

ADDITIONAL ITEM

12 December 2012
To the Ordinary Council Meeting

Director's Report
Development and Building Department

4.5 DA/222/2012/A - Dwelling & Inground Pool including Demolition of Existing Dwelling at Wyong

TRIM REFERENCE: DA/222/2012/A - D03203403

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SUMMARY

An application under Section 96 of the *Environmental Planning and Assessment Act 1979* (EP&A) has been received seeking to modify the consent to development application DA/222/2012. That consent was for the construction of a new dwelling and inground pool and the demolition of the existing dwelling at 37 McDonagh Road, Wyong. The modification sought is to reduce the floor level of the proposed dwelling from 3.63m AHD to 2.7m AHD. The application has been examined having regard to the statutory matters for consideration detailed in Sections 79C and 96 of the EP&A Act and other statutory requirements with the issues requiring attention and consideration being addressed in the report.

Applicants	Kerrie Chisholm and Andrew Chisholm
Owners	Kerrie Chisholm and Andrew Chisholm
Application No	DA222/2012/A
Description of Land	Lot 19 Sec 33 DP 4526 (37 McDonagh Road, Wyong)
Proposed Development	Dwelling & inground pool including demolition of existing dwelling
Site Area	2130m ²
Zoning	2A Residential
Existing Use	Residential dwelling
Estimated Value	\$420,000

RECOMMENDATION

That Council, having regard to the matters for consideration detailed under Sections 96 (1A) and 79C of the Environmental Planning and Assessment Act and other relevant issues, refuse the application for the reasons set out in the schedule attached to the report.

PRECIS

- Development application DA/222/2010 sought consent for development that included the erection of a dwelling with a floor level of 3.63m AHD and a garage with a floor level of 1.8m AHD. Council granted, under delegation, conditional consent to that development application. One consideration in the granting of that consent was that the proposed floor level for the new dwelling of 3.63m AHD substantively complied with the (then) NSW government Sea Level Rise policy.
- The pending s.96 application seek approval to modify the consent so as reduce the floor height of the proposed dwelling from 3.63m AHD to 2.7m AHD.

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- The pending s. 96 application is reported to Council as a consequence of Council's resolution of 10 October 2012, which states in part:
 - “3 That Council resolve that its sea level rise interim policy consist of compliance with the 1% AEP flood level and 500mm freeboard allowance.
 - 7 In circumstances where existing Government legislation or policy conflicts with Council's policy in No 3 above, the General Manager ensure that the matter is brought to Council for determination.”
 - The site is zoned 2(a) Residential under the provisions of *Wyong Local Environmental Plan 1991* (WLEP). A single dwelling-house is permissible with consent.
 - The site is subject to two potential flood impacts. The first is flooding from the Wyong River, with the predicted level for a 1% AEP event for the site being 2.56m AHD. The second is flooding from Tuggerah Lake with the predicted level for a 1% AEP event for the site being 2.2m AHD. The NSW Flood Plain Development Manual advises that when setting a flood planning level (“FPL”) a consent authority should adopt the higher of two alternate predicted flood heights.
 - The alternate FPLs for the site, if calculated in accordance with Council's resolution of 10 October 2012, are as follows:
 - a 1% AEP Wyong River flood = 2.56m AHD+0.5m (freeboard) = 3.06m AHD.
 - b 1% AEP Tuggerah Lakes flood = 2.2m AHD+ 0.5m (freeboard) = 2.7m AHD.
- In the circumstances of this site, if Council calculates the FPL for the site based on its resolution of 10 October 2012, then the NSW Flood Plain Development Manual would operate to recommend that Council adopt an FPL of 3.06m. AHD.
- Application of the State Government Chief Scientist's recommended flood planning benchmarks for Tuggerah Lakes for the year 2100 raises the 1% AEP to 3.1m AHD. The addition of a 500mm free board results in a finished floor level (FFL) and flood planning level (FPL) for habitable rooms of 3.6m AHD. (1% AEP Tuggerah Lakes flood = 2.2m AHD + 0.9m (SLR) + 0.5m (freeboard) = 3.6m AHD).

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INTRODUCTION

The Site

The site consists of a regular shaped allotment with a total area of 2,130m². The allotment is generally flat with a ground level ranging from RL 1.4m AHD to RL 1.8m AHD, and is currently vacant. The north-eastern boundary adjoins Wyong River.

The site is bounded on either side by residential dwellings with the front setbacks to McDonagh Road of the dwellings in this locality generally exceeding 70m.



The proposed site- 37 McDonagh Road, Wyong

The Proposed Modification

The proposal modification seeks to modify the current development consent so as to reduce the floor level for the proposed dwelling from 3.63m AHD to 2.7m AHD. The major issue for consideration relates to flooding.

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RELEVANT STATE/COUNCIL POLICIES AND PLANS

The s.96 application has been assessed against the relevant provisions of the following environmental planning instruments, plans and policies:

- State Environmental Planning Policy 71 (Coastal Protection)
- Wyong Local Environmental Plan 1991
- Development Control Plan 2005, Chapter 100 (Quality Housing)
- Development Control Plan 2005, Chapter 67 (Engineering Requirements)
- Development Control Plan 2005, Chapter 69 (Waste Management)
- Flood Prone Land Development Policy F5
- NSW Flood Plain Development Manual
- Office of Environment and Health (DECCW) Floodplain Management Guidelines
- Council's Interim Sea Level Rise Policy.

RELEVANT TECHNICAL DOCUMENTS

- The NSW Chief Scientist and Engineer's Report, April 2012 examines the science behind the NSW Sea Level Rise Planning Benchmarks. This Report includes the following relevant statement, which highlights the difficulties Council faces when assessing planning applications where sea level rise and flooding are issues:

"A major barrier to efficient implementation of planning changes consequent on revised sea level projections relates to the ability to communicate the complexities of the issues in a form that is accessible to a broad audience. In particular communication of the likelihood of frequent revisions and refinements as more data becomes available and models improve, is vital. The broad audience for this communication includes local councils that need to implement policies and local communities and the general public who have to live with the impact of changed policies. The issues are highly complex, the debate among scientists is confusing and, given the long term nature of various aspects of sea level rise, it is difficult for people to appreciate the logic of early action and adaptation...The way the science has been used to date to determine benchmarks for sea level rise in NSW is adequate, in light of the evolving understanding of the complex issues surrounding future sea levels"

The Report recommends that a Technical Advisory Centre be established to assist local councils in interpreting and translating new scientific findings, and assist local councils to develop strategies, infrastructure planning and appropriate risk management activities related to sea level rise and associated impacts, To date no such Centre has been established.

- The Fourth Intergovernmental Panel on Climate Change (IPCC) Report, 2007 is the main reference to Sea Level Rise ("SLR") projections both in Australia and internationally A copy of the IPCC Report will be available at the Council Meeting of the 12 December 2012.
- Information on SLR both historical and projections can be obtained from the CSIRO Website <http://www.cmar.csiro.au/sealevel/index.html>. The site has been designed to put in simple terms information on SLR and its causes. It also includes estimates of global and regional sea level, links to other web pages and data sets and a list of CSIRO publications.

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- The NSW Sea Level Rise Policy Statement (“the 2009 Policy”) was published in October 2009 by the former NSW Government. A copy of that Policy Statement is attached. The 2009 Policy includes the following statement:

“Sea level rise is an incremental process and will have medium- to long-term impacts. The best national and international projections of sea level rise along the NSW coast are for a rise relative to 1990 mean sea levels of 40 cm by 2050 and 90 cm by 2100”

- The 2009 Policy is referenced in subsequent planning policy documents, including:
 - The NSW Coastal Planning Guideline – Adapting to Sea Level Rise” of August 2010. A copy of the Guideline is attached,
 - The “Flood Risk Management Guide” and “Coastal Risk Management Guide” published by the then NSW Department of Environment, Climate Change and Water (“DECCW”) in August 2010. A copy of each Guide is attached.
- In September 2012 the NSW Government announced that the 2009 Policy was no longer the policy of the NSW Government.
- The NSW Government’s [Flood Prone Land Policy](#), copy attached.
- The Floodplain Development Manual 2005 and associated technical and operation policy to aid councils in the management of flood risk.

ECOLOGICALLY SUSTAINABLE PRINCIPLES

The development, if approved, would not be consistent with the overall objective of the Lower Wyong River Floodplain Risk Management Plan, in particular:

- The Precautionary Principle – Accurate scientific evidence detailing the full extent of predicted flood levels during extreme weather events as a result of climate change does not exist, however it is well known that significant flooding does occur in this locality.

The Precautionary Principle requires that ‘*where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation*’.

In terms of this application, there is a lack of full scientific certainty over the impacts of climate change on predicted localised flood levels over the life of the proposed development. The information relied upon in determining the flood planning levels within this report are consistent with the benchmarks previously endorsed by the NSW Government based on modelling carried out by IPCC and CSIRO. The proposal approved under the originally granted consent complied with these benchmarks, however the current proposal does not.

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Recently obtained legal advice from Local Government Legal states that *'where there is no credible regional or local assessment of SLR projections, we are of the view that adopting the Benchmarks previously endorsed by the NSW Government (which are based on IPCC and CSIRO modelling) would be likely to be consistent with the application of the Precautionary Principle and be considered to be a 'reasonable' response to address the risk of coastal hazards'*.

The proposed modification seeks to reduce the floor level of the dwelling to a height lower than the previously endorsed Benchmarks. Accordingly, the proposal is considered to be inconsistent with the Precautionary Principle.

- Inter-generational equity – the proposal does not have regard for maintaining the quality of the environment for future generations. The proposal would be highly vulnerable to risk of flooding which would potentially result in damage to the built environment.

Taking the above into consideration the proposal is considered to be **inconsistent** with the Ecologically Sustainable Development (ESD) principles.

ASSESSMENT

Having regard for the matters for consideration detailed in Section 79C of the EP&A Act 1979 and other statutory requirements, Council's policies and Section 149 Certificate details, the assessment has identified the following key issues, which are elaborated upon for Council's information. Any tables relating to plans or policies are provided as an attachment.

Environmental Planning and Assessment Act 1979

The applicant seeks amendment to DA 222/2012 under Section 96(1A) of EP&A Act 1979.

Section 96 (1A) of the Act states the following:

'A consent authority may, on application being made by the applicant or any other person entitled to act on a consent granted by the consent authority and subject to and in accordance with the regulations, modify the consent if:

- (a) it is satisfied that the proposed modification is of minimal environmental impact, and*
- (b) it is satisfied that the development to which the consent as modified relates is substantially the same development as the development for which the consent was originally granted and before that consent as originally granted was modified (if at all), and*
- (c) it has notified the application in accordance with:*
 - (i) the regulations, if the regulations so require, or*
 - (ii) a development control plan, if the consent authority is a council that has made a development control plan that requires the notification or advertising of applications for modification of a development consent, and*
- (d) it has considered any submissions made concerning the proposed modification within any period prescribed by the regulations or provided by the development control plan, as the case may be'.*

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If Council is satisfied that the proposed modification is of minimal environmental impact, the proposed modification is development substantially the same as the development for which the consent was originally granted and the application has been notified in accordance with Chapter 70 of *Development Control Plan 2005*. Accordingly, the proposal meets the provisions of Section 96 (1A) of the EP&A Act 1979.

The application requirements for an application made under Section 96 (1A) are contained within cl. 115(1)(a) – (i) of the *Environmental Planning and Assessment Regulation 2000*. This section describes the information necessary to make an application. In this regard, the application comprises owner's authority (to submit the application), description of the modification and likely impacts thereof in addition to supporting documentation.

It is considered that the information accompanying the application satisfies the responsibilities of the applicant under the provisions of the EP&A Regulation 2000.

THE PROVISIONS OF RELEVANT INSTRUMENTS/PLANS/ POLICIES (s79C(1)(a)(i-iv):

NSW Flood Plain Development Manual

The subject site is located within an existing high hazard flood area and the NSW Flood Plain Development Manual ('The Manual') requires that a safe (i.e. low hazard flooding) escape route be available for the residents.

Given the location of the site and surrounding topography, there is no opportunity to provide an escape route during a flood event. It is considered that a habitable floor level, in this case, the ground floor level with an RL of 3.60m AHD would provide a safe harbourage and sufficient opportunity for residents to remain in the dwelling during a flood event or alternatively to enable rescue. However, this safe harbourage may potentially be for longer periods than currently experienced and residents would be without water, telephone, power or sewerage servicing during this time.

The Manual further provides that a 0.5m freeboard is adopted for general residential development to provide a factor of safety ensuring that the risk exposure selected is accommodated. This freeboard includes a component related to climate change impacts on flood levels in both coastal and non-coastal areas and for a wide variation in sensitivity of estimated design flood levels as well as other unquantified factors such as wind-wave impacts.

The freeboard provides only a relatively small allowance to accommodate some of the projected increases in rainfall intensity of flood-producing storm events associated with climate change, which has currently not been accurately quantified or included with the SLR projections. The manual's small allowance for climate change in the 0.5m freeboard figure should be considered to only address some of the uncertainty associated with estimating climate change impacts and as such should not be used to allow for SLR impacts, which should be quantified and applied separately. The State Government Floodplain Management Guideline (2010) clarifies that SLR allowance must be included on top of freeboard.

Taking the above into consideration, the proposal is inconsistent with the requirements of the NSW Flood Plain Development Manual.

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State Environmental Planning Policy 71 (Coastal Protection)

The provisions of State Environmental Planning Policy (SEPP) No 71 - Coastal Protection requires Council to consider the Aims and Objectives of the SEPP together with the matters for consideration listed in Clause 8 of the SEPP when determining an application within the Coastal Zone. The Coastal Zone is an area defined on maps issued by the Department of Planning and Infrastructure (DoPI) NSW with the subject property falling within this zone.

8 Matters for consideration

The matters for consideration are the following:

- (a) the aims of this Policy set out in clause 2,*
- (b) existing public access to and along the coastal foreshore for pedestrians or persons with a disability should be retained and, where possible, public access to and along the coastal foreshore for pedestrians or persons with a disability should be improved,*
- (c) opportunities to provide new public access to and along the coastal foreshore for pedestrians or persons with a disability,*
- (d) the suitability of development given its type, location and design and its relationship with the surrounding area,*
- (e) any detrimental impact that development may have on the amenity of the coastal foreshore, including any significant overshadowing of the coastal foreshore and any significant loss of views from a public place to the coastal foreshore,*
- (f) the scenic qualities of the New South Wales coast, and means to protect and improve these qualities,*
- (g) measures to conserve animals (within the meaning of the Threatened Species Conservation Act 1995) and plants (within the meaning of that Act), and their habitats,*
- (h) measures to conserve fish (within the meaning of Part 7A of the Fisheries Management Act 1994) and marine vegetation (within the meaning of that Part), and their habitats*
- (i) existing wildlife corridors and the impact of development on these corridors,*
- (j) the likely impact of coastal processes and coastal hazards on development and any likely impacts of development on coastal processes and coastal hazards,*
- (k) measures to reduce the potential for conflict between land-based and water-based coastal activities,*
- (l) measures to protect the cultural places, values, customs, beliefs and traditional knowledge of Aboriginals,*
- (m) likely impacts of development on the water quality of coastal waterbodies,*
- (n) the conservation and preservation of items of heritage, archaeological or historic significance,*
- (o) only in cases in which a council prepares a draft local environmental plan that applies to land to which this Policy applies, the means to encourage compact towns and cities,*
- (p) only in cases in which a development application in relation to proposed development is determined:*
 - (i) the cumulative impacts of the proposed development on the environment, and*
 - (ii) measures to ensure that water and energy usage by the proposed development is efficient.*

Note. Clause 92 of the Environmental Planning and Assessment Regulation 2000 requires the Government Coastal Policy (as defined in that clause) to be taken into consideration by a consent authority when determining development applications in the local government areas identified in that clause or on land to which the Government Coastal Policy applies.

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The aims of the policy are:

- (a) *to protect and manage the natural, cultural, recreational and economic attributes of the New South Wales coast, and*
- (b) *to protect and improve existing public access to and along coastal foreshores to the extent that this is compatible with the natural attributes of the coastal foreshore, and*
- (c) *to ensure that new opportunities for public access to and along coastal foreshores are identified and realised to the extent that this is compatible with the natural attributes of the coastal foreshore, and*
- (d) *to protect and preserve Aboriginal cultural heritage, and Aboriginal places, values, customs, beliefs and traditional knowledge, and*
- (e) *to ensure that the visual amenity of the coast is protected, and*
- (f) *to protect and preserve beach environments and beach amenity, and*
- (g) *to protect and preserve native coastal vegetation, and*
- (h) *to protect and preserve the marine environment of New South Wales, and*
- (i) *to protect and preserve rock platforms, and*
- (j) *to manage the coastal zone in accordance with the principles of ecologically sustainable development (within the meaning of section 6 (2) of the Protection of the Environment Administration Act 1991), and*
- (k) *to ensure that the type, bulk, scale and size of development is appropriate for the location and protects and improves the natural scenic quality of the surrounding area, and*
- (l) *to encourage a strategic approach to coastal management.*

The development is not considered to be consistent with objective (j) due to the proposal not being ecologically sustainable and (l) due to insufficient consideration with regard to coastal management. Furthermore, the matters listed under Clause 8 have been considered with the proposal being generally compliant, with the exception of Clauses 8(a) due to its inconsistency with the abovementioned objectives and (j) due to the likely impact of the development on the coastal processes.

Taking the above into consideration, the proposal is inconsistent with the requirements of SEPP 71 (Coastal Protection).

Flood Prone Land Development Policy F5

As discussed earlier in the report, the higher of the two flood scenarios (Wyong River flood level), rather than the (Tuggerah Lakes flood level) shall be used to determine the required floor level. The FPL, without SLR benchmarks, for the site under Council's Flood Prone Land Development Policy is set at 1% AEP Wyong River flood = 2.56m AHD + 0.5m (freeboard) = 3.06m AHD say RL 3.1m AHD.

The application proposes ground floor habitable floor levels of 2.7m AHD and therefore does not meet this requirement. This is inconsistent with Council's approach to the determination of development on flood prone land throughout Wyong Shire and should not be supported.

THE LIKELY IMPACTS OF THE DEVELOPMENT (s79C(1)(b)):

The relationship to the regional and local context and setting

The approval of the application would result in a structure that is 900mm less in height than the approved development. This would not create any issue with its relationship to the local setting.

The access, transport and traffic management measures

No issues to report.

The impact on utilities supply

No issues to report .

Any effect on the conservation of soils or acid sulphate soils

No issues to report.

Any effect on the flora and fauna

No issues to report.

Whether the development will be energy efficient

No issues to report.

Any risks from natural hazards (flooding, tidal inundation, bushfire, subsidence, slip etc)

Flooding

The NSW Coastal Planning Guideline - Adapting to Sea Level Rise (DOP 2009) provides detail about the consideration of flooding and SLR information in land use planning and development assessment. It is noted that this document remains current.

The subject s. 96 Application is contrary to the principles within the NSW Coastal Planning Guideline including:

- Avoid intensification of land use in coastal risk areas:
- Minimising exposure to coastal risks for proposed development in coastal areas;
- Implementing appropriate management responses and adaptation strategies, with consideration for environmental, social and economic impacts.

The subject site is recognised as being flood affected by both Wyong River and Tuggerah Lake. The current designated Wyong River flood level (1% AEP) for the site is 2.56m AHD, with a FPL of 3.1m AHD being the inclusion of a 500mm freeboard requirement.

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The current designated Tuggerah Lake 1% AEP for the site is 2.2m AHD, with a FPL of 2.7m AHD being the inclusion of a 500mm freeboard requirement.

In relation to the Tuggerah Lake 1% AEP the following is considered:

Incorporating the State Government Chief Scientist's recommended flood planning benchmark for the year 2100 of 0.9m for the proposed development, the 1% AEP increases to 3.1m AHD with a FPL of 3.6m AHD being the inclusion of a 500mm freeboard requirement.

Taking the above into consideration, the proposal is inconsistent with the principles within the NSW Coastal Planning Guideline titled 'Adapting to Sea Level Rise'.

In terms of legal risk, if Council fails to take into account the climate change considerations contained within the NSW Flood Plain Development Manual or the Coastline Management Manual, both which consider climate change (and remain current), it will be unable to establish "good faith" in accordance with the defences provided by Section 733 of the *Local Government Act, 1993*. Council would also lose its protection under the *Civil Liability Act*.

In times of flood, the Electricity Authority may be required to shut down the network in the flood areas where sewer pump stations are located due to inundation of flood waters.

The NSW Department of Health considers all flood waters as potentially contaminated and may contain untreated sewage. They advise that all unnecessary contact with flood waters should be avoided and children should be kept away from flood waters. This is pertinent to the safe evacuation of residents particularly children in deeper flood waters.

Any social impact in the locality.

The approval of the amended floor level is likely to make both people and property vulnerable to flooding events as it would result in a development that would not have a safe harbourage in the event of a significant flood event. This could result in failed attempts to escape from the area during peak flood periods resulting in potential risk to lives.

Any economic impact in the locality.

The proposed development is considered likely to have negative economic impacts if it were to be approved by Council as a result of reliance on emergency services personnel to assist occupants in the event of a flood, in rectifying flood damaged property, and placing greater demands on surrounding services and infrastructure in this locality.

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Any impact of site design and internal design.

The site design is not considered appropriate in terms of the finished floor levels for habitable rooms as they fail to take into account any SLR planning benchmark and also is below the floor level required by the Flood Prone Land Development Policy F5. This would result in a development that would be subject to inundation to above the floor level regardless of SLR projections.

Any cumulative impacts.

Allowing the proposed development contrary to the State Government Chief Scientist's recommended flood planning benchmarks would contravene Council's obligation to consider certain matters as specified in Section 79C of the Act, including the likely impacts of the development and the public interest.

Allowing a development contrary to Council's adopted flood policy would set an undesirable precedent and could lead to increased pressure to vary this policy.

THE SUITABILITY OF THE SITE FOR THE DEVELOPMENT (s79C(1)(c)):

Whether the proposal fits in the locality.

As outlined earlier in this report, the proposed development is not considered suitable for the site given that the proposed amended floor level would not adequately address SLR or comply with the minimum floor levels under Council's current flood prone land development policy.

Whether the site attributes are conducive to development.

As mentioned above, the low lying nature of the site creates the potential for frequent future flooding with greater impacts due to projected SLR. Under these circumstances, the proposed amended floor level is not conducive to development.

ANY SUBMISSION MADE IN ACCORDANCE WITH THIS ACT OR REGULATIONS (s79C(1)(d)):

Any submission from the public.

The application was advertised in accordance with DCP 2005 Chapter 70 - Notification of Development Proposals with no submissions being received.

Any submission from public authorities.

Nil.

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THE PUBLIC INTEREST (s79C(1)(e)):

Any Federal, State and Local Government interests and community interests.

The information currently available to Council indicates that the site will likely be inundated if a designated flood event (1%AEP) occurs during the life of the proposed development. The information relied upon to make this prediction includes Council's flood studies and the State Government Chief Scientist's recommended SLR planning benchmarks.

Having assessed the proposal in accordance with Council's Flood Prone Land Development Policy, the NSW Floodplain Development Manual and the projected flood level increase of 900mm by 2100; the amended development is not considered suitable for the site.

CONCLUSION

The proposal has been assessed having regard to the matters detailed within Section 79C of the EP&A Act 1979. The approval of the development at the requested floor level of 2.7m AHD would not comply with Council's current flood policy regardless of SLR projections. Accordingly it is not justified and an appropriate level would be 3.6m AHD.

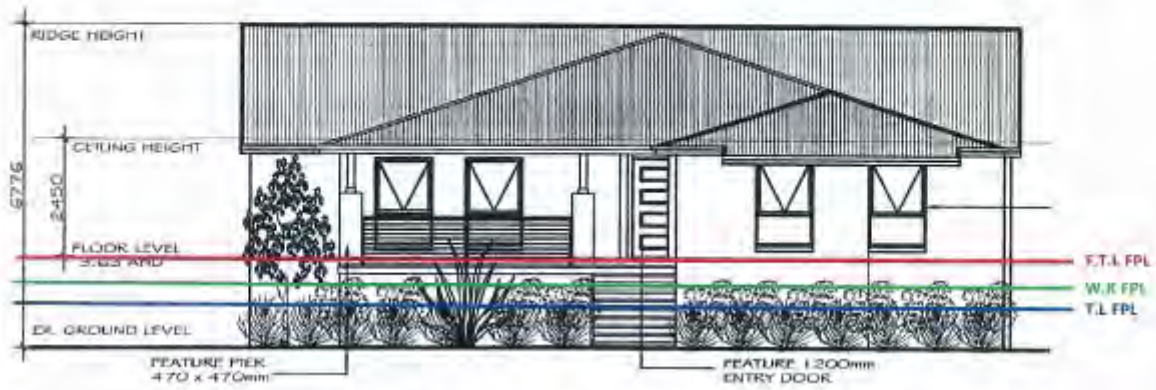
ATTACHMENTS

1	Draft Reasons for Refusal	D03209330
2	Flood Affection Map (A3 Portrait, Colour)	D03209231
3	Development Plans (A3 B&W)	D03203915
4	NSW Sea Level Rise Policy Statement (rescinded)	D03211142
5	NSW Coastal Planning Guideline: Adapting to Sea Level Rise	D03211173
6	Flood Risk Management Guideline - Incorporating Sea Level Rise Benchmarks in Flood risk assessments	D03211166
7	Coastal Risk Management Guideline	D03211169
8	NSW Flood Prone Land Policy	D03211157

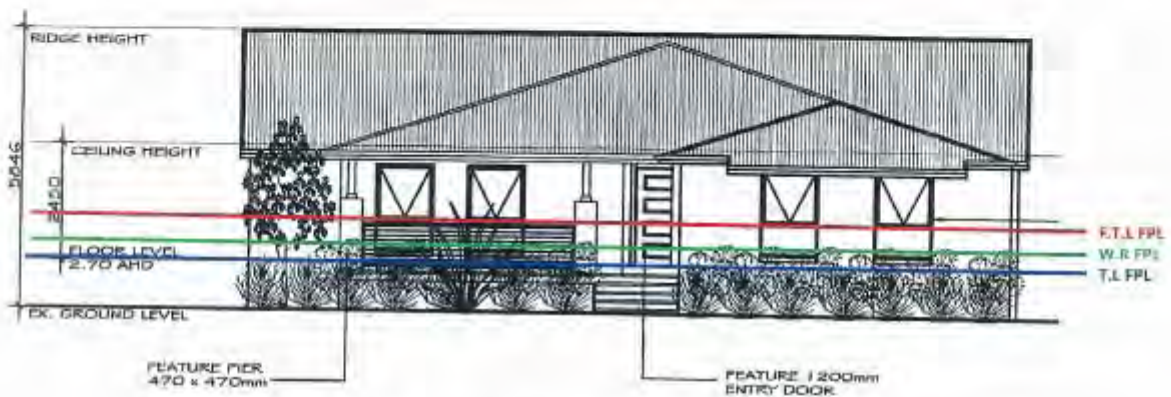
PROPOSED REASONS FOR REFUSAL OF S.96 APPLICATION (DA 222/2012/A)

- 1 Pursuant to Section 79C (1)(c) of the Environmental Planning and Assessment Act 1979 the site is not considered to be suitable for the proposed modified development having regard to Council's Flood Prone Land Development Policy.
- 2 Pursuant to Section 79C(1)(a)(i) of the Environmental Planning and Assessment Act 1979 the proposed modified development is inconsistent with Clause 2 of State Environmental Planning Policy 71 (Coastal Protection) in the following manner:
 - a The proposed modified development fails to satisfy Aim 2(1)(j) in that it does not accord with the precautionary principle by proposing the floor level of the dwelling below the Flood Planning Level of Council's adopted Flood Policy and also the recommended Flood Planning benchmarks allowing for sea level rise projections.
 - b The proposed modified development fails to satisfy Aim 2(1)(j) in that it does not promote inter-generational equity by proposing the floor level of the dwelling below the Flood Planning Level of Council's adopted Flood Policy and also the recommended Flood Planning benchmarks allowing for sea level rise projections.
 - c The proposed modified development fails to satisfy Aim 2(1)(l) in that the proposed modified development does not encourage a strategic approach to coastal management by proposing the floor level of the dwelling below the Flood Planning Level of Council's adopted Flood Policy and also the recommended Flood Planning benchmarks allowing for sea level rise projections.
- 3 Pursuant to Section 79C(1)(a)(i) of the Environmental Planning and Assessment Act 1979 the proposed modified development is inconsistent with Clause 8 "Matters for consideration" of State Environmental Planning Policy 71 (Coastal Protection) in the following manner:
 - a The proposed modified development fails to satisfy Matters for consideration 8 (a) because it does not satisfy Aims 2(1)(j), and 2(1)(l) as explained 1 above.
 - b The proposed modified development fails to satisfy Matters for consideration 8(j) because the proposed modified development proposes floor level of the dwelling below the Flood Planning level of Council's adopted Flood Policy and also the recommended Flood Planning benchmarks allowing for sea level rise projections.

- 4 Pursuant to Section 79C(1)(a)(i) of the Environmental Planning and Assessment Act 1979 the proposed modified development is inconsistent with Wyong Local Environmental Plan 1991 Clause 2(g)(ii) because the proposed modified development proposes the floor level of the dwelling below the Flood Planning level of Council's adopted Flood Policy and also the recommended Flood Planning benchmarks allowing for sea level rise projections, where it is likely to suffer damage.
- 5 Pursuant to Section 79C (1)(b) of the Environmental Planning and Assessment Act, 1979 the proposed modified development is at risk of flooding; would have a negative social and economic impact; does not respond to the specific site attributes and would contribute to the cumulative adverse impact on the environment by way of its unsuitable design for flood prone land.
- 6 Pursuant to Section 79C(1)(e) of the Environmental Planning and Assessment Act 1979 the proposed modified development is not considered to be in the public interest given it does not adequately consider the impacts of flooding including the potential damage to the structure and the potential danger to future occupants and rescuers, and the proposed modified development would set an undesirable precedent for the future.



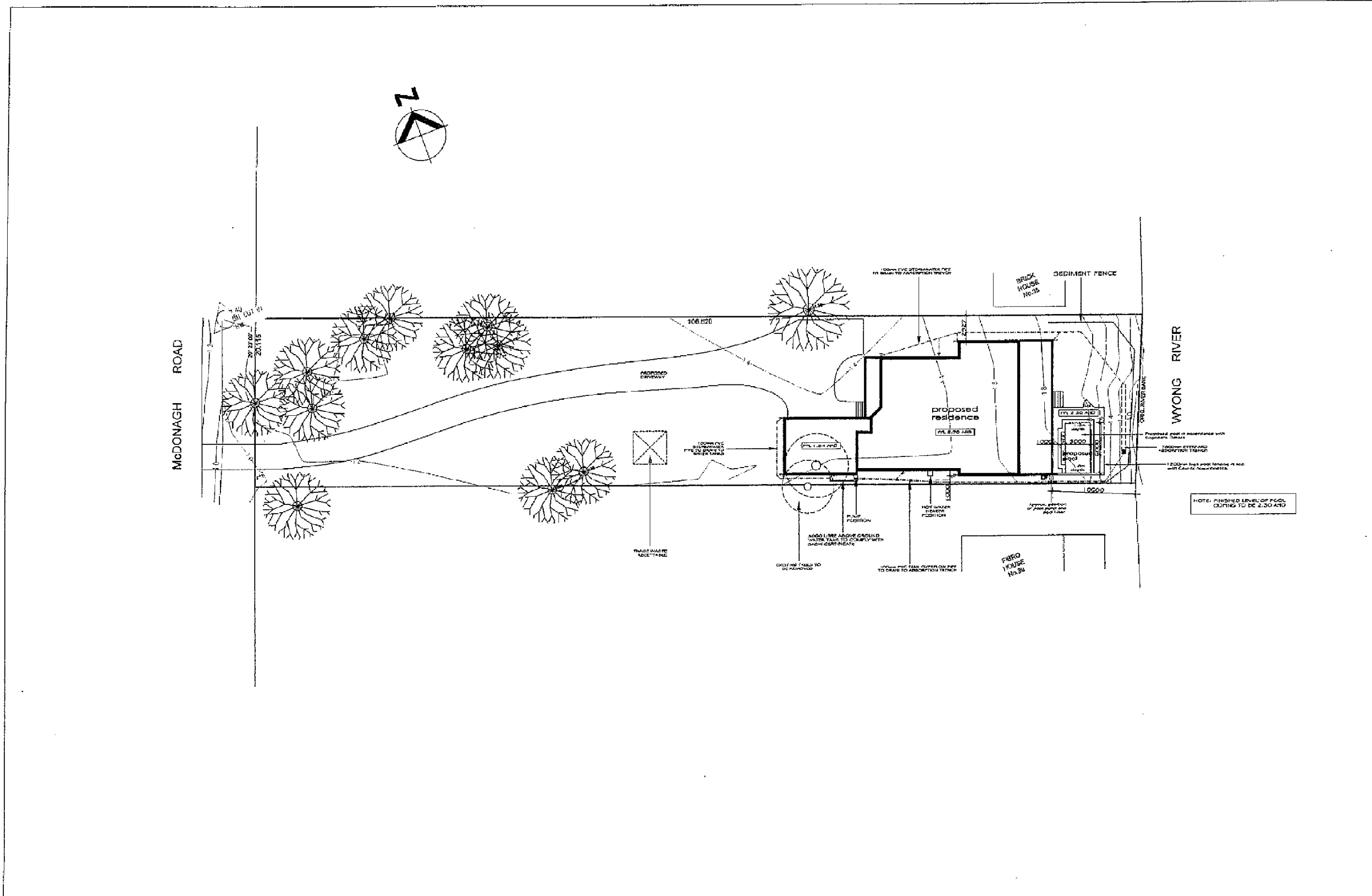
Flood Affection - Western Elevation – Original application (DA/222/2012)



Flood Affection - Western Elevation – Amended application (DA/222/2012/A)

KEY

- **F.T.L. FPL (2100) – 3.6m AHD** Tuggerah Lakes Flood Planning Level. Derived by adding 500mm freeboard and 2100 sea level rise projection of 900mm to the adopted 1993 1% AEP flood level
- **W.R. FPL (1984) – 3.1m AHD** Wyong River Flood Planning Level. Derived by adding 500mm freeboard to the adopted 1984 1% AEP flood level
- **T.L. FPL (1993) – 2.7m AHD** Tuggerah Lakes Flood Planning Level. Derived by adding 500mm freeboard to the adopted 1993 1% AEP flood level



PROPOSAL DWELLING & POOL
CLIENT M. GORDON

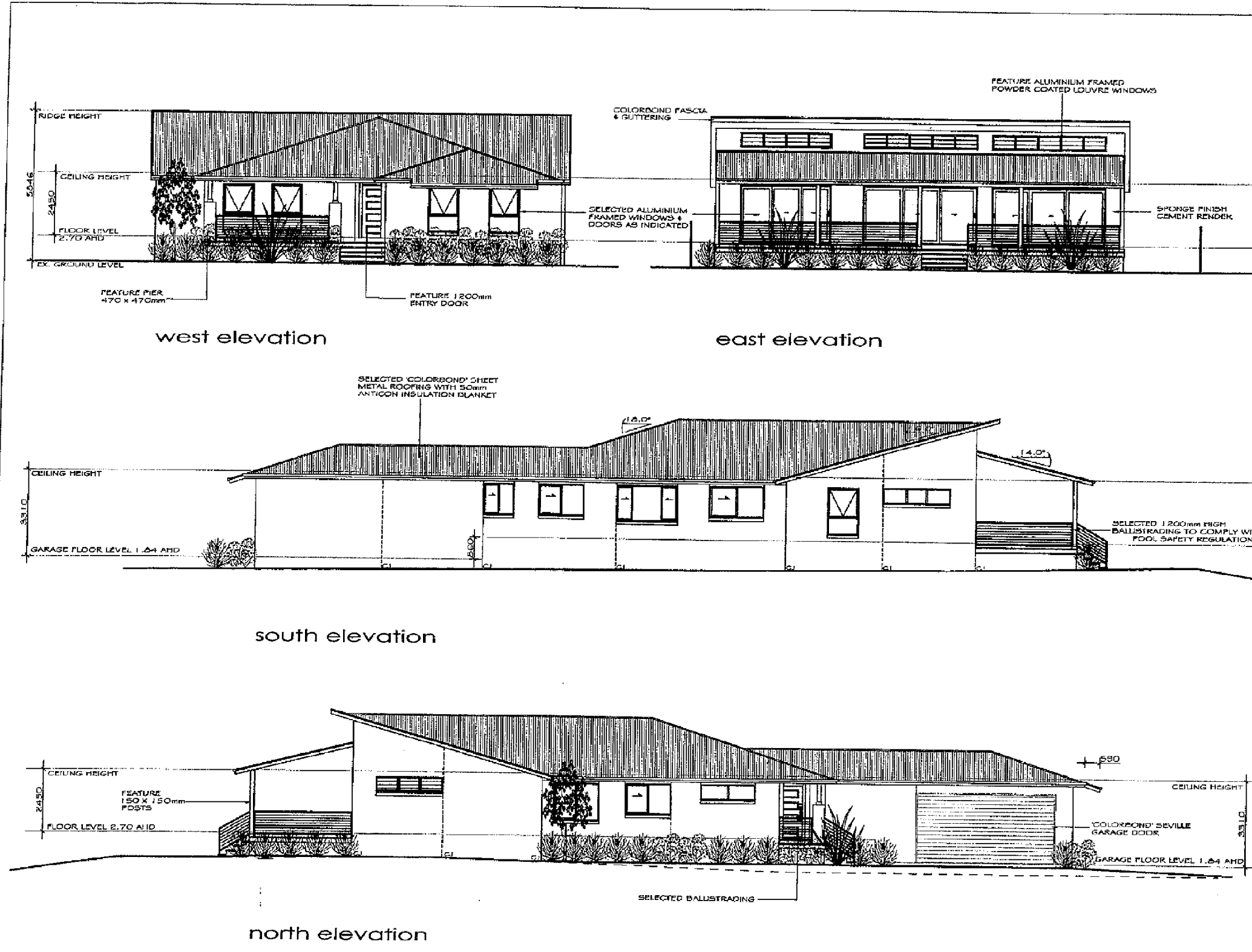
DATE LOT 19 SEC 33 DP452G 37 McDONAGH ROAD WYONG
--


NOTES
1. All dimensions shall be taken from the centre line of the road unless otherwise stated.
2. Dimensions shall be taken from the centre line of the road unless otherwise stated.
3. Dimensions shall be taken from the centre line of the road unless otherwise stated.
4. The site shall be developed in accordance with the S.C.A. and all other relevant standards and any other governing bodies.

APPROVED BY A. [Signature]
DATE OF APPROVAL [Date]
DATE OF PROTECTION [Date]



SITE & POOL PLAN	PLAN NO. 1116	SHEET NO. 1/4
14 Dudley St. GORDON NSW 2263 Phone: (02) 4913355 Fax: (02) 4992314	DATE October 2012	SCALE 1:200 on A3





96 Dudley Street Gosford 2263
Phone: (02) 43923333 Fax: (02) 43923344
www.marshallhale.com.au

PROPOSAL:
DWELLING

CLIENT:
A & K CHISHOLM

SITE:
**LOT 19 SEC 33 DP4526
37 McDONAGH ROAD
WYONG**

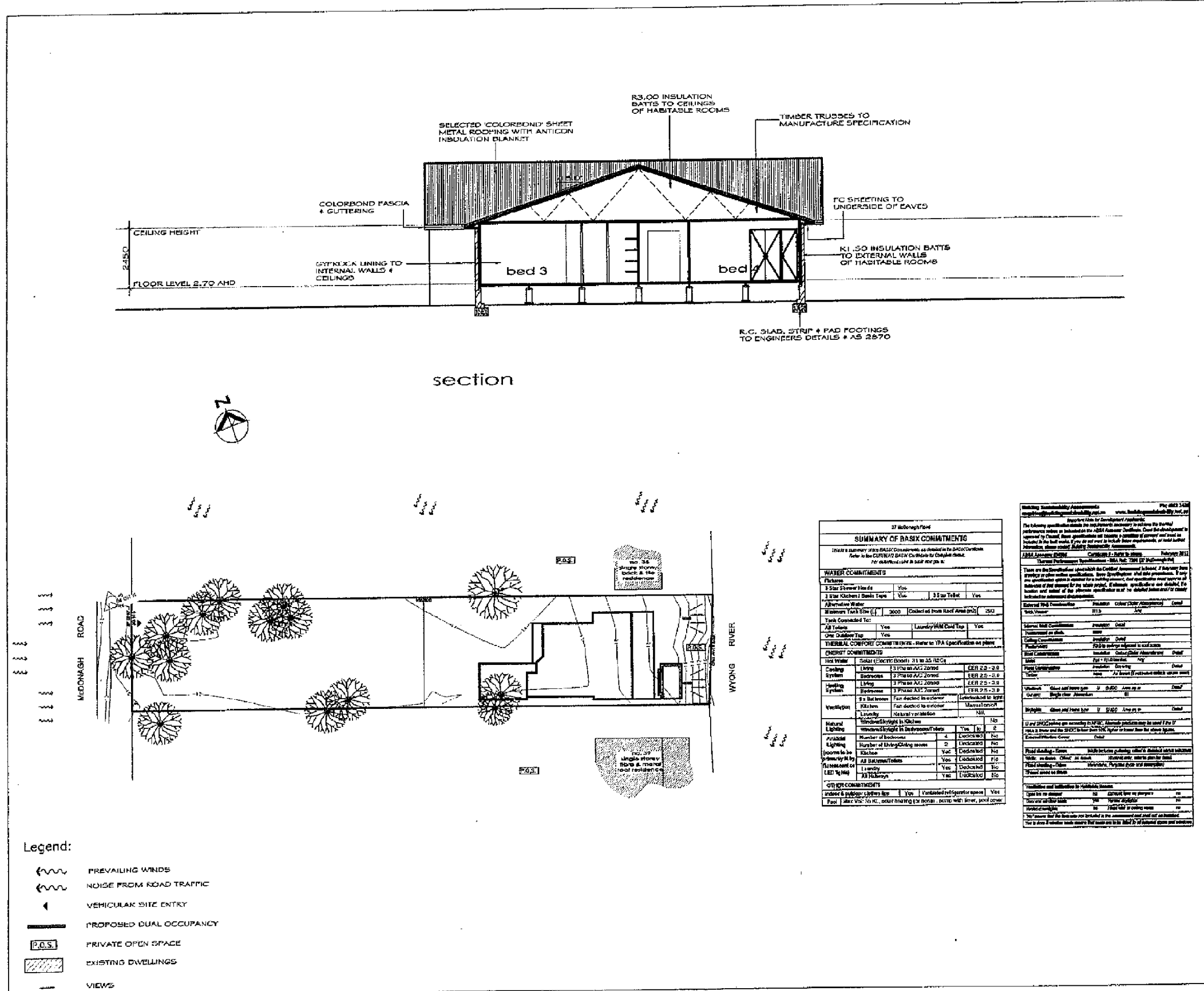
NOTES:

- 1 Builders shall check all dimensions, details and levels prior to commencement of setting any materials.
- 2 Dimensions shall be read in accordance to scale.
- 3 Architectural detailing drawings shall be read in conjunction with structural drawings issued at which best practice in determining the structural adequacy of the building.
- 4 The building shall be constructed in accordance with the B.C.A., relevant Australian standards and any other governing bodies.

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ELEVATIONS

JOB NO: 1116	SHEET NO: 3/4
DATE: October 2012	
SCALE: 1:100 on A2	
DRAWN: R. HALE	
AMENDMENTS:	
A 24/10/12	Amended finished floor heights



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PROPOSAL:
DWELLING

CLIENT:
A & K CHISHOLM

SITE:
LOT 19 SEC 33 DP4526
37 McDONAGH ROAD
WYONG

NOTES:

1. Dimensions shall include all dimensions, details and levels prior to commencement of ordering any materials.
2. Dimensions shall be noted in preference to scale.
3. Architectural working drawings shall be read in conjunction with structural engineers details of which shall predominate in determining the structural adequacy of the building.
4. The building shall be constructed in accordance with the N.S.W. relevant Australian standards and any other governing bodies.

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SITE ANALYSIS, SECTION & BASIX

JOB NO: **1116** SHEET NO: **4/4**

DATE: **October 2012**

SCALE: **1:100 on A2**

DRAWN: **R. HALE**

AMENDMENTS:

A	24/10/12	Amended finished floor heights
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SUMMARY OF BASIX COMMITMENTS		
WATER COMMITMENTS		
3 Star System Rating	Yes	
1 Star Shower Drain Tap	Yes	33 on Tap
Alternative Water		
Water Tank Size (L)	2000	Collected from Roof Area (m ²)
Tank Considered To:		
Hot Water	Yes	Laundry/Wash Cold Tap
One Outlet Tap	Yes	
THERMAL COMFORT COMMITMENTS - Refer to VPA Specification on plans		
ENERGY COMMITMENTS		
Hot Water	3 Star (Energy Efficient)	31 to 35 (R2C4)
Cooling System	3 Star (Energy Efficient)	CEER 2.5 - 2.9
Refrigerator	3 Star (Energy Efficient)	CEER 2.5 - 2.9
Lighting	3 Star (Energy Efficient)	CEER 2.5 - 2.9
Washing System	3 Star (Energy Efficient)	CEER 2.5 - 2.9
5 x 6 Bathrooms	Fan decked to exterior	Referenced to R2C4
Ventilation	Fan decked to exterior	Manual Control
Natural Lighting	Natural ventilation	Yes
Natural Lighting	Windows/Doors in Bedrooms/Study	Yes No
Artificial Lighting	Number of Lighting/Daylight sensors	4 (L20C30) No
Openings for Daylight	Yes	Yes
Measurement of LED Lighting	All Daylight/Sensors	Yes (L20C30) No
LED Lighting	All Daylight/Sensors	Yes (L20C30) No
OTHER COMMITMENTS		
Under & surface water	Yes	Varied (Refer to plans)
Floor slab	Yes	Refer to plans

Building Sustainability Assessment - www.marshallhale.com.au

The following specifications are required to achieve the target performance levels as indicated on the BASIX Assessment Checklist. The checklist is approved by Council. These specifications are based on current and best practice information. Please contact BASIX Designers for more information.

AS/NZS 3000 (Wiring Rules) - Part 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100



NSW Sea Level Rise Policy Statement



New South Wales
Government

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Bellinger River flooding at Myleston (B. Rees, Coffs Harbour Advocate);

coastal erosion at Old Bar (P. Watson, DECCW);

flooding from the Richmond River at Casino, January 2008 (P. Campbell, NSW State

Emergency Service); coastal erosion at Belongil Beach, Byron Bay (P. Watson, DECCW).

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DECCW 2009/708
October 2009

Introduction

The NSW Government acknowledges that increased sea levels will have significant medium- to long-term social, economic and environmental impacts. As an integral part of the state's response to climate change, the Government is committed to supporting coastal communities in adapting to long-term rising sea levels in a manner that minimises the resulting social disruption, economic costs and environmental impacts. Sea level rise is a global problem that will impact locally on the NSW coastline and will require action by communities, the Government and local councils.

Coastal communities and environments are particularly vulnerable to climate change due to the potential for permanent coastal inundation and increasing coastal hazards associated with changing weather patterns and extreme weather events. This policy statement deals with sea level rise only, and represents an important component of the Government's response to climate change.

This policy statement outlines the Government's objectives and commitments in regards to sea level rise adaptation. It outlines the support that the Government will provide to coastal communities and local councils to prepare and adapt to rising sea levels.

The impacts of rising sea levels

Over the period 1870–2001, global sea levels rose by 20 cm, with a current global average rate of increase approximately twice the historical average¹. Sea levels are expected to continue rising throughout the twenty-first century and there is no scientific evidence to suggest that sea levels will stop rising beyond 2100 or that the current trends will be reversed.

Sea level rise is an incremental process and will have medium- to long-term impacts. The best national and international projections of sea level rise along the NSW coast are for a rise relative to 1990 mean sea levels of 40 cm by 2050 and 90 cm by 2100¹. However, the Intergovernmental Panel on Climate Change (IPCC) in 2007 also acknowledged that higher rates of sea level rise are possible.

In simple terms, sea level rise will raise the average water level of oceans and estuaries. As the average water level rises, so too will high and low tide levels affecting the natural processes responsible for shaping the NSW coastline. Exactly how the coast and estuaries will respond is complex and often driven by local conditions but, in general, higher sea levels will lead to:

- increased or permanent tidal inundation of land by seawater
- recession of beach and dune systems and to a lesser extent cliffs and bluffs
- changes in the way that tides behave within estuaries
- saltwater extending further upstream in estuaries

¹ Refer to the Department of Environment, Climate Change and Water 2009 *Technical note: Derivation of the NSW Government's sea level rise planning benchmarks* for further details

NSW Sea Level Rise Policy Statement

- higher saline water tables in coastal areas and
- increased coastal flood levels due to a reduced ability to effectively drain low-lying coastal areas.

These physical changes will have an impact on coastal ecosystems, access to and use of public and private lands, historical and cultural heritage values, arable land used for agriculture, freshwater access, public and private infrastructure, and low-lying areas of coastal land that are affected by flooding.

Sea level rise will also affect coastal hazards such as beach erosion during storms and coastal flooding. As the sea level rises, severe erosion of beaches during storms will affect areas further inland, while the depth of floodwaters and the areas affected by flooding will increase due to a reduced ability to effectively drain low-lying coastal areas. Climate change will also affect the frequency and intensity of storms, further exacerbating the effects of sea level rise. Such hazards will further impact coastal ecosystems, historical and cultural heritage values, agriculture and infrastructure, and residential and other urban land uses on land around beaches, estuaries, bays and harbours.

Related NSW Government initiatives

The NSW Government currently has in place policies, programs and legislation that allow for ecologically sustainable growth in coastal areas, while reducing the risks to life and property from coastal hazards and flooding. These are also relevant to managing the projected increased risks from sea level rise.

The [NSW Coastal Policy 1997](#) sets the overall strategic direction for coastal management in NSW and is based on the principles of ecologically sustainable development. It aims to facilitate the development of the coastal zone in a way that protects and conserves its values. One of the policy's goals is to recognise and accommodate coastal processes and hazards, including a related objective to recognise and consider the potential effects of climate change in the planning and management of coastal development. The NSW Coastal Policy is given statutory effect through State Environmental Planning Policy 71 – Coastal Protection and through a Ministerial Direction to local councils under section 117 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The State Environmental Planning Policy 71 – Coastal Protection (SEPP 71) also requires that both land use planning and development assessment within the NSW Coastal Zone consider the likely impact of coastal processes and coastal hazards on development and any likely impacts of the development on coastal processes and coastal hazards.

In 2006, the State Government gazetted the new Standard Instrument – Principal Local Environmental Plan. Clause 5.5 of the Standard Instrument prevents the granting of development consent on land that is wholly or partly within the NSW Coastal Zone, unless consideration has been given to the effect of coastal processes and coastal hazards and potential impacts, including sea level rise on the proposed development, and arising from the proposed development.

Two additional NSW Government policies of relevance to sea level rise are the 1988 NSW Coastline Hazard Policy and the NSW Flood Prone Land Policy. This Sea Level Rise Policy Statement supersedes the 1988 NSW Coastline Hazard Policy. Most of the objectives from that policy were included in the NSW Coastal Policy 1997, which remains current. Other objectives from the NSW Coastline Hazard Policy are updated by this Sea Level Rise Policy Statement.

NSW Sea Level Rise Policy Statement

The NSW Flood Prone Land Policy remains in effect and has a primary objective to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods.

These policies are supported by the Government's Coastal, Estuary and Floodplain Management programs, which provide technical policy support and grants to local councils in order to identify and manage coastal hazards and flooding risks. The hazards associated with sea level rise have been incorporated into these programs from as early as 1990, and the benchmarks established under this policy statement will support the consistent consideration of sea level rise across these activities.

The NSW Government's objective and commitments for action on adapting to sea level rise

The NSW Government has an objective to see coastal communities adapt to rising sea levels in a manner that minimises the resulting social disruption, economic costs and environmental impacts. To assist in meeting this objective, the Government will support local councils and the community in adapting to sea level rise by:

1. promoting an adaptive risk-based approach to managing the impacts of sea level rise
2. providing guidance to local councils to support their sea level rise adaptation planning
3. encouraging appropriate development on land projected to be at risk from sea level rise
4. continuing to provide emergency management support to coastal communities during times of floods and storms
5. continuing to provide up-to-date information to the public about sea level rise and its impacts.

Further details of these commitments are provided below.

1. Promoting adaptive risk-based management

The NSW Government will promote an adaptive, risk-based approach to managing the impacts of sea level rise. The adaptive risk-based approach recognises that there are potentially significant risks from sea level rise and that the accuracy of sea level rise projections will improve over time.

Planning and investment decisions should therefore consider the sea level rise projections over timeframes that are consistent with the intended timeframes of the decision. For example, these decisions should consider likely sea levels over the expected life of an asset in order to decide on how the asset can be located or designed, thereby avoiding or minimising any associated impacts. This early consideration will minimise the initial costs of considering sea level rise and the future costs of adapting to sea level rise, such as through relocation of affected buildings or infrastructure.

The NSW Government has adopted sea level rise planning benchmarks to support this adaptive risk-based approach. These benchmarks will enable the consistent consideration of sea level rise within this adaptive risk-based management approach. The primary purpose of the benchmarks is to provide guidance supporting consistent considerations of sea level rise impacts, within applicable decision-making frameworks. This will include strategic planning and development assessment under the EP&A Act and infrastructure planning and renewal.

NSW Sea Level Rise Policy Statement

The use of the benchmarks will be required when undertaking coastal and flood hazard assessments in accordance with the Coastline Management and Floodplain Development Manuals. It is already a statutory requirement that the preparation of local environmental plans give effect to and be consistent with these manuals.

The NSW sea level rise planning benchmarks are an increase above 1990 mean sea levels of 40 cm by 2050 and 90 cm by 2100, with the two benchmarks allowing for consideration of sea level rise over different timeframes. The benchmarks were established by considering the most credible national and international projections of sea level rise² and take into consideration the uncertainty associated with sea level rise projections. The Government will continue to monitor sea level rise observations and projections and will periodically review these planning benchmarks, with the next review likely to coincide with the release of the fifth IPCC report, due in 2014.

The sea level rise planning benchmarks can be used for purposes such as:

- incorporating the projected impacts of sea level rise on predicted flood risks and coastal hazards
- designing and upgrading of public and private assets in low-lying coastal areas where appropriate, taking into account the design life of the asset and the projected sea level rise over this period
- assessing the influence of sea level rise on new development (see below for further details)
- considering the impact of sea level rise on coastal and estuarine habitats (such as salt marshes) and identifying valuable habitats at most risk from sea level rise
- assessing the impact of changed salinity levels in estuaries, including implications for access to fresh water.

2. Supporting local councils

The NSW Government recognises that local councils are responsible for many of the land use planning and development assessment decisions made in coastal areas. Local councils prepare studies to identify areas at risk from coastal flooding and coastal hazards through the coastal, estuary and floodplain management programs, and the NSW Government will continue to provide assistance. Priority for funding assistance will be given to areas at greatest current and future risk from flooding and coastal hazards. These studies will provide information on the influence of sea level rise on coastal hazards and flood risk, which can be considered at the land use planning and development assessment stage.

The Government will also continue to provide guidance and assistance to local councils on reducing the risks to private and public property from coastal hazards. The risks from coastal hazards are significant and are projected to increase with sea level rise. Government financial assistance to local councils is unlikely to extend to protecting or purchasing all properties at risk from coastal hazards and sea level rise.

When allocating funding assistance to local councils for coastal protection works, the

² Refer to the Department of Environment, Climate Change and Water *Technical Note: Derivation of the NSW Government sea level rise planning benchmarks*

NSW Sea Level Rise Policy Statement

Government will give priority to public safety and protecting valuable publicly-owned assets, and then to private land. The criteria that the Government will use to allocate any funds to local councils to protect or voluntarily purchase private property will include the:

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

Where assistance is provided to reduce the impacts of coastal hazards, the Government does not assume any responsibility for these hazards. The Government will continue to provide funding assistance to local councils for coastal hazard studies and management planning.

These criteria will not affect the NSW Coastal Lands Protection Scheme, where the criteria for land purchase under the scheme does not include coastal hazard reduction.³

3. Supporting appropriate coastal development

Provisions under the EP&A Act require consent authorities to consider coastal and flooding hazards in their planning and development approval decisions. The NSW Coastal Policy and coastal regional strategies also require consideration of sea level rise, as does the Standard Instrument for Local Environmental Plans where relevant.

The sea level rise planning benchmarks will support consistent consideration of the influence of sea level rise on any coastal hazards and flooding risks that may influence a development or redevelopment site. The benchmarks are not intended to be used to preclude development of land that is projected to be affected by sea level rise. The goal is to ensure that such development recognises and can appropriately accommodate the projected impacts of sea level rise on coastal hazards and flooding over time, through appropriate site planning, design and development control.

Department of Planning guidelines will describe how sea level rise should be considered in land use planning and development assessment. These guidelines will provide assistance to local councils, landowners, infrastructure providers and developers.

Coastal hazards and flooding are natural processes and the Government considers that the risks to properties from these processes appropriately rest with the property owners, whether they be public or private. This will continue where these risks are increased by sea level rise. Under both statute and common law, the Government does not have nor does it accept

³ The Coastal Lands Protection Scheme is used to bring significant coastal lands into public ownership. The criteria for acquisition under the Scheme are to promote public access to the coastal foreshore, to maintain the scenic quality of the NSW coast, and to protect ecological sites of regional, state and/or national significance.

NSW Sea Level Rise Policy Statement

specific future obligations to reduce the impacts of coastal hazards and flooding caused by sea level rise on private property.

Landowners affected by current and future coastal hazards may seek approval from their local council to construct works on their land to protect their property. These works may be approved under the EP&A Act where they do not cause adverse impacts on coastal processes beyond the property boundary or on public amenity or the environment. Private landowners will not normally be permitted to construct works on State-owned land to protect their property. All required approvals must be obtained before any works commence and unauthorised works may be removed at the landowner's cost.

4. Community support during emergencies

The Government currently provides emergency management support to coastal communities during and following floods and major storms. This support is normally coordinated by the State Emergency Service, operating under the *State Emergency and Rescue Management Act 1989*. The Government will continue to provide this support to coastal communities likely to be affected by sea level rise.

The Government's direct community support will be focused on emergency management. The Government currently does not provide compensation to the owners or potential developers of land affected by coastal hazards or flood risks, except for some compensation and other payments that may be made in relation to an emergency or disaster. This arrangement will continue and will include land where these hazards or risks are increased by sea level rise. Compensation will not be provided for any impact on property titles due to erosion or sea level rise.

5. Information availability

The Government has provided information to the community on sea level rise projections and the likely impacts of sea level rise on low-lying coastal areas. The Government will continue to provide up-to-date information on sea level rise and its impacts, and will continue to work with local councils to provide information on the impacts of sea level rise on local flooding and coastal hazards.

Continuing public access to current and credible information on sea level rise is important for various reasons, including:

- supporting community adaptation to sea level rise
- supporting the community and the private sector to make appropriate investment decisions in coastal areas
- assisting the insurance industry to price risks from sea level rise in their insurance policies.





NSW COASTAL PLANNING GUIDELINE:
ADAPTING TO SEA LEVEL RISE

AUGUST 2010



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Cover photos
Narrabeen – Yolande Stone
Korora Beach, September 2009 - Santina Camroux
Back Lake – DECCW
Tweed Heads, Ukerabah, 12 Jan 2009 king tide – Lance Tarvey

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1 INTRODUCTION

1.1 SCOPE AND AIMS OF THE GUIDELINE

The most recent climate change projections indicate increased temperature and evaporation rates for coastal NSW, along with changes to seasonal rainfall and runoff and subsequent impacts on bushfire regimes, biodiversity, soils, erosion and flooding. The primary impacts in coastal areas are likely to result from sea level rise which, coupled with storms, may lead to increased coastal erosion, tidal inundation and flooding.

The NSW Coastal Planning Guideline: Adapting to Sea Level Rise (this Guideline) has been prepared to provide guidance on how sea level rise is to be considered in land use planning and development assessment in coastal NSW. Other climate parameters affecting coastal processes may be considered when preparing coastal and flood risk studies.

This Guideline applies to all coastal areas of NSW¹. The term 'coastal areas' is used broadly in this Guideline to be all land fronting tidal waters including the coastline, beaches, coastal lakes, bays and estuaries and tidal sections of coastal rivers. It also includes other low lying land surrounding these areas that may be subject to coastal processes in the future as a consequence of sea level rise.

In this Guideline 'coastal risks' are taken to include risks from coastal erosion, tidal inundation and coastal flooding, including impacts of sea level rise.

Of note, coastal flooding in lowland areas will be of particular concern in the future as a consequence of sea level rise, including increased likely frequency, duration and height of flooding and consequent emergency evacuations and likely property and infrastructure damage. Areas where tidal water flows back up the stormwater drains in king tides under current climatic conditions will be subjected to more frequent tidal inundations.

The aim of this Guideline is to promote ecologically sustainable development (ESD), and in particular to encourage a precautionary approach to land use planning and development assessment in light of potential sea level rise impacts in coastal areas. This Guideline therefore adopts a risk-based approach to planning and development assessment in coastal areas.

1.2 POLICY CONTEXT OF THE GUIDELINE

Land use planning and development assessment processes require a balance between social, economic and environmental considerations. As a consequence of climate change, councils and the State Government face additional challenges in decision-making, particularly in coastal areas of NSW.

The NSW Government has made a concerted effort to incorporate climate change into relevant planning policies, manuals, plans, strategies and directions including the following documents:

- **NSW Sea Level Rise Policy Statement (2009)** – specifies sea level rise planning benchmarks of an increase above 1990 mean sea levels of 40cm by 2050 and 90cm by 2100 and outlines that responsibility for coastal protection works rests with landowners, both public and private.
- **NSW Coastal Policy (1997)** – requires that climate change be considered in planning and development assessment matters.
- **Coastal Regional Strategies** – strategic plans at a regional scale that:
 - seek to ensure future urban development is not located in areas of high risk from natural hazards including sea level rise, coastal recession, rising water tables and flooding;
 - state that in order to manage the risks associated with climate change, councils will undertake investigations of lands with the potential to be affected by sea level rise and inundation to ensure that risks to public and private assets are minimised; and
 - specify that local environmental plans (LEP) will make provision for adequate setbacks in areas at risk from coastal erosion and/or ocean-based inundation in accordance with coastal management plans;
- **Sydney Metropolitan Strategy (2005) and draft Sub-Regional Strategies** – contain a variety of actions factoring climate change into metropolitan planning frameworks.

¹ Coastal areas of NSW include the NSW Coastal Zone, as well as Sydney Harbour, Botany Bay, the Hawkesbury River and their tidal tributaries.

- **Coastline Management Manual (1990) and Floodplain Development Manual (2005)** – require consideration of climate change in the preparation of coastal hazard and flood studies and management plans.
- **State Environmental Planning Policy 71: Coastal Protection** – requires that councils consider the impact of coastal processes and coastal hazards when preparing LEPs and assessing development in the NSW Coastal Zone.
- **Section 117 Direction 2.2 – Coastal Protection** – directs that a draft LEP shall include provisions that give effect to and are consistent with the NSW Coastal Policy, the Coastal Design Guidelines for NSW and the Coastline Management Manual.
- **Section 117 Direction 4.3 – Flood Prone Land** – requires that a draft LEP shall include provisions that give effect to and are consistent with the Floodplain Development Manual and the NSW Flood Prone Land Policy.
- **Standard Instrument: Principal Local Environmental Plan** – contains clause 5.5: development within the coastal zone which requires that all development consent authorities within the NSW Coastal Zone consider the effect of coastal processes and coastal hazards and potential impacts, including sea level rise on the proposed development, and arising from the proposed development.

This Guideline builds on these initiatives to encourage more consistent consideration of potential sea level rise impacts in coastal areas, including incorporation of the NSW sea level rise planning benchmarks.

Implementation of this Guideline will ensure more effective application of these existing policies and directions in light of greater understanding and scientific certainty with respect to sea level rise.

This Guideline supports NSW Government policy, and as such, councils, state agencies, planners and development proponents are to have regard to it when addressing sea level rise matters in land use planning and development assessment in coastal areas.

1.3 GUIDELINE PRINCIPLES

This Guideline adopts six coastal planning principles for sea level rise adaptation. The principles should be applied in decision-making processes for land use planning and development assessment in coastal areas.

Coastal planning principles: adapting to sea level rise

Principle 1 – Assess and evaluate coastal risks taking into account the NSW sea level rise planning benchmarks.

Principle 2 – Advise the public of coastal risks to ensure that informed land use planning and development decision-making can occur.

Principle 3 – Avoid intensifying land use in coastal risk areas through appropriate strategic and land use planning.

Principle 4 – Consider options to reduce land use intensity in coastal risk areas where feasible.

Principle 5 – Minimise the exposure of development to coastal risks.

Principle 6 – Implement appropriate management responses and adaptation strategies, with consideration for the environmental, social and economic impacts of each option.

Note: In this Guideline, 'coastal risks' refer to coastal erosion, tidal inundation and coastal flooding. That means that coastal risk areas are those currently at risk and those additional areas that are likely to be at risk in the future as sea level continues to rise unless the impacts of sea level rise can be effectively mitigated (**Figures 1 and 2**).



Umina – DECCW

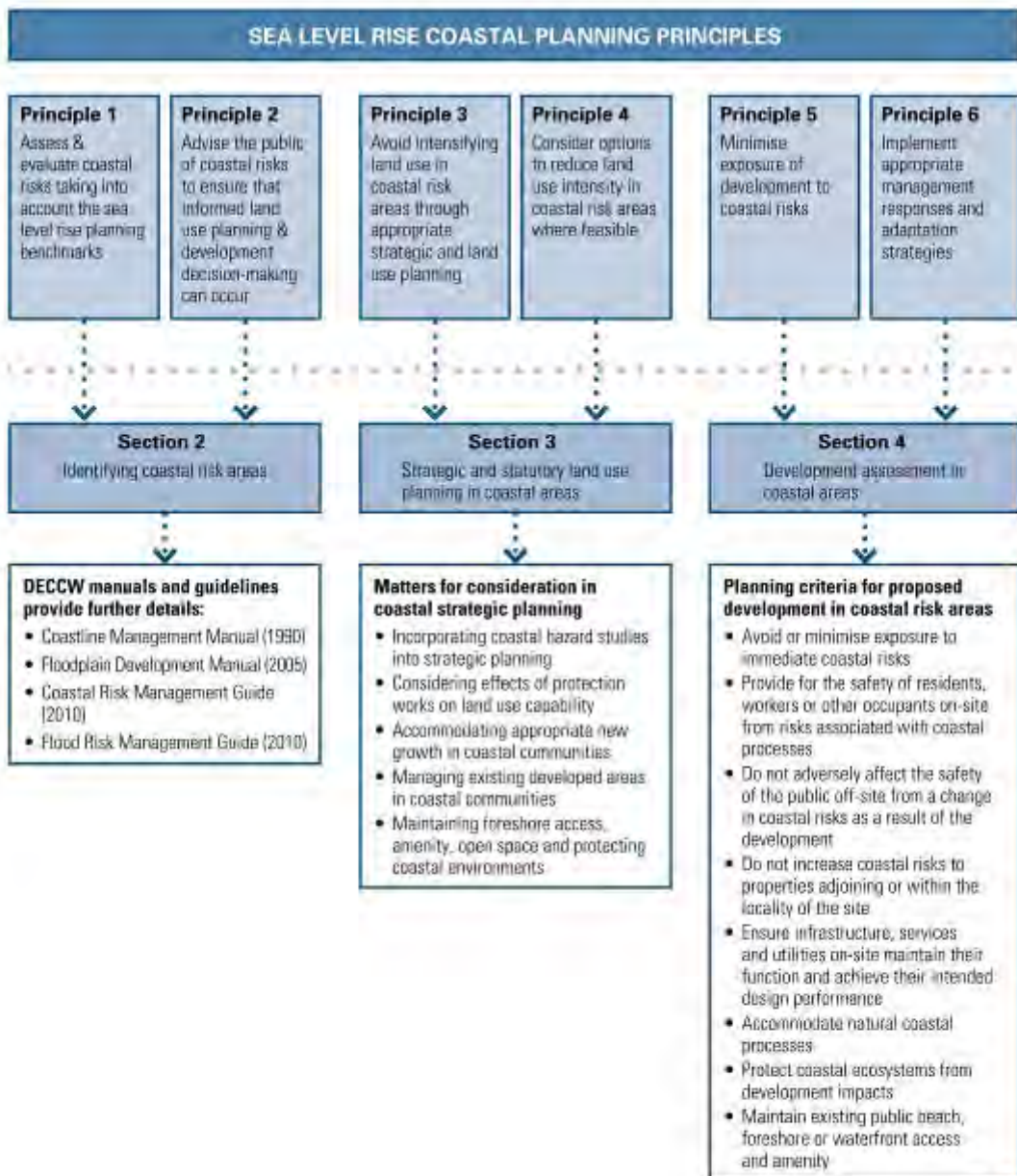
1.4 STRUCTURE OF THE GUIDELINE

This Guideline is structured around the implementation of six coastal planning principles for the consideration of sea level rise. The following diagram illustrates the relationship between these principles and the structure of this Guideline.

SECTION 2 – IDENTIFYING COASTAL RISK AREAS outlines how sea level rise should be incorporated into coastal risk assessment.

SECTION 3 – STRATEGIC AND STATUTORY LAND USE PLANNING provides information on how sea level rise impacts can be factored into strategic and statutory land use planning.

SECTION 4 – DEVELOPMENT ASSESSMENT outlines the process for considering sea level rise in the preparation and assessment of development applications in coastal areas.



2 IDENTIFYING CURRENT AND FUTURE COASTAL RISK AREAS

PRINCIPLE 1 – Assess and evaluate coastal risks taking into account the NSW sea level rise planning benchmarks.

PRINCIPLE 2 – Advise the public of coastal risks to ensure that informed land use planning and development decision-making can occur.

2.1 SEA LEVEL RISE PLANNING BENCHMARKS

This Guideline adopts the NSW sea level rise planning benchmarks in the NSW Sea Level Rise Policy Statement (2009).

The NSW sea level rise planning benchmarks are an increase above 1990 mean sea levels of **40cm by 2050 and 90cm by 2100**. These benchmark figures were established by considering the most credible national and international projections of sea level rise for the NSW coast and take into consideration the uncertainty associated with sea level rise projections.

These benchmark figures are to be used in NSW when planning for sea level rise.²

The adoption of the sea level rise planning benchmarks will ensure consistent consideration of the influence of sea level rise in coastal areas of NSW. The sea level rise planning benchmarks will be updated in light of any changes to accepted science, such as may be in the next Intergovernmental Panel on Climate Change assessment report expected in 2014.

The sea level rise planning benchmarks are not intended to be used as a blanket prohibition on development of land projected to be affected by sea level rise. New LEPs and development applications will continue to be assessed on their merits using a risk-based approach to determine whether the impacts of sea level rise and other coastal processes can be mitigated and managed over time.

² For the year 2100, the Federal Government adopted a sea level rise figure of 1.1m coupled with Highest Astronomical Tide levels to illustrate potential impacts across the nation in its recently completed First Pass National Assessment – Climate Change Risks to the Australian Coast (2009). The NSW sea level rise planning benchmarks are specific to the NSW coast and will not be changed in light of the first pass assessment.

Coastal planning **Principle 1** emphasises the need to undertake coastal risk assessments incorporating the sea level rise planning benchmarks so that both current and future hazards can be determined.

2.2 IDENTIFIED COASTAL RISK AREAS

There are two primary documents currently used in NSW that guide the identification of coastal erosion and coastal flood risk areas:

- Coastline Management Manual (1990) outlines the methodology for assessing and managing coastal hazards including beach erosion, shoreline recession, coastal entrance instability, vegetation degradation and sand drift, coastal inundation, slope and cliff instability and stormwater erosion; and
- Floodplain Development Manual (2005) outlines the methodology for assessing and managing flood hazards.

The sea level rise planning benchmarks are to be used in coastal hazard and coastal flood studies. Existing coastal hazard and coastal flood studies that have not incorporated the sea level rise planning benchmarks will need to be updated over time.

Two additional guides have been developed to assist councils in preparing coastal hazard and flood risk studies to incorporate the sea level rise planning benchmarks:

- Coastal Risk Management Guide: Incorporating sea level rise benchmarks in coastal risk assessments (2010), and
- Flood Risk Management Guide: Incorporating sea level rise benchmarks in flood risk assessments (2010).

The information in these guides updates the guidance in the Coastline Management and Floodplain Development Manuals related to sea level rise.

Some coastal councils have prepared coastal hazard studies that define coastal hazard zones in areas most at risk from coastal erosion and recession. The Coastal Risk Management Guide provides guidance on how the sea level rise planning benchmarks can be factored into the identification of additional areas projected to be at risk in the future from coastal erosion.

Flood studies have also been prepared for some coastal rivers and creeks likely to be affected by sea level rise. The Flood Risk Management Guide provides guidance on how the sea level rise planning benchmarks can be factored into the identification of additional areas projected to be at risk in the future from flooding.

As new studies incorporating the sea level rise planning benchmarks are completed, additional 'at risk' areas of coastline, foreshore and floodplain, that previously were of lower risk, will be identified. These coastal erosion and coastal flood risk areas will need to be taken into consideration when undertaking strategic land use planning and development assessment.

2.3 SEA LEVEL RISE INVESTIGATION AREAS FOR STRATEGIC PLANNING

Preparing new and updating existing coastal erosion and coastal flood studies will take some time. Prior to the completion of new or revised studies, councils may adopt sea level rise investigation areas (potential coastal risk areas) for the purpose of informing **strategic** land use planning.

For example, consideration should be given to not increasing the zoning intensity in sea level rise investigation areas without more detailed information. Councils could also use sea level rise investigation areas to help prioritise adaptation strategies, including asset management, in existing developed areas. Consideration should also be given to appropriate community based information about the specification and use of sea level rise investigation areas. Sea level rise investigation areas should not be included in environmental planning instruments or DCPs or used in development assessment.

A sea level rise investigation area can be used by a council as an interim guide to indicate land potentially subject to coastal risks now or in the future as a consequence of sea level rise. The sea level rise planning benchmarks should be incorporated into council's calculation of the sea level rise investigation areas.

Examples of possible measures that can be used in the identification of sea level rise investigation areas include:

- projected coastal erosion and recession distances along relatively long and straight sandy coastlines – 90cm sea level rise may result in coastal recession of 45 to 90 metres landward;
- projected tidal inundation in the lower reaches of a coastal waterway – additional 40cm by 2050 and 90cm by 2100;

- projected extension of flood prone land in tidal river reaches – additional freeboard added to the mapped flood planning area; and
- coastal areas below a set elevation in metres (AHD).

Sea level rise investigation areas should not be included in environmental planning instruments such as LEPs, or in DCPs until they can be confirmed by relevant local studies at which point they should be identified as coastal risk areas in maps within an LEP, regardless of the underlying zone.

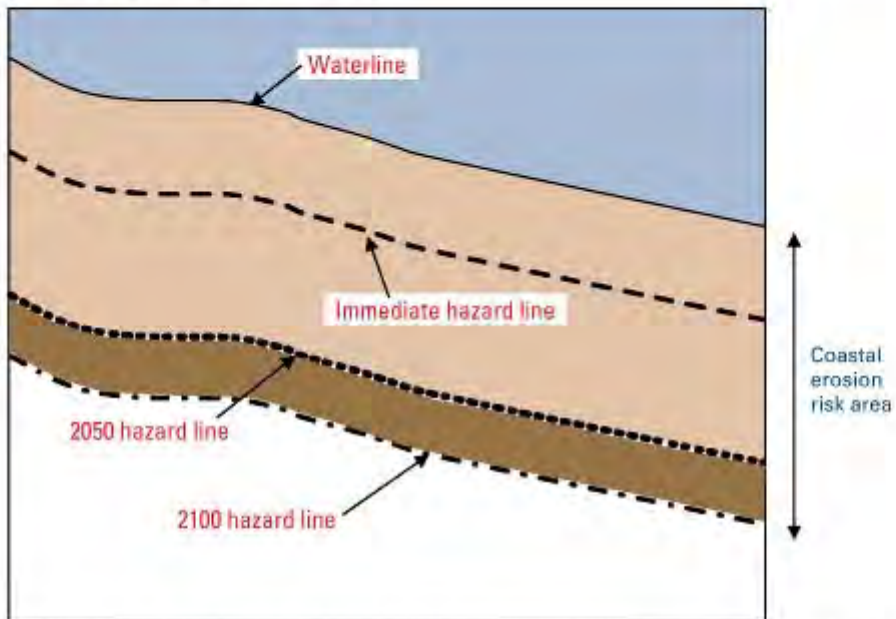
2.4 CHANGES IN COASTAL RISKS OVER TIME

Coastal erosion hazards are often depicted on relevant LEP, DCP or risk maps as immediate, 50 year and 100 year lines, showing areas of potential impact. With consideration of the sea level rise planning benchmarks, revised coastal risk studies for open sandy coastlines, estuaries and coastal lakes should identify immediate hazard lines, as well as future hazard lines based on sea level rise to 2050 and 2100 (**Figure 1**).



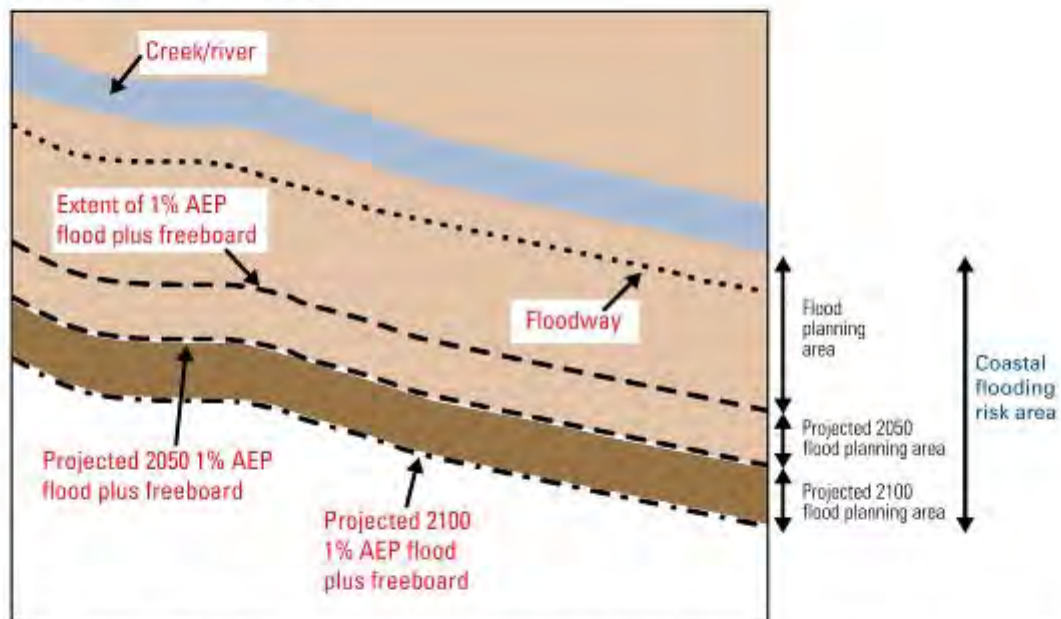
Old Bar – 7 July 2007

Figure 1 – Coastal erosion risk areas



Nb: Coastal erosion risk areas are identified in studies undertaken in accordance with the Coastline Management Manual complemented by the Coastal Risk Management Guide. The latter shows how the sea level rise planning benchmarks should be included in the modelling of the 2050 and 2100 hazard lines.

Figure 2 – Coastal flood risk areas



Nb: Coastal flood risk areas are identified in studies undertaken in accordance with the Floodplain Development Manual complemented by the Flood Risk Management Guide. The latter shows how the sea level rise planning benchmarks should be included in the modelling of the projected 2050 and 2100 1% AEP flood lines.

Flood studies, which generally depict the 1 in 100 year average recurrence interval (ARI) and the probable maximum flood (PMF) lines on maps, should also include modelling of the impact of sea level rise to 2050 and 2100 where relevant (**Figure 2**). The 100 year ARI is equivalent to the 1% annual exceedance probability (AEP), which represents a 1% chance of such a flood occurring in any given year.

While current climate change projections extend to the year 2100 this does not mean that sea level rise is projected to cease after that time or that other climate change parameters will be static. It is also important to note that climate change impacts are not occurring in a linear pattern, with future acceleration possible (IPCC, 2007).

2.5 MAKING INFORMATION AVAILABLE TO THE PUBLIC

Coastal planning **Principle 2** emphasises the importance of providing the public with timely advice on coastal risks so that informed land use planning and development decision making occurs.

The current process for the development of coastal hazard and floodplain risk management plans includes community consultation and involvement. Councils' coastal hazard and flood studies should be made available to the public when completed.

Advice provided or action undertaken by councils relating to coastal risks does not incur liability if it is done in good faith, which includes, but is not limited to, acting substantially in accordance with the principles in the Coastline Management Manual or Floodplain Development Manual (section 733 of the Local Government Act 1993).

Planning certificates issued under section 149(2) of the Environmental Planning & Assessment Act 1979 must include reference to coastal risks where council or a public authority has adopted a policy that imposes development restrictions on the specified parcel of land. These restrictions must be listed in a LEP, DCP or other council policy (including policies adopted by other public authorities).

Section 149 certificates are generally issued at the time of property purchase. Therefore other mechanisms should be considered in addition to Section 149 certificates to inform and keep landowners and the broader coastal community up to date on issues relating to coastal risks. Brochures, maps and other information could be distributed including via the internet, with rate notices or council newsletters, in targeted or ongoing programs.



Tuggerah Lake - DECCW

3 STRATEGIC & STATUTORY LAND USE PLANNING IN COASTAL AREAS

PRINCIPLE 3 – Avoid intensifying land use in coastal risk areas through appropriate strategic and land use planning.

PRINCIPLE 4 – Consider options to reduce land use intensity in coastal risk areas where feasible.

3.1 STRATEGIC PLANNING

Strategic planning includes land use planning activities at the regional, sub-regional and local level, including the preparation of Regional Strategies, LEPs, as well as local studies that inform the preparation of statutory plans such as LEPs and DCPs.

Land use intensification refers to processes that increase intensity or density of land use. For example, changing from low density residential to high density residential or from a rural zoning to a residential zoning would result in intensification. LEP and DCP controls can also be used to affect intensity. For example, principal development standards within an LEP relating to minimum lot size, height or floor space ratio can be used to change land use intensity.

In order to implement coastal planning **Principle 3** and **Principle 4** above, the following matters should be considered as part of the strategic planning process:

- Incorporating coastal risk studies into strategic planning
- Considering the effects of protection works on land use capability
- Accommodating appropriate new growth in coastal communities
- Managing existing developed areas in coastal communities
- Maintaining foreshore access, amenity and open space and protecting coastal environments.

Incorporating coastal risk studies into strategic planning

Councils are to assess and map risks in accordance with the NSW Government's Floodplain Development Manual (2005) and Coastline Management Manual (1990) together with the Coastal Risk Management Guide: Incorporating sea level rise benchmarks in coastal risk assessments (2010); and the Flood Risk Management Guide:

Incorporating sea level rise benchmarks in flood risk assessments (2010) which DECCW has prepared to complement these manuals.

As new coastal risk studies incorporating the sea level rise planning benchmarks are completed, coastal risk areas may include new areas of coastline, foreshore and floodplain that previously were considered to be of lower risk. Once identified, these extended areas of risk will need to be taken into consideration when undertaking strategic and statutory planning.

In the interim, councils may adopt sea level rise investigation areas to inform their strategic planning, as described in Section 2.3 of this Guideline.

Considering the effects of protection works on land use capability

The decision to construct comprehensive coastal, foreshore or river protection works is an important strategic planning consideration, as it may influence the viability and appropriateness of different land uses.

Structural protection works may be important adaptation strategies, whether they are comprehensive works by the local planning authority or by individual landholders, provided they do not adversely affect coastal processes or the environment.

Where feasible, 'soft engineering' options are preferred to hard engineering works if protection of both assets and coastal habitats are to be achieved. For instance, options such as beach nourishment or re-establishing barrier dune systems may have the advantage of allowing ecological communities to persist, while still protecting landward development from coastal processes.

Structural works to minimize coastal erosion can include seawalls, revetments, gabion walls, artificial reefs and groynes as well as temporary protection works such as sand bags.

Structural protection works can protect immediate areas from coastal erosion but may divert or deflect erosive forces elsewhere if designed incorrectly or sited inappropriately.

To minimise such risks, the installation of structural protection works should be consistent with any approved management plan, such as the relevant coastline or floodplain management plan or related emergency action plan.

The long term maintenance and management of any such works, including the need for long term beach nourishment, are important considerations in the application of these measures.

While structural protection works have generally been undertaken by or on behalf of public authorities in the past, they may be proposed on private foreshore land or public land on a site-by-site basis by landowners, subject to development approval and specified conditions.

Private structural protection works, as with public works, should be based on sound engineering and environmental principles.

In late 2009, the NSW Government released a suite of measures to address coastal erosion, including legislative amendments. These measures provide further guidance relating to coastal protection works.

Structural works to manage coastal flooding can include levees, filling, retarding basins, flood mitigation dams, bypass floodways, channel modifications and floodgates. Such works should be permitted only where they do not adversely affect flood processes, other parts of the floodplain or the environment.

Accommodating appropriate new growth in coastal communities

Strategic planning plays an important role in accommodating future urban growth in a sustainable manner. It can assist in addressing the challenges faced by coastal communities that are affected by both development pressure and the impacts of climate change.

The Coastal Design Guidelines for NSW (2003) provide advice on the design of coastal urban settlements. Those Guidelines include advice on retaining foreshores and headlands in public ownership and protecting buildings and properties from storm events and sea level rise.

Coastal planning **Principle 3** of this Guideline discourages the intensification of development in coastal risk areas, particularly in 'greenfield' sites where the potential impacts of sea level rise cannot be effectively mitigated. For example, changing land use from rural to urban, or increasing the density of housing from low to medium or high density is strongly discouraged in high risk areas due to the potential future risk to life, property and the environment.

New urban centres should be sited away from coastal risk areas, where the potential impacts of sea level rise cannot be effectively mitigated, with consideration for other strategic planning issues that affect where new centres are located, such as adequate transport networks, proximity to populations and urban services, and the commercial viability of locations.



Sydney, Meadowbank – 12 Jan 2009 king tide – Peter Scaft

Managing existing developed areas in coastal communities

Coastal planning **Principle 4** of this Guideline encourages the reduction of land use intensity in coastal risk areas where feasible and where potential impacts of sea level rise cannot be effectively mitigated. Reducing land use intensity may however be difficult to achieve in areas that have already undergone significant urban development, such as established residential zones and town centres.

Similarly, changing land use zoning from medium density housing to low density or prohibiting new urban development in general would affect the future development potential of a given area. This may be unnecessary, particularly if the coastal risks are only minor and the future development potential of the land is not otherwise restricted by other environmental, social or economic constraints.

In other areas, management responses and adaptation strategies may be limited and thus projected sea level rise may significantly affect the development potential. Appropriate planning now is needed to minimise the social and economic impacts of development in the long term.

In addition to coastal risks, when councils consider reducing land use intensity, the following factors must be considered:

- land tenure – public or private ownership;
- current land uses and existing use rights;
- the availability, effectiveness and feasibility of impact mitigation options;
- existing environmental constraints on development, such as, bushfire and coastal erosion hazards, flood risks, slope stability constraints, vegetation, threatened species and acid sulfate soils;
- other planning constraints on development, such as, distance to community services, access to transport, sewage, water and utilities and aboriginal cultural heritage; and
- the potential for requiring land acquisition.

Examples of Zoning Options in Coastal Risk Areas

For rural or undeveloped land in coastal risk areas, particularly seaward of the immediate hazard line, the E3 Environmental Management Zone may be appropriate in certain instances to manage land subject to environmental hazards or processes that may require careful management.

Other rural or undeveloped land in coastal risk areas may be zoned E2 Environmental Conservation Zone which provides the highest level of protection, management and restoration for such lands, while allowing uses compatible with those values. It must be noted that the range of permitted uses should not be drawn too restrictively as they may, depending on circumstances, invoke the Land Acquisition (Just Terms Compensation) Act 1991 and the need for the Minister to designate a relevant acquiring authority.

For risk areas on coastal floodplains that have not yet been zoned for urban uses, retaining low intensity rural zones with large lot sizes may be more appropriate than intensifying land use by allowing residential, industrial or business uses – particularly if the land is projected to be flood prone in the future.

Where coastal risk areas are identified in a National Park or Nature Reserve, the E1 National Parks and Nature Reserves Zone will apply.

For other public land subject to coastal risks, councils may consider applying other zones with low intensity land uses permitted.

For instance, in areas currently subject to coastal erosion such as beach and foreshore areas, it may be appropriate to zone the land RE1 Public Recreation Zone. In other circumstances, E2 Environmental Conservation Zone or E3 Environmental Management Zone may be more appropriate.



Coffs Creek penetrating back up stormwater system, 12 Jan 2009 king tide – Mel Bradbury

Rather than prohibiting infill or redevelopment in existing areas, councils could consider measures that would allow ongoing sustainable occupation of coastal areas, until such times as coastal risks threaten life and property. This may include the use of time and/or trigger limited development consent conditions, as discussed in Section 4.7.

As well as appropriate consent conditions, in existing developed areas, councils and/or landowners could consider the use of long term coastal protection works.

Structural protection works to reduce flood exposure to existing development can include flood levees which exclude flooding of the protected area for a particular design event. Sea level rise is likely to reduce the protection provided by levees in lower coastal waterways. Strategic planning for these areas needs to consider plans for future flood risk management. Options could include maintaining current protection levels by upgrading current or constructing new protection works or changing development controls.

Maintaining foreshore access and amenity, open space and protecting coastal environments

Strategic planning should address and accommodate the effects of sea level rise on public foreshore access and coastal assets such as reserves, recreation areas or natural areas.

This also includes addressing the implications on the long term protection of coastal and estuarine ecology and the importance of landward migration of wetlands, mangroves and salt marsh communities.

Coastal public reserves in particular provide important public open space and the loss of these assets may place additional pressure on other open space areas.

3.2 STATUTORY PLANNING

The coastal risk strategic planning considerations discussed in Section 3.1 should directly inform the preparation of planning proposals, LEPs and DCPs.

Strategic planning mechanisms, that is, Regional Strategies and local studies, in general provide broad guidance on suitable locations for large-scale coastal developments to meet future housing and employment needs.

The Regional Strategies also require councils to manage risk in accordance with flood management studies and coastal hazard studies, including sea level rise. In areas where studies have not been completed, councils are not to zone land or approve development or re-development in potential hazard areas unless assessed within a risk assessment framework.

Where possible, new urban developments and coastal subdivisions should be located outside coastal risk areas (for the 2100 sea level rise projection) to avoid increasing the community's exposure to coastal hazards unless the potential impacts of sea level rise can be effectively mitigated. In particular, developments such as hospitals, schools, child care or aged care facilities should not be located in existing or potential coastal risk areas where risks are high or where evacuation may be difficult.

Developments that are of a hazardous or potentially hazardous nature, for example manufacture or storage of hazardous or dangerous materials, or waste disposal, should also be sited outside coastal risk areas.

The following sections outline how an LEP can be used to implement coastal planning **Principle 3** and **Principle 4** to avoid intensifying land use or reduce land use intensity in coastal risk areas.

Land use zones and zoning objectives

Land use zones in the Standard Instrument for LEPs provide an important mechanism for regulating land use in coastal risk areas.

The appropriateness of using a particular land use zone will depend on the level of coastal risk, as well as other environmental and planning considerations, such as existing and permitted land uses on site.

Additional objectives must be consistent with the mandated objectives for development in the zone.

Where zones are identified as being subject to coastal risks it may be appropriate to include an additional objective for that zone requiring the accommodation of the projected impacts of sea level rise.

Principal development standards

The principal development standards provided in the Standard Instrument are the main tools for controlling the bulk, scale and intensity of permissible land uses and include minimum lot size, building height and floor space ratio.

Councils can vary the principal development standards across zones so that they reflect the underlying land capability.

Additional LEP provisions

The Standard Instrument contains clause 5.5 – development within the coastal zone. This clause addresses environmental and amenity issues and also requires that, when assessing development within the NSW Coastal Zone, the consent authority considers the effect of coastal processes and coastal hazards and potential impacts, including sea level rise, on the proposed development, and arising from the proposed development.



Wamberal Beach – 9 June 2007 – Phil Watson

Additional LEP clauses can be added to apply local provisions to the whole local government area or specifically mapped areas, regardless of the underlying zone. These types of clauses may contain controls for development including mitigation requirements, provided the local provisions are consistent with the intent and objectives of the underlying land use zone and compulsory provisions of the Standard Instrument.

Inclusion of clause 6.5 – foreshore building lines in LEPs may also be appropriate in some instances. That model clause prohibits certain development in foreshore areas, primarily in inner harbour/protected water locations. Foreshore building lines do not constitute a blanket prohibition of development.

Coastal risk areas could be identified in an LEP by a foreshore building line or a flood planning area, with development controls specified in the LEP including mitigation requirements, and performance criteria specified in a related DCP.

Model Local Provisions

Whilst clause 5.5 of the Standard Instrument applies to the NSW Coastal Zone, Section 1.1 of this Guideline explains that consideration of sea level rise is applicable to areas beyond the NSW Coastal Zone.

Two additional model local provisions have therefore been developed for use with mapped coastal erosion risk areas and coastal flood risk areas shown within LEPs. Both provisions are available from the Department of Planning.

3.3 DEVELOPMENT CONTROL PLANS

DCPs include controls and standards that are part of a consent authority's statutory considerations when assessing a development application. Development controls in a DCP must be consistent with the relevant LEP. For example, DCPs cannot control the permissibility of development. DCPs can relate to issues over a whole LEP or local government area, or can relate to a specifically mapped area, such as a coastal risk area.

Where an LEP outlines principal development standards, such as height of buildings, minimum subdivision lot size and floor space ratio, a DCP can make more detailed provision with respect to development. These provisions can take the form of text, maps and diagrams, and usually contain further development standards, performance criteria, matters for consideration or procedural matters associated with controlling development.

For example, coastal risk areas could be mapped, separately as coastal erosion or coastal flooding areas, in both the LEP and the associated DCP. Performance criteria for development assessment could be applied to that coastal risk area through the LEP. More detailed development controls can then be applied to the whole or sections of the coastal risk area, such as the immediate hazard line, the projected 2050 hazard line and the projected 2100 hazard line in the DCP.

Such development controls could cover required mitigation works, construction methods or materials, size of the development, building design, the need for development to be relocatable or temporary and the location of utilities or services within the site. The DCP could also specify the use of time and/or trigger limited conditions within a development consent to allow sustainable accommodation of the coast until such time as the impacts of sea level rise compromise life and property.

Figures 4 and 5 illustrate these matters.

Relevant components of Section 4 – Development Assessment in Coastal Areas, of this Guideline, such as the planning criteria, management responses and adaptation strategies, information requirements and assessment process could all be included in a council's DCP.



Old Bar – September 2009 – Santina Camroux

4 DEVELOPMENT ASSESSMENT IN COASTAL AREAS

PRINCIPLE 5 – Minimise the exposure of development to coastal risks.

PRINCIPLE 6 – Implement appropriate management responses and adaptation strategies, with consideration for the environmental, social and economic impacts of each option.

4.1 DEVELOPMENT IN COASTAL AREAS

This section is intended to assist proponents in preparing coastal development applications and consent authorities assessing these development applications under the Environmental Planning and Assessment Act 1979.

The strategic and statutory land use planning mechanisms outlined in Section 3 will assist councils in long term planning by avoiding intensifying land use in areas subject to coastal risks where the impacts of sea level rise cannot be effectively mitigated. The development assessment process provides a further opportunity to ensure that future coastal development does not increase exposure to coastal risks.

Coastal planning **Principle 5** of this Guideline indicates that proposed developments should seek to minimise exposure to coastal risks.

For development sites that are located within coastal risk areas, pre-DA consultation with the consent authorities and relevant State agencies will be an important component of the development assessment process.

4.2 SITE SELECTION

The planning criteria below should be considered by applicants when selecting coastal development sites and designing development proposals. These criteria will then be considered by consent authorities when assessing coastal development proposals.

4.3 PREPARATION OF DEVELOPMENT APPLICATION (DA)

Figure 3 outlines the process for development assessment in coastal areas.

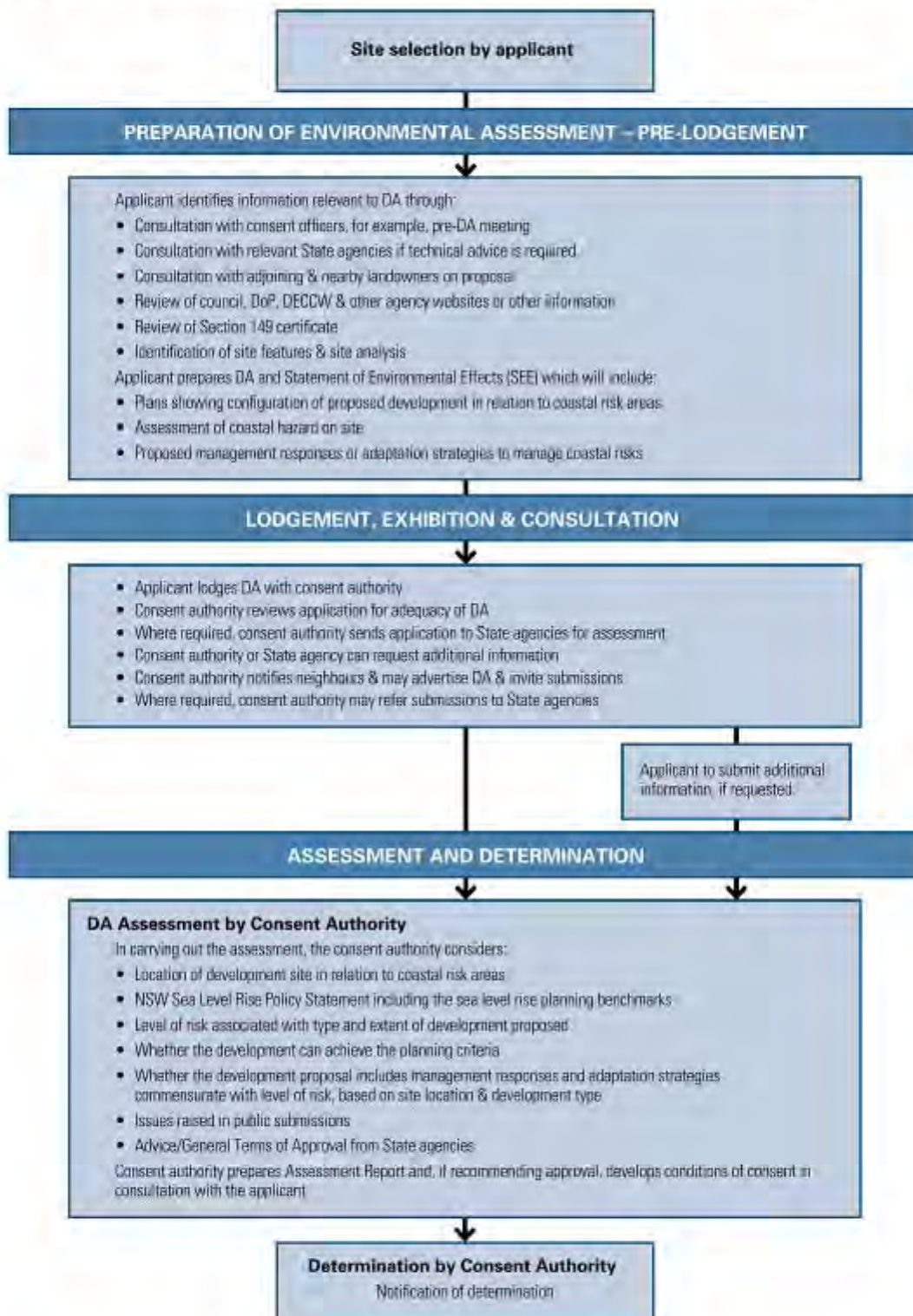
Pre-DA consultation

Proponents who intend to submit development applications in coastal risk areas should seek early advice from the consent authority on the nature and extent of the coastal risks that may affect the development site. Proponents should consult with relevant State agencies where required under legislation. Proponents should also review relevant guidelines, technical documents and reports including the NSW sea level rise planning benchmarks.

PLANNING CRITERIA FOR PROPOSED DEVELOPMENT IN COASTAL RISK AREAS

1. Development avoids or minimises exposure to immediate coastal risks (within the immediate hazard area or floodway).
2. Development provides for the safety of residents, workers or other occupants on-site from risks associated with coastal processes.
3. Development does not adversely affect the safety of the public off-site from a change in coastal risks as a result of the development.
4. Development does not increase coastal risks to properties adjoining or within the locality of the site.
5. Infrastructure, services and utilities on-site maintain their function and achieve their intended design performance.
6. Development accommodates natural coastal processes including those associated with projected sea level rise.
7. Coastal ecosystems are protected from development impacts.
8. Existing public beach, foreshore or waterfront access and amenity is maintained.

Figure 3 – Assessment process for development applications (DAs) in coastal areas



Councils may have DCPs, management plans or other council policies or strategies which apply to the land or the type of development being proposed which may assist proponents in siting and designing developments in coastal risk areas.

Early discussions with councils could also assist in identifying how the proposed development could contribute to any initiatives proposed by the council to manage or avoid coastal hazard risks.

It is also important to consult with adjoining and nearby landowners to discuss both the proposed development and any actions proposed to manage or mitigate offsite coastal risks associated with the proposed development.

Site design and layout

For proposed developments located in coastal risk areas, the assessment criteria will need to be addressed through site design and layout.

The council may also be able to provide advice on appropriate site design and layout for developments in coastal areas.

Management responses and adaptation strategies

Coastal planning **Principle 6** indicates that implementation of appropriate management responses and adaptation strategies will be an important component of any new development in coastal areas.

Applications for coastal development should outline any management responses or adaptation strategies that will be adopted to address the planning criteria such as:

- configuring the development site layout to minimise exposure to coastal risks, such as, ensuring that buildings and infrastructure are placed in low risk areas on site and provide open space and landscaping between buildings and areas of higher hazard risk (illustrated in **Figure 4** and **Figure 5**);
- installing and maintaining protection works;
- constructing buildings or structures that are easily decommissioned, dis-assembled or relocatable either on-site or off-site as required;
- providing for safe evacuation routes during storm and flood events;
- designing buildings with all habitable floors above flood planning levels; and
- designing buildings to be structurally sound in the planning flood.

The appropriateness of these management responses and adaptation strategies will differ on a case-by-case basis.

DA information requirements

Applicants submitting DAs for development in coastal risk areas must demonstrate that the proposal satisfies the planning criteria in Section 4.2. In order to do so, the following information is to be submitted with the DA, as part of the Statement of Environmental Effects (SEE), as appropriate to the scale and location of the proposal.

- Information outlining the type of proposed development including:
 - nature, bulk, scale and location of proposed development; and
 - proposed use and occupation of buildings, and those on adjoining land.
- Plans illustrating the position and configuration of the proposed development in relation to coastal risks including:
 - position of the existing and proposed buildings;
 - existing ground levels in AHD around the perimeter of the building;
 - existing or proposed floor levels in AHD;
 - foundation type; and
 - topographic levels of the site to an accuracy of 0.1m, and structures to an accuracy of 0.01m, showing relative levels in AHD.
- A report addressing the following issues relating to sea level rise as they relate to the development site, where relevant:
 - increase in sea level and increased tidal range;
 - soft coast erosion – beach and foredune loss and/or migration, shoreline recession, beach realignment;
 - coastal flooding;
 - coastal entrance behaviour;
 - reconfiguration of intermittently open and closed lakes and lagoons;
 - cliff and slope instability;



Batongli Beach, Richard Hagley

- wetland migration; and
- groundwater elevation and/or salinisation.
- Information that demonstrates whether the development proposal:
 - is consistent with the relevant coastline or flood risk management plan;
 - is consistent with any relevant DCP that relates to coastal or flood issues;
 - meets the coastal protection and flood risk management requirements of the LEP; and
 - incorporates appropriate management responses and adaptation strategies.

4.4 CONSULTATION

The consultation process informs the community of a development application and enables input from the community as well as other agencies that may have an interest in the development assessment process.

The consultation process for a development application within a coastal risk area is the same as for other developments. The consultation process and procedures is often outlined in a council's DCP.

4.5 ASSESSMENT OF DEVELOPMENT APPLICATION

When assessing a development application in a coastal area the consent authority should assess the level of risk of the proposal. Risk is a function of proximity and exposure to coastal hazards and the likely severity of the impacts of the event on the particular type of development.

$$\text{Risk} = \text{Probability of an event occurring} \times \text{Likely severity of the impacts}$$

If the proposed development is not located within a coastal risk area, additional assessment under this Guideline is not required.

Assess risk related to location of proposed development

The probability of an event occurring will be dependent on the location and nature of the development site. The consent authority should determine whether any part of the development site is located in a coastal risk area (illustrated in **Figure 4** and **Figure 5**).

The proponent must provide the consent authority with the appropriate information to determine whether the development is sited within a coastal risk area. In some cases, this information will be available in council plans or studies, in other cases, the applicant will need to undertake their own studies.

Assess risk related to type of proposed development

The impact of an event, being the effects of coastal hazard events on a development site, will be a function of the type and siting of development.

As a guide, the following types of development proposals in coastal risk areas would require further detailed assessment of risks to life, property and/or the environment:

- construction of new residential, commercial, retail or industrial buildings or structures or substantially increasing the floor space ratio of existing buildings or structures;
- subdivision, with consideration for proposed building envelopes, access and service easements;
- institutional developments, especially where evacuating people may be particularly difficult, such as, hospitals, schools, child care or aged care facilities;
- material change of use that substantially increases the number of people living or working on site;
- manufacture or storage of hazardous or dangerous materials or waste disposal; or
- sewage treatment works, substations and other key infrastructure essential in emergency response and recovery.

If these types of development are proposed in a coastal risk area, the consent authority should determine whether the type of development proposed, that is, its nature, bulk or scale and its use is likely to have implications for:

- exposure to immediate coastal risks, that is, within the immediate hazard area;
- maintenance of flow conveyance; that is, within the floodway;
- safety of residents, workers or other occupants on-site;
- safety of public off-site from a change in coastal hazards as a result of the development;
- safety of properties adjoining or within the locality of the development site;



Wooli, River Street - 12 Jan 2009 king tide - Wayne Uilbb

- performance of infrastructure, services and utilities on-site including emergency response requirements during and in the aftermath of an extreme coastal and/or flood event;
- changes to natural coastal processes as a result of the design of the development;
- coastal ecosystems on or adjoining the site; or
- existing public beach, foreshore or waterfront access and amenity.

If the consent authority considers the proposed development to be minor development, applications need not be assessed against the above criteria.

The following types of development could generally be considered minor, however the consent authority should consider each application on a case-by-case basis:

- internal fitouts, minor alterations, additions or extensions to existing buildings or structures that are landward of the seaward alignment of the existing buildings or structures;
- waterway-based structures including jetties, slipways, wharves, boat sheds and pontoons;
- exempt development; or
- temporary or minor relocatable structures.

Assess proposed development against criteria

Based on the risk assessment process identified above, applications for development, other than minor development, in coastal risk areas will need to demonstrate how the proposed development will be designed and managed to achieve safety, planning and environmental performance outcomes.

This assessment approach promotes appropriate development in coastal risk areas through the merit assessment of proposals based on social, economic and environmental factors, rather than strict compliance with a set of prescriptive development controls.

The planning criteria will need to be considered by a consent authority before determining development applications in coastal risk areas.

4.6 DETERMINATION OF DEVELOPMENT APPLICATION

When assessing development applications in coastal areas, consent authorities must have regard to the coastal planning **Principle 5** and **Principle 6** of this Guideline.

In addition, consent authorities should take into consideration:

- location of the development site in relation to coastal risk areas (**Figures 4** and **5**).

- NSW Sea Level Rise Policy Statement including the sea level rise planning benchmarks;
- level of risk associated with the type and extent of development proposed;
- whether the development can achieve the planning criteria, including for a defined period of time;
- whether the development incorporates appropriate management responses and adaptation strategies commensurate with the level of risk associated with the site location and the type of development being proposed;
- issues raised in public submissions; and
- advice/general terms of approval from State agencies.

In addition to this Guideline, consent authorities should have regard to other relevant policies and development controls that apply to the development and this subject site.

4.7 CONDITIONS OF CONSENT

The development consent can include conditions relating to the management responses and adaptation actions necessary for the development to meet the planning criteria. This may include site layout and design, construction type and materials, protection works, as well as trigger and/or time limited consents.

A trigger point could be defined as the erosion escarpment receding to a specified distance from the lot boundary. The distance should be defined consistently with NSW Government policies relating to coastal protection.

Time limited consents could provide a renewal option in the event that conditions at that time still provide for safe occupation.

Such conditions may be particularly appropriate for areas of existing development. They may allow sustainable occupation of coastal land until such time as coastal risks compromise the safety of life and property.

4.8 OTHER DEVELOPMENT ASSESSMENT PROCESSES

Complying development under the General Housing Code of the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 cannot be undertaken on flood control lots (see glossary for definition) or land identified in an environmental planning instrument as a coastal erosion hazard.

Figure 4 – Coastal erosion consideration in DA assessment

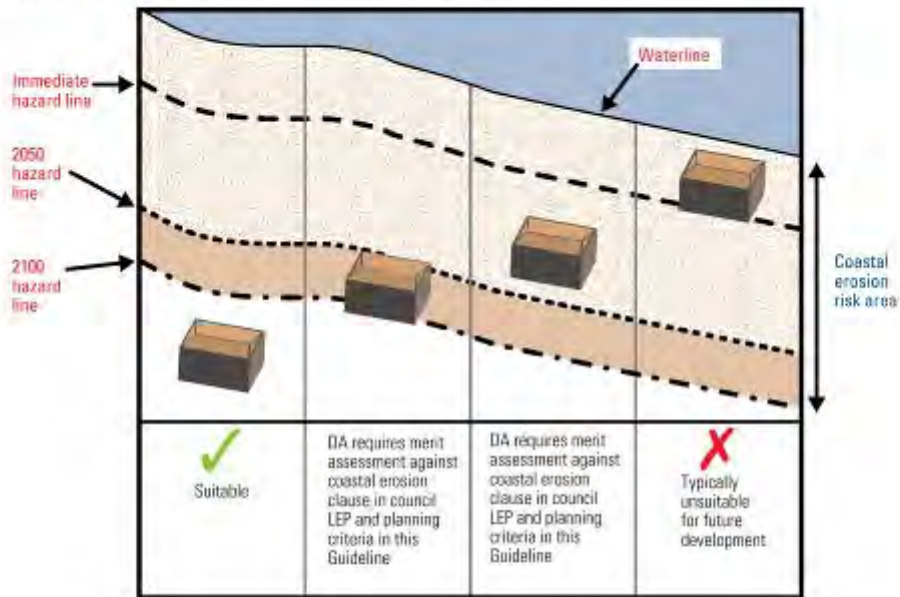
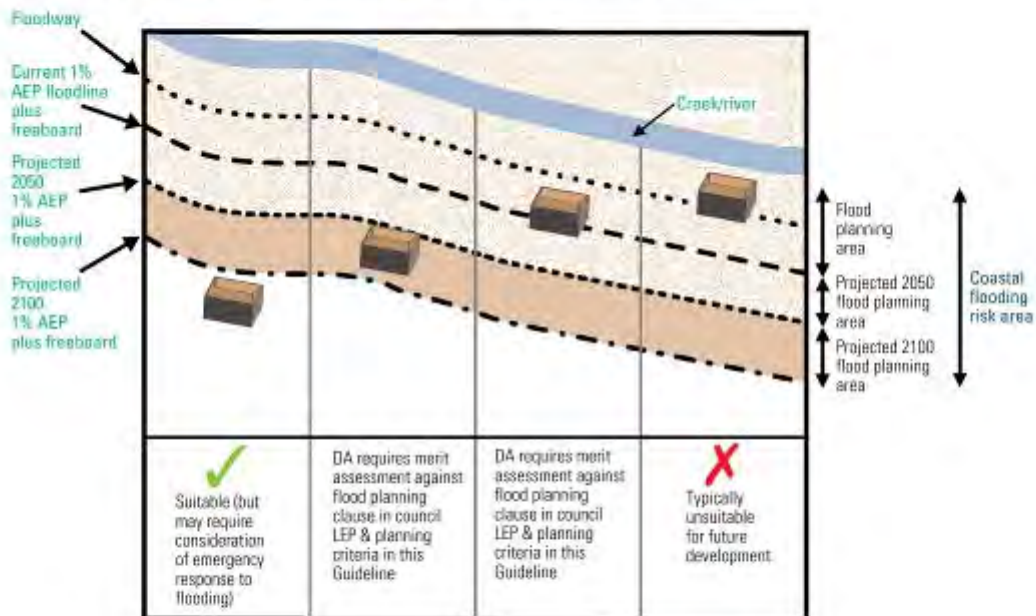


Figure 5 – Coastal flooding consideration in DA assessment



Part 3A of the Environmental Planning and Assessment Act 1979 specifies a process-based approach to assessment of major projects. This includes Director General Requirements that specify all issues of relevance to a proposal that need to be assessed. Environmental, social and economic considerations are factored into this assessment, commensurate with their relevance to the proposal and site in question. Where relevant to a particular proposal, the sea level rise planning benchmarks and principles in this Guideline would inform the Director General's requirements.

Whilst this Guideline is not specifically focused on public assets and infrastructure, the planning criteria outlined in Section 4.2 are equally relevant to the consideration of such developments.



North Coast - Greg Yeates

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- Standard Instrument – Principal Local Environmental Plan. <http://www.planning.nsw.gov.au/LocalEnvironmentalPlans/StandardInstrument/tabid/247/Default.aspx>
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GLOSSARY

annual exceedance probability (AEP) – the chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage.

Australian Height Datum (AHD) – a common national surface level datum approximately corresponding to mean sea level in 1968.

average recurrence interval (ARI) – the long term average number of years between the occurrence of a flood as big as or larger than the selected event, ARI is a way of expressing the likelihood of occurrence of a flood event.

coastal area – is used broadly in this Guideline to be all land fronting tidal waters including the coastline, beaches, coastal lakes, bays and estuary sections or tidal sections of coastal rivers. It also includes other low lying land surrounding these areas that may be subject to coastal processes in the future as a consequence of sea level rise.

coastal erosion risk area – refers to the extent of calculated shoreline recession plus any allowance for reduced foundation capacity.

coastal flooding – refers to catchment-related flooding of coastal areas.

coastal risk area – the term used in this Guideline to identify the land covered by both the coastal erosion risk area (Figure 1), as well as the coastal flooding risk area (Figure 2).

coastal risk – in the context of this Guideline means coastal erosion, tidal inundation and coastal flooding, including impacts of sea level rise.

DA – Development Application

DCP – Development Control Plan

DECCW – NSW Department of Environment, Climate Change and Water

DoP – NSW Department of Planning

flood control lot – means a lot to which flood related development controls apply in respect of development for the purposes of dwelling houses, dual occupancies, multi-dwelling houses or residential flat buildings (other than development for the purposes of group homes or seniors housing).

flood planning area – the area of land below the flood planning level and thus subject to flood-related development controls. Commonly, the flood planning area covers the extent of a design flood, for example, 100 year ARI or 1% AEP, plus an appropriate freeboard, for example, 0.5m.

flood planning levels (FPLs) – are the combinations of flood levels, derived from significant historical flood events or floods of specific AEPs, and freeboards selected for floodplain risk management purposes, as determined in management studies and incorporated in management plans.

floodway – those areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flow, or a significant increase in flood levels.

identified coastal risk area – as new coastal hazard and flood studies incorporating the NSW sea level rise planning benchmarks are completed, identified coastal risk areas may include new areas of coastline, foreshore and floodplain that previously were of lower risk.

immediate hazard line – mapped line representing the estimated extent of beach erosion from an extreme oceanic storm event plus any allowance for reduced foundation capacity.

LEP – Local Environmental Plan

NSW Coastal Zone – identified in the series of gazetted maps under the Coastal Protection Act 1979.

NSW sea level rise planning benchmarks – are specified in the NSW Sea Level Rise Policy Statement as an increase above 1990 mean sea levels of 40 cm by 2050 and 90cm by 2100.

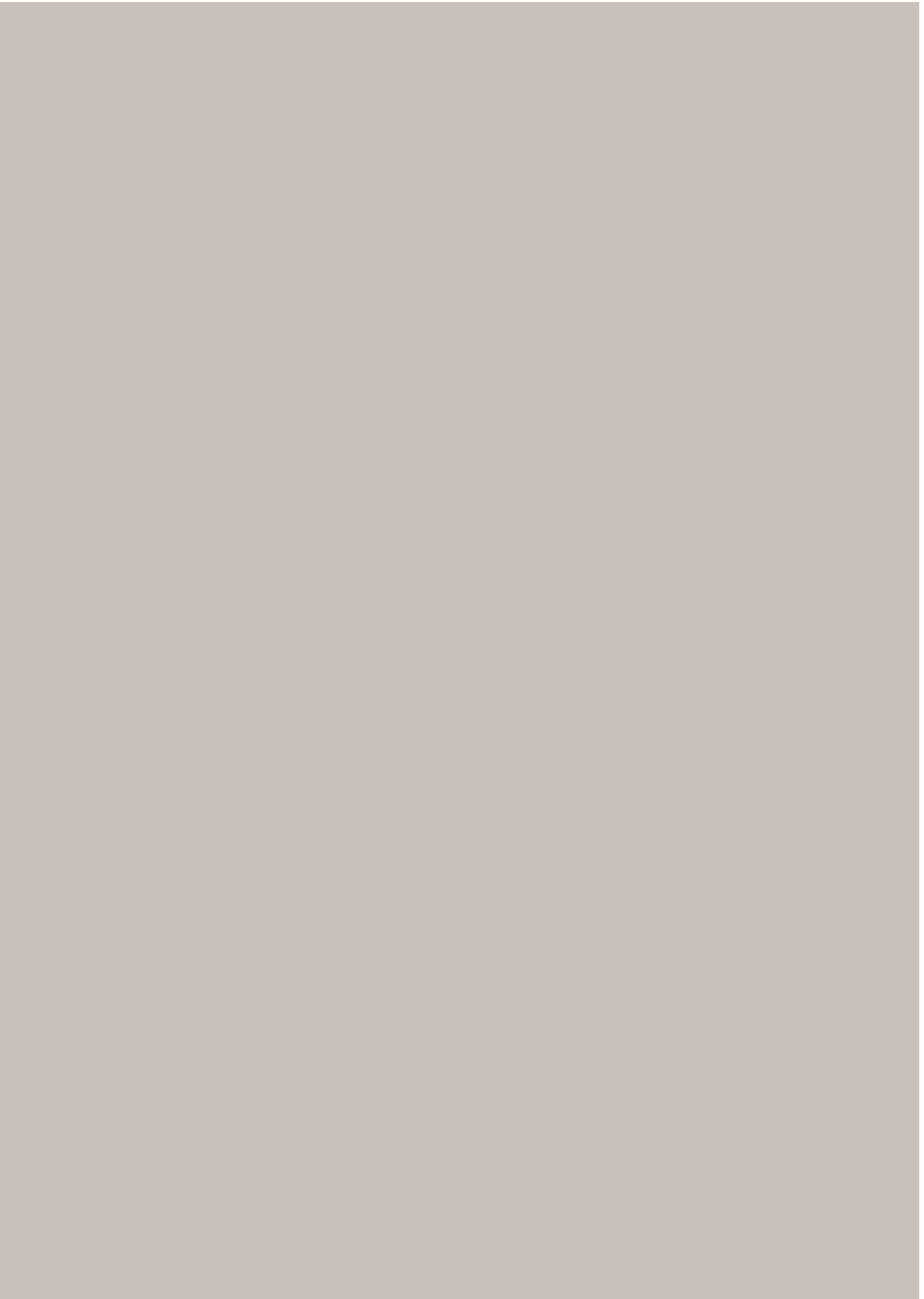
planning criteria – eight criteria to be considered by consent authorities when assessing development applications in coastal risk areas (detailed in section 4.2).

risk – is assessed on the basis of the probability of an event occurring multiplied by the impact of the event.

sea level rise investigation areas – potential coastal risk areas adopted by council prior to preparing new and updating existing coastal hazard and flood studies. The sea level rise planning benchmarks should be incorporated into the calculation of sea level rise investigation areas.

SEE – Statement of Environmental Effects

tidal inundation – refers to flooding of land by tidal waters





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& Water



Flood Risk Management Guide

Incorporating sea level rise benchmarks in flood risk assessments

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Abbreviations

AEP	Annual exceedance probability
AHD	Australian Height Datum
ARI	Average recurrence interval
DECC	Department of Environment, Climate Change NSW
DECCW	Department of Environment, Climate Change and Water NSW
ICOLL	intermittently closed and open lakes and lagoon

1 Introduction

The NSW Sea Level Rise Policy Statement (NSW Government 2009) was prepared to support consistent adaptation to projected sea level rise impacts. The policy statement includes sea level rise planning benchmarks for use in assessing potential impacts of sea level rise in coastal areas, including in flood risk and coastal hazard assessment.

The benchmarks are a projected rise in sea level, relative to the 1990 mean sea level, of 0.4 metres by 2050 and 0.9 metres by 2100. The sea level rise planning benchmarks will be periodically reviewed if new information indicates change is required.

This guide has been prepared to assist local councils, the development industry and consultants to incorporate the sea level rise planning benchmarks in floodplain risk management planning and flood risk assessments for new development. The information in this guide updates the sea level rise information in the *NSW Floodplain Development Manual* (NSW Government 2005) and should be read in conjunction with the Manual.

This guide also updates the sea level rise section of the *Floodplain Risk Management Guideline: Practical Consideration of Climate Change* (DECC 2007). The 2007 guideline provides additional information relating to the management of the impacts of climate change on existing developed areas and on potential changes to flood-producing rainfall events caused by climate change.

The *NSW Coastal Planning Guideline – Adapting to Sea Level Rise* (Department of Planning 2010) provides detail about the consideration of this information in land-use planning and development assessment.

2 The impacts of sea level rise in areas vulnerable to flooding and tidal inundation

Sea level can have a significant impact upon the tidal range and flood levels in tidal waterways (Figure 2.1).

This influence usually diminishes with increasing distance upstream from the entrance of the waterway. Flood levels can be affected even in areas that are mostly separated from the ocean by outlet berms, such as intermittently closed and open lakes and lagoons (ICOLLs).

The Appendix to this guide provides advice and information on the setting and modelling of ocean boundary conditions for hydraulic flood modelling in tidal waterways.



Figure 2.1. Inundation during high tide at Carrington, near Newcastle (14 December 2008).

The degree of the impact of sea level rise will vary significantly with location and vulnerability to the impacts of sea level rise and may lead to:

- an increase in normal tidal depth and an increase in areas affected by inundation due to normal tidal fluctuations
- an increase in the frequency and duration of inundation in areas already affected by tides
- tidal influences occurring at higher elevations in tidal waterways and associated geomorphic and environmental impacts
- an increase in the duration, frequency and magnitude of coastal flooding and the levels reached by flood waters during these events
- a reduction in the capacity of drainage systems that discharge into tidal waters; this may lead to an increase in localised stormwater flooding and more water flowing overland rather than through drainage systems.

3 Where is sea level rise likely to impact on flood levels?

This guide applies to areas where the sea level rise planning benchmarks are likely to have an impact on predicted flood levels. This includes areas in the vicinity of tidal waterways, including ICOLLs. In particular, this is likely to apply if the land is:

- likely to be inundated if water levels are 1 metre above the upper limit of the current tidal range, which is usually defined by annual exceedance from local tidal records
- likely to be inundated if water levels are 1 metre above the current flood planning level in tidally affected waters
- within 1.5 metres of the maximum historic height of the entrance berm or the upper limit for management intervention identified in entrance management plans for any ocean entrance to the waterway which controls flooding (this commonly applies to ICOLLs)
- below 4 metres Australian Height Datum (AHD).

Major infrastructure crossings (road and rail bridges) often have a significant impact on flood levels and may represent the upper limit of the area that will be influenced by changes in sea level due to flooding. This needs to be assessed on a case by case basis because it depends upon the configuration and size of the structure relative to the crossing's waterway area.

The effects of sea level rise are influenced by the configuration and behaviour of a creek or river's entrance and will usually diminish with distance upstream of the entrance (Figure 3.1).



Figure 3.1. Bellingin River flooding at Mylestom (2009).

4 Projected changes to flood planning areas

Flood behaviour may have been identified in a flood study prepared as part of the floodplain risk management planning process described in the *NSW Floodplain Development Manual* (NSW Government 2005), or carried out on behalf of a developer for new urban development proposals. This may have involved the prediction of flood levels and mapping of flood extents, which usually correspond to the current 1% annual exceedance probability (AEP) or 1-in-100-year average recurrence interval flood. Additional mapping may have been prepared to define the flood planning area, which represents the extent of the residential flood planning level or the limit of the design flood (typically the 1% AEP event) plus an appropriate freeboard, such as 0.5 metres. Mapping may also identify areas affected by the probable maximum flood.

Sea level rise will increase flood levels and the areal extent of floodwaters over coastal floodplains. This effect usually diminishes with distance upstream from the coast and results in changes in the extent of flood planning areas, as illustrated in Figure 4.1. These changes cover the area between the current flood planning area, derived from a flood assessment excluding consideration of sea level rise, and the projected flood planning area for the relevant planning horizon.

Modelling of the projected flood planning area should be undertaken using the 2050 and 2100 sea level rise planning benchmarks and should be based upon the predicted extent of the 1% AEP flood level, incorporating the relevant sea level rise planning benchmark plus an appropriate freeboard (as used in the derivation of the flood planning level, such as 0.5 metres).



Figure 4.1. Flood levels, flood planning areas and the influence of the sea level rise benchmarks (cross-section view).

The typical 0.5 metre freeboard outlined in the *NSW Floodplain Development Manual* (NSW Government 2005) for general residential development provides a factor of safety to ensure that the risk exposure selected is accommodated. This freeboard includes a component related to climate change impacts on flood levels in coastal and non-coastal areas and a wide variation in sensitivity of estimated flood levels to flood flow. The freeboard provides a relatively small allowance to accommodate some of the projected increases in rainfall intensity from flood-producing storm events associated with climate change, which have

currently not been accurately quantified. The manual's small allowance for climate change in the 0.5 metre freeboard figure should be considered to address only some of the uncertainty associated with estimating climate change impacts. Freeboard should not be used to allow for sea level rise impacts, instead these should be quantified and applied separately as shown in Figure 4.1.

The estimation of flood planning areas will usually involve extension of an existing floodplain risk management study and plan for a tidal waterway. This involves changing model parameters in consideration of the sea level rise planning benchmarks. These include increasing the ocean boundary conditions, whether static or dynamic and increasing initial water levels in tidal reaches by the sea level rise planning benchmark.

Specific local requirements may apply to these flood studies, including:

- key parameters to be used in the study (such as downstream boundary conditions and initial water levels) that may be influenced by sea level rise
- the use of appropriate flood models used in previous studies
- the availability of improved land surface elevation data, such as detailed ground or aerial laser survey
- the availability of new flood information
- allowances for the potential impact of climate change on flood producing rainfall events or antecedent catchment conditions.

Flood levels in tidal waterways are influenced by a combination of catchment and coastal flooding which can result from the same storm cell. The degree of influence of coastal flooding varies significantly with the type of ocean-waterway interface, the distance from the ocean boundary, the catchment, the floodplain and the location (Figures 4.3 and 4.4).

Therefore, flood studies need to account for the coincidence of catchment and coastal flooding and

their varying influence with location in the tidal waterway in deriving flood

levels and associated flood planning levels. This requires appropriate assumptions on downstream boundary conditions and initial water levels and examination of a number of combined catchment and coastal flooding scenarios. The Appendix to this guide provides advice on this assessment for a variety of classes of entrances and conditions. It is likely to be updated once the current update of *Australian Rainfall and Runoff* (Engineers Australia 1999) is completed.

Where flood modelling has been undertaken, it can be updated to include the sea level rise planning benchmarks or a conservative assumption can be made about sea level rise impacts. Where the site is below 4 metres AHD, an appropriate conservative assumption to estimate the 1% AEP flood level considering sea level rise is to add the sea level rise planning benchmarks to the 1% AEP flood level relevant to the site. Site-specific modelling should be undertaken to refine this approach where warranted, for example, where additional development controls would be applied as a result, and/or where the area was to be shown in a local environmental plan.



Figure 4.2. Flooding in Coffs Harbour (2009).

In such cases, the additional extent of flooding, beyond the current flood planning area, can then be determined based on the flood level (derived by incorporation of the sea level rise planning benchmarks) and freeboard.

In addition to the 1% AEP flood, the probable maximum flood should be modelled, including the effects of sea level rise, for emergency response planning purposes, and consideration in strategic planning for critical infrastructure, such as emergency care hospitals, and vulnerable developments, such as residential aged care facilities.



Figure 4.3. Flooding from the Richmond River at Coraki (January 2008).

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6 Glossary

The majority of terms in the document are defined in the NSW Government's Floodplain Development Manual. Additional relevant terms are defined as indicated below.

ocean boundary conditions	The ocean water level(s) used as the downstream boundary level for hydraulic modelling for a flood study.
tidal waterways	The lower portions of coastal rivers, creeks, lakes, harbours, and ICOLLs affected by tidal fluctuations.

7 Appendix – Modelling the interaction of catchment and coastal flooding for different classes of tidal waterway

7.1 Introduction

Flooding in tidal waterways may occur due to a combination of ocean and catchment flooding derived from the same storm cell. The influence of flooding from these two sources on overall flood risk in these waterways varies significantly with location, distance from the ocean and with the level of ocean influence affected by the ocean entrance conditions.

This appendix provides interim advice on undertaking flood risk assessments in tidal waterways considering the coincidence of catchment and coastal flooding for the varied classes of waterways and likely ocean boundary conditions. This advice will be reviewed when *Australian Rainfall and Runoff* (Engineers Australia 1999) is updated to provide advice on the coincidence of catchment and ocean flooding or when other improved information is available.

The sophistication of approach in selecting downstream water-level boundary conditions and the entrance morphology modelling approach should be consistent with the exposure of the community to flood risk. This appendix provides advice on a range of approaches of different levels of sophistication, with more simplistic approaches incorporating a degree of conservatism in lieu of a more detailed and costly site-specific analysis. The appendix is structured on a series of decision points relating to entrance classification (section 7.2), entrance modelling approaches and assumptions (sections 7.3 and 7.4) and key information (sections 7.5–7.7) to be determined to allow for the assessment outlined in this guideline.

7.2 Entrance classifications for catchment and coastal flood coincidence

The influence of the ocean on flooding as well as the required modelling approach varies depending on entrance type for the tidal waterway, which can be classified as follows:

- Class 1** – catchments that drain to a coastal lake (e.g. Lake Illawarra, Tuggerah Lakes)
- Class 2** – catchments that drain directly to the ocean via trained or otherwise stable entrances (e.g. Port Jackson, Hunter River estuary)
- Class 3** – catchments that drain directly to the ocean via shoaled entrances (e.g. Manning River, Shoalhaven River)
- Class 4** – catchments with normally closed or partially blocked entrances (e.g. Lake Cathie).

For each entrance type, assessing the risk of flooding and determining flood planning areas requires a decision on the appropriate modelling approach for the ocean boundary conditions, including entrance configuration (section 7.3) and the selection of an appropriate ocean entrance boundary water-level condition (section 7.4).

Table 7.1 provides guidance for the determination of:

- the extent of existing tidal inundation (section 7.5)
- modelled envelope scenarios to determine flood planning levels and areas and flood hazard (section 7.6)
- the influence of sea level rise in tidal inundation extent and flood planning areas (section 7.7).

Table 7.1. Summary of typical ocean boundary conditions and modelling issues.

Class of entrance	Modelling approaches (section 7.3)	Considering entrance morphology (section 7.3)	Elevated water levels at the ocean boundary (section 7.4)	Modelling scenarios to determine a flood envelope (section 7.6)	Influence of sea level rise planning benchmarks (section 7.7)
Class 1 Coastal lakes	Use of steady and unsteady models may be suitable. Considerations other than entrance conditions will determine form of modelling.	Should be considered part of lake flood study. If the lake is modelled as part of this study refer to classes 2–4.	May be obtained from lake flood studies, otherwise the lake should be modelled as part of this study. In the latter case, refer to classes 2–4.	Determine peak flood levels using the 1% AEP catchment flood with adopted downstream boundary condition.	Should be assessed as changed ocean water level boundary and initial water level conditions as part of flood study for lake.
Class 2 Trained or deep stable entrances	Use of steady and unsteady models may be suitable. Considerations other than entrance conditions will determine form of modelling.	Not applicable.	Use Figure 7.1 (particularly conservative for these entrances) or undertake site-specific analysis.	Develop an upper envelope of effects from scenarios.	Should be assessed as changed ocean water level boundary conditions and initial water level in the waterway.
Class 3 Shoaled entrances	Use unsteady models.	See section 7.3.	Use Figure 7.1 or undertake site-specific analysis.	Develop an upper envelope of effects from scenarios.	Should be considered as changed shoaled, initial water level and changed ocean water level boundary conditions for the waterway.
Class 4 Closed entrances	Use unsteady models.	See section 7.3.	Use Figure 7.1 or undertake site-specific analysis.	Develop an upper envelope of effects from scenarios.	Should be considered as changed entrance conditions and initial water level conditions for the waterway.

7.3 Entrance morphology

Modelling of ocean-related boundary conditions needs to take into account entrance boundary geometry, and, in the case of entrance shoaling and scouring, dynamics and physical limits. Modelling would usually be conducted using one of the following approaches.

- A simple approach based upon a steady- or fixed-entrance condition. The entrance condition adopted needs to be conservative and account for potential variations. For unmanaged entrances, peak shoaled and scoured states need to be determined. This involves consideration of the current entrance geometry (confirmed by survey) and historic entrance configurations based upon the interpretation of historical aerial photos and other relevant information.

For managed entrances, the trigger level for management intervention under the entrance management policy will govern catchment flood levels. The policy's trigger level should have regard to prevailing entrance conditions (that is, degree of choking/shoaling). Modelling of the post-intervention geometry (that is, fully scoured opening) should also be carried out to estimate maximum flow velocities.

- A more sophisticated unsteady or dynamic modelling approach. The initial entrance geometry conditions would be based upon the steady state approach above. An understanding of the entrance dynamics and physical limits can be derived from:
 - A particular historical event, this may require alteration to the entrance configuration within realistic limits to match available calibration data
 - Peak shoaled and peak scoured states over time, peak shoaled condition will govern catchment flood levels whereas peak scoured condition will govern discharge velocities and the ingress of coastal flows
 - The limits of the potential dynamics, these include limits to vertical and lateral scour, including any headlands, rock shelves or reefs known to exist in the locality. This is essential to appropriate modelling of the area rather than the use of arbitrary limits.
 For ICOLLs, a more sophisticated approach to breakout involves detailed modelling via a built-in dynamic scour model or by interfacing with a breach model to examine scouring. The dynamics of the situation may be complex; i.e. different conditions may dominate flooding at different times during an event and different starting conditions can govern peak flood levels and catchment flow velocities. Therefore, a number of runs may be required to develop upper boundary curves for flood levels and flow velocities.

7.4 Selection of appropriate ocean water level boundary approach

Elevated water levels at the ocean boundary can vary significantly with the class of entrance and the specifics of the location and can be costly to derive. The tiered approach to the selection of a downstream ocean water level boundary condition outlined below weighs up the degree of investigation required against the potential implications.

The first two approaches comprise components related to elevated ocean water levels, tidal anomalies and wave setup and can be considered conservative in some situations, particularly where these factors are reduced or negated by entrance conditions. The degree of conservatism is in lieu of a more sophisticated and costly site-specific analysis. The three levels of the tiered approach, in order of increasing sophistication are as follows.

- A conservative assumption for the elevated water level at the ocean boundary for a catchment that drains directly to the ocean (that is, does not drain into an ICOLL or tidal waterway). This involves adopting a 1% AEP ocean level of 2.6 metres AHD.
- Using the default dynamic open-ocean water level boundary condition (Figure 7.1) in modelling. In addition, if the timeframe for flooding at the location exceeds 36 hours, the ocean boundary condition provided in Figure 7.1 needs to be extended (see Figure 7.1 note) or a detailed site-specific analysis should be undertaken.
- A detailed site-specific analysis of elevated water levels at the ocean boundary at the entrance. This analysis should include all contributions to the ocean water level at the specific entrance, for example, tides, storm surge, shelf waves, wave setup and steric effects. Further, the analysis should be done in a manner which appropriately examines the probabilities of ocean conditions at the entrance, their potential variation (in terms of absolute ocean height as well as duration of the event where relevant) and their potential coincidence with catchment flooding. This provides information that is more directly relevant to a particular entrance. It also gives a further degree of sophistication and a potentially lower, less conservative answer.

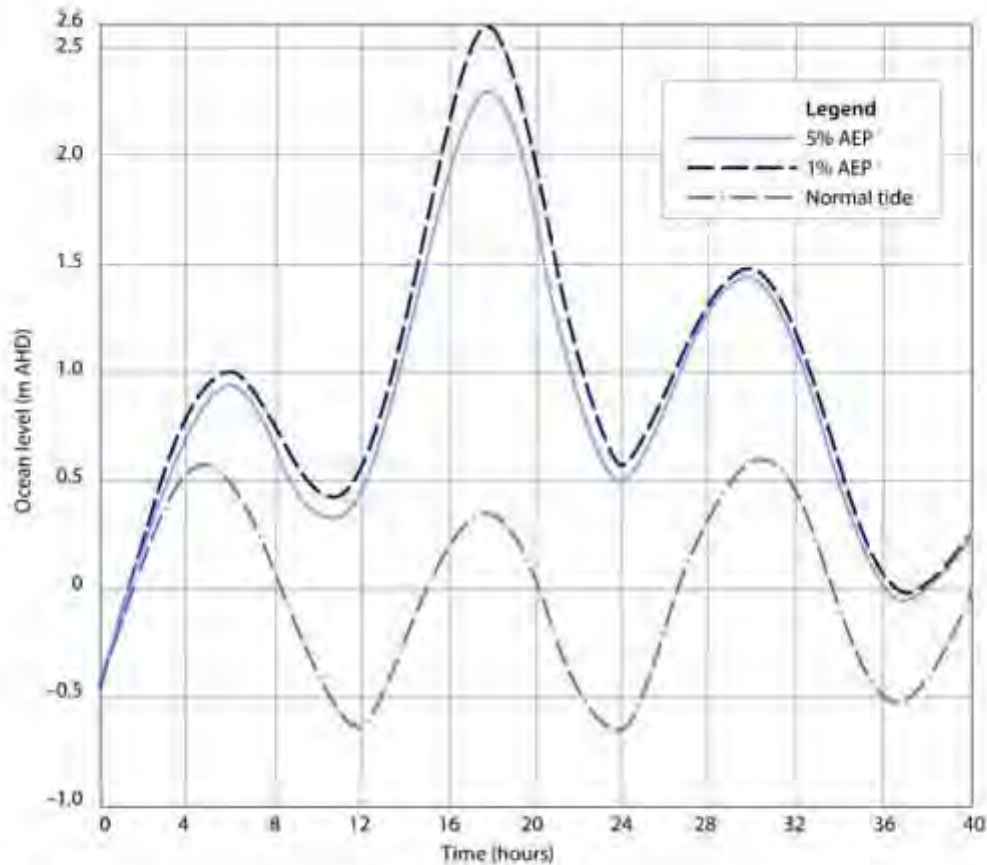


Figure 7.1. Default open-ocean elevated water level boundary condition.

Note: Where the length of flooding at a location exceeds 36 hours, a longer duration anomaly needs to be included. The duration of Figure 7.1 can be extended by 48 hours either side by adding an assumed anomaly of 0.4 metres on top of the normal tide cycle for the 1% and 5% AEP events for this assessment.

7.5 Extent of existing tidal inundation

Current tidal limits and extents resulting from normal ocean processes provide an understanding of current tidal penetration into tidal waterways. Normal ocean processes can be based upon different records for the different entrance morphologies as follows.

- open entrances – annual exceedance from local tide records
- unmanaged closed entrances – the berm height determined from historical records
- managed closed entrances – the trigger level for management intervention under the entrance management policy will govern catchment flood levels.

7.6 Envelope scenarios for determining flood planning levels and areas

Determining flood planning areas in tidal waterways requires consideration of the interaction of catchment and coastal flooding and requires the selection of peak flood levels and flow velocities from an envelope of scenarios such as:

- estimated 1% AEP ocean flooding with 5% AEP catchment flooding with coincident peaks
- estimated 5% AEP ocean flooding with 1% AEP catchment flooding with coincident peaks
- neap tide cycle with 1% AEP catchment flooding with coincident peaks.

These scenarios assume that initial water levels within a tidal waterway are based upon the peak tidal water level in the waterway (section 7.5) or the height of any controlling entrance outlet. They provide an envelope of peak levels and velocities that can be used to estimate the 1% AEP flood effects in the tidal waterway.

7.7 Influence of sea level rise on tidal extents and flood planning levels and areas

Any rise in sea level will result in a direct change to tidal levels and directly impact upon:

- ocean water level boundary conditions
- ocean entrance configurations including geomorphology
- initial water level conditions in the tidal waterway.

This will result in increased extents of tidal inundation and changes to flood levels in tidal waterways.

To assess the impacts of sea level rise, the benchmarks outlined in the *NSW Government Sea Level Rise Policy Statement* (NSW Government 2009) need to be added directly to:

- the ocean water level boundary conditions
- the starting conditions and dynamics for entrance configurations
- initial water level conditions in the tidal waterway.

The extent of tidal inundation (section 7.5) as well as flood planning levels and areas determined using the envelope approach (section 7.6) need to be determined for 2050 and 2100 considering sea level rise planning benchmarks.

7.8 Conclusion

The above guidance is intended to provide a structured approach to ensure adequate consideration of the interaction between catchment and coastal flooding for different classes of tidal waterways. The decision points in each section should be followed sequentially. This will ensure that, where a conservative approach is required and site-specific modelling is limited, an assumption can be made on a uniform basis. Conversely, where information is available to undertake a more sophisticated modelling approach, guidance is provided on consideration of site-specific characteristics. The most appropriate conditions for determining the interactions between catchment and coastal flooding should be based on expert knowledge and acknowledging that the class of waterway fundamentally affects the type of interactions expected.



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Coastal Risk Management Guide

Incorporating sea level rise benchmarks in coastal risk assessments

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Abbreviations

AHD	Australian Height Datum
ARI	Average recurrence interval
CSIRO	Commonwealth Scientific Industrial Research Organisation
DECC	Department of Environment, Climate Change NSW
DECCW	Department of Environment, Climate Change and Water NSW
ICOLL	intermittently closed and open lakes and lagoon
IPCC	Intergovernmental Panel on Climate Change

1 Introduction

The NSW Government has adopted a Sea Level Rise Policy Statement (NSW Government 2009) to support consistent adaptation to projected sea level rise impacts. The Policy Statement includes sea level rise planning benchmarks for use in assessing the potential impacts of projected sea level rise in coastal areas, including flood risk and coastal hazard assessments, development assessment, coastal infrastructure design processes and land-use planning exercises.

These benchmarks are a projected rise in sea level (relative to the 1990 mean sea level) of 0.4 metres by 2050 and 0.9 metres by 2100 (Department of Environment, Climate Change and Water (DECCW) 2009). The projections were derived from sea level rise projections by the Intergovernmental Panel on Climate Change (IPCC 2007) and the CSIRO (McInnes et al 2007). These benchmarks will be periodically reviewed.

The Coastal Risk Management Guide has been prepared to assist local councils, the development industry and consultants incorporate the sea level rise benchmarks in coastal hazard assessments. This includes coastal hazard assessments carried out as part of a coastal hazard definition study during a coastal zone management planning process or for assessing coastal hazard constraints for proposed coastal developments. The information in this guide updates the sea level rise information in the *NSW Coastline Management Manual* (NSW Government 1990).

The *NSW Coastal Planning Guideline – Adapting to Sea Level Rise* (Department of Planning 2010) provides detail about the consideration of this information in land-use planning and development assessment.

2 The impact of sea level rise in coastal areas

Of all the impacts from climate change, the projected rise in mean sea level is one of the most significant concerns for integrated coastal zone management. In addition to higher projected storm surge and oceanic inundation levels, a rise in the mean sea level will also result in landward recession of unconsolidated (sandy) shorelines (Figure 2.1).



Figure 2.1. Erosion at Belongil Spit, Byron Bay (2 June 2009).

Depending on the rate and scale of sea level rise, the environmental, social and economic consequences, in particular within low-lying intertidal areas, are expected to be significant. In addition to open coast recession and higher inundation levels, saltwater intrusion and landward advance of tidal limits within estuaries will have significant implications for freshwater and saltwater ecosystems and development margins, particularly building structures and foundation systems within close proximity to the shoreline. Existing coastal gravity drainage, stormwater infrastructure and sewerage systems may become compromised over time as the mean

sea level rises. Sea level rise will also influence entrance opening regimes for intermittently closed and open lakes and lagoons (ICOLLS). The level of protection provided by existing seawalls and other hard engineering structures will decrease over time due to the increasing threat from larger storm surges and inundation at higher projected water levels.

This guide has been developed in recognition that adaptation to sea level rise will require careful planning and management now and into the future to minimise social, environmental and economic impacts.

3 Coastal hazard assessment

The *Coastline Management Manual* (NSW Government 1990) identifies a range of coastal hazards, two of which will be directly exacerbated by sea level rise – shoreline recession and coastal inundation (Figure 3.1).

Coastal hazard studies or assessments commonly identify hazard limits or hazard areas, which define the estimated extent of land projected to be impacted upon by coastal processes and hazards over defined planning periods. These studies can be used to define coastal hazard areas which are used in land-use planning and development assessment. The immediate hazard area represents the landward extent of beachfront land that could be at direct threat from beach erosion resulting from a



Figure 3.1. Erosion at Old Bar, Taree (7 July 2008).

single extreme event or from several very severe beach erosion events in close succession with cumulative impacts, commonly referred to as 'storm bite'. In addition to storm bite, an adjoining zone of reduced foundation capacity will exist landward of an erosion escarpment in sandy dunal systems, as described by Nielsen *et al* 1992 (see Figure 3.2).

It is also important to estimate the extent of land that could be impacted upon by coastal processes and hazards (including sea level rise) over longer-term planning horizons (such as 2050 and 2100). These areas encompass the immediate hazard area whilst incorporating allowances for underlying long-term recession of the shoreline that could result from long-term sediment imbalance within the active beach system or from measured and projected sea level rise.

In addition to underlying recessionary trends, sea level rise will increase the predicted recession over the adopted planning period (see section 4.3), resulting in a landward movement of coastal hazard areas over time (see Figure 3.3).

Previous coastal hazard studies have commonly determined 2050 and 2100 coastal hazard lines or areas incorporating projected sea level rise (see Figure 3.3). Where these studies have considered sea level rise allowances other than the planning benchmark figures advised in the *NSW Sea Level Rise Policy Statement* (2009), the hazard lines should be recalculated through a revised hazard definition study to reflect the benchmark allowances.

Coastal inundation assessments should also incorporate increased still water levels resulting from sea level rise projections (see section 4.2). In most instances, dunal systems along the

open coastline are sufficiently elevated that episodic threat from oceanic inundation due to wave runup and overtopping of coastal dunes or barriers is negligible. Notwithstanding, the threat of oceanic inundation along the open coast in the vicinity of low-crested dunal barriers (less than 5 metres Australian Height Datum (AHD)) should also be considered where this is relevant. Around lower lying estuarine foreshores, the threat from tidal inundation will be significantly exacerbated with a projected rise in mean sea level. The interaction between this issue and catchment flooding is particularly important for coastal councils and has been considered in the companion document *Flood Risk Management Guide – Incorporating sea level rise benchmarks in flood risk assessments* (DECCW, 2010)



Figure 3.2. Idealised schematic of a dune profile depicting the immediate hazard area and associated zone of reduced foundation capacity (after Nielsen et al 1992).



Figure 3.3. Idealised schematic of a dune profile depicting the high hazard area, 2050 coastal hazard area and 2100 coastal hazard area.

4 Application of sea level rise planning benchmarks

4.1 Sea level rise benchmarks

Increasing mean sea level over time will have two primary impacts within and adjacent to tidal waterways:

- increasing still water levels over time and
- subsequent recession of unconsolidated shorelines.

In circumstances where it is necessary to consider physical coastal processes and/or the influence of tidal waters, it is recommended that the additional impact of projected sea level rise up to the planning benchmarks be considered. This will enable sea level rise to be appropriately considered in planning decisions, hazard mitigation strategies and infrastructure design.

For land-use planning purposes, 2050 and 2100 sea level rise benchmarks should be used. For other purposes (e.g. infrastructure design), linear interpolation between the 1990 base sea level and the 2050 and 2100 sea level rise benchmarks can be used to estimate projected sea level rise for coastal planning horizons or asset life other than those corresponding to the benchmark years.



Figure 4.1. Erosion at North Entrance, Wyong Shire (12 June 2009).

For consideration of sea level rise beyond 2100, an additional 0.1 metres per decade allowance can be used above the 2100 benchmark level. This approach assumes a linear rise beyond 2100 at rates equivalent to that projected for the last decade of the twenty-first century (2090–2100). These sea level rise projections will need to be discounted to accommodate the sea level rise measured between 1990 and present. This can be assumed to be approximately 3 millimetres/year from 1990 (CSIRO, 2009).

For practical implementation, sea level rise benchmarks, which are generally referenced to 1990 mean sea levels, can be broadly related to the AHD. Analysis of hourly water levels at Fort Denison (Sydney Harbour) over the period from January 1989 to December 1990 indicates a mean sea level over this period of approximately 0.06 metres AHD.

4.2 Design still-water levels

Table 4.1 provides an estimate of design ocean still-water levels at Fort Denison for varying average recurrence interval (ARI) events in 2050 and 2100 that incorporate provision for sea level rise. It is recommended that these levels be used in the Newcastle–Sydney–Wollongong area for the design of maritime structures, determining oceanic inundation/wave runup levels and for oceanic and hydrodynamic modelling processes where full oceanic tidal conditions are expected. In other locations (e.g. NSW North and South coasts), analysis of local tidal records will be needed to develop this information.

Where tidal conditions less than the oceanic range prevail (e.g. inside constrained estuarine environments), Table 4.1 does not apply and locally derived design still water levels would be determined on a site-specific basis, taking into consideration the sea level rise benchmarks for oceanic conditions.

Table 4.1. Design ocean still water levels at Fort Denison for 2010 and predicted levels for 2050 and 2100 incorporating projected sea level rise.

Average Recurrence Interval (years)	2010 design still water levels ⁽¹⁾ (metres AHD)	2050 design still water levels ⁽²⁾ (metres AHD)	2100 design still water levels ⁽²⁾ (metres AHD)
0.02	0.97	1.31	1.81
0.05	1.05	1.39	1.89
0.1	1.00	1.44	1.94
1	1.24	1.58	2.08
10	1.35	1.69	2.19
50	1.41	1.75	2.25
100	1.44	1.78	2.28

Notes: The design still water levels are only relevant where full ocean tide conditions prevail. (1.) Design still water levels for 2010 were derived from extreme value analysis of Fort Denison tide gauge data from June 1914 to December 2009 (after Watson and Lord, 2008). There are negligible tidal friction losses between the ocean and Fort Denison within Sydney Harbour; therefore, Fort Denison data provides an indicative representation of oceanic still-water levels. The design still-water levels inherently incorporate allowance for all components of elevated ocean water levels experienced over this timeframe (including tides, meteorological influences and other water level anomalies); however, they exclude wave setup and wave runup influences. (2.) Design still-water levels for 2050 and 2100 incorporate planning benchmark allowances for sea level rise with a reduction of 60 millimetres to accommodate the estimated amount of global average sea level rise that has occurred between 1990 and present. From satellite altimetry, this is estimated to be 3 millimetres/year (CSIRO, 2009). These design levels are indicative and provided for guidance only.

4.3 Recession of unconsolidated shorelines

It is widely acknowledged that the projected sea level rise will result in recession of unconsolidated (sandy) shorelines (Figures 4.1 and 4.2). The simple two-dimensional model, known as the '*Bruun Rule*' (Bruun 1962, 1988), can be used as a coarse first-order approximation for determining sea level rise induced recession for planning purposes along the open coast. Using the *Bruun Rule*, recession due to sea level rise can be estimated simply as the product of the sea level rise (over the planning timeframe of interest) multiplied by the inverse of the active profile slope (see 'X' in Figure 4.3).



Figure 4.2. Coastal erosion at Collaroy/Narabeen beach (June 2007).

It should, however, be clearly understood that there are limitations with the *Bruun Rule* for use throughout the coastal zone in determining foreshore recession due to sea level rise (Ranasinghe et al 2007). Improved three-dimensional modelling methodologies for estimating the shoreline response to sea

level rise are currently being developed to incorporate a broader suite of natural processes and physical attributes on a site-specific basis (see Patterson 2009 and Huxley 2009). These shoreline evolution modelling tools have the additional advantage of being able to consider the sensitivity of shorelines to other less certain climate change projections, such as changes to predominant wave directions.

When using the '*Bruun Rule*', use of the lower limit of profile closure (seaward limit of the Shoal Zone) as prescribed by Hallermeier (1981) is recommended in the absence of readily available information on active profile slopes at a location under consideration. It has been common practice along the NSW coastline to generically adopt active profile slopes in the range of 1:50 to 1:100; however, because of the intraregional variability in slope that exists across the offshore NSW shelf, more rigorous site-specific analysis is recommended to justify the use of a selected active profile slope for use in a '*Bruun Rule*' assessment. For planning purposes on estuarine foreshores, in the absence of better information, it is recommended that estimations of recession due to sea level rise use the same '*Bruun Rule*' approach with relevant average foreshore slopes inferred or estimated from survey information.

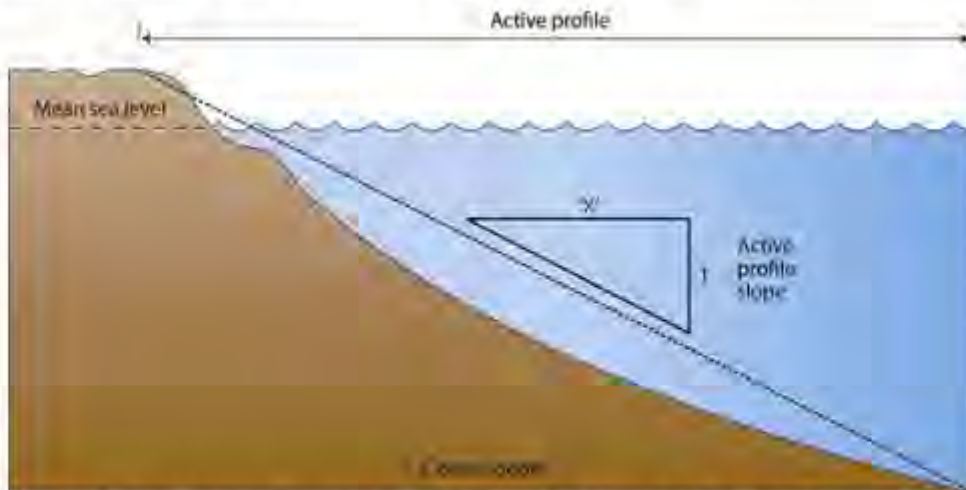


Figure 4.3. This diagram represents an idealised schematic of the active profile for consideration in '*Bruun Rule*' applications.

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6 Glossary

active profile slope	The average slope of the portion of a beach system (including the underwater section) which extends seaward to a point beyond which active sediment movement is largely immeasurable.
Australian Height Datum	A common national surface-level datum approximately corresponding to mean sea level.
oceanic inundation	A natural process whereby elevated ocean water levels combined with wave runup along beaches result in seawater overtopping frontal dune systems and coastal barriers during storm events. This process is generally rare and episodic, occurring principally around the peak of a high tide, creating a hazard mainly where frontal dunes or coastal barriers along the NSW coastline are crested below about 5 metres AHD.
shoreline recession	A net long-term landward movement of the shoreline caused by a net loss in the sediment budget.
storm surge	An increase in coastal water level caused by the effects of storms. Storm surge consists of two components: an increase in water level caused by a reduction in barometric pressure (barometric setup) and an increase in water level caused by the action of wind blowing over the sea surface (wind setup).
still water levels	Average water-surface elevation at any instant, excluding local variation due to waves and wave set-up, but including the effects of tides and storm surges.
tidal inundation	The submergence of land by seawater due mainly to the action of very high tides. This process is predominantly a hazard for low-lying estuarine foreshores and is exacerbated by coincidence of elevated ocean water levels during storms and catchment flooding.
wave runup	The vertical distance above mean water level reached by the uprush of water from waves across a beach or up a structure.
wave setup	The increase in water level within the surf zone above mean still water level caused by the breaking action of waves.
zone of reduced foundation capacity	Zone located adjacent to and landward of an erosion escarpment in unconsolidated dunal systems where load bearing capacity is reduced (see Nielsen <i>et al</i> , 1992).

1. FLOOD RISK MANAGEMENT IN NSW

1.1 Flood Prone Land Policy

The primary objective of the New South Wales Flood Prone Land Policy, as outlined below, recognises the following two important facts:

- flood prone land is a valuable resource that should not be sterilised by unnecessarily precluding its development; and
- if all development applications and proposals for rezoning of flood prone land are assessed according to rigid and prescriptive criteria, some appropriate proposals may be unreasonably disallowed or restricted, and equally, quite inappropriate proposals may be approved.

1.1.1 The Policy Statement

The primary objective of the policy is to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, utilising ecologically positive methods wherever possible. That is:

- a merit approach shall be adopted for all development decisions in the floodplain to take into account social, economic and ecological factors, as well as flooding considerations;
- both mainstream and overland flooding shall be addressed, using the merit approach, in preparation and implementation by councils of strategically generated floodplain risk management plans;
- the impact of flooding and flood liability on existing developed areas identified in floodplain risk management plans shall be reduced by flood mitigation works and measures, including on-going emergency management measures, the raising of houses where appropriate and by development controls; and
- the potential for flood losses in all areas proposed for development or redevelopment shall be contained by the application of ecologically sensitive planning and development controls.

To achieve its primary objective, the policy provides for:

- financial assistance by the NSW Government for works to reduce potential flood damage and personal danger in existing developed areas;
- technical support from the State Government to local councils in ensuring that the management of flood prone land is consistent with flood risk and that such development does not cause undue future distress to individuals nor unduly increase potential flood liability to them or the community;
- emergency management and flood recovery programs and their linkage with the floodplain risk management process; and
- the protection of councils, government agencies, and their staff against claims for damages resulting from their issuing advice or granting approvals on floodplains, providing such action was taken in accordance with the principles and guidelines in this manual.

The policy shall be implemented in the following manner:

- The management of flood prone land is, primarily, the responsibility of councils. In addition, the Department of Infrastructure Planning and Natural Resources (DIPNR) has a lead role in the development of regional strategies and plans under the Environmental Planning and Assessment Act (EP&A Act). Therefore, councils need to be cognisant of regional strategies and plans, when determining standards and implementation arrangements for flood prone land in their service areas.
- The NSW Government, through DIPNR and the State Emergency Service (SES), shall provide specialist technical assistance on all flooding and land use planning matters. This manual is provided to assist councils in the preparation of floodplain risk management plans.

- The establishment of local floodplain risk management committees by councils, through which local community groups and individuals can effectively communicate their aspirations concerning the management of the flooding problem.
- The State Government continuing to subsidise flood risk management studies, works and measures.

1.1.2 Policy Provisions

The policy provides for:

- a flexible merit based approach to be followed by councils, when dealing with development or redevelopment of flood prone land;
- high government priority for flood risk mitigation programs;
- a merit based approach to selection of appropriate flood planning levels (FPLs). This recognises the need to consider the full range of flood sizes, up to and including the probable maximum flood (PMF) and the corresponding risks associated with each flood, whilst noting that with few exceptions, it is neither feasible nor socially or economically justifiable to adopt the PMF as the basis for FPLs. FPLs for typical residential development would generally be based around the 1% AEP flood event plus an appropriate freeboard (typically 0.5m);
- councils to be responsible for the determination of appropriate planning and development controls, including FPLs, to manage future flood risk to an acceptable level based on social, economic, and ecological, as well as flooding considerations. These controls should be cognisant of the relevant regional planning and any associated controls;
- an emphasis on the importance of developing and implementing floodplain risk management plans based on an integrated mix of management measures that address existing, future and continuing risk;
- the provision of NSW government technical and financial support to councils in relation to flooding matters;

- floodway definition to be based on hydraulic, hazard and potential damage considerations related to the effect of loss of flow conveyance on flood conditions, with provision for restricted development depending on circumstances;
- explicit recognition that flood risk management needs to take into account the principles of ecologically sustainable development (ESD) through consideration of relevant government policies and legislation allowing for the sustainable use of the floodplain as a natural resource. Planning and assessment requirements laid down in these policies and legislation must be complied with by all agencies associated with the use, development and management of the floodplain;
- recognition of the need to consider ways of maintaining and enhancing riverine and floodplain ecology in the development of floodplain risk management plans;
- recognition of the importance of the continuing flood risk addressed in the State Emergency Service Act 1989 and State Flood Plan, and the close relationship between the emergency management and floodplain risk management processes;
- recognition of the potential implications of climate change on flooding behaviour;
- detailed implementation arrangements as outlined in this manual;
- protection of councils and other public authorities and their staff against claims for damages, providing they act in accordance with the government's policy at the time; and
- relief from land tax, council rates and water and sewerage rates where vacant land cannot be developed because of its flood prone nature.

1.1.3 Enquiries

Enquiries should be directed as follows:

- general enquiries on the policy, its currency, and implementation to DIPNR;
- enquiries on flood liability of individual properties and proposals for development should be directed to the relevant council; and

- enquiries on flood warning, evacuation and community education matters should be directed to the SES.

1.2 Purpose of the Manual

The manual supports the NSW Government's Flood Prone Land Policy in providing for the development of sustainable strategies for managing human occupation and use of the floodplain considering the risk management principles outlined in Appendix B. These are based upon a hierarchy of avoidance, minimisation (using planning controls) and mitigation works.

This manual provides councils with a framework for implementing the policy to achieve its primary objective. It considers the costs and benefits of floodplain occupation in full recognition that associated management decisions need to consider broader issues in an integrated approach.

This manual updates the 2001 Floodplain Management Manual to reflect the significant change in the roles of State Agencies and to clarify some planning issues which have led to inconsistent interpretations. It replaces the 1986 Floodplain Development Manual as the Government's manual relating to the management of flood liable land in accordance with Section 733 of the Local Government Act 1993. This provides councils and statutory authorities, and their staff, with indemnity for decisions made and information provided in good faith from the outcomes of the management process.

The manual also presents general principles and a process for floodplain risk management to enable councils and their floodplain risk management committees to understand flood behaviour and impacts. It provides for evaluation of strategies and formulation of plans that achieve effective floodplain risk management outcomes accounting for social, economic, ecological and cultural factors, together with community aspirations for the use of flood prone land. This provides for sustainable use and development of the floodplain in a wise and rational manner on a flexible merit basis.

1.3 Who is the Manual for?

The Manual is written principally for local government, including councillors, senior

managers, engineers, planners, environment officers, development assessors, reserve managers and others. However, the manual will also be of interest to other organisations and individuals involved in floodplain risk management such as government agencies, landholders, community groups and consultants.

1.4 Where does the Manual Apply?

The manual applies to floodplains across NSW, in both urban and rural areas. It is also used to manage major drainage issues in local overland flooding areas. As the 1986 manual was directed principally to mainstream flooding in urban areas Appendix C provides more details on the application of the manual to rural and local overland flooding.

1.5 How to Use the Manual

The manual is to be read and interpreted in a global sense with reference to the overall objectives of the policy, with particular reference to the primary objective.

The manual and policy are targeted at a strategic management level. To ensure that the underlying philosophies are applied in each case, without exception, individual portions or sections of the manual should not be interpreted outside:

- the overall philosophy of the manual and its application of strategic management; and
- the policy, as outlined in Section 1.1.

In the case of any inconsistency the main body of the manual takes precedence over the appendices.

The manual is broken down into sections as follows:

- Section 1 outlines the policy, the role of the manual in policy interpretation, and the principles and objectives of floodplain risk management;
- Section 2 describes the floodplain risk management process;
- Section 3 deals with the roles and responsibilities of participants in floodplain risk management; and
- Section 4 provides a glossary of terms used.

Appendices support the text in implementing the management process. Key appendices include:

- Appendix A discusses the history of policy development, improvements on previous manuals, and the cost of flooding in NSW;
- Appendix B provides a background on risk management;
- Appendix C outlines the floodplain risk management process, as shown in Figure 2.1, and references other relevant appendices;
- Appendix D discusses the need for, and role and make up of management committees;
- Appendix E outlines the necessary data and its collection;
- Appendix F outlines flood study preparation;
- Appendix G discusses issues addressed in, and preparation of, a floodplain risk management study;
- Appendix H discusses preparation and formalisation of a floodplain risk management plan;
- Appendix I discusses management plan implementation;
- Appendix J discusses floodplain risk management options;
- Appendix K discusses derivation of flood planning levels;
- Appendix L outlines hazard and hydraulic categorisation;
- Appendix M discussed flood damages; and
- Appendix N discusses emergency response planning for floods



PLATE 1 - South Murwillumbah, 1954



1.6 Effective Floodplain Risk Management

Floodplain risk management specifically considers the consequences of flooding as they relate to human occupation of the floodplain. The policy and manual focus on this risk whilst recognising that natural resource management policies and legislation need consideration by all agencies managing floodplain development and use.

The policy and manual use a broad risk management hierarchy of avoidance, minimisation and mitigation, as discussed in Appendix B, to:

- reduce the social and financial costs from the risks associated with occupying the floodplain;
- increase the sustainable benefits of using the floodplain; and
- improve or maintain floodplain ecosystems dependent on flood inundation.

The most effective means of achieving sound flood risk management outcomes is to formulate and implement management plans through the floodplain risk management process, discussed in Section 2.

The process enables decisions to be made on a balanced consideration of economic, social and environmental issues from a flood risk management perspective so as to achieve effective robust outcomes in an informed and consultative manner.

Management plans need to be specific to individual floodplain and specific locations within the floodplain due to variation in flood hazard, exposure and vulnerability.

Balanced management plans must address each of the three types of flood risk, discussed below, in a comprehensive manner and evaluate all factors (including social, economic, ecological and cultural impacts and flood risk) that affect the use of flood prone land. The three types of flood risk are:

- **existing flood risk**, associated with current development on flood prone land. For example, this may be the risk to existing development areas that can be effectively managed by the construction of a levee;

Section 1. Flood Risk Management in NSW

- **future flood risk**, associated with any new development on flood prone land. For example, this may be the risk to future development areas that can be managed by adopting appropriate development limits, and minimum fill levels for lots and minimum floor levels for buildings; and
- **continuing flood risk**, is the risk remaining, in both existing and future development areas, after floodplain risk management measures, such as works and planning controls, are implemented. This is the risk from rarer floods which may result in levee overtopping or flooding of buildings with minimum floor levels. The consequences of these rarer floods may include danger to personal safety and damages to infrastructure, and both public and private property.
- consideration of future development scenarios for a reasonable timeframe (say 20 years). Considering only existing planning or development scenarios cannot generally account for this future growth;
- cumulative assessment of decisions relating to mitigation works and measures, future development and environmental consequences on a long term strategic basis; and
- accounting for future growth in the numbers of occupants in the floodplain. Such growth increases the pressure on response and recovery agencies should an emergency occur.

A balanced management plan therefore requires a range of different management measures. These measures (including both works and planning controls) and their cumulative impacts, need to be considered strategically. This involves:

Incorporating future land use elements of management plans into Environmental Planning Instruments (EPIs) and development control plans and policies will facilitate effective management of the floodplain.

Case-by-case decision making cannot account for the cumulative impacts on flood behaviour and risks, caused by individual developments or works. This form of ad hoc assessment contravenes the principles of the manual.



PLATE 2 - Nyngan, 1990

(Continuing Flood Risk - Floodplain Risk Management Measures Overwhelmed)