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NSW Department of Planning

Albion Park Flood Review Supplementary Report

March 2008



Contents

1.	Introduction	1
2.	Available Information	2
3.	Review Comments	3
3.1	Overview	3
3.2	Additional Comments	6
4.	Conclusions and Recommendations	8



1. Introduction

GHD was commissioned by the NSW Government of Planning to review the flood issues relating to the proposed Illawarra Regional Business Park development by Delmo Albion Park Pty Ltd at 78 Tongarra Road Albion Park adjacent to the existing Albion Park Airport. The review report was completed in February 2008.

This supplementary report was prepared to finalise the issues raised in the February Report. It takes into account additional information requested by GHD and provided by the consultants working on behalf of Delmo Albion Park.

The additional information provided for this supplementary review is listed in Section 2. Our review comments are summarised in Section 3. The conclusions and recommendations are provided in Section 4.



2. Available Information

The following additional documents and information were provided for this supplementary review. This was in addition to the reports provided for the initial review:

- **Reference 1:** Flood Modelling Report, Land Adjacent to Albion Park Airport (Response to GHD Review), Rienco Consulting for Jordan Mealey Consulting Engineers, February 2008, provided to GHD by Costin Roe Consulting on 22 February 2008;
- **Reference 2:** Extension to Albion Park Flood Study for Council of Municipality of Shellharbour, Final Report, Kinhill, June 1993, provided to GHD by Costin Roe Consulting on 26 February 2008;
- **Reference 3:** A Review of Flooding at the Corner of Terry St and Tongarra Rd, Albion Park for Mobil Oil Australia, Forbes Rigby Pty Ltd, May 1995, provided to GHD by Costin Roe Consulting on 26 February 2008; and
- **Reference 4:** Flooding Modelling Report, Land Adjacent to Albion Park Airport (Response to GHD Review – Addendum 1), Rienco Consulting for Jordan Mealey Consulting Engineers, March 2008, provided to GHD by Costin Roe Consulting on 5 March 2008.

The following meetings were also held to provide further clarifications and background information:

- 15 February 2008 (Grant Roe of Costin Roe Consulting, Glenn Mealey of Jordan Mealey & Partners, Ricky Kwan and Rainer Berg of GHD);
- 22 February 2008 (Ted Rigby of Rienco Consulting, Glenn Mealey of Jordan Mealey & Partners, Grant Roe of Costin Roe Consulting, Ricky Kwan of GHD).



3. Review Comments

3.1 Overview

For the purposes of this review, it is considered that there are two primary flood related issues of importance to this development application, which are summarised as follows:

- Design 1% AEP flood level for the site; and
- Proposed creek realignment works.

These aspects and background information are discussed below.

3.1.1 Design 1% AEP Flood Level

The appropriate design 1% AEP flood level at the site is crucial in that it would impact on the extent of development that can be carried out and the amount of fill that would be required.

Council does not currently have a flood planning level for the area. However, based on our discussions with Council staff, we understand that Council is currently preparing to commission a flood and floodplain management study for the area.

Kinhill Engineers completed the previous most recent flood study for this area in 1993 and adopted a design flood level of 7.5m near the airport east west runway.

Rienco Consulting undertook a flood study for the proposed development (February and April 2007) and established a new design flood level of 6.6m near the airport east west runway.

A number of issues were raised during review by GHD and additional information was requested. GHD recommended that a conservative 1% AEP design flood level consistent with the previous lowest estimate of 7.5m AHD would be appropriate, pending the outcome of Council's investigations and resolution of those issues.

Following GHD's review, further clarifications have been provided by Rienco Consulting, Jordan Mealey Consulting and Costin Roe Consulting (References 1, 2, 3 and 4). At a meeting on the 22 February 2008, Ted Rigby (previously Forbes Rigby, now Rienco Consulting) contended that the water level of 7.5m adopted by Kinhill Engineers was incorrect. Apparently, that information was requested over the phone by Kinhill Engineers and provided over the phone by Forbes Rigby. Ted Rigby indicated that he personally provided that information to Kinhill Engineers while he was at Forbes Rigby, but had misunderstood the location Kinhill requested the information for. It appears that this was the reason Kinhill Engineers ended up adopting a design flood level of 7.5m near the airport in their 1993 flood study.

Rienco Consulting also provided further clarifications and additional supporting data in their Addendum dated 5 March 2008 (**Reference 4**), as requested at the 22 February 2008 meeting.



Based on the above additional information provided, the following findings are made in relation to the design 1% AEP flood level at the site:

- It is accepted that Kinhill's (1993) design 1% AEP flood level of 7.5m AHD assumed for this site has no basis on its own and was qualified by a number of assumptions. It is also apparent that Macquarie Rivulet and Frazers Creek were modelled as separate 1D creek systems rather than a combined floodplain system, which would (the former) result in higher creek flood levels.

The additional information provided (**References 1 and 4**) also supports the view that the modelling assumptions adopted by Rienco are acceptable. This relates to the EDS technique used, sensitivity of the model to tailwater conditions, and consistency of the results with those from other studies undertaken in the Illawarra region.

On this basis it is recommended that the 1% AEP design flood level of 6.6m AHD reported by Rienco, for existing conditions near the airport east-west runway, be accepted as valid.

- It is noted that while a 1% AEP flood level of 6.6m AHD (existing conditions) has been referred to for the purposes of our discussions, this applies mostly to locations near the airport east-west runway. It must be noted that within the overall site area, the existing 1% AEP flood level at Frazers Creek East is not constant but ranges from 6.6m AHD at the runway to 8.2m AHD immediately downstream of Tongarra Road (Appendix G1, Rienco for Jordan Mealey Consulting, April 2007).
- It is noted that under proposed post-development conditions, the existing 1% AEP flood levels are estimated to increase by about 40-55 mm near the runway, and up to 109-365 mm near Tongarra Road (Appendix D1, Flood Modelling Report, Post Development Conditions, Rienco, February 2007).
- It is noted that under existing conditions, for the Probable Maximum Flood (PMF) event, the flood levels are estimated to range from 8.1m AHD near the runway to 8.5m AHD just downstream of Tongarra Road (Appendix C2, Flood Modelling Report, Rienco, April 2007). Under post-development conditions, the existing PMF flood levels are estimated to increase by about 30 mm near the runway, and by up to about 100 mm just downstream of Tongarra Road (Appendix C2, Flood Modelling Report, Rienco, February 2007).
- It is noted that Rienco's modelling work was calibrated to the June 1991 flood event, which was then used to predict the 1% AEP event. The discharges for the 1% AEP event are about 3 times higher than those of the June 1991 event. Thus while the calibrated model is expected to be reliable in predicting flows within a similar range to that of the June 1991 event, it is stressed that its reliability cannot be certain when extrapolated to cover flows 3 times larger.

Nevertheless, it is considered that Rienco's results may be adopted on the basis that it represents the most current information that is available.

- GHD is not privy to Shellharbour City Council's detailed plans for a flood and floodplain study other than their advice that they are in the process of



commissioning the study. Presumably, Council would use the results of their flood study to establish the 1% AEP flood planning level for the area. Until the study is completed and all available information assessed, it is not clear at this stage whether Council's results for the site would be entirely consistent with those of Rienco's.

Unless shown otherwise and supported by new information, however, it is considered that Rienco's results are reasonable and may be adopted for the purposes of the proposed development.

3.1.2 Proposed Creek Re-Alignment Works

Issues relating to the proposed creek realignment works have been raised in GHD's review report (February 2008) and discussed at the 15 February and 22 February 2008 meetings. Grant Roe from Costin Roe Consulting indicated on the 22 February 2008 that another consultant is currently working on these aspects. It is noted that no other information has been provided to GHD at this stage in relation to those issues.

Notwithstanding the issues raised, it is considered that the realignment works can be engineered to minimise any adverse impacts on erosion and deposition patterns, and creek stability, if properly designed.

It is recommended that the design of the proposed creek re-alignment works, including the landscaping and riparian corridor system, satisfy the following requirements:

- That the works do not trigger any instability in the river system, including lateral and plan-form meander migration, bed and bank erosion, and headcut erosion;
- That the works do not result in any adverse changes in existing flow, sediment erosion and deposition patterns;
- That the works do not result in any adverse impacts in existing and upstream flood levels;
- That the full range of flows, including the lower flows, channel dominant discharge, bankfull discharge, and higher flows, are taken into account in assessment of the impacts on stream morphology;
- That the works do not result in any adverse redistribution or increases in flow velocities near its vicinity;
- That the design demonstrates the application of principles for the design of environmentally sustainable channels; and
- That potential maintenance issues are adequately addressed.

It is considered that the above requirements may be stipulated as a condition to any approvals granted.



3.2 Additional Comments

Some additional comments are provided in Table 1 below. It is considered that these comments are unlikely to impact on the primary findings discussed in Sections 3.1.1 and 3.1.2.

Table 1: Additional Comments

Item	Report Section	Comments
1	Reference 4, Discharge Ratios	<p>In Table 7.2.2 of the Flood Modelling Report (Rienco, Existing Conditions, April 2007), the PMF to 1% AEP ratios range from 1.97 (Sunny Bank Gauge Site) to 2.24 (Princes Highway Gauge Site, PMF flow corrected to 3239 m³/s as per Reference 1).</p> <p>The present results are at the lower end of the scale relative to those presented for the other Illawarra catchments (Table 1, Reference 1). However, they are within a similar range and the present results are therefore considered to be acceptable.</p> <p>It is noted that in Table 1 (Reference 1), the PMF and 1% AEP discharges presented for Fairy Creek are in typographical error.</p>
2	Reference 4, EDS Envelope Sensitivity	<p>A number of inconsistencies exist in the results and additional information provided.</p> <p>On page 58 of the Flood Modelling Report (Rienco, Existing Conditions, April 2007), it is stated that "A burst of 9 hrs, embedded in the 36 hr envelope was found to maximise flows within the study area". On page 62 of the same report, it is stated that "...The 9 hr burst embedded within the 36hr envelope storm was found to generate maximal discharge in the mainstream of Macquarie Rivulet adjacent to and downstream of the proposed development site". Similarly, on page 58 (2nd dot point, PMP bursts) it is stated that the PMF embedded design storm used was a 36hr, 500 year ARI storm.</p> <p>However, in Reference 4 (page 5), it is now stated that the adopted EDS combination is the "3 hr PMP burst in a 36hr 100 year envelope" (also Reference 1, page 9, item 8, Q=3239 m³/s and Reference 4, page 5, Q=3230 m³/s).</p> <p>It is recommended that these reports be updated to be consistent.</p> <p>However, on the basis of the information provided for the various design storm combinations for the EDS method, the existing results are shown to be sufficiently conservative and are therefore acceptable.</p>
3	Reference 4, Lake Tailwater Sensitivity	<p>Based on the results presented, the Macquarie Rivulet flood levels near the proposed site are found to be not particularly sensitive to water levels in the lake (up to the 1% AEP lake level) under design 1% AEP flood conditions.</p> <p>On this basis, it is considered that Rienco's results presented in the Flood Modelling Report (April 2007) are acceptable and that further sensitivity testing of lake water</p>



Item	Report Section	Comments
		levels is not necessary.
4	Macquarie Rivulet 1% AEP flow at Mansons Bridge (Main J), page 63, Flood Modelling Report (Rienco, April 2007) and Reference 1	<p>The 1% AEP flow at this location (see Appendix C1, Flood Modelling Report, April 2007) is presented as 818 m³/s.</p> <p>In the Kinhill Report (Reference 2, Figure 4.1 and Table 4.6, location D7), the 1% AEP discharge from the RAFTS model is found to be 1403 m³/s.</p> <p>From Appendix C1 and Figure 4.1, it appears that the above locations (Main J and D7) refer to about the same location, and it is therefore surprising that the design flows differ by about 70%.</p> <p>Unless the locations are somewhat different, the reasons for the above discrepancy are not clear at this stage.</p> <p>However, based on the comparison of flows presented in Reference 1 (page 6), it is concluded that the present model discharges are reasonable and consistent with those from other past studies.</p>
5	Creek re-alignment works GHD February 2008 Review Report (items 11, 12, 22)	<p>No further information has been provided to address the issues raised in the review report (GHD, February 2008).</p> <p>It is noted that details of the proposed creek-realignment works may be provided as a condition of any approvals granted.</p>
6	Flood Free Access (GHD February 2008 Review Report, item 25)	<p>It is noted that the proposed development layout does not currently provide for safe vehicular access during an extreme or PMF event (Appendix G2, Flood Modelling Report, Rienco, April 2007).</p> <p>This limitation may result in some potential issues with State Emergency Services.</p>
7	Cumulative impacts (GHD February Review Report, Item 19)	<p>The flood level increase resulting from the proposed development has been estimated to be between 32-60mm. Future filling is estimated to raise 1% AEP flood levels by less than an additional 5mm. For the PMF event, the flood levels are estimated to increase locally by up to a further 200 mm at the western platform crest (Supplementary Report on Flood Impacts of Filling Additional Land, Jordan Mealey & Partners, 23 November 2007).</p> <p>The above increases are not considered to be unreasonable. However, these impacts, as well as other potential floodplain filling scenarios, would need to be referred to the approval authorities, including Council, the Department of Planning, the Department of Environment and Climate Change, and the Department of Water and Energy to establish the extent of flood level increase that is acceptable.</p>



4. Conclusions and Recommendations

It is concluded that the additional information provided for this supplementary review are sufficient to support the findings presented in the Flood Modelling Reports (Rienco, February 2008 and March 2008).

On the basis of the available information, and under existing conditions, it is recommended that the 1% AEP design flood level of 6.6m AHD estimated near the airport east-west runway be adopted. It is noted, however, that within the overall site area, the 1% AEP design flood level ranges from 6.6m AHD near the runway, to 8.2m AHD immediately downstream of Tongarra Road.

Under post-development conditions, the 1% AEP flood levels are estimated to increase by about 40-55 mm near the runway, and by up to 109-365 mm immediately downstream of Tongarra Road.

Under existing conditions for the Probable Maximum Flood (PMF) event, the flood levels are estimated to range from 8.1m AHD near the runway, to about 8.5m AHD just downstream of Tongarra Road.

Under post-development conditions, the existing PMF flood level is estimated to increase by about 30 mm near the runway, and by up to about 100 mm just downstream of Tongarra Road.

It is recommended that the design of the proposed creek re-alignment works, including the landscaping and riparian corridor system, takes into account the issues raised in the review report (GHD, February 2008) and satisfy the following requirements:

- That the works do not trigger any instability in the river system, including lateral and plan-form meander migration, bed and bank erosion, and headcut erosion;
- That the works do not result in any adverse changes in existing flow, sediment erosion and deposition patterns;
- That the works do not result in any adverse impacts in existing and upstream flood levels;
- That the full range of flows, including the lower flows, channel dominant discharge, bankfull discharge, and higher flows, are taken into account in assessment of the impacts on stream morphology;
- That the works do not result in any adverse redistribution or increases in flow velocities near its vicinity;
- That the design demonstrates the application of principles for the design of environmentally sustainable channels; and
- That potential maintenance issues are adequately addressed.

It is recommended that the above requirements be placed as a condition to any approvals granted.



It is recommended that the provisions for flood free access to the northern section of the proposed development be reviewed in consultation with State Emergency Services.

It is recommended that the extent of flood level increase acceptable, under proposed development conditions and future floodplain filling scenarios, be referred to other authorities, including Shellharbour City Council, the Department of Environment and Climate Change, and the Department of Energy and Water, for comment and acceptance prior to any approvals granted by the Department of Planning.

It is recommended that the typographical errors and inconsistencies in the Flood Modelling Reports (Rienco, March and April 2007) highlighted in the reviews be corrected and updated in those reports.



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