WorleyParsons
resources & energy

Infrastructure & Environment
Level 12, 141 Walker Street,
North Sydney NSW 2060
Australia
Telephone: +61 2 8923-6866
Facsimile: +61 2 8923-6877
www.worleyparsons.com
WorleyParsons Services Pty Ltd
ABN 61 001 279 812

17 September 2010

Ref: lt01089-95gwb_prh100917coastal processes responses.doc

Australand Holdings Ltd
PO Box A148
SHELLHARBOUR NSW 2529

Attention: Mr Glenn Colquhoun

Dear Glenn

SHELL COVE BOAT HARBOUR PRECINCT - CONCEPT PLAN APPLICATION AND ENVIRONMENTAL ASSESSMENT - SUPPORTING INFORMATION ON COASTAL PROCESSES, RESPONSE TO SUBMISSIONS

Further to our recent discussions, I am writing to set out our response to the submissions supplied by NSW Planning in relation to the above matter. As agreed, our response is structured on an issue by issue basis with references to the various sources of the submissions as required.

1. BEACH EROSION AND SHORELINE RECESSION HAZARD LINES

1.1 General

Two submissions raised the issue of mapping the beach erosion and shoreline recession hazard lines for the present time, 2050 and 2100:

- The submission by Shellharbour City Council highlighted the need to include mapping of the Zone of Reduced Foundation Capacity and Stable Foundation Zone as well as the usual Zone of Wave Impact and Zone of Slope Adjustment. The submission also made reference to the Shellharbour Coastal Hazard Study prepared for Council by SMEC (2010) and the desirability of using this Study, rather than the hazard assessment in the Environmental Assessment, for purposes of determining planning and development controls for the Shell Cove Boat Harbour Precinct development.
- The submission from NSW Planning, which relied upon the report prepared by its external consultant Parsons Brinckerhoff.

In order to respond to the submissions it has been necessary to review the SMEC (2010) Coastal Hazard Study. This Study was not available at the time of preparation of the coastal processes / coastline hazard assessment included in the Environmental Assessment (September 2009).

1.2 Findings in SMEC Coastal Hazard Study (2010)

In the SMEC (2010) study, the combined beach erosion and shoreline recession hazard zones for three planning periods were presented, namely:

- present time, or immediate period (SMEC Appendix D, Figure D.25);

- Year 2050 (SMEC Appendix D, Figure D.28); and,
- Year 2100 (SMEC Appendix D, Figure D.31).

The hazard lines included definition of the Zone of Reduced Foundation Capacity and Stable Foundation Zone, as well as the Zone of Wave Impact and Slope Adjustment. Copies of Figures D.25, D.28 and D.31 are included with this letter at **Attachment B**.

South of the proposed boat harbour entrance two sets of hazard lines were produced for a given planning period, reflecting two possible values proposed for the 'storm demand', or 'storm bite', which makes up the beach erosion hazard; namely values of 190m^3/m and 100m^3/m. In the SMEC (2010) report it was noted that:

> *"The sensitivity of the hazard mapping to storm bite values of 190 m^3/m and 100 m^3/m has been illustrated on the map for the southern end of Shellharbour South Beach. While insufficient data are currently available to determine an accurate storm bite for this part of the beach, wave climate analysis in Appendix F indicates that wave climate is milder at the southern end of the beach than at the northern end and that storm bite is likely to be lower at the southern end".*

Detailed studies completed at Shellharbour South Beach by the writer as part of the further investigation and detailed design of Shell Cove Boat Harbour also confirm the milder wave climate at the southern end of the beach and thus the justification for a lesser storm bite or storm demand in this area.

The hazard mapping produced by SMEC (2010) and shown in Figures D.25, D.28 and D.31 (refer **Attachment B** to this letter) demonstrates the following:

- north of the proposed boat harbour entrance:
  - the limit of the Zone of Reduced Foundation Capacity in the immediate, 2050 and 2100 planning periods are all seaward of Boollwarroo Parade
- south of the proposed boat harbour entrance:
  - the limit of the Zone of Reduced Foundation Capacity in the immediate, 2050 and 2100 planning periods, for a storm bite of 100 m^3/m, are all seaward of Bass Point Road.

The SMEC (2010) study therefore demonstrates that development within the Shell Cove Boat Harbour Precinct landward of Boollwarroo Parade / Bass Point Road would not be impacted by beach erosion and shoreline recession hazards up to the planning period of 2100.

It should also be noted that the hazard mapping in SMEC (2010) assumes no management of the beach erosion and shoreline recession hazards into the future. The major component of the shoreline recession hazard is recession due to sea level rise which would potentially be addressed by a Beach Nourishment / Rehabilitation Management Plan. This Plan has been prepared for Shellharbour South Beach as a requirement of development consent and the conditions of concurrence under the *Coastal Protection Act 1979* and is to be implemented by Shellharbour City Council (refer **Section 5** of this letter).

The SMEC (2010) study establishes that even if the recession hazard due to sea level rise is not managed in the future, development within the Shell Cove Boat Harbour Precinct landward of Boollwarroo Parade / Bass Point Road would not be impacted.

The findings of the SMEC (2010) study are consistent with the hazard assessment contained in the Environmental Assessment which concluded that the proposed development within the Boat Harbour Precinct would be sufficiently set back not to be impacted by erosion and recession for a planning period of 100 years.

There are a number of matters of detail in the SMEC (2010) study that differ from the hazard assessment contained in the Environmental Assessment. These are noted in **Section 1.3** below. In particular, it is considered the recession allowance for sea level rise is high in SMEC (2010) due to the high multiplying factor adopted in the application of the Bruun Rule compared to what is considered reasonable for the local circumstances at Shellharbour South Beach.

As such, while the general findings of the SMEC (2010) study are endorsed, the specific positions of the hazard lines are regarded as being too far landward.

1.3 Comparison Between SMEC (2010) and Environmental Assessment

A comparison of the parameters adopted in SMEC (2010) and the Environmental Assessment for determination of the beach erosion and shoreline recession hazards is provided in **Table 1**.

Table 1 Comparison of Parameters in SMEC (2010) and Environmental Assessment

	SMEC (2010)	Environmental Assessment
Beach Hazard		
• storm demand	190m^3/m (see Note 1)	160m^3/m (see Note 1)
Shoreline Recession Hazard		
• due to net sediment loss	0 m/year	0.05m/year
• due to sea level rise		
- Sea level rise amount	0.4m (2050)	
	0.9m (2100)	0.91m (2100)
- Bruun Rule multiplier	31 and 43 (see Note 2)	25

Notes:

1. This storm demand is applicable north of the proposed entrance to Shell Cove boat harbour. South of the entrance SMEC (2010) considered a value of 100m^3/m. The Environmental Assessment noted that a value of less than 160m^3/m would be appropriate. The SMEC (2010) value of 100m^3/m is considered to be reasonable and conservatively high.
2. Value of 43 north of proposed boat harbour entrance, and value of 31 south of proposed boat harbour entrance.

Based on the parameters in **Table 1**, the following can be said about the difference between the hazard lines in SMEC (2010) and the lines that would be determined based on the approach taken in the Environmental Assessment (adopting the NSW Government's planning benchmark values for sea level rise in each case):

- present time, or immediate period:

  - north of proposed boat harbour entrance : Environmental Assessment line would be 6 m further seaward of SMEC (2010);
  - south of proposed boat harbour entrance : Environmental Assessment line would be equivalent to SMEC (2010);
- 2050:
  - north of proposed boat harbour entrance : Environmental Assessment line would be 12 m further seaward of SMEC (2010);
  - south of proposed boat harbour entrance : Environmental Assessment line would be equivalent to SMEC (2010);
- 2100:
  - north of proposed boat harbour entrance : Environmental Assessment line would be 18 m further seaward of SMEC (2010);
  - south of proposed boat harbour entrance : Environmental Assessment line would be equivalent to SMEC (2010);

The above outcome is depicted on the Figures included at **Attachment C**, for the extent of the Shell Cove Boat Harbour Precinct.

2. COASTAL INUNDATION / OVERTOPPING HAZARD

2.1 General

The issue of coastal inundation was raised in two submissions:

- the submission from Shellharbour City Council in which it was stated that the Environmental Assessment:
  - did not clearly demonstrate the influence of potential sea level rise on coastal inundation;
  - did not calculate inundation for the present, 2050 and 2100 climate change scenarios.
- the submission from NSW Planning, which relied on the report prepared by its external consultant Parsons Brinckerhoff, and in which it was requested more detail be provided in terms of overtopping volumes and how much land will be inundated taking into account sea level rise.

In the submission of Mairi Petersen it was also noted that “the ocean along South Shellharbour Beach has risen and crossed the roadway along Boollwarroo Parade at least twice in the last 100 years...”

2.2 Extent of Inundation

An estimate of the wave runup level (inundation level) along Shellharbour South Beach in a 100 year Average Recurrence Interval (ARI) event at the present time was provided in the Environmental Assessment, contrary to the statement in the Shellharbour City Council submission, and was equal to approximately 5m AHD. It was also noted that runup levels at the southern end of the beach, eg south of the proposed boat harbour entrance, would be lower than 5 m AHD due to the additional wave sheltering provided by Bass Point.

Inundation levels along Shellharbour South Beach at the present time have also been estimated by SMEC as part of their Shellharbour Coastal Hazard Study carried out for Shellharbour City Council (SMEC, 2010). In the SMEC (2010) study the maximum inundation level for a 100 year ARI event was estimated to be 4.6m AHD, ie slightly lower (lesser hazard) than that included in the Environmental Assessment (SMEC report, Appendix D, Table D.4).

In Section 3.4 of the SMEC (2010) report it was noted that the value of 4.6m AHD would be conservatively high since they had combined the 100 year ARI wave conditions with the 100 year ARI still water level (these conditions may not necessarily occur concurrently).

Accordingly, the value of 5m AHD adopted in the Environmental Assessment can also be regarded as conservative, consistent with the general approach that was taken in the Environmental Assessment.

SMEC (2010) produced a map showing the extent of the maximum inundation at present along Shellharbour South Beach by simply shading in the foreshore area that was at a level of 4.6m AHD or less (Appendix D, Figure D.7). This is overly simplistic in that it does not take into account the attenuation, spreading out and infiltration processes that occur as wave runup overtops the crest of a dune and attempts to propagate further landward. Even so, the SMEC map showed that inundation would not extend beyond Boollwarroo Parade, ie would not extend to the proposed development areas within the Shell Cove Boat Harbour Precinct.

SMEC (2010) noted that wave runup could reach some of the existing houses along Shellharbour South Beach, seaward of Boollwarroo Parade, but acknowledged that.... " the impact would be limited due to absorption of the wave runup along the dune and if the houses and roads are affected, the impact would not be significant as the energy would be very low" (Appendix D, Section 2.3.4).

It is apparent that the assessments of inundation at the present time outlined in the Environmental Assessment and in the Coastal Hazard Study for Shellharbour City Council are consistent in that no impact on development within the Shell Cove Boat Harbour Precinct is predicted.

Consideration then needs to be given to the expected inundation hazard for the 2050 and 2100 planning timeframes in response to climate change (sea level rise). This topic would not appear to be given any significant attention in the SMEC report for Council, the only reference that can be found is a footnote to Table 3 in Section 3.4 to the effect that wave runup levels calculated for the Present Day (ie 4.6m AHD) would be expected to increase as a result of future sea level rise due to climate change.

In the Environmental Assessment discussion was presented as to the expected change in the inundation hazard over time, ie that the wave runup level and overtopping of the dunes east of Boollwarroo Parade would increase (in the absence of any raising of the dune crest level). However, it was noted that the hazard was not considered significant due to several factors:

- when waves overtop a dune crest they tend to 'fold over' the crest and travel as a sheet flow at shallow depth, spreading out and infiltrating over the sandy profile landward of the crest;
- a swale is to be maintained behind the dune system (seaward of Boollwarroo Parade), north of the proposed boat harbour entrance, which would collect overtopping flows prior to them reaching Boollwarroo Parade and allow drainage back to the boat harbour entrance channel and / or natural infiltration. South of the proposed boat harbour entrance, wave runup levels

would be lower due to the lesser wave climate (sheltering by Bass Point) and wave overtopping of the foreshore is not expected;

- should any overtopping flows reach Boollwarroo Parade / Bass Point Tourist Road (not expected), the drainage systems in these roads would collect and distribute the flows to the boat harbour or other drainage systems without impacting on the proposed development.

As part of the preparation of the response herein to the submissions on the Environmental Assessment, calculations of the overtopping volumes have been made at the present time and for expected overtopping conditions in 2050 and 2100. These are based on the estimated wave runup levels (inundation levels) in 2050 and 2100 being equal to the present day wave runup level of say 4.6 m AHD plus the benchmark sea level rise values to 2050 (0.4 m) and to 2100 (0.9 m), ie inundation levels of 5.0 m AHD in 2050 and 5.5 m AHD in 2100. The method of calculation is discussed in **Section 2.3** below.

These calculations show that the overtopping volumes at the present time would be around 0.1 litres per second per metre length of dune parallel to the beach (0.1 L/s/m), would increase to around 0.5 L/s/m in 2050 and would increase to around 2 L/s/m in 2100. These volume rates would only exist around the peak of high tide, say for 2 hours, since when the astronomical tide level falls overtopping would cease. The volumes of water involved over this two hour period would be less than 1 m^3/m at present, around 4 m^3/m in 2050 and around 15 m^3/m in 2100.

The above flow rates and storage requirements are not excessive. Even at 2100 a combination of pipe drainage and / or storage could readily accommodate a flow rate of 2 L/s/m and storage of 15 m^3/m such that inundation does not extend beyond (landward of) Boollwarroo Parade / Bass Point Tourist Road. Figure D.7 in Appendix D of SMEC (2010) can therefore be taken to be a representation of the possible extent of inundation up to 2100. This figure is included at **Attachment A**.

It follows that the extent of the inundation hazard would not impact adversely on development within Shell Cove Boat Harbour Precinct, situated landward of Boollwarroo Parade / Bass Point Road.

2.3 Inundation Volumes and Land Inundated Taking into Account Sea Level Rise

This matter, raised by NSW Planning (Parsons Brinckerhoff), has been largely addressed in the above section. Calculations of overtopping volumes have been made based on the actual beach and dune profiles at Shellharbour South Beach, benchmark values of sea level rise of 0.4 m in 2050 and 0.9 m in 2100, and methods outlined in HR Wallingford Technical Report W178 "Overtopping of Seawalls Design and Assessment Manual" and EurOtop "Wave Overtopping of Sea Defences and Related Structures : Assessment Manual" (Die Kuste version), August 2008.

The overtopping volumes determined are:

- present time : 0.1 L/s/m
- 2050 : 0.5 L/s/m
- 2100 : 2 L/s/m

The land inundated would be confined to that land east of Boollwarroo Parade / Bass Point Road as noted above.

2.4 Ocean Crossing the Roadway along Boollwarroo Parade

It is difficult to comment in detail on the matter raised by Mairi Petersen as the timing and location of ocean waters crossing the roadway twice in the last 100 years are not specified in the submission.

It is possible that the area in question may be near the existing breakout point of the swamp across the beach where, as a result of the regular breakouts, the dunes are lower in elevation.

As part of the Shell Cove boat harbour development the dunes in this area will be reformed and stabilised at a crest level of 4.5 m AHD (to match the typical crest elevation further north), accordingly overtopping behaviour in the future would be consistent with the predictions made above. In addition, a Beach Nourishment / Rehabilitation Management Plan has been prepared and approved for Shellharbour South Beach as a requirement of the conditions of development consent and conditions of concurrence under the *Coastal Protection Act 1979*. This will ensure maintenance of a stable dune system into the future.

3. CLIMATE CHANGE

3.1 General

A number of the submissions raise the issue of climate change, including those prepared by the Illawarra Greens, Mairi Petersen, Sonya McKay, Shellharbour City Council, and NSW Planning / Parsons Brinckerhoff. The climate change matters raised can be summarised as follows:

- has sea level rise due to climate change been considered;
- provide further information on sea level rise impacts on wave climate and beach erosion hazard; and,
- impact of sea level rise on inundation.

The Environmental Assessment did give consideration to the impact of climate change on coastline hazards, specifically the impact on the shoreline recession hazard (discussed further above in **Section 1**) and on inundation (discussed further above in **Section 2**).

The magnitude of the sea level rise considered in the Environmental Assessment to the year 2100 comprised three values corresponding to 'low' (0.18 m), 'mid' (0.55 m) and 'high' (0.91 m) sea level rise scenarios, which was the appropriate approach at the time (September 2009). Subsequently, planning benchmark values for sea level rise of 0.4 m to 2050 and 0.9 m to 2100 have been recommended by the NSW Government and have been considered in the responses prepared in this letter.

Parsons Brinckerhoff in their report on behalf of NSW Planning has referred to a potential sea level rise of 1.1 m by 2100. This value is not current NSW Government policy and has not been conveyed to Australand by NSW Planning and accordingly is not addressed in this response.

Of the above bullet points, the points not addressed elsewhere in this letter and which are addressed below comprise:

- sea level rise impact on wave climate; and,
- sea level rise impact on beach erosion hazard.

3.2 Sea Level Rise Impact on Wave Climate

Ocean waves are generated by the wind. Sea level rise per se would not affect the wave climate (height, period and direction) approaching the coast.

At the shoreline, waves are 'depth limited', ie the maximum wave height that can occur (for a given wave period) is a function of the available water depth, which in turn is governed by the prevailing water level and seabed level (including consideration of seabed scour at the times of storms).

Although the water level will increase in elevation with sea level rise, giving the potential for greater water depth and thus larger wave heights, morphological changes to the beach profile will also occur as a result of sea level rise such that the beach berm level and nearshore profile will adjust upwards. As a consequence it is considered unlikely that there would be any significant change in the nearshore wave climate due to sea level rise.

3.3 Sea Level Rise Impact on Beach Erosion Hazard

The beach erosion hazard is generally defined by the "storm demand" which is the volume of sand measured above 0 m AHD which can be eroded from a beach in a severe storm or closely linked series of storms.

The storm demand is dependent on a number of factors but importantly the height and period of the incident wave climate. As sea level rise is not expected to significantly alter the incident wave climate at the beach (as noted above), sea level rise would not be expected to have a significant impact on the beach erosion hazard. Therefore the value of storm demand adopted for assessment of the present day beach erosion hazard is also appropriate for adoption in 2050 and 2100. This is accepted methodology in coastline hazard assessment and, it is noted, was the methodology adopted by SMEC in the Shellharbour Coastal Hazard Study conducted for Shellharbour City Council

4. SEAWALL CREST LEVEL

4.1 General

NSW Planning in its letter dated 4 June 2010 raises the matter of the proposed crest level of the seawall within the boat harbour of 2.0 m AHD and has sought the basis for this adopted height. The request follows from the review report prepared by its external consultant Parsons Brinckerhoff.

Firstly, it should be noted that the seawall crest level does not represent the building platform level. The actual building platforms will step up above the seawall crest to a minimum of approximately 3m AHD.

4.2 Basis of Adopted Seawall Crest Level

The seawall crest level was established having regard to a number of factors:

- elevated still water levels in the boat harbour at times of ocean storms;
- consideration of sea level rise due to climate change;
- foreshore design objectives; and
- available adaption measures.

4.2.1 Elevated Still Water Levels

Water levels in the boat harbour are potentially influenced by the following factors (excluding sea level rise):

- astronomical tide;
- storm surge (wind setup plus inverted barometric pressure effect);
- wave setup.

Estimates of the combined level of astronomical tide and storm surge for a range of Average Recurrence Interval (ARI) events are well established for the NSW coast based on analysis of long term records of water level at locations such as Fort Denison, eg MHL (1992).

A reasonable estimate of the 100 year ARI water level, including astronomical tide and storm surge, but excluding wave setup, is 1.5 m AHD. The highest recorded water level at Fort Denison over the period of record analysed by MHL, May 1914 to December 1991, was 1.48 m AHD in May 1974. It is noted here that SMEC, in its Shellharbour Coastal Hazard Study undertaken for Shellharbour City Council, adopted a maximum water level of 1.48 m AHD for a 100 year ARI storm event.

Wave setup is defined as the superelevation of the mean water level caused by wave action alone. The phenomenon is related to the conversion of the kinetic energy of wave motion to quasi-steady potential energy.

The wave setup experienced within the boat harbour is predicted to be negligible since the boat harbour entrance has been extended into sufficiently deep water to comply with non-breaking wave climate criteria established in the original Environmental Impact Statement (EIS) for the boat harbour (Patterson Britton, 2005). Extensive three dimensional (3D) physical model testing undertaken for detailed design of the boat harbour entrance has shown that wave breaking at the entrance would occur for less than 2 hours per year and only then at the inshore side of the entrance (Patterson Britton, 2005).

The above breaking wave conditions are not sufficient for any material component of wave setup to develop within the boat harbour. Accordingly, a reasonable estimate of the 100 year ARI elevated still water level within the boat harbour remains at 1.5m AHD. Since a major component of this level is associated with astronomical tide, typically accounting for 0.9 to 1.0 m AHD, and since astronomical tide is also independent of storm activity, the elevated still water level of 1.5m AHD is not sustainable for a long period of time, ie the high tide will be followed by low tide. Accordingly, the peak water level of 1.5m AHD would occur for a period of less than a few hours around high tide.

Consideration of Sea Level Rise

Consideration was given to sea level rise due to climate change at the time of setting the seawall crest level, although at that time the current planning benchmark levels adopted by the NSW Government were not available, ie 0.4m by 2050 and 0.9m by 2100. This is further discussed below.

Foreshore Design Objectives

An objective of the foreshore design was to have the promenade level as low as practicable to achieve a relationship between the promenade level and water level for the enjoyment of persons using the public domain, which extends around the entire boat harbour perimeter.

Available Adaption Measures

A number of adaption measures are available for the crest of a seawall to mitigate the impacts of increased still water level over time. These include installation of a raised capping stone or similar along the seawall crest, or if necessary a low wall. Boardwalks constructed on the harbour side of the seawall could be increased in level over time if required.

Synthesis of the Above Factors

The available minimum freeboard of 0.5 m between the 100 year elevated still water level of 1.5m AHD and the minimum seawall crest level of 2.0m AHD are essentially fully available to accommodate an amount of postulated sea level rise. The extent of wave action on top of the still water level in the Inner Harbour at times of extreme storms is relatively low, typically less than 0.1 to 0.2 m (Patterson Britton, 2005). In any case, some lapping of waves over the seawall crest for a period of less than a few hours in extreme storms is considered acceptable.

Having regard to the planning benchmark values for sea level rise, temporary inundation beyond the seawall crest in a 100 year ARI storm event (for less than a few hours), for the sections of seawall at the minimum crest level of 2.0 m AHD, would not be expected to occur for some 50 to 60 years into the future. Inundation beyond the seawall crest in the absence of storms, ie due to astronomical tide only plus sea level rise, would not be expected to occur until the next century (beyond 2100). This situation is considered reasonable when such time frames are beyond the life of boardwalk structures (which could be rebuilt at a higher level) and when the crest of seawalls can be increased in level over time.

5. BEACH NOURISHMENT / REHABILITATION MANAGEMENT PLAN

5.1 General

The issue of beach nourishment and / or rehabilitation management was raised in two submissions:

- the submission from Mairi Petersen; who asked:
  - who will pay for the Beach Nourishment / Rehabilitation Management Plan; and,
  - what will happen if the prediction in the WorleyParsons report that “the development would not be threatened by coastal processes over a planning period of 100 years and beyond” is not correct.
- the submission from Shellharbour City Council, who asked:
  - whether the Beach Nourishment / Rehabilitation Management Plan has been reviewed and approved by the appropriate stakeholders and, if so, what agencies were involved; and,
  - who will be responsible (Council or Developer) to implement and fund initiatives recommended in the Plan.

5.2 Need for a Beach Nourishment / Rehabilitation Management Plan

Preparation of a Beach Nourishment / Rehabilitation Management Plan was necessary to address Conditions of Consent clause 15(d)(xi), the original Conditions of Concurrence Clause 3(v) under the *Coastal Protection Act 1979* (March 1998), and the further Conditions of Concurrence (second dot point) for the modified development (September 2007).

The Beach Nourishment / Rehabilitation Management Plan was prepared in two parts, reflecting the Construction Phase of the project and the Operational Phase of the project. The former part of the Plan was included in the Construction Environmental Management Plan (Patterson Britton, 2007a), and the latter part of the Plan was included in the Operation Environmental Management Plan (Patterson Britton, 2007b).

It was a requirement of the Construction Phase Beach Nourishment / Rehabilitation Management Plan (Patterson Britton 2007a) that the Construction Contractor prepare a detailed Beach Nourishment / Rehabilitation Plan for implementation during construction, which took into account the Contractors actual work methods and plant and equipment. This detailed Plan would be included in the Contractor's Site Environmental Management Plan (SEMP).

5.3 Review and Approval of the Beach Nourishment /Rehabilitation Management Plan

It was a requirement of the Conditions of Consent (Clause 15(d)(xi)) that the Beach Nourishment / Rehabilitation Management Plan (construction phase and operational phase) be prepared in consultation with and to the satisfaction of NSW Land and Water Conservation (now Department of Environment, Climate Change and Water (DECCW)).

Furthermore, it was a requirement of the Conditions of Consent (clause 15(a)) that all Environmental Management Plans (EMPs) for the boat harbour, of which the Beach Nourishment / Rehabilitation Management Plan forms a part, be approved by NSW Planning, Infrastructure and Natural Resources (now NSW Planning), in consultation with the Shell Cove Compliance Committee.

The establishment and make up of the Shell Cove Compliance Committee was a Condition of Consent (clause 5(a)). The make up of the Committee was also referred to in the further Conditions of Concurrence. The Committee includes, among other members, a local community representative and a Shellharbour City Council technical officer.

It is a requirement of the further Conditions of Concurrence that a draft of the Beach Nourishment / Rehabilitation Management Plan be lodged with the Shell Cove Compliance Committee prior to commencement of the boat harbour entrance works and that compliance against the Conditions of Concurrence be assessed by this Committee.

It is evident from the above that the Beach Nourishment/Rehabilitation Management Plan (construction phase and operational phase) has been subject to significant review and approval procedures. All of the required review processes and the approval procedures have been met.

5.4 Responsibility for Implementation and Funding of the Beach Nourishment / Rehabilitation Management Plan

Responsibility for implementation and funding of the construction phase Beach Nourishment / Rehabilitation Management Plan rests with the appointed Construction Contractor. This

responsibility would extend to the end of the Construction Contract. The Construction Contractor has not yet been appointed.

In accordance with the further Conditions of Concurrence issued by the then Minister for Climate Change, Environment and Water in September 2007, Shellharbour City Council is responsible for implementation and funding of the operational phase Beach Nourishment /Rehabilitation Management Plan.

5.5 Prediction of Coastal Processes Impacts in WorleyParsons (2009)

The predictions made in WorleyParsons (2009) are considered to follow accepted methodology and to be conservatively based. The report has been reviewed technically by a range of parties, including Shellharbour City Council and consultants on behalf of NSW Planning.

Specific matters raised during the review process have been addressed throughout the letter response herein. The original WorleyParsons (2009) report together with the responses provided herein are considered to provide a sound conservative basis for prediction of coastal processes impacts and management of coastline hazards.

6 GROUNDWATER

6.1 General

The issue of groundwater was raised in two submissions:

- the submission by the NSW Office of Water (Attachment B to NSW Planning letter dated 10 May 2010):
  - this submission outlined the requirements of the NSW Office of Water in relation to basement construction and temporary, semi-permanent and permanent dewatering. The submission is of a guideline nature and does not require a specific response at this time;
- the submission by NSW Planning (Attachment 1 to NSW Planning letter dated 4 June 2010), which was informed by the review report prepared by its external consultant Parsons Brinckerhoff. Two issues were raised:
  - clarify why acid sulfate soils will not become oxidised in the long term and affect groundwater quality;
  - the impacts to groundwater quality should be discussed making reference to the NSW State Groundwater Protection Policy.

6.2 Long Term Oxidation of Acid Sulfate Soils

The acid sulfate soils (ASS) in question are those which would remain insitu under the land platform of the boat harbour development. A Coffey Geotechnics (2009) report which was reviewed by Parsons Brinckerhoff notes that this material would be capped and consolidated (Section 3.2.2). Some explanation as to why this material would not be subject to oxidation in the longer term is provided by Coffey Geotechnics in Section 5.4 of their report. Further explanation is provided in Patterson Britton (2005) which it is apparent Parsons Brinckerhoff did not review.

The capping and consolidation approach for management of insitu ASS under the land platform was developed in collaboration with Dr Ian White of Australian National University, based on

Dr White's successful employment of the methodology for management of insitu ASS in the Tweed area.

Consolidation and capping has the following beneficial effects in the management of the insitu ASS:

- consolidates ASS down the soil profile;
- causes the watertable to rise;
- decreases the rate of transport of oxygen into the soil profile;
- decreases the hydraulic conductivity of the soil;
- increases the capillary fringe thickness above the watertable.

The minimum total thickness of capping material above the insitu ASS would be approximately 2 m, comprising a bridging layer, a drainage layer, general fill, and structural fill. Coffey Geotechnics (2009) confirmed that the consolidation of the insitu ASS which would take place due to the capping material and surcharging would be such that the top surface of the ASS would be below the long term groundwater levels at the site following boat harbour construction, thereby avoiding oxidation. Long term groundwater levels were established from detailed modelling undertaken by Coffey Geotechnics.

Specific geotechnical investigations were conducted onsite under the direction of Dr Ian White to confirm the feasibility of the consolidation and capping proposal for application on the Shell Cove Boat Harbour project. This involved determination of selected properties of the Unit 3B material (the silt/clay ASS material) under an area of historical filling on the site, ie. where capping and consolidation had taken place, to allow comparison with corresponding properties of the Unit 3B material where no consolidation has taken place.

6.3 Impacts to Groundwater Quality

This issue is addressed in a letter by Coffey Geotechnics (2010), included at **Attachment D**.

7 ACID SULFATE SOILS

7.1 General

The issue of acid sulfate soils was raised in the submission by Shellharbour City Council. Council noted that any concept plan approval should give due consideration to how the preloading process and treatment of acid sulfate soils will be staged and managed throughout the life of the project.

Acid sulfate soils were also referred to in the report prepared by Parsons Brinckerhoff on behalf of NSW Planning, but NSW Planning did not identify acid sulfate soils as a key issue in its letter of 4 June 2010. This is likely due to the wealth of information held by NSW Planning on acid sulfate soils at Shell Cove by virtue of their review of the Construction Environmental Management Plan, which contains an Acid Sulfate Soils Management Plan, and their more recent consideration of the s96 application for modification of the acid sulfate soils management at the site.

7.2 Staging and Management of Preloading and Treatment of Acid Sulfate Soils

The long term treatment of the ASS that is left in insitu on the site has been described in the preceding section of this letter, ie. capping and consolidation. The manner in which this process is

staged will depend on the Contractor's final work method and construction programming but is likely to take place progressively over a total period of 3 to 4 years.

The ASS that is excavated rather than left insitu would be managed by a number of techniques:

- excavation and reburial below the Inner Harbour;
- excavation and transport off site to a DECC licensed landfill;
- excavation, neutralisation and beneficial reuse (sandy textured ASS); and,
- excavation, neutralisation and incorporation into landscaped mounds, with interim use as surcharge material (silt/clay textured ASS).

Again the staging of the above activities will depend on the Contractor's final work method and construction programming but is likely to take place progressively over a period of 3 to 4 years. Any short term stockpiling of untreated ASS for subsequent use as surcharge material would be limited to one week, based on the results of bench scale oxidation tests. Daily monitoring would be used to check that the pH of the stockpiles does not lower to unacceptable levels.

The entire process of the management of ASS is the subject of an Acid Sulfate Soil Management Plan and associated Water Quality Management Plan (incorporated within an Environmental Management Plan), and a s96 modification application, all of which require approval of NSW Planning.

The applicant must also obtain an Environment Protection Licence (EPL) from the Department of Environment, Climate Change and Water for construction of the boat harbour. This EPL will include a range of conditions relating to the management of acid sulfate soils to ensure no measurable environmental impact.

In addition to the specific requirements of the EPL, a licensee also has a number of general obligations as set out under the Protection of the Environment Operations Act 1997 and the Regulations made under the Act, including to:

- ensure persons associated with the licensee comply with EPL;
- control the pollution of waters and pollution of air; and,
- report incidents causing or threatening material environmental harm to the environment.

The above approval processes provide significant controls on potential environmental impacts associated with the management of acid sulfate soils at the site.

Potential future disturbance of insitu ASS below the thick capping layer will be investigated and mitigated in compliance with the ASS Manual (Stone et al, 1998). Any disturbance should be minor and limited to deep service trenches.

8 REFERENCES

Coffey Geotechnics (2009), *Shell Cove Boat Harbour Precinct – Concept Application and Environmental Assessment: Appendix D – Geotechnical*, prepared for Australand Holdings Ltd

Coffey Geotechnics (2010), "Re: Shell Cove Boat Harbour Precinct - Acid Sulphate Soils & Groundwater Quality", letter report from Manuel Fernandez to WorleyParsons, 17 September

Manly Hydraulics Laboratory (MHL) (1992), *"Mid New South Wales Coastal Region Tide – Storm Surge Analysis"*, MHL report No 621, Public Works Department, PWD Report No 92098, 2 October, ISBN 0 73059420 3

Patterson Britton (2005), *Shell Cove Boat Harbour Section 96 Modification of Consent 95/133 – Support Information*, prepared for Australand Holdings Ltd and Shellharbour City Council, Issue No 4, December 2005

Patterson Britton (2007a), *Shell Cove Boat Harbour Construction Environmental Management Plant,* prepared for Australand Corporation (NSW) Pty Ltd, Issue No 8, December 2007

Patterson Britton (2007b), *Shell Cove Boat Harbour Operation Environmental Management Plan"*, prepared for Australand Corporation (NSW) Pty Ltd, Issue No 5, December 2007

SMEC (2010), *Shellharbour Coastal Hazard Study*, prepared for Shellharbour City Council, April 2010

Stone, Y, Ahern CR and B Blunden (1998), *Acid Sulfate Soils Manual 1998*, Acid Sulfate Soils Management Advisory Committee (ASSMAC), Wollongbar, NSW

WorleyParsons (2009), *Shell Cove Boat Harbour Precinct – Concept Application and Environmental Assessment : Support Information on Coastal Processes and Water Cycle Management,* prepared for Australand Holdings Ltd and Shellharbour City Council, September 2009

Yours faithfully
WorleyParsons

Review / Verification by Date

..... 17/9/10
Peter Horton, Principal Engineer

Greg Britton
Select Manager, Coastal and Marine (Southern Operations)
WorleyParsons

Attachment A

Figure D.7 from Appendix D of SMEC (2010)

SMEC
SHELLHARBOUR CITY
COASTAL HAZARD STUDY

MAXIMUM WAVE RUNUP
NORTH AND SOUTH
SHELLHARBOUR BEACHES

Figure D.7 – Maximum Wave Runup, North and South Shellharbour Beaches

Attachment B

Figures D.25, D.28 and D.31 (for Shellharbour South Beach) from Appendix D of SMEC (2010)

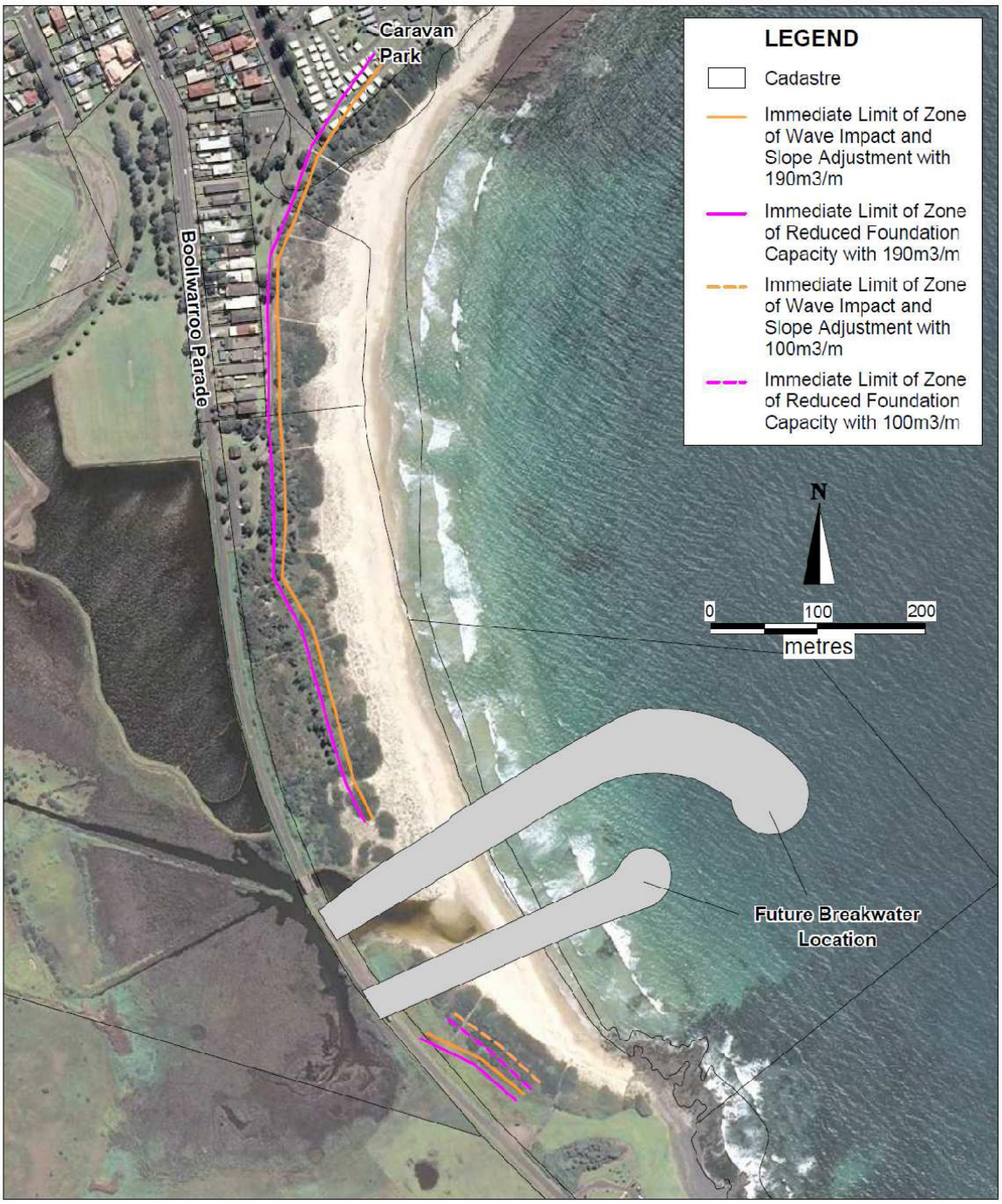

Figure D.25 –Immediate Hazard Zone at South Shellharbour Beach

N.B.: the sensitivity of the hazard mapping to storm bite values of 190m³/m and 100m³/m has been illustrated on the map for the southern end of Shellharbour South Beach. While insufficient data are currently available to determine an accurate storm bite for this part of the beach, wave climate analysis in Appendix F indicates that wave climate is milder at the southern end of the beach than at the northern end and that storm bite is likely to be lower at the southern end.

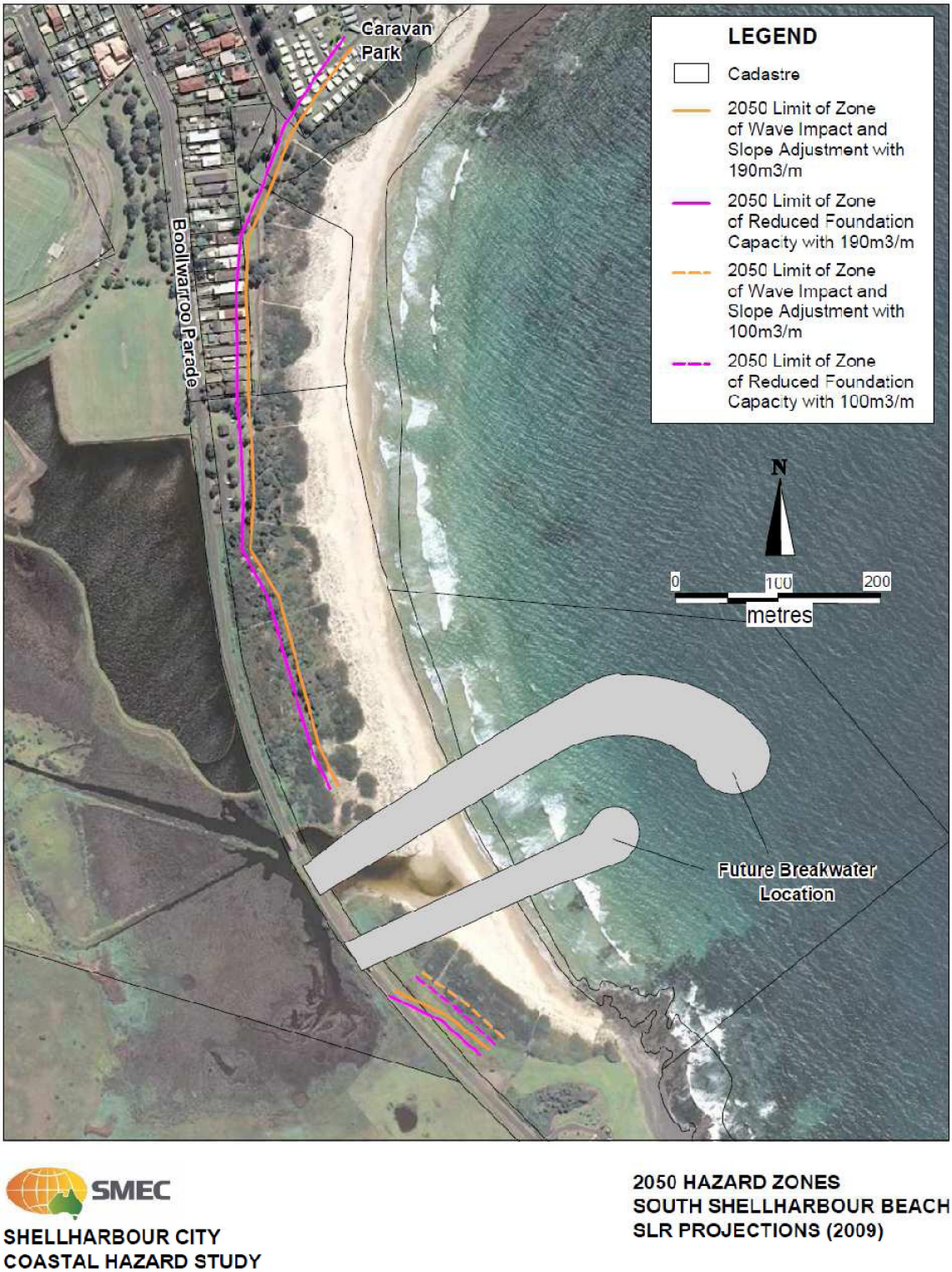

Figure D.28 –2050 Hazard Zone at South Shellharbour Beach

N.B.: the sensitivity of the hazard mapping to storm bite values of 190m³/m and 100m³/m has been illustrated on the map for the southern end of Shellharbour South Beach. While insufficient data are currently available to determine an accurate storm bite for this part of the beach, wave climate analysis in Appendix F indicates that wave climate is milder at the southern end of the beach than at the northern end and that storm bite is likely to be lower at the southern end.

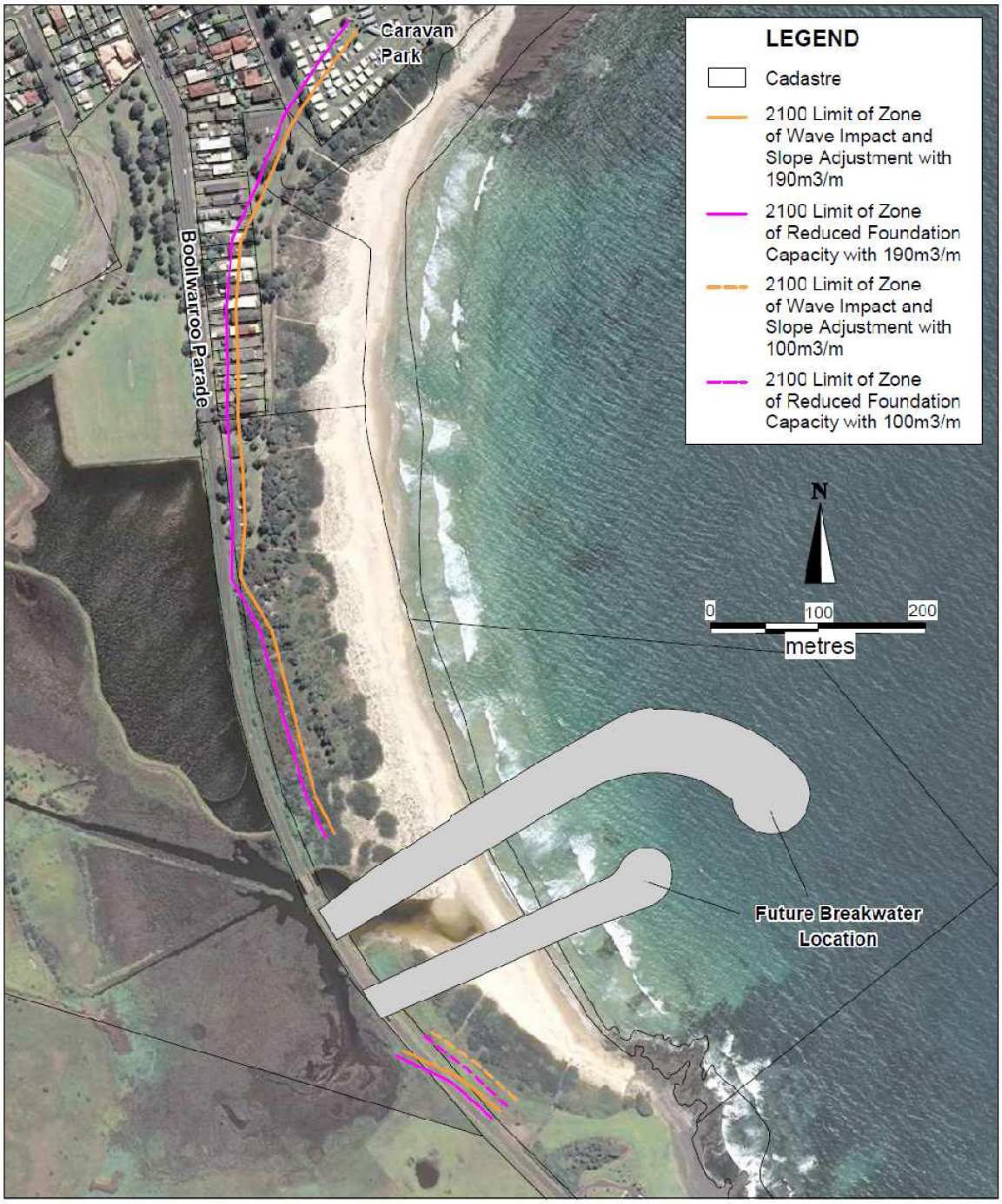

Figure D.31 –2100 Hazard Zone at South Shellharbour Beach

N.B.: the sensitivity of the hazard mapping to storm bite values of 190m³/m and 100m³/m has been illustrated on the map for the southern end of Shellharbour South Beach. While insufficient data are currently available to determine an accurate storm bite for this part of the beach, wave climate analysis in Appendix F indicates that wave climate is milder at the southern end of the beach than at the northern end and that storm bite is likely to be lower at the southern end.

Attachment C

Comparison of Hazard Lines from SMEC (2010) and Environmental Assessment at southern end of Shellharbour South Beach

Figure C1: Comparison of SMEC (2010) and Environment Assessment Immediate Coastline Hazard Lines (at landward limit of Zone of Reduced Foundation Capacity)

Figure C2: Comparison of SMEC (2010) and Environment Assessment 2050 Coastline Hazard Lines (at landward limit of Zone of Reduced Foundation Capacity)

Figure C3: Comparison of SMEC (2010) and Environment Assessment 2100 Coastline Hazard Lines (at landward limit of Zone of Reduced Foundation Capacity)

Attachment D

Coffey Geotechnics (2010) Letter on Groundwater Quality

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

17 September 2010

WorleyParsons
Level 12, 141 Walker Street
North Sydney NSW 2060

Attention: Greg Britton / Peter Horton

Dear Sirs

RE: SHELL COVE BOAT HARBOUR PRECINCT - ACID SULPHATE SOILS & GROUNDWATER QUALITY

At the request of WorleyParsons, Coffey Geotechnics Pty Ltd was requested to provide advice in relation to potential impacts to groundwater quality for the Shell Cove Boatharbour precinct relating to acid sulfate soils (ASS) that will be left insitu in the proposed land platform area.

The NSW State Groundwater Protection Policy is designed to protect valuable groundwater resources against pollution. Based on the locality of the site and its proximity to the sea, the beneficial uses for groundwater are expected to be protection of aquatic ecosystems and recreational use. Other uses are likely to be prohibitive due to the saline nature of the groundwater. It is considered that the proposed capping and consolidation management approach (as assessed by Dr Ian White) would result in the top surface of the ASS being below the long term groundwater levels at the site following boat harbour construction, hence avoiding oxidation. Therefore, significant changes to existing groundwater quality would not be expected from oxidation of ASS left below the land platform.

We trust this information is suitable for your present needs. Please do not hesitate to contact the undersigned if you have any questions.

For and on behalf of Coffey Geotechnics Pty Ltd

Manuel Fernandez

Associate Environmental Engineer

Coffey Geotechnics Pty Ltd ABN 93 056 929 483
118 Auburn Street Wollongong NSW 2500 Australia
PO Box 1651 Wollongong NSW 2500 Australia
T (+61) (2) 4201 1400 F (+61) (2) 4201 1401 coffey.com