceries, personal care products, clothing, music, homewares, stationery, electrical goods or other items of general merchandise, and may include a neighbourhood shop, but does not include food and drink premises or restricted premises.

Shop Top Housing: Means one or more dwellings located above (or otherwise attached to) ground floor retail premises or business premises.

Short-Term Site: Means a dwelling site within a caravan park which is designated as a short – term site for tourists for a period not exceeding 3 months.

Signage: Means any sign, notice, device, representation or advertisement that advertises or promotes any goods, services or events and any structure or vessel that is principally designed for, or that is used for, the display of signage, and includes:

- a) Building identification signs, and
- b) Business identification signs, and
- c) Advertisements,
- d) But does not include traffic signs or traffic control facilities.

Siltation: The filling or rising up of the bed of a watercourse or channel by deposited silt.

Site: Is the parcel of land, whether comprising one or more allotments, to which an application for consent relates.

Site Area: Means the area of any land on which development is or is to be carried out. The land may include the whole or part of one lot, or more than one lot if they are contiguous to each other, but does not include the area of any land on which development is not permitted to be carried out under this Plan.

Site Audit: An independent review of completed site contamination remediation works by an accredited site auditor under the Contaminated Land Management Act 1997.

Site Audit Statement: The written statement by the accredited site auditor (under the Contaminated Land Management Act 1997) that summarises the findings of the site audit and confirms what land uses may be undertaken on the site, taking into account the nature of the remediation works completed upon the subject site.

Site Classification: Means a classification of the site in accordance with the current version of Australian Standard AS 2870 - Residential Slabs and Footings.

Site Width: Means the width of the allotment measured perpendicular to the side boundary for the full length of the building envelope. For corner allotments the site width is measured parallel to the primary street frontage.

Slope Instability: Means a condition with the potential for causing the movement of soil, rock or debris.

Spurs: Secondary ridges typically occurring at right angles to a main ridge line, formed by stream erosion of the slopes of the main ridge.

Storey: Means a space within a building that is situated between one floor level and the floor level next above, or if there is no floor above, the ceiling or roof above, but does not include:

a) A space that contains only a lift shaft, stairway or meter room, or

- b) A mezzanine, or
- c) An attic.

Stormwater: Surface runoff generated from rainfall events.

Stacked Parking Space: Is a carparking space that relies on gaining access by passing through another carparking space.

Standard Lot: Is a lot which has a single frontage to a residential street.

Social Housing: Means the development of housing for or on behalf of government and/or community organisations such as the Department of Housing and Office of Community Housing, but does not include residential development to which State Environmental Planning Policy (Seniors Living) 2004 or State Environmental Planning Policy No. 9 – Group Homes applies.

Solid Wall: Is a wall which incorporates at least 75% non transparent materials.

Stratigraphy: The sequence of layers in which soils/rocks have been deposited.

Streetscape: Means the form, character and visual amenity of the street environment.

Street Vending: The setting up or use within the road reserve of any box, stall, stand, barrow or stationary vehicle, other than a roadside stall or mobile vending vehicle defined hereunder for the purpose of offering for sale any goods or for the pursuit of any business, calling or employment.

Structural Design: Means a design for any structure to be erected on the site (which may be in the form of drawings) having structural elements where the design makes recommendations in respect of the structural works and has been prepared by a structural engineer or civil engineer requiring certification in accordance with form M12 of this policy.

Structural engineer: Means a civil engineer or structural engineer who is a member of or eligible for membership of a professional engineering institution, is university degree qualified with a minimum of five years practice during the last ten years as a structural engineer , and is listed on the National Professional Engineers Register, and either has or is employed by a corporation which has professional indemnity insurance of not less than \$2 million, such insurance being evidenced to Council

to be in force, for the year in which any information is submitted to the Council in accordance with this policy. The professional indemnity insurance must have retroactive cover extending back to at least the engineer's first submission to Council.

Structural Works: Means the elements of any structure designed by a structural engineer or civil engineer.

Spruikers: Persons located on the public way, usually associated with or employed by a Sex Services Premises, who seek to entice customers to enter the premises.

Sub – Critical Flow: The state of flow where the water depth is above the critical depth. Here, the influence of gravity forces dominates the influences of inertial forces, and flow, having a low velocity, is often described as tranquil

Sub-Surface (Micro-trench) Irrigation: Means the disposal of effluent through microtrenches at a depth of between 100mm and 300mm below ground level.

Suitably Qualified Civil Engineer: A civil engineer who is included in the National Professional Engineers Register, administered by the Institution of Engineers Australia.

SULE Rating: SULE - Safe Useful Life Expectancy

The SULE rating system, based on Barrell 2001, rates existing trees on their safe useful life expectancy, and are determined in view of both the current state of health and age of the tree.

Supercritical Flow: The state of flow where the water depth is below the critical depth, inertial forces dominate the gravitational forces, and the flow is described as rapid or shooting.

Surcharge Flow: Unable to enter a culvert or exiting from a pit as a result of inadequate capacity

Surface Irrigation: Means the use of effluent applied to the ground from above ground level.

Survey plan: Is a plan prepared by a registered surveyor which shows the information required for the assessment of an application in accordance with the provisions of this Policy.

Swimming Pool: Has the same meaning as in the Swimming Pools Act 1992 as an excavation, structure or vessel that is capable of being filled with water to a depth of 300 millimetres or more, and (b) that is solely or principally used, or that is designed, manufactured or adapted to be solely or principally used, for the purpose of swimming, wading, paddling or any other human aquatic activity, and includes a spa pool, but does not include a spa bath, anything that is situated within a bathroom or anything declared by the regulations made under the Swimming Pools Act 1992 not to be a swimming pool for the purposes of that Act.

Take Away Food and Drink Premises: means food and drink premises that are predominantly used for the preparation and sale of food or drink (or both) for immediate consumption away from the premises.

Tank-Based Aquaculture: Means aquaculture utilising structures that are constructed from materials such as fibreglass, plastics, concrete, glass or metals, are usually situated either wholly or partly above ground, and may be contained within a purpose built farm or industrial style sheds or plastic covered hothouse to assist in controlling environmental factors.

Telecommunications Facility: Means:

- a) Any part of the infrastructure of a telecommunications network, or
- b) Any line, equipment, apparatus, tower, mast, antenna, tunnel, duct, hole, pit, pole or other structure or thing used, or to be used, in or in connection with a telecommunications network.

Telecommunications Network: Means a system, or series of systems, that carries, or is capable of carrying, communications by means of guided or unguided electromagnetic energy, or both.

Temporary Structure: Has the same meaning as in the Act defined as including a booth, tent or other temporary enclosure (whether or not part of the booth, tent or enclosure is permanent), and also includes a mobile structure.

The Act: Means the Environmental Planning and Assessment Act 1979.

Thermal Mass: The heat storage capacity of a given assembly or system. Generally, thee heavier and denser the material is, the more heat it will store and the longer it will take to release the heat.

Third Party Advertising: The content of an advertisement which is not directly related to the actual land use or goods or services produced on the subject parcel of land to which the advertising is proposed.

Topography: The natural surface features of a region.

Townhouse: Means a two storey dwelling within a multi dwelling development, which may or may not be attached to other dwellings, with separate access from the ground floor level and direct access to private open space at natural ground level.

Transpiration Pit: An excavation which has been filled with material conducive to the drainage of stormwater and which is designed to drain sideways, into the atmosphere, via a retaining medium.

Treatment plan: Means a plan explaining how treatment options will be implemented to manage the risk.

Treatment options: Means methods to control and treat the risk including but not limited to:

- Alternative forms of development such that the revised risk would be acceptable or tolerable;
- Stabilisation measures to control the initiating circumstances such that the revised risk would be acceptable or tolerable after implementation;
- Defensive stabilisation measures, amelioration of the behaviour of the hazard or relocation of the development to a more favourable location to achieve an acceptable or tolerable risk.

Tree: Is a perennial plant with a self-supporting stem or trunk, when mature, and for the purpose of this DCP means any tree (other than an exempt tree) including the roots of that tree, if it is 3 metres or more in height, or has a trunk diameter of 200mm or more at a height of 1 metre from the ground, or has a branch spread of 3 metres or more. A significant tree also includes a tree identified as a Heritage Item in Wollongong Local Environmental Plan 2009.

Tree Dripline or Zone: Means the area defined under a tree by the outer edge of the tree canopy projected to ground level.

Tree Protection Zone: The tree protection zone defines the optimal distance from the trunk of a tree that should be maintained free of development and construction activity.

Trunk Drainage: A stormwater system serving catchments larger than 15 hectares.

Tolerable risk: Means the risk which has been assessed and may be accepted provided that a treatment plan is implemented to maintain or reduce the risks.

Tourist and Visitor Accommodation: Means a building or place that provides temporary or short-term accommodation on a commercial basis, and includes hotel or motel accommodation, serviced apartments, bed and breakfast accommodation and backpackers' accommodation.

Urban Consolidation Area: Land identified in the maps in Appendix 1, which have been identified as areas where higher densities are permitted, due to their proximity to railway stations and ability to satisfy urban consolidation objectives.

Urbanisation: The change in land use from natural to developed state.

Urban Zone: For the purposes of this DCP includes a residential, commercial /business, industrial or other similar zone which contains predominately urban land uses.

Validation and Monitoring: The process of determining whether the remediation strategies and measures have been achieved during the remediation of the site.

Vehicular Ramp: Refers to a vehicular circulation carriageway which connects a driveway crossing to an internal off-street car park on a different level, or which connects two levels in a multi-level car park.

Verge: Means the part of the road reserve between the road carriageway and the boundary of adjacent lots. This may include the footpath area and includes the portion of land which accommodates the utility installations and street lighting poles.

Verifier: Means a geotechnical engineer or engineering geologist, as defined by this policy, who verifies a geotechnical report.

View Corridor: Refers to a direct line of sight provided from the public space or a road to a significant object, place or feature.

Villa: Means a single storey dwelling within a multi dwelling development, which may or may not be attached to other dwellings, with separate access from the ground floor level and direct access to private open space at natural ground level.

Virgin Excavated Material: Inert waste (eg clay, gravel, sand, soil and rock) that is not mixed with any other waste and that:

- Has been excavated from areas that are not contaminated, as the result of industrial, commercial, mining or agricultural activities, with manufactured chemicals and that does not contain sulphidic ores or soils; and
- Consists of excavated natural materials that meet such criteria as may be approved by the Department of Environment and Climate Change.

Visibility: Is a measure of the extent to which the escarpment may be visible from surrounding locality taking into account the period of the view, view distance and context of the view. The underlying rationale for this aspect of the visual quality analysis is

to analyse the visibility of the escarpment by precinct and identify key viewpoints necessary for visual absorption capacity and Development Opportunity Envelope identification. Distance plays a strong influence on visibility as the preparation of the view frame occupied by the escarpment decreases with distance. In addition atmosphere influences tend to reduce the level of contrast between development disturbances and he escarpment landscape.

Visual Absorption Capacity: Is an estimation of the capacity of a particular locality of landscape to absorb development without creating a significant change in visual character or a reduction in scenic environmental quality of the locality. The capacity to visually absorb development is primarily dependent on landform, vegetation and existing development. A major factor influencing visual absorption capacity is the level of visual contrast between the proposed development and the existing elements of the landscape in which the proposal is occupied. For example, flat or gently sloping open forest has a higher capacity to visually absorb development than strongly undulating cleared escarpment ridges and escarpment slopes. Further, if visually prominent development already exists on the escarpment than the capacity of the locality to absorb an additional development is higher, than a similar section of the escarpment that has a natural undeveloped visual character.

Warehouse or Distribution Centre: Means a building or place used mainly or exclusively for storing or handling items (whether goods or materials) pending their sale, but from which no retail sales are made.

Waste Disposal Facility: Means a building or place used for the disposal of waste by landfill, incineration or other means, including such works or activities as recycling, resource recovery and other resource management activities, energy generation from gases, leachate management, odour control and the winning of extractive material to generate a void for disposal of waste or to cover waste after its disposal.

Waste Management Facility: Means a facility used for the storage, treatment, purifying or disposal of waste, whether or not it is also used for the sorting, processing, recycling, recovering, use or reuse of material from that waste, and whether or not any such operations are carried out on a commercial basis. It may include but is not limited to:

- a) An extractive industry ancillary to, required for or associated with the preparation or remediation of the site for such storage, treatment, purifying or disposal, and
- b) Eco-generating works ancillary to or associated with such storage, treatment, purifying or disposal.

Waste Management Plan (WMP): A waste management strategy / plan for the collection, recovery and / or disposal of waste material and the recycling of materials during the demolition, construction and post construction periods. The Waste Management Plan also includes estimates of volumes of waste produced and proposed recycling or reuse strategies to be implemented in order to minimise waste material being required to be taken to a registered land fill waste disposal site.

Wastewater: Means blackwater, greywater or a combination of blackwater and greywater arising from activities such as the use of toilets, bathrooms (basins, baths and showers), kitchens and laundries.

Waterbody means a waterbody (artificial) or waterbody (natural).

Waterbody (Artificial) or Artificial Waterbody: Means an artificial body of water, including any constructed waterway, canal, inlet, bay, channel, dam, pond, lake or artificial wetland, but does not include a dry detention basin or other stormwater management construction that is only intended to hold water intermittently.

Waterbody (Natural) or Natural Waterbody: Means a natural body of water, whether perennial or intermittent, fresh, brackish or saline, the course of which may have been artificially modified or diverted onto a new course, and includes a river, creek, stream, lake, lagoon, natural wetland, estuary, bay, inlet or tidal waters (including the sea).

Watercourse: Means any river, creek, stream or chain of ponds, whether artificially modified or not, in which water usually flows, either continuously or intermittently, in a defined bed or channel, but does not include a waterbody (artificial).

Water Sensitive Urban Design (WSUD): WSUD is a philosophy which aims to mitigate environmental impacts particularly on water quantity, water quality and receiving waterways, conventionally associated with urbanisation. WSUD incorporates holistic management measures that take into account urban planning and design, social and environmental amenity of the urban landscape and stormwater management which are integrated with stormwater conveyance by reducing peak flows, protection of natural systems and water quality, stormwater reuse and water conserving landscaping. This can be achieved through a design approach that strives to maintain or replicate the natural water cycle through an incremental "treatment train" approach, through the optimisation the use of rainwater on-site whilst minimising the amount of water transported from the catchment.

Water Table: Means the surface of groundwater below the ground surface.

Waterway: Means the whole or any part of a watercourse, wetland, waterbody (artificial) or waterbody (natural).

Wetland: means:

a) Natural wetland, including marshes, mangroves, backwaters, billabongs, swamps, sedgelands, wet meadows or wet heathlands that form a shallow waterbody (up to 2 metres in depth) when inundated cyclically, intermittently or permanently with fresh, brackish or salt water, and where the inundation determines the type and productivity of the soils and the plant and animal communities, or b) Artificial wetland, including marshes, swamps, wet meadows, sedgelands or wet heathlands that form a shallow waterbody (up to 2 metres in depth) when inundated cyclically, intermittently or permanently with water, and are constructed and vegetated with wetland plant communities.

Zero lot line: Refers to the situation where the wall of the dwelling has no side boundary setback on one (1) side of the allotment and the allotment is benefited by a 1 metre wide restriction on the use of the land under Section 88B of the Conveyancing Act 1919 on the adjoining parcel of land, in order to enable on-going maintenance of the wall and / or roof of the subject dwelling

tem? Attachment 10

Attachment 11

ITEM 1 Residential Flat Buildings and Wollongong Development Control Plan 2009 Sustainability review, Clause 21A of the Environment and Planning Act Regulations 2000

MEETING DATE: 15 September 2016

A review of the sustainability provisions within the Wollongong Development Control Plan (DCP) 2009 has been undertaken with the intent to enhance the sustainability of development occurring throughout Wollongong. On 30 May 2016, Council considered a report on the sustainability review. Council resolved to exhibit a Sustainability Review of the Wollongong Development Control Plan 2009 (DCP), as well as the following DCP chapters proposed for amendment.

- A1 Introduction
- A2 Ecologically Sustainable Development
- B1 Residential Development
- B3 Mixed Use Development
- B5 Industrial Development
- D13 Wollongong City Centre
- E3 Car Parking, Access, Servicing, Loading Facilities and Traffic Management
- E6 Landscaping
- Appendix 4 Definitions

A number of amendments to the Wollongong DCP 2009, including amended provisions relating to residential apartment buildings are proposed as a result of the sustainability review and associated public exhibition period. Table 1 provides an outline of such amendments in comparison with current DCP provisions, and their relationship with the NSW Department of Environment and Planning *Apartment Design Guide 2015* (ADG).

The Design Review Panel reviewed the proposed amendments and discussed them with Council staff. Following this discussion, the following comments were prepared by the Panel for consideration by Council:

| Amendment provisions proposed | UDRP Comments | Council response |
|--|--|--|
| 6. Residential Flat Buildings - General | No comments | Noted |
| 6.11 Landscaping Requirements6.11.1 Objective | The panel considers that the objective should more closely reflect the ADG clause as some sites in Wollongong will have significant features and if this is not mentioned such features would be lost. The application of the objective can be considered on a site specific basis. | Noted. Discussion at the UDRP meeting 15 September 2016 indicated preference for inclusion of the first design guidance in objective 4O-2 of the Apartment Design Guideline (ADG). This report recommends inclusion of this design guidance within Chapter B1, as an additional objective for development. |
| 6.11.2 Development Controls - 1 | The panel advises that it is important that the definition of landscape area used in the DCP is consistent with the LEP template definition to avoid confusion. | Noted. DCP updated. |
| 6.11.2 - 6. | The panel was also concerned that Council appears to be requiring different soil volumes when compared with the ADG requirements. Unless there is a strong justification for this to vary the panel suggest that these volumes should be consistent. | Noted. Soil volumes table revised to be similar to the requirement of the ADG with the largest difference relating to small trees category. ADG requires soil volume of $9m^3$ and minimum area of $3.5 \times 3.5m$. Soil volume and area recommended in this report for small trees results from internal consultation and is $16m^3$ volume, and $4m \times 4m$ minimum soil area. |
| | The panel considers that the requirement for the number of trees may need to vary depending on the site location i.e. the tree requirement in the CBD ma be lower than one would expect in a less dense location. Also if only required on the basis of deep soil this could be used to justify no tree planting on mixed use sites. The panel recommends that this clause be revisited so that the number of trees is related to location and context and is also required based on podium soil provision for mixed use sites. | Noted. The minimum number of trees table has been updated in light of the UDRP comments. Note as chapter B1 applies to residential flat building development city wide. Provisions for deep soil planting are included in Chapter D13 Wollongong City Centre. Revised provisions include slight increase in minimum number trees onsite, adapted from the ADG. |

| Amendment provisions proposed | UDRP Comments | Council response |
|--|--|--|
| 6.15 Adaptable Housing | No comments. | Noted |
| 6.15.1 Objective 6.15.2 Development control - 1 and 5 | The panel recommends that the requirements for both liveable apartments and adaptable apartments be tested to ensure that such percentages are economically sustainable in developments within the LGA. | Noted. The proposed increase for adaptable dwellings, and introduction of livable dwellings has not been market tested. The post exhibition DCP amendments recommended for adoption take the UDRP comments into consideration. No increase in adaptable dwellings now recommended. The ADG requires provision for livable dwellings, and the requirement for 20% of dwellings to achieve silver standard level benchmark. This post exhibition report recommends retention of requirement for livable dwelling for residential flat building development (as per Chapter B1 & D13 Wollongong City Centre) and for mixed used development (as per Chapter B3). The requirement for livable dwellings for multi – unit housing is no longer recommended for inclusion based on the UDRP comments. |
| A2 Ecologically Sustainable Development New chapter for Ecologically sustainable development | The panel supports inclusion of such a chapter in the DCP. However, the panel recommends some caution in the proposed control 1.4.1 where Council may consider variation to the provisions of the DCP where an applicant proposes to achieve the highest Green Star Rating. Whilst the control notes that the variation may be varied if it is hindering the achievement to the rating the panel considers that the wording may need to be strengthened to make it clear that this is the only circumstance that will be considered i.e. no variation to setback or other built form controls on any other basis. | Noted. This report notes amendments relating to ESD, particularly relating to incentivising development that achieves excellence in environmental sustainability, for consideration in a future report to Council. |
| B3 Mixed Use Development | No Comments | Noted |

| Amendment provisions proposed | UDRP Comments | Council response |
|--|----------------------------|------------------|
| D13 Wollongong City Centre | | |
| 2.9 Green roofs, green walls and Planting on structures | No comments No comments | Noted Noted |
| 2.9.2 | | |
| 5.2 Energy Efficiency and conservation 5.2.2 Development controls – Residential | No comments | Noted |
| 6. General Development Controls | No comments | Noted |
| 6.1 SEPP 65 and Apartment Design Guide | * ach | Noted |
| Adaptable and universally designed housing | No comments | |
| B1 Residential Development, B3 Mixed Use, D13 Wollongong City Centre | No comments | Noted |

End of advice



1 INTRODUCTION

The Floodplain Risk Management Committee has been established to provide advice to Council on the preparation and implementation of flood management plans for catchments within the Wollongong Local Government Area (LGA). The Committee comprises people interested in the sustainable management of the floodplains within the Wollongong LGA.

2 AUTHORITY

The Floodplain Risk Management Committee will provide advice, feedback and support to Council in developing, implementing and monitoring flood studies and floodplain risk management plans and their associated projects.

The Committee does not have decision making authority, the power to bind the Council or the power to incur expenditure.

3 RESPONSIBILITIES AND FUNCTIONS

The responsibilities and functions of the Floodplain Risk Management Committee are to:

- assist Council to develop Floodplain Risk Management Plan or Plans in accordance with the NSW Government guidelines, as set out in the Floodplain Development Manual;
- develop a better understanding of floodplains and identify issues which need to be addressed;
- assist in developing suitable strategies to address floodplain management issues; and
- monitor and evaluate the implementation of Floodplain Risk Management Plan or Plans.

4 PRIORITIES

The priority of the Floodplain Risk Management Committee is to support the completion of Flood Studies and Floodplain Risk Management Studies and Plans and the review of these studies where appropriate for catchments located within the Wollongong LGA.

5 COMPOSITION OF THE FLOODPLAIN RISK MANAGEMENT COMMITTEE

The Floodplain Risk Management Committee is made up of:

- A maximum of two (2) Councillors in total (one from each ward where the study is across two wards. In the event of the study covering more than two wards it is recommended that a Councillor from each ward be appointed to the committee);
- Council staff from engineering, planning and environmental disciplines to service the Committee and oversee the technical requirements of the studies, as and when required;
- Officers (representatives) from State Government Departments and Agencies, including the Office of Environment and Heritage, Roads and Maritime Services, State Emergency Services, Transport for NSW -Sydney Trains and the Department of Planning;
- Representatives of relevant industry bodies;
- An appropriate number of representatives of the local community (local flood affected landholders both residential and business), flood action groups and environmental groups;
- Guests as deemed necessary by the Committee to provide specialist advice outside the capabilities of the committee members (for example The Bureau of Meteorology, representatives from Welfare Services).

The Chairperson will be appointed by Council from the Councillor representatives.

Vacancies that occur on the Committee will be filled by nomination.

Council staff may attend meetings as observers, to provide information to the Committee or to fulfil an administrative function (eg taking minutes). These individuals will act as ex-officio members.

The term of appointment for Committee members is to be for a period up to the completion of the Floodplain Risk Management Study and the commencement or implementation of the Floodplain Risk Management Plan.



Where necessary the use of a 'Technical Sub-Committee' of the Floodplain Risk Management Committee should be used to enable the commit to fulfil its advisory role to council efficiently, confident that studies and option assessments are technically adequate and the options proposed are practical and feasible. The role of the technical sub-committee may include:

- Preliminary development of process and individual study objectives;
- Collection of background data for studies;
- Preparation of technical project briefs in consultation with the committee;
- Review of proposals from consultants in consultation with the committee;
- Review of modelling, management options, reports and presentations for technical adequacy prior to presentation and review by the full committee; and
- Advice on any other technical matters upon request by the committee.

The Technical Sub-Committee should have membership from Council staff (engineering, planning and environmental disciplines) and The Office of Environment and Heritage. Other technical government representative may be invited to the Sub-Committee as and when required.

6 OBLIGATIONS OF MEMBERS

Members of the Floodplain Risk Management Committee, in performing their duties, shall:

- Act honestly and in good faith;
- Declare all conflicts of interests;
- Participate in the work of the Committee;
- Perform their duties in a manner that ensures public trust in the integrity, objectivity, and impartiality of the Committee;
- Exercise the care, diligence and skill that would be expected of a reasonable person;
- Comply with the Committee Charter; and
- Comply with Council's Code of Conduct.

7 MEETINGS AND MINUTES

The Committee shall meet as required to progress the work involved in the Floodplain Risk Management Process.

A quorum will consist of seven (7) of the Committee members.

Meetings will be chaired by the Council appointed Chairperson. If the Chairperson is absent from a meeting, the meeting will be chaired by the second nominated Councillor, or in their absence the most senior Council officer present.

The Floodplain Risk Management Committee has an advisory role to Council and will make recommendations by consensus. In the absence of consensus, advice from the Floodplain Risk Management Committee may be presented with supporting and dissenting views of members.

Meeting agendas will be distributed at least one week prior to the meeting.

8 REPORTS

The minutes of Floodplain Risk Management Committee meetings will be provided to Councillors and Council's Executive Management for information. Minutes will also be distributed to all Floodplain Risk Management Committee members.

Advice and recommendations of the Floodplain Risk Management Committee may be reported to Council by the Manager Infrastructure Strategy and Planning at their discretion.



9 EVALUATION AND REVIEW

A review of the Floodplain Risk Management Committee will be undertaken every 12 months to ensure the purpose, membership and operation of the Committee is effective and to make appropriate changes.

10 REMUNERATION AND EXPENSES

There is no remuneration for members.

Reasonable expenses incurred by the Floodplain Risk Management Committee members in relation to their responsibilities as members of the Committee will be met by prior approval. These expenses should relate directly to tasks completed for Floodplain Risk Management Committee business and will be reimbursed at the discretion of Council.

11 FAILURE TO COMPLY WITH CHARTER

Failure to comply with the Floodplain Risk Management Committee Charter as set out above may terminate the member's membership of the relevant Floodplain Risk Management Committee.

Jerrent Commission



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(A) PROPOSED EASEMENT FOR SUCTION LINE 3.0 WIDE

(B) EASEMENT FOR SUCTION LINE 3.0 WIDE (VIDE DP 1047304)





ing City Council



From the mountains to the sea

WOLLONGONG CITY COUNCIL

WOLLONGONG 2022

Draft Quarterly Review Statement

September 2016





WOLLONGONG CITY COUNCIL

| Table of Contents | |
|--|----|
| MESSAGE FROM THE GENERAL MANAGER | 3 |
| STRATEGIC PROGRAMS PROGRESS REPORT | 4 |
| ANNUAL PLAN 2016-17 PROGRESS SUMMARY | 10 |
| GOAL 1: WE VALUE AND PROTECT OUR ENVIRONMENT | |
| GOAL 2: WE HAVE AN INNOVATIVE AND SUSTAINABLE ECONOMY | 21 |
| GOAL 3: WOLLONGONG IS A CREATIVE, VIBRANT CITY | |
| GOAL 4: WE ARE A CONNECTED AND ENGAGED COMMUNITY | 27 |
| GOAL 5: WE ARE A HEALTHY COMMUNITY IN A LIVEABLE CITY | 29 |
| GOAL 6: WE HAVE SUSTAINABLE, AFFORDABLE AND ACCESSIBLE TRANSPORT | |
| HOW WE PERFORMED AGAINST OUR BUDGET | 37 |
| REPORT OF MANAGER FINANCE | 37 |
| APPENDIX 1 – ANNUAL DELIVERABLE PROGRESS BY 5 YEAR ACTION | 57 |

MESSAGE FROM THE GENERAL MANAGER

WOLLONGONG CITY COUNCIL

This draft Quarterly Review Statement reports the period from July – September 2016 and reports on progress towards achieving the five Councillor Strategic Programs from the Delivery Program 2012-17 and the Annual Deliverables from the Annual Plan 2016-2017. Highlights and significant progress with key projects from the Annual Plan 2016-2017 are reported by the six Community Goals from the Wollongong 2022 Community Strategic Plan.

Highlights from this quarter include:

- 1 Council received the 50:50 Vision for Gender Equity Award.
- 2 The Figtree Oval Masterplan was endorsed.
- 3 The Disability Inclusion Action Plan was endorsed.
- 4 Council hosted its first ever Trainee Expo.

The organisational performance is also reported by the inclusion on the performance indicators which monitor the status and progress our Council programs, activities, projects, finances, people and process.

This report also includes an overview of how Council is tracking against its budgets and expenditure. It is a concise visual summary of Council's financial situation for the quarter including budget, capital budget and expenditure.

would like to thank all staff and the community for their contributions to the achievements identified in this draft Quarterly Review and Budget Review Statement. This review will inform the Annual Report due in November 2017.

David Farmer General Manager

STRATEGIC PROGRAMS **PROGRESS REPORT**

WOLLONGONG CITY COUNCIL

Our Councillors have made a commitment to support our organisation and the community in making Wollongong a better place to live, work, visit and play. To focus Council's attention to achieve this, Councillors have agreed to five Strategic Programs. These are outlined in the Delivery Program 2012-17. Progress Made in the September 2016 quarter is outlined below:

1. Financial Sustainability

Our Council is committed to improving the standards of community assets over the five-year Council term. This will be achieved by directing 85% of all capital investment into asset renewal, and a strong emphasis of cost effectiveness in service provision.

Project Sponsor: General Manager Executive Strategy Manager Project Manager:

un Track Program Achievements Council adopted a revised target, minor service be reflected Council adopted a revised budget and annual plan in June 2014 that included a special rate variation, efficiency target, minor service adjustments and planned increases in fees and charges. This three year strategy continues to be reflected in the expansion of the capital works program to address asset renewal across the city.

Program Risks

With the approval of a special rate variation by the Independent Pricing and Regulatory Tribunal (IPART) in June 2014, and the adoption of a multi-faceted strategy, the risk rating for the Financial Sustainability Program has decreased. The focus is now to ensure ongoing business improvements resulting in efficiencies and the delivery of a significant capital works program focusing on renewal.

2. West Dapto Urban Release

Council will work in collaboration with key agencies to provide the infrastructure needed to support growth within the West Dapto Urban Release Area. This will include improving access, infrastructure and local services which are needed to support the additional 17,000 future housing lots within the release area.

Project Sponsor:Director Planning + Environment | Future City and NeighbourhoodsProject Manager:Manager Project Delivery

Strategic Program Progress

0n Track

Program Achievements

Fowlers Road to Fairwater Drive - Council has continued to undertake investigations into the preferred concept design with detailed documentation underway for the Stage 1 early earthworks component.

Wongawilli Road/West Dapto Road - The design of road upgrade works along Wongawilli Rd and part of West Dapto Road has been continuing. Council has commenced negotiations with affected property owners where property acquisitions are required.

Overall Access Strategy - Council has commenced investigations into the next stages of the overall access strategy with planning commencing on the future road network for the following segments:

- · West Dapto Road, Darkes Road and Sheaffes Road
- · Cleveland Road
- Jersey Farm Road through to Hayes Lane

A review of the vision, Masterplan and Development Control Plan (DCP) for West Dapto is underway. A new Draft Section 94 Local Infrastructure Plan has been prepared and exhibited. Council has provided technical advice and additional information in response to IPART requests and clarifications. Following this Council prepared a response to the draft IPART recommendations and awaits the final report to be published.

Program Risks

Both access projects (Fowlers to Fairwater and Wongawilli Roads/West Dapto Road) have risk registers which identify a number of significant risks. Reviews of the project risk assessments are being undertaken at regular milestones to manage these risks.

3. Waste Management

During Council's Term we will work to reduce the environmental impact of waste by improving waste management across the city. We will finalise and deploy Council's Waste Strategy, assess the impacts of the carbon tax, and work toward the development of a new landfill cell at Whyte's Gully to increase landfill capacity for the region.

Project Sponsor: Director Infrastructure + Works | *Connectivity Assets + Liveable City* Project Manager: Manager City Works and Services

Strategic Program Progress

On Track ü

Program Achievements

Helensburgh Waste Landfill Rehabilitation Project

Council has received formal approvals for landfill gas drainage infrastructure and the detailed design plans that have been prepared by a specialised consultant. Council staff are currently investigating sourcing capping material imported from a local site that will significantly reduce the volume of heavy vehicle movements through the township of Helensburgh and also save Council costs on capping construction material. Construction tender documentation has been finalised and will be advertised shortly pending a final approval to the design works package.

Whyte's Gully New Landfill Cell

- Stage 1A waste filling continues.
- Stage 1B is in place and ready to receive waste.
- Haul road construction 50% complete.
- Tender for Design and Construction of a Leachate Drainage System in Western Gully awarded, design has commenced.
- Design for new cell 95% complete.
- Design for new leachate pond complete.

Community Recycling Centre and Small vehicle transfer station

Development Application approval was received for the Community Recycling Centre and the tender for construction has recently been released, closing in late October 2016. Site works are expected to begin in December/January. Detailed site services investigations are ongoing to inform the Small Vehicle Transfer Station (SVTS) design and a consultant is to be procured to develop the SVTS design in the next 2 months.

Program Risks

Council needs to ensure delivery of the Community Recycling Centre by 30 June 2017 to guarantee grant funding requirements for the facility are met.

With the return of commercial waste tonnages and potential increases to general waste will see increased need for the delivery of stage 2 of the new cell to maintain the critical path for our capital expansion projects.

4. City Centre Revitalisation

Council's fourth aspiration in the Delivery Program is to improve the attractiveness of the Wollongong City Centre to work and visit, reinforcing its role as the region's major hub for investment and jobs growth.

Project Sponsor: Director Corporate + Community Services | *Creative, Engaged and Innovative City* Project Manager: Manager Project Delivery

Strategic Program Progress

Ü On Track

Program Achievements



West Crown Precinct - Stage 1 upgrade works (Railway Bridge to Atchison Street south side) is complete. Work is underway on Stage 2 (north side of Stage 1 area). These works will improve the amenity of the western area including replacement of the damaged footpath paving, new kerb and guttering, new utility lids and the installation of planters to brighten up the area.

Street scape works on Kembla Street from Crown to Market Streets are being designed as the next major works location in the City Centre.

Program Risks

Management of utilities and service pits, and of wet weather during construction of West Crown Precinct, will continue to be a risk potentially impacting on the delivery program

5. Connectivity / Walkability

Council's fifth aspiration is to improve the connectivity of the Local Government Area (LGA) through the upgrade of our network of footpaths and cycle ways. This focus on our path and cycle network will ensure that necessary works are carried out to achieve an accessible and connected city.

Project Sponsor:Director Infrastructure + Works | Connectivity Assets + Liveable CityProject Manager:Manager Infrastructure Strategy and Planning

Strategic Program Progress

i On Track

Program Achievements

The Wollongong Bike Plan was adopted in May 2014. Actions identified within the Bike Plan will and are being incorporated into the capital works and operational programs for progressive implementation. The Wollongong Pedestrian Plan has commenced and a draft will be presented to the Active Transport Reference Group in December 2016.

Scoping, traffic modelling and design work are continuing on the Smith and Kembla Streets on road cycleway which will provide access for cyclists into the city centre.

Option selection and design work is also progressing on the Smith Street shared path rail underpass. Funding submissions have been made to Transport for NSW for the rail underpass, and if funding is received, then construction can commence in 2017-18.

Detailed preconstruction investigations for the Tramway Seawall and share path are progressing, with construction due to commence in the second half of the financial year.

A significant proportion of the path design program has commenced.

The following designs have been completed:

- Galvin Park, North Wollongong, new footpath
- Hilltop Avenue at intersection with McKenzie Avenue, Mangerton, new footpath
- Kanahooka Cycleway; boat ramp to Lakeside Park, Kanahooka.

The following have commenced construction:

- Farmborough Road, Jenkins to Jemima Streets, south side, Unanderra, new footpath
- Bourke Street footpath, Corrimal to Flinders Streets (south side), North Wollongong, new footpath
- Cliff Road to Continental Pools staircase renewal, Wollongong.

The following have been completed:

- Mowbray Lane, Warrawong, new footpath
- Botanic Gardens, Keiraville, access way footpath
- Farmborough Road; shops #7 to #29, south side, Unanderra, footpath renewal
- Market Street; Corrimal Street to Queens Street, Wollongong, footpath renewal
- 4 4B Flinders Street, footpath, North Wollongong, footpath renewal
- Farmborough Road, Jenkins to Jemima Streets, south side, Unanderra, footpath renewal.

Program Risks

There are a number of sites on the network expansion program with significant geographical, technical, agency approval and community concerns that may impact on the design phase and hence construction time frames. To minimise the impact from this risk, designs for projects further down the delivery program are also being progressed such that construction programs can be re-phased to ensure continued delivery of the improvement program.

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WOLLONGONG CITY COUNCIL

The following section provides an overview of Council's progress with delivering Wollongong 2022. It provides a summary of progress for 2016-17 annual deliverables [Council's programs, projects and activities] and highlights significant progress with annual projects as outlined in the Wollongong 2022 community goals. This exception based reporting provides an overview of achievements for the September 2016 quarter. The organisations performance is also reported by the key performance indicators, budget summary information and Budget Review Statement.

The Annual Plan 2016-17 contains 311 annual deliverables across the 6 community goals. Table 1 below outlines how Council is tracking in the September quarter to achieve the annual deliverables for each community goal.

| Goal | On track (Projects / Ongoing) | Not Scheduled to Commence | Delayed | Deferred | Complete (Projects Only) |
|--|-------------------------------------|------------------------------|---------|----------|-----------------------------|
| 1 We value and protect our nate environment | ural 91% | 2% | 6% | 0% | 0% |
| 2 We have an innovative and sustainable economy | 96% | 0% | 0% | 0% | 0% |
| 3 Wollongong is a creative, vibran | a 92% | 6% | 3% | 0% | 0% |
| 4 We are a conne and engaged community | ected 86% | 3% | 6 % | 3% | 2% |
| 5 We are a health community in a liveable city | ny 87% | 1% | 5% | 2% | 0% |
| 6 We have sustainable, affordable and accessible transport | 70% | 10% | 15% | 0% | 5% |
| Total Annual Deliverable Progre | ess 89% | 3% | 5 % | 1% | 2% |

Table 1: Annual Deliverable Progress by Community Goal

*Note: Each Goal does not have equal number of Annual Deliverables; therefore the Annual Deliverable progress totals do not necessarily add together.

Overall 5.16% of annual deliverables were reported to be delayed, while 1.29% were deferred. Table 2 below outlines all annual deliverables that were reported as delayed of deferred at the end of September 2016.

| Community Goal | Annual Deliverable | Delayed | Deferred | Comment |
|---|--|---------|----------|--|
| 1 We value and protect our natural environment | Continue to pursue biodiversity certification of the West Dapto Urban Release Area including offsetting provisions | r | | Following the finalisation of the levy cost estimate/Lot and letter in December 2015 to NSW Planning and Environment seeking their support for the proposed levy, a follow up joint meeting was held with DPE, OEH and Council officers in late August 2016. Review of the new proposed Biodiversity Offset Scheme for the forthcoming NSW Biodiversity Conservation Act has been carried out and consultation has occurred with OEH officers to identify potential issues and risks for the work carried out to date on Bio certification. In addition, Council officers met with local OEH staff at the end of September to discuss risks associated with the recent listing of Illawarra and south coast lowland forest and woodland as a critically endangered ecological community under the Commonwealth EPBC Act which occurs in the urban release area. Consultation will occur with the Department of the Environment and Energy and with the support of local OEH officers. |

| Community Goal | Annual Deliverable | Delayed | Deferred | Comment |
|----------------|---|---------|----------|--|
| | Investigate and implement flaring, energy generation and other options. | | | Landfill gas flaring continues to successfully operate at Whytes Gully with 430,000 cubic metres of landfill gas captured and beneficially treated so far this financial year. Investigations into the quality and quantity of landfill gas being generated by the site have indicated that there is the potential for energy generation. A market appraisal has also been |
| | | r | | completed to ascertain the options available to Council to implement energy generation to compliment the flare already operating. The market appraisal compared various infrastructure procurement and delivery options and compared the benefit and risk of each option to Council and the community. This comparison has resulted in a preliminary recommendation to install new infrastructure that will allow for energy generation in a contractual arrangement with a private provider. Council staff is currently investigating this enpartumity |
| | Atta | | | |

| Community Goal | Annual Deliverable | Delayed | Deferred | Comment |
|--|--|---------|----------|--|
| | Coordinate the Urban Greening Strategy | r | | The Urban Greening Strategy work to date has included collaboration and input from key internal and external stakeholders, and been favourably reviewed by an external urban forest expert. Additional tasks have been undertaken to address gaps in data prior to finalisation. The framework of the Strategy has been refined, and includes a draft Implementation Plan. Spatial mapping tasks to inform priority areas for short-term investment are currently underway, whilst a range of immediate actions to support a street tree program have been identified. The immediate goal of the Strategy is to contribute towards a successful business case for a coordinated, ongoing, programmed, asset-based approach to urban greening and tree management across the City. The next quarter will see further internal consultation with stakeholders to ensure consensus for the Strategy's new approach, delivering an agreed vision, set of principles, key objectives and priority actions for managing vegetation in urban areas. |
| | Continue to deliver the Heritage Assistance Grant Program | Y | | The allocation of the 2016-17 Heritage Assistance Fund Grant has been delayed and will occur in the next quarter. |
| 2 Wollongong is a creative, vibrant city | Continue to progress design and construction of Wollongong SES Headquarters at Coniston | | | During 2015-16 Council undertook a concept design to expand the SES local offices at Coniston. This included a new Emergency Operations Centre for flood events, which would double as a training centre. |
| | | Y | | The project is under review awaiting advice from the SES about Regional Priorities pending amalgamation considerations. |
| | | | | Should the project continue Council will seek financial contributions from the State Government to support the project. |

| Community Goal | Annual Deliverable | Delayed | Deferred | Comment |
|---|---|---------|----------|--|
| 3 We are a connected and engaged community | Continue the "Council Connect" project to enhance Councils on-line services and increase opportunities to conduct business with Council online | | Y | Council continues to improve our online services. The ability for customers to lodge requests for services via Web Self Service and track the progress of these requests both simplify and improve service delivery and provide an up to date status for customers. Customers can also access this site from Council's social media Facebook page and Council's website. Council also delivers answers question via our Ask Wollongong City Council Facebook page and web chat. Council is in the process of reviewing the ICT Strategy. Once strategy is completed direction on Council connect will be determined. |
| | Investigate opportunities to enhance library multi-media and online presence via the National Broadband Network (NBN) | Y | K Ite | Wollongong City Libraries continues to investigate opportunities to provide library-to-library multi-media services and online services via the NBN. However, progress has been delayed due to the slow roll-out of the NBN - with only Dapto Library currently operating on the NBN. |
| | Work in collaboration with the Aboriginal community to develop the Aboriginal specific space and its operations at the Kembla Grange Cemetery | Y | | Following consultations with the Aboriginal community and cemetery staff an area in the Kembla Grange cemetery has now been designated for the Aboriginal community. A working party has been formed from representatives of the peak local Aboriginal community organisations/members who have provided input into the design and operations process and to take information back to the local Aboriginal community to discuss. The progression of the project relies on the delivery of an access road to be built at Kembla Grange. |
| | Develop brief and initial design for the Southern Suburbs Community Centre and Library | Y | | Extensive and comprehensive investigations regarding flood issues identified for the proposed site of the SS CC&L and the potential cost of mitigation, have delayed the project moving ahead during the past quarter. |

| Community Goal | Annual Deliverable | Delayed | Deferred | Comment |
|--|--|---------|----------|---|
| | Continue to implement the "Creating a Customer Service Culture" Strategy | | Y | Work on this strategy has been partially completed. |
| | Coordinate a review of Wollongong 2022 and End of Term Report | Y | | As Council is currently subject to a merger proposal, the typical review times for the Wollongong 2022 Community Plan have been amended by the OLG. A new Community Plan will be required to be developed following the next Council election. A preliminary End of Term Report was adopted by Council in June 2016. Following the finalisation of 2015/16 audited financials; an updated final version of the End of Term Report will be disseminated. |
| 4 We are a healthy community in a liveable city | Pursue key actions outlined in the 2016-2026 Sports Ground & Sporting Facilities Strategy | | Y | The key principles of the draft strategy have been discussed with the Sports Reference Group but the strategy has been placed on hold pending the outcomes of the Council Merger Proposal |
| | Review West Dapto Recreation needs in line with the adopted Section 94 Plan including current concepts on Cleveland Road and West Dapto Road and ascertain recreation needs for Reed Park South | Y | | Early site assessment has been completed and a brief developed to complete a needs assessment to determine the level of facilities to be provided |

| Community Goal | Annual Deliverable | Delayed | Deferred | Comment |
|----------------|---|---------|----------|--|
| | Manage the West Dapto Home Deposit Assistance Program | Y | | Since the launch on 24 October 2014, there has been twelve applications under the Program with eleven of these approved. The first property purchase has been completed which is pleasing. While many people are interested in the program, there remains a mismatch between income limits, purchase limits and the entry level of new housing stock in the area. The Department of Social Services has been updated regularly on issues relating to the implementation of the Program. A letter written to the Department emphasised Council's view that the success of the Program had been adversely impacted by a particularly strong property market which has created such a strong demand in the area and that there was no need for developers to tailor product to meet niche demand such as smaller dwellings for lower income earners. The letter to the Department of Social Services served as an opportunity to outline some options to be considered as interim measures that may provide some success in the short term. Although these were rejected the Department provided a program extension of 9 months until 31 March 2017. The Department is currently preparing a report to the Minister reporting on the program. It is expected that advice for the finalisation of the Program and /or future operating requirements will be issued to participating Councils subsequent to the Minister receiving this report. |
| | Deliver Wollongong City Libraries Supporting Document 2015- 2022 | Y | | The Wollongong City Libraries Supporting Document 2015 - 2022 has been placed on hold pending the outcome of the proposed Council Merger. |

| | Annual | . | | |
|--|---|----------|----------|---|
| Community Goal | Deliverable | Delayed | Deferred | Comment |
| | Investigate a suitable location for an Integrated West Dapto Leisure / Community facility | Y | | A Scope has been completed. The Needs assessment and site selection for the West Dapto Recreation facility has been placed on hold pending the outcome of the proposed Council Merger. |
| | Continue the preparation of the housing study | | Y | The Housing Study project was deferred in February 2016 following the merger proposal announcement. The project will recommence once a merger decision is made. |
| | Finalise investigations into potential additional Gong Shuttle route | Y | | Investigations for the Southern Gong Shuttle route are currently underway. Completion of the project has been delayed by resources being diverted to higher priority work as part of the West Dapto Review project. |
| 5 We have sustainable, affordable and accessible transport | Undertake a 'Park n Ride' feasibility study | nner | K K | The "Park and Ride" initiative is identified in the adopted Wollongong City Centre Access and Movement Strategy. A draft feasibility assessment of a southern city centre shuttle bus route and service to support park and ride is being finalised and will be incorporated into revised planning and actions as part of the review of the Inner City Parking Strategy and also the City Centre Access & Movement Strategy. The allocated resource to the project is currently completing higher priority works as part of the West Dapto Review. |
| | Finalise design and approvals and commence construction of the road link | Y | | The design of the West Dapto Access - Fowlers Rd to Fairwater Dr has been continuing. Actions were being put in place to construct the project in two Stages. Stage 1 would involve the construction of the embankment from Fairwater Dr roundabout heading east to the proposed western bridge. Stage 2 would involve the remaining construction of embankments and bridge over the floodplain and railway line. However, delays have been encountered with resolving issues relating to geotechnical and flooding concerns. Efforts are being made to complete design documentation for the Stage 1 works for construction commencement early in 2017. |

GOAL 1: WE VALUE AND PROTECT OUR ENVIRONMENT

WOLLONGONG CITY COUNCIL

Continue to deploy Council's Waste and Resource Recovery Strategy

The Wollongong Waste and Resource Recovery Strategy 2022 was endorsed by Council in July 2014. The Strategy represents a pathway for Council and the community to work towards sustainable waste management. Actions contained within the Strategy are continuing to be implemented. The current priority actions in progress include:

- New community recycling centre development design complete, development consent received, facility construction currently being planned, tender closes 19 October 2016.
- New leachate management system at Whytes Gully currently undergoing laboratory bench scale analysis.
- Environmental rehabilitation of Helensburgh landfill design and approvals complete, construction tender progressing.
- New and ongoing arrangement for landfill gas extraction and power generation at Whytes Gully on hold pending outcome of potential amalgamation, however gas flaring and quality and quantity investigation continues.
- Construction of new landfill cell stages at Whytes Gully Stage 2 design has been completed with a tender currently being expedited for construction.

Implement Council's Floodplain Risk Management Plans.

Implementation of the Floodplain Risk Management Plans continues through the capital works and maintenance programs. The preparation and review of various Flood Studies/Floodplain Risk Management Plans is ongoing, including –

Ongoing Studies and Plans

• Review of Brooks Creek Flood Study and Floodplain Risk Management Study and Plan

Studies Commenced

- Review of Hewitts Creek Floodplain Risk Management Study and Plan
- Review of Towradgi Creek Floodplain Risk Management Study and Plan
- Review of Allans Creek Flood Study.

Designs for flood mitigation and stormwater projects are underway to enable progressive implementation. These include:

- The design of debris control structures in Allans Creek, Collins Creek and Fairy Cabbage Tree Creek Catchments has commenced and design is currently underway. The location of these structures has been a direct result of flood mitigation options identified in the above plans.
- Debris control devices for Chalmers Street, Gipps Street, Wellington Drive, Foothills Road, are currently under design
- A Debris Control Structure at Cosgrove Avenue has been completed
- Byarong Creek Bank support design is underway.
- Fairy Creek detention basin feasibility study is underway

Additional stormwater projects are identified in the Capital Works Program.

Develop and deliver diverse local studies projects that contribute to the preservation and continued relevance of local history and community stories

Wollongong City Libraries continue to develop and deliver diverse Local Studies projects that contribute to the preservation and continued relevance of local history and community stories. E.g. digitising the Illawarra Mercury photographic collection; recording, cataloguing and digitising oral histories from Thirroul and Dapto communities; continued work to develop the Illawarra Remembers website; collaborating with the Illawarra Museum Wollongong and the University of Wollongong on mutually beneficial projects. A particular highlight of the September quarter was the awarding of the Wollongong Local History Prize, in collaboration with the Friends of Wollongong City Libraries which had attracted 16 entries. Wollongong historian Julianne Morris won the inaugural Local History award with an in-depth look at six women and their incarceration in Wollongong Gaol from 1859 to1915. All entries will be added to the Local Studies collection, boosting the range of original historical research available for students, researchers and members of the community.



IMAGE: Winner of the 2016 Local History competition Julianne Morris with Lord Mayor Cr Gordon Bradbery OAM

Deliver new carbon abatement projects funded as a result of the carbon tax repeal

Due to the repeal of the Carbon Pollution Reduction Scheme (Carbon Tax) and the removal of the related liability, Council currently holds approximately \$1.8 million in Carbon Tax revenue that it cannot feasibly return to customers. The Federal Government released a "Waste Industry Protocol" (the Protocol) for handling of these funds, which provides a mechanism to invest the funds into suitable projects that have emissions reduction as one of their purposes.

Subsequent to Council resolving to participate and comply with the Protocol a project program has been established to deliver projects that comply with the Protocol.

The project list is as follows:

- Solar Photovoltaic Systems at Corrimal Tourist Park, Windang Tourist Park, Ribbonwood Centre, Beaton
 Park and Whytes Gully
- Energy efficient lighting upgrades for the Administration Building, the Art Gallery and Bulli, Corrimal and Windang Tourist Parks.
- Energy efficient hot water upgrade for Windang Tourist Park.
- Dapto pool heating system efficiency upgrade.

All projects are currently in design and progressing well.

PERFORMANCE MEASURES

- Participation rate in environmental programs | 6,464 (15/16 Q1 13,760)
- Number of volunteers worked at Bushcare and FIReady sites | 298 (15/16 Q1 326)
- Tonnes of Rubbish collected from clean-up activities | 14 (15/16 Q1 -16)
- Plants Distributed | 21,537 (15/16 Q1 21,918)
- Plants Propagated | 20,285 (15/16 Q1 32,022)
- Number of volunteers for Environmental Programs Greenhouse Park | 44 (15/16 Q1 95)

GOAL 2: WE HAVE AN INNOVATIVE AND SUSTAINABLE ECONOMY

WOLLONGONG CITY COUNCIL

Continue to implement the Infrastructure delivery program to support the West Dapto Urban Release Area

Designs are proceeding for road upgrades within the West Dapto Urban Release Area. Progress to date is as follows:

- Wongawilli Road concept design has been completed however, further investigations are underway to address community concerns raised during the community engagement process. Detailed design is scheduled to commence soon afterwards.
- West Dapto Road, Sheaffes Road and Darkes Road concept designs are in progress and about 50% complete.
- Cleveland Road concept design is in progress and about 50% complete.
- Jersey Farm Road concept design in progress and about 40% complete.

In addition, Council was advised in early October that it was successful in its \$10 million application under the National Stronger Regions Fund Round 3 for West Dapto Access Strategy, Fowlers Road extension project. This project continues through design with initial earthworks expected to comment later in the financial year.

Facilitate business and investment enquiries

The Economic Development Team assisted 105 businesses/investors in Wollongong throughout the September quarter ranging from support for small business (such as the region's first specialised Peking duck wine bar), through to a major light industrial development and potential establishment of an advanced preformed residential builder. Four enquiries were focused around micro-brewing/distilling and assistance was also provided to Wollongong's largest Yours and Owls festival to date.

NEC was officially launched by the NSW Minister for Trade Stuart Ayres MP on Wednesday 28 September 2016. NEC has invested \$25 million in Wollongong through their new corporate office and will employ around 130 employees. NEC has entered into a partnership arrangement with the University of Wollongong, which includes a graduate program for 2017 as well as signing a Memorandum of Understanding (MOU) in regards to Research and Development capabilities. NEC was the result of the work of the Advantage Wollongong team actively promoting Wollongong as a strong business relocation option.

The Economic Development Team and the Small Business Assessment teams hosted a Small Business Forum on 16 August 2016. This Forum provided an opportunity for small businesses looking to expand/establish their business learn about Council's planning processes and other relevant issues. It is anticipated this Forum will be held on a quarterly basis.

Implement the Bald Hill Masterplan

The Bald Hill redevelopment is nearing completion with the site programmed to reopen in time for the arrival of the cruise ship "Radiance of the Seas" to Wollongong on October 30.

With quality detailed specifications for mosaic artworks, replacement of amenities building including sewerage upgrades, car park renewal, landscaping and roundabout construction this project has been a challenging and diverse build, however is being delivered ahead of schedule.

Promote Wollongong City Council as an employer of choice for women in Local Government

Council received the 50:50 Vision Councils for Gender Equity Award in July from Australian Local Government Women's Association (ALGWA) The development of strategies and actions to support Council's Workforce Diversity Policy and Plan will include promoting Council as an employer of choice for Women in Local Government



IMAGE: Council received the 50:50 Vision Councils for Gender Equity Award in July from ALGWA

Deliver increased marketing collateral and product placement via the Marketing the Wollongong Advantage Program

The Marketing the Wollongong Advantage Program will focus on changing perceptions of Wollongong and promoting Wollongong as open for business, through the following 3 elements:

- 1 Promoting and supporting the existing work of Advantage Wollongong
- 2 Driving targeted campaigns aligned to the key messages promoting Wollongong's competitive advantages
- 3 Enhancing the connectivity and coordination of key influencers to promote Wollongong.

The Marketing the Wollongong Advantage Program was officially launched by the Lord Mayor on 9 September 2016. Around 30 local influencers attended the launch, which included a presentation by NEC on why they chose Wollongong as the location for their new corporate office. An engagement plan has been established and follow up meetings have been undertaken regarding key local organisations ongoing involvement in the project.

A full page advertisement was run this quarter in both the NSW Business Chamber's Business Connect magazine and Forge magazine. The theme of this quarter's Forge magazine was 'innovation' and a full page editorial appeared discussing Wollongong's transformation also appeared in this edition.

Advantage Wollongong's Facebook has experienced a 103% increase in 'likes' this quarter, with the average reach per post increasing to 375 people and an engagement rate of 6.2%. The top performing story this quarter about NEC's opening reached 2,950 people.

The Winter Edition of the Advantage Wollongong e-newsletter was sent out to around 1,500 recipients. The opening rate was high at 33% and the click through rate was high at 6.3% (compared to a previous average of 2.7%). The top three stories were on: cruise ships, Wollongong's city centre residential boom and 'What's on in Wollongong'.

PERFORMANCE MEASURES

- Occupancy rates of paid on street parking | 72 % (15/16 Q1 –72%)
- Tourist parks occupancy rate of powered sites | 34 % (15/16 Q1 33%)
- Tourist parks occupancy rate of unpowered sites | 18 % (15/16 Q1 6%)
- Tourist Park occupancy rate of cabins | 61 % (15/16 Q1 –50%)
- Number of visitations to the tourism information centres | 13,346 (15/16 Q1 15,999)

GOAL 3: WOLLONGONG IS A CREATIVE, VIBRANT CITY

WOLLONGONG CITY COUNCIL

Deliver the Berkeley Safer Spaces Projects

All aspects of the project have been implemented and completed except for the final community celebration event which was postponed due to inclement weather on the day.

This project has delivered: a community garden, new tap to water the community garden, a large graffiti prevention mural on a shop front and another on the 'planter box' which is now converted into a seat. Other garden beds in Winnima Way pedestrian walk have been weeded and mulched in keeping with the new communal garden and a bench seat in that area has been added.

In Berkeley Park, Illawarra's first permanent outdoor table tennis table has been installed, along with two bench seats. Evaluation of this outdoor table tennis table is ongoing over the next six months and to date it has shown a high usage.



IMAGE: Illawarra's first permanent outdoor table tennis table in Berkeley Park

Facilitate events occurring for NAIDOC Week, Reconciliation Week and Sorry Day

The following activities were undertaken during the quarter:

- NAIDOC Week Lord Mayor Elders Luncheon was held on 1 July 2016 at the "Towri Building" in the Wollongong Botanic Gardens. Approximately 15 Aboriginal Elders met with the Lord Mayor and enjoyed a conversation over lunch.
- Council provided NAIDOC Week grants totalling \$6,000 to community groups to conduct NAIDOC events across the Wollongong LGA, they included: Noogaleek Children's Centre Berkeley, Koonawarra Community Centre, Illawarra Aboriginal Corporation and the Illawarra Koori Men's Support Group Inc. Approximately 1500 people in total attended the events that were held by the four organisations during and for NAIDOC week.
- NAIDOC Week Regional Awards Dinner was held on 23 July at the Wollongong Entertainment Centre. The
 annual Regional NAIDOC Awards Dinner is a combined event run by Wollongong, Shellharbour, Kiama and
 Shoalhaven Councils. The Dinner is an occasion for Aboriginal Elders, the local Aboriginal and Torres Strait
 Islander community and the broader community to come together to celebrate NAIDOC Week. It is also an
 opportunity to showcase and highlight the achievements of local Aboriginal people and organisations across
 the local government areas through the presentation of awards for service to the community.

Deliver Council's Annual Community Events Program

A highlight this quarter was a welcome home for our local-based Rio Olympians in Crown Street Mall on 3 September. Hundreds of people turned out to welcome them and get autographs. Planning is well underway for the kick-off of our summer events program with Viva Ia Gong in November, New Year's Eve with an enhanced Illawarra 200 component, 4 outdoor movies across the summer, and Australia Day 2017.



IMAGE: Special celebration in Crown Street Mall to cheer and celebrate the wonderful athletes who did our region proud in the 2016 Olympic Games

Host six Major Events reflecting priority sectors

During this period Wollongong hosted a range of events, BRAVO the adventure sport activity, the Wollongong Fringe and Eastern University Games all fell into this period.

Destination Wollongong supported 9 events in the quarter for which the economic benefit was calculated at \$8 million. The Eastern University Games represented the highest windfall for the city during this period, with a calculated return of \$2.2 million.

PERFORMANCE MEASURES

- Library visitations | 245,445 (15/16 Q1 –260,198)
- Library programs: number of participants | 17,289 (15/16 Q1 10,071)
- Library programs: number of programs | 646 (15/16 Q1 464)
- Library total number of loans | 378,717 (15/16 Q1 355,955)

GOAL 4: WE ARE A CONNECTED AND ENGAGED COMMUNITY

WOLLONGONG CITY COUNCIL

Continue to seek external funding to support delivery of core community infrastructure projects

In the first quarter of 2016-17, the following external funding sources are being progressed or pursued -

- Port Kembla Community Investment Fund Council was successful in gaining \$1.142 million across 8 projects to support initiatives around Port Kembla. This in addition to the existing capital and operational works in the suburb.
- Resources for Regions Council awaits the outcome of our \$2.4 million final round application for the Wongawilli Access project

Continue to deliver friendly, courteous and efficient customer service through the Customer Service Centre

During the quarter the customer service team have provided a face to face service to 15,089 customers and a phone service to 33,963 customers. Customers have benefited from using the ASK WCC Facebook site to answer enquiries which has generated some interest as a quick and easy means to contact Council. We continue to use numerous channels to service our customers including online, web chat, video calling and the Report It App.

Work with NBN Co in the roll out of NBN through planning, infrastructure and engagement advice

Council worked closely with NBN contractors and management in the early phases to establish working expectations. The NBN rollout continues across the LGA - Wollongong, Dapto, Corrimal and the suburbs surrounding these centres as the initial rollout areas are now complete. Works are currently underway in Port Kembla, Lake Heights to the South, Balgownie and Fairy Meadow centrally and Thirroul and, Bulli in the North. Council has been asked to submit a satisfaction survey of NBN performance and impacts for their affirmation and improvement of process.

Deploy Council's Attraction and Retention Strategy

Council held it's first-ever Trainee Expo at its South Depot on Saturday 16 July to promote its largest ever intake of traineeship positions. There were 21 traineeships on offer with our Civil and Parks crews. There was a great response, with around 350 people attending the expo, and 259 applications received.



IMAGE: Council hosted its first ever Trainee expo for Civil and Park Crews.

PERFORMANCE MEASURES

- Number of media releases issued | 50 (15/16 Q1 48)
- Enquiries made in person are welcomed and attended to within 5 minutes | 90 % (15/16 Q1 91%)
- Number of Council Facebook page 'likes' | 15,327 (15/16 Q1 9,722)
- Lost Time Injury Frequency Rate | 22.39 (15/16 Q1 18.68)
- Carers Leave | 0.66 Days (15/16 Q1 0.61 Days)
- Number of Twitter followers for Council | 4,390 (15/16 Q1 3,530)
- Workers compensation costs as a percentage of payroll | 1.02 % (15/16 Q1 1.20%)
- Telephone calls are answered within 30 seconds | 80 % (15/16 Q1 70%)
- Sick Leave | 8.57 Days (15/16 Q1 7.38 Days)

GOAL 5: WE ARE A HEALTHY COMMUNITY IN A LIVEABLE CITY

WOLLONGONG CITY COUNCIL

Continue to seek opportunities to fund the implementation of priority recommendations from the Figtree Town Centre Studies

The Figtree Oval Masterplan was exhibited and endorsed by Council on 15 August.

The community identified key outcomes they wanted to see in the master plan including increased opportunities for community meeting spaces, enhanced sporting, social, environmental and recreational services and formalising a cycle and walking track along Allan's Creek. The ongoing and future access of existing local sporting groups including cricket and AFL utilising the ovals have also been secured in the master plan.



IMAGE: The endorsed Figtree Oval Masterplan

Coordinate and undertake Graffiti Prevention actions on Council assets and develop the Community Partnership program to remove graffiti from non-Council Assets

During the quarter the following actions were undertaken:

- Community graffiti prevention murals were completed at Berkeley Neighbourhood Centre by members of the Youth Group and at the Bellambi Surf Club by members of the surf club, the Youth Group from Bellambi Neighbourhood Centre, Corrimal High School and Bellambi Primary School.
- Community Partnership program graffiti removal from non-Council assets (private property) by Corrective Services NSW providing 17 days and by Essential Personnel who provided 13 days of graffiti removal service respectively.
- City Works Caravans graffiti prevention mural project for 8 vans during 2016-17 commenced with expressions of Interest being sought and four applications were received. One applicant will commence work on two vans by the end of October and the remaining 6 caravans are anticipated to begin in early in 2017.

Accelerate delivery of building renewal and maintenance programs through allocation of additional funds

The 2016-17 Capital Works program includes almost \$24 million allocated to programs supporting the renewal and upgrade of Council's Buildings and Facilities.

In addition, the maintenance budgets for buildings and facilities have been maintained at the increased value of over \$6.5 million, \$1 million higher than previously allocated. This increase followed a detailed review of historical and required funding levels and will result in an ongoing increased level of service for our building assets.

Enhance Botanic Garden visitor experience via programs, interpretation, education and events

A number of successful smaller events including the National Tree Day for Schools with Botanic Garden staff hosting education and planting activities at 8 schools across the City in July. Botanic Garden Friends Soiree in the garden event held Rose pruning workshop in conjunction with the Rose Society of NSW.

The Discovery Centre held a range of National Science week events based on Puckey's Estate and funded via regional innovation fund. A total of 98 booked tours, Ranger parties, Towri centre bookings, Education Programs including the 'Eco- Foot Print' July School Holiday Program, weddings and activities across the site during the quarter.

Undertake programmed renewal works at Council's rock pools in accordance with the capital works programme

A number of rock pools have been undergoing restoration works. These include Austinmer, Towradgi, Woonona and the Gentleman's Rock Pools.

The work at Austinmer Rock Pool has been challenging due to sea conditions and is in the final phases of construction. Work is proceeding in the southern pool on the eastern seawall and (subject to ocean, tide and sea conditions work) are scheduled to be completed by end of October.

Works at the Towradgi Rock Pool have included upgrade to the southern concourse area and retaining wall. These works were completed in September.

Works at Woonona Rock Pool have included upgrade to the western concourse area and replacement of three asbestos cement pipes with poly pipe. The old slag fill below the concourse has been replaced with concrete. These works are scheduled to be completed by end of October.

Works at the Gentleman's pool adjacent to the continental pools has involved the restoration of the walls which had been deteriorating. These works are scheduled to be completed by mid-October.

Implement, monitor and report on the Disability Inclusion Action Plan

On 5 September 2016, the Minster for Disability Services The Hon John Ajaka MLC together with the Lord Mayor, launched Council's Disability Inclusion Action Plan, the first in NSW. The launch was attended by community members who had participated in the engagement for the Plan's development. Significant progress is under way in the delivery of the Plan and further work has been undertaken on the evaluation framework to measure progress. Actions within the Plan have been identified for consideration in the development of the draft 2017-18 Annual Plan. Plans are also under way for the development of a Mobility Parking Scheme awareness raising campaign and improved access at Council's New Year's Eve and Viva Ia Gong events. Council also partnered with Para Meadows School and Aspect to develop a visual communication sign for children with disability who use alternative communication. A trial sign has been put in Luke's Place Playground Corrimal and is currently being evaluated A calendar of events to celebrate International Day of Persons with a Disability is being developed.



IMAGE: Council's Disability Inclusion Action Plan
Support the delivery of aged care programs that provide social connection for frail aged people, young people with a disability and their carers

This quarter a number of new initiatives to provide social connection for the program target group have been introduced:

- A 'Community Services Newsletter' for clients and volunteers was launched and received a lot of positive feedback. It provides an engaging communication medium for those involved with the service as well as an avenue for promoting services.
- Training on how to use IT devices, such as tablets and laptops was delivered at the Day Centres combined with further technology training for clients to provide assistance with use of technology in everyday life. Clients showed considerable interest in this program, leading to further sessions being planned for the future.
- Illawarra Public Forum Expo Still Dementia in a Changing World as part of Dementia Awareness Month. Council's Community Services team participated in the expo to promote our services, particularly respite services available to carers of people with dementia. We also recruited interest in volunteering for Social Support on this day.
- A 'Corrimal Shopping Bus Flyer' was created and distributed to Corrimal Community Transport Clients. This initiative has generated an increase in bookings for future shopping bus trips until the end of 2016.

Deliver a range of youth services with a focus on youth participation and community development, targeted programs, music and culture, and sector development and coordination

Youth Services delivered programs and activities to 7,605 young people during this quarter including 2,125 in targeted programs, 3,477 for drop in, 581 in music and culture, 356 in engagement and community development, 225 support and referrals and 724 participants in sector development. Highlights for the quarter include: Changing the focus of service delivery to structured programs and diversifying program offering; Art and barista workshops commenced; A Young Men's Forum was held in partnership with Wollongong Women's Information Centre involving students from four high schools; The Refugee Challenge mentor program culminated in a simulated refugee camp; Youth Services participated in Wear It Purple and RUOK Days; Illawarra Multicultural Youth Conference was held over two days; Presenters from 'OnAir/PlayOut' participated in training which has invigorated participants and the program; KLAW continued to provide circus, cooking and a social and support group for young CALD women at Warrawong High School.

Provide funding for Bulli Surf Life Saving Club extension and building renewal

Work began on the alterations and additions to the Bulli Surf Life Saving Club on 25 July and is estimated to be completed in early 2017, weather permitting.

Works include the refurbishment of the existing club premises, new electrical works, painting, an extra bathroom and change facilities for lifesaving club members. The new extension will include enclosed storage space, an expansion of the existing area to provide a training room and storage and extra showers, new offices, kitchen and toilet facilities.

GOAL 5: WE ARE A HEALTHY COMMUNITY IN A LIVEABLE CITY

PERFORMANCE MEASURES

- Social Support hours of service | 23,070 Hours (15/16 Q1 12,750 Hours)
- Utilisation of Direct-Run District Level Community Facilities | 10,100 Hours (15/16 Q1 10,185 Hours)
- Direct-Run District Level Community Facilities visitation | 64,191 (15/16 Q1 59,479)
- Community Transport trips | 40,563 (15/16 Q1 40,365)
- Utilisation/visitation at beaches | 83,340 (15/16 Q1 35,351)
- Total Visits commercial heated pools: Dapto | 13,588 (15/16 Q1 3,290)
- Total Visits commercial heated pools: Corrimal | 16,841 (15/16 Q1-3,525)
- Utilisation/visitation at pools | 62,184 (15/16 Q1 27,601)

GOAL 6: WE HAVE SUSTAINABLE, AFFORDABLE AND ACCESSIBLE TRANSPORT

WOLLONGONG CITY COUNCIL

Implement footpath and cycleway improvement programs and the development of city wide pedestrian plan.

Significant works are planned and underway to deliver continual improvements in Council's footpath and cycleway networks. A key highlight is the completion of the new pathway and bridge from Squires Way to the popular Stuart Park playground which was opened in September. This provides pram, bike/scooter and wheelchair-friendly access from the west, which was previously not available.



IMAGE: Stuart Park Pathway

Work with Shellharbour Council and others to extend the Lake Illawarra cycleway

Through the establishment of the Lake Illawarra Estuary Management Committee and supporting Memorandum of Understanding, future investigative work will be undertaken following resource allocation.

Council continues to maintain, renew and extend section of shared path around the Lake on Council land through allocation of budgets within Capital and Maintenance Programs.

Accelerate capital program for footpath renewal

During the quarter the following projects have either commenced construction or been completed:

- Farmborough Road; shops #7 to #29, south side, Unanderra, (Completed)
- Market Street; Corrimal Street to Queens Street, Wollongong, (Completed)
- 4 4B Flinders Street, footpath, North Wollongong, (Completed)
- Farmborough Road; Jenkins to Jemima Streets, south side, Unanderra, (Completed)

A following renewal footpath projects are at various stages of design:

- Northcliffe Drive, Kully Way to Griffin Street, North, Warrawong
- Farmborough Road; Jenkins to Jemima Streets, south side, Unanderra.

Further to this, Trial trenching work for the Blue Mile Tramway was done in July to test the equipment and see if it would work how we need it to. The trial went so well, in September we started doing the remainder of the trenching work to make things go faster when the major portion of work on this project starts in 2017.



IMAGE: Blue Mile Tramway trenching

Continue to construct Stage 1 of the Grand Pacific Walk

Design documentation for the construction of Stage 1 which includes Sections 1, 2 and 4 has been completed. Section 1 will be from Stoney Creek bridge to Tom and Norma Rest Area, Section 2 will be from Tom and Norma Rest Area to Lower Coast Road and Section 4 will be from Murrawal Road to the Stanwell Park shops. Tenders for the works have been called and will close in late October 2016. Constructions of the works are scheduled to commence in February 2017.

| PERFORMANCE MEASURES |
|---|
| Delivery of Council's Capital Program 15.6% (15/16 Q1 –14%) |
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HOW WE PERFORMED AGAINST OUR BUDGETS

WOLLONGONG CITY COUNCIL

Budget 2016-2017

The graph below shows Council's expenses from ordinary activities by expenses by for the quarter:

| Expense Type (\$'M) | YTD Actual | Proposed Budget |
|---|------------|-----------------|
| Employee Costs less Internal Charges | 25.8 | 106.4 |
| Borrowing Costs | 1.0 | 4.1 |
| Materials & Contracts | 17.8 | 89.4 |
| Depreciation | 16.1 | 64.8 |
| Loss on Disposal of Assets | 0.0 | 0.0 |
| Total | 60.8 | 264.7 |



The graph below shows Council's revenue from ordinary activities by revenue type for the quarter:

| Income Type (\$M) | YTD Actual | Proposed Budget |
|------------------------------|------------|-----------------|
| Rates & Annual Charges | 46.5 | 184.1 |
| Other Revenue | 2.1 | 9.8 |
| Profit on disposal of Assets | 0.0 | 0.0 |
| Grants & Contributions | 7.4 | 30.0 |
| User Fees & Charges | 9.2 | 34.5 |
| Interest & Investments | 1.4 | 4.5 |
| Total | 66.5 | 262.9 |



REPORT OF MANAGER FINANCE

WOLLONGONG CITY COUNCIL

The review of financial estimates carried out as at 30 September shows a continued improvement in Council's underlying financial performance and substantial progress towards finalising the four year "Secure our Future" targets set in 2014.

While the revised 2016-17 forecast Operating Result [pre capital] indicates a net deterioration of \$1.8 million, this includes one off adjustments for the introduction and reintroduction of projects funded primarily from prior year's revenues (\$2.1 million) that were restricted for the delivery of these projects. The inclusion of these projects will not impact the Fund Results as the proposed expenditure will be offset by a transfer of funds from restricted cash.

The revised Operating Result [pre capital] also includes a number of predominately positive adjustments that have been recognised for the current and in part for future year budgets including:

- Increased Tourist Park Revenue \$0.45 million (F)
- Increased recovery of Capital Project Design and Delivery costs \$0.48 million (F)
- Market Street Car Park Rental \$0.26 million (U)
- Plant & Vehicle Fuel \$0.25 million (F)
- Emergency Service Contribution \$0.19 million (U)
- Interest on Investments \$0.30 million (F)

Where possible the recurrent improvement in specific operating performance (\$0.7 million) has been allocated against the remaining Secure our Future targets (that have been held as a negative expense line in the budget) and therefore does not show as an improvement in the reported result. The proposed allocation and implications of this approach are detailed later in this report.

The Operating Result (inclusive of capital grants and contributions) indicates a reduction of \$15.9 million compared to the original budget. In addition to the variations discussed above, this change includes proposed decreases to West Dapto developer contributions income (\$9.7 million) and a net decrease in capital grants of \$4.4 million. It is anticipated that these funds will be received in future periods.

After the operational and capital adjustments, it has been proposed that the overall Funds Result not be changed. This position would allow an additional \$0.5M of funds improvements that are non-recurrent to be transferred to the Strategic Projects restricted asset for future year's expenditure.

The following table and comments provides a summary view of the organisation's revised forecast and proposed variations for 2016-17 financial year based on year to date performance and anticipated results to June 2017.

| | | Original | Current | Proposed | YTD | Proposed |
|---------------------------------|------|--------------|---------|----------|--------|-----------|
| FORECAST FOSTITION | | Budget | Budget | Budget | Actual | Variation |
| KEY MOVEMENTS | | 1-Jul | 30-Sep | 30-Sep | 30-Sep | Q1 |
| Operating Revenue | \$M | 262.0 | 262.0 | 262.9 | 66.5 | 0.9 |
| Operating Costs | \$M | (262.1) | (262.1) | (264.7) | (60.8) | (2.7) |
| Operating Result [Pre Capital] | \$M | (0.0) | (0.0) | (1.8) | 5.7 | (1.8) |
| Capital Grants & Contributions | \$M | 32.9 | 32.9 | 18.8 | 2.4 | (14.1) |
| Operating Result | \$M | 32.9 | 32.9 | 17.0 | 8.1 | (15.9) |
| | | | | | | |
| Funds Available from Operations | \$M | 61.8 | 61.8 | 61.8 | 19.6 | (0.0) |
| | | | | | | |
| Capital Works | | 101.6 | 101.6 | 100.6 | 15.5 | (1.0) |
| Transfer to Restricted Cash | | - | 2.6 | 8.1 | 8.1 | 5.5 |
| Contributed Assets | | - | - | (-) | - | - |
| Borrowing Repaid | | 7.3 | 7.3 | 7.3 | 0.9 | - |
| Funded from: | | | | | | |
| Operational Funds | ¢M | 61 0 | 61.0 | 61 0 | 10.6 | (0,0) |
| Other Funding | ¢M | 01.0 47.1 | 17.1 | 51 F | 19.0 | (0.0) |
| | ΦIVI | 47.1 | XU | 51.5 | 10.1 | 4.0 |
| Total Funds Surplus/(Deficit) | \$M | (0.1) | (2.7) | (2.7) | 5.2 | - |

Details of variations are discussed through this report with favourable changes identified as (F) and unfavourable (U) with a more comprehensive list is provided in Table 6.

- 1 Income & Expense
 - Ÿ
 Rates \$0.1 million (F). Minor variation to total rate revenues
 - V User Charges and Fees \$1.0 million (F). The key improvements include an adjustment to Tourist Park income (\$447K, \$335K recurrent), improvements in Development Assessment income (\$369K) that are offset by requirement for additional resourcing and other more minor items.
 - İ Interest and Investment Income \$0.3 million (F). Proposed variance is due to increase interest associated with higher cash holdings from the favourable 2015-16 financial year result and current year expenditure trends. Part of this (\$130K) relates to Restricted Assets that attract interest and is offset by transfer to reserves.
 - V Other Revenue \$0.4 million (U). This decrease in income is due to the renewed lease for Market Street car park (\$257K) and an increase in the level at which outstanding rates are actioned legally (\$141K) and other more minor items.
 - Ÿ Grants and Contributions Capital \$14.1 milion (U). This variation is mostly due to the timing of Developer Contributions for West Dapto (\$9.9M) and timing of grants relating to capital works including the Restart Illawarra program (\$6.3M).
 - Ÿ Employee Costs \$1.3 million (U). Employee cost projections have increased due to resourcing requirements for funded projects (\$515K), additional activity in the current year for the Development Assessment area (\$297K), temporary resourcing of Regulation & Enforcement projects (\$233K), additional delivery management for capital and other projects (\$98K) and other minor items. These variations do not flow through to the Funds result as they are offset by restricted cash, application of operational contingency budget, or additional income.

- Y Materials, Contracts and Other Expenses \$1.9 million (U). Proposed budget adjustments relate to the introduction or adjustment of funded projects (\$1.6 million) and increased emergency services contributions (\$190K). This has been partially offset by reduced fuel cost resulting from lower than projected pricing (\$250K) and various other more minor adjustments.
- Ϋ Internal Charges \$0.6 million (F). The favourable variance is generally due to a higher overall level of internal resources allocated for capital delivery based on current trends.

2 Capital Budget

The capital projections that have been approved by Council through the Monthly Financial reporting process show a decrease to the program from \$101.6 million to \$100.6 million that is related to the rephasing of the delivery of some funded projects.

3 Proposed Projects funded from Internal Restrictions

A number of projects are proposed in this review to be reintroduced from prior years and/or introduced. These projects have generally proposed to be funded from Internal Restricted Assets. The proposed adjustments to forecasts have been reviewed and are considered to be in compliance with Section 23A of the Act in the context of the merger proposal.

| Projects Ir | ntroduced in Sept | ember Quarterly Review | | |
|--|-------------------|--------------------------|---------|---------|
| Project | Duration | Funding | 2016/17 | 2017/18 |
| Property Investment Planning & Analysis | Fixed Duration | Property Investment Fund | 200 | 200 |
| Real Time Parking System Investigation | Fixed Duration | Strategic Projects | 50 | |
| Commercial Activation Study for Mt Keira Summit Park | Fixed Duration | Strategic Projects | 50 | |
| West Dapto Review | Fixed Duration | Strategic Projects | 316 | |
| Mt Keira Masterplan & Plan of Mgmt* | Fixed Duration | Strategic Projects | 15 | |
| Sandon Point Aboriginal Heritage Impact Study* | Fixed Duration | Strategic Projects | 23 | |
| Arts Precinct Master Plan* | Fixed Duration | Strategic Projects | 17 | |
| Integrated Facilities Planning* | Fixed Duration | Strategic Projects | 46 | |
| West Dapto Aquatic Facility Investigations* | Fixed Duration | Strategic Projects | 40 | |
| Urban Greening Strategy* | Fixed Duration | Strategic Projects | 20 | |
| Mt Keira Geotechnical Study* | Fixed Duration | Strategic Projects | 11 | |
| Reinstate Waterfall Cemetery* | Fixed Duration | Future Projects | 180 | |
| * Projects in progess at 30 June 2016 now reintroduced | | | | |

4 Cash & Investments

The decrease in projected cash and investments of \$6.6 million at September is due to the decrease in Developer Contributions and Capital Grants in the current year and increased expenditure that is partially offset by the receipt of the LIRS 3, part 2 subsidised loan and net increased income.

The Available Funds forecasts shown below excludes movement in externally and internally restricted cash such as timing of special purpose grants and progress of funded projects. There is a projected increase in Available Funds at September of \$0.8 million that is due to a prior year adjustment.

| CASH, INVESTMENTS & AVAILABLE FUNDS | | | | | | | |
|-------------------------------------|-------------------|-------------------------------|----------------------------|------------------------------------|--|--|--|
| | Actual 2015/16 | Original Budget 2016/17 | September QR 2016/17 | Actual Ytd 30 September 2016 | | | |
| | \$M | \$M | \$M | \$M | | | |
| Total Cash and Investments | 154.0 | 133.7 | 127.0 | 171.2 | | | |
| Attributed to: | | | | | | | |
| EXTERNAL RESTRICTIONS | 15 4 | 24 9 | 15.8 | 16.1 | | | |
| Specific Purpose Unexpended Grants | 4 9 | 96 | 3.3 | 5.6 | | | |
| Special Rates Lew City Centre | 4.5 0 1 | 0.1 | 0.0 | 0.0 | | | |
| Unexpended Loans | 25.4 | 27.6 | 27.8 | 30.4 | | | |
| Domestic Waste Management | 10.0 | 10.8 | 9.5 | 10.2 | | | |
| Private Subsidies | 3.9 | 3.6 | 4.1 | 4.3 | | | |
| West Dapto Home Assistance | 9.9 | 9.9 | 10.1 | 10.0 | | | |
| Stormwater Management Charge | 1.4 | 1.2 | 0.8 | 1.4 | | | |
| Carbon Pricing | 4.4 | 1.1 | 1.1 | 3.8 | | | |
| Total External Restrictions | 75.3 | 88.8 | 72.7 | 81.8 | | | |
| Internal Restrictions | | 110 | , | | | | |
| Property Investment Fund | 8.1 | 8.3 | 8.2 | 8.2 | | | |
| Future Projects | 5.6 | 3.5 | 3.3 | 5.3 | | | |
| Property Development | 4.1 | 2.5 | 2.5 | 4.0 | | | |
| Strategic Projects | 23.9 | 17.9 | 23.0 | 26.0 | | | |
| Cor Parking strategy | 0.5 | 0.5 | 0.4 | 0.3 | | | |
| MacCabe Park Development | 0.9 | 0.7 | 1.1 | 0.9 | | | |
| Darcy Wentworth Park | 0.0 | 0.2 | 0.2 | 0.9 | | | |
| Garbage Disposal Facility | 10.0 | 2.2 | 3.0 | 10.3 | | | |
| Telecommunications Revenue | 0.2 | 0.2 | 0.2 | 0.2 | | | |
| West Dapto additional rates | 0.5 | 0.1 | 0.7 | 0.7 | | | |
| Natural Areas | 0.5 | 0.4 | 0.3 | 0.4 | | | |
| Lake Illawarra Management Fund | 0.1 | 0.1 | 0.1 | 0.1 | | | |
| Total Internal Restrictions | 55.3 | 37.6 | 43.7 | 57.6 | | | |
| Available Cash | 23.5 | 7.3 | 10.7 | 31.8 | | | |
| Net Pavable & Receivables | (9.1) | 4 0 | 15 | (12 1) | | | |
| Current pavables | (34.9) | (23.6) | (23.8) | (40.0) | | | |
| Receivables | 22.9 | 23.0 | 22.0 | 21.0 | | | |
| Other | 2.9 | 4.6 | 3.3 | 6.9 | | | |
| Available Funds | 14.4 | 11.3 | 12.1 | 19.7 | | | |
| | | | | | | | |

5 Securing Our Future Outcomes

A set of targets were set as part of the 'Securing Our Future' program that was endorsed by Council through the adoption of the 2014-15 Annual Plan. The four year targets, designed to move Council to a sustainable long term financial position, planned for a number of measures including rate rises, efficiency improvements, service adjustment, and other revenue increases as outlined below.

| Securing Our Future | EFFICIENCY | | SERVICES | REVE | TOTAL | |
|---------------------|--------------|-------------|----------|---------|---------|---------|
| Adopted Outcomes | Lower Impact | High Impact | | Rates* | Other | |
| | \$000'S | \$000'S | \$000'S | \$000'S | \$000'S | \$000'S |
| 2014/15 | 1,000 | | 1,000 | 4,950 | 120 | 7,070 |
| 2015/16 | 1,000 | | 200 | 4,560 | 250 | 6,010 |
| 2016/17 | 1,500 | 500 | 200 | 4,990 | 130 | 7,320 |
| 2017/18 | | 500 | 100 | | | 600 |
| Total | 3,500 | 1,000 | 1,500 | 14,500 | 500 | 21,000 |

Over the past two financial years Council has progressed the Securing Our Future outcomes and achieved results in excess of the set targets. In that time an additional \$15.3 million of surplus funds from non-recurrent improvements have been transfer to the Strategic Projects restricted asset for future use. The September Review proposes the transfer of a further \$0.5 million to the Strategic Projects restricted asset.

At the beginning of 2016-17 the remaining improvement targets which require recurrent operational improvements were as follows:

| SECURING OUR FUTURE TARGETS | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---------|---------|---------|---------|---------|
| | \$000's | \$000's | \$000's | \$000's | \$000's |
| Efficiency Improvments - Lower Impact (Distributed to Services) | 437 | 449 | 462 | 476 | 489 |
| Efficiency Improvements - High Impact | • | 263 | 259 | 259 | 258 |
| Service Adjustments | 276 | 500 | 513 | 526 | 540 |
| Revenue - Rates | | | | | |
| Revenue - Other | | | | | |
| TOTAL | 713 | 1,212 | 1,234 | 1,261 | 1,287 |
| | | | | | |

Council has continued with significant and sustainable improvement against budget through operational savings and income performance. At this review an additional \$713K is available, primarily from reduced operational employee cost in design and delivery and income from areas such as Tourist Parks. We are now in a position where the recurrent improvements from 'Efficiency' and 'Additional Revenue' targets have exceeded the Secure our Future targets. This provides opportunity to reduce the necessity to seek further cuts, that were forecast through 'Service Adjustments' in future periods, if desired.

Allocation of the additional 'Efficiency" improvements to the overall Secure our Future target would reduce future requirements to the targets outlined below. It is proposed that continued effort on achieving further efficiency savings or revenue improvements during the current year as a single target should be sufficient to finalise the Secure our Future program without further service adjustment.

| SECURING OUR FUTURE TARGETS | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---------|---------|---------|---------|---------|
| Remaining Target proposed post September QR | \$000's | \$000's | \$000's | \$000's | \$000's |
| TOTAL | | (436) | (212) | (226) | (232) |
| | | | | | |

While based on current performance it is considered the targets can be fully achieved in this year, it is important to remember that the sustainability targets set through Secure our Future were aimed at providing sustainability at the current service levels, by allowing sufficient funding to carry out our existing services at existing levels and replace existing assets with equivalents as required over a period of time. Council will need to consider future expectations and direction through its planning process which may well include desire to achieve higher levels or breadth of service delivery through additional improvement to operational performance.

6 Long Term Financial Projections

Key Performance Information shown below is based on the financial forecasts that are contained in the Revised Delivery Program 2012-17 and Resourcing Strategy 2012-22 that were adopted by Council on 17 February 2014 and updated through the Adoption of the 2016-17 Annual Plan. Council has a continuous budget process that revises the long term forecasts in line with quarterly changes and resets assumptions and indices annually or where new information leads to an immediate requirement to change the indices.

The revised long term projections are indicative at this stage and will continue to be reviewed through the annual planning process and to reflect more recent information from both external sources and internal analysis.

Long Term Operating Surplus/(Deficit) [pre capital]

The Operating Result [pre capital] provides an indication of the long term viability of Council. In broad terms, a deficit from operations indicates that Council is not earning sufficient revenue to fund its ongoing operations (services) and continue to renew existing assets.

The 2016-17 revised result is impacted by the introduction of new, as well as projects that were in progress during 2015-16 but were not completed during the prior year.

These projections are preliminary and are subject to review through the 2016-17 planning process.



Funds Available from Operations

The Funds Available from Operations is a primary objective of Council over time to provide for effective renewal of assets and growth in assets.

The following graph also shows forecast deprecation expenses compared to Funds available from Operations. This is an important indicator as it demonstrates the capacity to generate sufficient funds from operations to meet asset renewal requirements. The graphs generally show Council achieving its target of providing funds from operations equal to depreciation. The Adopted Plan (green line) that is provided for comparison purposes indicated a divergence between Funds Available from Operations and Depreciation in the latter years. This was largely due to surplus funds being allocated to Strategic Projects restricted cash as longer term asset requirements have not yet been fully defined. These funds have now been included in the capital budget to allow a more holistic and consistent consideration of the capital program in the latter years.



Available Funds

Available Funds are the uncommitted funds of an organisation that assist in meeting the short term cash requirements, provide contingency for unexpected costs or loss of revenue, and provide flexibility to take advantage of opportunities that may arise from time to time. Council's Financial Strategy has a target to achieve and maintain an Available Funds position between 3.5% and 5.5% of operational revenue [pre capital].

The Available Funds remain largely above Council's Financial Strategy target of 3.5% to 5.5% of operational revenue [pre capital]. Based on the 2016-17 Adopted Annual Plan the target range for Available Funds is between \$9.2 million and \$11.9 million (lower range) and between \$14.4 million and \$18.7 million (upper range) over the life of the Long Term Financial Plan. The revised projections that include the updated indices and proposed September Quarterly Review adjustments indicate that Council is within the above parameters.



Table 5

| 2016 Qu me Sta 135 194 153 105 161 147 | Iterity Rev Current Budget \$'000 Itement 184,035 33,594 4,253 10,205 29,961 00 47 | View YTD Actual YTD \$'000 46,490 9,158 1,353 2,092 7,200 | Proposed Variation \$'000 71 951 265 (449) | Proposed Budget \$'000 184,106 34,545 4,517 9,756 |
|--|--|--|--|---|
| ne Sta 135 194 153 105 161 147 | Current Budget \$'000 tement 184,035 33,594 4,253 10,205 29,961 | YTD Actual YTD \$'000 46,490 9,158 1,353 2,092 7,209 | Proposed Variation \$'000 71 951 265 (449) | Proposed Budget \$'000 184,106 34,545 4,517 9,756 |
| Ne Sta 035 - 594 - 253 - 205 - 961 - 147 - | 184,035 33,594 4,253 10,205 29,961 | 46,490 9,158 1,353 2,092 7,300 | 71 951 265 (449) | 184,106 34,545 4,517 9,756 |
| 035 594 253 205 961 147 | 184,035 33,594 4,253 10,205 29,961 | 46,490 9,158 1,353 2,092 | 71 951 265 (449) | 184,106 34,545 4,517 9,756 |
| 035 594 253 205 961 147 | 184,035 33,594 4,253 10,205 29,961 | 46,490 9,158 1,353 2,092 | 71 951 265 (449) | 184,106 34,545 4,517 9,756 |
| 035 594 253 205 961 147 | 184,035 33,594 4,253 10,205 29,961 | 46,490 9,158 1,353 2,092 | 71 951 265 (449) | 184,106 34,545 4,517 9,756 |
| 594 253 205 961 947 | 33,594 4,253 10,205 29,961 | 9,158 1,353 2,092 7,200 | 951 265 (449) | 34,545 4,517 9,756 |
| 253 205)61)47 | 4,253 10,205 29,961 | 1,353 2,092 7,300 | 265 (449) | 4,517 9,756 |
| 205 961 947 | 10,205 29,961 | 2,092 | (449) | 9,756 |
| 961 947 | 29,961 | 7 200 | | |
| 947 | 00.047 | 7,399 | 47 | 30,008 |
| | 32,947 | 2,362 | (14,129) | 18,818 |
| | | | | |
| 0 | 0 | (10) | 0 | 0 |
| 994 | 294,994 | 68,844 | (13,245) | 281,750 |
| 960 | 118,193 | 28,828 | 1,323 | 119,283 |
| 131 | 4 131 | 1 009 | 0 | 4 131 |
|)66 | 89.032 | 18 124 | 1 894 | 90,959 |
| 340 | 64 840 | 16,121 | 0 | 64 840 |
| 52) | (12,352) | (2.985) | (562) | (12 914) |
| 66) | (1,566) | (308) | 6 | (1,560) |
|)79 | 262,278 | 60,769 | 2,661 | 264,740 |
| 16 | 32,717 | 8,076 | (15,906) | 17,009 |
| 16 | 32,717 | 8,076 | (15,906) | 17,009 |
| 31) | (230) | 5,713 | (1,777) | (1,808) |
| <u>D%)</u> | (0.1%) | 8.3% | 13.4% | (0.5%) |
| | 0 994 960 131 066 840 152) 166 079 916 916 916 916 | 0 0 0 994 294,994 960 118,193 131 4,131 066 89,032 840 64,840 152 (12,352) 166 (1,566) 079 262,278 116 32,717 311 (230) 0% (0.1%) | 0 0 (10) 994 294,994 68,844 960 118,193 28,828 131 4,131 1,009 066 89,032 18,124 840 64,840 16,101 152) (12,352) (2,985) 166) (1,566) (308) 079 262,278 60,769 116 32,717 8,076 311 (230) 5,713 0% (0.1%) 8.3% | 0 0 (10) 0 994 294,994 68,844 (13,245) 960 118,193 28,828 1,323 131 4,131 1,009 0 066 89,032 18,124 1,894 840 64,840 16,101 0 152) (12,352) (2,985) (562) 166 (1,566) (308) 6 016 32,717 8,076 (15,906) 16 32,717 8,076 (15,906) 311 (230) 5,713 (1,777) 9% (0.1%) 8.3% 13.4% |

| Funding Statement | | | | | | | | |
|--|-----------|----------|----------|----------|-----------|--|--|--|
| Net Operating Result for the Year | 32,916 | 32,717 | 8,076 | (15,906) | 17,009 | | | |
| Add back : | | | | | | | | |
| - Non-cash Operating Transactions | 78,451 | 78,451 | 19,570 | 226 | 78,677 | | | |
| - Restricted cash used for operations | 15,013 | 15,212 | 2,670 | 1,881 | 16,894 | | | |
| - Income transferred to Restricted Cash | (52,636) | (52,636) | (7,763) | 13,799 | (38,837) | | | |
| - Payment of Accrued Leave Entitlements | (11,943) | (11,943) | (2,949) | (0) | (11,943) | | | |
| - Payment of Carbon Contributions | 0 | 0 | 0 | 0 | 0 | | | |
| Funds Available from Operations | 61,801 | 61,801 | 19,604 | 0 | 61,800 | | | |
| Advances (made by) / repaid to Council | 0 | 0 | 0 | 0 | 0 | | | |
| Borrowings repaid | (7,285) | (7,285) | (929) | 0 | (7,285) | | | |
| Operational Funds Available for Capital Budget | 54,516 | 54,516 | 18,675 | 0 | 54,516 | | | |
| CAPITAL BUDGET | | | | | | | | |
| Assets Acquired | (101,627) | (99,271) | (15,522) | 1,049 | (100,577) | | | |
| Contributed Assets | 0 | 0 | 0 | 0 | 0 | | | |
| | | | | | | | | |
| Transfers to Restricted Cash | 0 | (2,600) | (8,100) | (5,500) | (8,100) | | | |
| Funded From :- | | | | | | | | |
| - Operational Funds | 54,516 | 54,516 | 18,675 | 0 | 54,516 | | | |
| - Sale of Assets | 1,743 | 1,743 | 199 | 0 | 1,743 | | | |
| - Internally Restricted Cash | 21,770 | 19,586 | 1,593 | (2,381) | 19,389 | | | |
| - Borrowings | 0 | 0 | 5,500 | 5,500 | 5,500 | | | |
| - Capital Grants | 11,065 | 11,357 | 953 | 1,551 | 12,616 | | | |
| - Developer Contributions (Section 94) | 6,008 | 6,109 | 668 | 121 | 6,129 | | | |
| - Other Externally Restricted Cash | 5,620 | 5,025 | 1,056 | (595) | 5,025 | | | |
| - Other Capital Contributions | 850 | 880 | 177 | 255 | 1,105 | | | |
| TOTAL FUNDS SURPLUS / (DEFICIT) | (55) | (2,655) | 5,199 | 0 | (2,655) | | | |

Table 6

| MAJOR VARIATIONS | | | | | | | |
|--|---------------------------------|---------|---------|----------------|--|--|--|
| Compared to Budget \$'000s | Offsetting Items for Fund | Surplus | Deficit | Net by type | | | |
| REVENUES FROM ORDINARY ACTIVITIES | | | | | | | |
| Rates & Annual Charges | | 71 | | 71 | | | |
| User Charges & Fees | | | | | | | |
| Tourist Parks | | 447 | | | | | |
| Development Assessment & Certification | 339 | 30 | | | | | |
| Park & Sports field Income | 60 | 66 | | 051 | | | |
| Unter | 09 | | | 901 | | | |
| Increased cash holdings nartly offset by transfer to reserve | 130 | 135 | | 265 | | | |
| Other Revenue | 150 | | | 203 | | | |
| Market St Car Park Wollongong | | | (257) | | | | |
| Recovery Legal Costs - Rates | | | (141) | | | | |
| Other | (69) | 18 | | (449) | | | |
| | | | | ~ / | | | |
| Expenses FROM ORDINART ACTIVITIES | | | | | | | |
| City Planning Additional Cover Staff | (297) | | | | | | |
| Introduction of funded projects | | | | | | | |
| West Dapto Review | (455) | | | | | | |
| Pt Kembla 2505 Study | (60) | | | | | | |
| Other | 3 | | | | | | |
| Beaches & Pools Wages Reductions | | 83 | | | | | |
| Temporary Development Project Officers | (233) | | | | | | |
| Civil Asset Engineer | (98) | | | | | | |
| Paper Storage Reduction | (73) | | | (1 | | | |
| Other | (187) | | (6) | (1,323) | | | |
| Attacht | | | | | | | |

Table 6 (cont'd)

| MAJOR VARIATIONS | | | | | | | | |
|---|---------------------------------|-----------------|---------|----------------|--|--|--|--|
| Compared to Budget \$'000s | Offsetting Items for Fund | Surplus | Deficit | Net by type | | | | |
| Materials, Contracts & Other Expenses | | | | | | | | |
| Legal Expenses | 64 | | | | | | | |
| Motor Vehicle and Major Plant Fuel | | 250 | | | | | | |
| Emergency Services Contributions | | | (190) | | | | | |
| Adjustments to funded projects | | | | | | | | |
| Community Transport | 717 | | | | | | | |
| Property Investment Fund Land Sales | (200) | | | | | | | |
| West Dapto Review | (154) | | | | | | | |
| Natural Areas and Environmental | (579) | | | | | | | |
| Asset Protection Zone & Fire Trails | (122) | $\mathbf{\cap}$ | | | | | | |
| Pt Kembla 2505 Study | (68) | | | | | | | |
| Other | (94) | | | | | | | |
| Introduction of Business Proposals | | | | | | | | |
| Emergency Services Property Levy | (212) | | | | | | | |
| Domestic Waste Material Recovery | (164) | | | | | | | |
| Drainage & Barrier Inspections | (104) | | | | | | | |
| Commercial Activation Mt Keira Summit Park* | (50) | | | | | | | |
| Real-time Parking Signage Investigation* | (50) | | | | | | | |
| Playground Safety | (50) | | | | | | | |
| Other | (47) | | | | | | | |
| Prior Year Projects requiring completion | | | | | | | | |
| Reinstating Waterfall Cemetery* | (180) | | | | | | | |
| Integrated Facilities Planning* | (46) | | | | | | | |
| West Dapto Aquatic Facility Investigations* | (40) | | | | | | | |
| Other Strategic Projects Funded* | (96) | | | | | | | |
| Other | (69) | | | | | | | |
| Southern Gateway Remediation | (70) | | | | | | | |
| Operational Contingency | 444 | | | | | | | |
| Telecommunication Generator Fuel | | | (45) | | | | | |
| Sustainability Implementation Program | | | (92) | | | | | |
| Efficiency Target allocations | (712) | | | | | | | |
| Various other adjustments | 46 | 20 | | (1,894) | | | | |
| Internal Charges | | | | | | | | |
| Project Delivery Labour Recovery | 475 | 5 | | | | | | |
| Infrastructure Labour Recovery | 98 | | | | | | | |
| Other | (22) | | (1) | 555 | | | | |

*FUNDED FROM THE STRATEGIC PROJECTS OR FUTURE PROJECTS RESERVE

Table 6 (cont'd)

| MAJOR VARIA | TIONS | | | | | | |
|--|-----------------------------|------------|---------|---------|----------------|--|--|
| Compared to Budget \$'000s | Offsetti Items f Fund | ng or | Surplus | Deficit | Net by type | | |
| Cronte & contribution Operating | | | | | | | |
| Additional grants advised transferred to reserve | | | | | | | |
| Community Services | | (361) | | | | | |
| Emergency Services Property Levy | | 212 | | | | | |
| Flood Mitigation | | 117 | | | | | |
| Financial Assistance Grant | | | 73 | | _ | | |
| Other | | 5 | | | 4 | | |
| Operating Variation [pre capital] | (2, | 243) | 1,198 | (732) | (1,777 | | |
| Capital Grants & Contributions | | (| 7 | | | | |
| Developer Contributions | | | | | | | |
| Calderwood | (0 | 174 | | | | | |
| West Dapto | (9 | ,887) | • | | | | |
| Restart Illawarra Deferral | (6 | 319) | | | | | |
| Roads to Recovery | | ,244 | | | | | |
| Black Spot Funding Introduced | | 878 | | | | | |
| National Stronger Regions | | (720) | | | | | |
| Active Transport Funding | | 464 | | | | | |
| Other | | 37 | | | (14,129 | | |
| Operating Variation [post capital] | (16, | 372) | 1,198 | (732) | (15,906 | | |
| FUNDING STATEMENT | | | | | | | |
| Non Cash Expenses | | | | | | | |
| Leave Liability | | 226 | | | 22 | | |
| Restricted Cash Used for Operations | | | | | | | |
| Internally funded project adjustments | | | | | | | |
| Strategic/Future Projects Reserve | | 462 | | | | | |
| Property Investment Fund Land Sales | | 200 | | | | | |
| Natural Areas & Environmental Sustainability | | 208 | | | | | |
| Externally funded project adjustments | | 440 | | | | | |
| Domestic Waste Receive | | 002 164 | | | | | |
| Other | | 185 | | | 1.88 | | |
| Income Transferred to Restricted Cash | | | | | ., | | |
| Developer Contributions | Ģ | 9,713 | | | | | |
| Grants & contributions - capital | 4 | 1,416 | | | | | |
| September 2016 QR Result | | | | (489) | | | |
| Grants & contributions - operational | | 260 | | | | | |
| Interest applicable to restricted assets | | (130) | | | | | |
| Other | | 6 | 23 | | 13,79 | | |
| OPERATIONAL FUNDS AVAILABLE FOR CAPITAL | | - | 1,221 | (1,221) | - | | |
| CAPITAL BUDGET | | | | | | | |
| Decrease in capital program | (1 | ,049) | | | | | |
| Decrease in associated funding | 1 | l,049 | | | - | | |
| | | | | 4 | | | |
| TOTAL FUNDS SURPLUS/(DEFICIT) | | - | 1.221 | (1 221) | - | | |

| | CAPITAL PROJECT REPORT | | | | | | | |
|---|------------------------------------|---------------------------------|--|---------------------------------------|-------------------------------|---------------------------------------|-------------------------------|--|
| | as at t | he period er | nded 30th Se | ptember 201 | 16 | | | |
| | \$'0 | 00 | \$'0 | 00 | | \$'00 | 0 | |
| | Current | Pudaot | Dropocod | Rudget | YTD Evronditure | voriot | | |
| Program | Expenditure | Other Funding | Expenditure | Other Funding | Expenditure | Expenditure | Other Funding | |
| Roads And Related Assets | | | | | | | | |
| Traffic Facilities Public Transport Facilities Roadworks | 700 271 12,720 | (550) (20) (3,600) | 1,900 271 13,610 | (1,561) (20) (4,315) | 421 5 2.555 | 1,200 (0) 890 | (1,011) 0 (715) | |
| Bridges, Boardwalks and Jetties | 1,940 | (100) | 1,939 | (100) | 496 | (1) | 0 | |
| Total Roads And Related Assets | 15,631 | (4,270) | 17,720 | (5,996) | 3,477 | 2,089 | (1,726) | |
| West Dapto | | | | | | | | |
| West Dapto Infrastructure Expansion | 9,296 | (8,826) | 9,296 | (8,826) | 533 | 0 | 0 | |
| Total West Dapto | 9,296 | (8,826) | 9,296 | (8,826) | 533 | 0 | 0 | |
| Footpaths And Cycleways | | | | | | - | | |
| Footpaths | 3,953 | (1,000) | 4,408 | (1,650) | 1,286 | 455 | (650) | |
| Cycle/Shared Paths Commercial Centre Upgrades - Footpa | 9,485 5,615 | (6,285) (1,995) | 7,540 4,115 | (3,540) (1,000) | 837 1,147 | (1,945) (1,500) | 2,745 995 | |
| Total Footpaths And Cycleways | 19,053 | (9,280) | 16,063 | (6,190) | 3,269 | (2,990) | 3,090 | |
| Carparks | | | | 0 | | | | |
| Carpark Construction/Formalising Carpark Reconstruction or Upgrading | 350 1,221 | 0 0 | 350 1,221 | 0 | 78 468 | 0 0 | 0 0 | |
| Total Carparks | 1,571 | 0 | 1,571 | 0 | 546 | 0 | 0 | |
| Stormwater And Floodplain Manag | ement | | | | | | | |
| Floodplain Management | 2,550 | (560) | 2,433 | (560) | 271 | (117) | 0 | |
| Stormwater Management Stormwater Treatment Devices | 1,650 250 | (550) (175) | 1,768 373 | (550) (175) | 66 201 | 118 123 | 0 | |
| Total Stormwater And Floodplain Ma | 4,450 | (1,285) | 4,574 | (1,285) | 537 | 124 | 0 | |
| Buildinas | | | | | | | | |
| Cultural Centres (IPAC, Gallery, Town Administration Buildings Community Buildings Public Facilities (Shelters, Toilets etc. Carbon Abatement | 1,100 950 12,704 720 0 | 0 0 (1,960) (170) 0 | 1,100 1,475 11,128 2,020 1,000 | 0 0 (1,743) (170) (1,000) | 9 65 2,886 493 15 | 0 525 (1,576) 1,300 1,000 | 0 0 217 0 (1,000) | |
| Total Buildings | 15,474 | (2,130) | 16,723 | (2,913) | 3,469 | 1,249 | (783) | |
| Commercial Operations | | | | | | | | |
| Tourist Park - Upgrades and Renewal | 750 | 0 | 750 | 0 | 5 | (0) | 0 | |
| Crematorium/Cemetery - Upgrades an Leisure Centres & RVGC | 210 150 | 0 0 | 130 150 | 0 0 | 11 2 | (80) 0 | 0 0 | |
| Total Commercial Operations | 1,110 | 0 | 1,030 | 0 | 18 | (80) | 0 | |
| Parks Gardens And Sportfields | | | | | | | | |
| Play Facilities Recreation Facilities Sporting Facilities Lake Illawarra Foreshore | 1,250 1,495 805 150 | (50) (833) (290) 0 | 1,250 2,225 971 50 | (50) (413) (455) 0 | 2 869 318 13 | (0) 730 165 (100) | (0) 420 (165) 0 | |
| Total Parks Gardens And Sportfields | 3,700 | (1,173) | 4,496 | (918) | 1,202 | 795 | 255 | |
| Beaches And Pools | | | | | | | | |
| Beach Facilities | 575 | 0 | 660 | 0 | 29 | 85 | 0 | |
| Rock/Tidal Pools Treated Water Pools | 1,210 1,190 | 0 | 1,825 1,470 | (165) (10) | 595 340 | 615 280 | (165) (10) | |
| Total Beaches And Pools | 2,975 | 0 | 3,955 | (175) | 964 | 980 | (175) | |

| CAPITAL PROJECT REPORT | | | | | | | |
|--|---------------|---------------|--------------|-------------|-------------|-------------|------------|
| | as at t | he period er | nded 30th Se | ptember 201 | 16 | | |
| | \$'000 \$'000 | | | \$'000 | | | |
| | Current . | Dudaat | Dremene | Dudaat | YTD | | |
| Program | Expenditure | Other | Expenditure | Other | Expenditure | Expenditure | Other |
| | | Funding | | Funding | | | Funding |
| Natural Areas | | | | | | | |
| Environmental Management Program Natural Area Management and Rehabi | 0 525 | 0 (250) | 0 354 | 0 (250) | 0 13 | 0 (171) | 0 |
| Total Natural Areas | 525 | (250) | 354 | (250) | 13 | (171) | 0 |
| | | | | | | | |
| Waste Facilities | 6.790 | (6.790) | 5.790 | (5,790) | 657 | (1.000) | 1.000 |
| Whytes Gully Renewal Works | 795 | (795) | 795 | (795) | 10 | 0 | (0) |
| Total Waste Facilities | 4,129 | (4,129) | 4,129 | (4, 129) | 673 | (1,000) | 1 000 |
| | 11,714 | (11,714) | 10,714 | (10,714) | 0/3 | (1,000) | 1,000 |
| Fleet | 1 702 | (0.40) | 1 792 | (040) | 200 | (0) | (0) |
| | 1,783 | (940) | 1,783 | (940) | 280 | (0) | (0) |
| Totarrieet | 1,783 | (940) | 1,783 | (940) | 280 | (0) | (0) |
| Plant And Equipment | 055 | (50) | 055 | | | (2) | |
| Mobile Plant (trucks, backhoes etc.) | 355 3,000 | (53) (750) | 355 3,611 | (1,361) | 9 | (0) 611 | 0 (611) |
| Fixed Equipment | 320 | 0 | 320 | 0 | (0) | (0) | 0 |
| Total Plant And Equipment | 3,675 | (803) | 4,286 | (1,414) | 16 | 611 | (611) |
| Information Technology | | | | | | | |
| Information Technology | 1,160 | 0 | 1,160 | 0 | 77 | 0 | 0 |
| Total Information Technology | 1,160 | 0 | 1,160 | 0 | 77 | 0 | 0 |
| Library Books | | | | | | | |
| Library Books | 1,194 | (66) | 1,193 | (66) | 338 | (0) | 0 |
| Total Library Books | 1,194 | (66) | 1,193 | (66) | 338 | (0) | 0 |
| Public Art | N N | | | | | | |
| Public Art Works Art Gallery Acquisitions | 200 110 | 0 | 200 110 | 0 | 27 4 | (0) (0) | 0 0 |
| Total Public Art | 310 | 0 | 310 | 0 | 31 | (0) | 0 |
| | | | | | | | |
| Emergency Services Plant and Equipm | 1,800 | 0 | 900 | 0 | 4 | (900) | 0 |
| Total Emergency Services | 1,800 | 0 | 900 | 0 | 4 | (900) | 0 |
| | | | | | | | |
| Land Acquisitions | 2,943 | (2,825) | 2,943 | (2,825) | 48 | 0 | 0 |
| Total Land Acquisitions | 2,943 | (2,825) | 2,943 | (2,825) | 48 | 0 | 0 |
| Non-Project Allocations | | | | | | | |
| Capital Project Contingency | 2,984 | 0 | 1,227 | 0 | 0 | (1,757) | 0 |
| Capital Project Plan | 280 | 0 | 280 | 0 | 26 | 0 | 0 |
| Total Non-Project Allocations | 3,264 | 0 | 1,507 | 0 | 26 | (1,757) | 0 |
| GRAND TOTAL | 101,627 | (43,561) | 100.577 | (42.512) | 15,522 | (1.049) | 1.049 |

| WOLLONGONG CITY COUNCIL | | | | | | |
|---|---|---|--|--|--|--|
| | Actual 2016/17 \$'000 | Actual 2015/16 \$'000 | | | | |
| BALANCE SHEET | as at 30/00/16 | as at 30/06/16 | | | | |
| CURRENT ASSETS | | 45 41 50/00/10 | | | | |
| Cash Assets Investment Securities Receivables Inventories Other Assets classified as held for sale Total Current Assets | 127,305 33,806 21,028 6,059 6,907 0 195,105 | 112,276 31,663 21,280 6,028 3,207 0 174,453 | | | | |
| NON-CURRENT ASSETS | | | | | | |
| Non Current Cash Assets Property, Plant and Equipment Investment Properties Westpool Equity Contribution Intangible Assets | 10,085 2,277,227 4,775 1,310 890 2,294,287 | 10,085 2,265,412 4,775 1,310 1,042 2,282,624 | | | | |
| | | 0,457,027 | | | | |
| CURRENT LIABILITIES | 40,034 | 33,258 16 908 | | | | |
| Current Provisions payable > 12 months | 37,858 | 37,858 | | | | |
| Total Current Liabilities | | 0,090 | | | | |
| NON-CURRENT LIABILITIES | 101,434 | 94,604 | | | | |
| Non Current Interest Bearing Liabilities Non Current Provisions | 33,193 44,504 | 33,940 44,031 | | | | |
| Total Non-Current Liabilities | 77,697 | 77,970 | | | | |
| TOTAL LIABILITIES | 179,131 | 172,774 | | | | |
| | 2,310,261 | 2,284,303 | | | | |
| Accumulated Surplus Asset Revaluation Reserve Restricted Assets | 1,185,714 985,155 139,392 | 1,168,876 984,780 130,647 | | | | |
| TOTAL EQUITY | 2,310,261 | 2,284,303 | | | | |

| WOLLONGONG CITY CASH FLOW STATEME as at 30 September 20 | | | |
|---|-----------------------|-------------------|-----|
| | YTD Actual 2016/17 | Actual 2015/16 | |
| | \$ '000 | \$ '000 | |
| CASH FLOWS FROM OPERATING ACTIV | ITIES | | |
| Receipts: | | | |
| Rates & Annual Charges | 44,142 | 174,893 | |
| User Charges & Fees | 25,959 | 33,314 | |
| Interest & Interest Received | (358) | 5,633 | |
| Grants & Contributions | 10,675 | 55,323 | |
| Other | 4,565 | 22,139 | |
| Payments: | (07.070) | (400.070) | |
| Employee Benefits & Un-costs | (27,670) | (100,072) | |
| Materials & Contracts | (12,896) | (56,091) | |
| Borrowing Costs | (328) | (1,547) | |
| Other | (8,801) | (37,388) | |
| Net Cash provided (or used in) Operating Activities | 35,288 | 96,204 | |
| CASH FLOWS FROM INVESTING ACTIVIT | TIES | | |
| Receipts: | | | |
| Sale of Infrastructure, Property, Plant & Equipment | 199 | 919 | |
| Deferred Debtors Receipts | - | - | |
| Payments: | | | |
| Purchase of Investments | - | - | |
| Purchase of Investment Property | - | - | |
| Purchase of Infrastructure, Property, Plant & Equipment | (17,316) | (81,467) | |
| Purchase of Interests in Joint Ventures & Associates | - | - | |
| Net Cash provided (or used in) Investing Activities | (17,117) | (80,548) | |
| CASH FLOWS FROM FINANCING ACTIVIT | TIES | • | |
| Receipts: | | | |
| Proceeds from Borrowings & Advances | - | | 1 1 |
| Payments: | | | |
| Repayment of Borrowings & Advances | (999) | (6,369) | |
| Repayment of Finance Lease Liabilities | | XU | |
| | | | |
| Net Cash Flow provided (used in) Financing Activities | (999) | (6,369) | |
| Net Increase/(Decrease) in Cash & Cash Equivalents | 17,172 | (15,832) | |
| plus: Cash & Cash Equivalents and Investments - beginning of year | 154,024 | 169,856 | |
| Cash & Cash Equivalents and Investments - year to date | 171,196 | 154,024 | |

| WOLLONGONG CITY COUNCIL | | | | | | | |
|---|------------|---------|--|--|--|--|--|
| CASH FLOW STATEMENT | | | | | | | |
| as at 30 September 201 | 6 | | | | | | |
| | YTD Actual | Actual | | | | | |
| | 2016/17 | 2015/16 | | | | | |
| | \$ '000 | \$ '000 | | | | | |
| | | | | | | | |
| Total Cash & Cash Equivalents and Investments | 171 106 | 154 024 | | | | | |
| - year to date | 171,190 | 134,024 | | | | | |
| Attributable to: | | | | | | | |
| External Restrictions (refer below) | 81,824 | 66,137 | | | | | |
| Internal Restrictions (refer below) | 57,568 | 22,208 | | | | | |
| Unrestricted | 31,804 | 65,679 | | | | | |
| | 171,196 | 154,024 | | | | | |
| • | | | | | | | |
| External Restrictions | | | | | | | |
| Developer Contributions | 16,076 | 11,758 | | | | | |
| RMS Contributions | 527 | 238 | | | | | |
| Specific Purpose Unexpended Grants | 5,083 | 10,910 | | | | | |
| Special Rates Levy Wollongong Centre Improvement Fund | - | - | | | | | |
| Special Rates Levy Wollongong Mall | 181 | 251 | | | | | |
| Special Rates Levy Wollongong City Centre | 37 | 11 | | | | | |
| Local Infrastructure Renewal Scheme | 23,095 | 18,791 | | | | | |
| Unexpended Loans | 7,264 | 12,877 | | | | | |
| Domestic Waste Management | 10,199 | 6,408 | | | | | |
| Private Subsidies | 4,254 | 1,883 | | | | | |
| West Dapto Home Deposit Assistance Program | 9,868 | - | | | | | |
| Stormwater Management Service Charge | 1,368 | 834 | | | | | |
| West Dapto Home Deposits Issued | 85 | | | | | | |
| Carbon Price | 3,787 | 2,176 | | | | | |
| Total External Restrictions | 81.824 | 66.137 | | | | | |
| | 0.10-1 | | | | | | |
| Internal Restrictions | | | | | | | |
| Property Development | 4.032 | (252) | | | | | |
| Property Investment Fund | 8,200 | - | | | | | |
| Strategic Projects | 26,035 | - | | | | | |
| Future Projects | 5,348 | - | | | | | |
| Sports Priority Program | 307 | 850 | | | | | |
| Car Parking Stategy | 902 | 489 | | | | | |
| MacCabe Park Development | 878 | 391 | | | | | |
| Darcy Wentworth Park | 179 | 99 | | | | | |
| Garbage Disposal Facility | 10,273 | 20,281 | | | | | |
| Telecommunications Revenue | 164 | 279 | | | | | |
| West Dapto Development Additional Rates | 737 | 71 | | | | | |
| Southern Phone Natural Areas | 433 | - | | | | | |
| Lake Illawarra Estuary Management Fund | 80 | - | | | | | |
| Total Internal Restrictions | 57 569 | 22 209 | | | | | |
| | 57,500 | 22,200 | | | | | |

The Quarterly Budget Review Statement (QBRS) requirements issued by the Department of Local Government in December 2010 require Council to provide additional information that is included in the following schedules and this report should be read in conjunction with these.

The QBRS guidelines require councils to provide a listing of contracts that have been entered into during the Quarter that have yet to be fully performed. Details of contracts, other than contractors that are on a council's preferred supplier list, that have a value equivalent of 1% of estimated income from continuing operations or \$50K, whichever is the lesser, are required to be provided.

| Contract Listing | | | | | | | | |
|--|--|---------------|------------|------------|-----|--|--|--|
| Budget Review for Quarter ended September 2016 | | | | | | | | |
| Contract Commencement Duration of | | | | | | | | |
| Contractor | Contract Detail & Purpose | Value \$000's | Date | Contract | Y/N | | | |
| Commonwealth Bank | Banking services | 72 | 1/07/2016 | FY 2016/19 | YES | | | |
| Paul Robins | Crown Street West Precinct Stage 2 Paver Laying | 79 | 4/07/2016 | FY 2016/17 | YES | | | |
| Advanced Landscapes | Footway Paving Queens Parade | 103 | 4/07/2016 | FY 2016/17 | YES | | | |
| Cadifem Pty Ltd | Gentleman Rock Pool Repair of Seaward Wall | 208 | 6/07/2016 | FY 2016/17 | YES | | | |
| Project Coordination (Australia) Pty Ltd | Bulli Surf Club Refurbishment | 1,802 | 7/07/2016 | FY 2016/17 | YES | | | |
| SPA (Stabilised Pavements Australia) | Stanleigh Crescent West Wollongong (Therry St to #55) stabilisation | 61 | 15/07/2016 | FY 2016/17 | YES | | | |
| SPA | Alexander Street Fairy Meadow (Balgownie Rd to Breda St) stabilisation | 68 | 21/07/2016 | FY 2016/17 | YES | | | |
| Abergeldies Contractors | Farrell Road Pedestrian Bridge Upgrade | 327 | 22/07/2016 | FY 2016/17 | YES | | | |
| SPA | Aldridge Avenue East Corrimal (Cawley to Carroll) stabilisation | 63 | 27/07/2016 | FY 2016/17 | YES | | | |
| Downer | McPhail Street Unanderra - Central Road to Cook Street | 87 | 1/08/2016 | FY 2016/17 | YES | | | |
| Cadifem Pty Ltd | Debris Control Structure for Cosgrove Avenue Keiraville | 165 | 1/08/2016 | FY 2016/17 | YES | | | |
| GC Civil | Port Kembla SLSC Retaining Wall | 149 | 9/08/2016 | FY 2016/17 | YES | | | |
| GHD Pty Ltd | Lowering of Gurungaty Causeway | 70 | 10/08/2016 | FY 2016/18 | YES | | | |
| Ledacon | Nicholson Road Bank Support works | 92 | 16/08/2016 | FY 2016/17 | YES | | | |
| Programmed Property Services | City Beach SLSC Exterior Cleaning and Painting | 54 | 29/08/2016 | FY 2016/17 | YES | | | |
| Programmed Facilities Management | Capital Works Upgrades to Gallery | 91 | 5/09/2016 | FY 2016/17 | YES | | | |
| Programmed Facilities Management | Kitchen/ Theatre/ Roof Upgrades level 1 Integral Building | 107 | 7/09/2016 | FY 2016/17 | YES | | | |
| Downer | Kurraba Road Woonona stabilisation | 63 | 14/09/2016 | FY 2016/17 | YES | | | |
| YNWA Enterprises Pty Ltd | Port Kembla Pool kiosk lease | 160 | 24/09/2016 | FY 2016/22 | YES | | | |
| Downer | Central Road Unanderra stabilisation | 87 | 26/09/2016 | FY 2016/17 | YES | | | |
| Batmac Constructions Pty Ltd | Central Depot Lunchroom and amenities building refurbishment | 991 | 26/09/2016 | FY 2016/17 | YES | | | |
| Downer | Bath Street Thirroul stabilisation | 86 | 28/09/2016 | FY 2016/17 | YES | | | |

The QBRS guidelines also require councils to identify the amount expended on consultancies and legal fees for the financial year. Consultants are defined as a person or organisation that is engaged under contract on a temporary basis to provide recommendations or high level specialist or professional advice to assist decision making by management. Generally, it is the advisory nature of the work that differentiates a consultant from other contractors.

| Consultancy and Legal Expenses Bodget Review for Quarter ended September 2016 | | | | | | |
|--|--|----------------------------|----------------|--|--|--|
| Expense | | Expenditure YTD \$000's | Budgeted (Y/N) | | | |
| Consultancies | | 228 | YES | | | |
| Legal Fees | | 76 | YES | | | |

STATEMENT OF RESPONSIBLE ACCOUNTING OFFICER

All investments held at 30 September 2016 were invested in accordance with Council's Investment Policy.

Bank reconciliations have been completed as at 30 September 2016.

Year to date cash and investments are reconciled with funds invested and cash at bank.

BUDGET REVIEW STATEMENT - REVISION TO FULL YEAR ESTIMATES

The following statement is made in accordance with Clause 203(2) of the Local Government (General) Regulation 2005.

It is my opinion that the financial statements and schedules contained within the Quarterly Review Statement for Wollongong City Council for the quarter ended 30 September 2016 indicate that Council's projected financial position at 30 June 2017 will be satisfactory having regard to the projected estimates of income and expenditure and the original budgeted income and expenditure.

The overall year to date position is within expectations of the adopted budget across the broad range of indicators and on a budget outcome basis is acceptable.

BRIAN JENKINS Responsible Accounting Officer

Attachment

Appendix 1: Annual Deliverable Progress by 5 Year Action – Delivery Program 2012-17

| 5 Year Action | On track (Projects / Ongoing) | Not Scheduled to Commence | Delayed | Deferred | Complete (Projects Only) |
|---|----------------------------------|------------------------------|---------|----------|-----------------------------|
| 1.1.1.1 Implement programs and events which facilitate community participation | 100% | 0% | 0% | 0% | 0% |
| 1.1.2.1 Impacts from development on the environment are assessed, monitored and mitigated | 88% | 0% | 13% | 0% | 0% |
| 1.1.2.2 Establish effective urban stormwater management programs | 100% | 0% | 0% | 0% | 0% |
| 1.1.3.1 Manage vegetation to reduce bushfire risk in Asset Protection Zones on natural areas under Council care and control | 100% | 0% | 0% | 0% | 0% |
| 1.1.3.2 Implement a coordinated approach to floodplain and stormwater management | 100% | 0% | 0% | 0% | 0% |
| 1.1.4.1 Implement priority actions from the Illawarra Biodiversity Strategy | 80% | 0% | 20% | 0% | 0% |
| 1.1.4.2 Implement priority actions from the Illawarra Escarpment Strategic Management Plan | 100% | 0% | 0% | 0% | 0% |
| 1.2.1.1 Finalise and implement the Coastal Zone Management Plan | 100% | 0% | 0% | 0% | 0% |
| 1.2.2.1 Assess the impact of day visitors on service levels | 100% | 0% | 0% | 0% | 0% |
| 1.2.2.2 Coordinate a range of Water Safety Education programs to enhance safe community access to our beaches | 100% | 0% | 0% | 0% | 0% |

| 5 Year Action | On track (Projects / Ongoing) | Not Scheduled to Commence | Delayed | Deferred | Complete (Projects Only) |
|--|----------------------------------|------------------------------|---------|----------|-----------------------------|
| 1.3.1.1 Develop and implement programs that encourage community participation in reducing Wollongong's ecological footprint | 100% | 0% | 0% | 0% | 0% |
| 1.3.2.1 Finalise and deploy Council's Waste & Resource Recovery Strategy in consultation with industry leaders | 67% | 33% | 0% | 0% | 0% |
| 1.3.2.2 Implement water and energy saving strategies | 100% | 0% | 0% | 0% | 0% |
| 1.3.2.3 Emissions are monitored and reduction methods are investigated and utilised | 100% | 0% | 0% | 0% | 0% |
| 1.3.2.4 Investigate a landfill gas management system for Whytes Gully | 0% | 0% | 100% | 0% | 0% |
| 1.3.3.1 Develop and implement an Environmental Sustainability Policy and Strategy | 80% | 0% | 20% | 0% | 0% |
| 1.3.3.2 Seek external funds to support programs for Lake Illawarra, following the closure of the Lake Illawarra Authority | 100% | 0% | 0% | 0% | 0% |
| 1.3.3.3 Establish and maintain an Estuary Management Committee to protect the health of Lake Illawarra | 100% | 0% | 0% | 0% | 0% |
| 1.4.1.1 Work in partnership with others to promote a diverse range of heritage education and promotion programs | 50% | 0% | 50% | 0% | 0% |
| 1.4.1.2 Implement priority actions of the Heritage Strategy | 100% | 0% | 0% | 0% | 0% |
| 1.4.1.3 Implement community and cultural promotions program | 100% | 0% | 0% | 0% | 0% |

| 5 Year Action | On track (Projects / Ongoing) | Not Scheduled to Commence | Delayed | Deferred | Complete (Projects Only) |
|--|----------------------------------|------------------------------|---------|----------|-----------------------------|
| 1.4.2.1 Work with the local Aboriginal community in the management of Indigenous heritage | 100% | 0% | 0% | 0% | 0% |
| 1.5.1.1 Facilitate a range of programs and activities which improve food security and local food production | 100% | 0% | 0% | 0% | 0% |
| 1.6.1.1 Review planning controls for environmentally sensitive locations | 100% | 0% | 0% | 0% | 0% |
| 1.6.2.1 Implement the West Dapto Release Area Masterplan | 100% | 0% | 0% | 0% | 0% |
| 1.6.3.1 Provide high quality development assessment and certification based on QBL principles (note: QBL or the Quadruple Bottom Line takes consideration of environmental, economic, social and governance factors) | 100% | 0% | 0% | 0% | 0% |
| 1.6.3.2 Maximise sustainability principles in the design and construction of Wollongong's built form | 100% | 0% | 0% | 0% | 0% |
| 2.1.1.1 Support regional activities and partnerships that result in increased business investment and jobs growth | 100% | 0% | 0% | 0% | 0% |
| 2.1.2.1 Ensure that Wollongong is attractive to diverse companies for business expansion, establishment and relocation | 100% | 0% | 0% | 0% | 0% |
| 2.1.2.2 Progress implementation of the CBD Action Plan | 100% | 0% | 0% | 0% | 0% |
| 2.1.3.1 Build on partnerships which enable the retention of local talent | 100% | 0% | 0% | 0% | 0% |
| 2.1.3.2 Establish Wollongong City Council as an employer of choice | 100% | 0% | 0% | 0% | 0% |

| 5 Year Action | On track (Projects / Ongoing) | Not Scheduled to Commence | Delayed | Deferred | Complete (Projects Only) |
|---|----------------------------------|------------------------------|---------|----------|-----------------------------|
| 2.1.4.1 Develop and maintain partnerships with the business sector to fund and contribute to a broader range of community projects and activities | 100% | 0% | 0% | 0% | 0% |
| 2.1.5.1 Work with community, government and business partners to support development of local employment opportunity for people who are disadvantaged within the labour market | 100% | 0% | 0% | 0% | 0% |
| 2.1.6.1 In collaboration with key agencies, facilitate the West Dapto Taskforce to deliver the first stages of the West Dapto Urban Release area | 100% | 0% | 0% | 0% | 0% |
| 2.2.1.1 Facilitate the delivery of business and tourism information services | 100% | 0% | 0% | 0% | 0% |
| 2.2.2.1 Support projects that investigate opportunities for the provision of tourism infrastructure | 100% | 0% | 0% | 0% | 0% |
| 2.2.2.2 Use funds obtained from Restart NSW Illawarra to commence concept designs and planning for the Bald Hill Improvement Program | 100% | 0% | 0% | 0% | 0% |
| 2.2.3.1 Review the current investment to deliver a more efficient and targeted destination marketing program | 100% | 0% | 0% | 0% | 0% |
| 2.3.1.1 Undertake major refurbishment works in the City Centre | 100% | 0% | 0% | 0% | 0% |
| 2.3.1.2 Manage and deliver improved marketing and promotion of the City Centre | 100% | 0% | 0% | 0% | 0% |
| 2.3.1.3 Provide a diverse range of activities in the City Centre that target and engage a broad community | 100% | 0% | 0% | 0% | 0% |
| 2.3.1.4 Improve policies and systems to support the revitalisation of the City Centre | 100% | 0% | 0% | 0% | 0% |

| 5 Year Action | On track (Projects / Ongoing) | Not Scheduled to Commence | Delayed | Deferred | Complete (Projects Only) |
|---|----------------------------------|------------------------------|---------|----------|-----------------------------|
| 2.3.1.5 Deliver the Access and Movement Strategy for the City Centre | 100% | 0% | 0% | 0% | 0% |
| 2.3.2.1 Review the current investment to deliver a more efficient and targeted destination marketing program | 100% | 0% | 0% | 0% | 0% |
| 2.3.2.2 Deliver Visitor Information Services to the city and our visitors | 100% | 0% | 0% | 0% | 0% |
| 2.3.2.3 Pursue initiatives that promote the region as place to holiday to both the domestic and international markets | 100% | 0% | 0% | 0% | 0% |
| 2.4.1.1 Support the creation & expansion of green industries | 100% | 0% | 0% | 0% | 0% |
| 2.4.2.1 Ensure that Wollongong is attractive to research & development based companies & organisations | 100% | 0% | 0% | 0% | 0% |
| 2.5.1.1 Implement a range of programs that incorporates learning and development | 75% | 0% | 0% | 0% | 0% |
| 3.1.1.1 Promote Made in Wollongong through a variety of locally produced events, productions and programs | 100% | 0% | 0% | 0% | 0% |
| 3.1.2.1 Provide support to existing and emerging arts workers & their networks | 100% | 0% | 0% | 0% | 0% |
| 3.1.2.2 Provide opportunities for local artists and performers to exhibit, promote and perform at Council venues and events | 100% | 0% | 0% | 0% | 0% |
| 3.1.3.1 Successful collaborations with other organisations and agencies are established | 50% | 0% | 50% | 0% | 0% |

| 5 Year Action | On track (Projects / Ongoing) | Not Scheduled to Commence | Delayed | Deferred | Complete (Projects Only) |
|--|----------------------------------|------------------------------|---------|----------|-----------------------------|
| 3.2.1.1 Seek funding for the promotion of heritage sites and museums to the community and visitors | 75% | 25% | 0% | 0% | 0% |
| 3.2.2.1 Encourage the integration of urban design & public art | 100% | 0% | 0% | 0% | 0% |
| 3.2.3.1 Deliver and support a range of projects and programs which build harmony and understanding | 100% | 0% | 0% | 0% | 0% |
| 3.3.1.1 Implement a coordinated approach to event acquisition & provision in Wollongong via the delivery of the Events Strategy | 100% | 0% | 0% | 0% | 0% |
| 3.3.1.2 Encourage Sports Associations to conduct regional, state and national events in the city | 67% | 33% | 0% | 0% | 0% |
| 3.3.1.3 Implement a sustainable program of local events via the Events Strategy | 100% | 0% | 0% | 0% | 0% |
| 3.3.1.4 Plan for, and host, culturally sensitive events and programs celebrating the Bi-Centenary of European Settlement in Wollongong across 2015- 2016 | 100% | 0% | 0% | 0% | 0% |
| 3.3.1.5 Coordinate Council's support and investment in events and festivals | 100% | 0% | 0% | 0% | 0% |
| 3.3.2.1 Coordinate an integrated approach to infrastructure improvement and service delivery in the Civic Plaza and through the re-establishment of an Arts Precinct in the city | 100% | 0% | 0% | 0% | 0% |
| 3.4.1.1 Support the coordination of an externally funded delivered calendar of activities across the City | 100% | 0% | 0% | 0% | 0% |
| 3.4.2.1 Develop a new Cultural Plan | 100% | 0% | 0% | 0% | 0% |

| 5 Year Action | On track (Projects / Ongoing) | Not Scheduled to Commence | Delayed | Deferred | Complete (Projects Only) |
|--|----------------------------------|------------------------------|---------|----------|-----------------------------|
| 3.4.3.1 Deliver a program of activities in local communities | 100% | 0% | 0% | 0% | 0% |
| 4.1.1.1 Ensure an effective community engagement framework connects the community to Council decision making | 100% | 0% | 0% | 0% | 0% |
| 4.1.2.1 Expand Council's use of social media and online options for communication and engagement | 33% | 0% | 33% | 33% | 0% |
| 4.1.3.1 A coordinated approach to communication is developed and implemented | 100% | 0% | 0% | 0% | 0% |
| 4.1.3.2 Re-establish Council's commitment to partnering with our local Aboriginal community | 0% | 0% | 100% | 0% | 0% |
| 4.1.3.4 Continue to provide regular information updates to the community about Council's Financial Sustainability Review | 100% | 0% | 0% | 0% | 0% |
| 4.2.1.1 Increase opportunities for the community to connect with volunteering organisations | 100% | 0% | 0% | 0% | 0% |
| 4.2.1.2 Support community participation in non-profit activities | 100% | 0% | 0% | 0% | 0% |
| 4.2.1.3 Build the capability of community based organisations in managing, developing and sustaining their volunteers | 100% | 0% | 0% | 0% | 0% |
| 4.2.2.1 Support a range of projects and programs in the city | 100% | 0% | 0% | 0% | 0% |
| 4.2.3.1 Contribute to activities and programs that enhance civic pride in Wollongong | 100% | 0% | 0% | 0% | 0% |

| 5 Year Action | On track (Projects / Ongoing) | Not Scheduled to Commence | Delayed | Deferred | Complete (Projects Only) |
|---|----------------------------------|------------------------------|---------|----------|-----------------------------|
| 4.3.1.1 Lobby for the expansion of NBN to all suburbs within the LGA within the next five years | 100% | 0% | 0% | 0% | 0% |
| 4.3.2.1 Review community facilities and consider rationalisation, replacement or refurbishment to achieve facilities that are strategically located, good quality and meet identified community need | 100% | 0% | 0% | 0% | 0% |
| 4.3.2.2 Investigate the provision of a district level community and library centre for the southern suburbs | 0% | 0% | 100% | 0% | 0% |
| 4.3.3.1 Continue to participate and contribute to an integrated community service network | 100% | 0% | 0% | 0% | 0% |
| 4.4.1.1 Improve community understanding and awareness of Council decisions | 100% | 0% | 0% | 0% | 0% |
| 4.4.1.2 Ensure appropriate strategies and systems are in place, monitored and reviewed | 100% | 0% | 0% | 0% | 0% |
| 4.4.1.3 Continue to build a professional, customer focussed quality organisation | 67% | 0% | 0% | 33% | 0% |
| 4.4.1.4 Lead continuous improvement in Council's health and safety culture and behaviour | 100% | 0% | 0% | 0% | 0% |
| 4.4.2.1 Coordinate a service review program with a focus on business development and improvement | 75% | 25% | 0% | 0% | 0% |
| 4.4.2.2 Deliver the Asset Management Strategy and Improvement Plan 2012-17 | 100% | 0% | 0% | 0% | 0% |
| 4.4.2.3 Investigate provision of cremation services across the region and determine Council's role in the market | 100% | 0% | 0% | 0% | 0% |

| 5 Year Action | On track (Projects / Ongoing) | Not Scheduled to Commence | Delayed | Deferred | Complete (Projects Only) |
|---|----------------------------------|------------------------------|---------|----------|-----------------------------|
| 4.4.3.1 Improve systems for recording community & staff ideas | 100% | 0% | 0% | 0% | 0% |
| 4.4.4.1 Ensure policies and procedures are regularly reviewed, updated and promoted | 100% | 0% | 0% | 0% | 0% |
| 4.4.4.2 Streamline reporting across the organisation and provide user friendly, plain English reports | 33% | 33% | 33% | 0% | 0% |
| 4.4.5.1 Effective and transparent financial management systems are in place | 100% | 0% | 0% | 0% | 0% |
| 4.4.5.10 Explore innovative options to increase revenue at Council facilities | 100% | 0% | + 0% | 0% | 0% |
| 4.4.5.11 Improve the efficiency of supply management in order to achieve operational efficiencies | 100% | 0% | 0% | 0% | 0% |
| 4.4.5.12 Pursue alternative funding options to deliver Council services and facilities | 0% | 0% | 0% | 0% | 100% |
| 4.4.5.2 Achieve an operational savings as a part of Council's financial sustainability Review with savings to be directed to asset renewal | 100% | 0% | 0% | 0% | 0% |
| 4.4.5.3 Reduce Council's discretionary spend (excluding assets) by 5% with savings to be directed to asset renewal | 100% | 0% | 0% | 0% | 0% |
| 4.4.5.4 Undertake a review of Council's employment conditions including the consideration of more flexible employment conditions and Enterprise Agreement | 100% | 0% | 0% | 0% | 0% |
| 4.4.5.5 Continue to pursue alternative funding option to deliver financially sustainable services and facilities | 100% | 0% | 0% | 0% | 0% |

| 5 Year Action | On track (Projects / Ongoing) | Not Scheduled to Commence | Delayed | Deferred | Complete (Projects Only) |
|---|----------------------------------|------------------------------|---------|----------|-----------------------------|
| 4.4.5.6 Apply for a special rate variation of 6.13% in 2014-15, 6.23% in 2015-16 and 6.24% in 2016-17 with additional funds to be directed to asset renewal | 100% | 0% | 0% | 0% | 0% |
| 4.4.5.8 Investigate removing the pensioner and charitable waste exemptions | 100% | 0% | 0% | 0% | 0% |
| 4.4.5.9 Continue to actively seek grants and contributions to deliver core community infrastructure and services | 100% | 0% | 0% | 0% | 0% |
| 4.4.6.1 Deliver a consistent and effective integrated frontline customer service centre | 100% | 0% | 0% | 0% | 0% |
| 5.1.1.1 Partner with community based organisations in the provision of services | 100% | 0% | 0% | 0% | 0% |
| 5.1.2.1 Actively engage children and young people in planning and design processes | 100% | 0% | 0% | 0% | 0% |
| 5.1.3.1 Partner with agencies and health authorities to support improvements to the region's medical services | 100% | 0% | 0% | 0% | 0% |
| 5.1.4.1 Assess the changing profile of the community and reprioritise services appropriately | 100% | 0% | 0% | 0% | 0% |
| 5.1.4.2 Investigate provision of Leisure Services in the greater Dapto area, taking into account expansion of West Dapto, and determine Council's role in the market | 50% | 0% | 50% | 0% | 0% |
| 5.1.4.3 Investigate the future provision of Aquatic Services across the local government area and implement improvements | 100% | 0% | 0% | 0% | 0% |
| 5.1.5.1 Continue to undertake social, land use and environmental planning activities that assists in service planning | 100% | 0% | 0% | 0% | 0% |

| 5 Year Action | On track (Projects / Ongoing) | Not Scheduled to Commence | Delayed | Deferred | Complete (Projects Only) |
|--|----------------------------------|------------------------------|---------|----------|-----------------------------|
| 5.1.5.2 Carry out commercial business management of Council's operational lands | 100% | 0% | 0% | 0% | 0% |
| 5.1.6.1 Review planning controls for priority locations | 86% | 0% | 14% | 0% | 0% |
| 5.1.6.2 Provide an appropriate and sustainable range of quality passive and active open spaces and facilities | 80% | 0% | 0% | 20% | 0% |
| 5.1.6.3 Policies and plans are developed, reviewed and implemented to encourage physical activity | 50% | 0% | 50% | 0% | 0% |
| 5.2.1.1 Prepare a Housing Study and Strategy incorporating Affordable Housing Issues | 0% | 0% | 50% | 50% | 0% |
| 5.2.2.1 In partnership with relevant agencies and networks lobby and advocate for improved service levels and quality and enhanced access to services | 100% | 0% | 0% | 0% | 0% |
| 5.3.1.1 Promote and enforce compliance with litter reduction | 100% | 0% | 0% | 0% | 0% |
| 5.3.2.1 Manage and maintain public facilities | 100% | 0% | 0% | 0% | 0% |
| 5.3.2.3 Use additional funds achieved through the financial sustainability review for renewal of major building projects as per capital program | 100% | 0% | 0% | 0% | 0% |
| 5.3.3.1 Manage and maintain community infrastructure portfolio with a focus on asset renewal | 100% | 0% | 0% | 0% | 0% |
| 5.4.1.1 Facilitate a range of partnerships and networks to develop community safety initiatives | 100% | 0% | 0% | 0% | 0% |
APPENDIX 1: ANNUAL DELIVERABLE PROGRESS BY 5 YEAR ACTION DELIVERY PROGRAM 2012-17

| 5 Year Action | On track (Projects / Ongoing) | Not Scheduled to Commence | Delayed | Deferred | Complete (Projects Only) |
|---|----------------------------------|------------------------------|---------|----------|-----------------------------|
| 5.4.1.2 Provide lifeguarding services at beaches (in partnership with Surf Life Saving Illawarra) and Council pools | 100% | 0% | 0% | 0% | 0% |
| 5.4.2.1 Continue to liaise with Local Area Commands on key initiatives and crime reduction strategies. | 100% | 0% | 0% | 0% | 0% |
| 5.4.2.2 Deliver projects and programs to reduce crime in the Wollongong Local Government Area | 100% | 0% | 0% | 0% | 0% |
| 5.4.3.1 Safety is considered in the planning and design of any development | 100% | 0% | 0% | 0% | 0% |
| 5.5.1.1 Maintain and establish corridors and parks that strengthen open space connections and people movement. | 100% | 0% | + 0% | 0% | 0% |
| 5.5.1.2 Coordinate an access improvement program through pre-planning and renewal activities | 100% | 0% | 0% | 0% | 0% |
| 5.5.2.1 Use data to assess the current community infrastructure available, community demand and develop a strategic framework and policies to either rationalise, enhance or expand to meet hanging community needs | 67% | 0% | 33% | 0% | 0% |
| 5.5.2.2 Implement Council's Planning, People, Places Strategy | 100% | 0% | 0% | 0% | 0% |
| 5.5.2.3 Develop a Regional Botanic Garden of Excellence | 100% | 0% | 0% | 0% | 0% |
| 5.5.2.4 Provide statutory services to appropriately manage and maintain our public spaces | 100% | 0% | 0% | 0% | 0% |
| 5.5.2.5 Develop a play strategy to support the planning of high quality centralised and integrated park facilities | 100% | 0% | 0% | 0% | 0% |

APPENDIX 1: ANNUAL DELIVERABLE PROGRESS BY 5 YEAR ACTION DELIVERY PROGRAM 2012-17

| 5 Year Action | On track (Projects / Ongoing) | Not Scheduled to Commence | Delayed | Deferred | Complete (Projects Only) |
|---|----------------------------------|------------------------------|---------|----------|-----------------------------|
| 5.5.2.6 Use additional achieved through the Financial Sustainability Review to replace below standard playground facilities informed by the Play Strategy | 100% | 0% | 0% | 0% | 0% |
| 5.5.3.1 Deliver a range of programs for older people | 50% | 50% | 0% | 0% | 0% |
| 5.5.3.2 Deliver a range of recreational pursuits for older people | 100% | 0% | 0% | 0% | 0% |
| 5.6.1.1 Deliver a diverse suite of projects to the community that foster and enhance community strengths | 60% | 0% | 0% | 0% | 0% |
| 6.1.1.1 Establish a strategic framework and a plan for cycle ways and bicycle facilities within Wollongong | 100% | 0% | 0% | 0% | 0% |
| 6.1.2.1 Assess the feasibility to expand the Gong Shuttle service to outer suburbs | 0% | 50% | 50% | 0% | 0% |
| 6.1.3.1 Improve the connectivity of the local government area through the upgrade in our network of footpaths and cycle ways | 100% | 0% | 0% | 0% | 0% |
| 6.1.3.2 Use additional funds achieved through the Financial Sustainability Review to accelerate the footpath renewal program by about \$4M | 100% | 0% | 0% | 0% | 0% |
| 6.1.3.3 Extend the average lives of footpaths to 80 years to create about \$1M saving in depreciation annually | 100% | 0% | 0% | 0% | 0% |
| 6.1.3.4 Use funds obtained from Restart NSW Illawarra to design and construct the Grand Pacific Walk - Stage one | 100% | 0% | 0% | 0% | 0% |
| 6.1.4.1 Work in partnership with key stakeholders to consider the establishment of a 'Park n Ride' commuter bus network | 0% | 0% | 100% | 0% | 0% |

APPENDIX 1: ANNUAL DELIVERABLE PROGRESS BY 5 YEAR ACTION DELIVERY PROGRAM 2012-17

| 5 Year Action | On track (Projects / Ongoing) | Not Scheduled to Commence | Delayed | Deferred | Complete (Projects Only) |
|---|----------------------------------|------------------------------|---------|----------|-----------------------------|
| 6.2.1.1 Develop an integrated Transport Strategy | 100% | 0% | 0% | 0% | 0% |
| 6.2.1.2 Deliver sustainable transport asset renewal programs | 100% | 0% | 0% | 0% | 0% |
| 6.2.1.3 Allocate approximately \$6M of additional funds achieved through the Financial Sustainability Review to road resurfacing and reconstruction | 100% | 0% | 0% | 0% | 0% |
| 6.2.2.2 Use funds obtained from Restart NSW Illawarra and funds contributed by Council to construct the road link between Fowlers Road Dapto to Fairwater Drive Horsley | 0% | 0% | 100% | 0% | 0% |
| 6.2.3.1 Work with State and Government agencies and lobby improve rail services and stations across the LGA. | 100% | 0% | 0% | 0% | 0% |
| 6.2.4.1 Work with State and Government agencies to lobby and promote opportunities for transport to reduce travel time between Sydney and Wollongong | 0% | 0% | 0% | 0% | 100% |
| 6.2.5.1 Work with key agencies and partners to continue and improve late night transport options | 100% | 0% | 0% | 0% | 0% |
| 6.3.1.2 Promote access to community transport | 50% | 50% | 0% | 0% | 0% |
| Total Annual Deliverable Progress | 89% | 3% | 5% | 1% | 2% |

Standard Conditions for Road Closures

For Special Events and Work Related activities Within Council Road Reserves.

Following approval by Wollongong City Council, road closures are subject to the additional Council conditions:

- 1. **The Applicant must complete the Council form** 'Application to Open and Occupy or Underbore a Roadway or Footpath' (Refer to Checklist below relates to Section 138 of the Roads Act.)
- 2. **NSW Police Approval:** The Applicant must obtain written approval from NSW Police, where required under the Roads Act.
- 3. If the Road Closure is within 100m of any traffic control signals or on a 'State Classified Road' the Applicant must obtain a Road Occupancy Licence (ROL) from NSW Roads & Maritime Services (RMS).
- 4. **The Applicant must advise all affected residents and business owners** within the closure area of the date/s and times for the closure, at least 7 days prior to the intended date of works.
- 5. **The Applicant must advise Emergency Services:** Ambulance, Fire Brigade and Police, Taxi and Bus Companies of the closure dates and times in writing, 7 days prior to the intended date of works. The Applicant must endeavour to minimise the impact on bus services during the closure.
- 6. **Traffic Management Plan:** The closure must be set up in accordance with the approved **Traffic Management Plan (TMP)** prepared by an appropriately qualified traffic controller; a copy of whose qualifications must be included with the submitted TMP.
- 7. **Traffic Management Plan Setup:** The Traffic Management Plan must be set up by appropriately qualified traffic control persons or the NSW Police.
- 8. Access to properties affected by the road closure must be maintained where possible. Where direct access cannot be achieved, an alternative arrangement must be agreed to by both the applicant and the affected person/s.
- 9. **Public Notice Advertisement:** The Applicant must advertise the road closure in the Public Notices section of the local paper, detailing closure date/s and times at least 7 days prior to the closure.
- 10. **Public Liability Policy:** The Applicant must provide Council with a copy of their current insurance policy to a value of no less than \$20 million dollars to cover Wollongong City Council from any claims arising from the closure.

Checklist:

☑ Completed Council Form:

'Application to Open and Occupy or Underbore a Roadway or Footpath'.

Required information as shown below MUST be attached:

- \square A copy of the letter from the Traffic Committee authorising the closure
- ☑ The Traffic Management Plan (TMP)
- ☑ The Road Occupancy Licence (ROL) *if required*
- ☑ Written approval from NSW Police
- ☑ Public Liability Insurance

Applications may be lodged in the Customer Service Centre located on the Ground Floor of Council's Administration Building, 41 Burelli Street Wollongong between 8.30am and 5pm Monday to Friday.

STANDARD CONDITIONS FOR ROAD CLOSURES FOR STREET PARTIES

- 1 Each road affected by the closure approval shall be restored to full and uninterrupted traffic flow prior to the end of the closure.
- 2 The road shall be cleared sufficiently to allow an emergency vehicle access to a property within the closure area. For this reason, no barbeques, heavy tables or other heavy equipment is to be set up on the road pavement.
- 3 You are required to advertise the road closure in the local newspaper
 - E.g. Temporary Road Closure Larkins Lane, Yallah Date: 18 December 2015 Time: 2 pm – 7 pm Event: Street Party
- 4 Council will notify emergency services and the Police Service.
- 5 NSW Police Service directions are to be strictly adhered to.
- 6 Council will endeavour to make available to you the following equipment for the closure

| Regular Street Equipment Requirements | Cul - De - Sac Street Equipment Requirements |
|---------------------------------------|--|
| 6 Barrier legs | 3 Barrier legs |
| 12 Road Barriers | 6 Road Barriers |
| 2 Road Closed Signs | 1 Road Closed Signs |
| 4 Flashing Lights | 2 Flashing Lights |
| | • |

It should be noted that Council does not supply 9 volt batteries for flashing lights, however batteries can be made available for approximately \$3.40 each.

The flashing lights must be fixed to the barriers and operating prior to sunset.

It is your responsibility to collect this equipment from Council's Works Depot Store, Montague Street, North Wollongong, prior to 2.00 pm on the last working day prior to your proposed road closure, and return same on the next working day following the closure. Please ensure you sign a receipt when collecting and returning this equipment.

Equipment, which is returned damaged beyond use or not returned at all, will be replaced at your cost.

A sufficient number of people (at least 2), together with a vehicle suitable for the purpose of transporting the relevant equipment, are to be provided by the organisers for the loading and unloading of this equipment at the Depot.

- 7 You are requested to email Council's Events and Functions Coordinator <u>events@wollongong.nsw.gov.au</u> two weeks prior to pick-up to ensure availability of the equipment.
- 8 If Council's Store does not have sufficient equipment to lend, you are to obtain equipment from another source (e.g. hire firm), at your expense.





Attachment 3 - Thirroul Seaside & Arts Festival 2017



Attachment 4 - Building Works, Church Street, Wollongong