



# WorleyParsons

resources & energy

Incorporating

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BBK Development Corporation Pty Ltd  
PO Box 79  
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Dear Sir,

## **45 HEARNS LAKE ROAD WOOLGOOLGA, UPDATED CLIMATE CHANGE ESTIMATES AND EFFECT ON COASTLINE HAZARDS**

### **1. BACKGROUND**

In October 2004, Patterson Britton & Partners (now incorporated into WorleyParsons) completed the report "45 Hearns Lake Road Woolgoolga, Coastline Hazard Definition and Lake Entrance Processes", Issue No. 3. This report was included in a Masterplan Application (No. 22-11-2003) to the Department of Planning for a 51 lot subdivision of the subject property.

In March 2008, Barry Mann from BBK Development Corporation advised that the following comments had been received from the Department of Planning in relation to coastal processes:

- "The EA [Environmental Assessment] does not consider the latest climate change scenarios. Reference should be made to the latest Intergovernmental Panel on Climate Change [IPCC] Report: The AR4 Synthesis Report, 'Climate Change 2007', released November 2007. The Coastline Hazard report and the Stormwater Quality Management Strategy should be updated accordingly.
- In particular further comment is needed on how the design of this proposal responds to likely impacts resulting from predicted sea level rise and intensity of rainfall events."

Our response to the above comments that relate to coastal processes is set out herein.

### **2. LATEST CLIMATE CHANGE SCENARIOS**

In our 2004 report, sea level rise estimates due to climate change were based on the Third Assessment IPCC reports (IPCC, 2001a, b), the latest IPCC reports available at that time. The adopted sea level rises at 2054 and 2104 were 0.2m and 0.5m respectively, consistent with the IPCC (2001b) predictions for the upper limit of the average of all 35 emission scenarios tested. It was also noted in our 2004 report that future sea level rise could be much smaller or larger than predicted.

As well as sea level rise, another potential outcome of climate change is an increase in the frequency and intensity of coastal storm events and changes in wave directions. In our 2004 report, we noted these effects were not able to be quantified at that time, but that a generally



conservative approach had been used in the estimation of other coastline hazards to account for this uncertainty.

The most recent (Fourth Assessment) IPCC estimates of future sea level rise were released in 2007 (IPCC, 2007; Meehl et al, 2007). There are only relatively minor differences between the sea level rise estimates presented in the Third and Fourth IPCC Assessments, and it still remains difficult to confidently quantify other climate change effects.

To take account of sea level rise and other climate change effects in relation to the latest IPCC report, the Department of Environment and Climate Change [DECC] (2007) have recommended that the sensitivity of sea level rise scenarios of 0.18, 0.55 and 0.91m are considered where a 100 year planning period is relevant.

Two of these three scenarios have essentially already been considered in our 2004 report, with the previously adopted sea level rises of 0.2m and 0.5m close to 0.18 and 0.55m. It remains to consider the coastline hazards relating to the highest estimate sea level rise of 0.91m over a 100 year planning period, as discussed in Section 3.

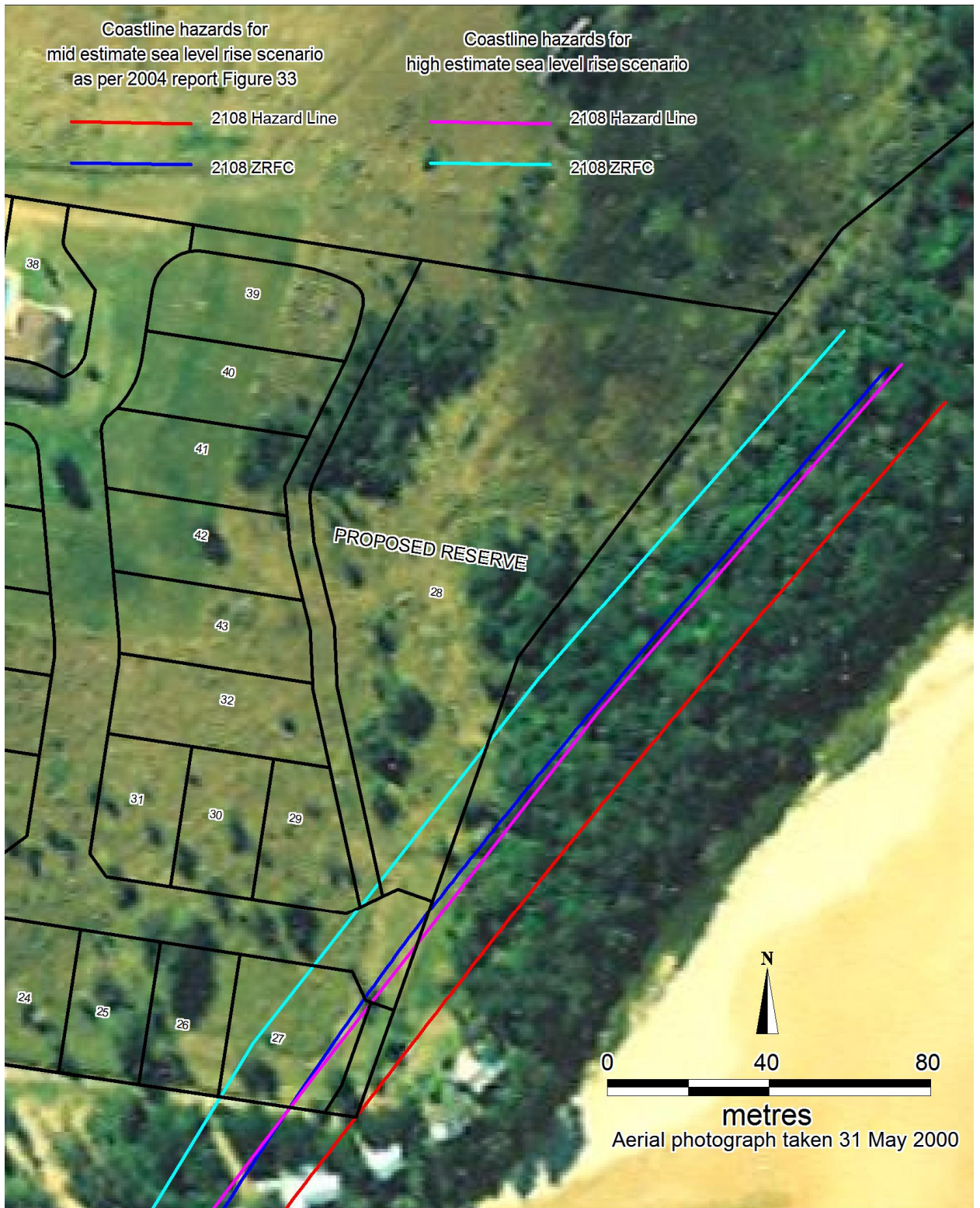
### 3. COASTLINE HAZARDS FOR HIGHEST ESTIMATE SEA LEVEL RISE

In Figure 33 of our 2004 report, the 2104 Hazard Line and Zone of Reduced Foundation Capacity (ZRFC) at the subject property were presented. This was based on a sea level rise of 0.5m. An update of this Figure 33 is below as **Figure 1**, with addition of the 2108 Hazard Line and ZRFC relating to the highest estimate sea level rise of 0.91m<sup>1</sup>. These high estimate lines are about 14.3m landward of the mid estimate lines, based on a setback of 16.4m for sea level rise variation, but discounted by 2.1m as per Section 6.4.3 of the 2004 report<sup>2</sup>.

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<sup>1</sup> Given the uncertainty and inherent conservatism in considering this scenario, note that the 2104 and 2108 years are essentially interchangeable for hazard estimation. That is, the previous 2104 estimate can now be considered to be a 2108 estimate. Also note that the subdivision layout has altered since our 2004 report, with the latest layout being shown in Figure 1.

<sup>2</sup> The 16.4m value was derived as 0.41 times 40, with the latter being the inverse slope of the active beach profile in the Bruun Rule. The discounting for historical sea level rise is appropriate given that the only reason that the discounting was not applied in our 2004 report was to partially account for the range of sea level rise estimates, and the 0.91m sea level rise value is essentially an upper bound.



**Figure 1: 2108 Hazard Line and ZRFC at subject property for mid and high estimate sea level rise scenarios**



## 4. IMPLICATIONS WITH REGARD TO DEVELOPMENT

The conclusions of our 2004 report remain unaltered. That is, given that the 2108 Hazard Line is seaward of the subject property for a mid estimate sea level rise and 100 year planning period, the location of the proposed development is considered to be reasonable from a coastal engineering perspective.

If the Department of Planning considers that it is appropriate to apply the high estimate sea level rise and 100 year planning period, then again the overall subdivision and development is generally considered to be acceptable from a coastal engineering perspective.

However, the 2108 Hazard Line (for high estimate sea level rise) intersects the seaward portion of Lot 27. Although it is considered that it is reasonable for development to occur on this Lot at this time (given the long time frame for this hazard to be realised, and conservative and short-term<sup>3</sup> nature of the hazard), it is recommended that there is consideration of some restrictions on development on this Lot<sup>4</sup>. These could include:

- setting back development at Lot 27; and,
- requiring special foundations (such as piling) for residential building development at Lot 27 to take account of the ZRFC as per Nielsen et al (1992).

These restrictions do not necessarily have to be applied now. For example, the risk of future coastline hazards at Lot 27 could be recognised through inclusion of coastline hazard information on a Section 149 certificate associated with the property, without any actual development restrictions at this time. In the context that the design life of residential structures is about 40 years<sup>5</sup>, a reassessment of the coastline hazard risks at the subject property can be made in about 40 years time (which may lead to restrictions being applied on future development in this area) without compromising the proposed development before then.

It is considered to be prudent to locate services assets (such as water and sewer mains, and telephone and electricity cables) landward of the 2108 Hazard Line based on high estimate sea level rise, since there is the opportunity to do so and still service all lots in the proposed subdivision.

There are not considered to be any particular coastal engineering requirements for the road turning circle between Lots 27 and 29, given that it is only just intersected by the 2108 Hazard Line based on high estimate sea level rise.

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<sup>3</sup> The Hazard Lines do not represent future shorelines, but the position of the back beach erosion escarpment after a severe storm, after 100 years of recession associated with sea level rise.

<sup>4</sup> These would typically be applied as part of the Local Environmental Plan or a particular Development Control Plan.

<sup>5</sup> A 50 year planning period is usually adopted for residential development in accordance with industry practice. This is commensurate with the typical economic life of a residential structure. The cost of new residential development is amortised for tax purposes over 40 years (Adamantidis and Nielsen, 2004).



## 5. CONCLUSIONS

Based on the latest IPCC climate change scenarios, the 2108 Coastline Hazard Line is entirely seaward of the subject property for low and mid estimate sea level rise values. For high estimate sea level rise, the 2108 Coastline Hazard Line intersects the seaward portion of Lot 27, with a Zone of Reduced Foundation Capacity also affecting the majority of the Lot for this upper bound scenario.

On this basis, the location of the proposed development is generally considered to be reasonable from a coastal engineering perspective.

Although it is considered that it is reasonable for development to occur at Lot 27 at this time, it is recommended that there is consideration of some restrictions on development on this Lot, such as setbacks and special foundation requirements. These restrictions do not necessarily have to be applied now. For example, the risk of future coastline hazards at Lot 27 could be recognised through inclusion of coastline hazard information on a Section 149 certificate associated with the property, without any actual development restrictions at this time.

## 6. REFERENCES

Adamantidis, CA and AF Nielsen (2004), "Callala Beach Coastal Hazard Study", *Report No. 31434-002*, prepared by SMEC Australia for Shoalhaven City Council, August

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## 7. SALUTATION

If you have any further queries, please do not hesitate to contact the undersigned or Peter Horton.

Yours faithfully  
**WorleyParsons**

Greg Britton  
Manager, Coastal and Marine  
WorleyParsons

Review / Verification by                      Date

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Peter Horton, Principal Engineer