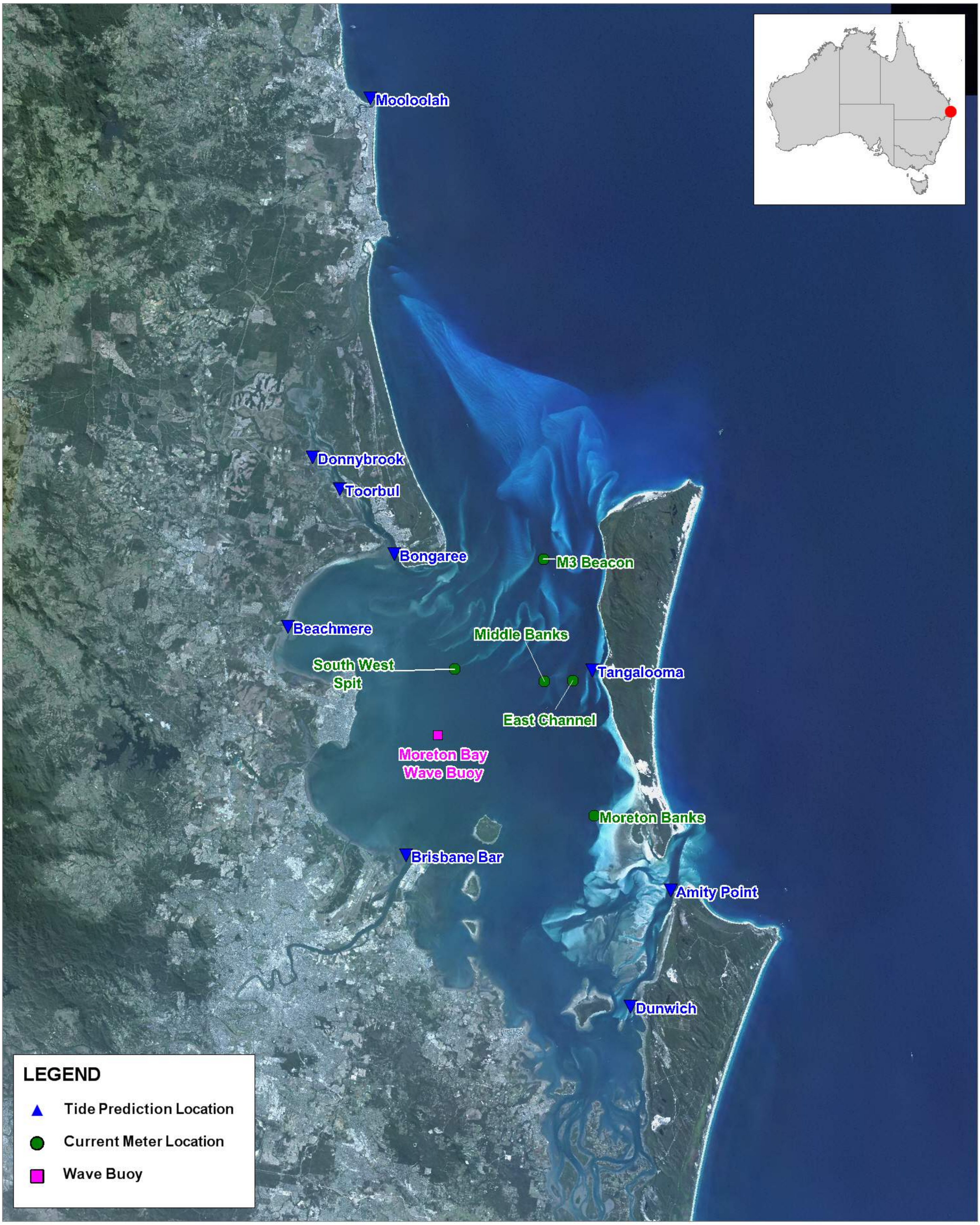
Appendix A Hydrodynamic Model Calibration

A.1 Introduction

Formal calibration of the TUFLOW FV hydrodynamic model refined and utilised in this study has been undertaken previously. Data used for calibration included MSQ tidal predictions, Acoustic Doppler Current Profiler (ADCP) velocity and water level measurements from Brisbane Airport Corporation (2005) and CSIRO (2012). The locations for the various data sources are indicated in Figure A-1 and calibration plots are provided in Figure A-2 to Figure A-17.



Title:

Hydrodynamic and Wave Model Validation Locations

Figure: **A-1**

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A.1.1 Water Level Validation

The Moreton Bay model has been calibrated to ensure that it reproduces tidally varying water levels with sufficient accuracy throughout the study area. This exercise included optimisation of model resolution at across the sand shoals at the Moreton Bay entrance. The tidal calibration results for Standard Port and selected Secondary Port locations within the Moreton Bay model domain are presented in Figure A-2 to Figure A-7. In these figures the tidal variation calculated by the TUFLOW FV model is compared to MSQ tidal predictions. Generally the phase and amplitude of the tide is well predicted by the modelling system at all locations.

The sum of the root mean square error (RMSE) of the instantaneous tidal predictions for the locations throughout Moreton Bay is typically within ±0.1m. These results suggest that the TUFLOW FV model can predict the instantaneous tidal water levels with an accuracy of ±0.1m for these locations. This is a satisfactory result with some of the error attributed to the input boundary conditions to the Coral Sea model, which come from a reduced set of harmonic constituents supplied by the NTC, and potential bathymetric inaccuracies.

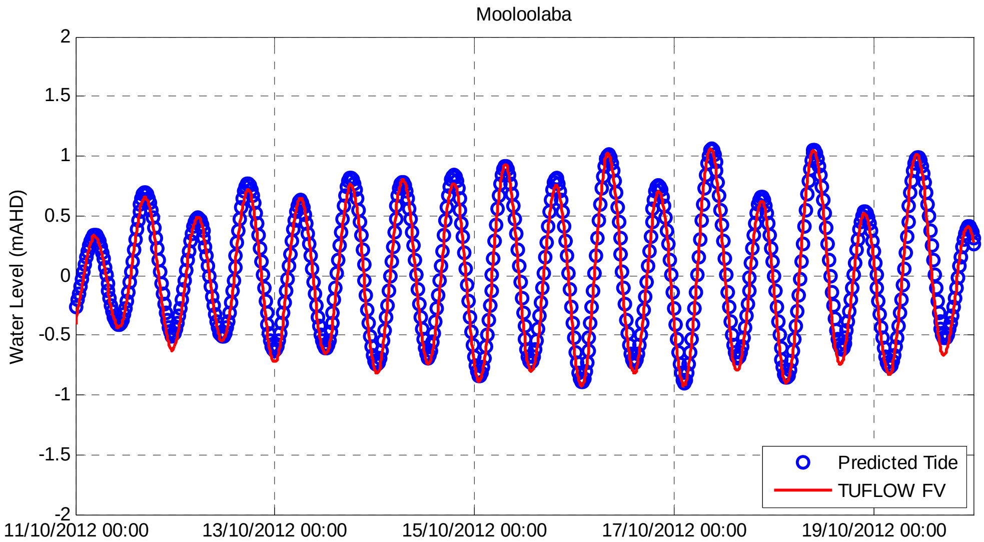


Figure A-2 Water Level Validation – Mooloolaba Standard Port

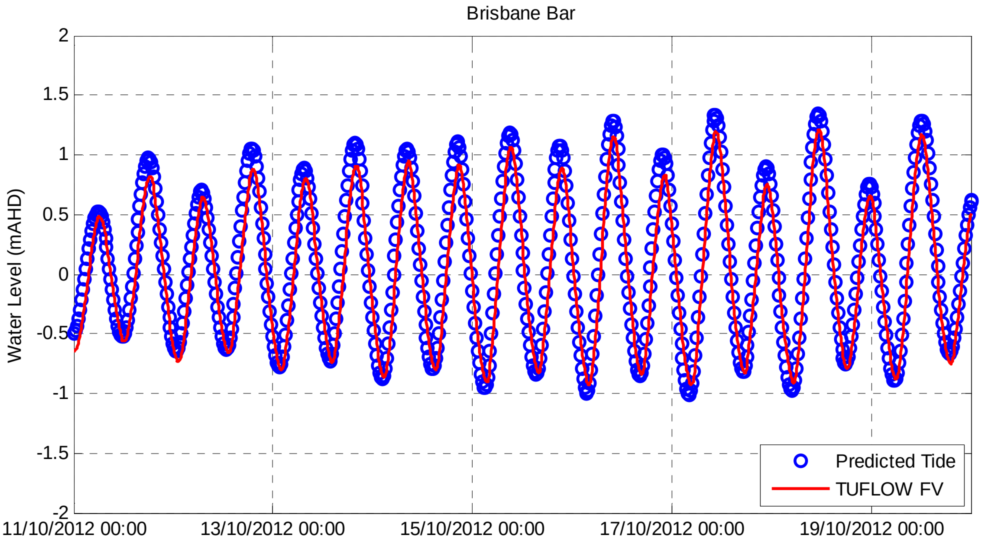


Figure A-3 Water Level Validation – Brisbane Bar Standard Port

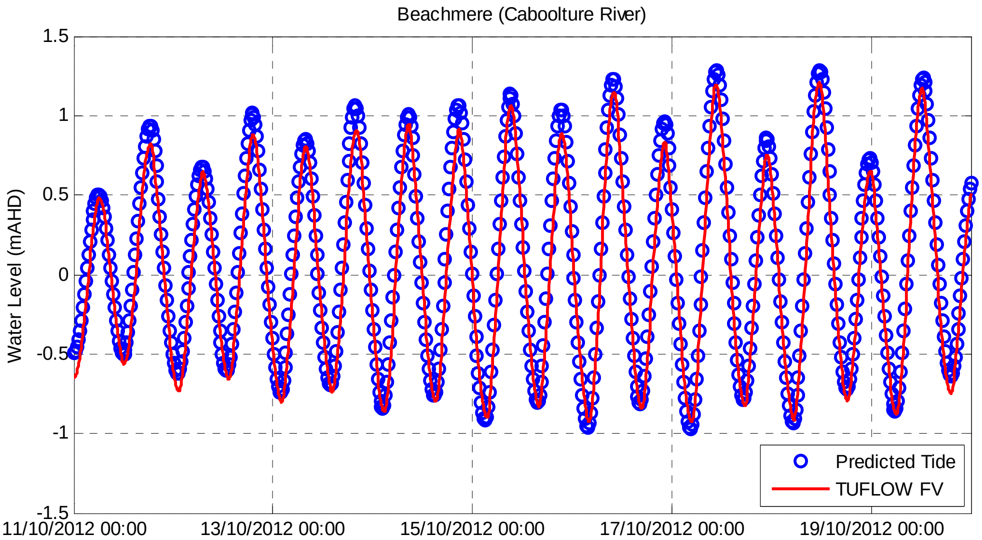


Figure A-4 Water Level Validation – Beachmere (Caboolture River) Secondary Place

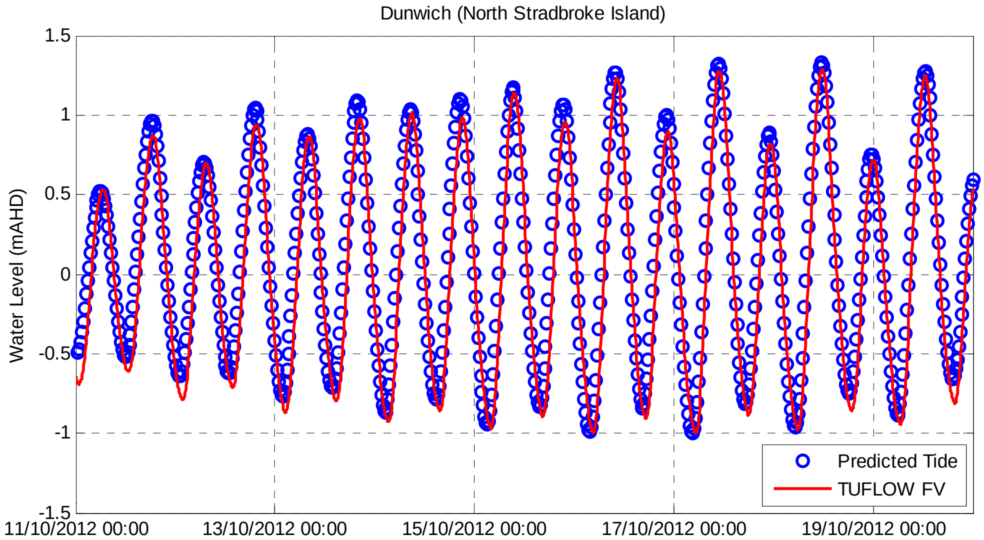


Figure A-5 Water Level Validation – Dunwich (North Stradbroke Island) Secondary Place

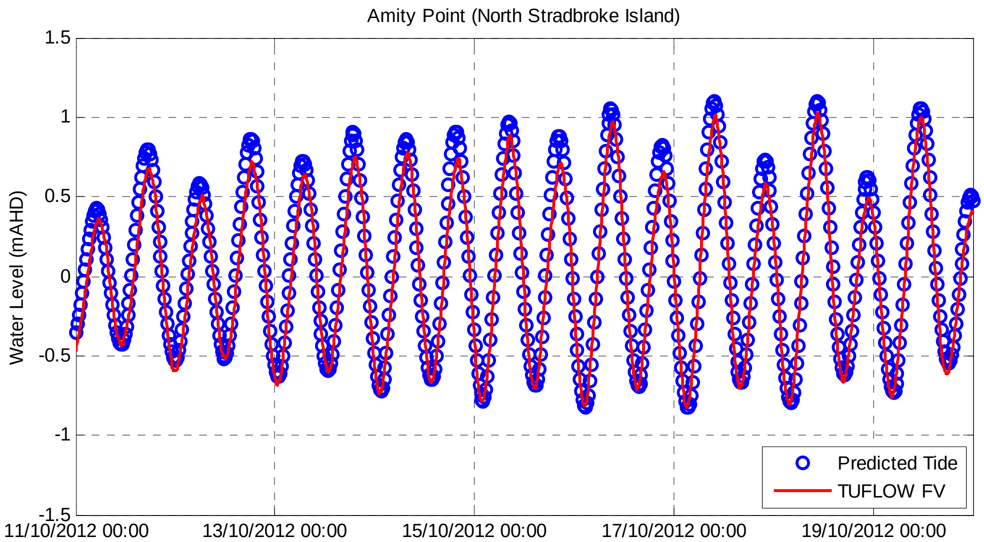


Figure A-6 Water Level Validation – Amity Point (North Stradbroke Island) Secondary Place

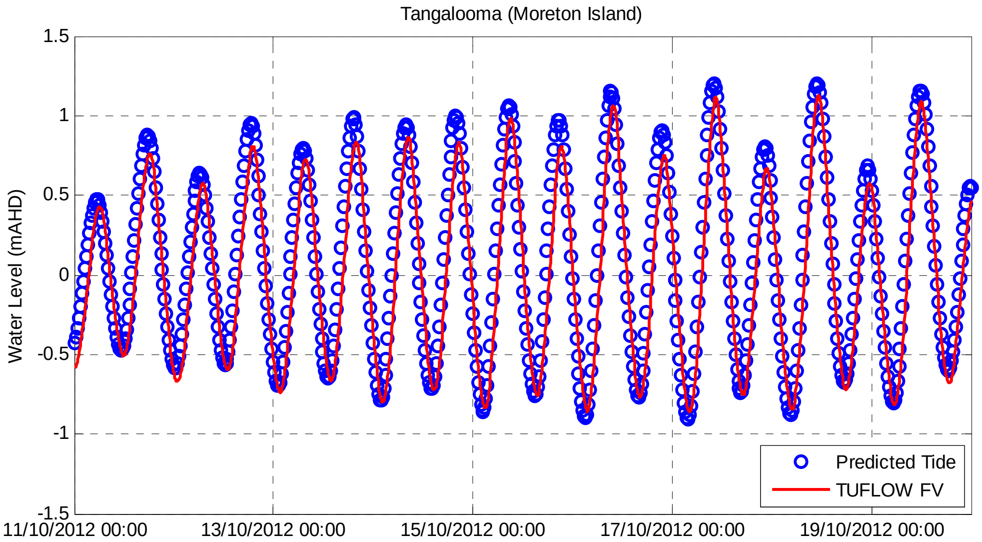


Figure A-7 Water Level Validation – Tangalooma (Moreton Island) Secondary Place

A.1.2 Current Speed and Direction Validation

Model outputs were compared to currents recorded at various locations throughout Moreton Bay as part of previous studies (Brisbane Airport Corporation, 2005 and CSIRO 2012). The locations are indicated in Figure A-1 and referred to as:

- East Channel;
- Middle Banks;
- M3 Beacon;
- South West Spit; and
- Moreton Banks.

Time series comparisons of the measured and predicted depth-averaged current speed and direction are presented in Figure A-8 to Figure A-17. Note that the direction convention is Cartesian and corresponds to the direction the current is going (measured counter-clockwise from the positive x-axis). Model performance at the locations where validation data was available is generally acceptable and within the bounds of the accuracy of the recoding instruments. Specifically, the model data comparisons display the following features:

- The recorded current speed and direction is generally well predicted at East Channel (Figure A-8 and Figure A-9) and Middle Banks (Figure A-10 and Figure A-11) during both the ebb (aligned approximately 90 deg) and flood (aligned approximately 260 deg) phases of the tide. The data and model show a clear tidal component with higher peak velocities associated with the flooding tide. Occasionally the peak current speeds are slightly under/over predicted by up to ±0.2 m/s.
- Model performance at the M3 Beacon (Figure A-12 and Figure A-13) adjacent to the target dredge area is considered satisfactory with occasional under/over prediction of the peak current speed by up to ±0.2 m/s. At this location the ebb and flood current align close to 360 deg (or 0 deg) and 170 deg respectively which is well predicted.
- Model performance is relatively poor at South West Spit (Figure A-14 and Figure A-15) with the peak flood conditions consistently under predicted. The current recording instrument was located at the end of a linear sand bank (refer Figure A-1) and it appears this location was exposed to the flood current and relatively sheltered from the ebb current. It is assumed the poor model performance is due to misrepresentation of the model bathymetry at this location. It is noted that hydrodynamic simulations in three-dimensional mode did not improve the comparison.
- The flood and ebb currents at Moreton Banks (Figure A-16 and Figure A-17) are relatively consistent with no obvious tidal component. This behaviour is generally well predicted by the model with occasional over prediction of the peak flood current speed. The model slightly over predicts the current direction alignment by approximately 10 deg during both phases of the tide. The most likely cause for this is misrepresentation of the sand bank morphology in the model bathymetry at this location.

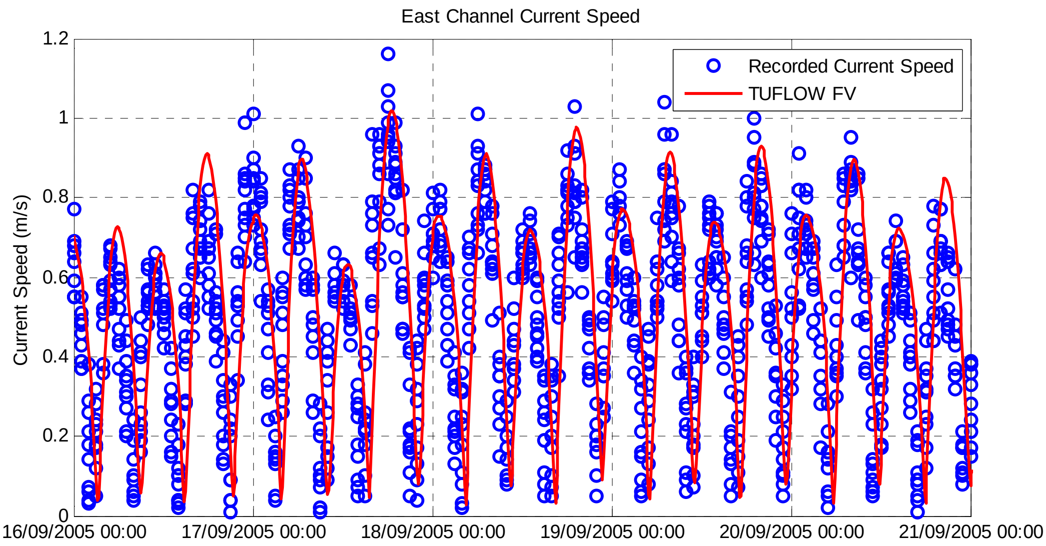


Figure A-8 Current Speed Validation – East Channel

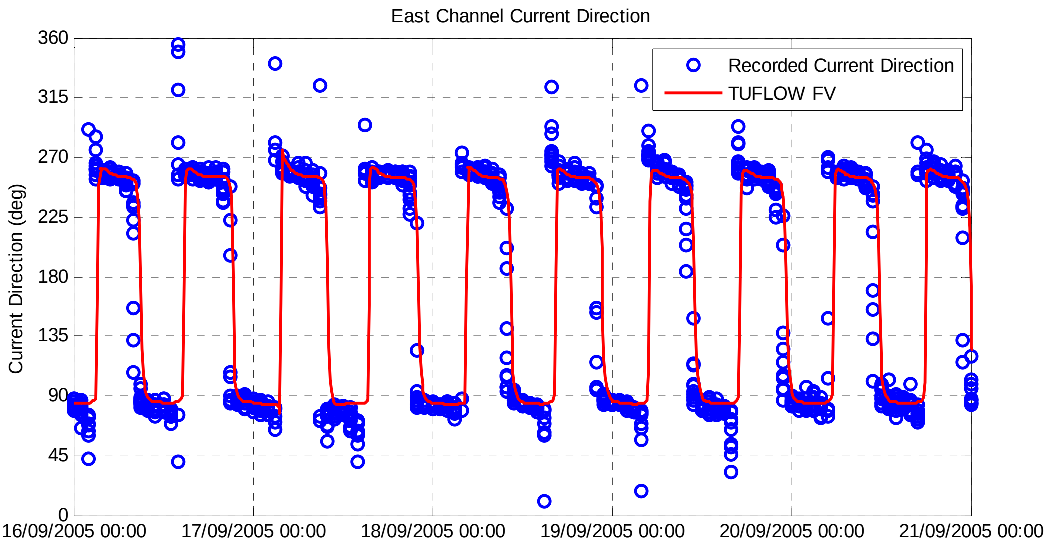


Figure A-9 Current Direction Validation – East Channel

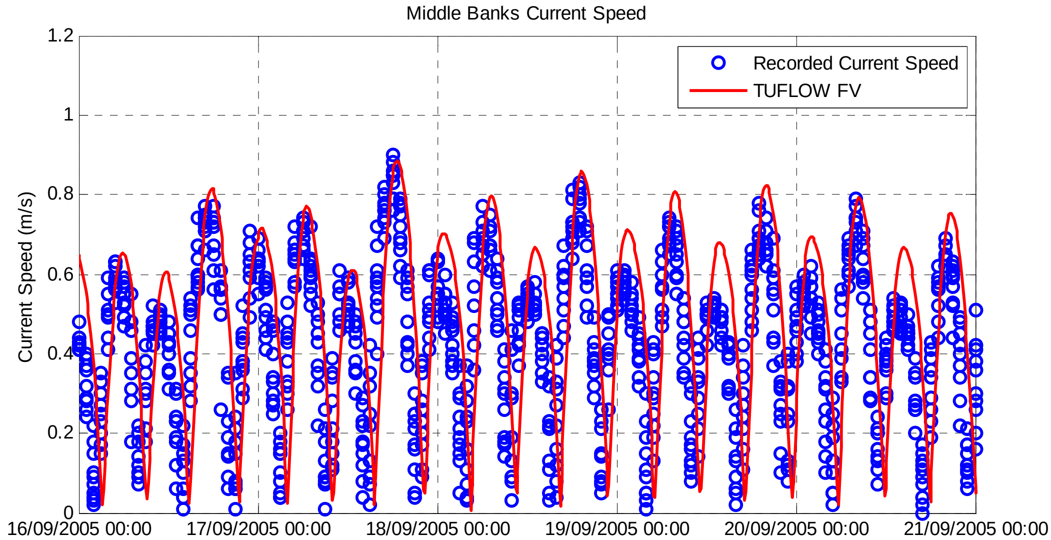


Figure A-10 Current Speed Validation – Middle Banks

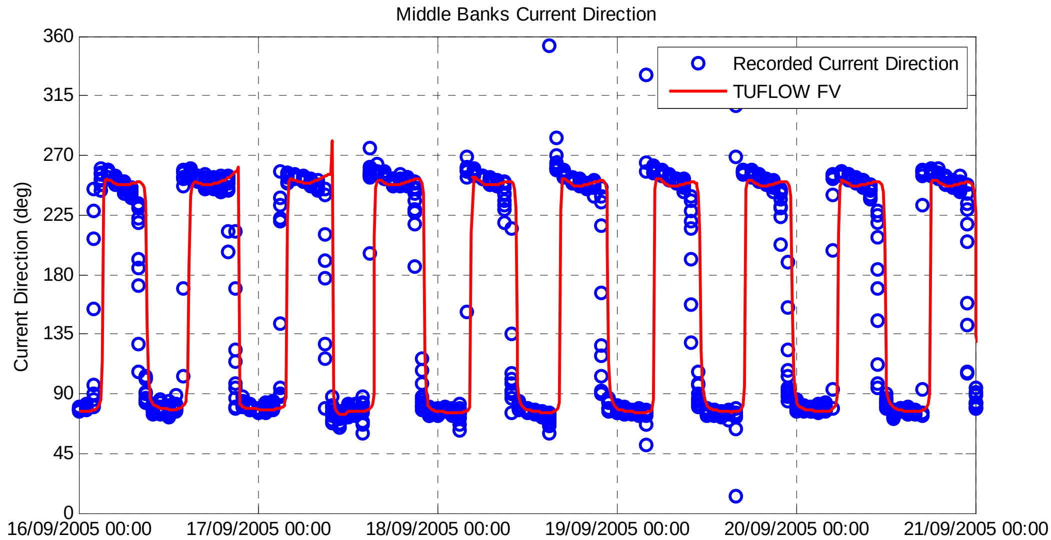


Figure A-11 Current Direction Validation – Middle Banks

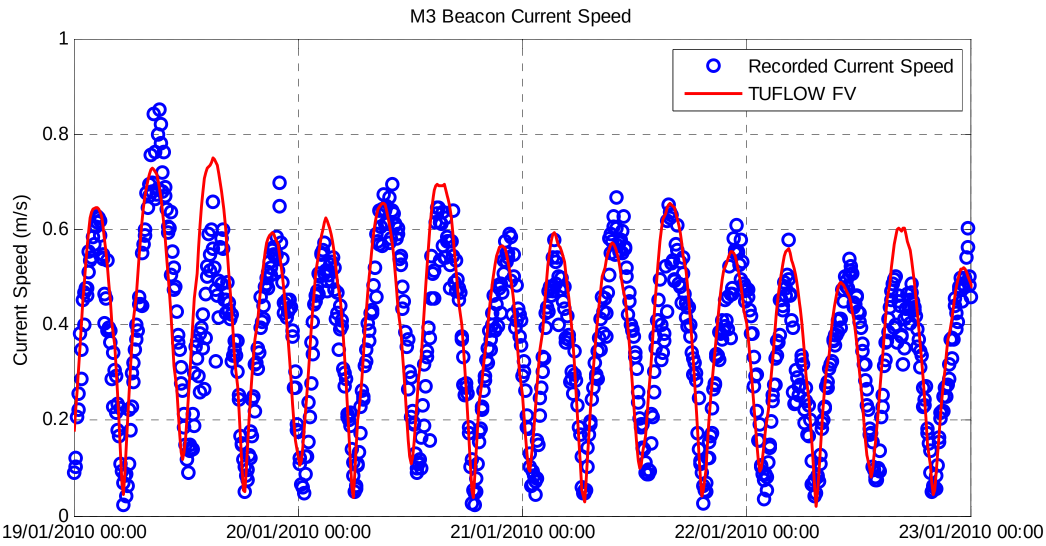


Figure A-12 Current Speed Validation – M3 Beacon

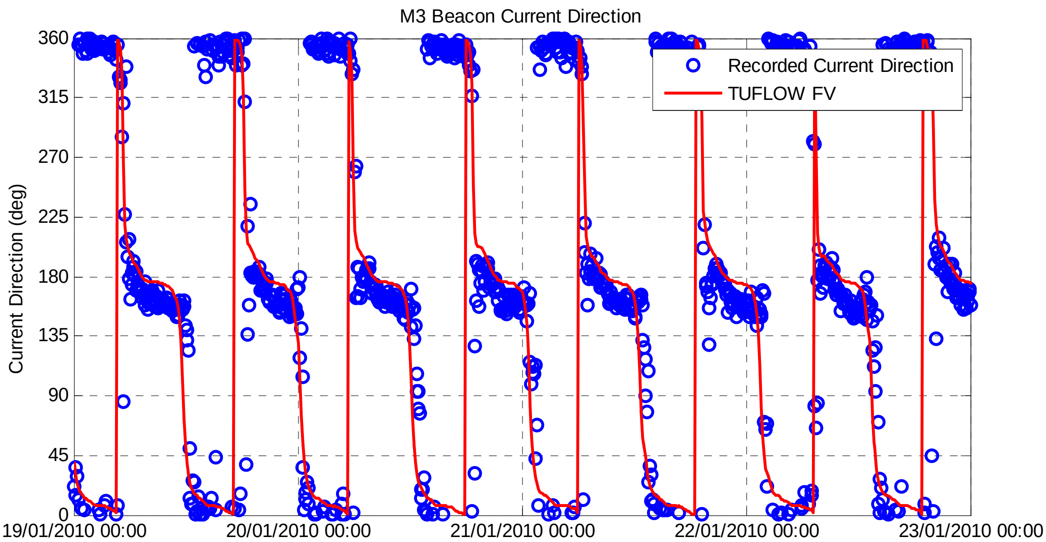


Figure A-13 Current Direction Validation – M3 Beacon

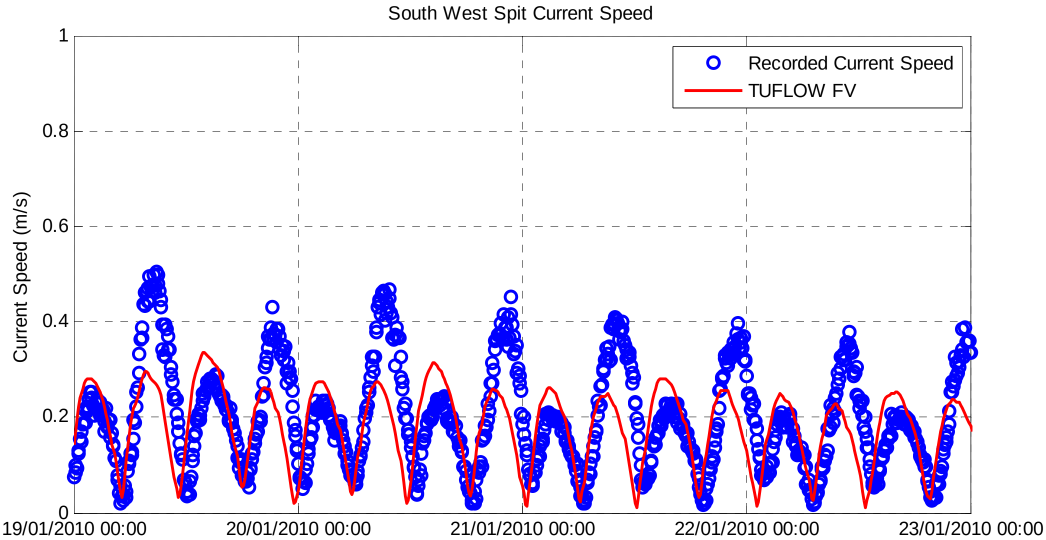


Figure A-14 Current Speed Validation – South West Spit

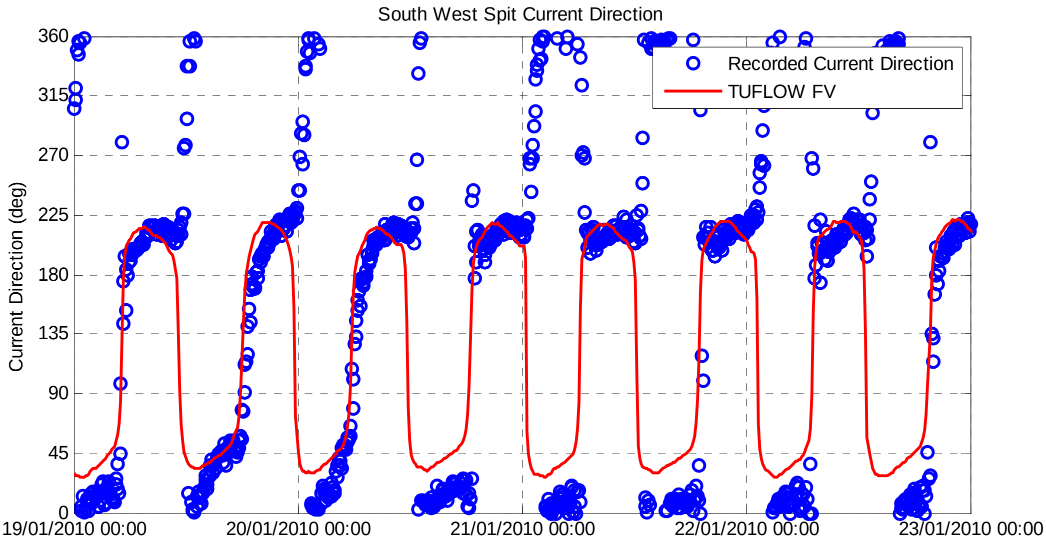


Figure A-15 Current Direction Validation – South West Spit

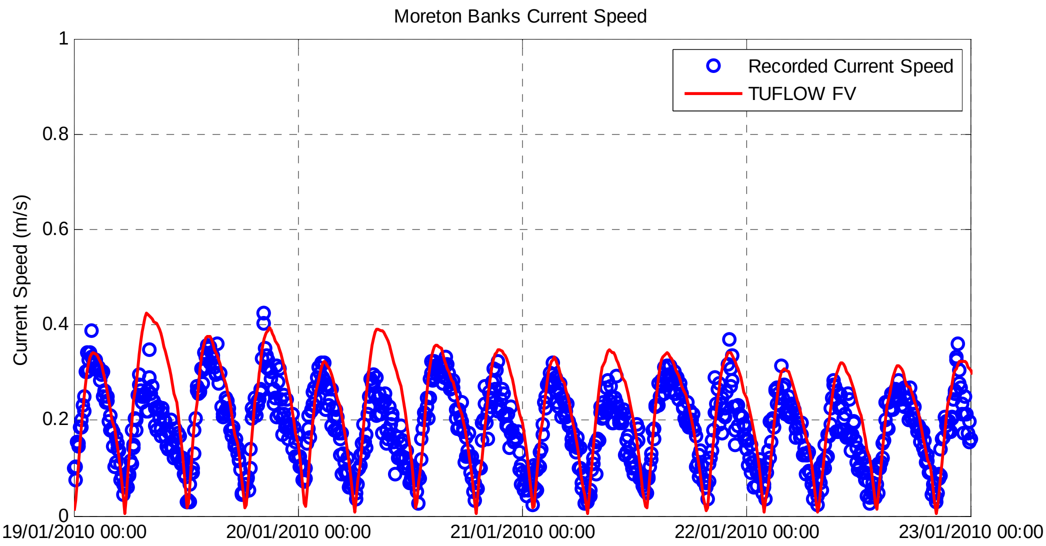


Figure A-16 Current Speed Validation – Moreton Banks

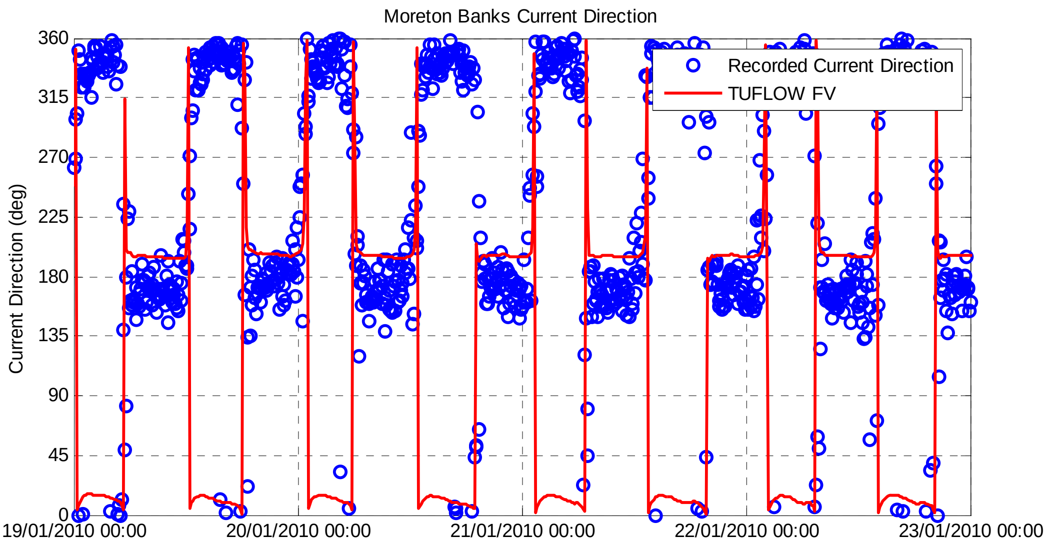


Figure A-17 Current Direction Validation – Moreton Banks

Appendix B Storm Erosion Assessment

Predicted storm erosion profiles following the methodology described in Section 6.5 are provided in Figure B-1 through Figure B-23. The location of each profile is indicated in Figure B-15.

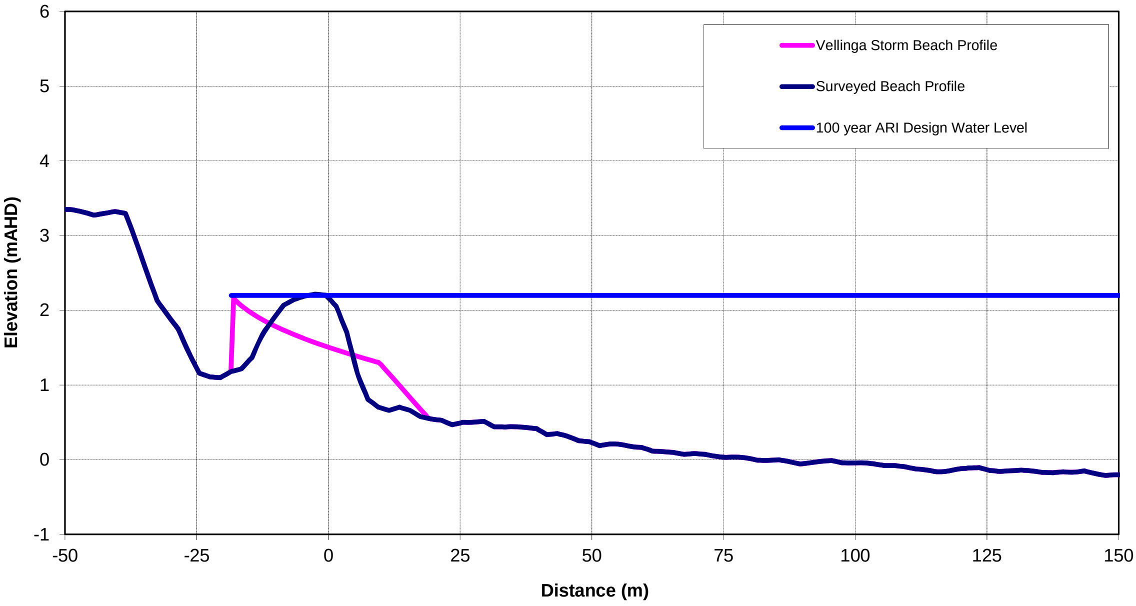


Figure B-1 Deception Bay – Profile 1

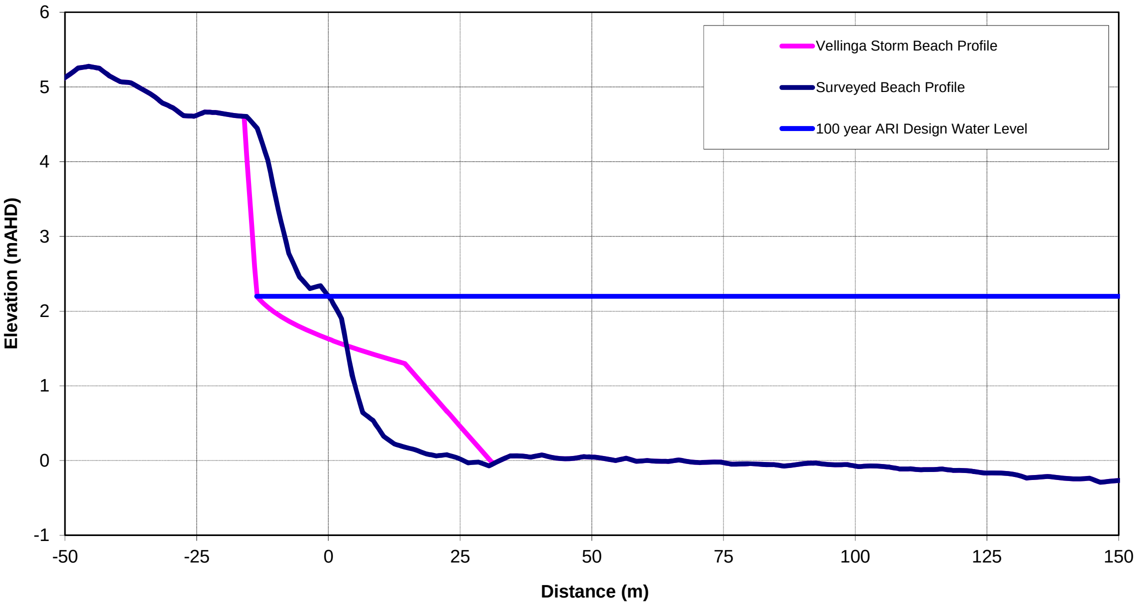


Figure B-2 Deception Bay – Profile 2

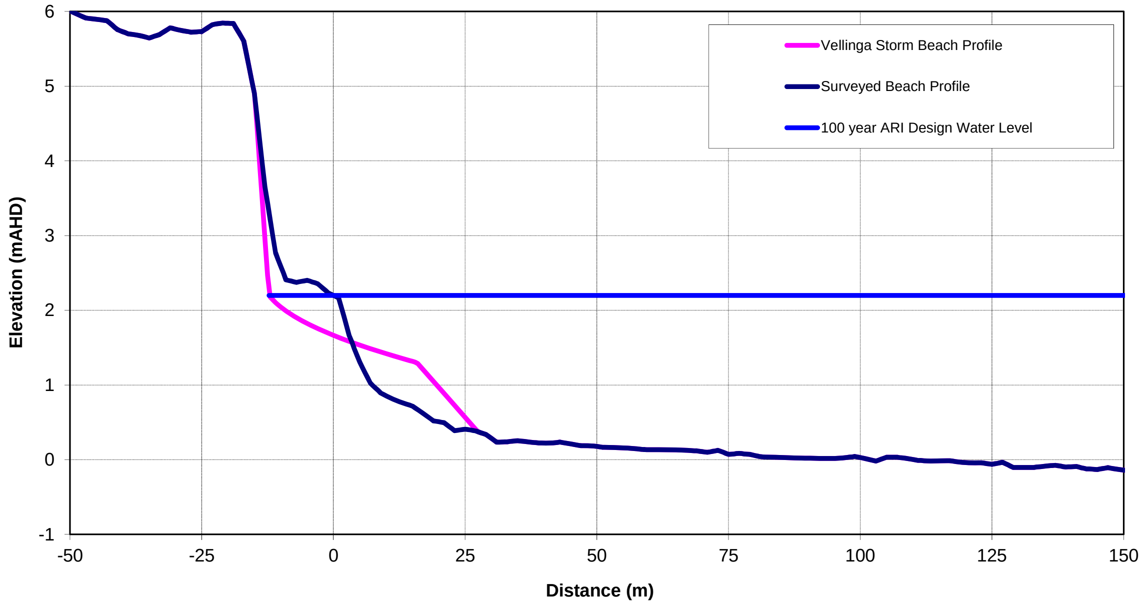


Figure B-3 Deception Bay – Profile 3

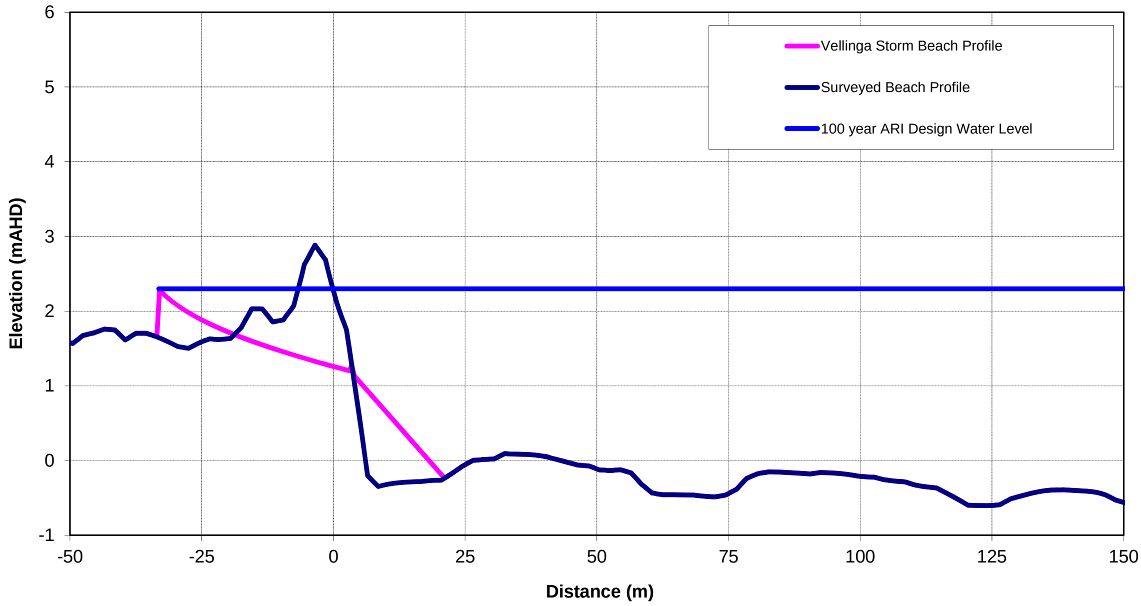


Figure B-4 Beachmere – Profile 4

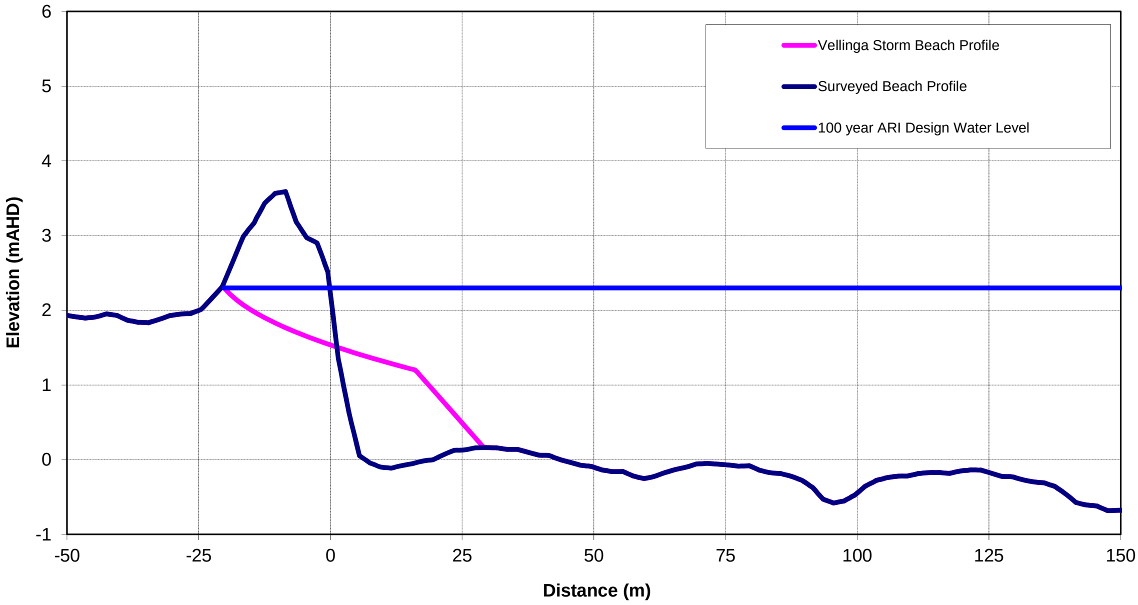


Figure B-5 Beachmere – Profile 5

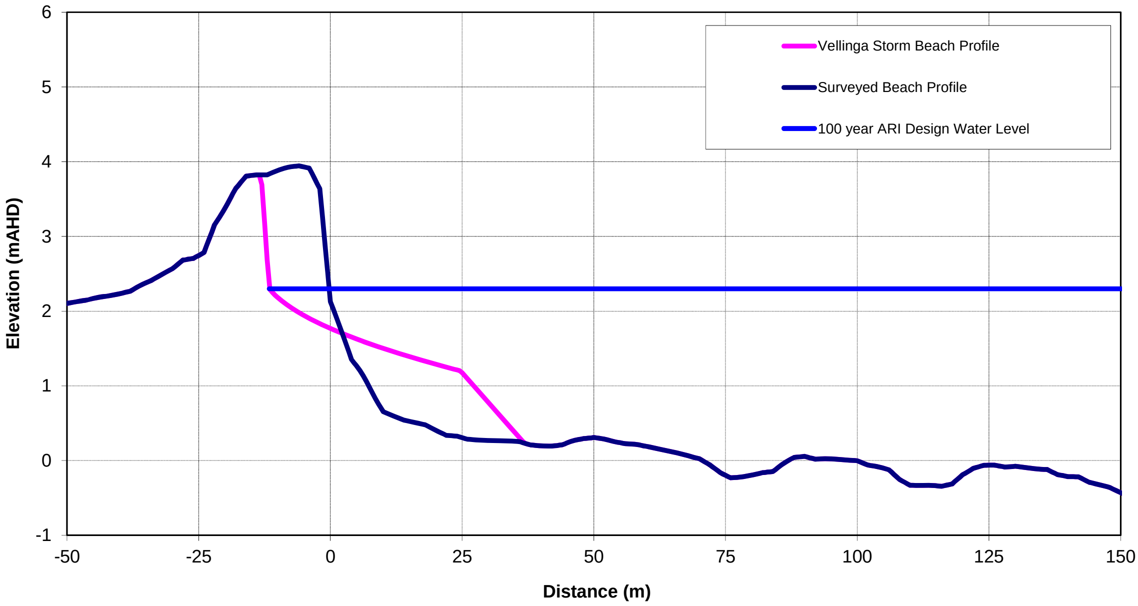
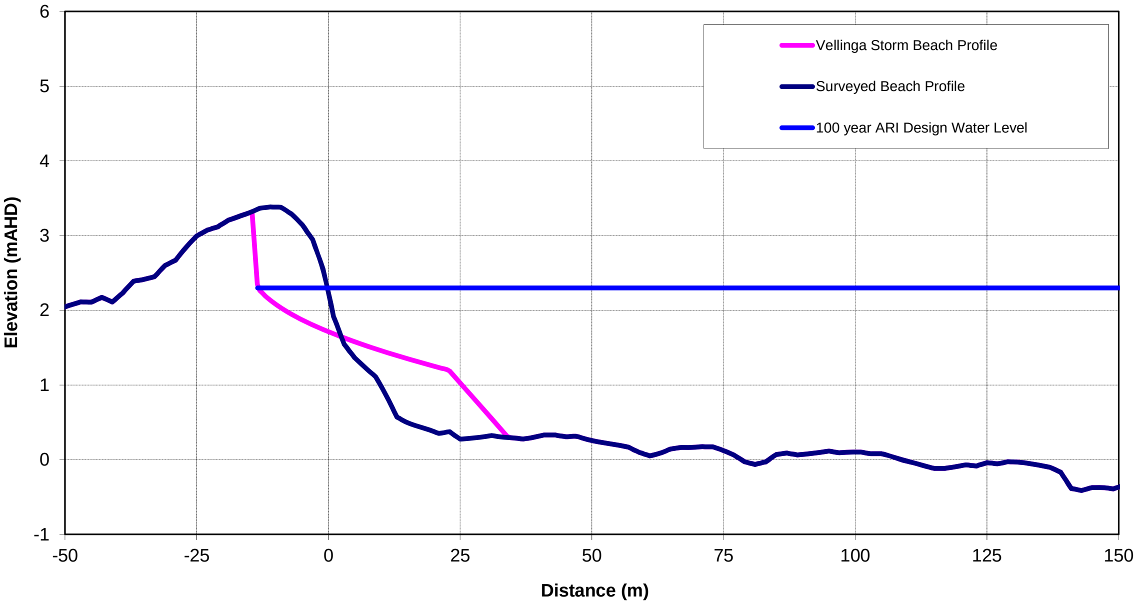


Figure B-6 Beachmere – Profile 6



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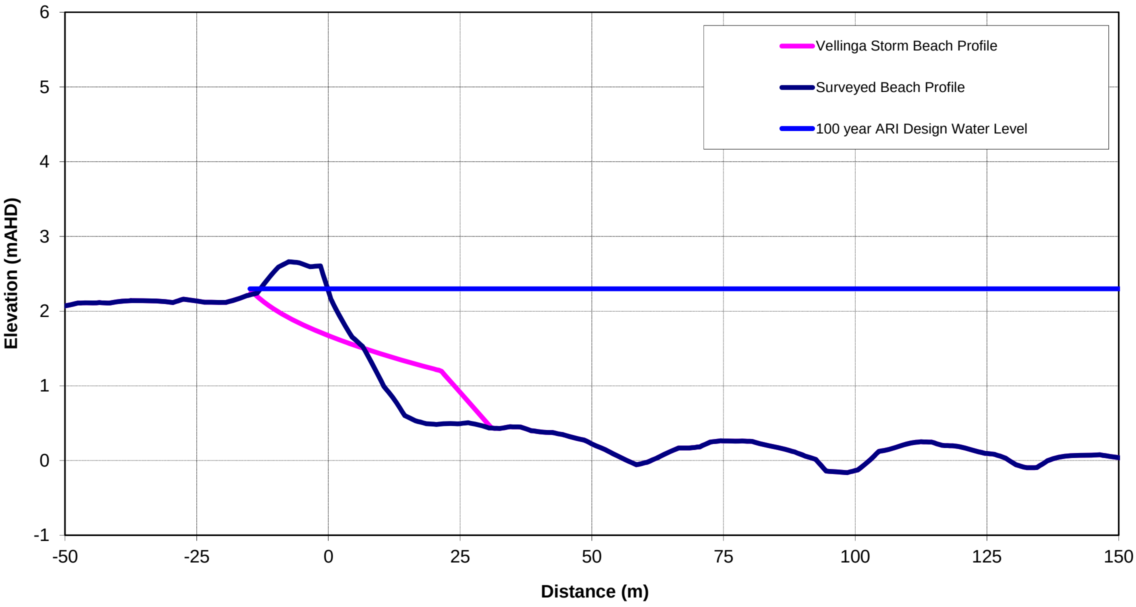


Figure B-8 Beachmere – Profile 8

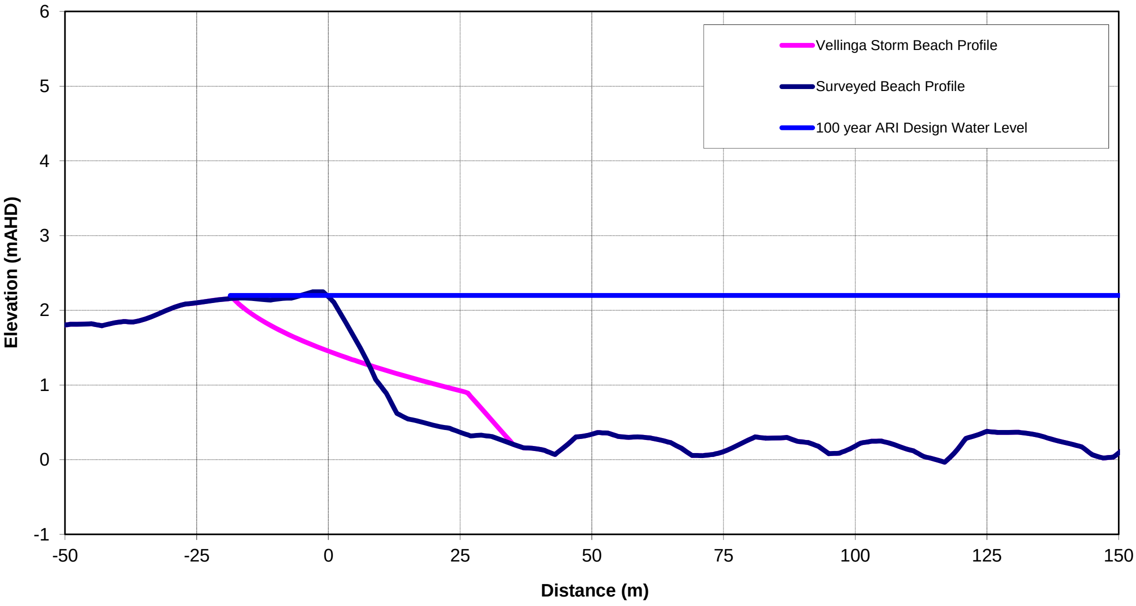
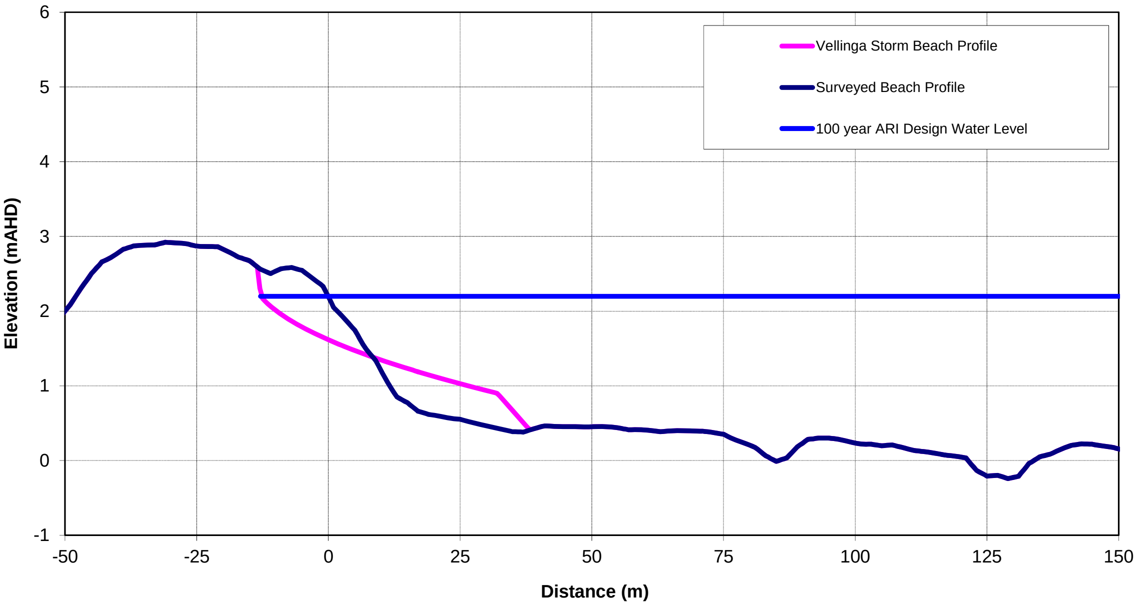


Figure B-9 Godwin Beach – Profile 9



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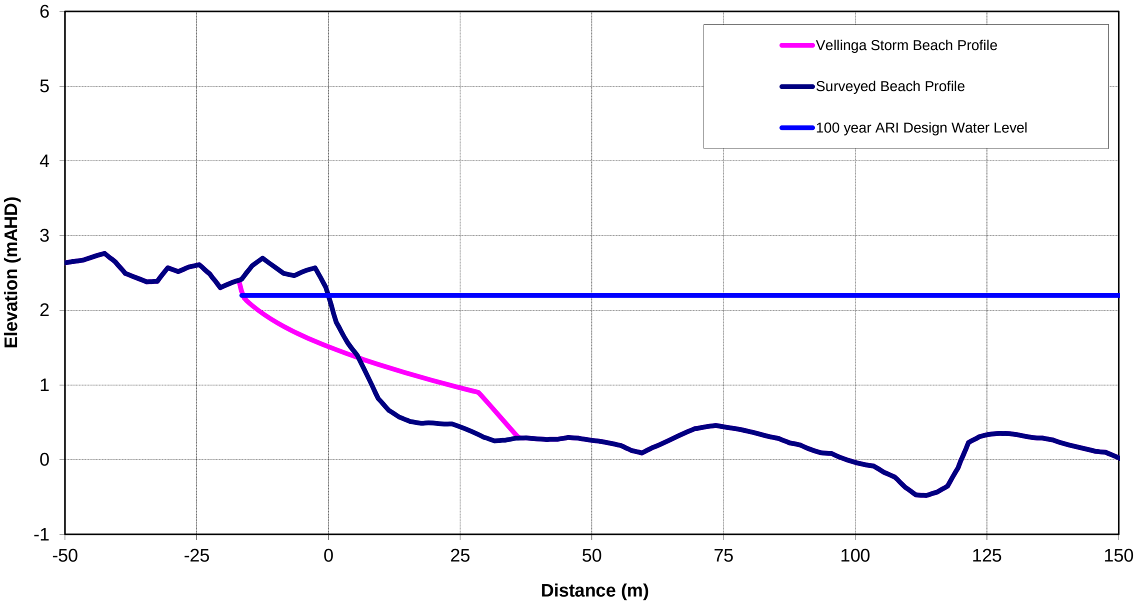


Figure B-11 Godwin Beach – Profile 11

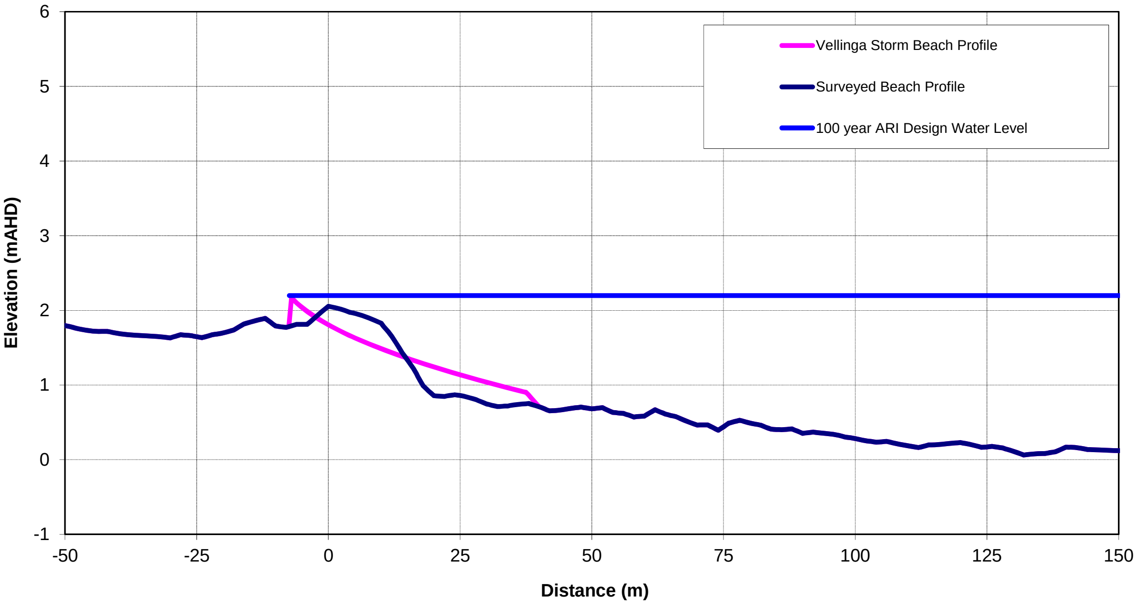


Figure B-12 Godwin Beach – Profile 12

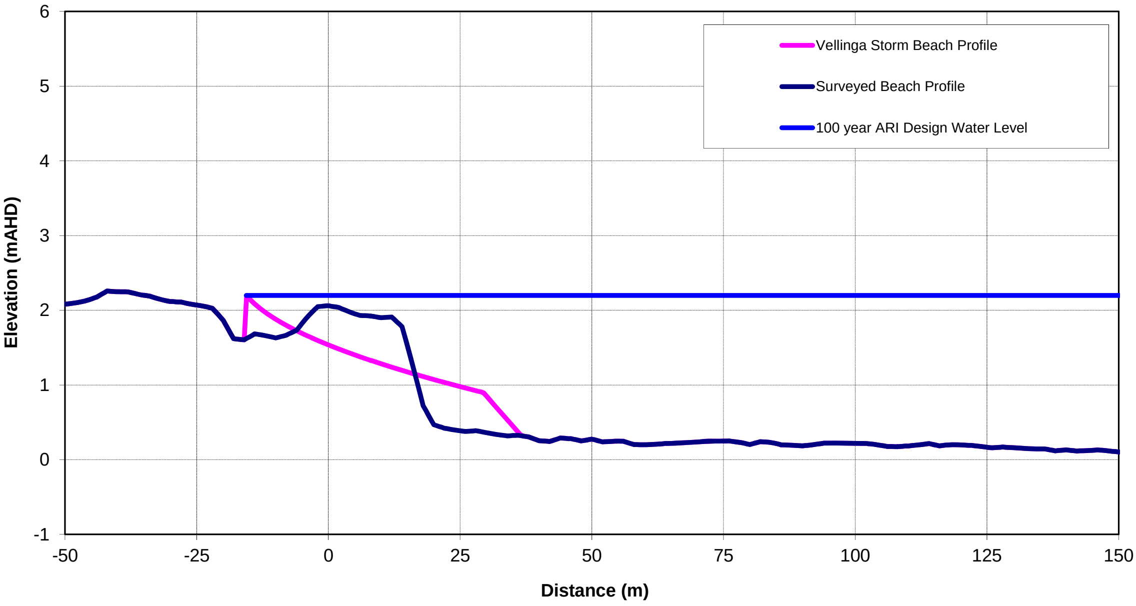


Figure B-13 Godwin Beach – Profile 13

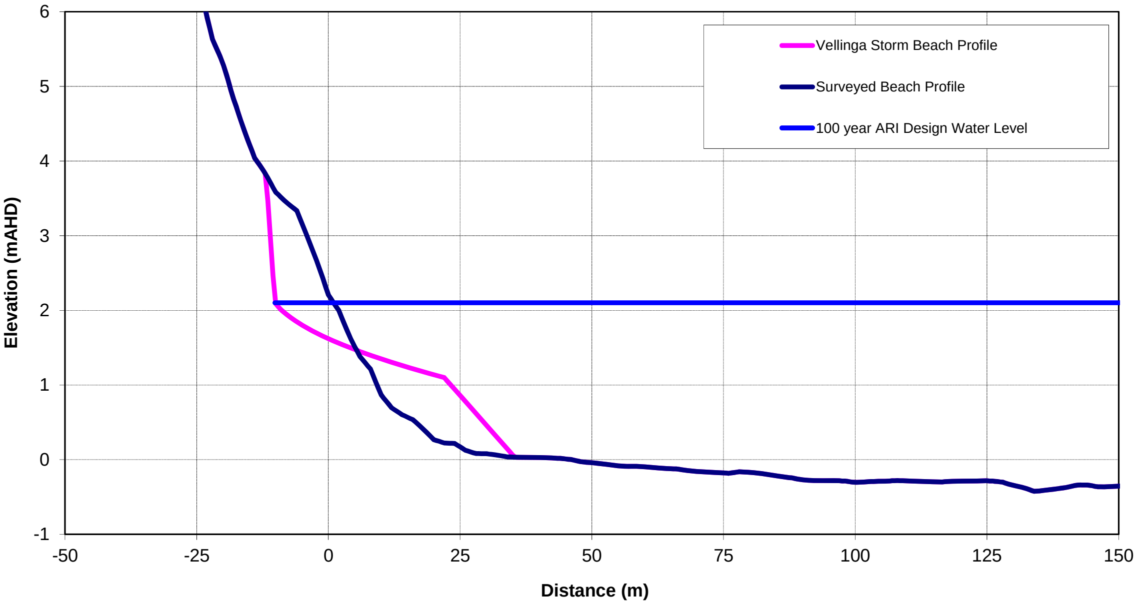


Figure B-14 Sandstone Point – Profile 14

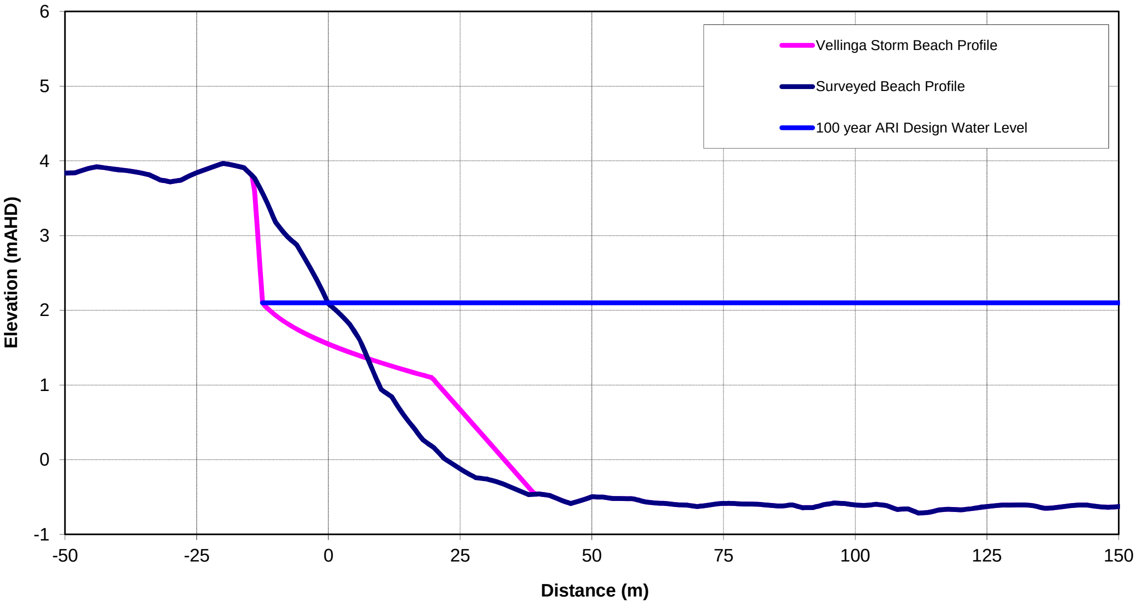
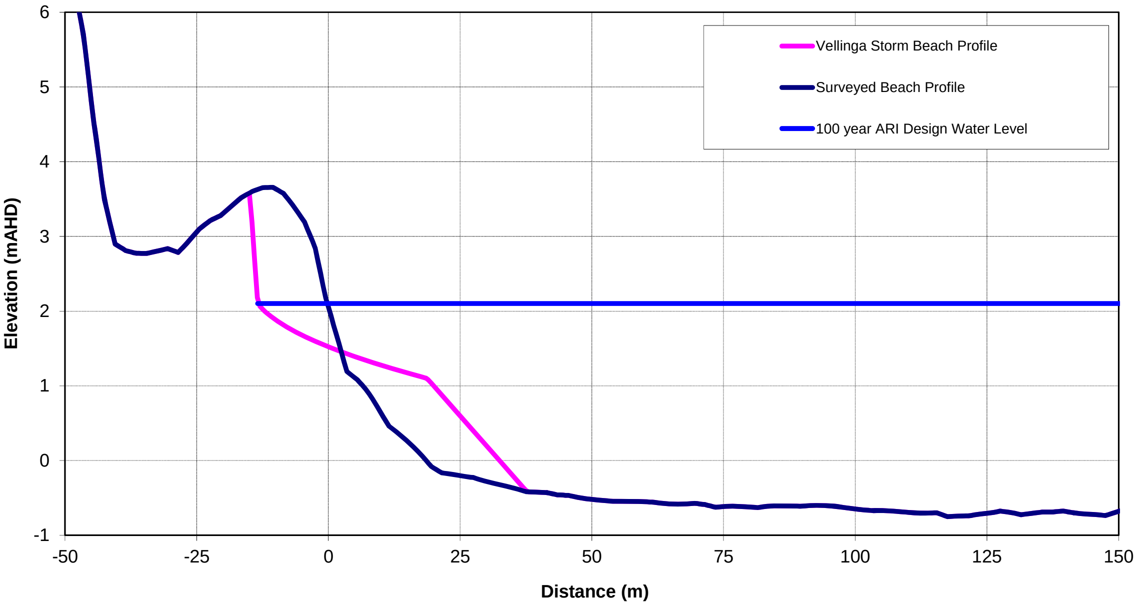


Figure B-15 Sandstone Point – Profile 15



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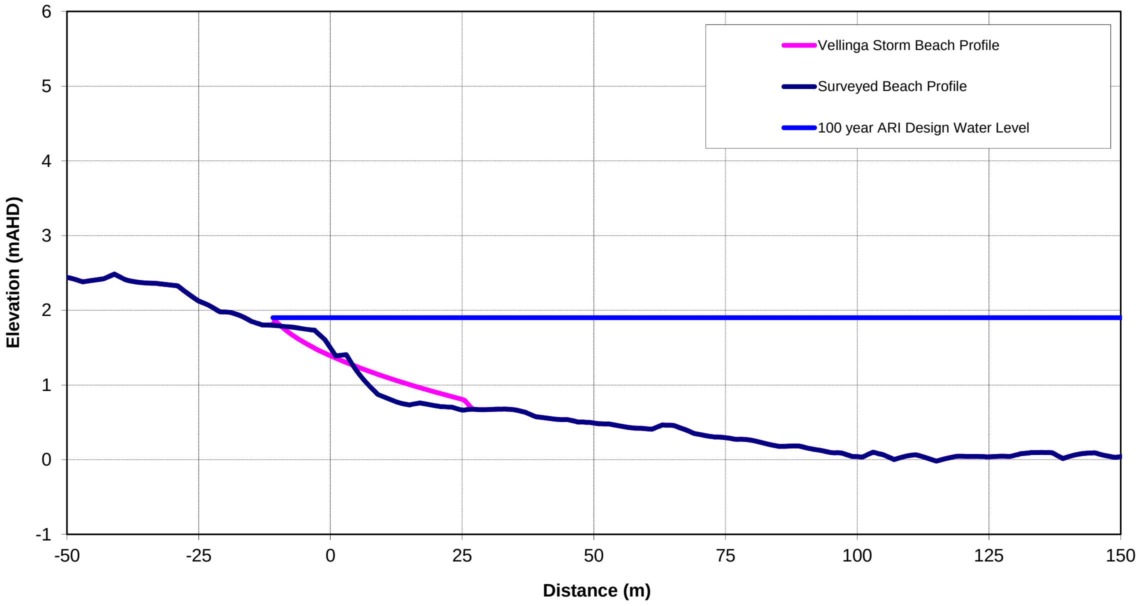


Figure B-17 Toorbul – Profile 17

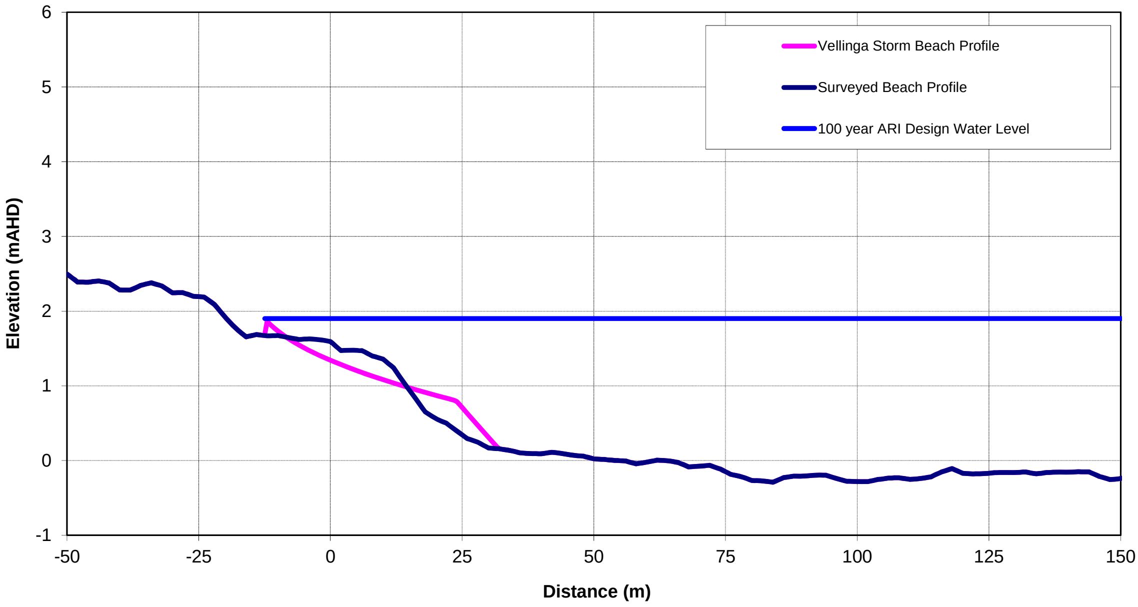
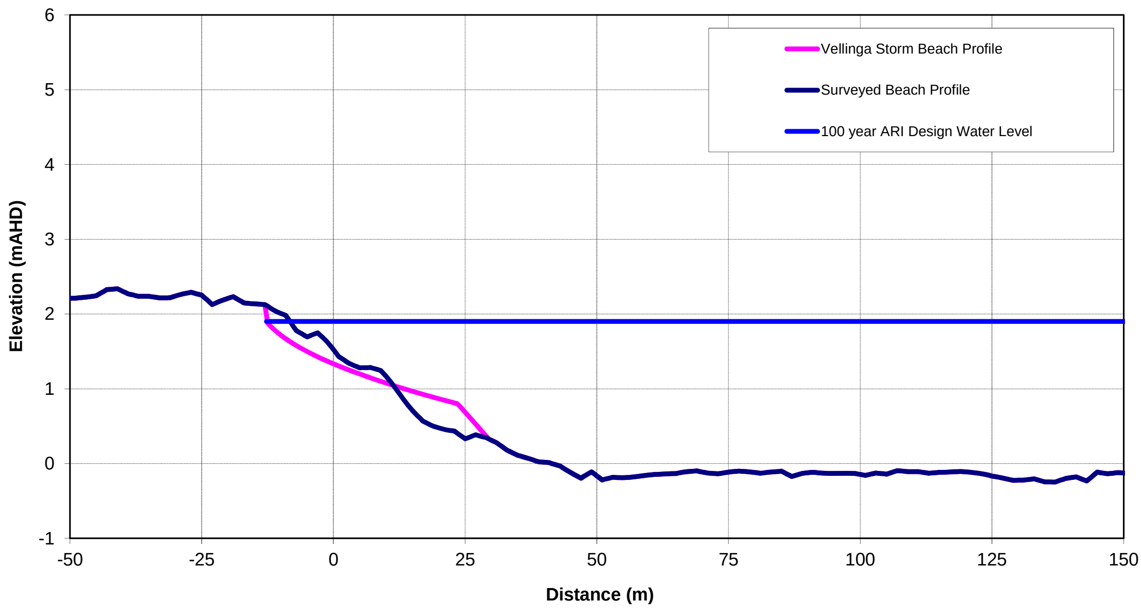


Figure B-18 Toorbul – Profile 18



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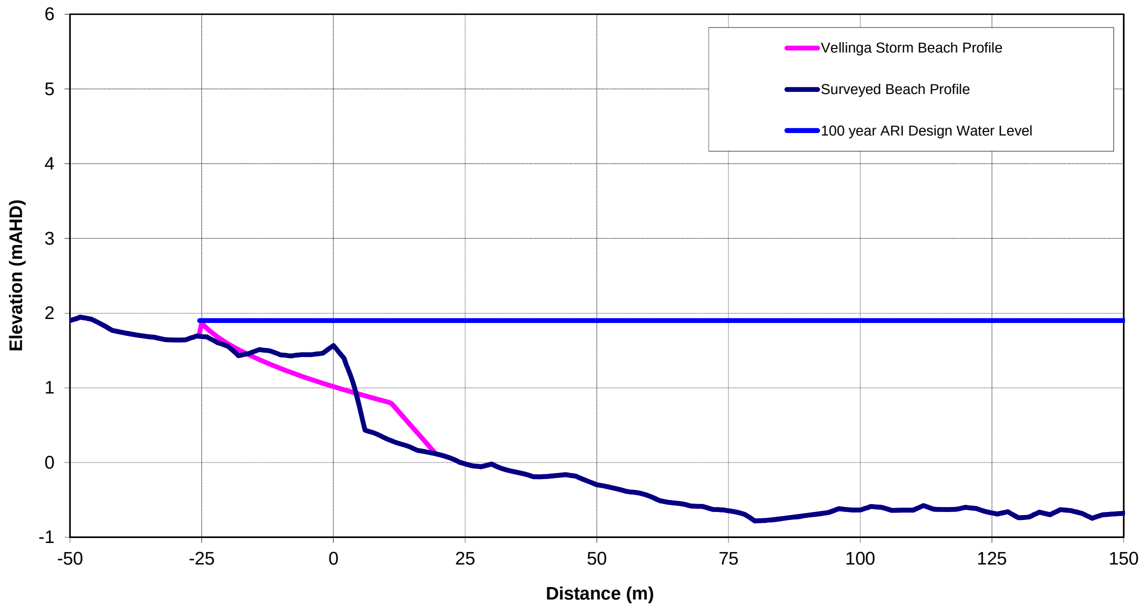

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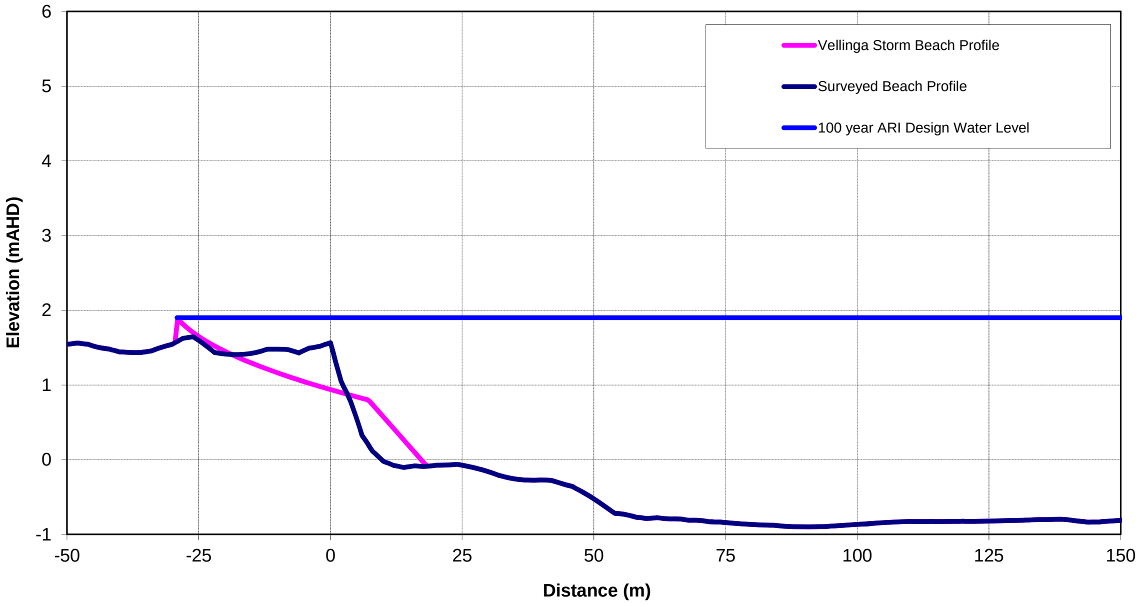

Figure B-21 Toorbul – Profile 21

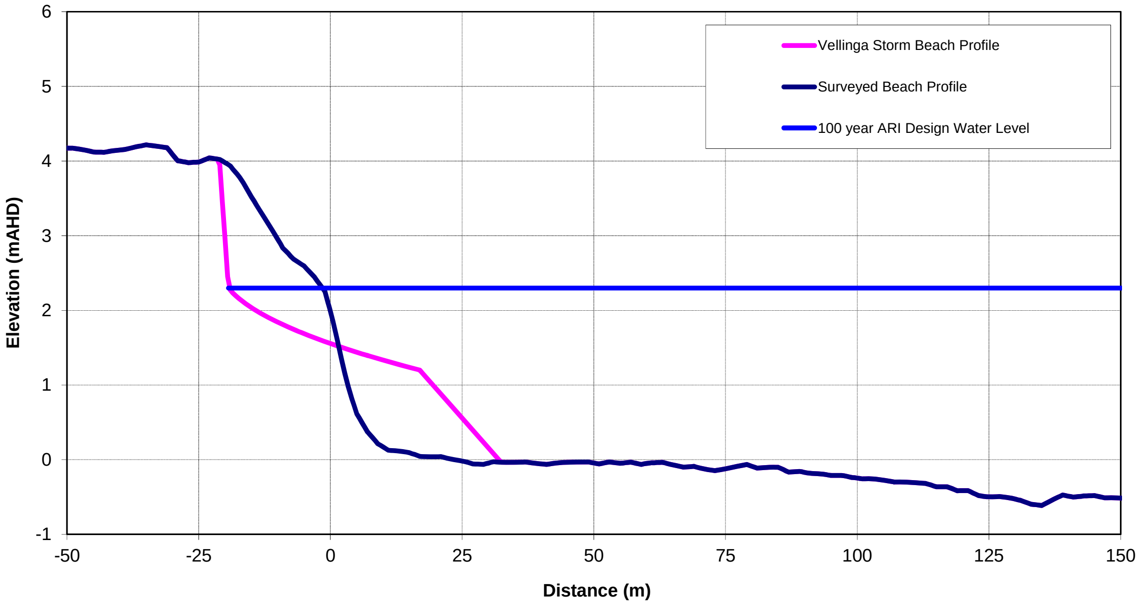

Figure B-22 Donnybrook – Profile 22

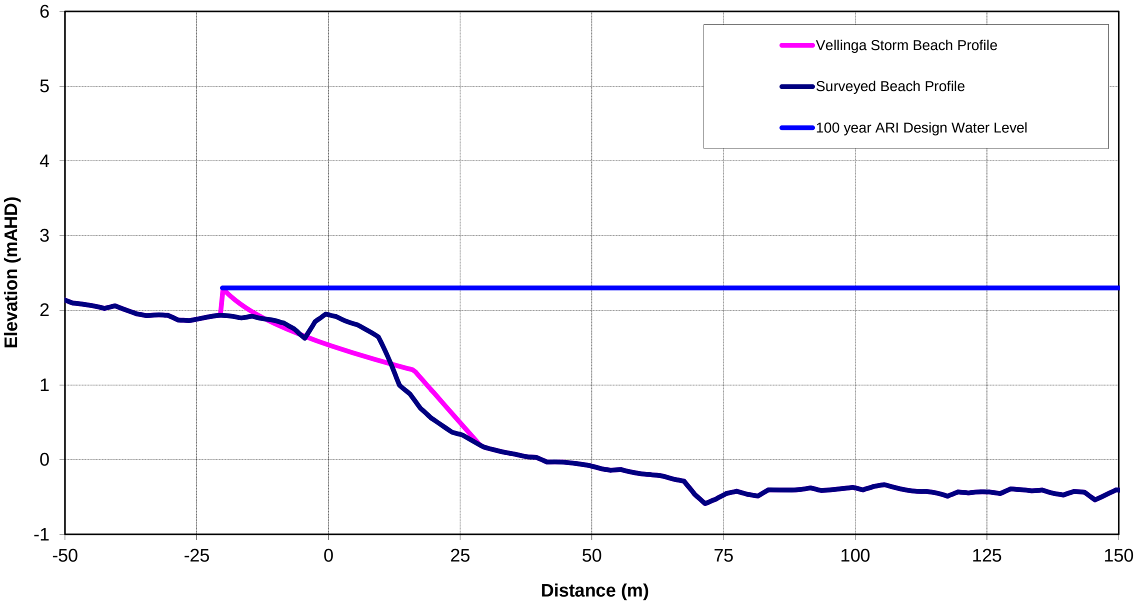

Figure B-23 Donnybrook – Profile 23

Appendix C Storm Erosion Hazard Area and 50-Year Planning Horizon Erosion Prone Area Mapping

Storm Erosion Hazard Area and 50-year Planning Horizon Erosion Prone Area Mapping is provided in Figure C-1 to Figure C-6. The methodologies used to calculate the erosion prone areas are described in Section 6.5 and Chapter 7.

The storm erosion width estimates are not expected to be realised at shorelines with terminal protection or where non-erodible material is present at the shoreline. Nevertheless, the erosion potential results help to identify assets potentially at risk and areas where existing structures may be vulnerable due to relatively high erosion pressure.

The 50-year Planning Horizon Erosion Prone Area is intended to guide future land use decision making. It is important to note that the calculated widths do not represent the predicted position of the shoreline in 50 years but rather an area that may be exposed to increasing erosion pressure associated with coastal processes throughout the planning period.

Title:

Deception Bay Beach Unit - Erosion Hazard Areas

Figure: C-1

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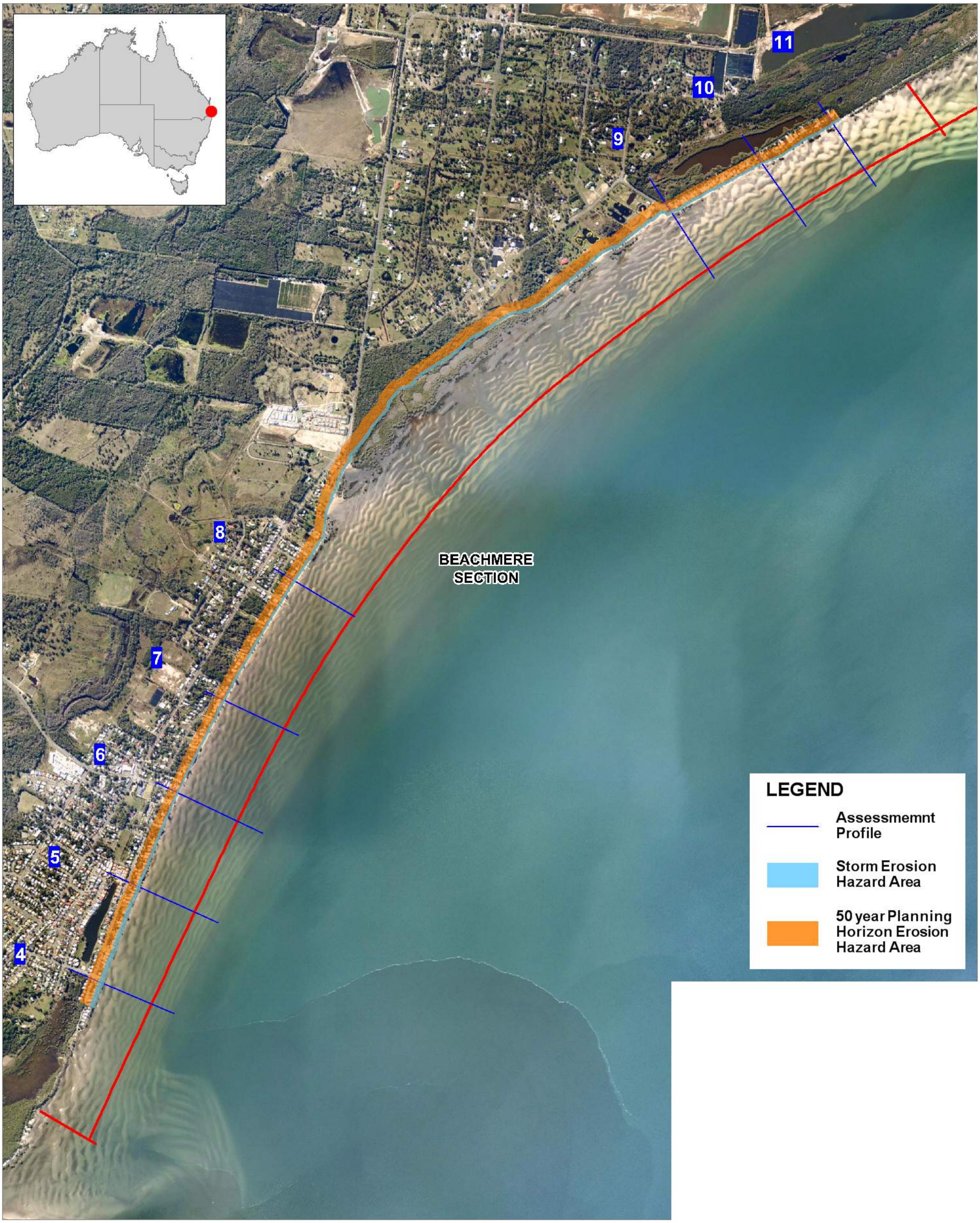

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Beachmere Beach Unit - Erosion Hazard Areas

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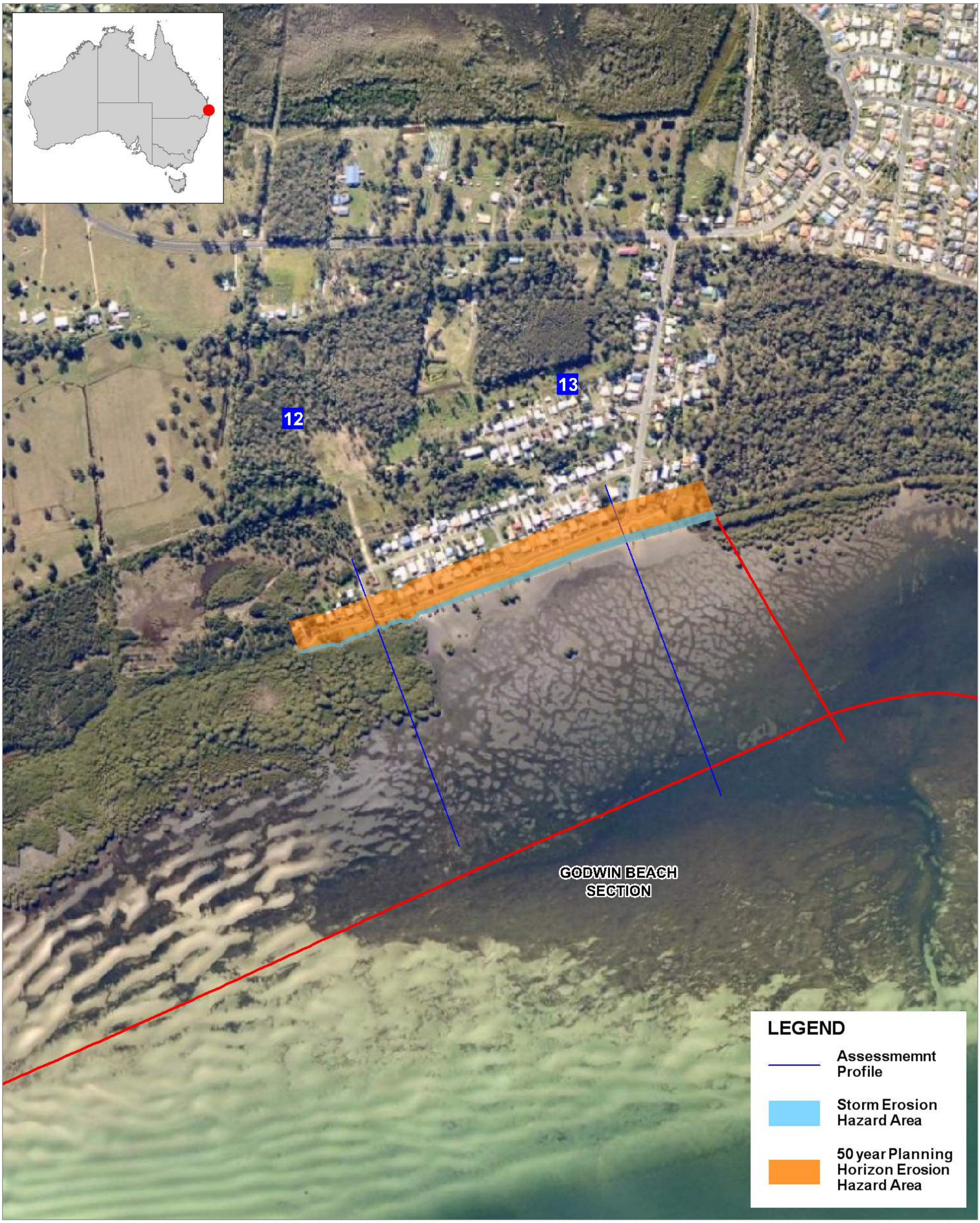

Title:

Godwin Beach Beach Unit - Erosion Hazard Areas

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Rev: A

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Title:

Sandstone Point Beach Unit - Erosion Hazard Areas

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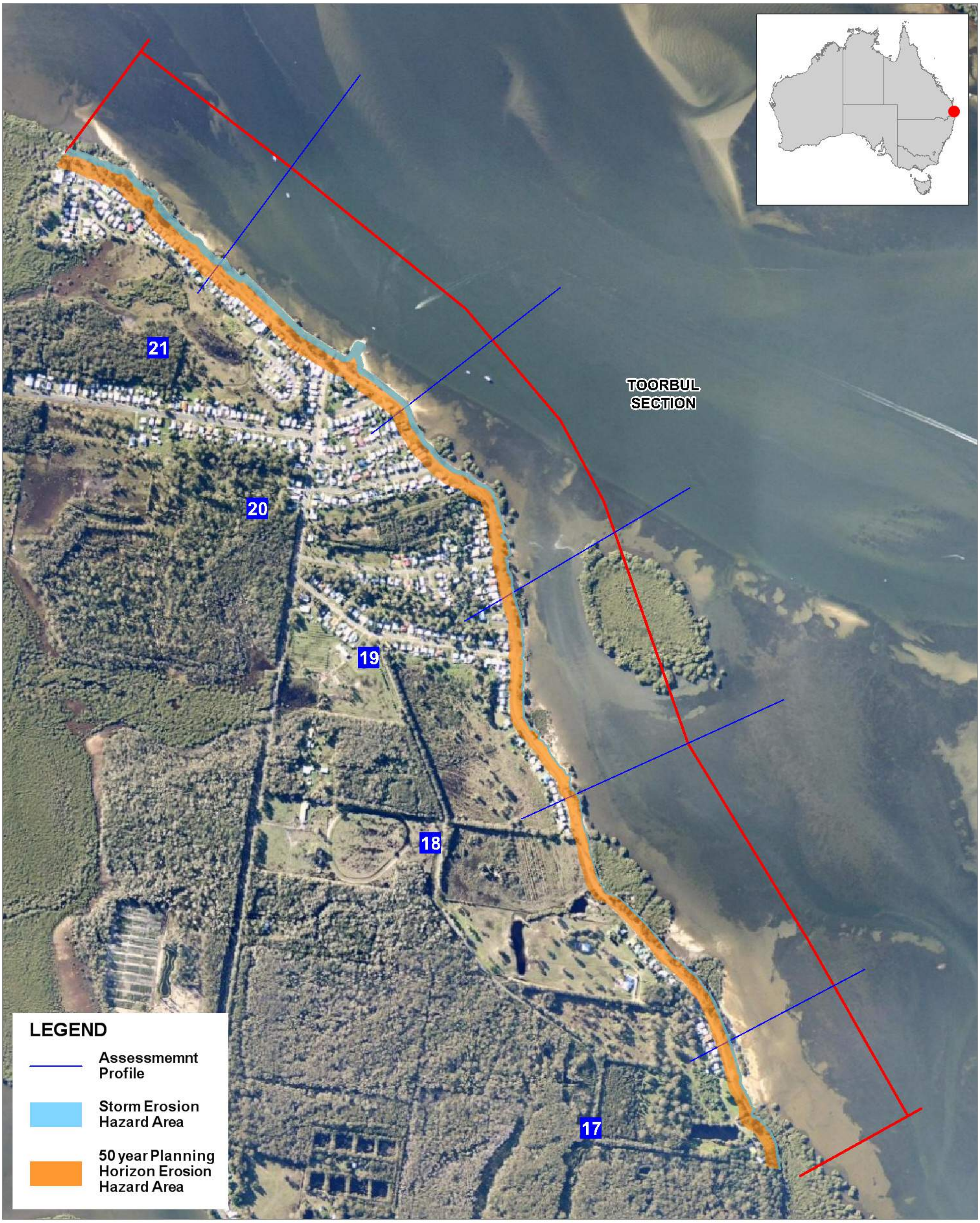

Title:

Toorbul Beach Unit - Erosion Hazard Areas

Figure: C-5

Rev: A

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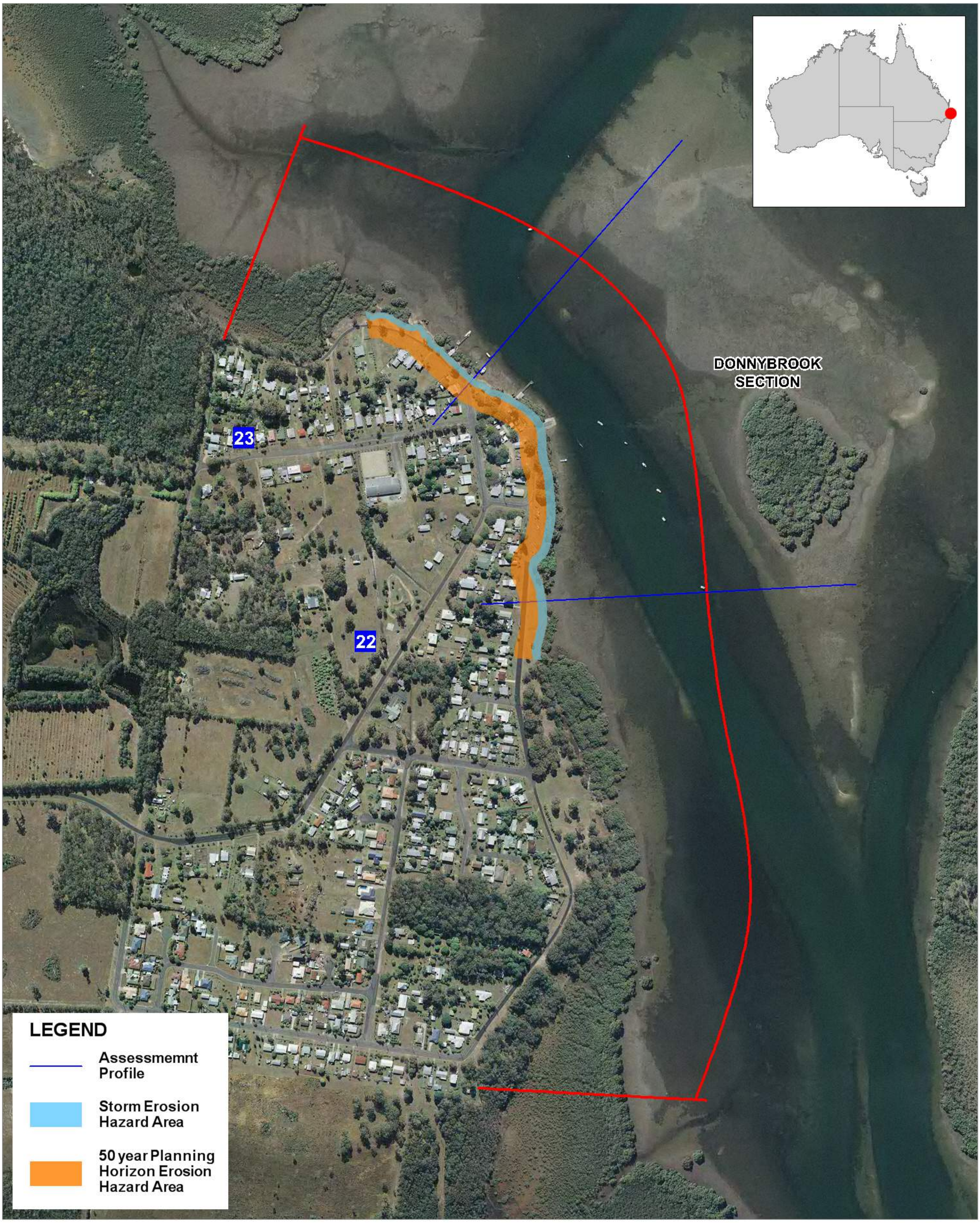

Title:

Donnybrook Beach Unit - Erosion Hazard Areas

Figure: C-6

Rev: A

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