



Office of  
Environment  
& Heritage

Your reference: SSD 5916  
Our reference: DOC15/206126-28  
Contact: Steve Lewer, 4927 3158

Ms Kate MacDonald  
Team Leader – Industry Assessments  
Department of Planning and Environment  
GPO Box 39  
SYDNEY NSW 2001

Dear Ms MacDonald

**RE: REVIEW OF THE BAY RESORT ENVIRONMENTAL IMPACT STATEMENT – ANNA BAY**

I refer to your letter received 4 June 2015, requesting comments for the exhibited The Bay Resort Environmental Impact Statement (EIS) located at Anna Bay (SSD 5916). The Office of Environment and Heritage (OEH) understands the EIS was on public exhibition from 9 June 2015 to 7 August 2015.

OEH has undertaken a review of the EIS titled 'The Bay Resort – Environmental Impact Statement (SSD 13-5916), Anna Bay, New South Wales (Volumes 1 and 2)', prepared for Raphael Shin Enterprises Pty Ltd by RPS Australia East Pty Limited (RPS) and dated April 2015. OEH has reviewed the EIS of the proposed development in relation to threatened biodiversity, Aboriginal cultural heritage, and flooding / floodplain issues. OEH understands that the proponent requested to have the project assessed under the NSW Biodiversity Offsets Policy for Major Projects which includes the requirement to comply with the Framework for Biodiversity Assessment (FBA - OEH 2014a). As part of this process the EIS must include a Biodiversity Assessment Report (BAR), which assesses the impacts on threatened biodiversity. OEH has assessed the BAR and is of the opinion the FBA requirements have not been fully met by this project, however, during the current transitional period of implementation of the new policy the consent authority may use its discretion in the application of the policy for this project.

Further details of OEH's assessment are provided in **Attachment A**. Due to the number of matters that remain outstanding with respect biodiversity (in particular the BAR) and flooding / floodplain management, OEH is unable to support the project until these matters are adequately addressed.

If you require any further information regarding this matter please contact Steve Lewer, Regional Biodiversity Conservation Officer, on 4927 3158.

Yours sincerely

7 AUG 2015

**RICHARD BATH**  
**Senior Team Leader Planning, Hunter Central Coast Region**  
**Regional Operations**

Enclosure: Attachment A

## ATTACHMENT A: OEH REVIEW OF THE BAY RESORT ENVIRONMENTAL IMPACT STATEMENT – ANNA BAY - SSD 5916

### THREATENED SPECIES

OEH has undertaken a review of Biodiversity Assessment Report (BAR, Appendix 6 of the EIS), prepared for Raphael Shin Enterprises Pty Ltd by RPS Australia East Pty Limited (RPS) (dated April 2015, in accordance with the Framework for Biodiversity Assessment (FBA) operational manual (OEH 2014a). OEH is of the opinion the FBA requirements have not been fully met by this project. Given the amount of issues that are either outstanding or incorrect, OEH is unable to support to the project until these matters adequately addressed.

OEH provides the following points on why the BAR is either incomplete and/or has been applied incorrectly in reference to the FBA operational manual (OEH 2014a).

#### **Biodiversity Offsets – Ecosystem Credits**

Overall the BAR fails to provide an adequate offset package for the project. Under the FBA, the proponent must provide a Biodiversity Offset Strategy (BOS) as part of the BAR that is commensurate with the development impact, either via the retirement of appropriate biodiversity credits (as determined via the application of the BioBanking Assessment Methodology in accordance with the FBA operational manual [OEH 2014a]) and/or via the application of supplementary measures or credit generation via appropriate rehabilitation. The latter two requiring supporting documentation as to why these would be used.

Based on the BAR and the BOS it appears that the proponent is offering a 'land-based' biodiversity offset site (that will be conserved under an official BioBanking Agreement) as the only mechanism to offset the impacts of the development site. No other measures have been discussed in the BAR, such as generation of credits via rehabilitation and/or supplementary measures. Section 11.0 of the BAR provides a summary of the biodiversity credits that both the development site and proposed offset (BioBanking Agreement) site provide. With respect to 'ecosystem' credits the development site generates 417 credits across two Plant Community Types (PCTs): 'Saltmarsh Estuarine Complex' (361 credits) and 'Swamp Oak – Sea Rush – *Baumea juncea* swamp forest on coastal lowlands of the Central Coast and Lower North Coast' (56 credits), compared with the offset (BioBank) site generating 457 credits across four PCTs: 'Mangrove forest in estuaries of the Sydney Basin Bioregion and South Coast Bioregion' (7 credits), 'Saltmarsh Estuarine Complex' (87 credits), 'Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion' (48 credits) and 'Swamp Oak – Sea Rush – *Baumea juncea* swamp forest on coastal lowlands of the Central Coast and Lower North Coast' (315 credits). Whilst there is a 40 credit (ecosystem) surplus between the offset set and the development site, there is a specific shortfall between tradable PCTs, notably a 274 credit deficiency for 'Saltmarsh Estuarine Complex'.

Under the Subsection 10.5.4.2 of the FBA (Variation of the offset rules for ecosystem credits) the consent authority (OEH), may approve a variation of the offset rules for matching ecosystem credits, by allowing ecosystem credits created for a PCT from the same vegetation formation as the required ecosystem credit to be proposed as part of the BOS, where in the consent authority's opinion the BOS demonstrates that:

- a) all reasonable steps to secure a matching ecosystem credit have been taken by the proponent, and
- b) the required ecosystem credit is not for a PCT associated with a Critically Endangered Ecological Community (CEEC) listed on the *Threatened Species Conservation Act 1995* (TSC) Act or an ecological community listed on the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and
- c) the PCT from the same vegetation formation has a percent cleared value of the PCT in the major catchment area equal to or greater than the percent cleared of the PCT to which the required ecosystem credit relates, or

- d) where the required ecosystem credit is for a PCT that is associated with a CEEC/Endangered Ecological Community (EEC), the PCT from the same formation is also associated with an CEEC/EEC.

Under the above scenario, the credits generated for 'Mangrove forest in estuaries of the Sydney Basin Bioregion and South Coast Bioregion' (7 credits) could be traded for 'Saltmarsh Estuarine Complex' credits as they both occur within the 'Saline Wetlands' formation (as per Keith 2004). However, this would still leave a short fall of 267 ecosystem credits for the project. OEH notes that although there is a surplus 307 ecosystem credits across the two swamp forest PCTs they cannot be traded for 'Saltmarsh Estuarine Complex' credits as they fall within a different vegetation formation, namely 'Forested Wetlands'. As such there is a significant ecosystem credit shortfall outlined in the BAR.

Although the EIS recognises the above deficit in ecosystem credits, as outlined in Subsection 5.3.3 of the EIS, it suggests that that the credit categories are met and exceeded, and that the BioBank site delivers a collective positive credit balance. However, this statement fails to acknowledge overall the proposed measures do not meet the rules set out in the FBA, namely those relating to credit trading, and that the BOS fails to provide additional measures that compensate for this deficit. OEH notes that the surplus 'Swamp forest' credits could be used for other projects that require these type of credits or sold on the open market to other developments. Furthermore, the implication that the proponent will finalise the ecological offset package prior to commencement of works (as outlined in Section 7.0 'Mitigation Measures – Statement of Commitments') is not sufficient as OEH is of the opinion that: (i) all biodiversity offset measures should have been finalised as part of the BAR and not at a later date (apparently after approval), and (ii) the provision offset details prior to approval ensures surety in that appropriate biodiversity credits and/or measures are available. In general, the EIS fails to provide any details on how the credit shortfall will be met, such as supplementary measures and/or retirement of appropriate credits from another registered BioBank site.

As such, OEH is of the opinion the BAR and BOS fails to deliver the appropriate offsets measures with respect to the retirement of appropriate ecosystem credits, namely the 267 'Saltmarsh Estuarine Complex' credits. OEH recommends to the Department of Planning and Environment (DPE) that the BAR and BOS need to be amended or revised to clearly outline how the shortfall of credits will be met, either via the retirement of appropriate credits from another registered BioBank site and/or through the application of supplementary measures. However, OEH notes if supplementary measures are used, then the BAR / BOS must clearly demonstrate that criteria listed under Subsection 10.5.4.3 (Use of supplementary measures for ecosystem credits) have been met, and that all supplementary measures are undertaken in accordance with Appendix B of the *NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014b).

OEH notes that the proponent intends to secure and manage the proposed offset site with a BioBanking agreement under the TSC Act. OEH supports this mechanism, and notes that under a registered BioBanking agreement a site-specific management plan will be developed as part of the process.

### **Biodiversity Offsets – Species Credits**

OEH has a number of concerns regarding the species credit generation for both the development site and the offset (BioBank) site, these are:

#### Development Site:

- Four 'species credits' type species were assessed as being impacted upon on the development site, those being:
  - Black Bittern (5.61 ha of habitat impacted) – generates 73 credits,
  - Eastern Cave Bat (1.02 ha of habitat impacted) – generates 13 credits,
  - Little Bent-wing Bat (1.02 ha of habitat impacted) – generates 13 credits, and
  - Wallum Froglet (1.02 ha of habitat impacted) – generates 13 credits.

- Determination of species habitat polygons appears correct for both the Black Bittern and the Wallum Froglet, though Figure 6 of the BAR which shows the location of the 'Black Bittern' polygon is difficult to read due to green being used on a green background. As such it is recommended a different colour be used. Additionally, appropriate justification should be provided as to why that the 'Swamp Oak – Sea Rush – *Baumea juncea* swamp forest on coastal lowlands of the Central Coast and Lower North Coast' PCT is not considered too saline for Wallum Froglet.
- Both the Little Bent-wing Bat and the Eastern Cave Bat should be removed from the BAR, as OEH does not consider the development site provides appropriate roosting and/or breeding habitat. Little Bent-wing Bats generally roost in caves, tunnels and abandoned mines, but will also utilise tree hollows (including crevices), stormwater drains, culverts, bridges and sometimes buildings during the day; whilst the roosting habitat for the Eastern Cave Bat is poorly known, though it is generally thought to be large caves or rock overhangs (Churchill 2008). The 'Swamp Oak – Sea Rush – *Baumea juncea* swamp forest on coastal lowlands of the Central Coast and Lower North Coast' PCT does not contain tree species that readily produce hollows or 'under bark crevices' and as such would not be considered suitable roost / breeding habitat. Reference to the Greater-broad Nosed Bat and Yellow-bellied Sheath-tail Bat should also be removed as these are not 'species credit' species.
- Based on above, the BAR should only include species credits generated for the Black Bittern and the Wallum Froglet on the development site, providing the site is not too saline for the latter. If the site is considered too saline then the Wallum Froglet should be removed.

#### Offset (BioBank) Site:

- Seven 'species credits' type species were assessed as being impacted upon on the development site, those being:
  - Black Bittern (31.3 ha of alleged habitat) – generates 222 credits,
  - Eastern Cave Bat (31.3 ha of alleged habitat) – generates 222 credits,
  - Grey-headed Flying Fox (4.51 ha of alleged habitat) – generates 32 credits,
  - Koala (approx. 6 ha of alleged habitat) – generates 45 credits
  - Little Bent-wing Bat (31.3 ha of alleged habitat) – generates 222 credits,
  - Squirrel Glider – not listed in credit sheet, and
  - Wallum Froglet (12.32 ha of alleged habitat) – generates 87 credits.
- Determination of species habitat polygons appear correct for the Black Bittern, though Figure 8 of the BAR which shows the location of the 'Black Bittern' habitat polygon is difficult to read due to green being used on a green background. As such it is recommended a different colour be used.
- The calculation of the Wallum Froglet habitat is incorrect. The BAR states 12.32 ha of habitat is present, that being the Swamp Oak – Sea Rush – *Baumea juncea* swamp forest on coastal lowlands of the Central Coast and Lower North Coast' PCT, however, there is 21.16 ha of this PCT based on the areas shown in Table 8 (of the BAR). Additionally, OEH considers the 'Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion' PCT would also represent habitat, which adds another 3.97 ha to the habitat polygon. OEH recommends that the species credit calculations be rerun for this species, providing adequate justification is provided indicating that these PCTs are not too saline for Wallum Froglet.
- Grey-headed Flying-fox should be removed as there are no known roosting sites and/or breeding camps on the offset site. Foraging habitat, such as that present in the swamp and mangrove forests are included in the generation of 'ecosystem' credits.
- Both the Little Bent-wing Bat and the Eastern Cave Bat should be removed from the offset (BioBank) calculations as per the reasons given for the development site.

- The Koala habitat polygon needs to be amended to 3.97 ha (not 6.35 ha) to reflect the true extent of habitat on the site. OEH is of the opinion that only the 'Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion' PCT represents suitable habitat given the clear presence of known food trees (i.e. *Eucalyptus robusta*). The adjoining small area of Swamp Oak (*Casuarina glauca* dominated) does not represent suitable, regardless of the records on OEH's 'Atlas of NSW Wildlife' database. Swamp Oak is not a listed feed or considered habitat under Schedule 2 of SEPP 44 – Koala Habitat Protection, Appendix 2 of NSW State Koala Recovery Plan (DECC 2008), or Port Stephens Comprehensive Koala Plan of Management (DECC 2008, PSC 2002). Additionally in Subsection 9.2.3 of the BAR the habitat polygon is incorrectly stated as being 36.35 ha, which is larger than the overall offset site. This should be corrected to 3.97 ha.
- Generally the Squirrel Glider is not a 'species credit' species, though it is acknowledged in some areas it is on the basis of suitable breeding habitat being present. OEH does not consider the site has suitable breeding habitat due to the lack of large hollow-bearing trees / den sites. OEH recommends that this species be removed from the BAR.
- Based on above, the BAR should only include species credits generated for the Black Bittern, Koala and the Wallum Froglet on the offset site, providing the site is not too saline for the latter. If the site is considered too saline then the Wallum Froglet should be removed.
- OEH notes that the species credits generated on the offset (BioBank) site adequately compensate those impacted on the development site, both in type and quantum.

### Threatened Species Surveys

OEH notes that one (1) threatened flora species has not been adequately surveyed for, that is *Lindernia alsinoides* (Noah's False Chickweed). In accordance with the BBAM credit calculator this species should have had targeted flora surveys undertaken between November to February (as shown in Table 5 of the BAR). The BAR states that the vegetation surveys and BBAM plots were undertaken in March, clearly outside the recommended survey time frame. Furthermore, OEH cannot rely on the previous surveys of Cumberland (2007) and HWR (2003, 2005) as they are greater than five years old (which is generally outside OEH accepted timeframes), they do not specify the areas / habitat targeted nor the methodologies used, and/or were also conducted at the wrong sampling time (e.g. Cumberland 2007 – surveyed in March). Furthermore, *Lindernia alsinoides* was only gazetted / listed on the TSC Act in late 2004, so it is highly unlikely that it was surveyed for in the HWR surveys, particularly the 2003 dated survey that pre-dates the listing.

OEH recommends to DPE that the appropriate targeted flora survey for *Lindernia alsinoides* be conducted between November to February or an expert report is prepared in accordance with Subsection 6.6.2 of the FBA to confirm whether or not the site is likely habitat or not.

### Plant Community Type (PCT) Descriptions

Although OEH is of the opinion the PCTs appear correct for vegetation types recorded, to be confident, the BAR needs to describe the vegetation communities present, both floristically and structurally, on the basis of the BBAM plots undertaken (i.e. specific PCT descriptions should be provided in the BAR in accordance with the FBA operational manual). This needs to be done for both the development and offset (BioBank) sites. The BAR lacks these PCT and appends the 2007 Cumberland Draft Species Impact Statement report as an alternative for providing the community descriptions. This is inappropriate as: (i) the descriptions in the Cumberland report are different, (ii) they are not aligned to state-wide PCT classification, which the BBAM and FBA uses, and (iii) the boundaries and extent of the vegetation recorded in 2007 has changed in comparison to current site condition. These reports may be used to supplement or support the descriptions of PCT communities, but ultimately the descriptions should be based on the current BBAM plots.

OEH recommends that appropriate PCT descriptions be included in the BAR as per the FBA operations manual (OEH 2014a). These descriptions should include details about the species and landscape features used to identify the PCTs, as well as provide justification on disturbed communities and why a PCT was

chosen over a similar PCT (e.g. HU960 'Saltmarsh Estuarine Complex' vs. HU606 'Saltmarsh in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion' – based on absence / presence of *Sporobolus virginicus*).

### Other Operational Issues

The following issues need to be corrected in the BAR and or/provided (as per the FBA operational manual [OEH 2014]):

- Digital shape files for all maps in the BAR and associated spatial data that was used (e.g. assessment circles for landscape score) must be provided to OEH and DPE.
- With respect to the determining the landscape value score (Section 2.2 of the BAR), specifically the 1000 ha assessment circle, OEH requests further clarification on how the vegetation cover was determined / assessed. It appears to OEH that the Stockton sand bight was removed in the calculations and the outer circle (1000 ha) re-calibrated to account for this. This is within the parameters of the methodology; however, it needs to be explained in the BAR to clarify the process. This applies to both the development and offset (BioBank) sites.
- Explanation is required as to why the 'water body' type has changed between the development and offset (BioBank) sites within the actual credit calculator (i.e. estuarine area for development site vs. important wetland for offset site. They should be the same. OEH notes that the BAR states 'estuarine area' for the offset (BioBank) site, as such the credit calculator should be corrected.
- Overall page numbering is out of order or there are multiple pages with the same number in the BAR. This needs correcting.

#### References:

Churchill, S. (2008) *Australian Bats*. Second Edition. Allen & Unwin.

DECC (2008) *Recovery Plan for the Koala (Phascolacrtos cinereus)*. Department of the Environment and Climate Change, Sydney.

Keith, D. (2004) *Ocean Shores to Desert Dunes: The Native Vegetation of New South Wales and the ACT*. Department of Environment and Conservation (NSW), Hurstville, NSW.

OEH (2014a) *Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects*. Office of Environment and Heritage, detailed at: [www.environment.nsw.gov.au/biodivoffsets/140675fba.htm](http://www.environment.nsw.gov.au/biodivoffsets/140675fba.htm)

OEH (2014b) *NSW Biodiversity Offsets Policy for Major Projects*. Office of Environment and Heritage, detailed at: [www.environment.nsw.gov.au/biodivoffsets/140675fba.htm](http://www.environment.nsw.gov.au/biodivoffsets/140675fba.htm)

PSC (2002) *Port Stephens Comprehensive Koala Plan of Management*. Port Stephens Council (June 2002).

### ABORIGINAL CULTURAL HERITAGE ASSESSMENT

OEH has reviewed 'The Bay Resort, Cultural Heritage Impact Assessment, Anna Bay New South Wales, prepared by RPS East Australia Pty Ltd, proposed for Raphael Shun Enterprises Pty Ltd, November 2014' and make the following comments and recommendations.

OEH notes that there is one (1) Aboriginal site registered on the Aboriginal Heritage Information Management System (AHIMS) within the proposed development footprint. AHIMS Site # 38-5-0250 (shell midden and artefact scatter) is classified as being of low scientific significance due to cumulative levels of disturbance and landscape modification. Whilst the site lies within the potential disturbance area, it is noted that if surface disturbance is to occur near the site that it should be subject to salvage under a Cultural Heritage Management Plan (CHMP). OEH supports this proposal and also concurs with the recommendation that prior to the CHMP being prepared that a high visibility 'no go zone' be placed around AHIMS Site # 38-5-0250, in order to temporarily mitigate any potential harm that may occur.

OEH further notes that Aboriginal community consultation has been conducted in line with the 'Aboriginal Cultural Heritage Requirements for Proponents 2010', in accordance with the National Parks and Wildlife Regulation 2009 and completed to the stage specified in subclause 80C. OEH is satisfied that all Registered

Aboriginal Parties involved with the assessment of SSD-5961 support the proposed AHIP application and associated management recommendations.

OEH concurs with the overall recommendations provided in the cultural heritage impact assessment that a CHMP should be prepared prior to any consultation works beginning to mitigate any future harm to *AHIMS Site # 38-5-0250* and that the CHMP should also address any potential impacts from surface and subsurface disturbance during construction activities. OEH has no other concerns with respect to Aboriginal cultural heritage and the proposed development of the proposed development.

## **FLOODING AND FLOODPLAIN MANAGEMENT**

The following comments are offered on the floodplain management components of the EIS for the proposed development at 4177 Nelson Bay Road, Anna Bay.

The site is an existing partially cleared site which currently has rural use. Port Stephens Council does not currently have a flood study specific to this area. A flood study for the Anna Bay area has been funded by OEH, however, the study has not yet commenced. Flooding in this area is very complex and the flood study brief for the proposed Council flood study indicates that during times of floods the area may be hydrologically connected with the Hunter River and Fullerton Cove, in addition to the Port Stephens Estuary. Flood studies undertaken on behalf the proponent consider the local catchment only and do not take into account the complex interactions which may occur.

The Director General's Requirements (DGR's) for the proposed development includes the requirement for a comprehensive assessment of the impact of flooding on the proposed development for the full range of flood events up to the probable maximum flood. The impacts of climate change, sea level rise and increase in rainfall intensity are also required to be assessed.

The impacts of the proposed development on flood behaviour on adjacent properties, levels, velocities and duration of flooding is required to be considered for properties upstream and downstream of the development.

An emergency response plan was required to be prepared together with consideration of flood free access to or from the development site in extreme flood events.

A flood impact assessment (Ref: NL130365 - dated 27 March 2015) has been prepared by Northrop Consulting Engineers in support of the development proposal. The flood impact assessment has been assessed against the DGR's and the following comments are provided.

### **Flood Study**

The flood study has used rainfall generated by a Rafts model to generate runoff directly by rainfall on grid in the hydraulic model. Parameters used in the model appear reasonable and sensitivity analysis has been carried out. However, the model considers only the local catchment of 13.1 square kilometres. Information provided by Port Stephens Council and reinforced by the Williamtown Salt Ash flood study, indicate that flooding mechanisms in this area are very complex and may include interactions with the Hunter River and Fullerton Cove. The proposed Port Stephens Council Anna Bay flood study is expected to provide this information, however, it will not be completed for some time. The flood study has adopted a design flood level of 2.2m AHD based on 1%AEP flood levels with a downstream boundary condition equivalent to the highest astronomical tide (HAT) and a 2050 sea level rise of 500mm.

The majority of the development site has existing levels of between 1.0 AHD and 0.5 AHD therefore flooding on the site would be considered to be high hazard floodway or high hazard flood storage based on the velocities and depths predicted in the flood study.

The development proposes to achieve required floor levels and amenity on the site by importation of up to three metres of fill depth over the majority of the development footprint. Basement car parking is proposed to

be constructed below flood level within the fill platform. Changing hydraulic classification through the extensive use of fill is not considered to be an appropriate flood mitigation measure. Under the NSW Floodplain Development Manual (NSWFDM) definitions these areas form a significant role in attenuation of floods and should not be filled or modified.

### **Flood Impact Assessment**

A number of flood scenarios have been modelled to determine the impact of the proposed fill on surrounding development. The consultant's report indicates the impact of the fill platform on flood levels in non-significant (less than 50mm) and has low increase in velocity. The development site forms part of a very extensive floodplain area therefore the impact of the fill is shared across the floodplain resulting in small impacts as a result of this development alone. NSWFDM section G6.1 requires the consideration of the cumulative effects of development on flood risk. Permitting fill to this extent may set a precedent for future filling in the floodplain.

The flood impact assessment also used high tailwater conditions in all flood modelling scenarios. Use of high tailwater conditions is appropriate for estimating floor levels for the development, however, in a drowned out catchment the effect of the development on surrounding properties will be masked by the tailwater conditions. The use of HAT as a tailwater level is not considered appropriate for frequent flooding analysis or for full impact assessment. It is recommended that the more frequent flood events up to the 5% AEP flood event be re-run with a more realistic tailwater level such as MHWS of 0.69.

The un-named road to the east of the site is noted in the flood study as providing a barrier to flood water leading up to the peak flood before being overtopped. This road is proposed to be raised to provide the primary access to the site. It is likely that the use of high tailwater levels will have masked the effect of raising this road on flood levels to the east of the site. Raising the road will increase the level at which the road is overtopped and the additional fill to the west constrains the flow area once the road is overtopped. This change in flood behaviour is significantly different than the pre-developed scenario and is not adequately reflected in the flood model results. The recommendations in the conclusions to the flood study indicate that there are issues with the impact of road raising on adjoining properties and that this has been minimised by adopting a 5% AEP level of service for the road and providing an upgraded drain on the eastern side of the raised roadway.

### **Climate Change Analysis**

Climate change analysis has been undertaken by coupling a 10% increase in rainfall intensity with the 2050 increase in sea level. Current recommendations for climate change analysis include 10%, 20% and 30% increase in rainfall and 2050 and 2100 sea level rise considerations. Increases in rainfall should be modelled coupled and uncoupled with sea level rise. Port Stephens Council has currently adopted the 2100 sea level rise with a 20% rainfall increase as the design criteria to be used for climate change sensitivity and modelling should reflect these requirements.

### **Sensitivity Analysis**

Sensitivity analysis has been carried out for changes in Mannings roughness and for a 50% increase in rainfall only. The 50% increase in rainfall is considered too extreme for the purposes of sensitivity analysis and the flood study indicates that a large flood impact from development was produced by this increase, no results are included in the study. The more usual scenarios of 10%, 20% and 30% increase in rainfall as noted in the climate change criteria should be used. No sensitivity analysis has been carried out on adopted rainfall losses which were very low for both initial and continuing loss. These values may be appropriate on the lower floodplain, however, other values should have been considered for the extended catchment. The groundwater study indicated considerable variation in groundwater levels therefore adopting very low initial and continuing losses will result in increased flow rates which may mask differences between the developed and pre developed flood behaviour.

## **Flood Emergency Response Plan**

The consultant has provided a draft emergency response plan. The plan advocates either early evacuation or shelter in place as the required flood response. In addition it is stated that the hazard is low because occupants will avoid the flood water.

The traffic study for the development indicates provision of 12 bus spaces and 570 car parking spaces on site, with 416 of the car spaces provided in basement parking. Primary access and egress for the site is proposed to be via the improved unnamed road to the east with a secondary access only via left turn from Nelson Bay Road.

Nelson Bay road generally remains flood free up to the 1% AEP event, however, the unnamed road is proposed to be raised to the 5% level only due to flood impacts from road raising.

Basement levels are well below flood level and are proposed to be protected by the use of rollover ramps and/or flood gates together with stormwater pumps. Stormwater pumps may fail if power failure occurs during a flood event and backup systems would be required to protect the basement.

The proposed floor level of the building is above the PMF level indicated in the flood study therefore shelter in place is possible. Flood warning time noted in the document is short and early evacuation is considered to be unlikely.

The large number of car parking spaces proposed to be provided indicates a significant increase the number of people who may need to be sheltered in place or evacuated. There is a possibility that flooding of the primary access road may generate a panic response from occupants concerned about being flooding in or having cars trapped within the basement in a flood event. The large number of cars which may attempt to leave the site under these conditions could result in considerable evacuation difficulties.

## **Water Balance**

The water balance modelling indicates that a considerable increase in average annual flows will be produced by the development even with reuse of rainwater for non-potable purposes on site. It is noted that use for toilet flushing is only considered in toilets in communal areas at this stage rather than the higher use which may be possible if dual reticulation to unit toilets was considered. The Music modelling has indicated an increase from 16.9ML/yr to 38.9ML/yr. This may have a significant impact on the downstream wetland habitat and adjacent salt marsh. In addition the DGR's indicated that the duration of flooding should not be impacted. Statements have been made in the EIS that this is the case, however, neither the flood study nor the water balance modelling have demonstrated this.

## **Stormwater**

There is inconsistency between the stormwater plan and the flood modelling with respect to invert levels of the channel proposed to drain the eastern side of the un-named roadway. The levels indicated on the stormwater plan cannot provide for draining of the proposed channel with an adopted invert of 0.4m AHD. The proposed stormwater treatment infrastructure is located with weir levels below the flood level nominated in the flood study. Raingardens and other treatment devices may be inundated in the 1% AEP event. Drainage from the raingardens/biofiltration could only take place once flood levels outside of the site have fully receded.

Stormwater from the site is proposed to be discharge via level spreaders in four locations around the fill permitter. Whilst this attempts to mimic pre developed flow patterns the flow will be more concentrated, of greater volume and of significantly greater flow rate than the pre-developed flow which was shared as sheet flow over the floodplain. The discharge points are also much closer to the sensitive salt marsh and wetland communities with the salt marsh proposed to provide a 'buffer' for the SEPP 14 wetland downstream.

Flows from the trapped low point on the adjacent site fronting Nelson Bay Road and trapped low points in the fill batter adjacent to the un-named road are proposed to be piped under the un-named road to a new drainage channel to the east of the road. This is not in the direction of the original flow which was generally across the floodplain in a northerly direction. The proposed drainage channel runs parallel to properties on the eastern side of the road and it is not known if the raised road or the drainage channel will affect access to these properties.

It is also mentioned that the flood gate will not be repaired/be removed as part of the works to return the area to more natural hydrology. The flood gate shown on plan appears to be located at the end of the drainage line on the northern end of the un-named road. The effects of removal of this flood gate on other properties has not been demonstrated.

**OEH – AUGUST 2015**