Appendix 18
Flood Modelling

DHI Water and Environment Pty Ltd

September 2007

Warner Industrial Park Concept Plan and Project Application

Precinct 14 WEZ

Sparks Rd and Hue Hue Rd
Warnervale
June 2008

80
TERRACE
TOWER
GROUP

Warner Business Park Pty Ltd
Part of the Terrace Tower Group

Peter Andrews + Associates Pty Ltd
architecture planning urban design

DHI Water and Environment Pty Ltd
PO Box 626
Broadway NSW 2007

Phone +61-2-92135700
Fax +61-2-92135701

Our Ref: 50470/002/gps

Date: 14 Sep 2007

TREHY INGOLD NEATE
PO Box 3205
Tuggerah NSW 2259

Attention: Mr Peter Ingold

Dear Peter,

Re: Wyong Employment Zone Precinct 14 – Further Flood Modelling

Introduction

DHI Water and Environment Pty Ltd (DHI) was engaged by Trehy Ingold Neate (TIN) to undertake further model testing of proposed channel shapes for the "F2" flow channel in Precinct 14 of the proposed Wyong Employment Zone (WEZ).

Precinct 14 is about 130 hectares in size and is located in the upper reaches of the Buttonderry Creek catchment immediately north of the Sydney-Newcastle F3 Freeway. The floodplain area on Precinct 14 is presently inundated by broad, shallow overland flows under flood conditions. This analysis extended previous investigations by testing different channel conveyance and floodplain storage scenarios within Precinct 14. The aim of this analysis to being to minimize the impact of development on existing flood levels immediately adjacent to the Sydney – Newcastle freeway embankment and on the proposed properties within the Precinct subdivision development. The analysis considered:

- Revised channel cross sections on the "F2" channel as suggested by TIN. Channel shapes were provided in document "Project Number 19426;Drawing No MC01 and Revision A"; and
- Development options also include compensatory flood storage area in the downstream end of the "F2" catchment adjacent to the freeway embankment.

Investigation of Development Options

The key objectives for this investigation were to:

1. Assess the capacity of channels with new cross-sections on catchment F2; and
2. Investigate the impact of flood storage on the flood levels along F2.

The investigation was performed using the existing Mike 11 hydraulic model for the area. The basis for comparison of the current modelling was the development scenario for new cross-section and the Existing Case as described in DHI's 2006 report (Wyong Employment Zone – Additional Flooding Assessment – Final Report for Wyong Shire Council).

Results

1. New Cross-Section Options on F2

Three proposed design cross-section options (see Appendix A) were tested. The design cross-section options for the channel F2 are introduced from chainage 140 to 910m at invert levels assumed from the existing topography. For each of the cross-sections, three Manning's roughness coefficients were tested.

Channel condition	Manning's "n" Roughness coefficient
Short grass (e.g. maintained monthly)	0.030
Longer grass/reeds (maintained less frequently e.g. half - yearly)	0.060
Overgrown i.e. not maintained	0.080

The model was run for both 1% AEP 2hr and 9hr events. The resulting maximum water levels from these two events are reported. The results are presented in Appendix A, Tables A1 – A6 for cross-section Options A, B and C respectively.

The longitudinal profiles along channel "F2" for the three cross-section options are also depicted in Figure 4, Figure 5 and Figure 6 where a Manning's roughness of 0.06 is used for the results in these profiles.

The results of the model analysis show that either of cross section Option A or C will be able to pass the 1% AEP flood within the allotted "F2" channel corridor with a channel roughness of 0.060. The channel width is exceeded in some areas for Option B at this roughness value.

The road surface in Option A, which slopes continuously towards the channel, will be significantly inundated under 1% AEP conditions. The road would however be passable to traffic with depths typically less than 0.2m on the high side of the road.

In Option C, floodwaters are largely confined to the channel under 1% AEP conditions. With the road surface largely free of floodwaters road traffic passage would be safest for this option.

For all cross-section options, the concrete edge beam of the road is flooded with a maximum depth of 0.83m (cross-section Option A – Table A1). However, the maximum flooded depth on the concrete edge beam for cross-section Option C is no more than 0.27m depth in a local area near chainage 770m (Table A5).

Results also indicate that a channel roughness of 0.03 reduces the flood levels compared to the other roughness values tested. An un-maintained channel with a roughness value of 0.080 produces significantly higher flood levels in some parts of the channel indicating that regular channel maintenance will be necessary.

2. ***Additional Storage at the South-East Corner adjacent to the Freeway Embankment***

Compensatory flood storage is proposed for the south-east corner of Precinct 14, adjacent to the Freeway embankment with the aim of minimizing the flood levels along the channel F2. The results are shown in Table A2 for cross-section Option A and Table A4 and Table A6 for cross-section option B and C respectively. The model testing showed the proposed storage reduced the maximum flood level in the downstream parts of the F2 channel for all options. With the storage in place, flood levels adjacent to the Freeway embankment are expected to reflect the levels for the existing (undeveloped) floodplain i.e. the analysis shows that the proposed development will have negligible impact over existing 1% AEP flood levels immediately adjacent the Freeway embankment

Yours faithfully
DHI Water and Environment Pty Ltd

Grantley Smith
State Manager
Personal Email: gps@dhigroup.com

Appendix A Figures and Tables

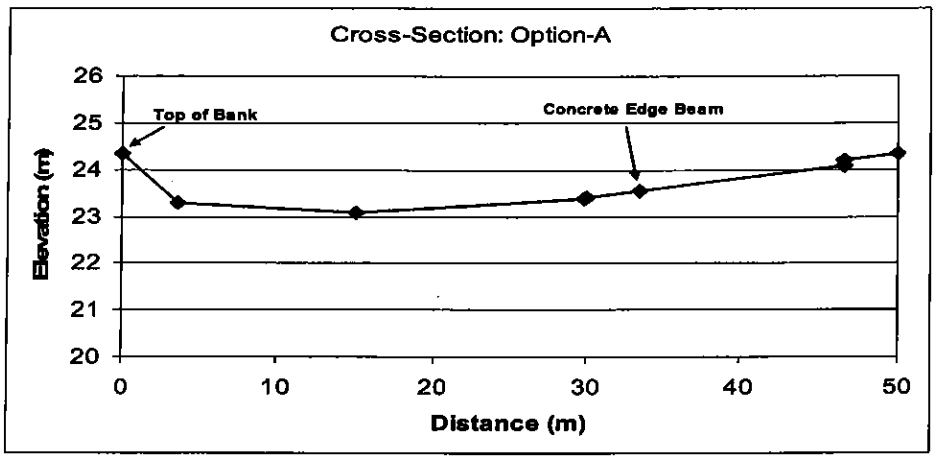

Figure 1 Design Cross-Section Option A at Chainage 140m

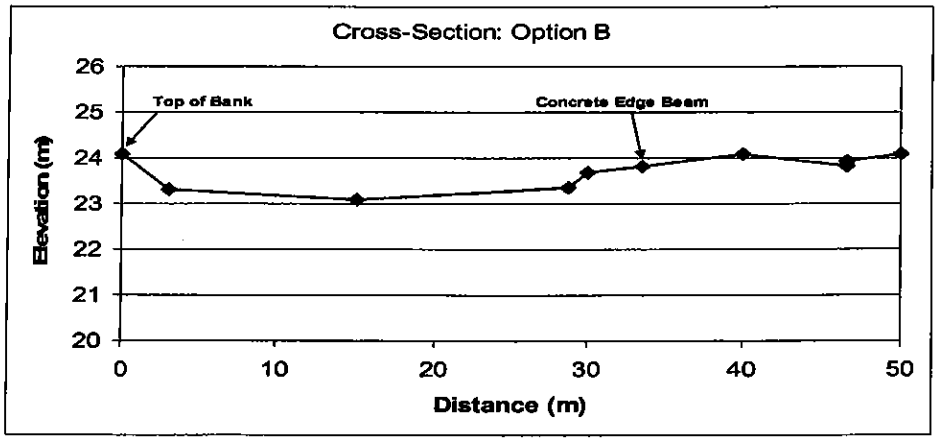

Figure 2 Design Cross-Section Option B at Chainage 140m

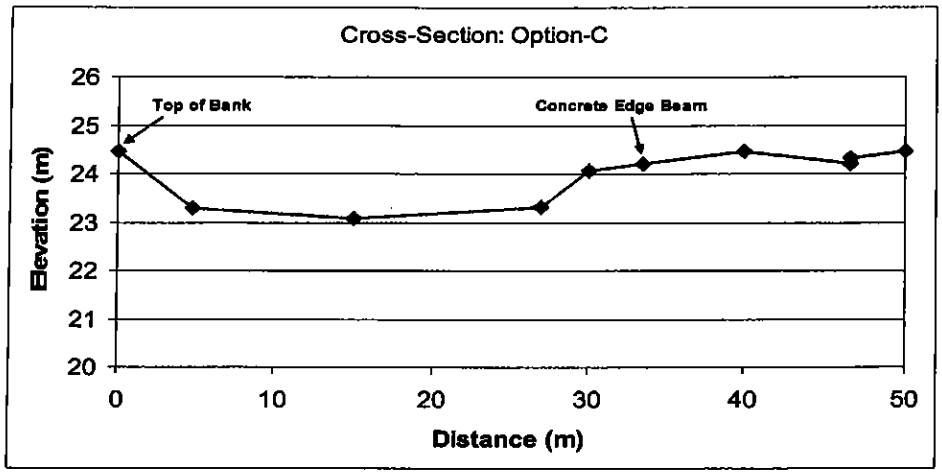

Figure 3 Design Cross-Section Option C at Chainage 140m

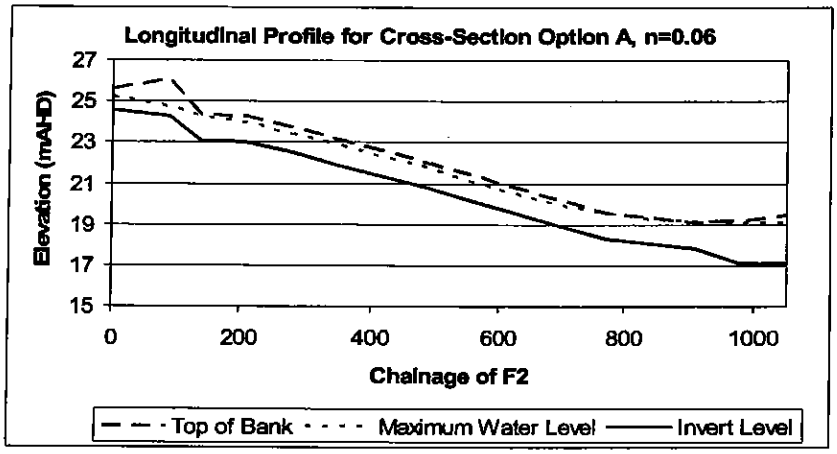

Figure 4 Longitudinal Profile for Cross-Section A with Manning's n 0.06

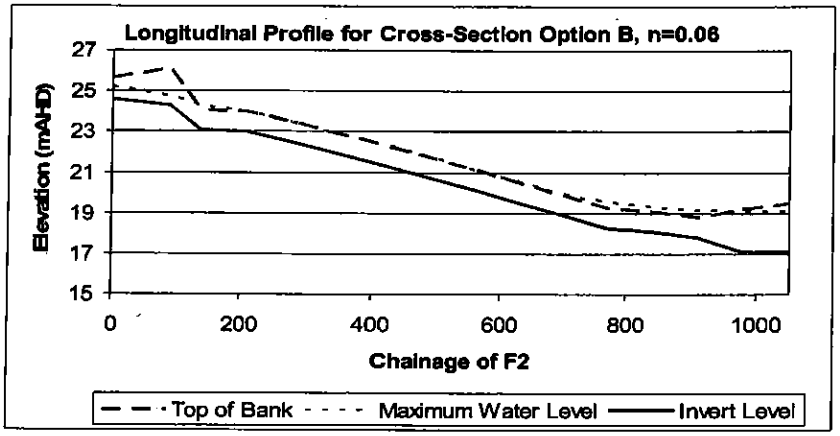

Figure 5 Longitudinal Profile for Cross-Section B with Manning's n 0.06

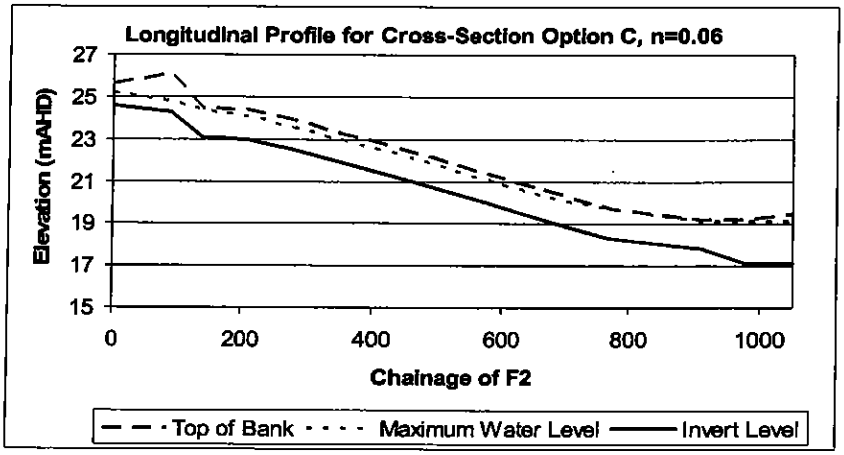

Figure 6 Longitudinal Profile for Cross-Section C with Manning's n 0.06

Table A1 Comparison of Flood Levels for Cross-Section A

Model Location	New Cross-Section Option A, (mAHD)								
	Top of Bank (TOB)	Concrete Edge Beam (CEB)	Existing Case	n=0.08	n=0.06	n=0.03	TOB-Option A (n=0.06)	CEB-Option A (n=0.06)	Option A (n=0.06)-Existing Case
F2 0	25.64		25.23	25.24	25.24	25.24	0.40		0.01
F2 90	26.12		24.71	24.78	24.76	24.73	1.36		0.05
F2 140	24.34	23.56	23.8	24.43	24.29	23.98	0.05	-0.73	0.48
F2 210	24.26	23.48	23.21	24.12	23.99	23.73	0.27	-0.51	0.78
F2 280	23.77	22.99	22.63	23.59	23.46	23.21	0.31	-0.47	0.83
F2 350	23.16	22.38	21.91	23.01	22.87	22.62	0.29	-0.49	0.96
F2 420	22.58	21.8	21.16	22.45	22.32	22.05	0.26	-0.52	1.16
F2 490	22.02	21.24	20.64	21.87	21.74	21.48	0.28	-0.50	1.10
F2 560	21.39	20.61	20.19	21.25	21.12	20.86	0.27	-0.51	0.93
F2 630	20.76	19.98	19.81	20.64	20.51	20.25	0.25	-0.53	0.70
F2 700	20.16	19.38	19.39	20.08	19.93	19.67	0.23	-0.55	0.54
F2 770	19.56	18.78	19.08	19.72	19.56	19.25	0.00	-0.78	0.48
F2 840	19.36	18.58	19.08	19.43	19.29	19.10	0.07	-0.71	0.21
F2 910	19.08	18.3	19.07	19.15	19.13	19.10	-0.05	-0.83	0.06
F2 980	19.2		19.07	19.15	19.13	19.10	0.07		0.06
F2 1050	19.48		19.07	19.15	19.13	19.10	0.35		0.06

Table A2 Comparison of Flood Levels for Cross-Section Option A with Flood Storage

Model Location	New Cross-Section Option A, (mAHD)								
	Top of Bank	Concrete Edge Beam	Existing Case	n=0.08	n=0.06	n=0.03	TOB-Option A(n=0.06)	CEB-Option A-(n=0.06)	Option A - Existing Case
F2 0	25.64		25.23	25.24	25.24	25.24	0.40		0.01
F2 90	26.12		24.71	24.78	24.76	24.73	1.36		0.05
F2 140	24.34	23.56	23.8	24.43	24.29	23.98	0.05	-0.73	0.48
F2 210	24.26	23.48	23.21	24.12	23.99	23.73	0.27	-0.51	0.78
F2 280	23.77	22.99	22.63	23.59	23.46	23.21	0.31	-0.47	0.83
F2 350	23.16	22.38	21.91	23.01	22.87	22.62	0.29	-0.49	0.96
F2 420	22.58	21.8	21.16	22.45	22.32	22.05	0.26	-0.52	1.16
F2 490	22.02	21.24	20.64	21.87	21.74	21.48	0.28	-0.50	1.10
F2 560	21.39	20.61	20.19	21.25	21.12	20.86	0.27	-0.51	0.93
F2 630	20.76	19.98	19.81	20.64	20.51	20.25	0.25	-0.53	0.70
F2 700	20.16	19.38	19.39	20.08	19.93	19.67	0.23	-0.55	0.54
F2 770	19.56	18.78	19.08	19.72	19.56	19.25	0.00	-0.78	0.48
F2 840	19.36	18.58	19.08	19.43	19.28	19.05	0.08	-0.70	0.20
F2 910	19.08	18.3	19.07	19.1	19.08	19.04	0.00	-0.78	0.00
F2 980	19.2		19.07	19.09	19.07	19.04	0.13		0.00
F2 1050	19.48		19.07	19.09	19.07	19.04	0.41		0.00

Table A3 Comparison of Flood Levels for Cross-Section B

Model Location	New Cross-Section Option B, (mAHD)								
	Top of Bank (TOB)	Concrete Edge Beam (CEB)	Existing Case	n=0.08	n=0.06	n=0.03	TOB - Option B (n=0.06)	CEB- Option B (n=0.06)	Option B (n=0.06)- Existing Case
F2 0	25.64		25.23	25.24	25.24	25.24	0.40		0.01
F2 90	26.12		24.71	24.79	24.76	24.74	1.36		0.05
F2 140	24.08	23.82	23.8	24.44	24.31	24.00	-0.23	-0.49	0.51
F2 210	24	23.74	23.21	24.15	24.03	23.75	-0.03	-0.29	0.82
F2 280	23.51	23.25	22.63	23.62	23.50	23.23	0.01	-0.25	0.87
F2 350	22.9	22.64	21.91	23.03	22.91	22.64	-0.01	-0.27	1.00
F2 420	22.32	22.06	21.16	22.47	22.35	22.07	-0.03	-0.29	1.19
F2 490	21.76	21.5	20.64	21.89	21.77	21.50	-0.01	-0.27	1.13
F2 560	21.13	20.87	20.19	21.27	21.15	20.88	-0.02	-0.28	0.96
F2 630	20.5	20.24	19.81	20.66	20.54	20.27	-0.04	-0.30	0.73
F2 700	19.9	19.64	19.39	20.10	19.96	19.70	-0.06	-0.32	0.57
F2 770	19.3	19.04	19.08	19.73	19.58	19.28	-0.28	-0.54	0.50
F2 840	19.1	18.84	19.08	19.45	19.31	19.10	-0.21	-0.47	0.23
F2 910	18.82	18.56	19.07	19.15	19.13	19.10	-0.31	-0.57	0.06
F2 980	19.2		19.07	19.15	19.13	19.10	0.07		0.06
F2 1050	19.48		19.07	19.15	19.13	19.10	0.36		0.05

Table A4 Comparison of Flood Levels for Cross-Section Option B with Flood Storage

Model Location	New Cross-Section Option B, (mAHD)								
	Top of Bank	Concrete Edge Beam	Existing Case	n=0.08	n=0.06	n=0.03	TOB- Option B (n=0.06)	CEB- Option B(n=0.06)	Existing Case - Option B
F2 0	25.64		25.23	25.24	25.24	25.24	0.40		0.01
F2 90	26.12		24.71	24.79	24.76	24.74	1.36		0.05
F2 140	24.08	23.82	23.8	24.44	24.31	24.00	-0.23	-0.49	0.51
F2 210	24	23.74	23.21	24.15	24.03	23.75	-0.03	-0.29	0.82
F2 280	23.51	23.25	22.63	23.62	23.50	23.23	0.01	-0.25	0.87
F2 350	22.9	22.64	21.91	23.03	22.91	22.64	-0.01	-0.27	1.00
F2 420	22.32	22.06	21.16	22.47	22.35	22.07	-0.03	-0.29	1.19
F2 490	21.76	21.5	20.64	21.89	21.77	21.50	-0.01	-0.27	1.13
F2 560	21.13	20.87	20.19	21.27	21.15	20.88	-0.02	-0.28	0.96
F2 630	20.5	20.24	19.81	20.66	20.54	20.27	-0.04	-0.30	0.73
F2 700	19.9	19.64	19.39	20.10	19.96	19.70	-0.06	-0.32	0.57
F2 770	19.3	19.04	19.08	19.73	19.58	19.28	-0.28	-0.54	0.50
F2 840	19.1	18.84	19.08	19.45	19.31	19.05	-0.21	-0.47	0.23
F2 910	18.82	18.56	19.07	19.10	19.07	19.04	-0.25	-0.51	0.00
F2 980	19.2		19.07	19.09	19.07	19.04	0.13		0.00
F2 1050	19.48		19.07	19.09	19.07	19.04	0.41		0.00

Table A5 Comparison of Flood Levels for Cross-Section C

Model Location	New Cross-Section Option C, (mAHD)								
	Top of Bank (TOB)	Concrete Edge Beam (CEB)	Existing Case	n=0.08	n=0.06	n=0.03	TOB-Option C (n=0.06)	CEB-Option C (n=0.06)	Option C (n=0.06)-Existing Case
F2 0	25.64		25.23	25.24	25.24	25.24	0.40		0.01
F2 90	26.12		24.71	24.83	24.79	24.75	1.33		0.08
F2 140	24.48	24.22	23.8	24.57	24.42	24.05	0.06	-0.20	0.62
F2 210	24.4	24.14	23.21	24.26	24.10	23.78	0.30	0.04	0.89
F2 280	23.91	23.65	22.63	23.72	23.57	23.26	0.34	0.08	0.94
F2 350	23.3	23.04	21.91	23.14	22.98	22.67	0.32	0.06	1.07
F2 420	22.72	22.46	21.16	22.58	22.43	22.11	0.29	0.03	1.27
F2 490	22.16	21.9	20.64	22.00	21.85	21.54	0.31	0.05	1.21
F2 560	21.53	21.27	20.19	21.39	21.23	20.92	0.30	0.04	1.04
F2 630	20.9	20.64	19.81	20.78	20.63	20.31	0.27	0.01	0.82
F2 700	20.3	20.04	19.39	20.23	20.07	19.75	0.23	-0.03	0.68
F2 770	19.7	19.44	19.08	19.87	19.71	19.34	-0.01	-0.27	0.63
F2 840	19.5	19.24	19.08	19.56	19.41	19.11	0.09	-0.17	0.33
F2 910	19.22	18.96	19.07	19.16	19.13	19.10	0.09	-0.17	0.06
F2 980	19.2		19.07	19.15	19.13	19.10	0.07		0.06
F2 1050	19.48		19.07	19.15	19.13	19.10	0.35		0.06

Table A6 Comparison of Flood Levels for Cross-Section Option C with Flood Storage

Model Location	New Cross-Section Option C, (mAHD)								
	Top of Bank	Concrete Edge Beam	Existing Case	n=0.08	n=0.06	n=0.03	Option C-TOB (n=0.06)	CEB-Option C (n=0.06)	Option C - Existing Case
F2 0	25.64		25.23	25.24	25.24	25.24	0.40		0.01
F2 90	26.12		24.71	24.83	24.79	24.75	1.33		0.08
F2 140	24.48	24.22	23.8	24.57	24.42	24.05	0.06	-0.20	0.62
F2 210	24.4	24.14	23.21	24.26	24.10	23.78	0.30	0.04	0.89
F2 280	23.91	23.65	22.63	23.72	23.57	23.26	0.34	0.08	0.94
F2 350	23.3	23.04	21.91	23.14	22.98	22.67	0.32	0.06	1.07
F2 420	22.72	22.46	21.16	22.58	22.43	22.11	0.29	0.03	1.27
F2 490	22.16	21.9	20.64	22	21.85	21.54	0.31	0.05	1.21
F2 560	21.53	21.27	20.19	21.39	21.23	20.92	0.30	0.04	1.04
F2 630	20.9	20.64	19.81	20.78	20.63	20.31	0.27	0.01	0.82
F2 700	20.3	20.04	19.39	20.23	20.07	19.75	0.23	-0.03	0.68
F2 770	19.7	19.44	19.08	19.87	19.71	19.34	-0.01	-0.27	0.63
F2 840	19.5	19.24	19.08	19.56	19.41	19.05	0.09	-0.17	0.33
F2 910	19.22	18.96	19.07	19.1	19.08	19.05	0.14	-0.12	0.01
F2 980	19.2		19.07	19.09	19.07	19.05	0.13		0.00
F2 1050	19.48		19.07	19.09	19.07	19.05	0.41		0.00