9.0 Action Plan for coastal erosion, recession and inundation risk areas

9.1 Scope of this Action Plan

This Action Plan focuses on effective management of risks associated with coastal erosion hazards, including both current erosion hazards and the erosion and recession hazards associated with climate change over the 2050 and 2100 planning timeframes.

The NSW government defines coastal erosion risk areas as the area that is affected by coastal erosion and/or recession hazards, including the zone of wave impact and zone of slope adjustment (see **Section 16.0**), within the relevant planning timeframe.

The Action Plan has been subdivided into two parts to address:

- Coastal erosion and recession on sandy beaches and dune systems (Section 9.3).
- Coastal inundation (Section 9.4).

Detailed technical assessments of coastal hazards associated with storm erosion, coastal recession and inundation have been prepared by SMEC (2010) and are included in **Appendix 3**.

Coastal erosion hazard studies have not been completed for the entire length of beaches in Wyong Shire. Council and OEH identified key location for which hazard studies would be prepared, at the outset of the project. Generally, these locations correspond with areas of residential development or locations of community infrastructure.

Morphology and processes at the entrance to the Tuggerah Lakes are expected to be modified by sea level rise, coastal recession and possible changes to patterns of major storms. Management of lake entrance issues is considered in **Section 10.0**. Risks to coastal ecological communities may be increased by coastal recession; these issues are addressed in **Section 12.0**.

9.1.1 Exposure of homes and community assets to coastal erosion and recession

Recent broad scale work on coastal vulnerability (Australian Government 2009) has identified Wyong Shire as one of the most exposed in Australia to risks associated with the sea level rise that is part of predicted climate change over the next century. Residential properties at North Entrance, Hargraves Beach and Blue Bay are within the immediate coastal risk area (zone of wave impact and slope adjustment). These properties were affected by coastal erosion in the May 1974 storm. Council assets such as surf clubs, beach access ways and stormwater systems have also already been affected by immediate storm bite erosion hazards. **Plate 9.1** shows the impact of storm wave erosion on The Entrance Surf Club and Soldiers Beach Surf Club in 1974.

North Entrance Beach and Hargraves Beach are identified by the NSW Government as Authorised Locations for emergency coastal protection works (see **Section 8.0**).





The Entrance Beach Surf Club



Soldiers Beach Surf Club

PLATE 9.1

Storm Erosion at The Entrance and Soldiers Beach Surf Clubs, 1974 More than 100 houses along the Wyong coastline are predicted to be within the zone of wave impact and slope adjustment in the 2050 planning period. Approximately 135 houses are predicted to be within the zone of wave impact and slope adjustment by 2100. When the zone of reduced foundation capacity is included in the coastal risk area (see **Section 9.1.2**), even more residences are affected.

All existing surf clubs are also within the 2050 zone of wave impact and slope adjustment and a wide range of community infrastructure would be affected. Many popular foreshore reserve recreation areas are expected to be severely impacted by coastal recession by 2050.

By 2100, the combined effects of coastal recession and coastal inundation (from wave overtopping and higher lake levels) mean that the low barrier at Budgewoi may be breached, if action is not taken to reduce the risk. The potential creation of a new entrance to the Tuggerah Lakes system clearly has major implications not only for lake ecology, but for local transport infrastructure. The current alignment of the Central Coast Highway would be threatened. Breaching of the sandy barrier into Budgewoi Lake, would expose high conservation value sand flats and low lying lake frontage properties to tidal processes.

Figures 9.1 to **9.7** and **9.8** to **9.14** show the coastal erosion risk areas for the 2050 and 2100 planning periods respectively. These coastal risk areas take into account the location of the zone of wave impact and slope adjustment with sea level 40 centimetres above 1990 levels (for 2050) and 90 centimetres above 1990 levels (for 2100).

Coastal erosion and coastal recession are major challenges for the Wyong community and for Council.

9.1.2 How will this Action Plan be different to what happens now?

To date, Wyong Council has relied on its LEP and DCP 77 to manage land use in areas affected by coastal hazards. These planning instruments are now outdated in their approach to land use planning and development assessment for land that is within a coastal risk area (as defined by NSW Government 2009 and 2010).

A coastal risk area includes all land that is predicted to be within the zone of wave impact, zone of slope adjustment or the zone of reduced foundation capacity by a given timeframe.

Council has decided that they key planning periods over which to consider risks for new development are 40 years (for residential development) and 90 to 100 years (for major infrastructure investment). Council appreciates the need for a transition from current land use and planning practice to the new climate change scenarios, and does not want to sterilise land before it is necessary. Council has deferred a number of decisions, pending State government advice and the development of a more appropriate planning framework, which recognises the current understanding of risks to coastal property over these planning horizons.

The Action Plan for coastal erosion risk areas takes into account the best available information on:

- Coastal land affected by immediate coastal process hazards.
- Coastal land predicted to be affected by coastal erosion (recession) hazards by 2050.
- Coastal land predicted to be affected by coastal erosion (recession) hazards by 2100.

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Legend

2050 Limit of Zone of Wave Impact and Slope Adjustment 2050 Limit of Zone of Reduced Foundation Capacity

FIGURE 9.1

2050 Coastal Erosion Risk Lines Shelly Beach



Source: SMEC (2010)

Legend

2050 Limit of Zone of Wave Impact and Slope Adjustment 2050 Limit of Zone of Reduced Foundation Capacity

FIGURE 9.2

2050 Coastal Erosion Risk Lines Toowoon and Blue Bays





2050 Limit of Zone of Wave Impact and Slope Adjustment 2050 Limit of Zone of Reduced Foundation Capacity

FIGURE 9.3

2050 Coastal Erosion Risk Lines The North Entrance



2050 Limit of Zone of Wave Impact and Slope Adjustment

FIGURE 9.4

2050 Coastal Erosion Risk Lines The North Entrance





2050 Limit of Zone of Wave Impact and Slope Adjustment

2050 Limit of Zone of Reduced Foundation Capacity

FIGURE 9.5

2050 Coastal Erosion Risk Lines Soldiers Beach





FIGURE 9.6

2050 Limit of Zone of Wave Impact and Slope Adjustment 2050 Limit of Zone of Reduced Foundation Capacity

2050 Coastal Erosion Risk Lines Hargraves and Lakes Beach





Source: SMEC (2010)

2050 Limit of Zone of Wave Impact and Slope Adjustment 2050 Limit of Zone of Reduced Foundation Capacity

FIGURE 9.7

2050 Coastal Erosion Risk Lines North of Lakes Beach

Umwelt



Legend

2100 Limit of Zone of Wave Impact and Slope Adjustment 2100 Limit of Zone of Reduced Foundation Capacity

FIGURE 9.8

2100 Coastal Erosion Risk Lines Shelly Beach



2100 Limit of Zone of Wave Impact and Slope Adjustment 2100 Limit of Zone of Reduced Foundation Capacity

FIGURE 9.9

2100 Coastal Erosion Risk Lines Toowoon and Blue Bays





2100 Limit of Zone of Wave Impact and Slope Adjustment 2100 Limit of Zone of Reduced Foundation Capacity

FIGURE 9.10

2100 Coastal Erosion Risk Lines The North Entrance



2100 Limit of Zone of Wave Impact and Slope Adjustment

FIGURE 9.11

2100 Coastal Erosion Risk Lines The North Entrance





2100 Limit of Zone of Wave Impact and Slope Adjustment

----- 2100 Limit of Zone of Reduced Foundation Capacity

FIGURE 9.12

2100 Coastal Erosion Risk Lines Soldiers Beach





Source: SMEC (2010)

Legend

100

FIGURE 9.13

2100 Coastal Erosion Risk Lines Hargraves and Lakes Beach

2100 Limit of Zone of Wave Impact and Slope Adjustment 2100 Limit of Zone of Reduced Foundation Capacity





Source: SMEC (2010)

Legend

2100 Limit of Zone of Wave Impact and Slope Adjustment 2100 Limit of Zone of Reduced Foundation Capacity

FIGURE 9.14

2100 Coastal Erosion Risk Lines North of Lakes Beach

The responses within the Action Plan are intended to provide Council staff and land holders with clear advice on the level of risk and to direct options that will help reduce risk. Many actions will be given effect through controls and regulations in the planning system, including zoning, clauses in the LEP, clauses in the DCP and other planning guidelines.

The Action Plan applies to private land owners and to Council's management of its own assets. Council has commenced detailed risk assessments of its assets which are in coastal risk areas, such as sewer infrastructure, roads, stormwater systems, surf clubs and beach access facilities. This risk assessment will allow Council to make decisions about cost effective, timely retreat of assets where necessary.

9.1.3 Council's strategic approach

Erosion and recession are reflections of environmental change at different time scales. Council's priority in relation to these hazards is to provide a clear planning framework for landholders, which will accommodate ongoing change to the areas affected by coastal hazards over the next 100 years.

A key element of Council's approach is the regular acquisition of LiDAR data and aerial photogrammetry, which will allow detailed analysis of how the coast is actually changing in response to climate change and management actions. Council will work closely with the NSW Government to secure access to this data. Sound data on change (and metadata explaining why change has occurred) is critical to effective adaptive management.

Council will use the planning system to reduce the exposure of coastal development to coastal processes over time and to control the increase of risk associated with coastal processes.

Council's proposed approach takes into account:

- The position and alignment of predicted coastal hazard zones for immediate, 2050 and 2100 planning periods. Development landward of the 2100 coastal risk area and 2100 geotechnical low hazard line is not constrained by coastal process issues at this time and there are no specific coastal hazard management requirements.
- Land tenure at North Entrance Beach, Hargraves Beach, Lakes Beach and Blue Bay.
- The implications of coastal erosion hazard risks for managing important values of the coastal zone context. For instance, at North Entrance, allowing the coast to recede past a certain alignment would have very large consequences for The Entrance Road, for development on low lying land east of The Entrance Road and for the entrance channel of Tuggerah Lakes.
- The need for a clear process to adapt and change planning controls over time. Council intends to review the zoning of land in and adjacent to coastal risk areas every five years.

9.1.4 Appropriate development in coastal risk areas

The NSW Government policy position is to encourage **appropriate** coastal development. This is also WSC's broad policy position.

DoP (2010) sets out eight planning criteria which councils can use in their assessment of development applications in coastal risk areas. These criteria amplify the requirements of DoP Clause 3 (in **Section 15.4.5**, **PART C**). DoP (2010) also provides some indicative solutions to these criteria, relating to site design and layout and to adaptation features of

development. These design and flexibility features are intended to allow some development on coastal dunes which are expected to be affected by sea level rise constraints in the future.

In Council's view, appropriate new development in coastal risk areas has the characteristics identified in **Table 9.1**.

Table 9.1 - Characteristics of appropriate	e <u>new</u> development in coastal risk areas
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General planning criteria	Examples of satisfactory solutions
Development avoids or minimises exposure to immediate coastal risks (seaward of the immediate hazard	Council will not give consent to or approve new development seaward of the immediate coastal hazard line, except for:
line)	 Structures which provide for safe community access to the beach, such as steps and ramps and surf lookout stations for life savers.
	 Structures to provide for safe community boating access to ocean waters, such as boat ramps and jetties. These structures must be designed to meet Australian National engineering standards
	Minor maintenance of existing residences
	Works to make existing residences relocatable
	 Interim removable protection structures (such as geotextile bags), installed in accordance with OEH requirements and Council's Emergency Response Management Plan, to allow other actions to be implemented.
Development provides for the safety	Provide safe exit routes above storm flood heights
of residents, workers or other occupants on site, from risks	Development is on foundations which will withstand coastal erosion during storms, such as deep piling
associated with coastal processes	For areas affected by coastal inundation, floor levels of development should be set above long term inundation hazard levels.
	Development for elderly or frail people is located outside coastal risk areas. Council does not support approval of development applications for nursing homes or hospitals within the 2100 year coastal risk area.
Development (including coastal protection works) does not affect the safety of the public off-site from a change in coastal risks as a result of development	Development does not have a detrimental impact on beach character in terms of sand volumes and location or severity of rip cells. Development does not drive more severe erosion of public access ways. Development (such as sea walls constructed using geotextile bags or rock) does not increase safety risks for beach users.
Development does not increase coastal risks to properties adjoining or within the locality of the site	Development applications for proposed development within the 2050 and 2100 coastal hazard zones must be accompanied by detailed studies which show that the development will not increase coastal risks to adjoining properties, such as by modifying the functioning of coastal processes. If coastal protection measures are proposed as part of a development, they must also meet this criterion (no significant impact).
Infrastructure, services and utilities on site maintain their function and achieve their intended design performance.	Essential services (water, sewer, power) provided to and passing the site must be located and designed to ensure that they continue to function in major storm events up to the design life of the infrastructure.
	located outside the 2100 coastal risk area.

General planning criteria	Examples of satisfactory solutions
Development accommodates natural coastal processes	Rezoning to permit new subdivisions should be located outside the 2100 coastal risk area.
	No new development (with specific exceptions) will be approved in the immediate coastal risk area. Design of development in the 2050 and 2100 coastal risk areas must allow for relocation or removal in the relevant timeframe.
Coastal ecosystems are protected from development impacts	Development on coastal dunes or headlands must not significantly impact on coastal endangered ecological communities.
Existing public beach, foreshore or waterfront access and amenity is maintained.	Development and any coastal protection structures that are part of a development, must not significantly reduce public access to the beach or the recreational and scenic amenity of the beach.

9.1.5 WSC planning provisions to reduce the risks associated with coastal recession driven by sea level rise or other coastal processes

Council proposes to use a combination of land use zoning and development assessment controls to reduce risks associated with new development in coastal risk areas.

Council does not propose to grant consent to new development in the immediate coastal risk area. Exceptions may be made for minor maintenance works and alterations, with details to be set out in the DCP. An exception may also apply to specified coastal protection structures.

Council does not propose to approve new subdivisions, vulnerable development (such as nursing homes and hospitals) or other permanent development that intensifies land use in the 2050 or 2100 coastal risk areas.

Council does not propose to approve new major infrastructure (such as main roads and sewerage systems) in the 2050 or 2100 coastal risk areas, except where it can be protected in a cost effective manner that does not increase risks to other coastal values.

Further information is provided below about Council's proposed approach for future development in areas which are currently mapped within the 2050 and 2100 coastal risk areas.

The concepts in **Sections 9.1.5.1** and **9.1.5.2** take into account the principles and draft standard clauses proposed by DoP 2010 (see **Section 15.4.6** for more information).

9.1.5.1 Assessment methods for coastal development, as specified in the DCP

Chapter 3.5 of the Wyong Council DCP deals with coastal hazards. Assessment methods are linked to *"Coastal Hazard Planning Lines*". These are equivalent to the landward boundaries of immediate, 2050 and 2100 Coastal Risk Areas, which are defined by the landward boundary of the Zone of Reduced Foundation Capacity (see **Section 15**).

The DCP outlines three Assessment Methods:

- A Coastal Erosion Risk
- B Geotechnical hazards
- C Combined Bluff, Beach and Dune zones.

Assessment Method A – Coastal Erosion Risk

- a No new development will be approved seaward of the Immediate Coastal Erosion Hazard Planning Line.
- b No new development will be approved between the Immediate Coastal Erosion Hazard Planning Line and the 2050 Coastal Erosion Hazard Planning Line unless adequate protection or adaptation measures can be designed and implemented (approved by either Council or the NSW OEH).
- c No intensification of development will be approved seaward of the 2100 Coastal Hazard Planning Line
- d Council shall require proponents of new development proposed between the Immediate Coastal Erosion Hazard Planning Line and the 2050 Coastal Erosion Hazard Planning Line to appropriately design residential buildings to address the hazard, including for example adaptive development which can be relocated landward should the coastal erosion scarp recede.
- e Council may (depending on the location) issue time limited development consents for new development proposed between the Immediate Coastal Erosion Hazard Planning Line and the 2100 Coastal Erosion Hazard Planning Line. Such consents may also identify "triggers" for adaptive actions. Prior to the expiry date of the timed consent, or at the time when the identified trigger is realised, the landholder must apply and obtain an extension of time, or relocate the structure landward on the site (where this is possible), or remove the development and stabilise the disturbed area. Further information is in **Section 9.1.5.2**.
- f Council will not approve new major infrastructure (such as main roads and sewerage systems) seaward of the 2100 Coastal Erosion Hazard Planning Line, except where it can be protected in a cost effective manner that does not increase risks to other coastal values.
- g Council will not approve new subdivisions, vulnerable development (including nursing homes and hospitals) or other development that intensifies land use between the 2050 Coastal Erosion Hazard Planning Line and the 2100 Coastal Erosion Hazard Planning Line.
- h Floor levels for new development seaward of the 2050 Coastal Erosion Hazard Planning Line must consider the 1 per cent AEP storm wave run-up for each beach (refer s. 2.4 and the accompanying maps).
- i Construction and maintenance of sea walls to protect existing private assets affected by coastal recession will be considered on a merit basis. Emergency provisions should be referred for consideration by the NSW OEH.
- j Council will plan for the relocation of surf clubs out of coastal erosion hazard areas when major upgrades of facilities are due, plus identify surf club services/facilities that must be in the immediate hazard zone.

Assessment Method B: Geotechnical Hazards

- a No new development will be approved seaward of the Immediate Geotechnical Hazard Planning Line.
- b Generally, no new dwellings will be approved seaward of the 2050 Geotechnical Hazard Planning Line
- c Any proposal for other new development within the area bounded by the Immediate Geotechnical Hazard Line and the 2050 Geotechnical Hazard Line shall be accompanied by appropriate geotechnical assessments of the subject site and a Structural Engineer's Design for the proposed development that addresses the identified geotechnical hazards.
- d Any proposal for new development within the area bounded by the 2050 Geotechnical Hazard Line and the 2100 Geotechnical Hazard Line shall be accompanied by appropriate geotechnical assessments of the subject site and a Structural Engineer's Design for the proposed development that addresses the identified geotechnical hazards.
- e Any proposal for new development within an identified Geotechnical Hazard Zone shall be accompanied by appropriate geotechnical assessments of the subject site and a Structural

Engineer's Design for the proposed development that addresses the identified geotechnical hazards.

- f Council will not approve new major infrastructure (such as main roads and sewerage systems) seaward of the 2100 Geotechnical Hazard Planning Line, except where it can be protected against or adapted to the hazard in a cost effective manner that does not increase risks to other coastal values.
- g Council will not approve new subdivisions, vulnerable development (including nursing homes and hospitals) or other development that intensifies land use between the 2050 Geotechnical Hazard Planning Line and the 2100 Geotechnical Hazard Planning Line.
- h Construction and maintenance of sea walls to protect existing private assets affected by coastal recession hazards will be considered on a merit basis.

Assessment Method C: Combined Bluff, Beach and Dune Zones

a Any proposal for new development within an identified Bluff, Beach and Dune Hazard Zone (SMEC Area of Advice) shall be accompanied by appropriate geotechnical assessments of the subject site and a Structural Engineer's Design for the proposed development.

9.1.5.2 Timed development consents – new development and modifications to existing development

Many residential properties and a few commercial properties along the Wyong coastline are situated within the 2100 coastal risk area, but are unlikely to be impacted by coastal processes until after 2050. Some properties span the immediate hazard area, the 2050 and 2100 coastal risk areas.

AS above, Council does not propose to approve new development inside immediate coastal risk areas, with limited and very specific exceptions.

All development within the 2050 coastal risk area will require development consent.

Council is considering using timed consents, with special conditions, to allow appropriate new development within those parts of the coastal risk area that will not be affected by coastal processes for some time.

A time limited consent means that the consent expires at a specified date and a new application must be made and approved prior to that time if the development is to remain. The maximum duration of development consent for new development within the 2050 coastal risk area would be until 2050. For instance, a development application for a house that will be located at the landward margin of the 2050 coastal risk area (the landward boundary of the zone of reduced foundation capacity at 2050) could be approved until 2050.

The development consent for permanent residential structures could have conditions such as the following attached:

- No later than 12 months before the expiry date of the development consent, the applicant must either apply to Council for a renewal (extension) of the consent, or notify Council that the house will be relocated on the land (to outside the 2050 coastal risk area boundary) or removed from the site altogether. The application would include information about the nearest approach of any erosion scarp and any approved coastal erosion protection measures that have been installed.
- Council will apply the best available knowledge of coastal processes and hazards to its assessment of any application for extension of a time-limited development consent.

- Council may approve or refuse the extension of consent, based on the best available information about coastal hazards for instance, whether sea level has risen at the rate expected, or has risen faster or slower; and whether coastal storm frequency and intensity is tracking as predicted and if there is more accurate information about the location of rock under the sand.
- If Council approves the extension of the timed development consent, it will issue an amended consent based on merit, but for no more than ten years, at which time, the same review and renewal process must take place.
- If at any time the development is directly impacted by storm bite erosion (e.g. the landward margin of the actual zone of wave impact is within 5 metres of the development, or another distance agreed by DP&I, OEH and Council), Council may issue an order to the landowner to vacate the premises and remove or relocate the structure.
- If the development application is for a coastal protection structure for existing development, Council will apply the design requirements set out in relevant statutory guidelines. The structure will be approved with a timed consent that expires no later than 2050. For some locations, Council proposes to offer an option of interim protection using geotextile bag structures designed for a 20 year ARI event, but with a 10 year time limited consent.

Figure 9.15 is a flow chart providing an indication of how this time limited consent would be applied.

9.1.5.3 Design buildings for retreat with triggers for relocating

Where a coastal property includes an area of land meeting the minimum size for development, within the 2050 coastal risk area and also the 2100 coastal risk area, Council will consider approving a development application for individual residences or some types of higher density development, such as relocatable homes, seaward of the 2050 coastal risk area, with certain conditions. Examples of the types of structures that may be suitable are provided in **Plate 9.2**. However, further work is required across National and State jurisdictions to update Building Codes for development in coastal risk areas. Ongoing review of appropriate standards for Building Codes at these institutional scales will be reflected in acceptable design solutions at the local level. Council will update its DCP over time, as new standards become available.

Conditions that could apply to development consent for these relocatable structures include the following:

- Relocatable or modular residences may be located within the 2050 coastal risk area, but must not impinge on the immediate coastal risk area.
- The consent would not be time limited in the sense of requiring renewal by 2050, but Council would require all structures to be relocated on the allotment, or removed from the allotment, so that they are always outside the immediate coastal risk area, plus an appropriate buffer. Specific trigger distances and buffer distances would be set in the DCP and reviewed regularly.
- The design of the development must allow for relocation of structures on the allotment, by moving the structure back outside the 2050 and eventually the 2100 coastal risk area. Where this is not possible, Council would require the structure to be removed. Slab on ground structures would not be approved with this type of consent; only modular structures which can be readily relocated. Slab on ground structures would be subject to the timed consent process as in **Section 9.1.5.1**.



FIGURE 9.15

Consent Processes for Coastal Risk Areas





PLATE 9.2 An example of a relocatable residence on a coastal dune in New Zealand. This modular design can be loaded on a truck and moved landward out of the coastal erosion impact area • Council may also require emergency relocation of the building or associated infrastructure at the owner's expense if a large storm threatens its structural integrity.

9.1.6 Coastal protection structures for existing development

Council is considering options to allow property owners to protect **existing** structures that are within the immediate coastal risk area. These protection options are intended to provide adjustment time for landholders.

- For properties where existing structures are inside the immediate coastal erosion risk area, land holders may apply to construct interim protection (for up to 10 years), pending further evidence about sea level rise driven recession on the Wyong coastline. Such works must be designed to withstand at least a 1 in 20 recurrence interval storm. Structures must be removed after 10 years, unless an extension of the consent is granted. Landholders who build these structures may be liable for a levy to be paid to Council for ongoing maintenance of beach amenity.
- Council will consider applications for the construction of permanent rock sea walls to protect existing houses which are located in the **immediate hazard zone** only if:
 - all affected properties along a section of beach are involved/included;
 - the wall is built entirely on private property;
 - the wall will have minimal impact/risk in terms of erosion at the ends;
 - the landholders agree to contribute to the ongoing cost of beach nourishment to maintain beach amenity for the agreed life of the rock wall;
 - landholders are responsible for ongoing maintenance of the structure, as per standards specified by OEH and Council; and
 - public safety and access are not compromised.

Council has identified some locations in the immediate hazard zone where it will not approve the construction of a permanent sea wall, because of unacceptable risks to community access to the beach and to the stability of adjoining areas.

- At this time Council will not consider the construction of rock sea walls to protect residential property in the 2050 or 2100 coastal risk areas. Council will manage new development in these hazard zones using planning controls.
- Council will prepare detailed designs and REF for providing interim (up to 10 years)
 protection for existing surf clubs and major access infrastructure at surf clubs which are at
 immediate risk. Council will continue to invest in relocation of surf club facilities in
 accordance with a schedule based on erosion hazard and the significance of the facility
 to safe beach use in the Shire.

9.1.7 Planning strategies for specific locations

Council will work towards an alignment of open ocean beaches which is based on natural along-shore sand movement and alignment, allows for retreat of public land and minimises risks to major community infrastructure.

Council has considered specific strategies for North Entrance, Hargraves Beach, Lakes Beach, Blue Bay and Toowoon Bay, Shelly Beach and Soldiers Beach.

9.1.7.1 Soldiers Beach and Lakes Beach

- Land seaward of the immediate coastal hazard line will be zoned as open space or environment protection with the intent of preventing new development that increases risk. Zoning will be reviewed at 5 yearly intervals.
- At Lakes Beach and Soldiers Beach, Council will allow coastal recession to proceed in the coastal dunes.
- Council will relocate surf club infrastructure at Lakes Beach and Soldiers Beach landward as necessary to minimise risks.
- At Lakes Beach, Council will defend the alignment of the Central Coast Highway as necessary. Interim works to extend the time before coastal recession threatens the Highway include dune nourishment (raise the height of the dune crest) and vegetation enhancement.

9.1.7.2 Shelly Beach

- Land seaward of the immediate coastal hazard line will be zoned as open space or environment protection with the intent of preventing new development that increases risk. Zoning will be reviewed at five yearly intervals.
- At Shelly Beach, Council will allow coastal recession to proceed. Council will relocate the surf club behind the 2050 coastal erosion hazard line. The new surf club will be designed with foundations to enhance its resilience to storm wave erosion.
- Relocatable units at the north Blue Lagoon Resort will be moved over time, as necessary, to outside the coastal erosion hazard areas.
- Relocatable units and other recreational infrastructure at the south Blue Lagoon Resort will be relocated over time, as necessary, to outside the coastal erosion hazard areas. Based on current hazard information, the south Blue Lagoon Resort would revert to open space by 2100.

9.1.7.3 Hargraves Beach

Figure 9.16 shows proposed erosion hazard management actions for Hargraves Beach.

- Land holders would be permitted to install immediate short term geotextile bag protection in front of their properties, in the case of imminent erosion and in accordance with the provisions of the *Coastal Protection Act* 1979 (as amended 2010).
- Land seaward of the immediate coastal hazard line will be zoned as open space or environment protection with the intent of preventing new development that increases risk. Zoning will be reviewed at five yearly intervals.
- Only relocatable/modular designs will be permitted for **new** development seaward of the 2050 coastal erosion hazard area.
- Council will work with local residents and Landcare groups to maximise sand accretion and stabilising vegetation cover on the frontal dune and incipient foredune.



Source: SMEC (2010) Note: Contour Interval 0.5m

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- Immediate Limit of Zone of Wave Impact and Slope Adjustment
- Immediate Limit of Zone of Reduced Foundation Capacity
- 2050 Limit of Zone of Wave Impact and Slope Adjustment 2050 Limit of Zone of Reduced Foundation Capacity
- 2100 Limit of Zone of Wave Impact and Slope Adjustment
- 2100 Limit of Zone of Reduced Foundation Capacity

FIGURE 9.16

Area Affected by **Coastal Erosion Hazard Hargraves Beach**

1:4000

- There is continuous residential development along Hargraves Beach. Permanent sea wall protection will be considered for the full length of Hargraves Beach, seaward of existing houses, with development consent. The protection structure must be located on private land. The design of the structure must take into account the position of several houses seaward of the general alignment of the frontal dune. If permanent structural protection is constructed, emergency response measures in the emergency action subplan would no longer be permitted.
- Council's preference is that the cost of protection at Hargraves Beach is shared by private residents, Council, State and Australian government.
- Private land owners at Hargraves Beach who contribute to the cost of construction of coastal protection works at Hargraves Beach will be required to contribute to the cost of maintaining the structure and to the cost of beach maintenance (in accordance with the *Coastal Protection Act* and Minister's Guidelines 2010).

9.1.7.4 North Entrance Beach

Council proposes to protect a dune alignment which follows the position of the 2050 coastal erosion (recession) hazard line. Other than a few houses in Hutton Road and 22 houses in Curtis Parade, all land along North Entrance Beach within the 2050 coastal risk area is open space. However, landward of the 2050 coastal risk area, multiple assets would be threatened. These include the Central Coast highway, sewerage and power infrastructure and a large number of houses in the back barrier area. In the low lying back barrier area, coastal recession hazards will interact with flood risk.

Land holders would be permitted to install immediate short term geotextile bag protection in front of their properties, in the case of imminent erosion and in accordance with the provisions of the *Coastal Protection Act* 1979 (as amended 2010).

Figures 9.17 and **9.18** show proposed management responses for erosion hazards at North Entrance Beach.

Council will relocate North Entrance Surf Club as necessary to minimise risk. The new surf club will be designed to allow for retreat over time and the design will take into account the optimal site for various surf club functions (for instance, see the discussion in **Section 17.2.6**).

As for other beaches, land seaward of the immediate coastal hazard line will be zoned as open space or environment protection with the intent of preventing new development that increases risk. Zoning will be reviewed at five yearly intervals.

Council is considering four options for land in **Curtis Parade**.

- As for Hargraves Beach, landholders may demolish or modify (with appropriate consent) existing development seaward of the 2050 coastal erosion risk boundary so that it is relocatable on the allotment to outside the 2050 hazard zone. Relocation on the allotment is possible for only a few properties in Curtis Parade.
- Council may consider applications for construction of short to medium term protection of properties along Curtis Parade. This would involve construction of properly engineered seawalls using large sand filled geotextile bags, for a period of no more than 10 years. Seawalls must be located on private property and will be financed by private landholders. The protection capacity of the seawall would be reviewed at 10 year intervals. Approval of geotextile bag sea walls could be renewed at ten yearly intervals. This provides for a lower up-front cost, but less certainty about how long protection can remain in place.

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Source: SMEC (2010) Note: Contour Interval 0.5m

Legend

- Immediate Limit of Zone of Wave Impact and Slope Adjustment Immediate Limit of Zone of Reduced Foundation Capacity 2050 Limit of Zone of Wave Impact and Slope Adjustment
- --- 2050 Limit of Zone of Reduced Foundation Capacity
- 2100 Limit of Zone of Wave Impact and Slope Adjustment
- 2100 Limit of Zone of Reduced Foundation Capacity

File Name (A4): R03_V1/1869_081.dgn

FIGURE 9.17

Management of **Coastal Erosion Hazard** The North Entrance

1:3000



- Immediate Limit of Zone of Wave Impact and Slope Adjustment Immediate Limit of Zone of Reduced Foundation Capacity 2050 Limit of Zone of Wave Impact and Slope Adjustment
- --- 2050 Limit of Zone of Reduced Foundation Capacity
- 2100 Limit of Zone of Reduced Foundation Capacity
- File Name (A4): R03_V1/1869_082.dgn

FIGURE 9.18

Management of Coastal Erosion Hazard The North Entrance

- Council may permit construction (with consent and conditions) of a permanent, properly engineered rock sea wall to protect private property along Curtis Parade. The wall would be approved only until such time as recession to the north and south approached to within 10 metres of the 2050 hazard line i.e. the alignment of the boundary of public land/open space. This means that protection of private residences at Curtis Parade is unlikely to be approved beyond 2050. The protection structure must be built on private land and would be financed by a consortium of private landowners. A condition of construction of any sea wall would be a financial contribution from the landholders towards dune nourishment to the north and south of the protection structure.
- Council would require nourishment to *enhance dune height and volume* (i.e. place sand on the frontal dune system), as well as vegetation cover.
- After 2050 or when the recession trigger has been reached, Council and/or State and Australian government **may** resume the private land along Curtis Parade. This is not currently State policy and it cannot be assumed to be policy in the future.

Council is considering five options for land along **Hutton Road**:

- Protection of residences in Hutton Road is linked to the management of The Entrance.
- New residential development along Hutton Road must be located landward of the 2050 coastal erosion risk area and be designed to allow for retreat.
- Council will permit existing residents along the southern part of Hutton Road to install properly engineered protection works, using large sand filled geotextile bags. These are expected to provide protection for approximately ten years.
- Council will continue to place sand dredged from the entrance channel onto this section of North Entrance Beach for the next ten years. The sand will be placed onto the incipient foredune, with appropriate sand trapping structures and a revegetation program.
- Council will conduct further research into the impact of sea level rise on the dynamics of The Entrance Channel. Based on the results of this research, Council may choose to allow permanent protection of the dune alignment along the southern part of North Entrance Beach, including the southern end of Hutton Road.

9.1.7.5 Blue Bay and Toowoon Bay

Blue and Toowoon Bays are small embayments, where beaches lie landward of rock reefs and shore platforms. Twenty three beach front properties are assessed as being within the immediate zone of reduced foundation capacity. There is also rock or indurated material in the hind beach area (for instance at Toowoon Bay). This means there is limited opportunity for the beach to roll landward as sea level rises.

Council is considering the following management options, which are also shown in **Figures 9.19** and **9.20**:

- Land seaward of the immediate coastal hazard line will be zoned as open space or environment protection with the intent of preventing new development that would increase risk. Zoning will be reviewed at five yearly intervals.
- Land holders would be permitted to install immediate short term geotextile bag protection in front of their properties, in the case of imminent erosion and in accordance with the provisions of the *Coastal Protection Act* 1979 (as amended 2010).



- Immediate Limit of Zone of Wave Impact and Slope Adjustment Immediate Limit of Zone of Reduced Foundation Capacity
- 2050 Limit of Zone of Wave Impact and Slope Adjustment 2050 Limit of Zone of Reduced Foundation Capacity
- 2100 Limit of Zone of Wave Impact and Slope Adjustment
- 2100 Limit of Zone of Reduced Foundation Capacity

FIGURE 9.19

Management of **Coastal Erosion Hazard Blue Bay**

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Rock reef in near shore

'Pocket' beach, backed by rock terrain. As sea level rises, beach width narrows; no room for roll back. Indurated sand deposits behind the beach have poor resistance to erosion/recession.

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Permit structural protection to minimise erosion risk to 2050 (with consent). Further investigation interaction of erosion and geotechnical risks

Immediate, short term geotextile bag protection acceptable for these properties, in accordance with NSW Government Policy and Legislation. Large sond filled geotextile bags are to be placed no more than 10m seaward of the seaward wall of houses or (resort buildings) and on private land wherever possible. Any stockpiles of sand for beach nourishment are to be on private property.

Permit structural protection of car park (geotextile) and sand nourishment

Source: SMEC (2010) Note: Contour Interval 0.5m

Legend

- Immediate Limit of Zone of Wave Impact and Slope Adjustment Immediate Limit of Zone of Reduced Foundation Capacity
- 2050 Limit of Zone of Wave Impact and Slope Adjustment
- 2050 Limit of Zone of Reduced Foundation Capacity
- 2100 Limit of Zone of Wave Impact and Slope Adjustment
- 2100 Limit of Zone of Reduced Foundation Capacity

FIGURE 9.20

<u>10</u>0 m

Management Actions for **Coastal Erosion Hazard Toowoon Bay**

1:2000

- Council will encourage beach nourishment if a suitable sand supply is available. Beach nourishment would help to maintain the beach alignment.
- Council will consider structural protection of private property (with development consent). Protection structures must be on private property and no further seaward than the landward margin of the immediate zone of slope adjustment. Structures must be anchored to rock. All landholders in a section of receding beach would participate and contribute to the cost of construction and maintenance. Structural protection works must be properly maintained and integrity will be checked at regular intervals.
- Geotextile bag protection of the car park at Toowoon Bay would be considered, together with beach nourishment to maintain beach amenity.
- Structural protection will be considered (with consent) for Kyms Beach Hideaway at Toowoon Bay, to minimise erosion risk to 2050, but will be reviewed for timeframes beyond that time. Further investigation of the interaction of coastal erosion hazards and geotechnical hazards (on indurated sand at this location) is needed for this location.

9.1.8 Funding for coastal protection works

Council considers that the cost of protection (or other management) of public and private assets in areas expected to be affected by coastal recession should be shared by public and private stakeholders.

Council proposes that from now until 2050, private landholders would be able to construct properly engineered protection structures, on their own land and at their own cost.

Private landholders will be required to make a contribution to mitigation of offsite impacts. The *Coastal Protection Act* 201 and the Ministers Guidelines 2010 provide details on the circumstances in which land owner contributions to the cost of coastal zone management will be required. The most important mitigation measure for this time frame is beach and dune nourishment.

Council will meet the costs of protecting or relocating community assets and infrastructure. There will be occasions when emergency works are required to protect community assets such as beach access ways, promenades, surf clubs and roads. A schedule of works will be developed that aligns asset life with hazard risk. Assets will be relocated or protected as necessary to manage risk. For some infrastructure projects, Council will seek grant funding from State and Australian governments.

Council acknowledges that over the next century, it will need additional funds to meet the cost of managing coastal recession impacts on public infrastructure.

In planning for these contingencies, Council is considering a **Shire-wide coastal erosion hazard management charge**. If introduced, this charge would apply to all ratepayers in the Shire. Council would invest the proceeds of this charge in a special Trust. The Trust would be used to help fund Council's share of the cost of protection of public coastal land and assets affected by coastal hazards. Council will also continue to make a case for State and Australian government financial contributions to the cost of these works.

The amount of the special hazard management charge would be determined in consultation with ratepayers, Department of Local Government, OEH, LGSA and NSW Treasury.

Council also acknowledges that some private landholders may experience hardship through loss of their primary asset to coastal erosion. As noted above, public acquisition of land affected by coastal hazards is not currently NSW or Australian government policy. Council may consider using some funds from its proposed coastal erosion hazard Trust to contribute to land acquisition, if the State and Australian government policy position changes. Any proposals for land acquisition because of coastal hazard impacts would be considered in conjunction with State and Australian government.

9.2 Contributions to achieving coastal zone objectives and targets

Table 9.2 shows how the actions in this plan contribute to achieving the objectives and targets for the Wyong coastline.

Table 9.2 – Achieving objectives and targets for reducing coastal erosion and recession risks

0	bjectives and performance targets	Action Summary
O cl T	2 To inform and facilitate WSC's adaptation to imate change impacts on the coast arget	See actions in Section 7.0 and Section 8.0 . Multiple actions in Section 9.0 also contribute to this target.
•	By mid 2010, Councillors and Council officers are able to articulate the key risks associated with climate change impacts on natural and human systems along the Wyong coastline.	
O Ca T	4 To maintain and enhance the condition and apacity of community assets and infrastructure argets	A10: Council may build temporary structural protection such as geotextile bag structures to protect existing public assets in immediate hazard zones, as a short term action prior to relocation
•	By 2012, an asset condition data base is complete and detailed Plans of Management and/or Master Plans are in place for high profile, "icon" seaside recreation areas.	In the longer term, this action is modified to A26 A21: Prepare a schedule with trigger points for action, for relocation of existing community
•	By 2015 Council has a funded strategy for post storm assessment and timely restoration of coastal access assets such as ramps, stairs and viewing platforms.	risk areas. A22: Council will plan for the relocation of surf clubs out of coastal risk areas for appropriate planning borizons when major upgrades of
•	By 2015 Council has commenced implementation of works to secure effective functioning of essential community infrastructure (such as stormwater drainage systems, sewage transport systems and water supply) in conditions of sea level rise.	facilities are due. Council will work with surf clubs to identify club services/facilities that must be in the immediate hazard zone.
•	By 2012 Council has an agreed strategy for reducing risks associated with sea walls not currently designed for higher sea level conditions.	

Objectives and performance targets	Action Summary	
O7 To enhance the awareness of residents, landholders and land users of coastal processes and climate change impacts and how they can adapt to change. (see also Section 7.0)	See actions in Table 7.2 regarding information sharing and awareness raising, such as signage, posters, information sheets with rate notices, community field days and summer beach	
Target	programs, web based information and newspaper features	
By 2012 there is a measurable increase in the awareness of coastal residents and landholders of the variability of coastal processes, the impacts of predicted climate change on the coastline and opportunities for adaptation.	A33: Council will place notation on the s149 certificate for all properties within immediate, 2050 and 2100 coastal risk areas (coastal erosion) and also on properties seaward of the 2100 low hazard line for geotechnical hazards. Council will also inform affected ratepayers via information supplied with rate notices.	
O8 To develop efficient and effective strategies for minimising Council's exposure to risk in the coastal context Target	A6: Introduce clauses in the Wyong LEP and DCP to restrict new development in immediate hazard zones. Other than specified coastal protection works, no new development will be	
 By 2012, Council business planning and reporting includes consideration of climate change risks for coastal landscapes, integrated with other aspects of climate change risk management across the Shire. 	approved seaward of the immediate coastal erosion hazard line or seaward of the immediate geotechnical hazard line. All development in the 2050 risk area will require development consent.	
	A9: Council will continue to dredge sand from the active tidal delta at The Entrance and place the sand on North Entrance Beach. Some sand may also be placed on The Entrance Beach to maintain beach amenity.	
	A29: Council will consider a Shire wide levy to provide funds for managing climate change impacts on community assets along the coast, such as sewerage systems, roads and public beach access ways.	
	A8: Conduct dune stabilisation and revegetation works to encourage sand accretion and stabilisation of frontal dunes. These on-ground dune maintenance and stabilisation works will be conducted in accordance with Plans of Management for ocean frontage reserves managed by Council.	
	A44: Use beach nourishment or beach scraping to reinforce dunes and to maintain dune crest height above 7 metres at affected locations (potentially 8 metres at North Entrance)	

Objectives and performance targets	Action Summary	
O9 To support WSC planning for sustainable coastal development	A80: Zone ocean frontage land that is within the immediate hazard zone for Open Space or Environment Protection	
 By 2012, the Wyong LEP includes planning measures to reduce risks and to improve the net social, cultural, economic and environmental benefits of coastal development. 	A84: Introduce appropriate zoning and related clauses into the LEP to de-intensify development in the immediate coastal fringe, which is affected by coastal hazards	
	A6: Introduce clauses in the Wyong LEP and DCP to restrict new development in immediate hazard zones. Other than specified coastal protection works, no new development will be approved seaward of the immediate coastal erosion hazard line or seaward of the immediate geotechnical hazard line. All development in the 2050 risk area will require development consent.	
	A18: Introduce clauses in the LEP and DCP to introduce timed consents for new development in 2050 coastal risk area. Before the expiry date of the timed consent, the land holder must apply and obtain an extension of time, or relocate the structure landward on the block (where this is feasible and approved) or remove the development. Council will review the LEP at intervals of approximately 5 years, using best available knowledge and a review of the costs and benefits of planning controls. Specific and/or local area details are in Sections 9.1.5, 9.1.6 and 9.1.7 of the WSCZMP	
	A19: Use clauses in the LEP and DCP to identify appropriate development in coastal risk areas (such as relocatable structures) and to allow for mandatory demolition in certain circumstances. Council will review the LEP at intervals of approximately 5 years, using best available knowledge and a review of the costs and benefits of planning controls. Further details are in Sections 9.1.5, 9.1.6 and 9.1.7 of the WSCZMP	
	A11: Council may grant development consent to private landholders to install temporary, short to medium term (maximum of ten years) structural protection such as sand filled geotextile bag structures, to protect existing private assets in immediate hazard zones. Requirements will be generally in accordance with Ministerial Guidelines and the Coastal Protection Act requirements for emergency protection works, but development consent will be required and conditions will be applied.	
	A61: Conduct research into specific coastal process issues: Council will work with the NSW Government to study the feasibility of off shore sand being used for beach nourishment purposes, for maintaining beach area, volume and amenity at key locations. This is not for immediate implementation, but is relevant in the context of likely increasing need after 2020.	

9.3 Coastal Erosion and Recession Action Plan

Coastal erosion and recession, in the immediate and in the 2050 and 2100 coastal risk planning periods, present the highest risk to the values of the Wyong coastline. Private development and public infrastructure are both threatened by coastal erosion and recession. This section sets out Council's preferred approach to reducing the risks associated with coastal erosion and recession hazards.

Council will make planning decisions in accordance with the principles set out in the NSW coastal planning guidelines (DoP, now DP&I), so that new development is located and/or designed in a manner which minimises risk from coastal recession.

Information about the implementation of actions to reduce risks associated with coastal erosion and recession hazards is set out in **Table 9.3**.

9.3.1 Who will be involved in making a difference?

More than any other part of the Wyong Coastline Management Plan, this Action Plan is about risk reduction. Effective implementation will involve both Councillors and Council officers – to develop, communicate and implement a clear risk reduction policy for coastal erosion and recession.

Also involved in implementing the Action Plan for coastal risk areas will be:

- landholders in ocean frontage and low lying coastal areas;
- OEH, DPI (relevant sections of former L&PMA), DP&I and SES;
- insurance industry and real estate industry; and
- community groups such as Landcare/Coastcare.

Council's Environment and Natural Resources Unit, within the Planning Directorate, will lead implementation of the Action Plan and coordinate liaison with other stakeholders.

9.3.2 Erosion and recession actions also in other Action Plans

The tables in this Action Plan include actions that are not already included in the Coastal Knowledge Action Plan and/or the Emergency Response Action Plan. Relevant actions from those Action Plans include E01 (repeat collection and processing of LiDAR data for the coastline); E04 (staff training in emergency management); E05 (enhance community awareness of immediate coastal erosion hazards); A12 (prepare an asset register and maintenance program), A13 (research into specific coastal processes), and the monitoring and review actions A14, A15, A16, and A17.

A33 (notification of landholders affected by coastal risk areas for all planning periods using s149 certificates) is also an important tool for reducing coastal erosion and recession risks. As an important communication tool, it is included in the Coastal Knowledge Action Plan.

Table 9.3 - Strategies for managing coastal erosion risks

Step 2: Take action to reduce risks

A6: Introduce clauses in the Wyong LEP and DCP to restrict new development in immediate hazard zones. Other than specified coastal protection works, no new development will be approved seaward of the immediate coastal erosion hazard line or seaward of the immediate geotechnical hazard line. All development in the 2050 risk area will require development consent.

Intent and logic

Provide a clear framework, with more certainty for landowners and reduce disputes in the Land and Environment Court. Control new development to reduce risks. Prohibiting new development in immediate coastal hazard zones (immediate coastal risk areas) other than very minor maintenance works, places a limit on the value of existing development and prevents major additional investment which would increase risk. Council will apply the same planning controls to its own activities as it would apply to private development. More details are in **Section 9.3.1** and **Section 9.3.2**.

Responsibility and key partners	When - Priority	Where – locations for investment	Indicative cost and source of funding
WSC Strategic Planning Support from DP&I and OEH	In new Wyong LEP (due 2010) Review period Review implementation issues within 5 years of gazettal of the new Wyong LEP and DCP.	Applies to all land within immediate coastal erosion risk areas in the Shire	No additional budget necessary. Council is currently preparing a new LEP and DCP.

Step 2: Take action to reduce risk

A18: Introduce clauses in the LEP and DCP to introduce timed consents for new development in 2050 coastal risk area. Before the expiry date of the timed consent, the land holder must apply and obtain an extension of time, or relocate the structure landward on the block (where this is feasible and approved) or remove the development. Council will review the LEP at intervals of approximately 5 years, using best available knowledge and a review of the costs and benefits of planning controls. Specific and/or local area details are in Sections 9.1.5, 9.1.6 and 9.1.7 of the WSCZMP

A19: Use clauses in the LEP and DCP to identify appropriate development in coastal risk areas (such as relocatable structures) and to allow for mandatory demolition in certain circumstances. Council will review the LEP at intervals of approximately 5 years, using best available knowledge and a review of the costs and benefits of planning controls. Further details are in Sections 9.1.5, 9.1.6 and 9.1.7 of the WSCZMP

Details are in Section 9.3.1 and Section 9.3.2

These two actions jointly address DP&I requirements that new development respects coastal erosion and recession risks. As noted in A6, all development in the 2050 risk area will require development consent.

Intent and logic

The intent is to increase the resilience of coastal development (outside the immediate coastal risk area) to coastal hazards. The planning requirements will provide clear guidance to Council, land owners and land developers about the location and types of development that is acceptable in coastal risk areas. These clauses will not prohibit development but will guide appropriate development.

Responsibility and key partners	When - Priority	Where – locations for investment	Indicative cost and source of funding
WSC Strategic Planning, implemented by Development Planning Support from DP&I and OEH	In new Wyong LEP (due 2011) Review period: Review impacts on development applications and land values after 3 to 5 years. Review to also consider ongoing evidence of sea level	Applies to all land within the 2050 and 2100 coastal erosion risk areas for the Shire	Within Council [®] s existing responsibility to update its LEP and DCP. No additional budget necessary
	change factors.		

A80: Zone ocean frontage land that is within the immediate hazard zone for Open Space or Environment Protection

A84: Introduce appropriate zoning and related clauses into the LEP to de-intensify development in the immediate coastal fringe, which is affected by coastal hazards

Intent and logic

The intent is to encourage, over time, lower intensity and lower risk development in coastal risk areas. The zoning is consistent with Council's longer term planned retreat strategy. Lower intensity development is also more likely to allow for landward retreat of coastal ecological communities (see A20 and A32).

Responsibility and key partners	When - Priority	Where – locations for investment	Indicative cost and source of funding
VSC Strategic Planning Directorate and DP&I Network and D	Applies to all land within the immediate, and 2050 coastal risk areas	Within Council's existing responsibility to update its LEP and DCP. No additional budget necessary	
	Review period: Council will review the LEP zones at intervals of approximately 5 years, linked to updates of trends in the impact of climate change on the coastline (e.g. from IPCC, NSW Government and from LiDAR analysis at the local scale).		

Step 2 Take actions to reduce risk:

A33: Council will place notation on the s149 certificate for all properties within immediate, 2050 and 2100 coastal risk areas (coastal erosion) and also on properties seaward of the 2100 low hazard line for geotechnical hazards. Council will also inform affected ratepayers via information supplied with rate notices.

Associated elements of planning measures to reduce risk are in Actions A6 and A18 See **Table 7.2** for details about this action

A8: Conduct dune stabilisation and revegetation works to encourage sand accretion and stabilisation of frontal dunes. These on-ground dune maintenance and stabilisation works will be conducted in accordance with Plans of Management for ocean frontage reserves managed by Council.

This involves preparation and implementation of vegetation management plans for ocean frontage reserves, to ensure that effective stabilisation outcomes are achieved, without degrading important coastal outlooks. It also includes beach scraping and/or direct dune nourishment to shore up dunes or to move sand from the swash zone to the back of the beach.

Intent and logic

Research observations suggest that vegetation management on coastal dunes is an effective for building resilience because it traps additional wind-blown sand and helps build up dune height and volume, providing a better buffer to coastal erosion. Enhancing dune vegetation also has biodiversity benefits and potential recreational amenity benefits. It can be applied in urban and non urban areas. Dune stabilisation works are important for resilience in the short to medium term. Well established dune vegetation communities are less effective for managing long term recession, but vegetation management programs can be used to stabilise dune forms if they roll landward as sea level rises.

Responsibility and key partners	When - Priority	Where – locations for investment	Indicative cost and source of funding
WSC Environment and Natural Resources Unit, with Coastcare/Dunecare groups (and CEN) Support from HCRCMA	Immediate and ongoing. Review period: Review success after no more than 5 years. The value of dune rehabilitation works will need to be reviewed as the impacts of sea level rise become more obvious – likely to be step changes after major storms in the 5 to 10 year planning horizon.	Key locations are Budgewoi Beach Lakes Beach Soldiers Beach North Entrance Beach Hargraves Beach	Allow \$50,000 per year for materials, plus \$60,000 per year salary to continue the role of the Landcare coordinator (role covers other aspects of coastal vegetation management too) Funds from CMA coastal projects funding stream and from OEH programs

Step 2: Take action to reduce risk

A9: Council will continue to dredge sand from the active tidal delta at The Entrance and place the sand on North Entrance Beach. Some sand may also be placed on The Entrance Beach to maintain beach amenity.

This action combines with A28: Review of entrance management strategy as sea level rises.

Intent and logic

Manage sand volume on North Entrance and South Entrance beaches, using locally available sand from the active tidal delta. Council currently dredges sand from the entrance channel of Tuggerah Lake and places it on North Entrance Beach. This small scale maintenance dredging distributes sand that would otherwise be stored in the tidal delta for prolonged periods and would be scoured from the entrance channel to the nearshore area in occasional very large storms/floods. Dredging allows Council to manage sand delivery gradually, rather than in pulses. It also allows control of where sand is placed.

Responsibility and key partners	When - Priority	Where – locations for investment	Indicative cost and source of funding
WSC asset manager, Environment and Natural Resources Unit, Shire Services Unit and Environmental Assessment unit. Council will work with advice from OEH and will consult with DPI (relevant sections of the former L&PMA) as the land owner.	Ongoing. Review period: Review outcomes at approximately 5 yearly intervals. In the longer term, sea level rise may affect the dynamics of the entrance channel and change the volume of sand available and/or pumping requirements.	Council already uses sand from the channel at The Entrance to nourish North Entrance Beach. Section 10.0 discusses use of dredged sand on both North Entrance and South Entrance beaches.	Allow \$80,000 per year. From Council resources (this cost continues an allocation that Council already makes for placing dredged sand on North Entrance Beach)

A10: Council may build temporary structural protection such as geotextile bag structures to protect existing public assets in immediate hazard zones, as a short term action prior to relocation. In the longer term, this action is modified to A26

A26: Council may build and maintain sea walls to protect existing public assets that are vulnerable in the 2050 and 2100 planning horizons. This action would only be used for major assets with a long asset life, whose function will not be compromised by other aspects of climate change or changing community requirements.

Intent and logic

Council has a number of existing community assets, such as surf clubs, in the immediate (or short term) coastal risk area. The intent of this action is to provide protection from storm bite erosion, over the asset life of those assets or until the asset can be relocated landward. It is not intended that Council would use a sea wall to maintain a surf club in the immediate hazard zone in the long term.

Proposed short to medium term geotextile bag structures are a pre-emptive component of managing coastal emergencies. Details about some benefits and concerns about the use of geotextile bag structures are in **Section 8.3.3**

In addition, for high usage recreational areas, a sea wall can provide a clear edge between pedestrian/picnic spaces and the active beach. The sea wall at The Entrance, is an example which Council will maintain. Where sand is available, sea walls or other structures can be combined with sand nourishment for aesthetic reasons and to enhance beach amenity.

Responsibility and key partners	When - Priority	Where – locations for investment	Indicative cost and source of funding
WSC Asset Manager and Engineering Support from WSC Environment and Natural Resources Unit and OEH, also DP&I and DPI (relevant sections of former L&PMA).	A short term action for structures such as surf clubs and some access ways that may be vulnerable to erosion in the next ten years and where relocation is not immediately feasible. Review period: Review after no more than 5 years.	Short term protection: Surf Cub sites – protect with sand filled geotextile bags. Note that these protection structures must not reduce beach amenity or exacerbate erosion nearby. Longer term protection and maintenance: The Esplanade at The Entrance (protect promenade). The sea wall needs structural design suitable for 2050 and 2100 sea level and wave impacts.	Interim protection for surf clubs using sand filled geotextile bags will cost approximately \$100,000 per site. Cost for maintaining rock walls at The Entrance is likely to be more than \$1 million over the next 20 years

A21: Prepare a schedule with trigger points for action, for relocation of existing community infrastructure and public assets to outside coastal risk areas.

(See also **Sections 9.4** and **11.0** in relation to assets affected by inundation and coastal geotechnical hazards). See also Actions A22 and A23 for surf clubs.

Intent and logic

Proactive management of community assets to maintain their functions and services in the long term. Although there are significant cots with relocating infrastructure, planned relocation linked to risk profile and asset life is more cost effective than emergency action when infrastructure has been broken/undermined by wave action.

Responsibility and key partners	When - Priority	Where – locations for investment	Indicative cost and source of funding
WSC Asset Manager (City Services) and Environment and Natural Resources Unit Partners will include Surf Life Saving clubs, OEH, RTA, NSW Maritime Authority, DPI (relevant sections for former L&PMA), Energy Australia and local community groups.	Prepare schedule within 12 months Review period The schedule will be reviewed and updated after approximately 5 years to ensure that priorities are informed by the best available information.	Applies to all assets within the immediate, 2050 and 2100 coastal erosion risk areas. In particular, consider surf clubs (see Actions A22 and A23), sewer infrastructure, water supply and electricity infrastructure, roads, pathways, parking areas, boat launching ramps, steps and ramps, viewing platforms. See Figure 9.21 for locations of affected infrastructure.	Within responsibilities of existing Council staff.

Step 2: Take action to reduce risk

A22: Council will plan for the relocation of surf clubs out of coastal risk areas for appropriate planning horizons when major upgrades of facilities are due. Council will work with surf clubs to identify club services/facilities that must be in the immediate hazard zone.

See also A23, which can provide additional flexibility for the location of some surf club structures. A10 addresses interim protection measures.

Intent and logic

Reduce risk to Council investment in surf club buildings and maximise the community value of surf club facilities. Council manages six surf club buildings and associated infrastructure, to meet both beach safety objectives and a range of other social objectives in the community. By locating new major surf club buildings outside the coastal risk areas for either 50 years or 100 years, Council will maximise the life of its investment in these buildings. Council acknowledges that some surf club infrastructure must be located very close to the beach, likely in the immediate coastal risk area, for safety reasons. Details of key services that could be located in or outside of short term coastal risk areas are in **Section 19.4.2** of **PART D**.

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Legend

- 2100 Limit of Zone of Wave Impact and Slope Adjustment
 2100 Limit of Zone of Reduced Foundation Capacity
- Sewer Line
- Water Line Footpath
- Surf Life Saving Club

FIGURE 9.21a

Infrastructure in Coastal Hazard Zones Shelly Beach





Source: SMEC (2010)

Legend

- 2100 Limit of Zone of Wave Impact and Slope Adjustment
 2100 Limit of Zone of Reduced Foundation Capacity
- Sewer Line
- Water Line Footpath
- Surf Life Saving Club

FIGURE 9.21b

Infrastructure in Coastal Hazard Zones Toowoon and Blue Bays





- 2100 Limit of Zone of Wave Impact and Slope Adjustment
 2100 Limit of Zone of Reduced Foundation Capacity
- Sewer Line
- Water Line
- Footpath
- Surf Life Saving Club

FIGURE 9.21c

Infrastructure in Coastal Hazard Zones The North Entrance



- 2100 Limit of Zone of Wave Impact and Slope Adjustment ----- 2100 Limit of Zone of Reduced Foundation Capacity
- —— Sewer Line
- Water Line
- Footpath

FIGURE 9.21d

Infrastructure in Coastal Hazard Zones The North Entrance





----- 2100 Limit of Zone of Wave Impact and Slope Adjustment

2100 Limit of Zone of Reduced Foundation Capacity

----- Sewer Line

—— Water Line

— Footpath

Surf Life Saving Club

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FIGURE 9.21e

Infrastructure in Coastal Hazard Zones Soldiers Beach





Source: SMEC (2010)

Sewer Line

Water Line Footpath Surf Life Saving Club

Legend

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FIGURE 9.21f

Infrastructure in Coastal Hazard Zones Hargraves and Lakes Beach

2100 Limit of Zone of Wave Impact and Slope Adjustment
 2100 Limit of Zone of Reduced Foundation Capacity





Source: SMEC (2010)

- 2100 Limit of Zone of Wave Impact and Slope Adjustment
 2100 Limit of Zone of Reduced Foundation Capacity
- Sewer Line
- Water Line
- Footpath

FIGURE 9.21g

Infrastructure in Coastal Hazard Zones North of Lakes Beach

Responsibility and key partners	When - Priority	Where – locations for investment	Indicative cost and source of funding
WSC asset management, development assessment and community planning. Surf Clubs. Consult L&PMA when facilities are on Crown land	Surf clubs and related facilities should be relocated as necessary to minimise risk. Because some buildings are in higher hazard locations than others, they may need to be relocated sooner.	See Figures 9.1 to 9.14 for surf clubs at risk and the extent of retreat of club buildings, access and car parks necessary to reduce risk for the 2050 and 2100 coastal risk planning periods.	Allow up to \$2.5 million for relocation of each surf club and access facilities.
	Review period: Review progress no later than 5 years and refocus if necessary		

A23: Council will design some surf club buildings and other structures for retreat during erosion emergencies or in accordance with long term erosion triggers. Relocatable facilities are an option when the terrain and land tenure are suitable.

See Plate 9.2 for examples of designs suitable for retreat.

Intent and logic

This action would allow some surf club infrastructure (but generally not main buildings) to be safely built close to the beach face, by focusing on flexible design. Similar management of relocatable structures could be used for some structures on private land (to be identified in Council's LEP and DCP – see Actions A18 and A19.

Responsibility and key partners	When - Priority	Where – locations for investment	Indicative cost and source of funding
WSC Asset managers, community planning, development assessment and Surf Club members. L&PMA should also be consulted about structures on Crown land.	Include in any modifications and refurbishment over the next 2 years and up to 10 years. All major club infrastructure should be redesigned and/or relocated over ten years.	All surf clubs in Wyong shire (see Figures 9.1 to 9.14 for locations). May be used particularly for facilities/functions that must be located in the immediate back beach	Cost for major redesign included in \$2.5 million for each surf club site, noted for Action A22. Cost to redesign only the functions for immediate back beach areas (closest to the beach), allow \$100,000
	Review period: Report on progress and remaining exposure to risks after no more than 5 years.		per site. Funds may be available in special climate change adaptation grants from the Australian government.

Step 2: Take action to reduce risk

A11: Council may grant development consent to private landholders to install temporary, short to medium term (maximum of ten years) structural protection such as sand filled geotextile bag structures, to protect existing private assets in immediate hazard zones. Requirements will be generally in accordance with Ministerial Guidelines and the Coastal Protection Act requirements for emergency protection works, but development consent will be required and conditions will be applied.

A27: Council may grant development consent to permit the construction and maintenance of sea walls to protect existing private assets affected by coastal recession (2050 coastal risk planning period), with specific conditions.

Intent and logic

Council is considering the use of geotextile structures to protect public assets in immediate coastal erosion hazard areas, for periods of up to ten years. Council proposes to allow the use of similar structures to protect private assets for short to medium periods, up to 10 years. This would provide private landholders with time to consider and implement retreat options for existing development that is located in immediate hazard zones. Any structural protection installed by private land holders (other than very temporary emergency protection works) must be installed on private land. Public land (beach and dune) is not to be used for medium term or longer coastal protection measures for private property. Council is not currently in favour of rock wall protection for coastal property in immediate hazard zones, whether it is private or public property (see also **Section 19.3.5** in **PART D**). See **Section 8.3.3** for further information about geotextile structures.

Council will only consider approval of structures that do not increase coastal erosion risk elsewhere along the beach and dune system and which do not reduce the public accessibility and amenity of the beach. Landholders may prevent loss of beach amenity by committing to long term beach nourishment (where a suitable sand supply is available). See Action A29.

Responsibility and key partners	When - Priority	Where – locations for investment	Indicative cost and source of funding
Private land holders in consultation with WSC, DP&I, OEH, and DPI (relevant sections of former L&PMA). by s now built prot	Property at North Entrance (Curtis Parade) is within the immediate coastal risk area and is threatened by storm bite erosion now. Applications to build structural protection are expected as soon as statutory	Could be considered for North Entrance (Curtis Parade and Hutton Road), Hargraves Beach and at Blue Bay.	Properly designed and engineered geotextile bag structures can cost up to \$8,000/linear metre and are suitable for interim protection applications up to a life span of approximately 10 years.
	context is clarified.		be at landholder
	Review period: If approved, structure integrity should be examined after not more than 5 years and development consent would generally expire after 10 years. Overall success of the		expense. Landholders would also be required to meet the cost of any beach nourishment that may be required to offset the effects of the sea wall on beach amenity, in perpetuity.
	approach to be reviewed after 10 years.		Councils may do protection works on behalf on private landholders, on a cost recovery basis.

Step 2: Take action to reduce risk or enhance opportunities

A29: Council will consider a Shire wide levy to provide funds for managing climate change impacts on community assets along the coast, such as sewerage systems, roads and public beach access ways.

This action supplements actions A26 (public assets) and A27 (private assets) and provides a mechanism for collecting funding contributions from private landholders who benefit from coastal protection works. A user (beneficiary) pays system, over and above normal rate charges, is proposed in amendments to the *Coastal Protection Act 1979*.

Council is also considering a broader rate levy to cover the costs to the community of climate change impacts on coastal assets.

Intent and logic

If sea walls are built to protect absolute ocean frontage private property from coastal erosion, impacts on beach amenity and access are likely over time as sand is lost from the beach in front of the wall. This action foreshadows that Council will levy an additional rate charge on benefitting land owners, to contribute to the cost of works such as beach nourishment to maintain the public values of the beach.

Responsibility and key partners	When - Priority	Where – locations for investment	Indicative cost and source of funding
Council would levy the additional rate in consultation with the Minister for Local Government, Minister for Planning and Minister for the Environment, and with	Discussion of levies will be concurrent with any discussion about construction of long term coastal protection works and would be subject to review.	Initial areas where this may apply are immediate coastal risk areas and/or coastal erosion Authorised Locations – such as North Entrance and Hargraves Beach.	Council will consider the cost effectiveness of administering a rate levy on specific properties.
affected landholders.		The broader levy for coastal protection works would apply to all ratepayers in the Shire	

Step 3: Enhance knowledge and monitor achievements

A61: Conduct research into specific coastal process issues: Council will work with the NSW Government to study the feasibility of off shore sand being used for beach nourishment purposes, for maintaining beach area, volume and amenity at key locations. This is not for immediate implementation, but is relevant in the context of likely increasing need after 2020.

Intent and logic

This action is one of several knowledge improvement tasks, required before decisions can be made about the scope and feasibility of another management response. In the medium to long term supplies of terrestrial sand and/or sand dredged from the entrance channel of the Tuggerah Lakes may not be sufficient to maintain dune height and volume as sea level rises and coastal recession continues or increases. One alternative source of sand is offshore sand from deep water on the continental shelf. For instance, one option to reduce the long term risk of a breach of the barrier at Budgewoi is beach nourishment to maintain dune height and volume. Research has commenced on the feasibility of accessing offshore sand supplies for beach nourishment in the Sydney metropolitan area, but not for the Central Coast. Offshore sand extraction for beach nourishment (or any other purpose) is not NSW government or Wyong Council policy at the moment. See **Section 10.0** in **PART B** and **Section 19.3.4** in **PART D** for more detail about sand sources and recent studies of offshore sand.

The NSW Minister for the Central Coast and Minister for Mineral Resources refused an application for an Exploration licence off the Central Coast in 2009, citing environmental concerns as the reason for the refusal.

Note that offshore sand supplies are a very high cost sand source and Council's decisions will be affected by decisions made for very high profile beaches in the Sydney metropolitan area, and the evolution of NSW Government policy over the next 5 to 10 years.

Responsibility and key partners	When - Priority	Where – locations for investment	Indicative cost and source of funding
DTIRIS (Department of Resources and Energy) OEH Australian government Sydney Coastal Councils Group	Over the next 10 years – this type of beach nourishment is not necessary now and is contra to State and local policy and regulations.	May be feasible for Budgewoi and North Entrance in the future.	See Sydney Coastal Councils research 2009. Very high capital costs (in the order of hundreds of millions of dollars) and ongoing costs are involved.

The actions listed in **Table 9.4** may be considered by Council in specific circumstances, but are **not currently** priority elements of Council's overall approach to sustainable management of the coastline. These actions **may be considered** in the future, in accordance with evolving NSW and Australian government policies.

Table 9.4 - Potential future actions

Step 2: Take action to reduce risk

A7: Require removal of existing development within immediate coastal hazard zones, when the landward margin of the zone of wave impact is within 5 metres of the structure. Note that if structures collapse onto the beach during a coastal emergency, the landholder will be responsible for the cost of removing the rubble from the beach. As immediate coastal hazard zones migrate landward, this requirement would also apply to assets in the 2050 and 2100 coastal risk areas.

Intent and logic

As the impacts of climate change and sea level rise begin to be revealed above the natural buffering capacity of coastal dunes, some coastal properties will be reduced in size and some residential and commercial buildings may not be viable, i.e. protection of some structures may not be feasible because of high costs or unacceptable impacts on other coastal values. This action places responsibility for the risk on the landholder. If implemented, it is likely that a version of Action A21 would also be required.

Responsibility and key partners	When - Priority	Where – locations for investment	Indicative cost and source of funding
Council will consult and seek advice from landholders, insurance providers, OEH and	The need for this action will become more apparent over the next 10 years.	The action may be implemented at North Entrance or at Hargraves Beach in the	Funding is partly dependent on the outcomes of policy decisions noted in
DP&I prior to implementing this action	Council will review the situation as new IPCC reports or State or Australian government climate change impact analyses and coastal management policies for existing development are released	first instance, but could also be relevant at some time in the future to Blue Bay and Toowoon Bay. Council is also affected by the need to demolish and relocate surf club infrastructure.	relation to Action A21.

Step 2: Take action to reduce risk

A24: Council will consider options for government acquisition of private land affected by coastal hazards. Council will work with NSW and Australian governments to develop an appropriate strategy for high risk locations. Government acquisition of private land in coastal risk areas is not currently supported by any of these levels of government.

At this time, WSC undertakes only to monitor State and National policy development in relation to acquisition of hazard impacted coastal land.

Intent and logic

There are several hundred properties in the immediate coastal risk area along the NSW coast and many hundreds more in longer term coastal risk areas. At current market value, purchase of affected properties by State or local government is not considered to be feasible. In the longer term, other options to manage coastal process impacts on these properties may not be cost effective and buy back may become a more beneficial option.

Responsibility and key partners	When - Priority	Where – locations for investment	Indicative cost and source of funding
Council and/or the NSW government, in negotiation with affected property owners.	Policy position to be reconsidered within the 10 year life of the coastline management plan.	Council and/or the state government would acquire private property within the immediate coastal risk area, or within a specified set back of an erosion scarp. Immediate coastal risks currently affect houses at North Entrance and Hargraves Beach in Wyong Shire.	Costs will depend on the value of coastal properties at the time of acquisition. Current market values of individual ocean frontage properties are often more than \$1.5 million.

9.4 Coastal Inundation Action Plan

This section sets out (in **Table 9.5**) Council's preferred approach to reducing risks associated with coastal inundation. Coastal inundation occurs when ocean waves overtop the coastal dunes. Inundation of lake shore property by high lake water levels associated with catchment runoff and future inundation of the lake shore line as sea level rises are addressed in the Tuggerah Lakes Estuary Management Plan (Wyong Shire Council 2006) and in Flood Risk Management Plans (currently being developed).

Areas along the Wyong coastline that are expected to be affected by wave overtopping include:

- Blue Lagoon Resort;
- Southern end of Blue Bay;
- South Entrance swimming pool;
- Curtis Parade at North Entrance; and
- Hargraves Beach

As for coastal erosion and recession risks, this Action Plan is designed to update Council's approach to existing and future development in areas now understood to be coastal risk areas. In most cases, the risk associated with overtopping are considered to be relatively minor. However, in the longer term, the combined impacts of recession and wave overtopping potentially have more significant implications for the Budgewoi area.

Figures 9.22 to **9.29** show the locations of areas affected by coastal inundation and proposed actions to reduce risks at these locations. Oceanic inundation associated with storm surge through The Entrance is considered in **Section 10.0** and in the Tuggerah Lakes Flood Risk Study (2011).

9.4.1 Council's priorities

To minimise the risk of coastal inundation impacts on residential areas, Council will use "soft" engineering options such as beach nourishment and dune management to maintain or increase the crest height of the frontal dune.

Council will ensure that all affected landholders and residents are aware of coastal inundation hazards to their property, by adding notation on s149 certificates and other information sharing measures.

Council will continue to work towards feasible sand sources for long term beach and dune nourishment. This is also addressed in the Coastal Erosion and Recession Action Plan. The extent to which dredging of the Entrance provides a sand source is discussed in **Section 10.0**.

9.4.2 Who will implement the Coastal Inundation Action Plan?

As for coastal erosion and recession risks, the implementation of this Action Plan will be managed by Council's Environment and Natural Resources Unit, within the Planning Directorate. Council will work closely with DP&I and OEH. Where coastal inundation impacts affect assets on Crown land, Council will also consult with DPI (relevant sections from the former L&PMA) about the details of any management action.





Legend — Maximum Wave Run-up

FIGURE 9.22

Area Affected by Wave Run-up and Coastal Inundation Shelly Beach



Source: SMEC (2010)

100 1:5000

Legend —— Maximum Wave Run-up

FIGURE 9.23

Area Affected by Wave Run-up and Coastal Inundation Toowoon and Blue Bays

Umwelt



Source: SMEC (2010)

1:3000

Legend —— Maximum Wave Run-up

FIGURE 9.24

Area Affected by Wave Run-up and Coastal Inundation South Entrance





—— Maximum Wave Run-up

FIGURE 9.25

Area Affected by Wave Run-up and Coastal Inundation The North Entrance







FIGURE 9.27

Area Affected by Wave Run-up and Coastal Inundation Soldiers Beach

Legend

----- Maximum Wave Run-up





Legend ----- Maximum Wave Run-up

FIGURE 9.28

Area Affected by Wave Run-up and Coastal Inundation Hargraves and Lakes Beach





Source: SMEC (2010)

100 1:5000

Legend

FIGURE 9.29

Area Affected by Wave Run-up and Coastal Inundation North of Lakes Beach

Landholders and community groups are also important partners in managing dune height and vegetation.

Table 9.5 - Strategies for managing coastal inundation risks

Step 2: Take action to reduce risk

A62: Reference maps showing areas affected by coastal inundation in the Wyong LEP. Amend the Wyong LEP and DCP to require development applications in areas affected by coastal inundation to take the inundation hazard into account. Floor levels for new development in immediate inundation hazard areas must consider the 1% AEP storm wave run up for each beach.

Intent and logic

To ensure that coastal inundation hazards are taken into account when new development is proposed.

Responsibility and key partners	When - Priority	Where – locations for investment	Indicative cost and source of funding
WSC – Strategic Planning and development assessment planners within the Planning Directorate	Include in the preparation of the new Wyong LEP, applying the standard State-wide template and draft clauses developed by DP&I for coastal risk areas Review period Review impact on landowners and development no later than 5 years. This review will also consider the impacts of any inundation events, and any modifications to hazard areas.	The maps referenced in the LEP will show areas affected by coastal inundation. Planning controls will apply to those areas. Other areas may be added later, after reviews of the hazard.	Within the roles of council's strategic planning team. No additional investment required.

Step 2: Take action to reduce risk

A43: Advise occupiers of property that is affected by coastal inundation risks by adding a notation on s149 certificates for the property and by direct communication, e.g. with rate notices, letters. Combine this with information about emergency response procedures in the event of inundation Emergency egress is important for occupiers of existing development where other risk reduction measures are not feasible. See also **Section 8.0**.

A35: Council will contribute to the development of new tools such as high resolution digital terrain models and other information to refine models for safe community egress during coastal emergencies and communicate new warning and egress models to affected residents.

Intent and logic

To ensure that land owners and potential land owners are informed of the coastal inundation risk that affects the property and that quality, cost effective information is used to advise residents and plan for emergency events. See also **Section 8.0**.

Responsibility and key partners	When - Priority	Where – locations for investment	Indicative cost and source of funding
Council Strategic planning and legal sections	This will be done when the LEP references the coastal inundation hazard areas.	As for OA1.	No additional budget required (other than small allowances for communication).
	Review period As for OA1. Review no later than 5 years.		

A44: Use beach nourishment or beach scraping to reinforce dunes and to maintain dune crest height above 7 metres at affected locations (potentially 8 metres at North Entrance)

This includes beach scraping to reinforce dune volume, use of sand catch fencing, revegetation or vegetation enhancement, control of beach access ways and potentially use of temporary geotextile structures to help trap and retain sand.

This action complements Action A8 in Table 9.2

Intent and logic

This action is designed to maximise the accretion potential of the frontal dune system, increasing its volume and height so that it provides an effective buffer to coastal erosion and wave overtopping in the short to medium term.

The action also has benefits for biodiversity connectivity and will work best with community involvement – e.g. Landcare/Coastcare in planting.

In the long term, actions such as A31 (research into identifying feasible offshore sand sources) would follow on from this action.

Responsibility and	When - Priority	Where – locations for	Indicative cost and
key partners		investment	source of funding
WSC environment and Natural Resources Unit and asset managers OEH for technical advice DPI (relevant sections of the former L&PMA) (land owner)	Council currently supports Landcare/Coastcare groups in dune protection works, in accordance with the NSW Coastal Dune Management Manual. Review period Review dune profiles and volume at intervals of not more than 5 years.	The action is relevant to all sandy beach and dune systems along the Wyong coastline, but is particularly important at North Entrance, Hargraves Beach and Lakes Beach/Budgewoi.	Allow \$50,000 per year, above staff salaries.

Step 3: Enhance knowledge and monitor progress

A61: Conduct research into specific coastal process issues: Council will work with the NSW Government to study the feasibility of off shore sand being used for beach nourishment purposes, for maintaining beach area, volume and amenity at key locations. This is not for immediate implementation, but is relevant in the context of likely increasing need after 2020.

Long term sand sources are relevant to both beach recession and inundation issues. Information about this action is in **Table 9.3** and is not repeated here. Preliminary information about potential sand sources is in **PART C** and in **Section 10.0** of **PART B**.

Step 3: Enhance knowledge and monitor progress

A65: Maintain a data base with information about coastal inundation episodes, including dates, context, photographs, impacts and response.

Intent and logic

Maintain a clear record of individual events, which can be used to review hazards and the effectiveness of any management actions. This action is a companion to Actions A10 and A1 in **Section 7.0**.

Responsibility and key partners	When - Priority	Where – locations for investment	Indicative cost and source of funding
Council staff – Environment and Natural Resources Unit. Involve Council Services unit where infrastructure assets are involved. Potential for community involvement particularly in relation to local photos and stories.	To commence immediately (i.e. be ready for use at the next oceanic inundation event) Review period. Review record at intervals of 3 to 5 years.	Relates to all locations along the Wyong coast expected to be affected by wave overtopping of coastal dunes: Blue Bay, Shelly Beach, North Entrance, Hargraves Beach, Budgewoi sand spit	Within existing responsibilities of Council staff. Additional budget required for assessment and monitoring resources such as aerial photos (around \$30,000 per run).