Cardno LawsonTreloar

Shaping the Future

SUPPLEMENTARY REPORT ON COASTAL PROCESSES

Northeast Business Park

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EXECUTIVE SUMMARY

Northeast Business Park (NEBP) is a multi-use marina and business park concept that will integrate marina facilities, appropriate business, residential, heritage and recreational greenspace precincts in a master planned riverside precinct on the Caboolture River.

The NEBP site is located approximately 10km upstream of the mouth of the Caboolture River. To facilitate safe navigable access to the NEBP, a capital dredging program is proposed within the designated navigation channel of the Caboolture River. The designated navigation channel of the Caboolture River is approximately 6.5km in length and will be dredged to an approximate depth of -4.25m AHD, providing a draft of 3m below Lowest Astronomical Tide. The remaining section of the river between the upstream extent of the proposed capital dredging and the site will not be dredged.

This report specifically addresses the submissions received in response to the EIS relating to tidal hydraulics, river flushing, sediment transport processes and boat traffic. Points of note are:

- The capital dredging of the navigation channel within the lower reaches of the Caboolture River is predicted to have only a small increase on the tidal prism.
- The NEBP development is predicted to have negligible impact on the tidal phase and high tide water levels throughout the Caboolture River.
- The NEBP development is predicted to result in slightly lower low tide levels within the upper estuarine section of the Caboolture River.
- The NEBP development is predicted to have negligible impact on tidal flushing processes within the Caboolture River when compared to the existing scenario due to the small changes in tidal prism and tidal flows.
- There is likely to be some localised redistribution of bed material adjacent to the dredged navigation channel, however the proposed capital dredging includes measures to avoid riverbank erosion.
- The Caboolture River is not a significant source of coastal sediment and the river mouth is relatively stable and as such the NEBP development is unlikely to have any significant adverse impact on tidal flats adjacent to the river mouth.
- The existing speed restrictions that apply to the Caboolture River should ensure that the impact of boating traffic is not significantly greater than existing wind wave impacts.
- An education program should be implemented to ensure boating users are aware of the existing speed restrictions and the impact of boat wake on the rate of riverbank erosion.

1. INTRODUCTION

This report has been prepared by Cardno Lawson Treloar (CLT), specialist coastal and hydraulic engineering consultants, for Northeast Business Park Pty Ltd, to provide supplementary coastal processes information to support the Environmental Impact Statement (EIS) dated 31 January 2008 prepared by Cardno.

Northeast Business Park (NEBP) is a multi-use marina and business park concept that will integrate marina facilities, appropriate business, residential, heritage and recreational greenspace precincts providing a place to live, to work and to play in a master planned riverside precinct on the Caboolture River.

The NEBP site is located approximately 10km upstream of the mouth of the Caboolture River. To facilitate safe navigable access to the NEBP, a capital dredging program is proposed within the designated navigation channel of the Caboolture River. The designated navigation channel of the Caboolture River is approximately 6.5km in length and will be dredged to an approximate depth of -4.25m AHD, providing a draft of 3m below Lowest Astronomical Tide. The remaining section of the river between the upstream extent of the proposed capital dredging and the site will not be dredged.

This report specifically addresses the submissions received in response to the EIS relating to tidal hydraulics, river flushing, sediment transport processes and boat traffic. This report also expands on the information provided in CLT's previous reports, '*Northeast Business Park - Marina Water Quality Management Plan*' (ref. 790033/03/R2) dated November 2007 and '*Northeast Business Park - Caboolture River Siltation Study*' (ref. 790033/03/R3) dated January 2008.

2. SITE DESCRIPTION

The site is situated on the southern bank of the Caboolture River approximately 8km inland from the coastline, adjacent to the Bruce Highway and 43km north of Brisbane CBD, the NEBP site encompasses 769 hectares of property. The site extents are shown on Figure 1 and include the following seven land parcels:

- Lot 2 on RP902075
- Lot 10 on RP902079
- Lot 24 on SP158298
- Lot 7 on RP845326
- Lot 15 on RP902073
- Lot 12 on RP145197
- Lot 17 on RP902072

The following components are incorporated into the NEBP development.

- Marina basin.
- Marine industry.
- Shipyard.
- Mixed Industry Business Areas.
- Marina Village.
- Marina Residential.
- Hotel.
- Marina Pavilion.
- Golf Residential.
- Residential.
- Hotels.
- Environmental open space.
- Golf club and golf course.
- Recreational areas and sporting fields.
- Heritage Park.
- Environmental Centre.
- Community Nodes.
- Educational and Training Facility.

The NEBP marina will be excavated to a depth of RL -1.0m AHD. The marina basin will be constructed using dry excavation techniques. Following excavation of the marina basin, a lock will be established to connect the marina basin to the Caboolture River. Fill obtained from the excavation of the marina basin and additional cuts within the property bounds will be used to raise ground levels within residential precincts to protect against flooding and storm surge.

The entrance of the proposed marina is approximately 10km upstream of the mouth of the Caboolture River. To facilitate safe navigable access to the NEBP, capital dredging will be undertaken within the defined navigation channel of the Caboolture River. Approximately 600,000m^3 of material will be removed from the bed of the Caboolture River during the capital dredging program. The navigation channel will be dredged to an approximate depth of -4.25m AHD, providing a draft of 3m below Lowest Astronomical Tide.

The NEBP development will include approximately 900 marina berths, 500 dry boat stacker berths, and associated Shipyard, and Marine Industry infrastructure, building on Queensland's blossoming national and international marine industry.

2.1 The Existing Caboolture River System

The Caboolture River adjacent to the site is a well defined, tidally dominated waterway with a main channel approximately 70 metres in width. Downstream of the site the channel meanders towards the mouth for approximately 4.3km whereupon the river widens to a maximum width of 400m. This area is dominated by sand banks either side of the main channel. The river entrance to the bay is approximately 280m wide.

Tidal details are presented in Table 1 for the Caboolture River Mouth Tide gauge.

Table 1 Tidal Planes at Mouth Caboolture River

Tidal Plane		**Level (m AHD)**
Highest Astronomical Tide	HAT	1.34
Mean High Water Springs	MHWS	0.81
Mean Sea Level	MSL	-0.05
Mean Low Water Springs	MLWS	-0.92
Lowest Astronomical Tide	LAT	-1.26

The main channel through the lower section of the Caboolture River, from King John Creek to the mouth of the River, meanders through a number of sand banks formed by ebb and flood tide flows. The lower section of the Caboolture River is also flanked by intertidal wetlands dominated by mangroves species. Tidal velocities adjacent to the site are up to 0.5 m/s on flood and ebb tides.

Bed sediments in the lower Caboolture River comprise fine to coarse grained sands and clayey sands. Towards the site, fine to coarse sand with silt and clay fines are prevalent. Coffey Geotechnics Pty Ltd report, “Caboolture River Dredging. Geo-Environmental Investigations”, May 2007 contains a detailed investigation of the river sediments.

Within the wider estuarine portion of the river however, elevated bed shear stresses (<0.5 Pa) are high enough to mobilise medium grain sands and therefore in this area, erosion, accretion and shifting of sand banks is common. During river floods, velocities are much higher (between 1.5m/s to 3m/s), and under such events, a greater amount sediment movement is likely to occur.

3. DATA

The siltation assessment within this report has been based on:

- Detailed bathymetric survey of the Caboolture River supplied by Queensland Transport and Mapping and Hydrographic services Pty Ltd;
- Geotechnical investigation by Coffey Geotechnics Pty Ltd entitled, "*Caboolture River Dredging Geo-Environmental Investigations*" dated May 2007;
- Navigation channel alignment prepared by Cardno and shown on drawing numbers 7900/33/01 100 to 117, included as reference drawings in this report;
- Tidal constituents supplied by Maritime Safety Queensland; and
- Site Inspections conducted by CLT.

The modelling has been based on the proposed navigation channel alignment shown on Cardno drawing numbers 7900/33/01 100 to 117. This alignment is based on a modification of the current location of the channel markers in order to smooth out sharp bends. It is understood that subsequent to this analysis, meetings were held with the Harbour Master which resulted in further alignment changes in 3 locations. These changes are not anticipated to significantly impact on the results of the modelling. Further discussion on the navigation channel alignments is presented in the Cardno Report, "Dredging Site Based Management Plan" for Northeast Business Park Pty Ltd, November 2007.

4. SCOPE OF WORK AND METHODOLOGY

The scope of this investigation has been to investigate the following:

- Tidal hydraulic and flushing impacts within the Caboolture River due to the capital dredging program associated with the NEBP development;
- Sediment transport impacts both within and at the mouth of the Caboolture River associated with the NEBP development and capital dredging program; and,
- Any impacts of increased boating traffic on riverbank erosion within the Caboolture River.

4.1 Tidal Hydraulics

The tidal hydraulic and flushing impacts of capital dredging within the Caboolture River have been assessed using a two-dimensional (2D) Delft3D model of the Caboolture River. The assessment includes the impact of capital dredging on the tidal prism, tidal currents and velocities, and predicted levels of high and low tide at selected sites between the Caboolture River mouth and the marina site.

In particular, the methodology of the analysis is described below:

- Use the calibrated Delft3D model of the Caboolture River developed for the previous assessment of siltation within the dredged navigation channel detailed in CLT's report, '*Northeast Business Park - Caboolture River Siltation Study*' (ref. 790033/03/R3) dated January 2008.
- Incorporate boundary conditions based on spring and neap tide flows into the Caboolture River.
- Analyse tidal hydrodynamics changes of the Caboolture River following capital dredging works.

4.2 Sediment Transport Processes

A literature review has been undertaken to determine the estimated sediment load supplied by the Caboolture River and the estimated longshore sediment transport rate and direction at the mouth of the Caboolture River. Analysis of aerial photography has also been undertaken to support the literature review.

4.3 Impacts of Boating Traffic

A literature review has been undertaken to determine the relationship between boat movements and river bank erosion. An assessment of the likelihood of wind wave generation within the Caboolture River will also be undertaken.

5. MODEL DETAILS

5.1 The Model Software

In order to model tidal flows a high-resolution Delft3D hydraulic model has been used. The Delft 3D model had been developed for the previous assessment of siltation and dredging requirements within the navigation channel in the lower reach of the Caboolture River detailed in CLT's report, '*Northeast Business Park - Caboolture River Siltation Study*' (ref. 790033/03/R3) dated January 2008. The model has been calibrated to tidal flows as discussed in Section 5.3.

Delft3D applies an alternating direction, implicit finite-difference scheme to the solution of the equations of mass and momentum conservation. Density is included through an equation of state for salinity and temperature, as well as suspended sediment concentration. Model forcing can be by tides, winds, inflows, air pressure and density gradients. An accurate, stable wetting-and-drying algorithm is included to describe wetting and drying of inter-tidal areas.

The model has been validated by Deltares (formerly WL|Delft Hydraulics) and applied successfully by CLT for many sites including investigations at the Murray River mouth, Lake Illawarra and Cairns. The latter study related to siltation investigations for the Royal Australian Navy. Historical siltation rates could be estimated from dredging records and some suspended sediment concentration data was available to verify the general character and variation with tidal range of that parameter.

5.2 General Model Setup

The topographic extent of the model is shown on Figure 2 and is such that boundary conditions are far enough away from the site that impacts can be reliably determined.

The pre-dredging (existing case) model has been constructed using available survey and aerial photographs in order to determine existing bathymetric details and roughness parameters. Detailed survey information obtained in 1998 and 2007 was supplied by Queensland Transport and Mapping and Hydrographic services Pty Ltd respectively. The proposed navigation channel alignment, shown on Cardno drawing numbers 7900/33/01 100 to 117, has been used in conjunction with the existing bathymetric details to construct the post-dredging bathymetric details. Figure 3 presents the pre- and post-dredging bathymetry used for the Delft3D model.

The model has been used to simulate hydrodynamics within the Caboolture River during typical tide conditions. The model simulated tidal conditions from 20 February 2006 until the 1 March 2006 using tidal constituents obtained from Maritime Safety Queensland. This period was selected to allow analysis of impacts during spring and neap tide conditions.

5.3 Model Calibration

5.3.1 Water Level and Discharge Measurements

To provide calibration data for the Delft3D model, a field work campaign of ADCP (Acoustic Doppler Current Profile) profiling and water level measurements was conducted. The ADCP instrument records current speed and direction across the profile and through the water column and integration of this data provides discharge information for the cross-section.

The field work consisted of ADCP current profiling, collection of sediment samples for sediment grading analysis as well as collection of 'close to bed' water samples for

suspended solids analysis. Field work was carried out at 4 locations within the Caboolture River and at a site within King John Creek immediately upstream of its confluence with the Caboolture River. The location of each of these sites is shown on Figure 4.

Field work was conducted on the 5 April 2006 and the ADCP transects were conducted over a full 12 hour tide cycle.

The field measurements used for calibration and validation of the tidal modelling are shown in Appendix A, along with the results of the computer modelling.

As well as current profiling, tide levels at the proposed marina site on the Caboolture River were also recorded for a period of around one month using an internal logging pressure gauge. Unfortunately this instrument was stolen while in the field and the data can not be retrieved. Consequently, the only recorded tide level information to come out of this field work campaign is a single water level spot height surveyed to enable conversion of water depths to Australian Height Datum (AHD) levels.

Field measurements of water level and discharge within the Caboolture River have also been undertaken in August 1990. The August 1990 water level and discharge measurements were recorded in the Caboolture River by WBM Oceanics and presented in the report entitled, '*Environmental Studies for the Proposed Beachmere Canals Development*' dated December 1990. The locations of all tidal field measurements are shown on Figure 4.

5.3.2 Hydrodynamic Model Calibration

Calibration of the Delft3D tidal model has primarily been carried out against the field measurements recorded in August 1990. This data was adopted as the primary calibration set for two reasons. Firstly, the water surface level measurements for the April 2006 monitoring campaign have been lost due to theft of monitoring equipment in the field. Secondly, the August 1990 field work campaign was slightly more comprehensive than the recent work.

A good calibration of Caboolture River tidal water surface levels and discharges has been achieved by adjusting model roughness values and by incorporating some additional storage area into the lower reaches of the model. This additional storage area accounts for the extensive regions of mangroves and sand flats downstream of King Johns Creek. The inclusion of this additional storage in the model resulted in a good fit of model results to recorded field measurements.

Model calibration using Manning's 'n' roughness values has been found to primarily affect timing within the model. The final adopted values are 0.014 in the Caboolture River, 0.035 in King Johns and Goong Creek and 0.15 for the overbank areas.

Results of the calibration to the August 1990 field measurements are shown in Appendix A and show a good fit of model results to both recorded water levels and flow rates. Results of the model validation to the April 2006 field measurements are also included in Appendix A and show a reasonable fit to the recorded flow rates.

5.3.3 Hydrodynamic Model Validation

The field measurements recorded in April 2006 have been used to validate the model calibrated to the August 1990 field measurements. Results of the verification to the April 2006 field measurements are shown in Appendix B and show a reasonable fit to the recorded flow rates.

6. TIDAL HYDRAULICS

6.1 Methodology

Hydraulic analysis was performed to determine the impact on tidal prism, high and low tide water levels and flushing within the Caboolture River following dredging of the navigation channel. The assessment considers both the pre- and post-dredging conditions using a two-dimensional Delft3D hydrodynamic model.

The pre- and post-dredged bathymetric conditions are based on the detailed survey provided by Queensland Transport and Mapping and Hydrographic services Pty Ltd. The post-dredging bathymetric conditions include the proposed navigation channel alignment as shown on Cardno drawing numbers 7900/33/01 100 to 117. Further discussion on the alignment is presented in Section 3. The modelling has been undertaken using a curvilinear grid based on the topography and model extents shown in Figure 2.

Calibration of the Delft3D model was achieved by varying the Manning's 'n' roughness assumed throughout the model domain as discussed in Section 5.3.

The modelling has considered the impact of capital dredging within the defined navigation channel of the Caboolture River on the hydraulics during typical tidal conditions. The model has simulated tidal flows between 20 February 2006 to 1 March 2006. The assessment of tidal hydraulic impacts includes the tidal prism, predicted high and low tide water levels and river flushing both pre- and post-dredging of the Caboolture River navigation channel.

6.2 Tidal Prism Impact Investigation Results

The tidal prism is defined as the volume of water that is drawn into the river from the ocean through the river mouth during a flood tide. The tidal prism has been calculated for existing and post-dredging scenarios at three locations from the Caboolture River mouth to the downstream extent of the NEBP site. Figure 5 shows the location of the Delft3D reporting cross-section used for the tidal prism calculations.

The tidal prism was calculated for the neap flood tide occurring on 22 February 2006 and the spring flood tide occurring on 28 February 2006. Table 6.1 presents the predicted tidal prism for the existing and post-dredging scenarios along with the predicted impact.

Table 6.1 Tidal Prism Impacts within the Caboolture River

Location	Tidal Prism (Neap Tide)		Impact (%)	Tidal Prism (Spring Tide)		Impact (%)
	Existing (m^3)	Post-Dredging (m^3)		Existing (m^3)	Post-Dredging (m^3)	
Section 1	2,107,741	2,159,549	2.5%	8,527,640	8,763,102	2.8%

Table 6.1 indicates that the NEBP development and associated capital dredging of the navigation channel within the lower reaches of the Caboolture River is predicted to have only a small increase on the tidal prism. At the mouth of the Caboolture River (Section 1) this is estimated to be an increase of only 2.5% and 2.8% for the neap and spring tide events, respectively.

The increase in tidal prism is due to the additional volume provided by the dredged channel and the improved conveyance of flow through the lower reaches of the Caboolture River following the capital dredging within the navigation channel.

6.3 Predicted Water Level Impact Investigation Results

As indicated in Section 6.2 the NEBP development and associated dredging of the navigation channel within the lower reach of the Caboolture River is predicted to slightly increase the tidal prism during both neap and spring tides.

The predicted water levels for both the existing and post-dredging scenarios have been recorded at five locations from the Caboolture River mouth to the upstream extent of the NEBP site. Figure 5 shows the location of the five Delft3D reporting points used to record water levels.

This analysis indicates that the NEBP development and associated dredging of the navigation channel in the lower reaches of the Caboolture River is predicted to have negligible impact on the tidal phase and high tide water levels throughout the River. In particular:-

- At the mouth of the Caboolture River (Uhlmann Road Boat Ramp and Beachmere Boat Ramp) the difference between the predicted existing and post-dredging scenario tidal water levels is negligible. The impact to the tidal phase at these two locations is also predicted to be negligible.
- At the confluence of the Caboolture River and King John Creek (King John Creek) the impact to the high tide water level and tidal phase is predicted to be negligible. However, there is predicted to be a minor reduction in the low tide water level at this location.
- Within the Caboolture River at the downstream extent of the NEBP site the impact to the high tide water level is predicted to be negligible. The low water level at this location is predicted to be reduced by up to 0.1m during spring tide events. However, there is a well defined channel through this section of the Caboolture River and the reduced low tide water level is not anticipated to impact on navigation to the marina.
- Within the Caboolture River at the upstream extent of the NEBP site the spring high tide water levels is predicted to be increased by up to 0.03m. The low water level at this location is predicted to be reduced by up to 0.07m during spring tide events. This reduced low tide water level is not anticipated to impact on navigation to the marina.

Appendix C provides the predicted water levels for the existing and post-dredging scenarios and the estimated impact for each of the five locations indicated in Figure 5.

6.4 Tidal Flushing

The NEBP development and associated dredging of the navigation channel within the lower reaches of the Caboolture River is predicted to slightly increase the tidal prism and have relatively minor impacts on the predicted low tide water levels within the River.

Appendix D provides the estimated tidal currents for the existing and post-dredging scenarios at the entrance to the Caboolture River (i.e. at Section 1 shown on Figure 5) and the predicted impact. During the simulation period the tidal discharge across the channel ranged in magnitude from 135m^3/s to 720m^3/s. It should be noted that the magnitude of the tidal current during the flood tide is greater than the magnitude of the tidal current during the following ebb tide. This trend is evident in both the existing and post-dredging scenarios and is related to driving force of the incoming tide.

As discussed in Sections 6.2 and 6.3, due to the small changes in tidal prism and tidal flows it is not anticipated that the tidal flushing processes will be significantly different following the dredging of the navigation channel within the lower reaches of the Caboolture River when compared to the existing scenario.

7. SEDIMENT TRANSPORT PROCESSES

In general the dredging of a navigation channel within the estuarine reach of a river can impact on the sediment supply to sand banks within the river and beaches at the mouth of the river. There is also potential for erosion of riverbanks if dredge batters are excessively steep and/or dredging occurs to close to the river bank. The following sections provide details on the assessment of river and coastal sediment processes.

7.1 River Sediment Transport

In relation to river sediment transport processes the primary impacts of dredging of the navigation channel within the Caboolture River are likely to involve riverbank erosion and redistribution of sand banks within the river.

CLT's previous report, '*Northeast Business Park - Caboolture River Siltation Study*' (ref. 790033/03/R3) dated January 2008 provided an assessment of the estimated morphologic changes within the Caboolture River following dredging of the navigation channel within the lower reaches of the Caboolture River.

CLT's previous assessment did not indicate that dredging within the navigation channel in the lower reaches of the Caboolture River would result in any direct erosion threats to the adjacent riverbanks. This is because:-

- It is intended to provide batter slopes of no greater than 1 in 3 between the existing bed level and the dredged navigation channel.
- It is also intended to provide buffers of sufficient width between the riverbank and the navigation channel dredge area to mitigate any direct riverbank erosion associated with dredging.

These measures should ensure that the dredging within the navigation channel does not result in any direct riverbank erosion.

The morphologic assessment presented in CLT's previous report predicted there would be some redistribution of material from the adjacent sandy bed resulting in siltation of the dredged navigation channel and regular maintenance dredging would be required.

Quantification of impacts to intertidal habitats is difficult given the nature of morphologic modelling. The slightly lower low tide level following dredging may increase the inter-tidal habitat area while redistribution of material adjacent to the dredged channel may reduce the inter-tidal habitat area.

7.2 Coastal Sediment Transport

Based on a review of available information to date there has not been a detailed study of sediment transport processes and patterns within the Caboolture River or the Deception Bay area.

The Caboolture River has a total catchment area of approximately 590km^2. The Caboolture River catchment is relatively small in comparison to the Brisbane River to the south and Mary River to the north-west which have catchment areas of approximately 15,000km^2 and 7000km^2, respectively. The Mary River is also one of the primary sources of sediment for the beaches in the Hervey Bay region.

Given the relative size of the Caboolture River catchment it is not anticipated that the river would supply a significant quantity of sediment to the coast. This is supported by an assessment of the tidal delta system at the mouth of the river. As shown on Figure 6, the

tidal delta system of the Caboolture River does not exhibit features that would suggest significant sediment supply to the coast. Had the Caboolture River supplied significant quantities of sand to the coast there would normally be a large system of flood and ebb tide sand banks at the river mouth. It should be noted that any sediment supplied by the Caboolture River is likely to be compromised by the existing weir located upstream of the NEBP development site.

With regards to the longshore sediment transport, Moreton Bay is protected from prevailing ocean swell conditions by offshore islands and the relatively shallow bathymetry. Due to the low wave energy conditions the longshore sediment transport rates within Moreton Bay are generally low. Beaches within Moreton Bay tend to exhibit features that indicate that the coastal processes are dominated by tidal currents. These features include wide inter-tidal flats, steep and narrow beach faces and low dune systems. These features are evident on the beaches adjacent to the mouth of the Caboolture River.

Given the dominance of tidal currents along this section of coast there is potential for sediment to be moved into the Caboolture River estuary from the adjacent beaches. O'Brien (1931) suggests that a relation exists between minimum channel cross-sectional area below mean tide level (Ac) and tidal prism during spring tide (P). Equation 1 presents the relationships proposed by O'Brien (1931).

$$P = 5 \times 10^4 A_c \qquad \text{(Equation 1)}$$

The tidal prism at the Caboolture River has been estimated at 8.5×10^6 m^3 and 8.8×10^6 m^3 for the existing and post-dredging scenarios, respectively. The minimum cross-sectional area for the Caboolture River estimated by the O'Brien relationship is 170m^2 and 175m^2 for the existing and post-dredging scenarios, respectively. The existing cross-sectional area at the mouth of the Caboolture River is approximately 920m^2. The O'Brien relationship would therefore suggest that the Caboolture River entrance is relatively stable and there would be minimal sediment moved into the estuary during normal tidal conditions in both the existing and post-dredging scenarios. This is backed by CLT's analysis which indicates maximum bed shear stresses on flood tides within the navigation channel are of the order of 0.5Pa.

It is therefore not anticipated that the dredging of an entrance channel from the mouth of the Caboolture River into Moreton Bay would adversely impact of sediment supply to the sand banks and beaches adjacent to the river mouth. There may be some lateral movement of the channel under extreme events, such as flooding. However, the impacts of the dredged channel under extreme events would not be significantly different to the impacts in the existing scenario.

8. IMPACTS OF BOAT TRAFFIC ON RIVERBANK EROSION

The NEBP development will include approximately 900 marina berths and a further 500 dry boat stacker berths and will also include associated shipyard and marine industry infrastructure. It is acknowledged that the NEBP development will increase boat traffic between the development site and the mouth of the Caboolture River.

The section of the Caboolture River between the NEBP site and the river mouth is currently used by vessels. The community consultation report contained in Appendix G of the NEBP Environmental Impact Statement provides information relating to existing vessel activity and states that up to 40 boat movements were recorded on a weekday in 2006.

The precise number and size of vessels using the marina and dry boat stacker berths will be formalised during the detailed design stage of the development. The increased boat traffic within the Caboolture River generated by the development is related to the number of vessels using the NEBP marina facilities and a precise estimate is therefore not available for this assessment. This assessment will therefore rely on assumptions relating to the size and number of vessels using the NEBP marina facilities.

There will be a degree of disparity between the number of vessel movements on weekends and weekdays, with the peak number of vessel movements most likely occurring on weekends. Table 2 shows an estimate of vessel movements that could potentially be attributed to the NEBP development.

Table 2 Estimated Number of Vessel Movements

Berth Type	Number of Berths	Percentage of Boats		Average Daily Boat Movements
		Weekday	Weekend	
Marina Berth	900	2%	20%	~66
Dry Berth	500	1%	10%	~16
Total	**1400**	**~1.6%**	**~16.4%**	**~82**

Based on the estimates presented in Table 2 there would be an average of 82 boat movements per day. This estimate is intended to provide an approximate number of boat movements and does not account for increases during holidays or decreases on days where the weather is unsuitable for boating.

Vessel speed and hull design are the primary factors that determine the size and nature of waves generated as a vessel travels through the water. It is anticipated that the majority of vessels using the marina berths and dry boat stacker will have a length of 8m or greater. For vessels 8m in length and over there is an existing 6 knot speed limit throughout the Caboolture River.

For the vessel sizes anticipated it is our experience that a typical wave train of 7 to 8 waves would be generated by the boat wash. The waves would have a significant wave height (H_S) of 0.2m to 0.3m with a wave period of 3 to 5 seconds. In comparison waves generated by a 20 knot winds would have a significant wave height (H_S) of 0.1m to 0.2m and a wave period of 1 to 1.5 seconds.

Table 3 shows the estimated number of waves generated on a daily basis due to varying numbers of boat movements and the estimated number of waves impacting the riverbank. The lower and upper estimates are based on typical wave trains of 7 to 8 waves generated by boat wash. Due to tidal water level variations, it is assumed that minimal waves impact the riverbank at low tide.

Table 3 Boat Wash Wave Generation Estimates

Number of Boat Movements per day	Estimated Number of Waves Generated Daily		Estimated Number of Waves impacting the Riverbank Daily	
	Lower	Upper	Lower	Upper
40	280	320	210	240
60	420	480	315	360
80	560	640	420	480
100	700	800	525	600

Under existing conditions wind waves can also be generated within the river. Figure 7 presents the orientation of the Caboolture River reaches and the roses of wind direction versus wind speed recorded at the Brisbane Airport. Between the NEBP site and the Caboolture River mouth, the major river reaches are aligned in either a north-south or east-west direction. The prevailing wind conditions and the alignment of the Caboolture River reaches would allow for the generation of wind waves that could impact on the riverbank.

This assessment has assumed that vessels will be operating at a speed sufficient to generate wash. However, speed restrictions do apply within the Caboolture River and for vessels 8m in length and over the speed limit throughout the Caboolture River is 6 knots or no wash. Provided vessels travelling between the NEBP site and the Caboolture River mouth comply with the existing speed limits the impact of boat wash on riverbank erosion should be no greater than existing conditions. An education program should be implemented to ensure boat users travelling between the NEBP site and the Caboolture River mouth are aware of the existing speed restrictions and the impact of generating boat wash on riverbank erosion.

It is acknowledged that policing of speed restrictions is difficult, hence a management plan of monitoring and remediation of banks is recommended. Should significant riverbank erosion associated with boat wash become evident following the commissioning of the NEBP marina works can be undertaken to remediate riverbank erosion problems. Remedial works may include the following:

- use of suitable dredge spoil to reprofile eroded banks;
- riparian zone revegetation;
- wave dissipation structures adjacent to the riverbank, such as riprap gabions designed to dissipate wave energy and assist in colonisation of marine plants; or
- construction of revetments.

9. CONCLUSIONS

The proposed development includes the dredging of the defined navigation channel within the lower reaches of the Caboolture River. This report specifically addresses the submissions received in response to the EIS relating to tidal hydraulics, river flushing, sediment transport processes and boat traffic.

The hydraulics of the existing and post-dredged scenarios has been modelled using the Delft3D modelling system. It has been determined that the proposed dredging works will increase the tidal prism of the Caboolture River by up to 2.8% during spring tide events. The increased tidal prism is due to increased conveyance of flow and a slight lowering of the low tide level in the upper reaches of the estuarine section of the river. There is minimal impact to the level of high tide and tidal phasing associated with the proposed dredging. It is therefore evident that the time of inundation of inter-tidal habitat should remain relatively unchanged.

There is a slight increase in peak tidal flow during the flood and ebb tides associated with the proposed dredging works. However this is not expected to significantly increase bed sediment mobilisation.

Sediment transport within the river will be impacted by the dredging of the navigation channel. However, the impacts are largely confined to the banks immediately adjacent to the navigation channel. The dredge area includes adequate batter slopes and buffers to adjacent riverbanks to minimise any riverbank erosion. Morphologic modelling undertaken by CLT and presented in the report, '*Northeast Business Park - Caboolture River Siltation Study*' (ref. 790033/03/R3) dated January 2008 did not indicate that the proposed dredging would have any direct erosion impact on adjacent riverbanks.

The Caboolture River is not likely to be a significant source of sand for the beaches at the mouth of the river. It is therefore not anticipated that the dredging of an entrance channel from the mouth of the Caboolture River into Moreton Bay would adversely impact of sediment supply to the sand banks and beaches adjacent to the river mouth. There may be some lateral movement of the channel under extreme events, such as flooding. However, the impacts of the dredged channel under extreme events would not be significantly different to the impacts in the existing scenario.

The waves generated by boat movements are generally similar in condition to wind generated waves. The Caboolture River is largely orientated in the direction of predominate winds and as such there is potential for wind generated waves to form within the river. There is also an existing speed restriction in the Caboolture River of 6 knots or no wash for boats in excess of 8m. Provided the speed restrictions are complied with the impact of boat wash associated with the development should be minimal. An education program should be implemented to inform boat users of there responsibilities in this regard.

10. REFERENCE

Cardno Lawson Treloar, 2006, "*Northeast Business Park, Caboolture – Tidal Prism Assessment*"

Cardno Lawson Treloar, 2007, "*Northeast Business Park - Marina Water Quality Management Plan*"

Cardno Lawson Treloar, 2008, "*Northeast Business Park - Caboolture River Siltation Study*"

Coffey Geotechnics Pty Ltd May 2007, "*Caboolture River Dredging Geo-Environmental Investigations*"

O'Brien, M.P., (1931). "*Estuary tidal prisms related to entrance areas*". Civil Engineering, 1(8), 738-739.

WBM, December 1990, "*Environmental Studies for the Proposed Beachmere Canals Development*".

11. QUALIFICATIONS

This report has been prepared by CLT specifically for Northeast Business Park Pty Ltd and specifically to provide supplementary advice on tidal hydraulics, sediment transport and boating traffic impacts due to the NEBP development and associated capital dredging of the navigation channel in the lower reaches of the Caboolture River. As such, its application is limited and may not be applicable beyond this scope.

The report relies on information by others, including:

- Detailed bathymetric survey of the Caboolture River supplied by Queensland Transport and Mapping and Hydrographic services Pty Ltd;
- CLT's previous reports, '*Northeast Business Park - Marina Water Quality Management Plan*' (ref. 790033/03/R2) dated November 2007 and '*Northeast Business Park - Caboolture River Siltation Study*' (ref. 790033/03/R3) dated January 2008.
- Tidal constituents supplied by Maritime Safety Queensland; and
- Navigation channel alignment prepared by Cardno and shown on drawing numbers 7900/33/01 100 to 117, included as reference drawings in this report.

The accuracy of the report is limited to the accuracy of this information.

Whilst Cardno Lawson Treloar's report accurately assesses tidal flows based on the proposed navigation channel alignment using industry standard techniques, extreme flood, storm tide or tsunami events beyond the scope of this assessment have not been considered in relation to tidal hydraulics and sediment transport impacts, in accord with current industry practice.

FIGURES

Figure 1 **Locality Plan**

Figure 2 **Delft3D Model Layout**

Figure 3 **Pre- and Post Dredging Model Bathymetry**

Figure 4 **Calibration Data Recording Locations**

Figure 5 **Delft3D Model Output Locations**

Figure 6 **River Mouth Aerial Photography Assessment**

Figure 7 **River Orientation and Wind Roses**

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Scale 1:50,000 (A4)

FIGURE 1
SITE LOCATION

Rev: Orig. Date: June 2008

Project No.: 790033/03

Northeast Business Park Pty Ltd

CAD FILE: O:\WorkLAT\790033_3\Figures\R4\Figures.dwg
XREF's: tl_cad_amg_84

PRINT DATE: 20 June, 2008 - 11:12am

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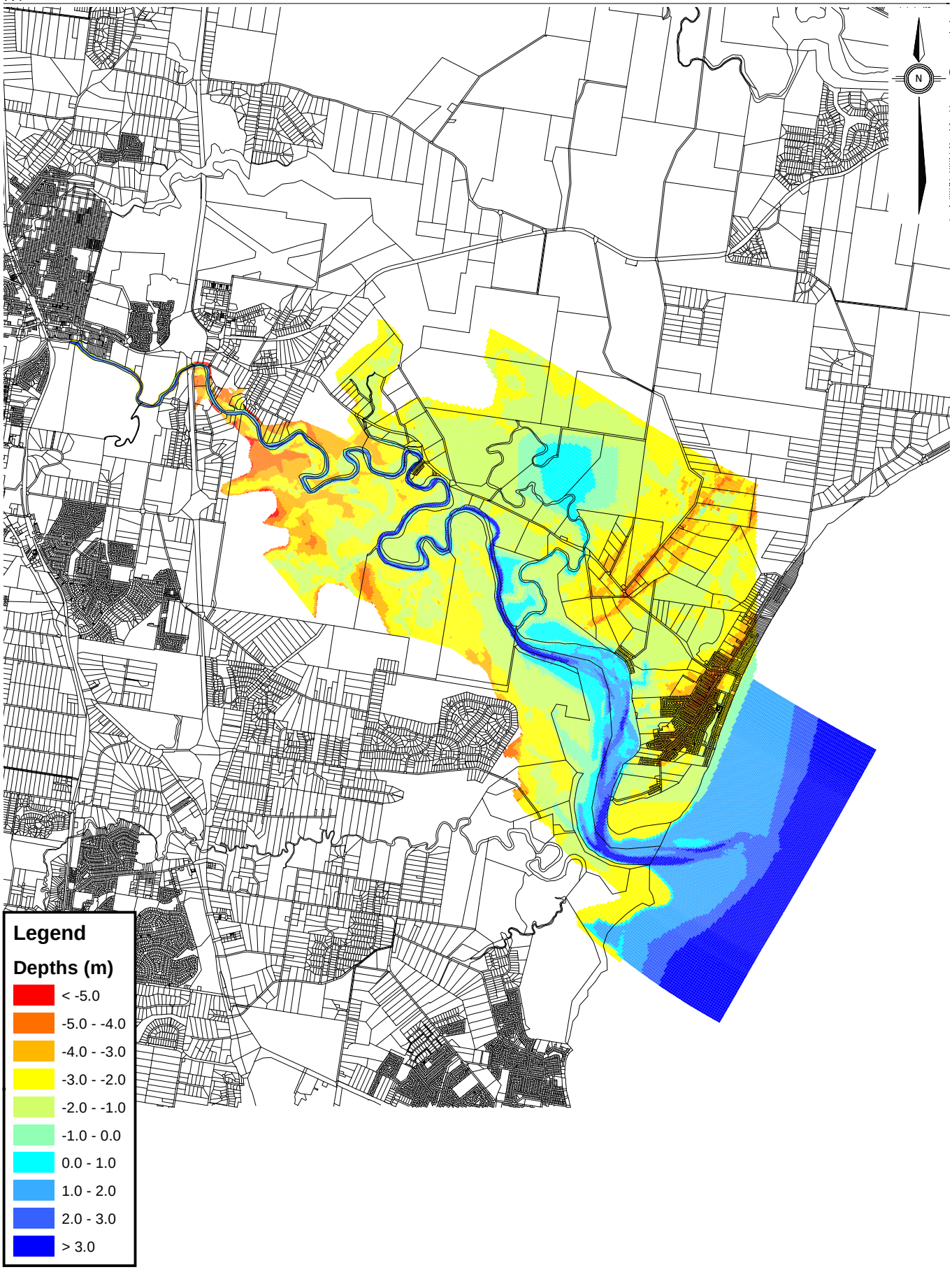

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FIGURE 2
Delft 3D Model Layout

Rev 0 **Date: June 2008**

Project No.: 790033

Northeast Business Park Pty Ltd

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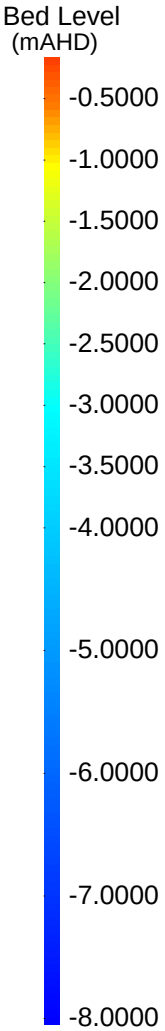
Base Bathymetry

Post-Dredge Bathymetry



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0 500 1,000
metres

Scale: 1:50,000 (A4)

Figure 3
Model Bathymetry

Rev: 0 **Date: June 2008**

Project No.: 790033/3

Port Binnli Pty Ltd
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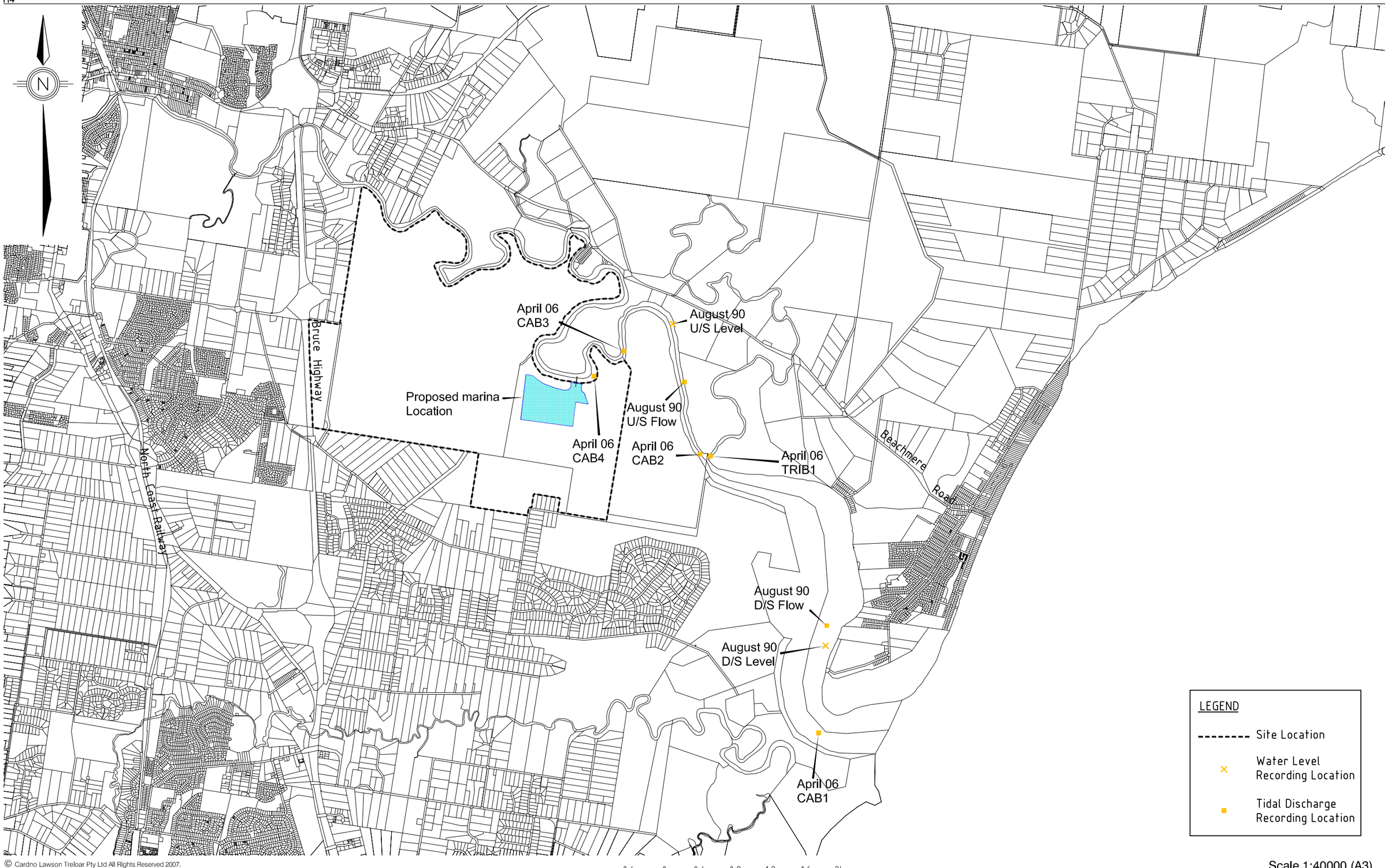
Northeast Business Park
R4

Cardno Lawson Treloar



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Scale 1:40000 (A3)

FIGURE 4
CALIBRATION DATA RECORDING LOCATIONS

Rev: Orig. Date: June 2008

Project No.: 790033/3

Northeast Business Park Pty Ltd

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PRINT DATE: 20 June, 2008 - 2:00pm

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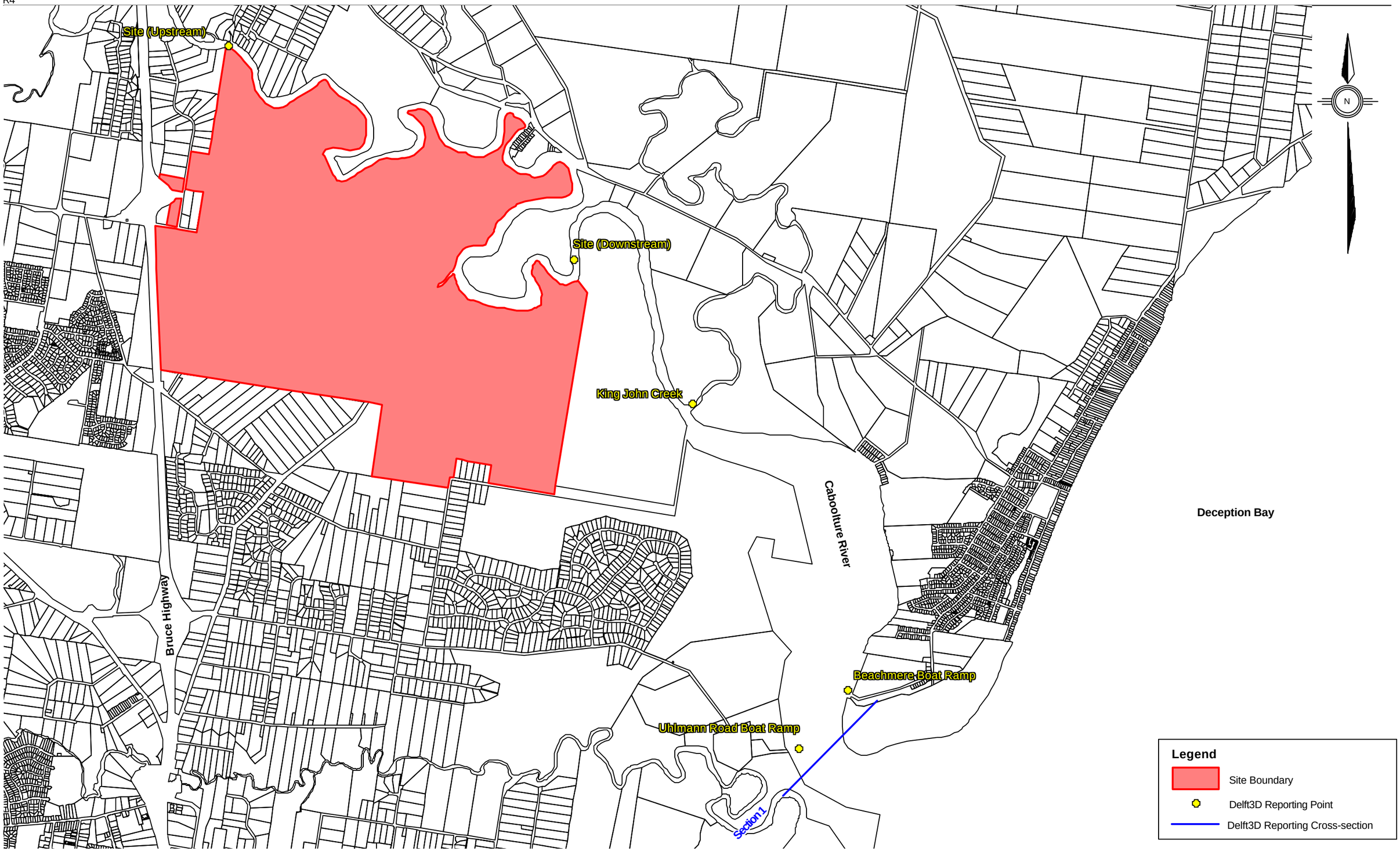

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FIGURE 5
Delft3D Model Output Locations

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Northeast Business Park Pty Ltd
(File Path)

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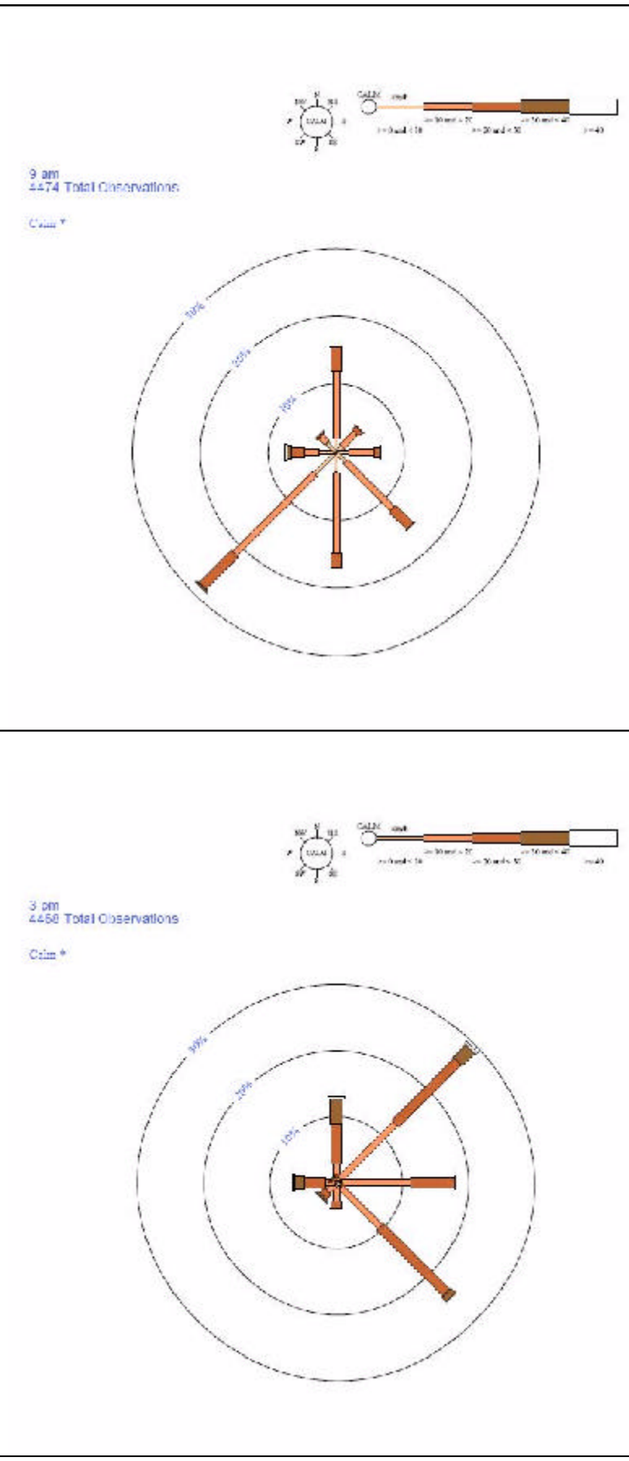
Scale 1:25,000 (A3)

FIGURE 6
River Mouth Aerial Photograph

Project No.: 790033/03



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Scale 1:25,000 (A3)

FIGURE 7
Reach Orientation within the Caboolture River

Rev: 0 Date: June 2008

Project No.: 790033/03

Northeast Business Park Pty Ltd

REFERENCE DRAWINGS

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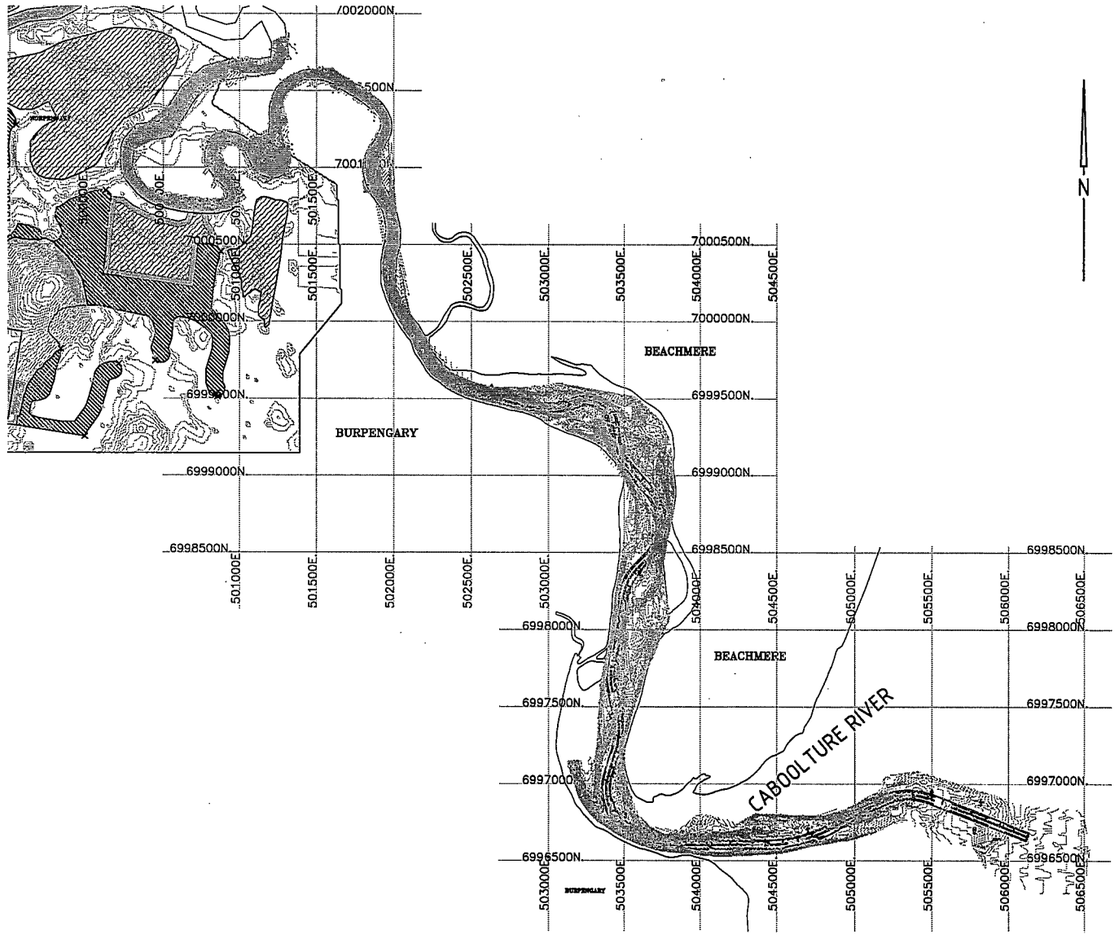
Engineering the Future

NORTH EAST BUSINESS PARK

CABOOLTURE RIVER DREDGING



SITE PLAN
1:20000

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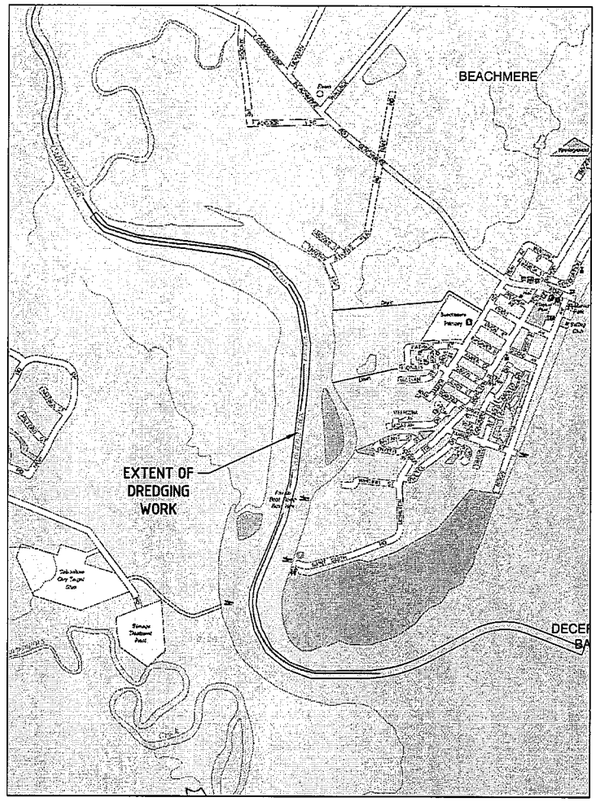
PO Box 388, Toowong QLD 4066 Australia

Telephone: 07 3369 9822
Facsimile: 07 3369 9722

Dwg No.: 7900/33/01-100 Date: 23.02.2007 Rev.:



LOCALITY PLAN
NTS

SCHEDULE OF DRAWINGS	
DRAWING No.	DESCRIPTION
7900/33/01-100	Cover Sheet
CABOOLTURE RIVER DREDGING	
7900/33/01-101	Locality Plan, Notes and Schedule of Drawings
7900/33/01-102	Layout Plan
7900/33/01-103	Centre Line Set Out
7900/33/01-104	Layout Plan - Sheet 1 of 10 - Chainage 0.000 - 800.000
7900/33/01-105	Layout Plan - Sheet 2 of 10 - Chainage 800.000 - 1600.000
7900/33/01-106	Layout Plan - Sheet 3 of 10 - Chainage 1600.000 - 2300.000
7900/33/01-107	Layout Plan - Sheet 4 of 10 - Chainage 2300.000 - 3100.000
7900/33/01-108	Layout Plan - Sheet 5 of 10 - Chainage 3100.000 - 3600.000
7900/33/01-109	Layout Plan - Sheet 6 of 10 - Chainage 3600.000 - 4100.000
7900/33/01-110	Layout Plan - Sheet 7 of 10 - Chainage 4100.000 - 4700.000
7900/33/01-111	Layout Plan - Sheet 8 of 10 - Chainage 4700.000 - 5200.000
7900/33/01-112	Layout Plan - Sheet 9 of 10 - Chainage 5200.000 - 5700.000
7900/33/01-113	Layout Plan - Sheet 10 of 10 - Chainage 5700.000 - 6522.954
7900/33/01-114	Cross Sections - Sheet 1 of 4 - Chainage 0.000 - 1900.000
7900/33/01-115	Cross Sections - Sheet 2 of 4 - Chainage 2000.000 - 3900.000
7900/33/01-116	Cross Sections - Sheet 3 of 4 - Chainage 4000.000 - 5700.000
7900/33/01-117	Cross Sections - Sheet 4 of 4 - Chainage 5800.000 - 6522.954

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STBD BCN	505818	6996864
PORT BCN	505776	6996683
STBD BCN	505499	6996929
PORT BCN	505385	6996895
STBD BCN	504703	6996690
PORT BCN	505098	6996766
STBD BCN	503879	6996660
PORT BCN	504756	6996622
SPECIAL BCN	503641	6996686
PORT BCN	503357	6996820
STBD BCN	503509	6996785
PORT BCN	503412	6997417
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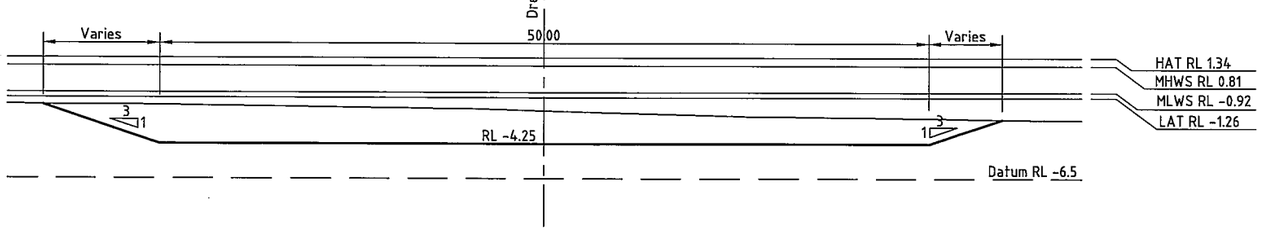

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DATE PLOTTED: 07 March, 2007 - 11:49am

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DRAWN:
CHECKED:
RECOMMENDED: PROJ. MGR
APPROVED: PROJ. DIR

A1 DATUM: A.H.D.

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XREF's: X-A1-BO-SHT A

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Rockhampton	(07) 4924 7500	(07) 4926 4375
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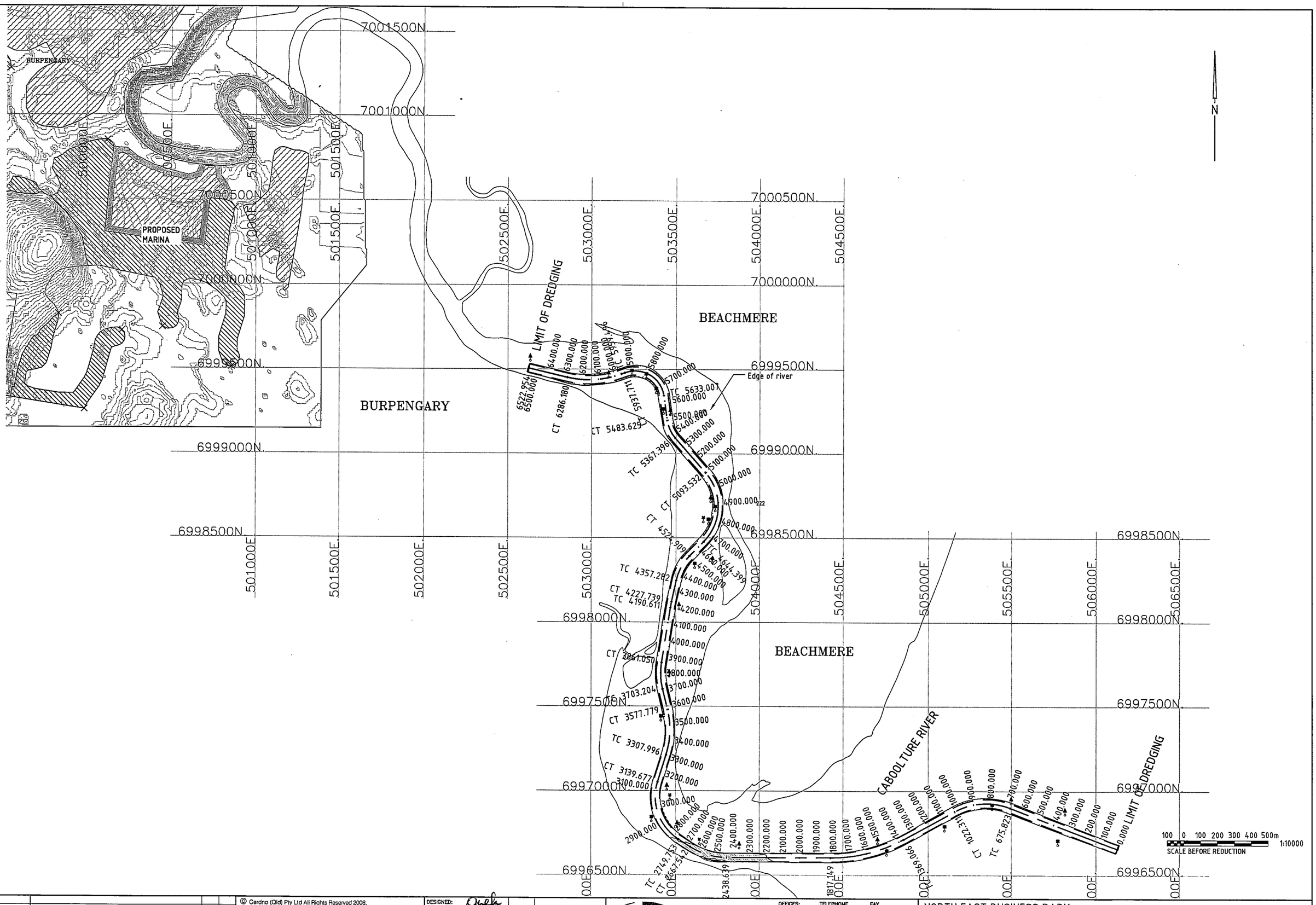
NORTH EAST BUSINESS PARK
CABOOLTURE RIVER DREDGING
LOCALITY PLAN, NOTES
& SCHEDULE OF DRAWINGS

DATE: 09-02-2007 Rv.
DRAWING No:
7900/33/01-101



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DESIGNED: DWH
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CHECKED: JSR
RECOMMENDED: PROJ. MAN.
APPROVED: PROJ. DIR.
A1 DATUM: A.H.D.
CAD FILE: L:\7900-33\SUB 01\Acad\7900-01-102.dwg
XREFs: X-A1-BO-SHT A; X-Base

DATE PLOTTED: 07 March, 2007 - 11:49am

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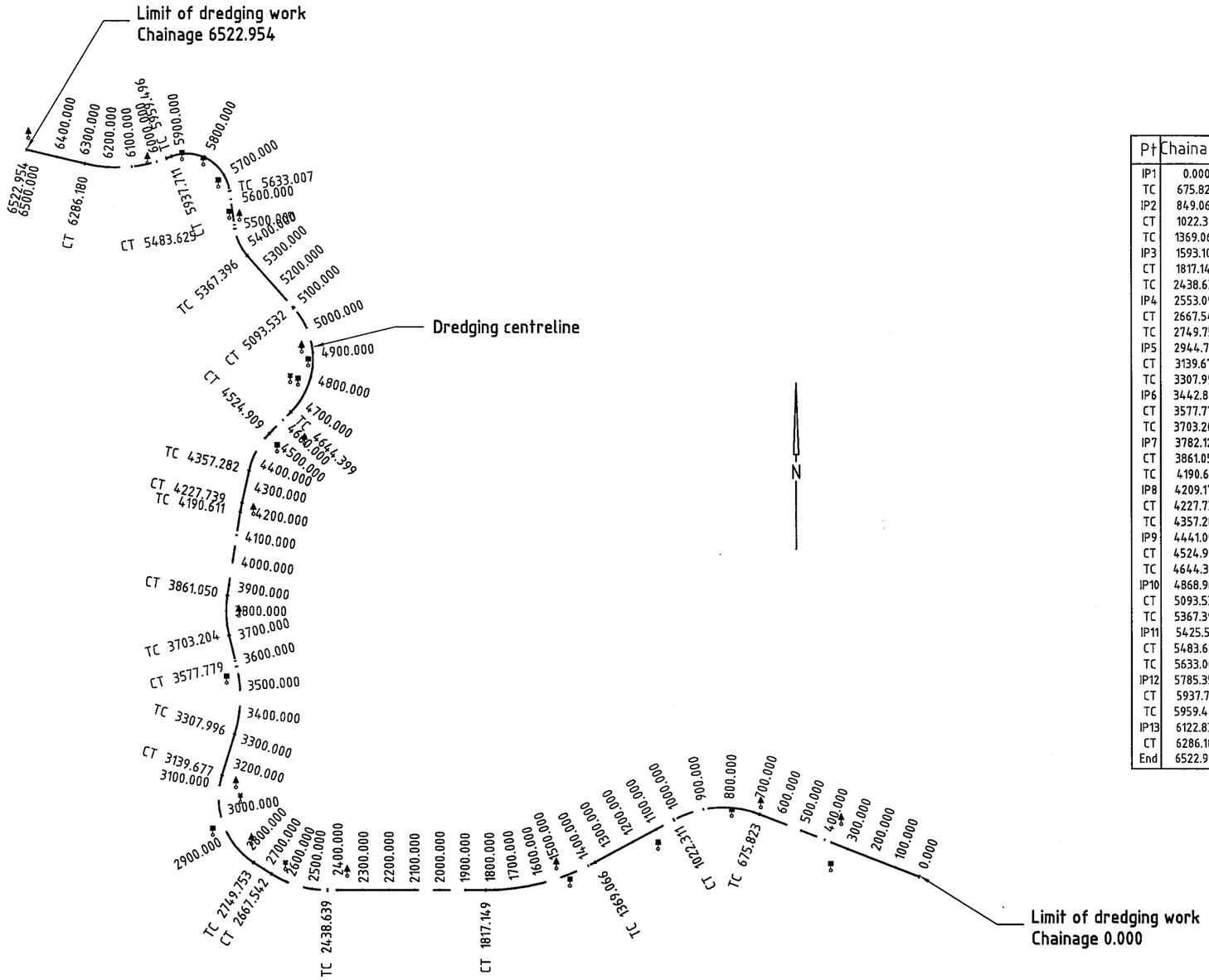
Hervey Bay	(07) 4124 5455	(07) 4124 5155
Central Coast	(07) 4323 2558	(07) 4324 3251
Melbourne	(03) 9818 7755	(03) 9818 7033
Rockhampton	(07) 4924 7500	(07) 4926 4375
Toowoomba	(07) 4637 8122	(07) 4637 8155

NORTH EAST BUSINESS PARK

CABOOLTURE RIVER DREDGING
LAYOUT PLAN

DATE: 09-02-2007
DRAWING No: 7900/33/01-102
Rv.



HORIZONTAL CENTRELINE CONTROL DETAILS

Pt	Chainage	Easting	Northing	Level	Bearing	Radius	Length	Angle
IP1	0.000	506125.109	6996658.439	-4.250				
TC	675.823	505494.473	6996901.411	-4.250	291°04'15"			
IP2	849.067	505321.884	6996967.907			-400.000	-346.488	49°37'51"
CT	1022.311	505159.433	6996879.483	-4.250	241°26'24"			
TC	1369.066	504854.873	6996713.708	-4.250	241°26'24"			
IP3	1593.107	504653.925	6996604.330			900.000	448.083	28°31'33"
CT	1817.149	504425.138	6996604.193	-4.250	269°57'57"			
TC	2438.639	503803.648	6996603.824	-4.250	269°57'57"			
IP4	2553.090	503685.968	6996603.754			400.000	228.903	32°47'16"
CT	2667.542	503586.998	6996667.422	-4.250	302°45'14"			
TC	2749.753	503517.858	6996711.901	-4.250	302°45'14"			
IP5	2944.715	503326.108	6996835.257			300.000	389.923	74°28'12"
CT	3139.677	503393.620	6997053.033	-4.250	17°13'25"			
TC	3307.996	503443.460	6997213.805	-4.250	17°13'25"			
IP6	3442.888	503484.400	6997345.867			-500.000	-269.783	30°54'53"
CT	3577.779	503451.675	6997480.200	-4.250	346°18'32"			
TC	3703.204	503421.988	6997602.061	-4.250	346°18'32"			
IP7	3782.127	503403.062	6997679.752			400.000	157.846	22°36'35"
CT	3861.050	503415.459	6997758.749	-4.250	8°55'07"			
TC	4190.611	503466.551	6998084.326	-4.250	8°55'07"			
IP8	4209.175	503469.430	6998102.671			600.000	37.127	3°32'43"
CT	4227.739	503473.438	6998120.803	-4.250	12°27'50"			
TC	4357.282	503501.397	6998247.293	-4.250	12°27'50"			
IP9	4441.095	503519.972	6998331.329			300.000	167.627	32°00'52"
CT	4524.909	503580.272	6998392.737	-4.250	44°28'42"			
TC	4644.399	503663.992	6998477.995	-4.250	44°28'42"			
IP10	4868.965	503859.240	6998676.830			-300.000	-449.134	85°46'42"
CT	5093.532	503675.317	6998886.187	-4.250	318°42'01"			
TC	5367.396	503494.567	6999091.931	-4.250	318°42'01"			
IP11	5425.511	503455.094	6999136.862			200.000	116.230	33°17'50"
CT	5483.625	503446.768	6999196.088	-4.250	351°59'51"			
TC	5633.007	503425.972	6999344.014	-4.250	351°59'51"			
IP12	5785.359	503396.380	6999554.503			-170.000	-304.705	102°41'45"
CT	5937.711	503197.541	6999479.375	-4.250	249°18'06"			
TC	5959.496	503177.163	6999471.675	-4.250	249°18'06"			
IP13	6122.838	503019.707	6999412.183			550.000	326.684	34°01'55"
CT	6286.180	502855.924	6999451.001	-4.250	283°20'02"			
End	6522.954	502625.533	6999505.607	-4.250				

100 0 100 200 300 400 500m
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A1 DATUM: A.H.D.

CAD FILE: I:\7900-33\SUB 01\Acad\7900330I-103.dwg
XREF's: X-Base; X-A1-B0-SHT A

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NORTH EAST BUSINESS PARK

CABOOLTURE RIVER DREDGING
CENTRE LINE SET OUT

DATE: 09-02-2007 Rv.
DRAWING No:
7900/33/01-103

N

Green Navigation Beacon

Red Navigation Beacon

Yellow Navigation Beacon

Existing minor contours

Existing minor contours

Area notbe dredged

Area to be dredged

800.000

700.000

TC 675.823

600.000

500.000

400.000

300.000

200.000

100.000

0.000

Channel starts from CH. 0.000 at RL -4.250. Slope at 1 in 5 to natural surface.

10 0 10 20 30 40 50m

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NORTH EAST BUSINESS PARK

CABOOLTURE RIVER DREDGING
LAYOUT PLAN - CH 0.000 - CH 800.000
SHEET 1 OF 10

DATE: 09-02-2007
DRAWING No:
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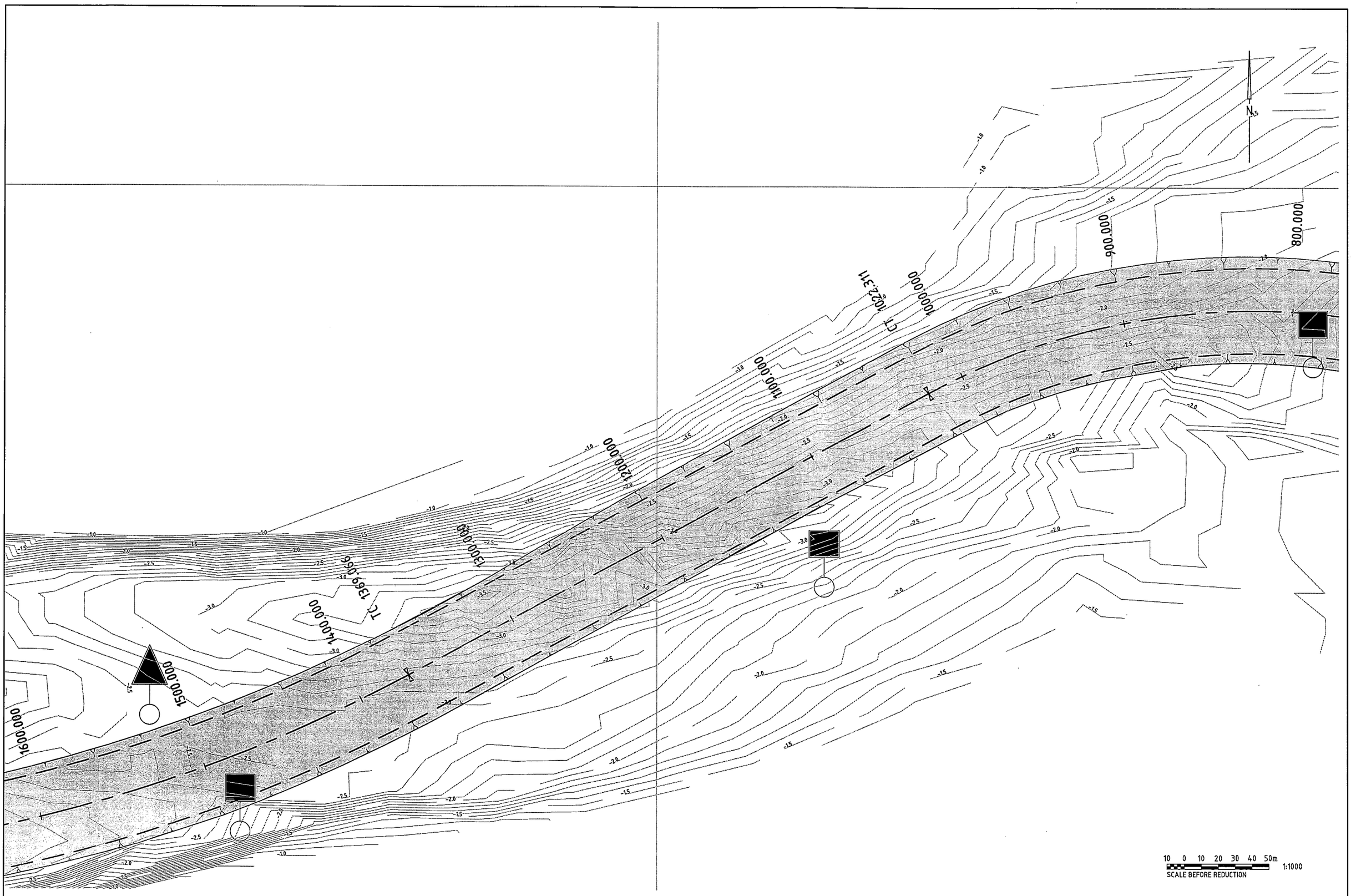

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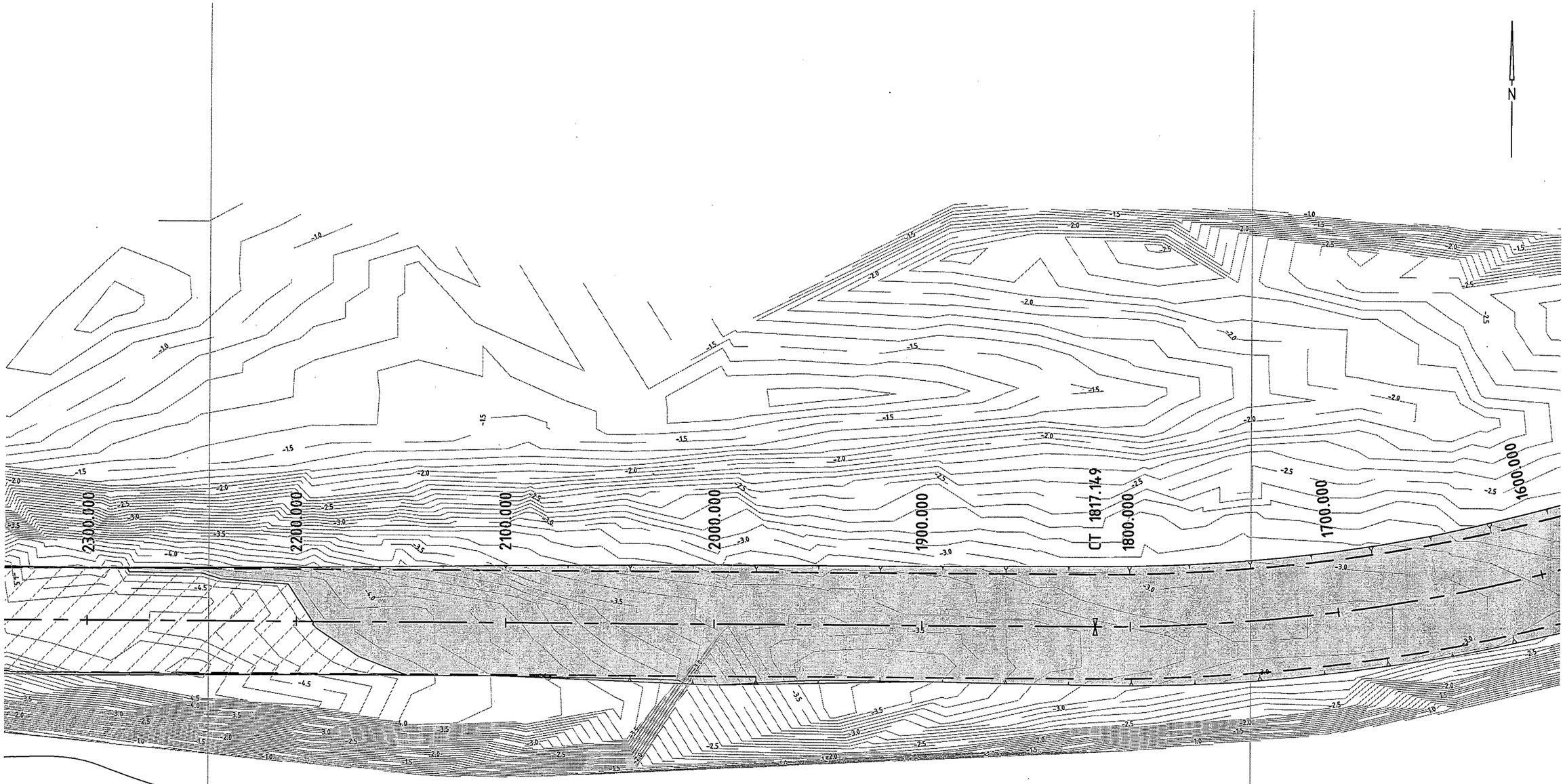
NORTH EAST BUSINESS PARK

CABOOLTURE RIVER DREDGING
LAYOUT PLAN - CH 800.000 - CH 1600.000
SHEET 2 OF 10

DATE: 09-02-2007 Rv.
DRAWING No:
7900/33/01-105



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NORTH EAST BUSINESS PARK

CABOOLTURE RIVER DREDGING
LAYOUT PLAN - CH 1600.000 - CH 2300.000
SHEET 3 OF 10

DATE: 09-02-2007
DRAWING No:
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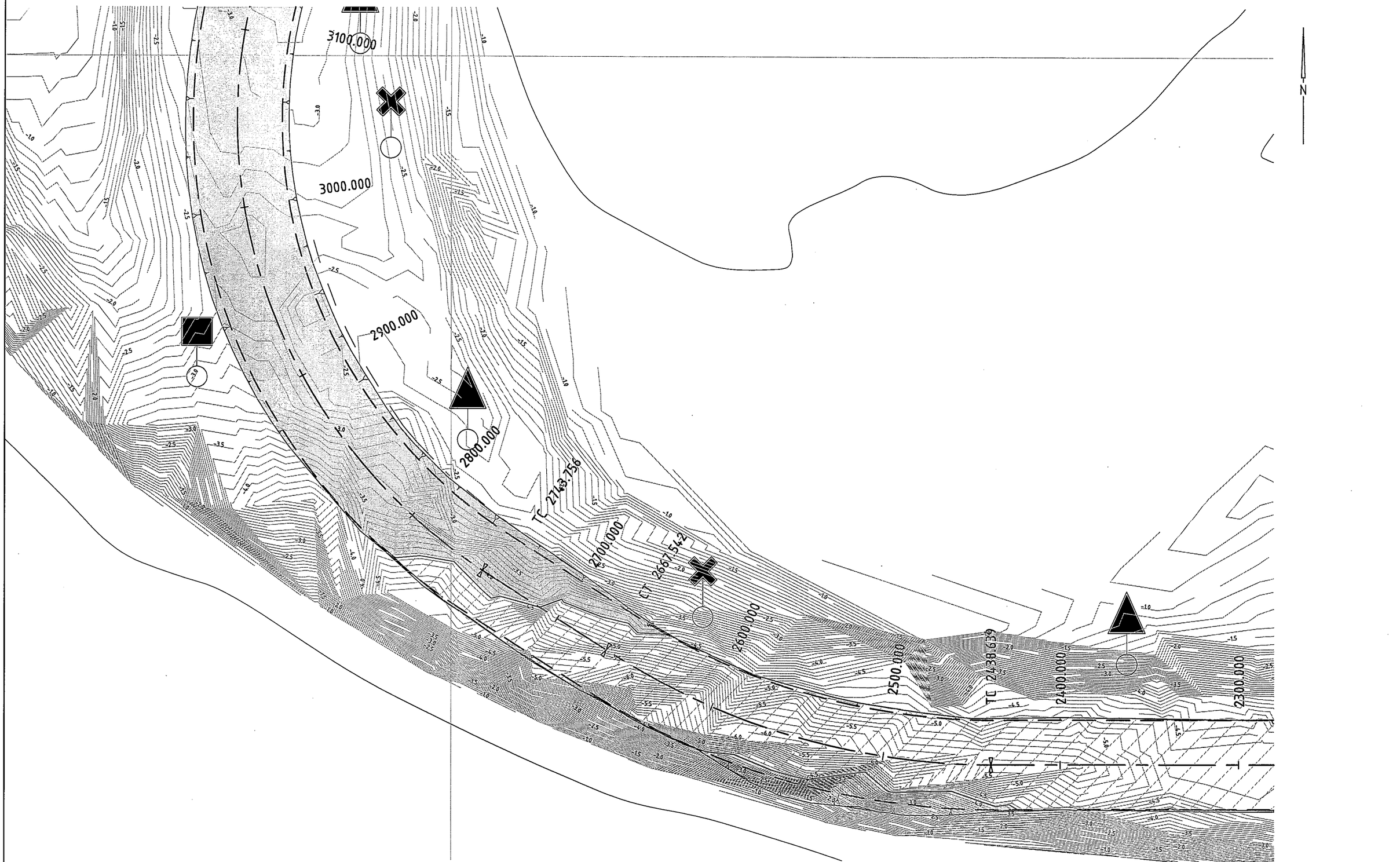

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NORTH EAST BUSINESS PARK

CABOOLTURE RIVER DREDGING
LAYOUT PLAN - CH2300.000 - CH 3100.000
SHEET 4 OF 10

DATE: 09-02-2007
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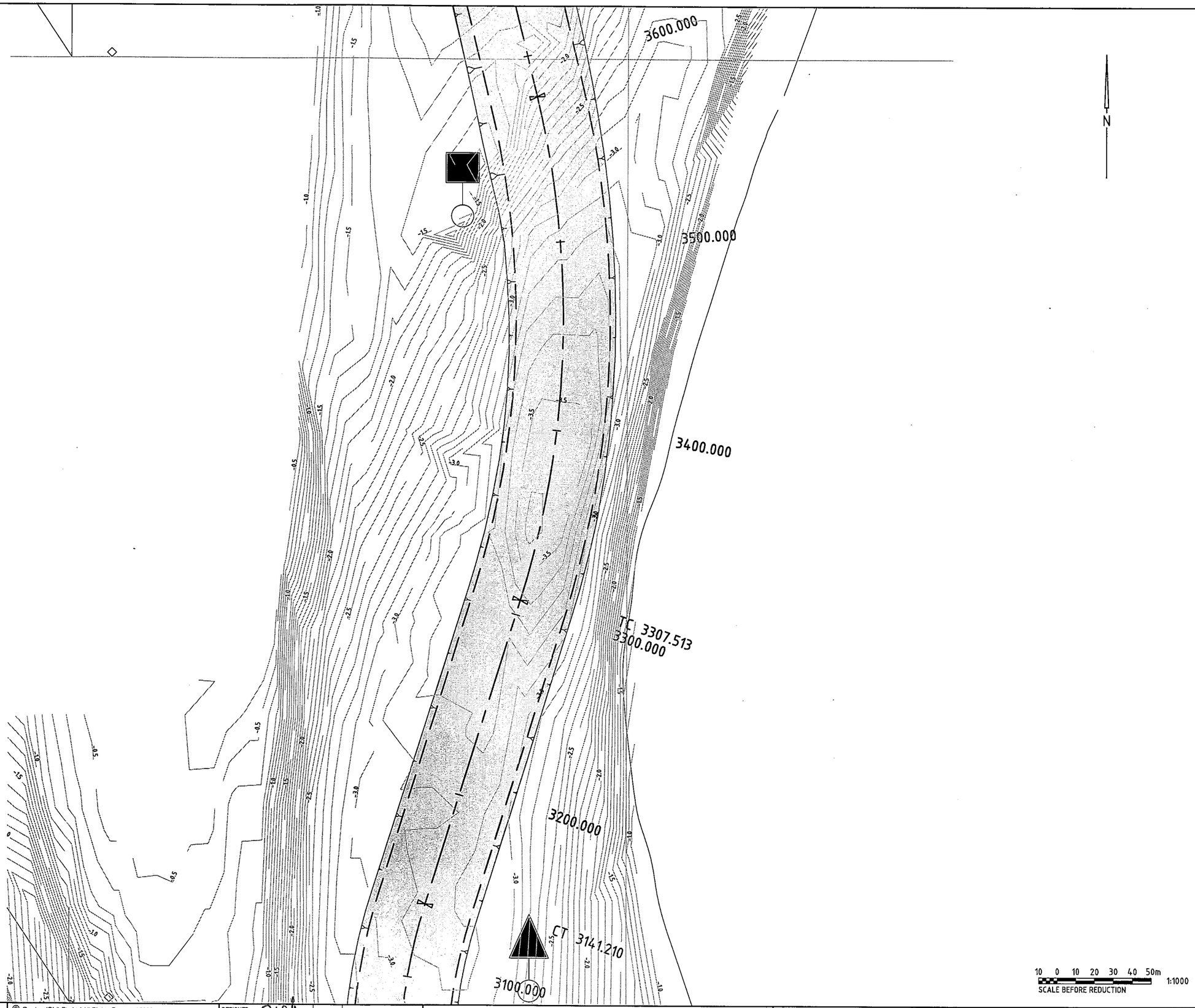

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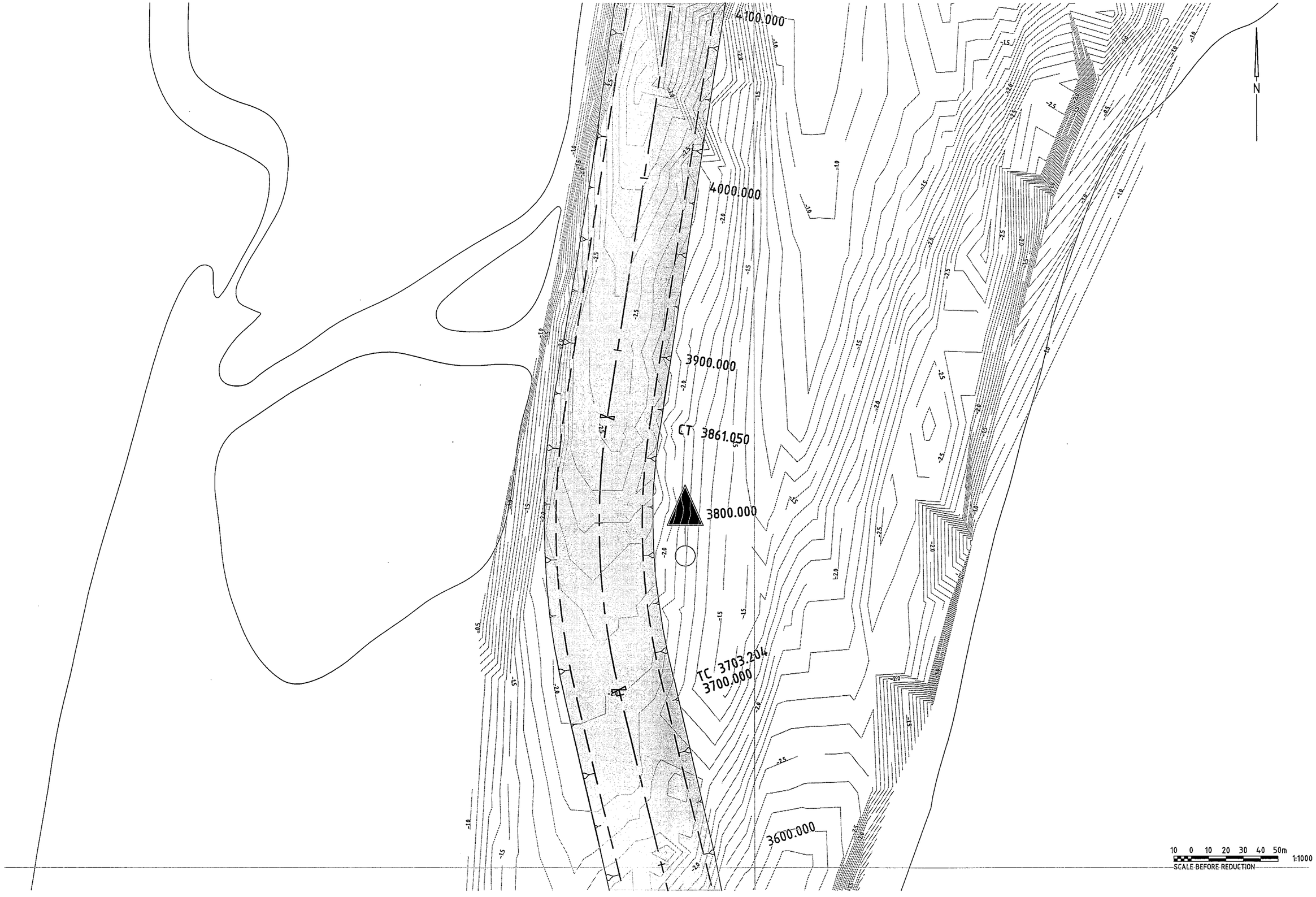
NORTH EAST BUSINESS PARK

CABOOLTURE RIVER DREDGING
LAYOUT PLAN - CH 3100.000 - CH 3600.000
SHEET 5 OF 10

DATE: 09-02-2007
DRAWING No: 7900/33/01-108
Rv.



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NORTH EAST BUSINESS PARK

CABOOLTURE RIVER DREDGING
LAYOUT PLAN - CH 3600.000 - CH 4100.000
SHEET 6 OF 10

DATE: 09-02-2007 Rv.

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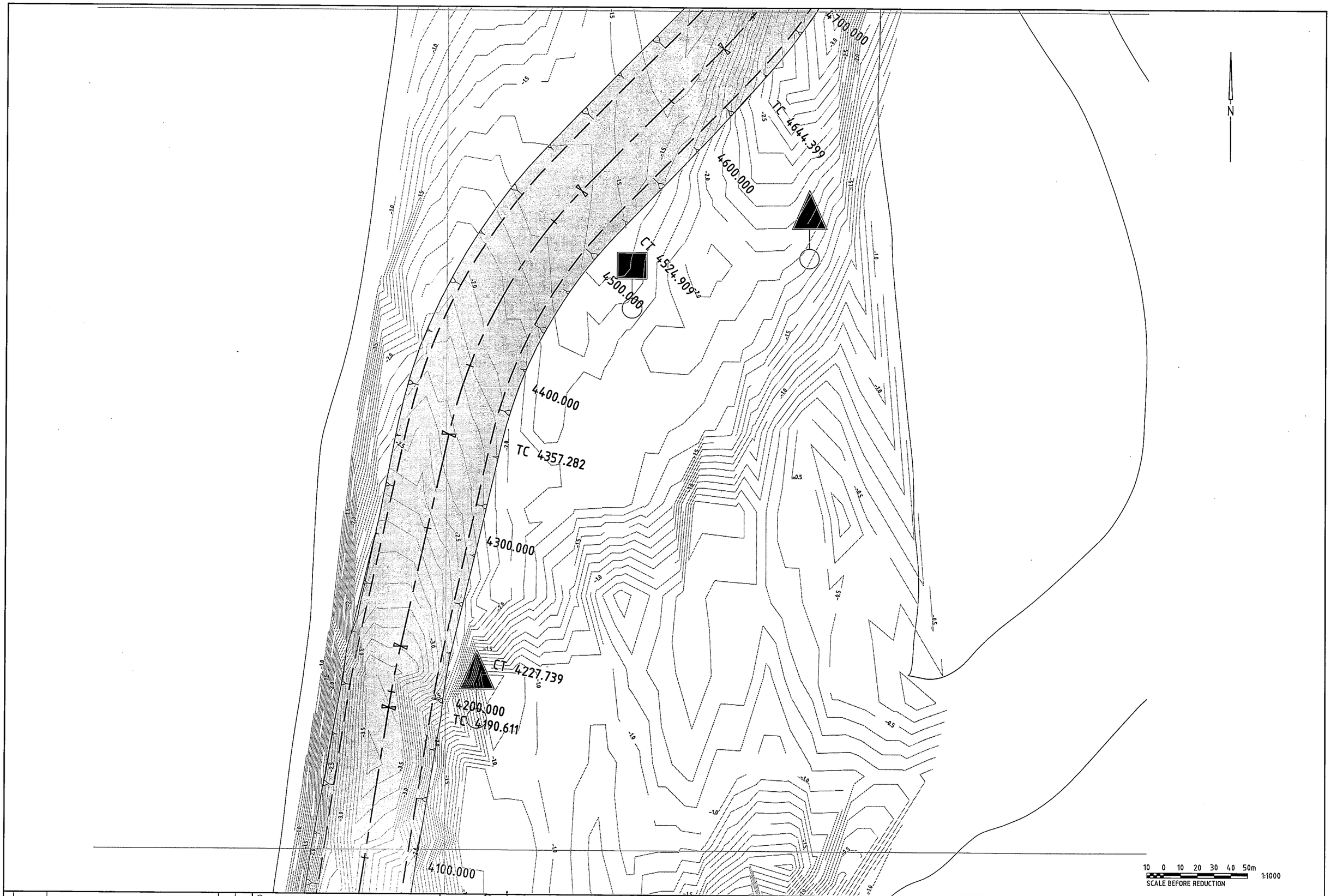
7900/33/01-109



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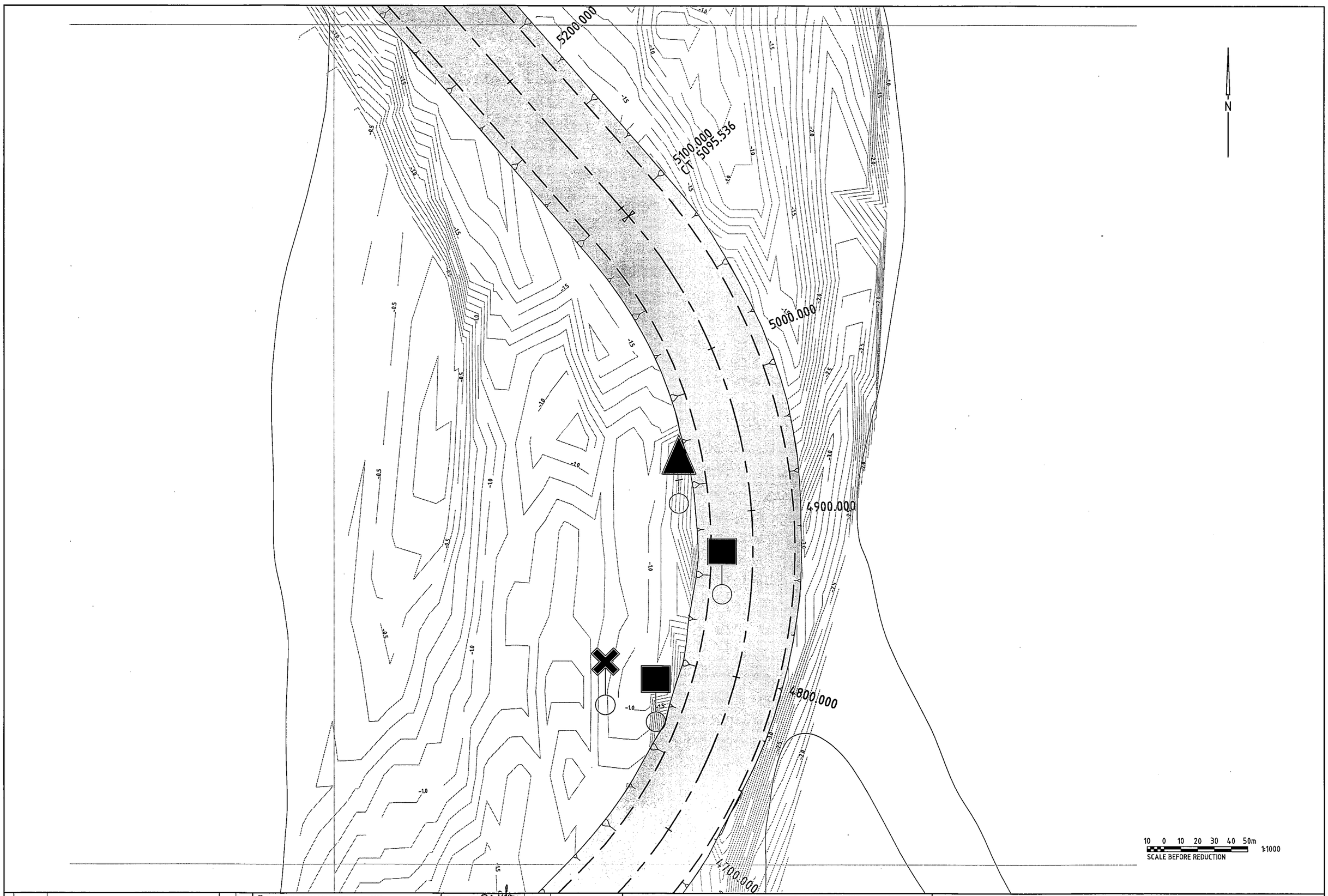

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NORTH EAST BUSINESS PARK

CABOOLTURE RIVER DREDGING
LAYOUT PLAN - CH 4700.000 - CH 5200.000
SHEET 8 OF 10

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Sydney	(02) 9496 7700	(02) 9499 3902
Gold Coast	(07) 5539 9333	(07) 5538 4647
Sunshine Coast	(07) 5443 5555	(07) 5443 5642
Townsville	(07) 4772 1166	(07) 4721 2508
Hervey Bay	(07) 4124 5455	(07) 4124 5155
Central Coast	(02) 4323 2558	(02) 4324 3251
Melbourne	(03) 9818 7755	(03) 9818 7033
Rockhampton	(07) 4924 7500	(07) 4926 4375
Toowoomba	(07) 4637 8122	(07) 4637 8155

NORTH EAST BUSINESS PARK

CABOOLTURE RIVER DREDGING
LAYOUT PLAN – CH 5200.000 – CH 5700.000
SHEET 9 OF 10

DATE: 09-02-2007
DRAWING No:
7900/33/01-112
Rv.

N

6522.954

6500.000

6400.000

6300.000

CT 6286.180

6200.000

6100.000

6000.000

TL 5959.496

CT 5937.711

5900.000

5800.000

5700.000

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Rv.	DATE	REVISIONS	REC.	APPR.

DESIGNED:
DRAWN:
CHECKED:
RECOMMENDED: PROJ. MGR
APPROVED: PROJ. DIR.

A1 DATUM: A.H.D.

CAD FILE: L:\7900-33_JSUB 01_Acad_7900333-01-113.dwg
XREFs: X-Base; EXISTING UNCLIPPED CONTOURS; X-A1-BO-SHT A

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Central Coast	(02) 4323 2558	(02) 4324 3251
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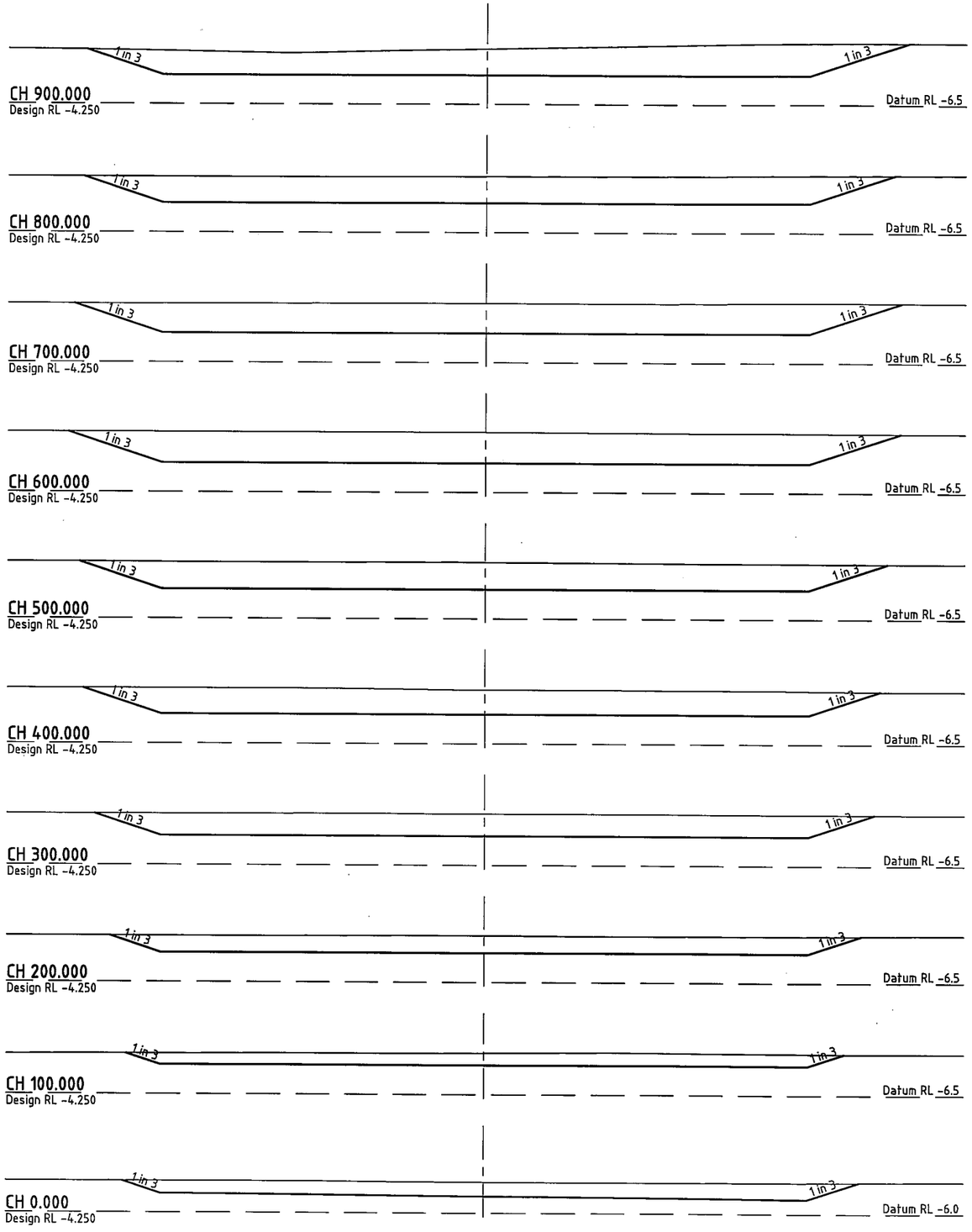
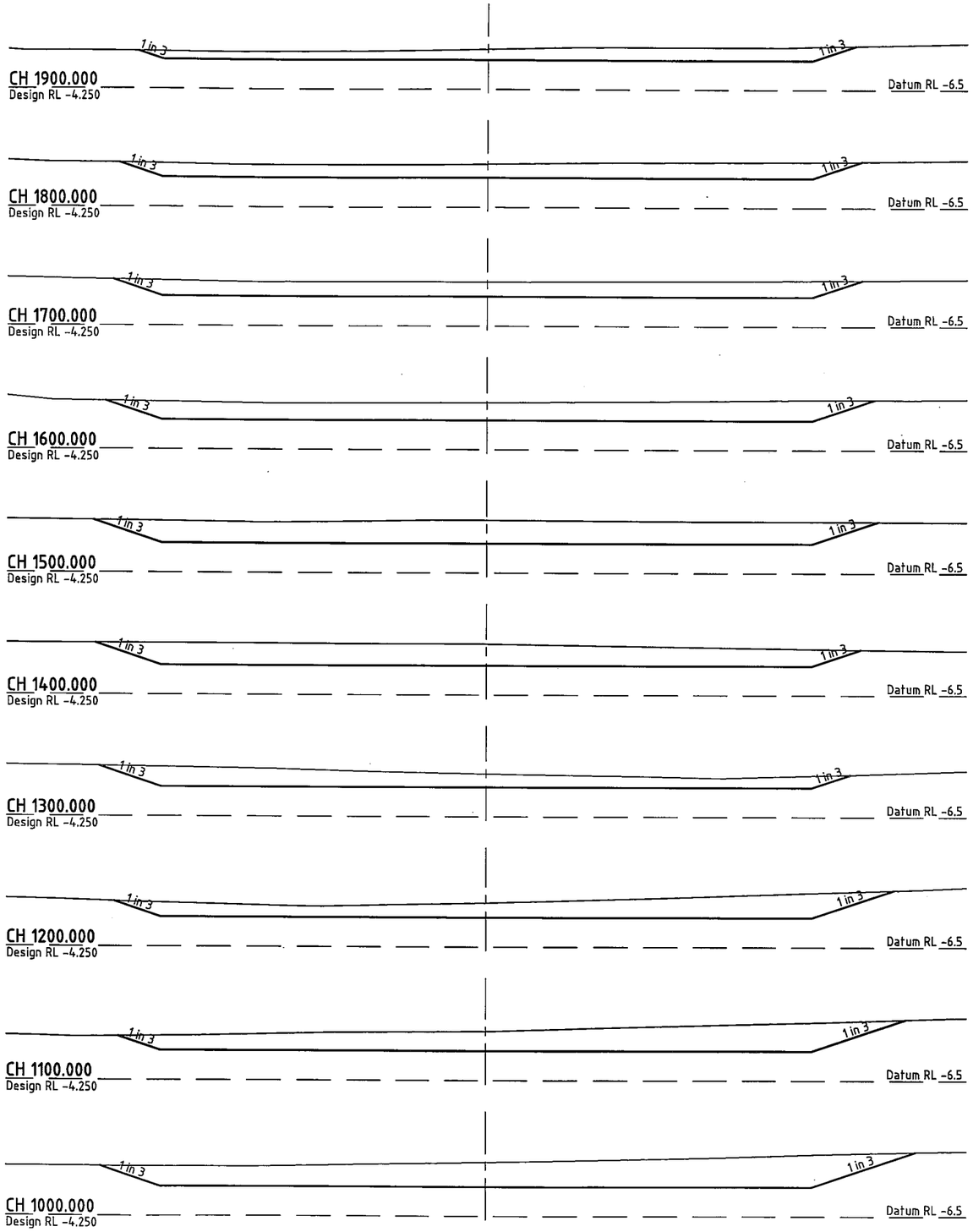
Toowoomba	(07) 4637 8122	(07) 4637 8155

NORTH EAST BUSINESS PARK

CABOOLTURE RIVER DREDGING
LAYOUT PLAN - CH 5700.000 - CH 6522.954
SHEET 10 OF 10

DATE: 09-02-2007 Rv.
DRAWING No:
7900/33/01-113





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Rv.	DATE	REVISIONS	REC.	APPR.

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DESIGNED:
DRAWN:
CHECKED:
RECOMMENDED: PROJ. MGR.
APPROVED: PROJ. DIR.
A1 DATUM: A.H.D.
CAD FILE: L:\7900-33_JSUB 01\Acad_\790033-01-114.dwg
XREFs: X-A1-BD-SHT A

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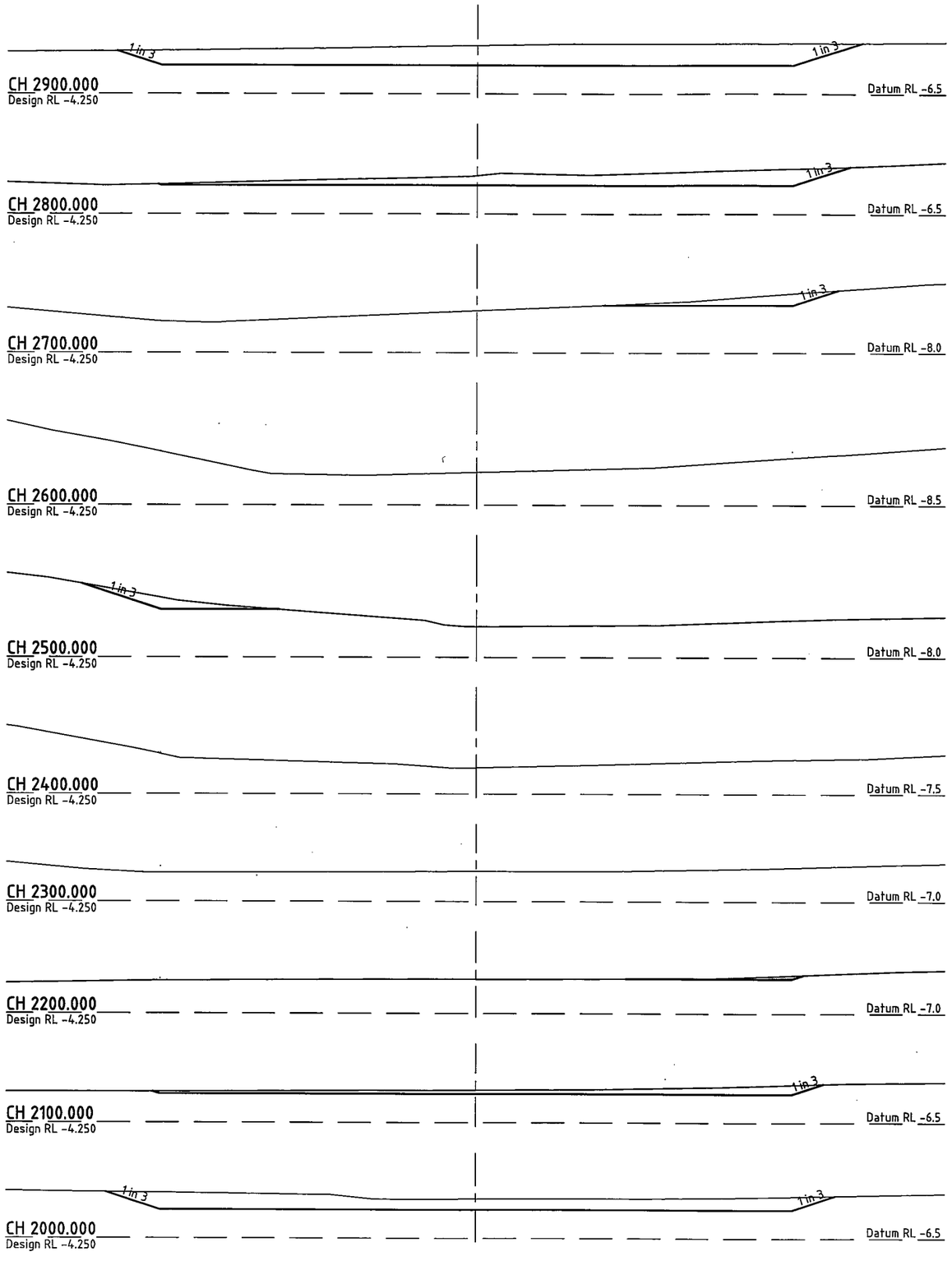
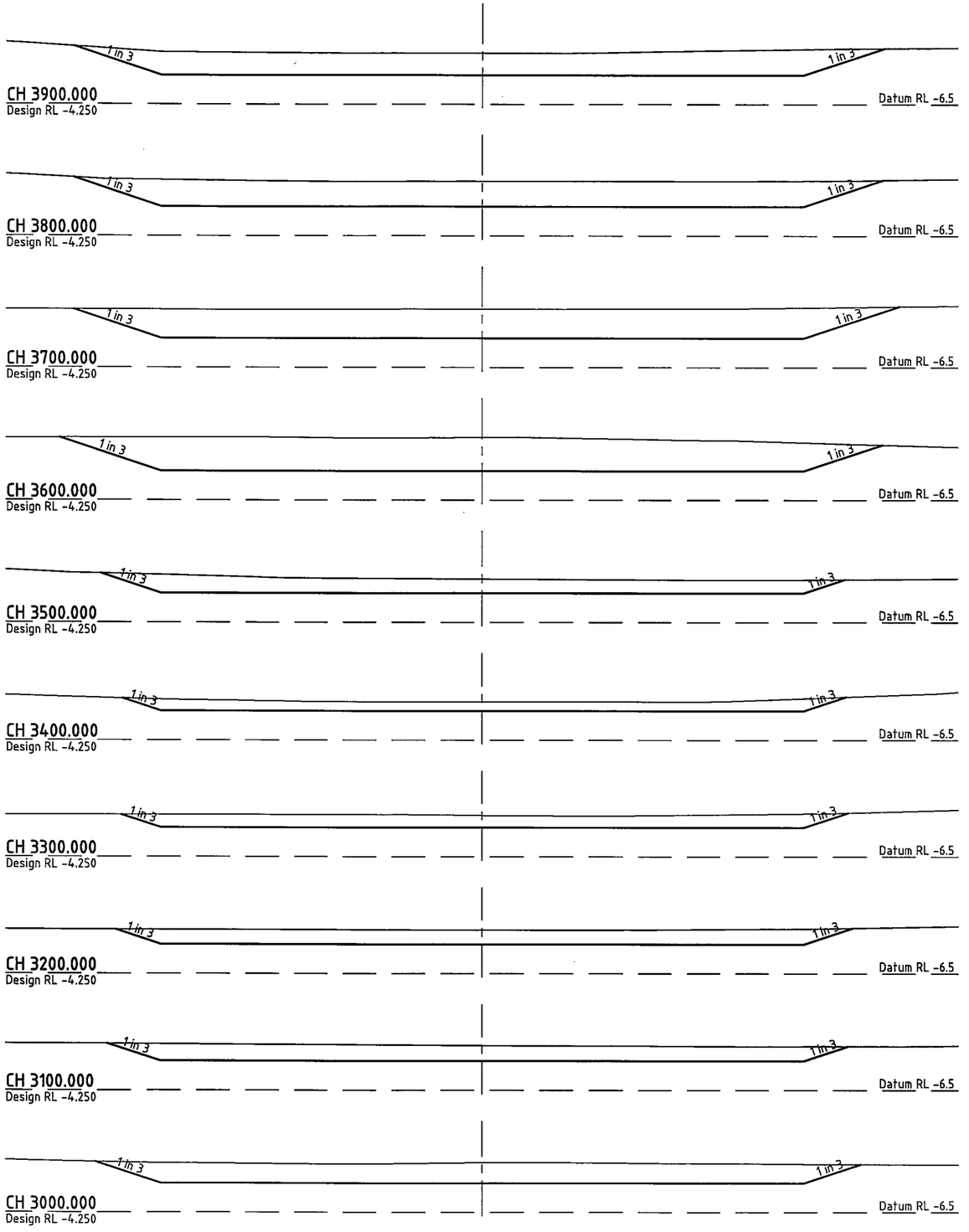
NORTH EAST BUSINESS PARK
CABOOLTURE RIVER DREDGING
CROSS SECTIONS - CH 0.000 - CH 1900.000
SHEET 1 OF 4

DATE: 09-02-2007
DRAWING No:
7900/33/01-114
Rv.





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SCALE BEFORE REDUCTION 1:200

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DESIGNED:
DRAWN:
CHECKED:
RECOMMENDED: PROJ. MAN.
APPROVED: PROJ. DIR.
CAD FILE: L:\7900-33_SUB 01_Acad\7900033-01-115.dwg
XREF's: X-A1-BO-SHT A

A1 DATUM: A.H.D.

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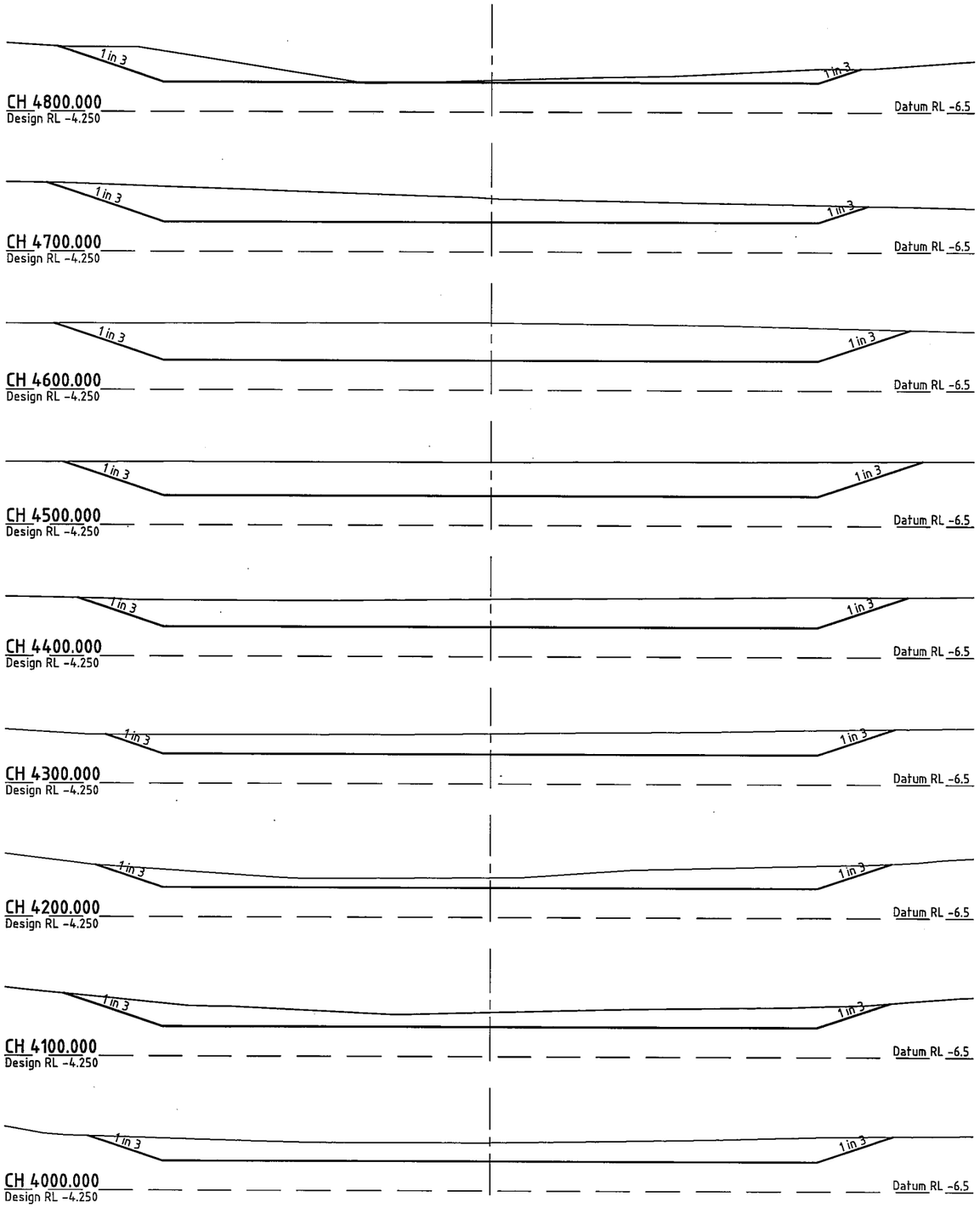
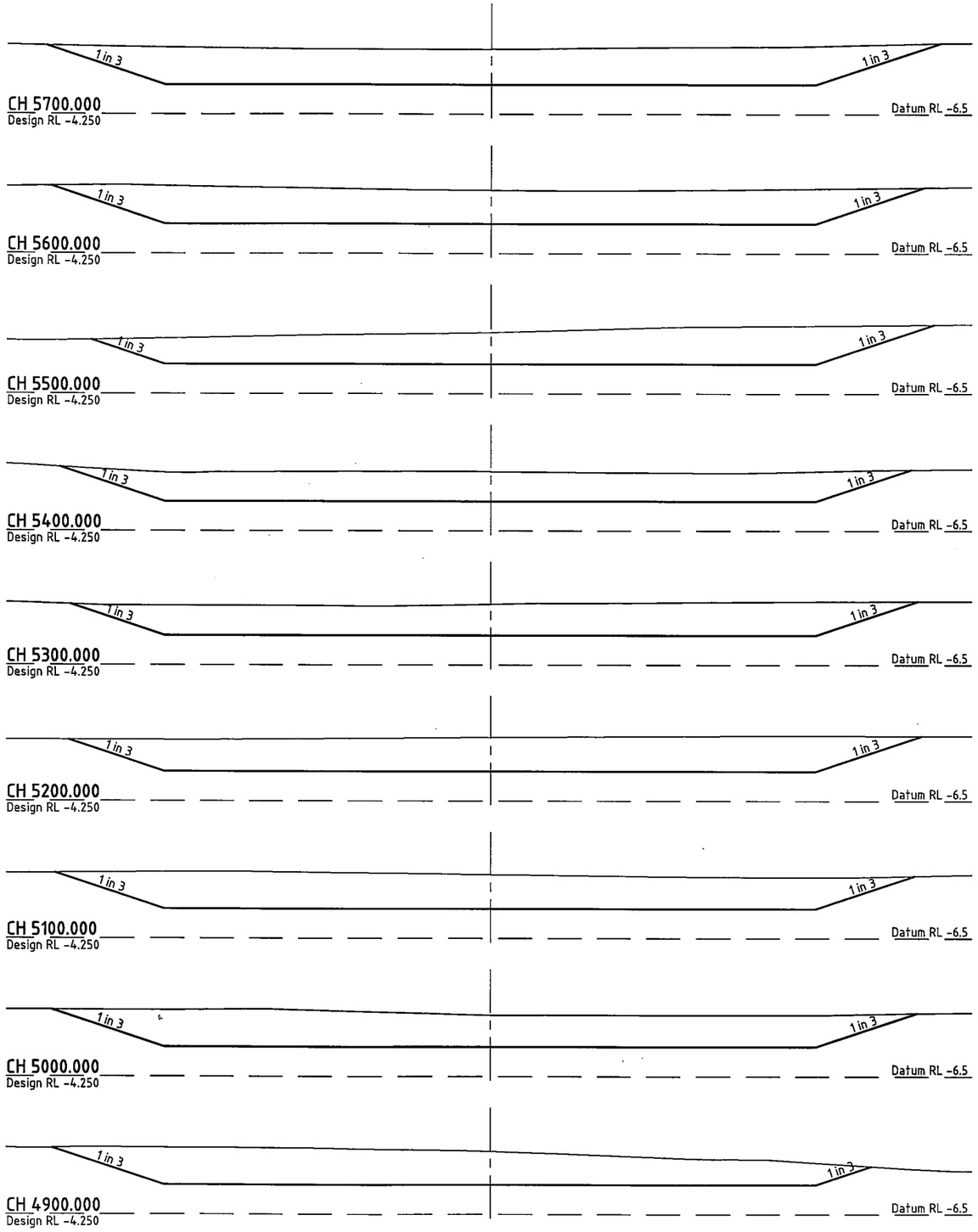
NORTH EAST BUSINESS PARK
CABOOLTURE RIVER DREDGING
CROSS SECTIONS - CH 2000.000 - CH 3900.000
SHEET 2 OF 4

DATE: 09-02-2007
DRAWING No:
7900/33/01-115
Rv.





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DESIGNED: owb
DRAWN: owb
CHECKED: J.M.
RECOMMENDED: PROJ. MAN.
APPROVED: PROJ. DIR.
A1 DATUM: A.H.D.
CAD FILE: L:\7900-33_SUB 01_Acad\7900033-01-116.dwg
XREF's: X-A1-80-SHT A

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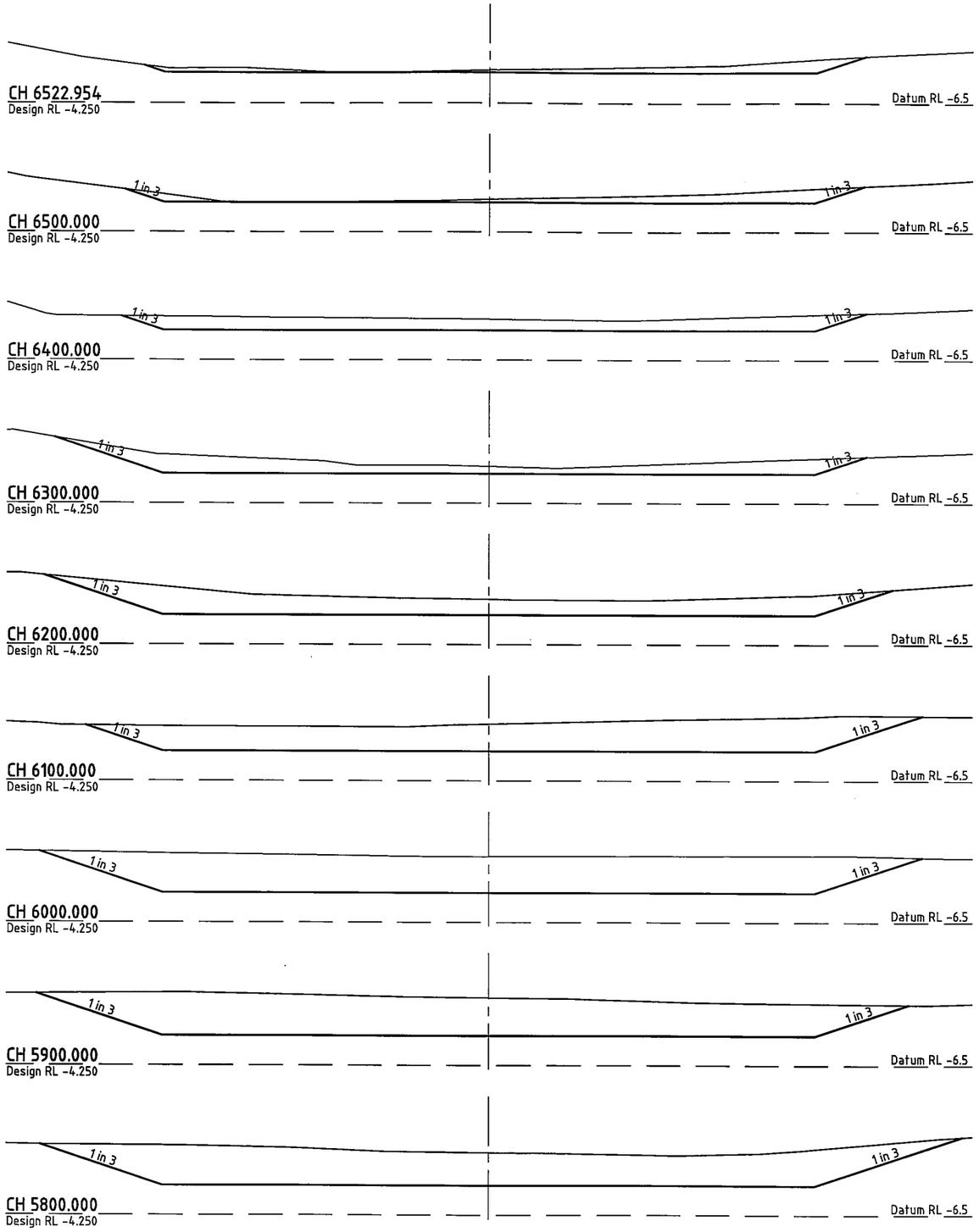
NORTH EAST BUSINESS PARK
CABOOLTURE RIVER DREDGING
CROSS SECTIONS - CH 4000.000 - CH 5700.000
SHEET 3 OF 4

DATE: 09-02-2007
DRAWING No: 7900/33/01-116
Rv.



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APPROVED: PROJ. DIR.
A1 DATUM: A.H.D.
CAD FILE: L:\7900-33_JSUB 01_Acad\7900033-01-117.dwg
XREFs: X-A1-BO-SHT A

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NORTH EAST BUSINESS PARK
CABOOLTURE RIVER DREDGING
CROSS SECTIONS - CH 5800.000 - CH 6522.954
SHEET 4 OF 4

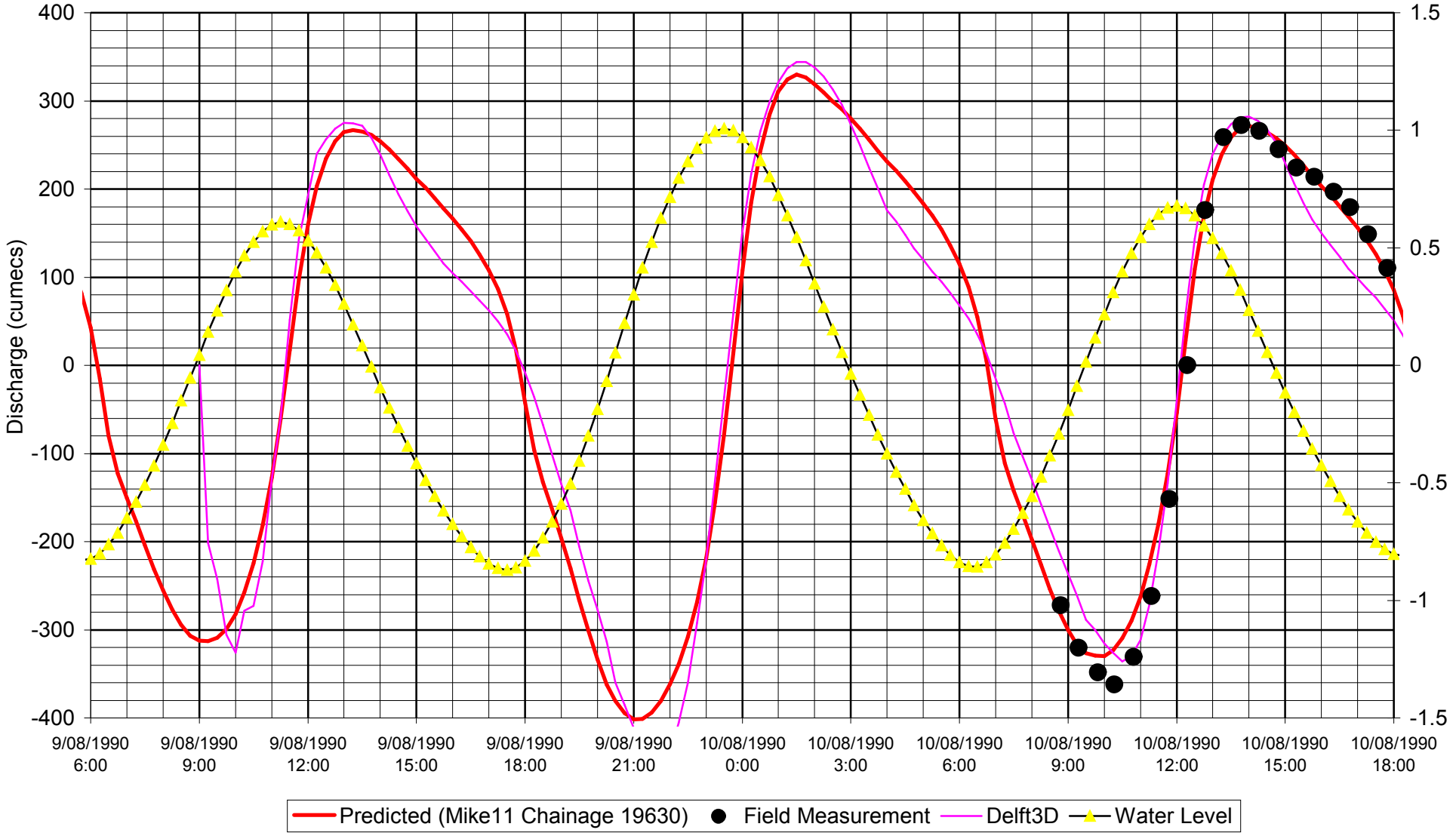
DATE: 09-02-2007
DRAWING No: 7900/33/01-117
Rv.

APPENDIX A

Hydrodynamic Model Calibration Results

Cardno Lawson Treloar

Caboolture River Tide Model Calibration
Discharge - "August 90 D/S Flow"



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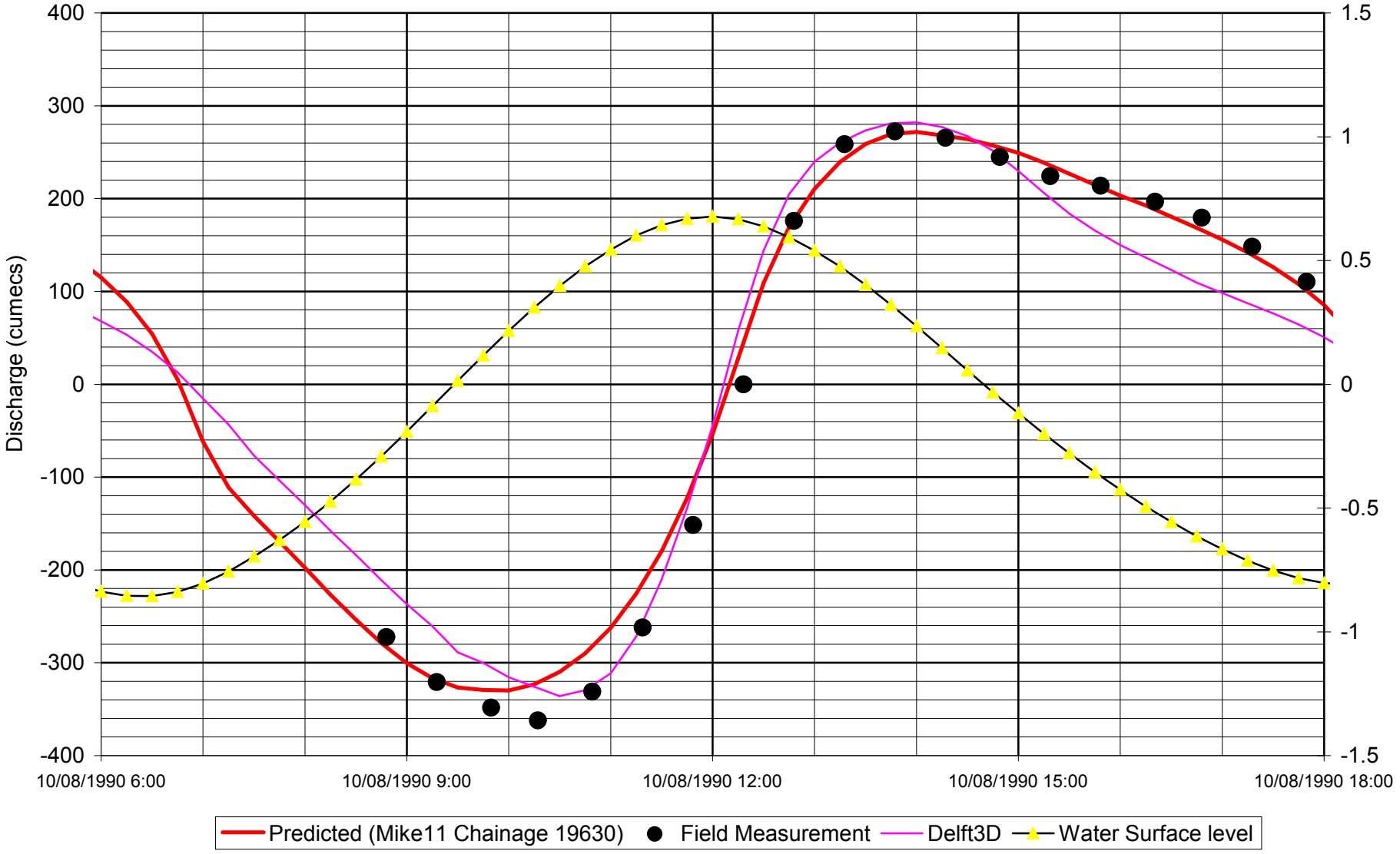
Cardno Lawson Treloar

Caboolture River Tide Model Calibration
Discharge - "August 90 D/S Flow"



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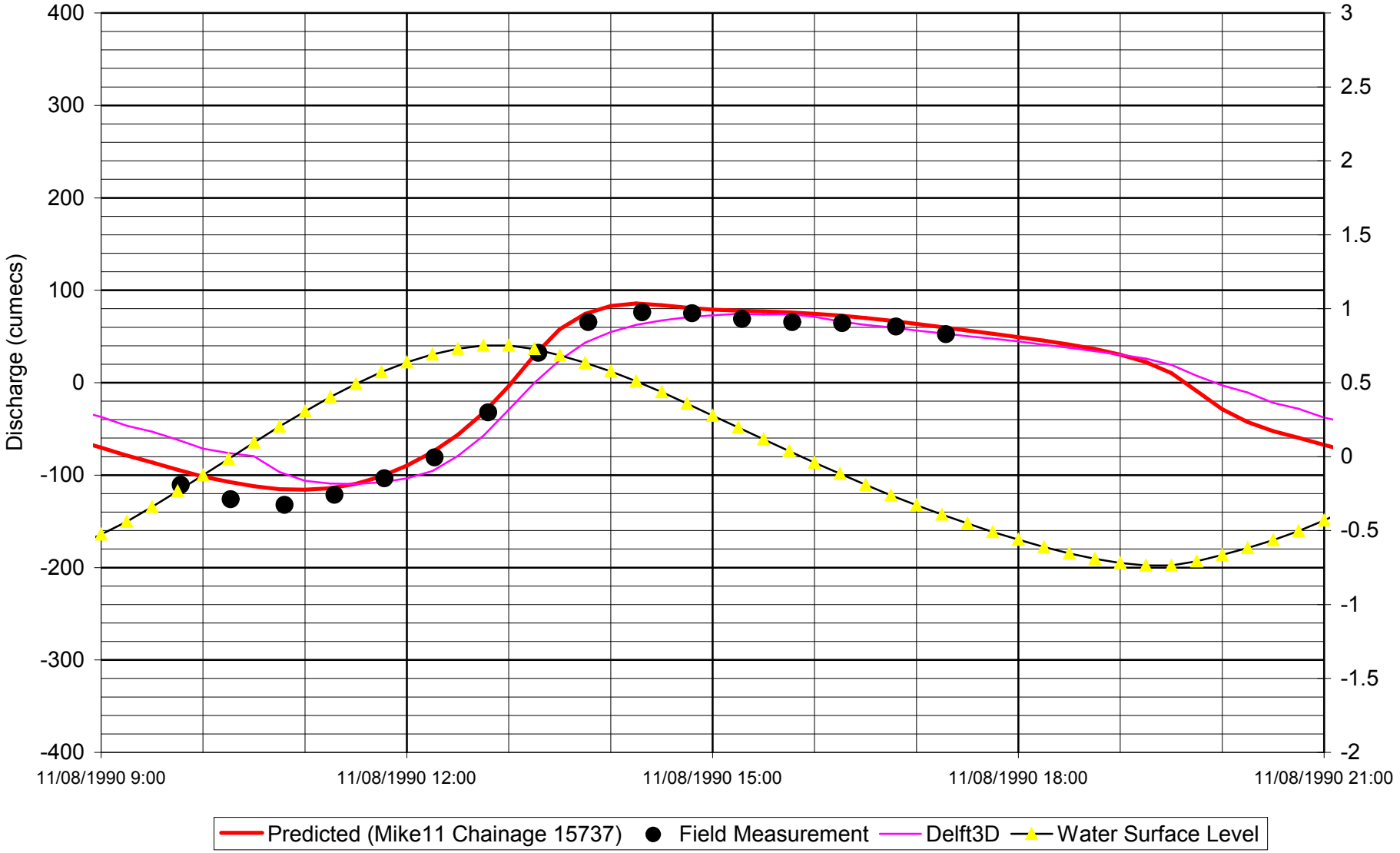
Cardno Lawson Treloar

Caboolture River Tide Model Calibration
Discharge - "August 90 U/S Flow"



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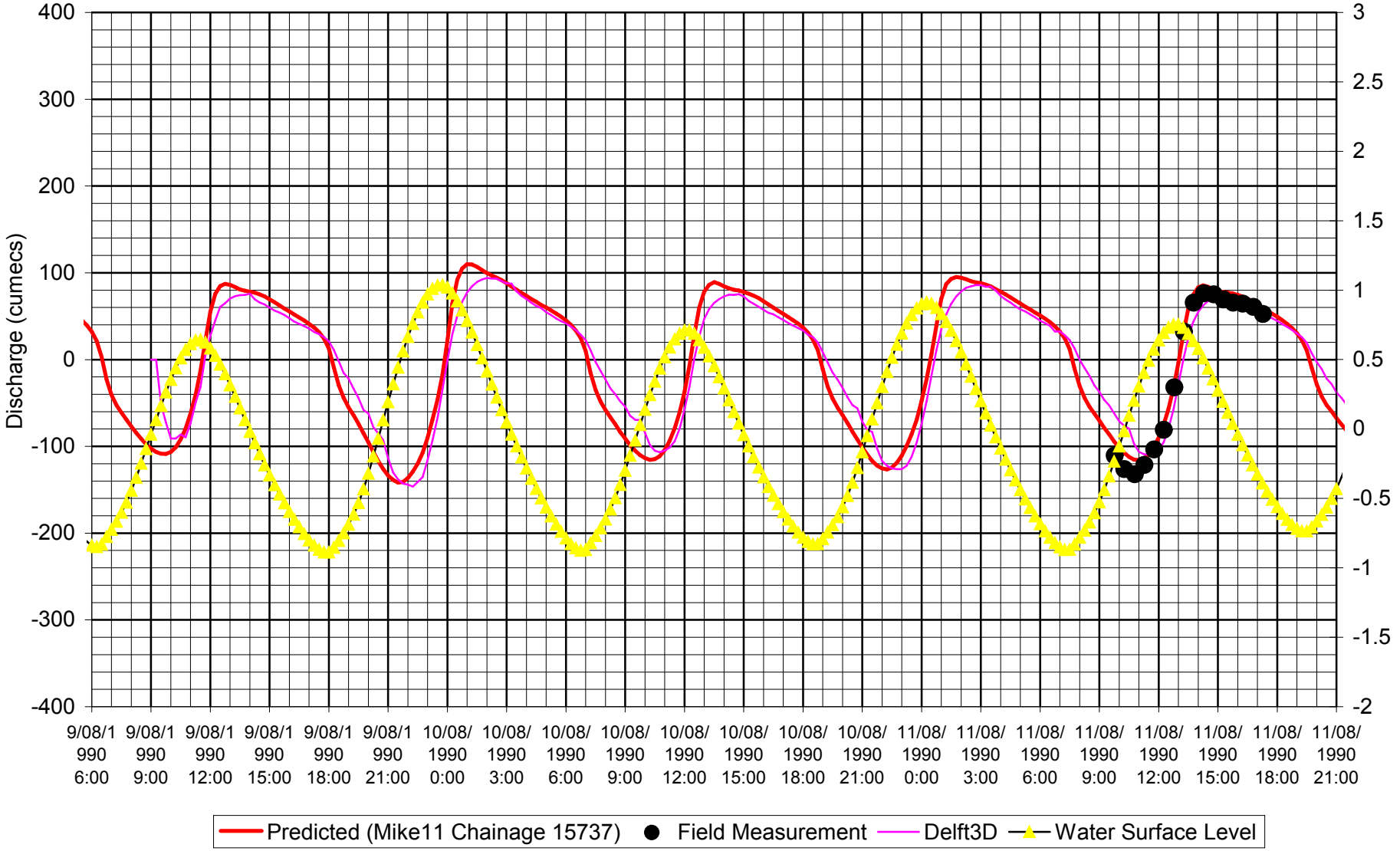
Cardno Lawson Treloar

Caboolture River Tide Model Calibration
Discharge - "August 90 U/S Flow"



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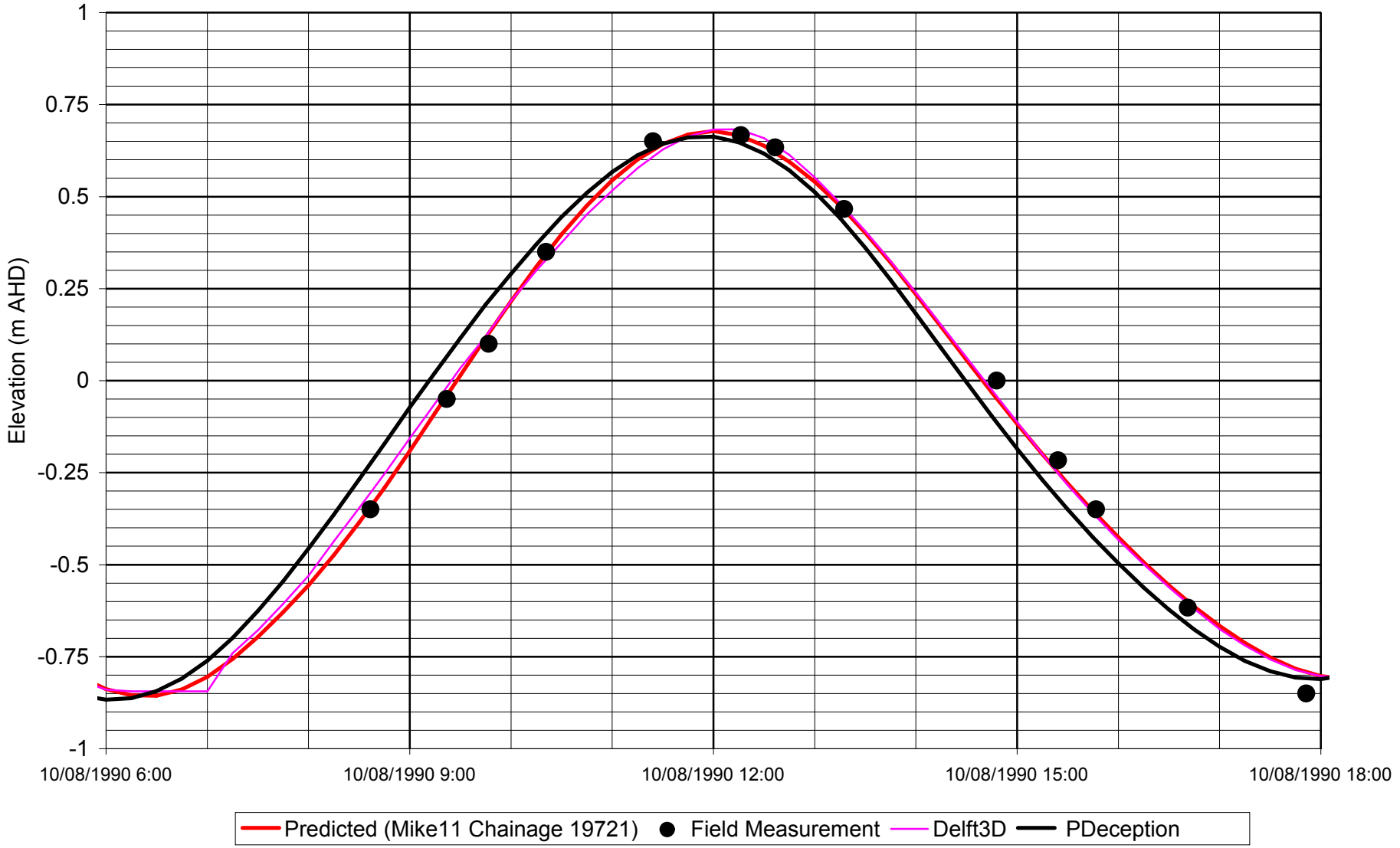
Cardno Lawson Treloar

Caboolture River Tide Model Calibration
Water Surface Level - "August 90 D/S Level"



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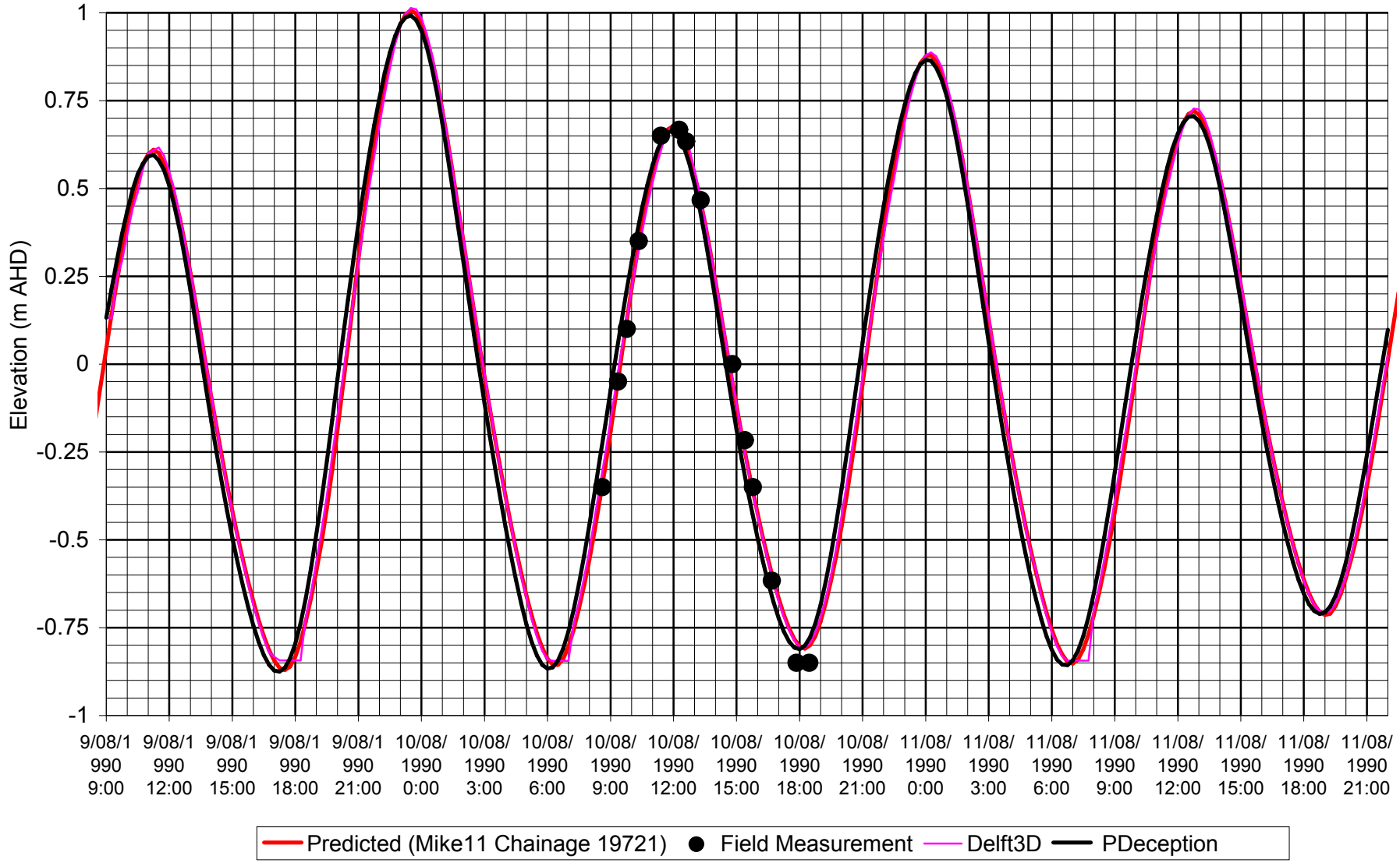
Cardno Lawson Treloar

Caboolture River Tide Model Calibration
Water Surface Level - "August 90 D/S Level"



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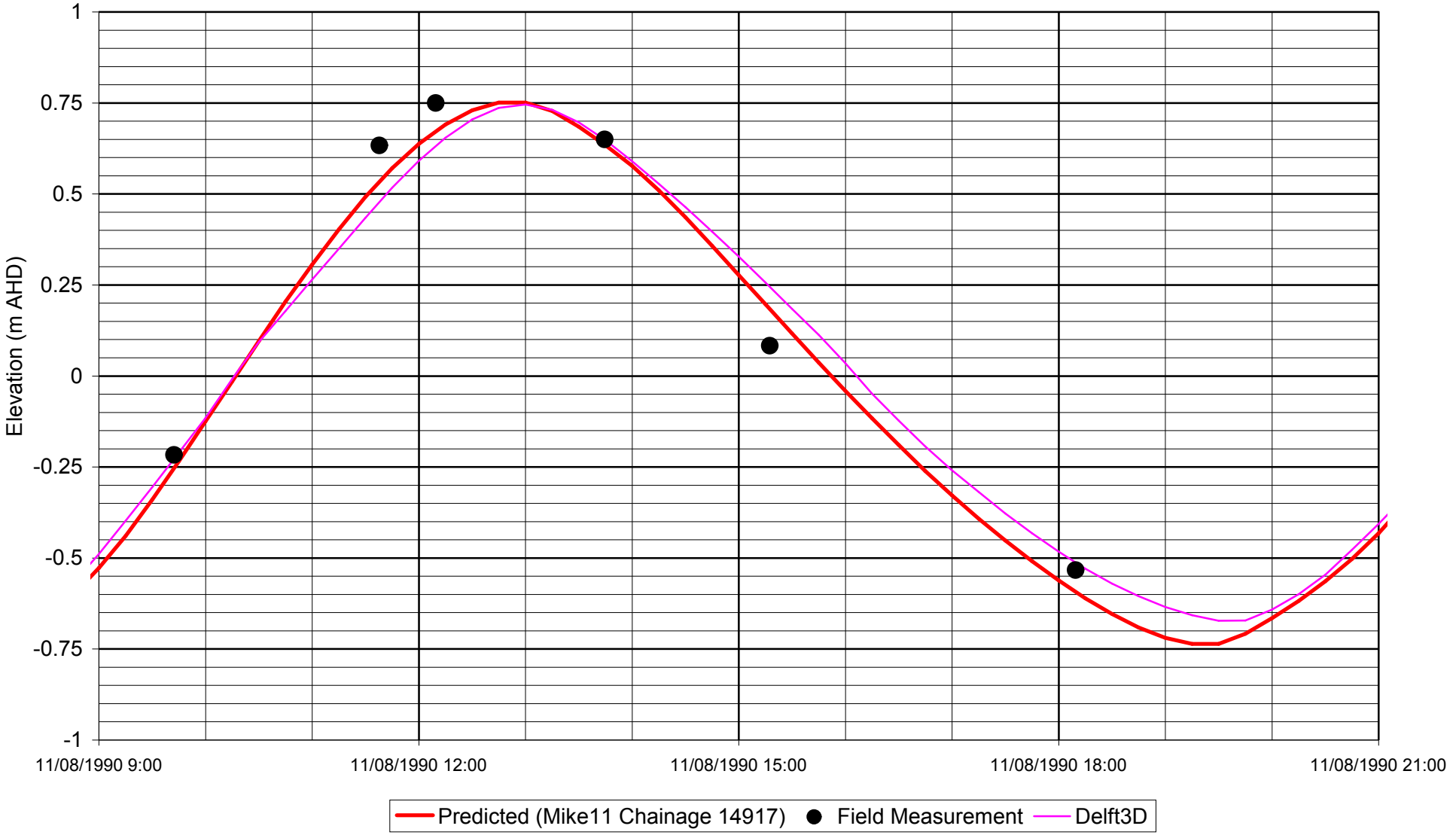
Cardno Lawson Treloar

Caboolture River Tide Model Calibration
Water Surface Level - "August 90 U/S Level"



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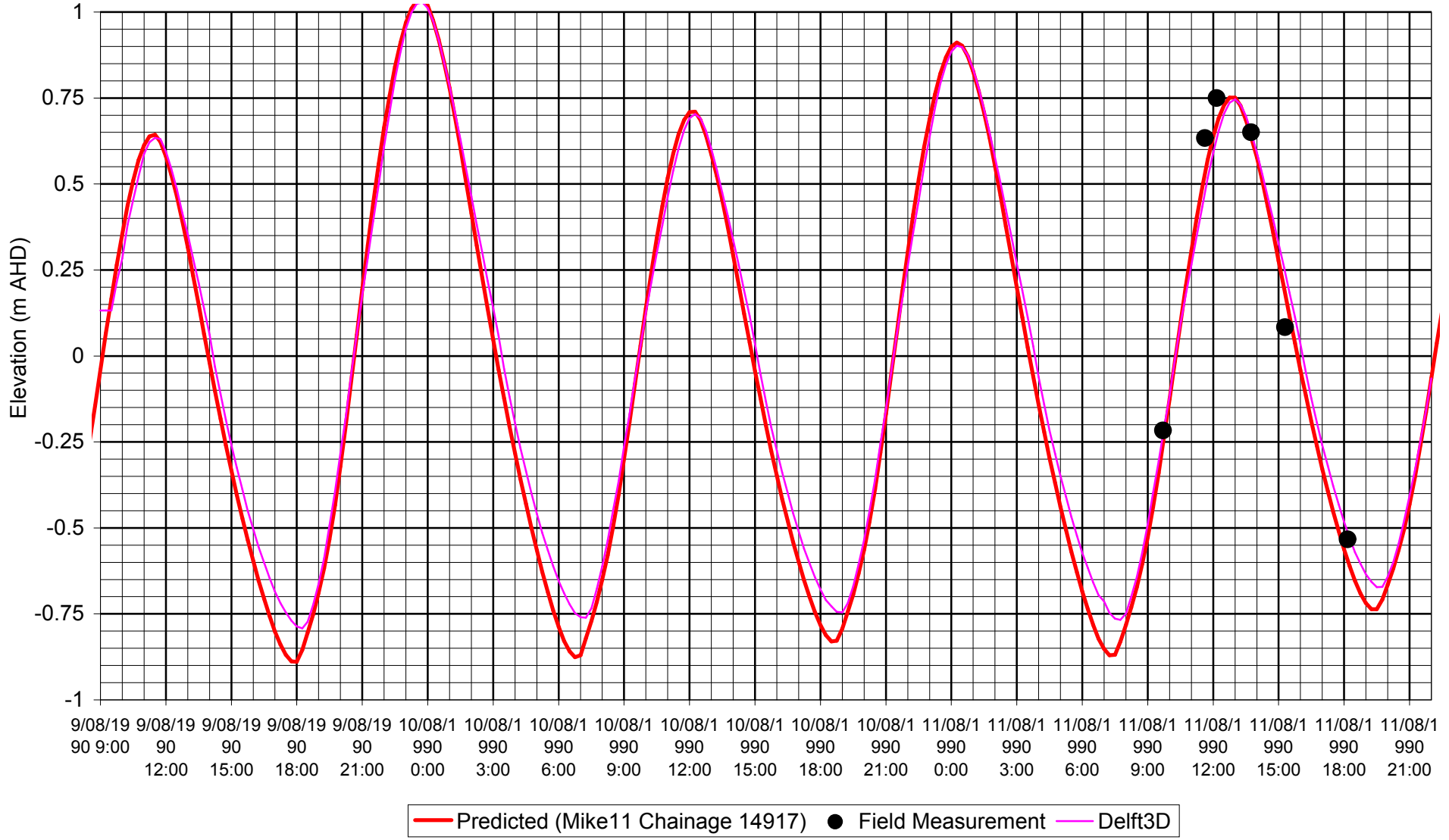
Cardno Lawson Treloar

Caboolture River Tide Model Calibration
Water Surface Level - "August 90 U/S Level"



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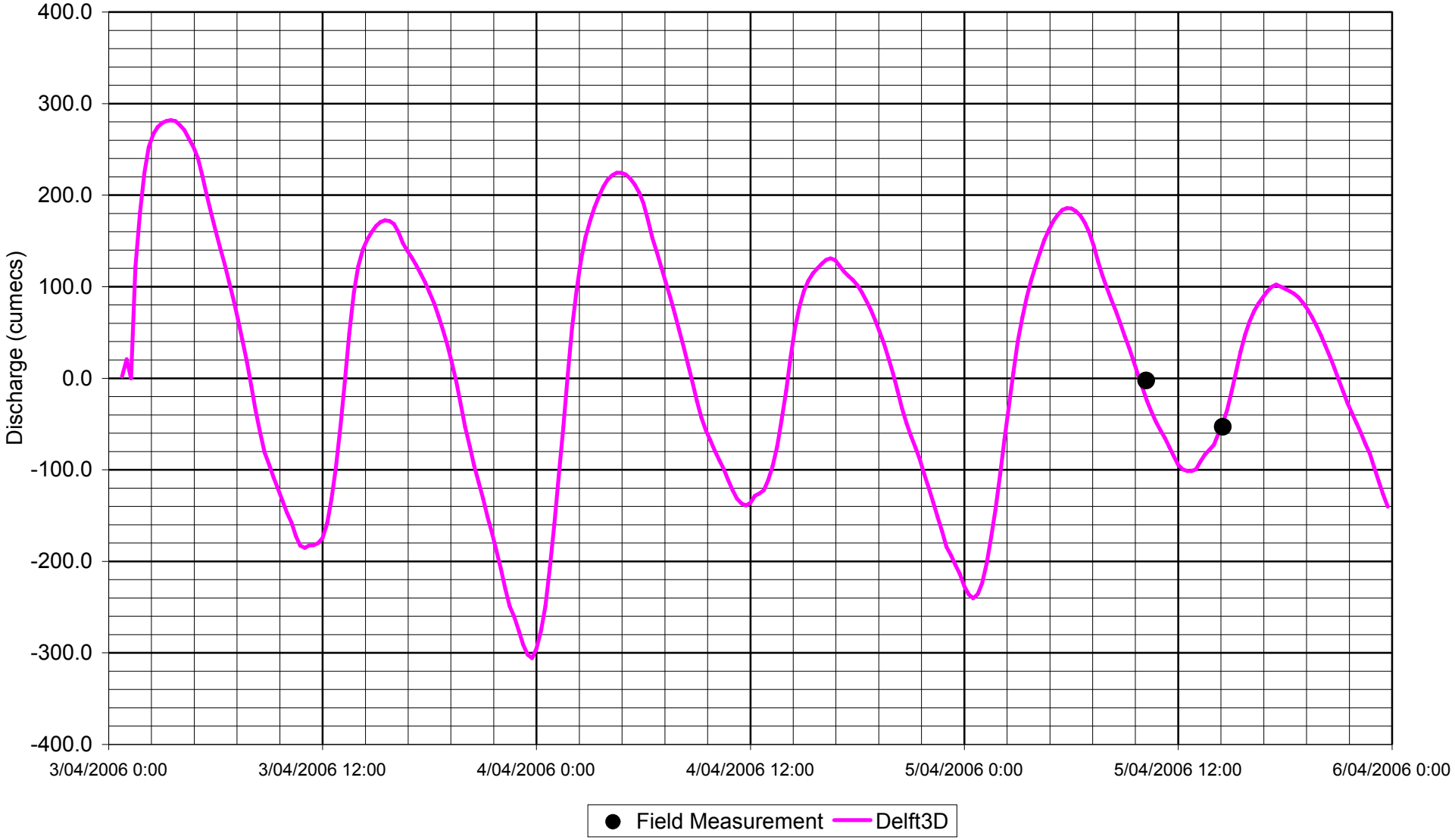
APPENDIX B

Hydrodynamic Model Validation Results

Cardno Lawson Treloar

Caboolture River Tide Model 2006 Verification Calibration
Discharge - "CAB1"



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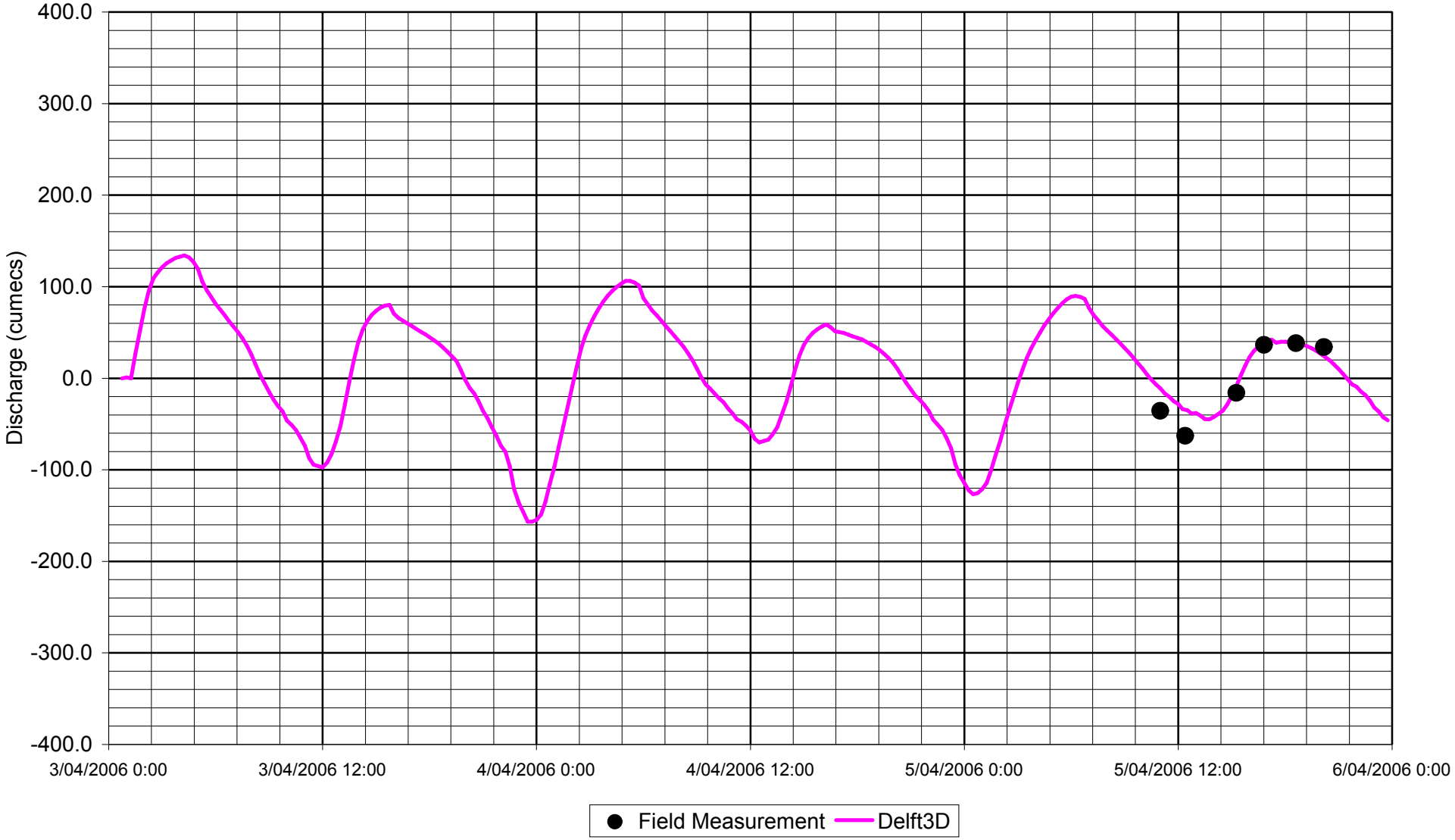
Cardno Lawson Treloar

Caboolture River Tide Model 2006 Verification Calibration
Discharge - "CAB2"



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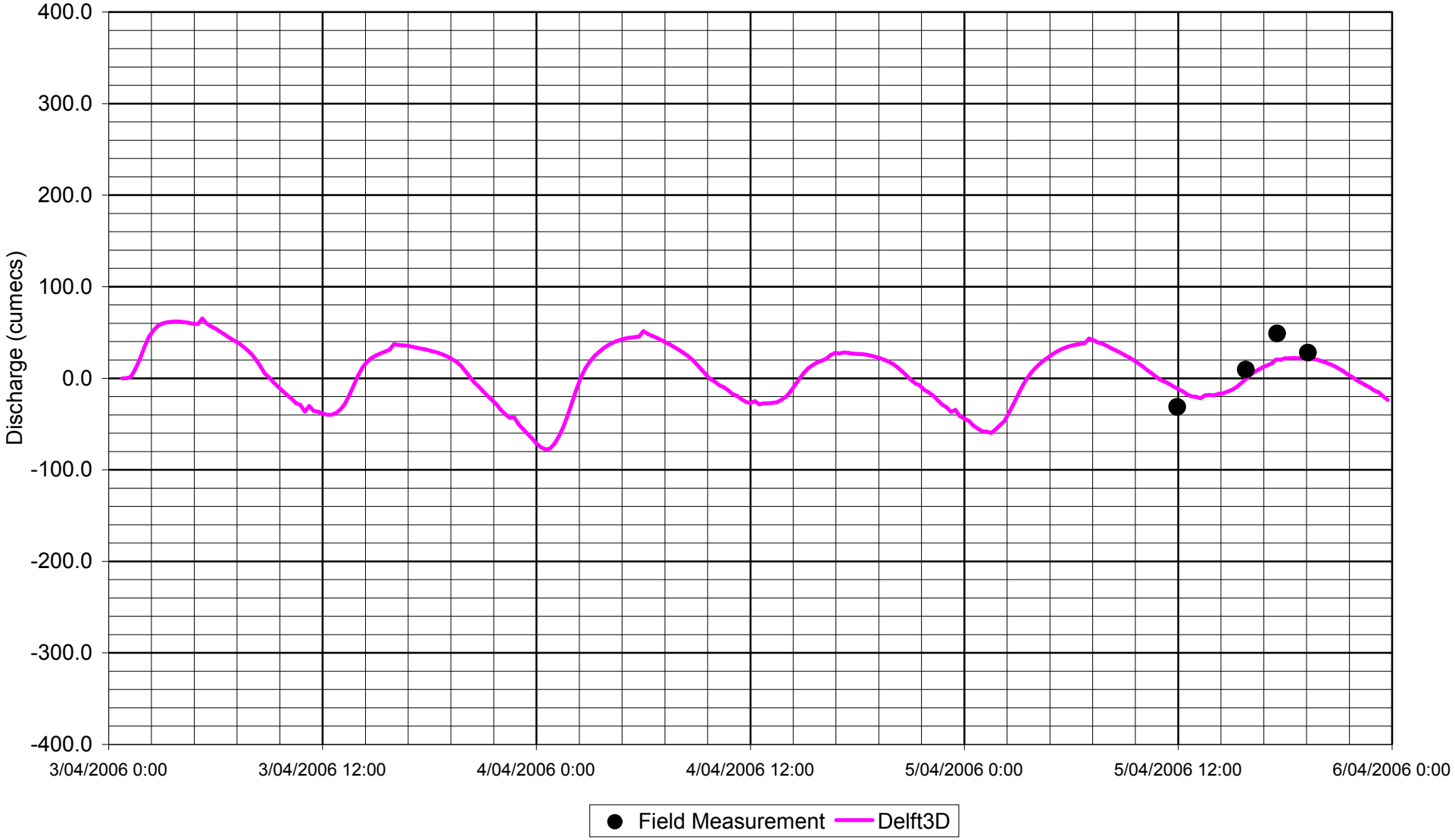
Cardno Lawson Treloar

Caboolture River Tide Model 2006 Verification Calibration
Discharge - "CAB3"



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Cardno Lawson Treloar

Caboolture River Tide Model 2006 Verification Calibration
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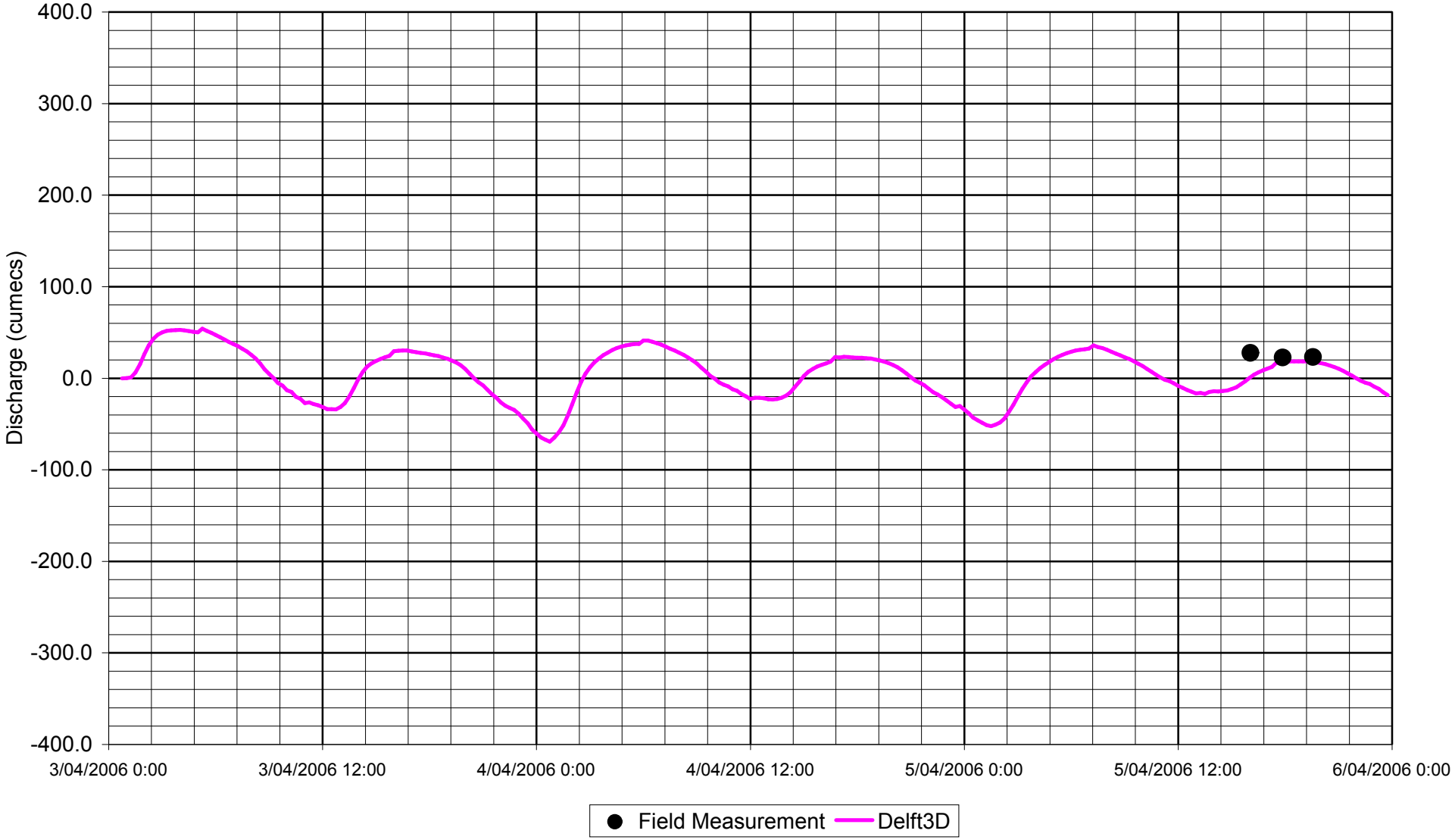

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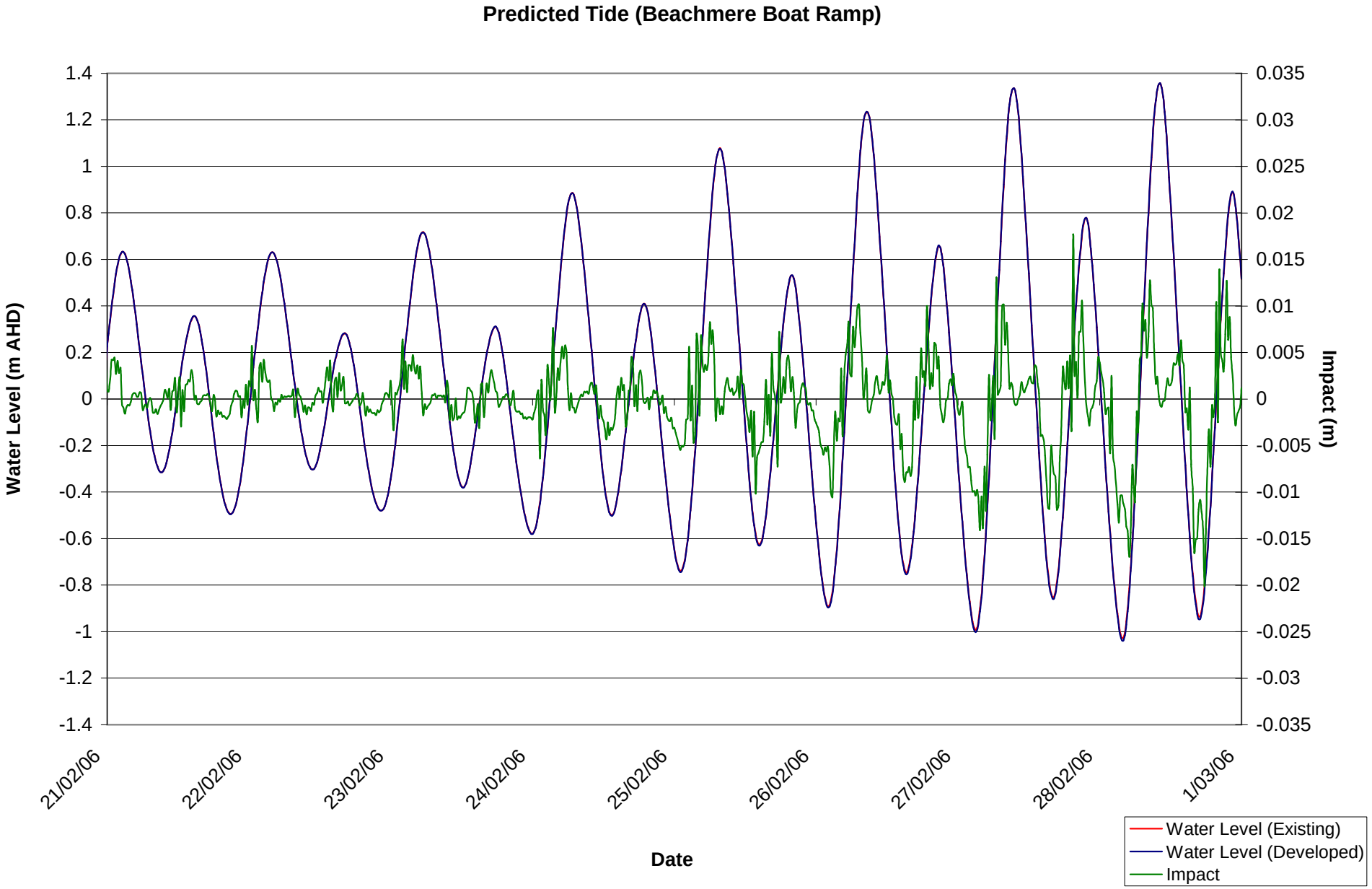
APPENDIX C

Predicted Water Level Impacts


Predicted Tide (Beachmere Boat Ramp)
Water Level (m AHD)
Impact (m)
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1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
-0.005
-0.01
-0.015
-0.02
-0.025
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-0.035
21/02/06
22/02/06
23/02/06
24/02/06
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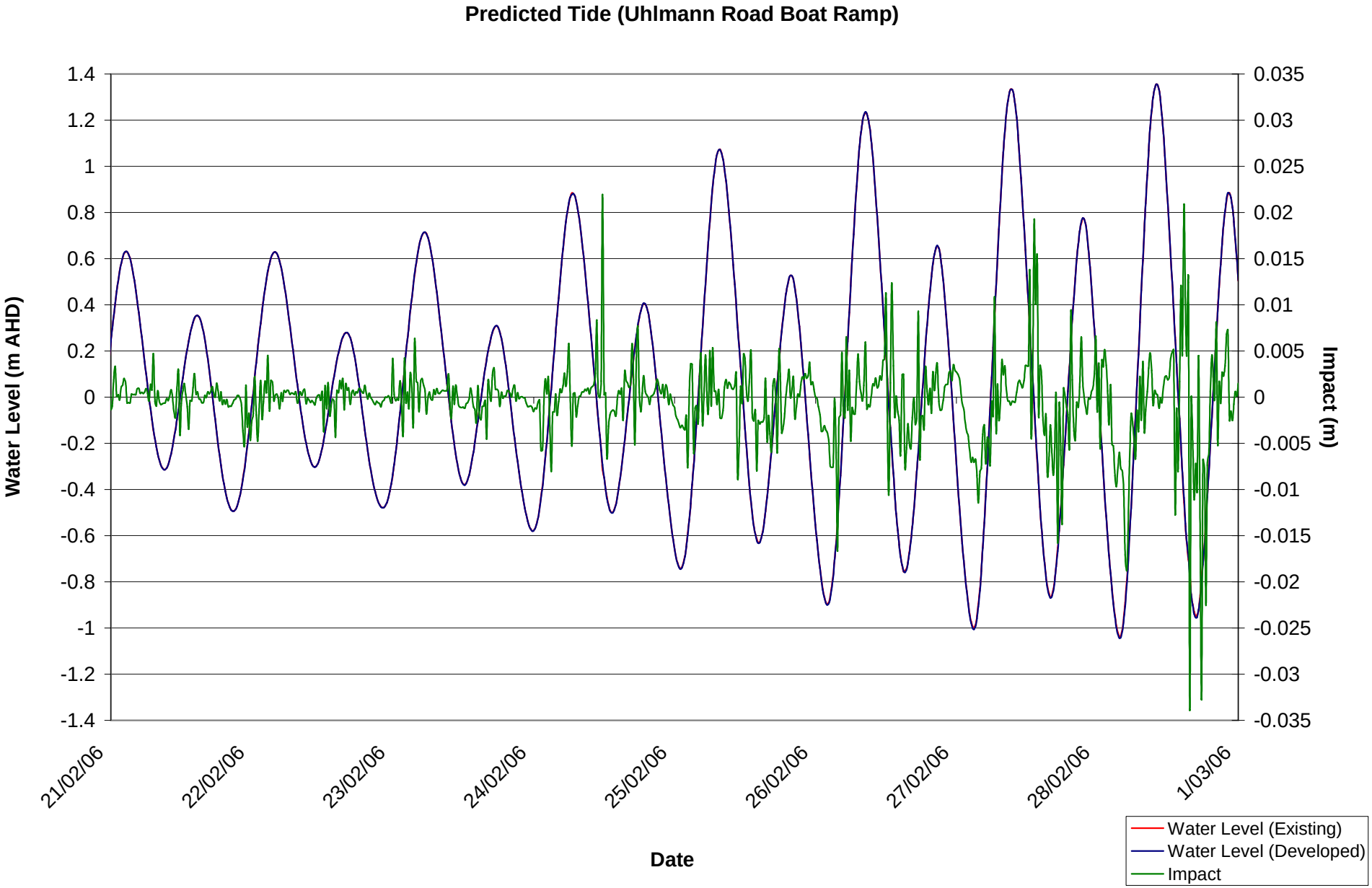
26/02/06
27/02/06
28/02/06
1/03/06
Date
Water Level (Existing)
Water Level (Developed)
Impact


Predicted Tide (Uhlmann Road Boat Ramp)
Water Level (m AHD)
Impact (m)
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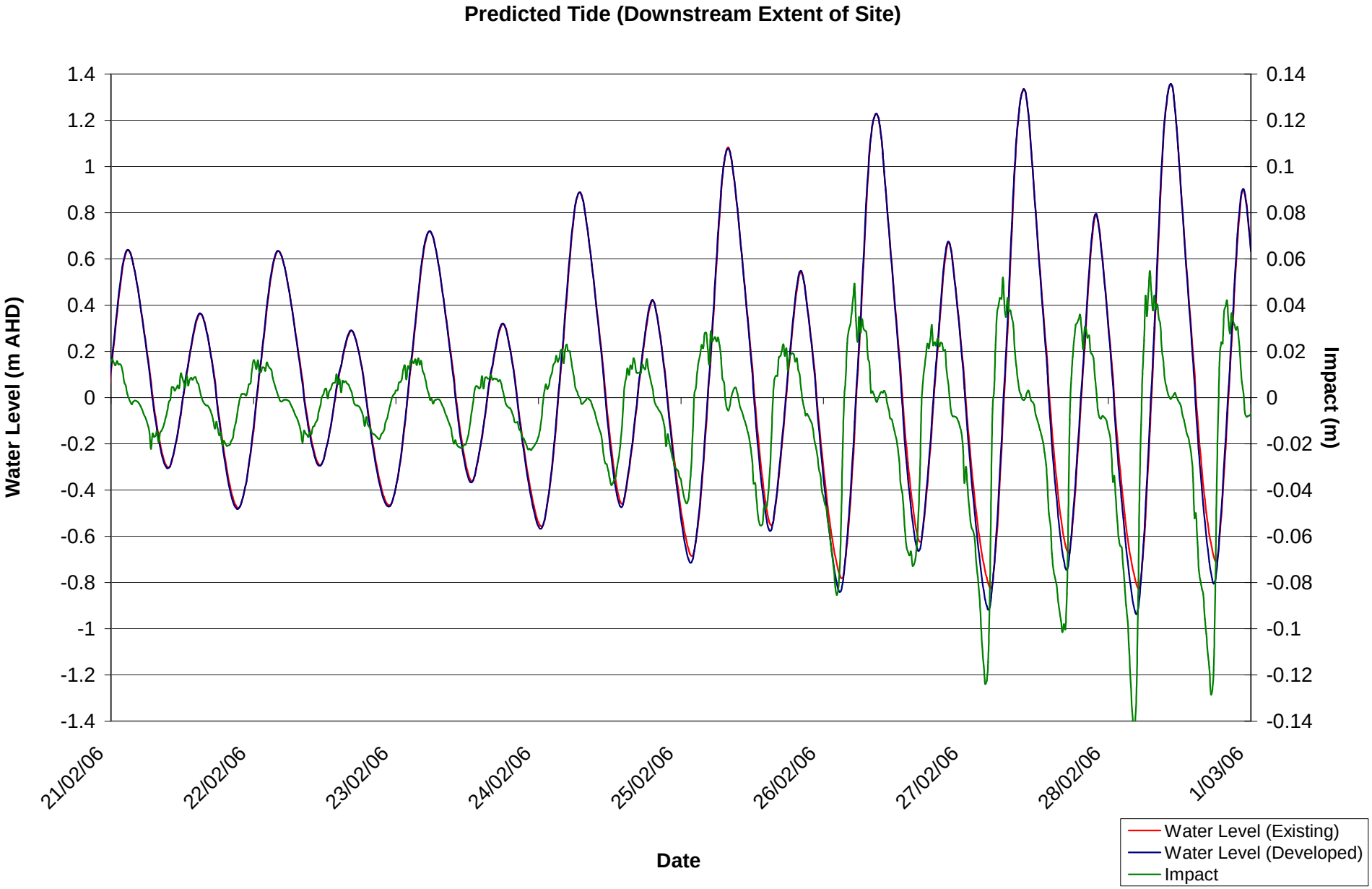
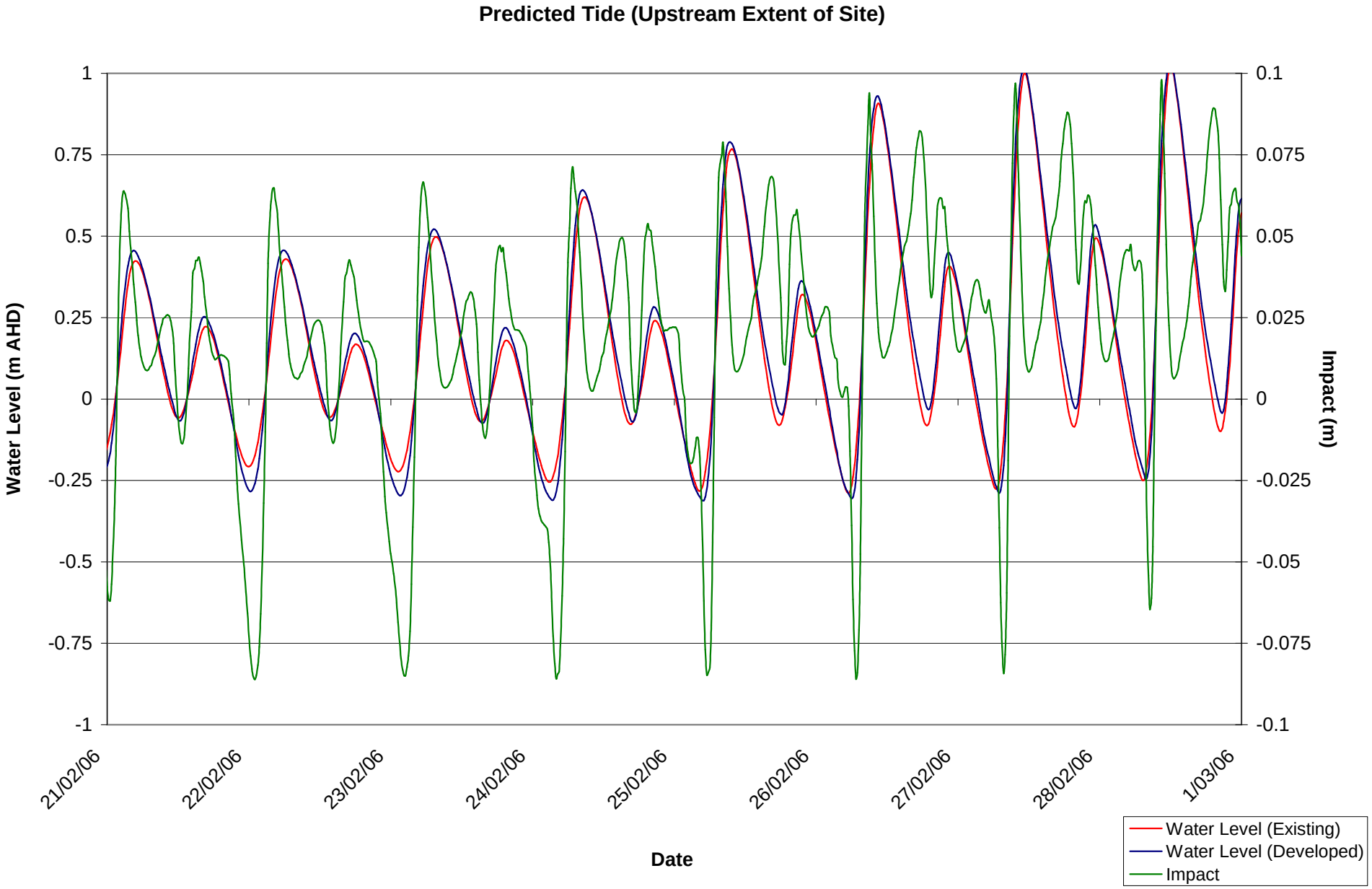
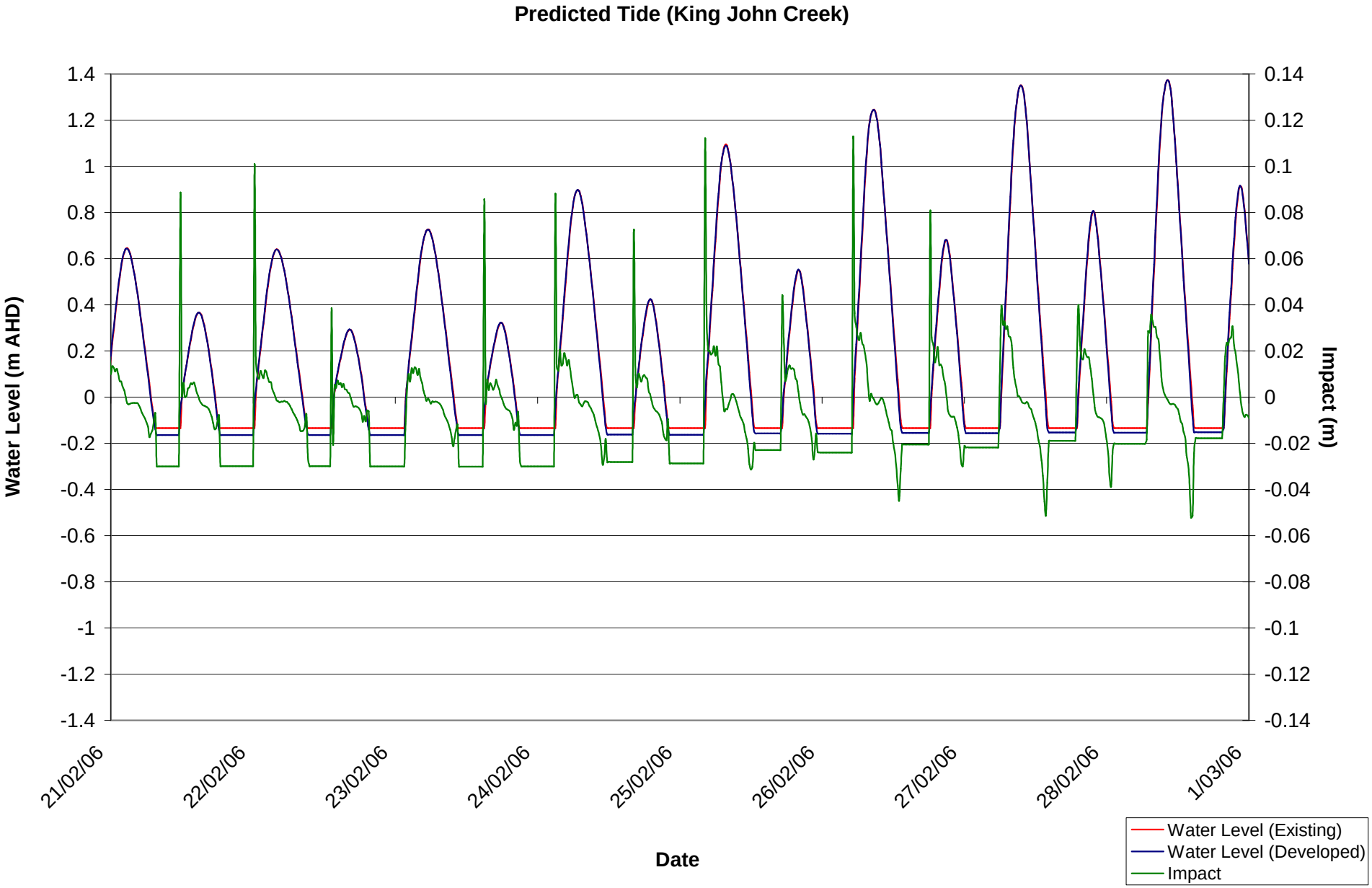
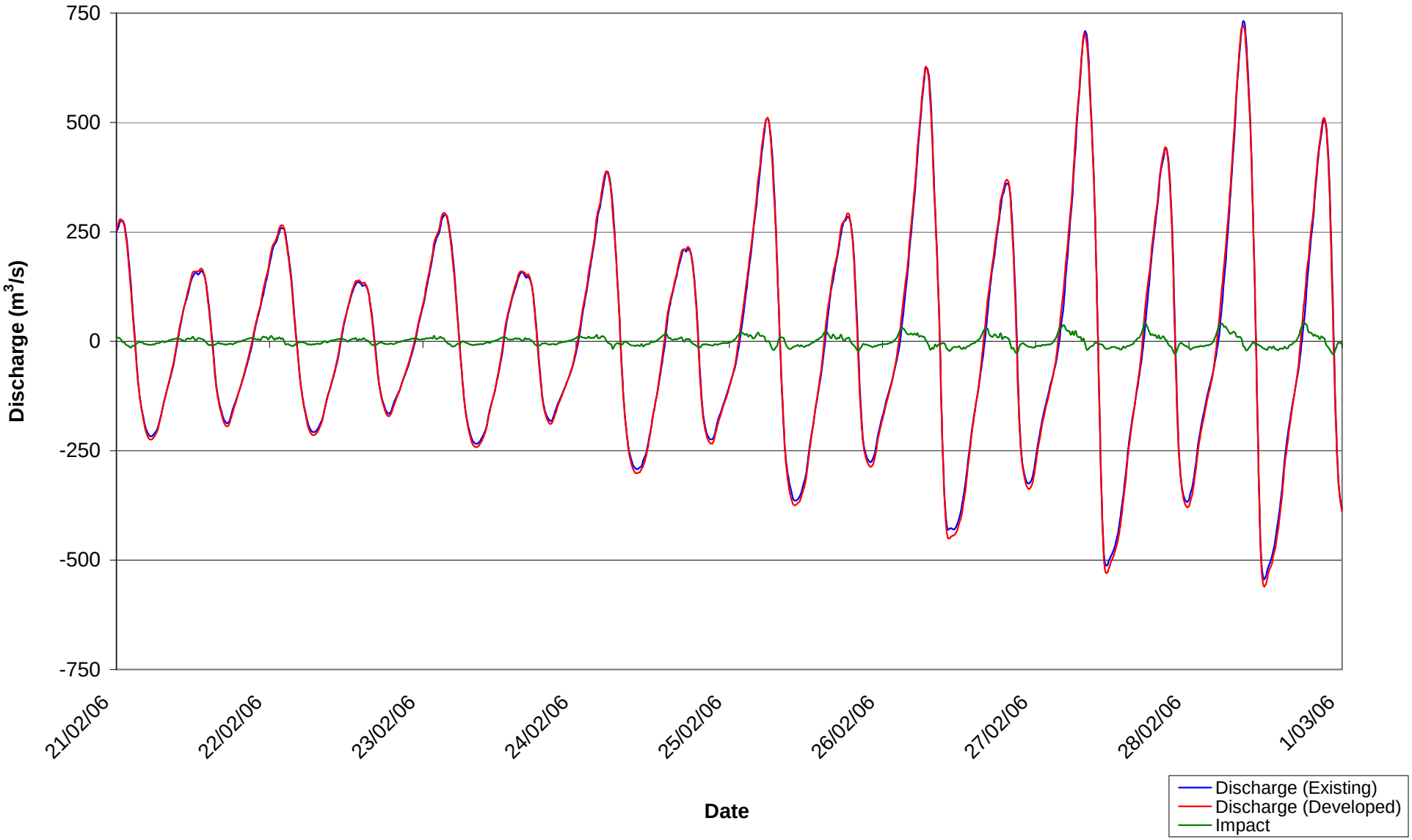
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
-0.005
-0.01
-0.015
-0.02
-0.025
-0.03
-0.035
21/02/06
22/02/06
23/02/06
24/02/06
25/02/06
26/02/06
27/02/06
28/02/06
1/03/06
Date
Water Level (Existing)
Water Level (Developed)
Impact


Predicted Tide (Downstream Extent of Site)
Water Level (m AHD)
Impact (m)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
21/02/06
22/02/06
23/02/06
24/02/06
25/02/06
26/02/06
27/02/06
28/02/06
1/03/06
Date
Water Level (Existing)
Water Level (Developed)
Impact


Predicted Tide (Upstream Extent of Site)
Water Level (m AHD)
Impact (m)
1
0.75
0.5
0.25
0
-0.25
-0.5
-0.75
-1
0.1
0.075
0.05
0.025
0
-0.025
-0.05
-0.075
-0.1
21/02/06
22/02/06
23/02/06
24/02/06
25/02/06
26/02/06
27/02/06
28/02/06
1/03/06
Date
Water Level (Existing)
Water Level (Developed)
Impact


Predicted Tide (King John Creek)
Water Level (m AHD)
Impact (m)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
21/02/06
22/02/06
23/02/06
24/02/06
25/02/06
26/02/06
27/02/06
28/02/06
1/03/06
Date
Water Level (Existing)
Water Level (Developed)
Impact

APPENDIX D

Predicted Tidal Current Impacts

Predicted Tidal Current (Section 1)