0541-06-A
20 April 2010

wrm water + environment

WRM Water & Environment Pty Ltd
ABN: 96 107 404 544 ACN: 107 404 544
Level 5, Paddington Central,
107 Latrobe Terrace, PO Box 809,
Paddington Qld 4064 Australia
tel +61 7 3367 1279 fax +61 7 3367 1679
www.wrmwater.com.au

Nicky Crane
Development Manager
ULDA
PO Box 3643
South Brisbane BC QLD 4101

Dear Nicky,

SUBJECT: FITZGIBBON UDA - IMPACTS OF PROPOSED WORKS WITHIN CARSELDINE DRAIN BETWEEN AREAS E2 & G ON 100 YEAR ARI FLOOD LEVELS

1 INTRODUCTION

1.1 General

Within the Fitzgibbon UDA, the ULDA are currently developing the area bounded by Area E2 to the south, Area G to the north, the North Coast Railway to the west and Bill Brown Sports fields to the east (known as the "development area" for reporting purposes), as shown in Figure 1.

Carseldine Drain, which has a catchment area of about 6.3 km^2, flows in a north-easterly direction through the development area. Within the development area, Carseldine Drain is poorly defined, with water spreading out to flow at a shallow depth over a large area. For example for a 100 year ARI event, the predevelopment flood extent is approximately 400 m wide at a depth of up to about 1 m.

To provide flood immunity for proposed development, it is proposed to place fill within part of the Carseldine Drain 100 year ARI food extent, as shown in Figure 1. A number of flood mitigation measures will be implemented to ensure that the proposed development does not increase flood levels on adjacent development when compared with undeveloped conditions. The proposed flood mitigation measures include excavation of the Carseldine Drain channel and floodplain immediately downstream of the North Coast Railway.

As requested we have assessed the impacts of the proposed works within Carseldine Drain between Areas E and G using our hydrologic and hydraulic models for Fitzgibbon Chase and the overall development of the Urban Development Area (UDA) as documented in the following report:

Flood and Stormwater Management Studies for the Fitzgibbon Development Scheme, Ref. 0541-01-G [Rev 1] dated 24 July 2009.

This letter presents the results of this impact assessment.

1.2 Previous TUFLOW Investigations Adopted for this Study

The following Fitzgibbon Urban Development Area (UDA) development features were included in the TUFLOW model in previous WRM studies:

- The Area A development (WRMa, 2009);
- Relocation of a footbridge crossing along Fitzgibbon Drain (WRMb, 2009);
- The Area E1 development (WRMc, 2009);
- The Area E2 development and temporary excavation of the future Roghan Road easement between Area E2 and Telegraph Road (WRMa, 2010);
- The revised DB1 outlet configuration (WRMb, 2010); and
- The revised DB2 and full UDA development (WRMc, 2010);

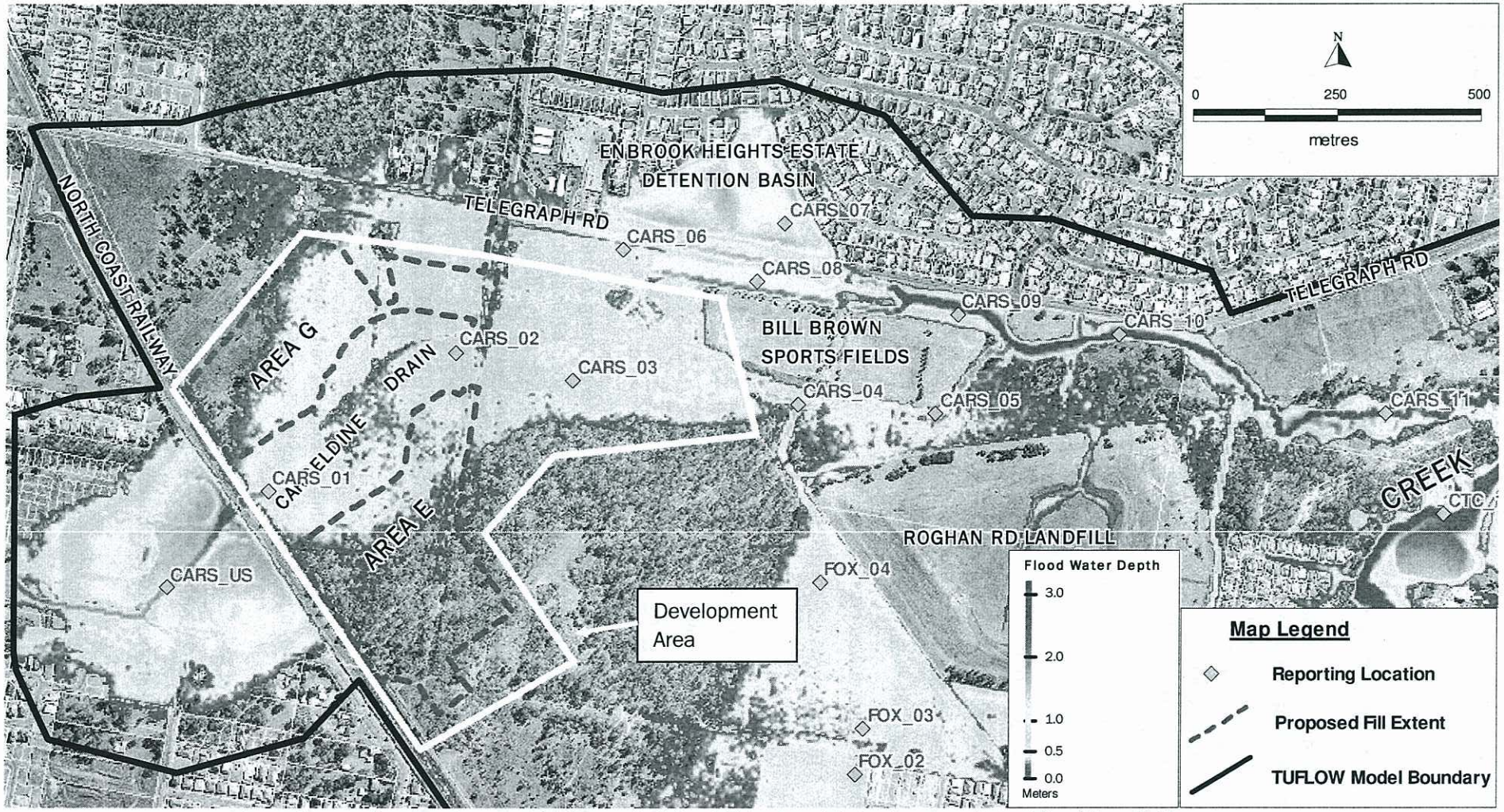


Figure 1 Pre-Development 100 year ARI Flood Extent and Reporting Locations, Fitzgibbon UDA

2 TUFLOW MODEL EXTENT CHANGES

The TUFLOW model extent was extended to include the area upstream of the North Coast Railway crossing of Carseldine Drain including the railway culverts along Carseldine Drain (see Figure 1). The North Coast Railway consists of three railway lines on two railway embankments with space available for a fourth line on the eastern embankment. The western (upstream) embankment is about 8 m wide and the eastern (downstream) embankment is about 12 m wide. The railway culverts were added to the TUFLOW model with the following configuration:

- Upstream culvert crossing:
  - Three 3 m (W) x 2.4 m (H) box culverts;
  - Length = 8 m;
  - Upstream invert = 9.5 m AHD;
  - Downstream Invert = 9.4 m AHD; and
  - Rail Deck = 12.7 m AHD.
- Downstream culvert crossing:
  - Three 3 m (W) x 2.4 m (H) box culverts;
  - Length = 12 m;
  - Upstream invert = 9.4 m AHD;
  - Downstream Invert = 9.3 m AHD; and
  - Rail Deck = 12.55 m AHD.

The energy loss through the two structures was checked using the HEC RAS 1D hydraulic model. The results of the TUFLOW and HEC RAS models were in good agreement. Note that during flood events, water will pond behind the railway embankment significantly reducing flows downstream of the railway. In a 100 year ARI event, the discharge is approximately halved due to the detention effect of the railway crossing.

3 CONFIGURATION OF PROPOSED CARSELDINE DRAIN WORKS

3.1 Overview

Figure 2 shows the proposed works within Carseldine Drain. The following major works within the Carseldine Drain waterway area were added to the developed conditions TUFLOW model:

- Bulk infilling of Area E to the south and Area G to the north (completed, see WRMa, 2010).
- Detention Basin 2 (completed, see WRMc, 2010).
- Channel widening and deepening immediately downstream of the North Coast Railway crossing (Ch_6).
- Construction of the Norris Road culvert crossing (Cu_4).
- Construction of the busway embankment between Area E and Area G parallel to the railway.

3.2 Channel Widening and Deepening (Ch_6)

The proposed excavation area (Ch_6) was modelled with the following characteristics:

- Length = 120 m;
- Width = 30 - 50 m at the top of bank;
- Invert level = 8.9 - 9.0 m AHD;
- Depth = up to 1 m;
- Side Batters = 1(V) : 6(H); and
- Area = 4350 m^2.

3.3 Norris Road Culvert Crossing (Cu_4)

The proposed Norris Road culvert crossing (Cu_4) was modelled with the following characteristics:

- Fifteen (15) 1.8 m (W) x 0.9 m (H) box culverts;
- Upstream Invert = 8.75 m AHD;
- Downstream Invert = 8.65 m AHD; and
- Road Deck Level = 10.96 m AHD;

3.4 Proposed Busway Culverts

Figure 3 and Figure 4 show the configuration of the proposed busway culvert crossing, designed by AECOM in 2008. Based on the drawings, it is proposed to extend the existing culverts from the downstream railway culverts through the proposed busway embankment. It is also proposed to demolish the end walls between the upstream and downstream railway embankments and install culverts. This effectively creates a single culvert group that would pass through the two railway embankments and the proposed busway embankment.

The proposed combined railway and busway culvert crossing included in the TUFLOW model is configured as follows:

- Three 3 m (W) x 2.4 m (H) box culverts;
- Upstream Invert = 9.5 m AHD;
- Downstream Invert = 9.1 m AHD;
- Length = 62 m;
- Railway embankment level = 12.7 m AHD;

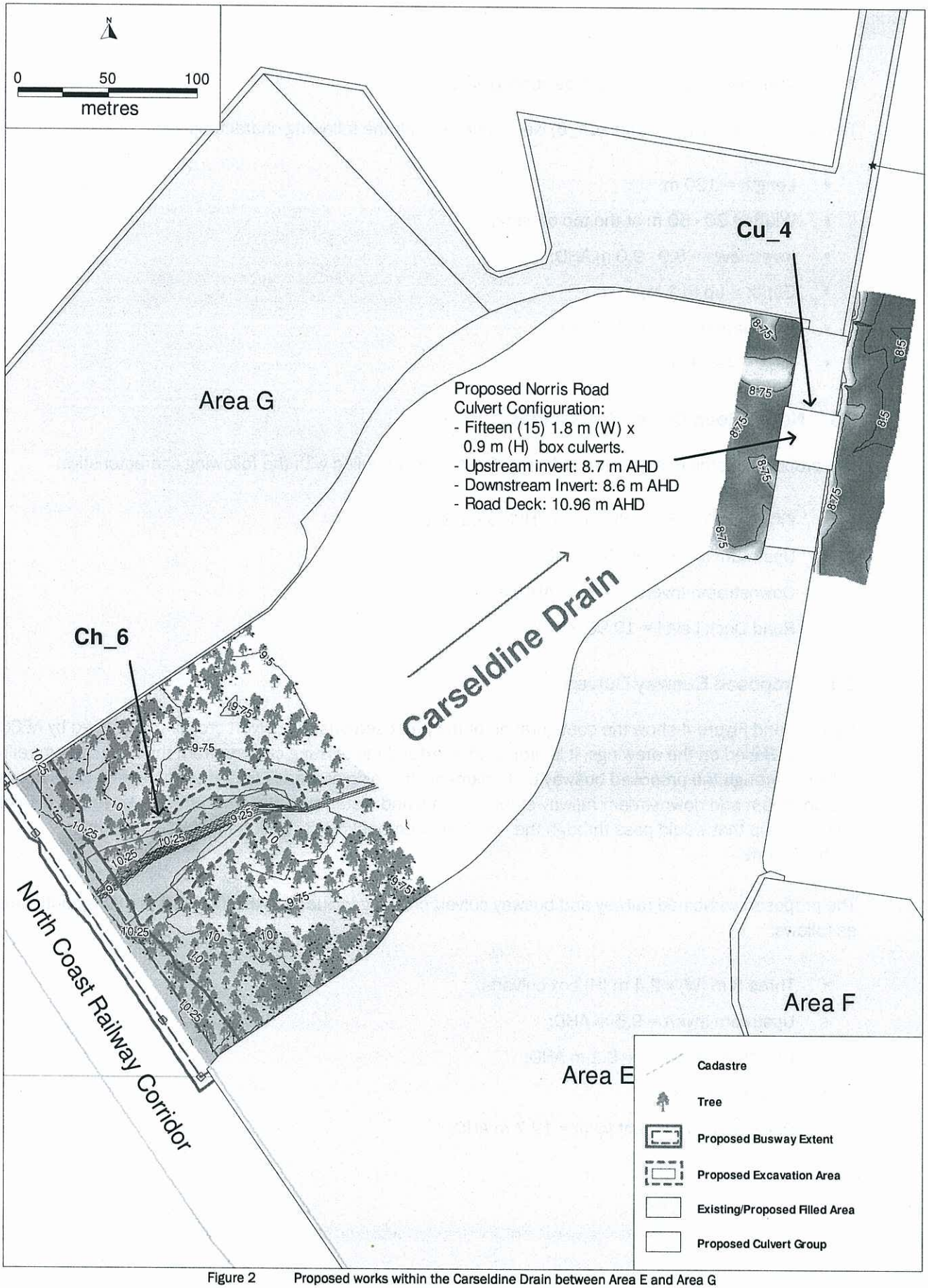


Figure 2 Proposed works within the Carseldine Drain between Area E and Area G

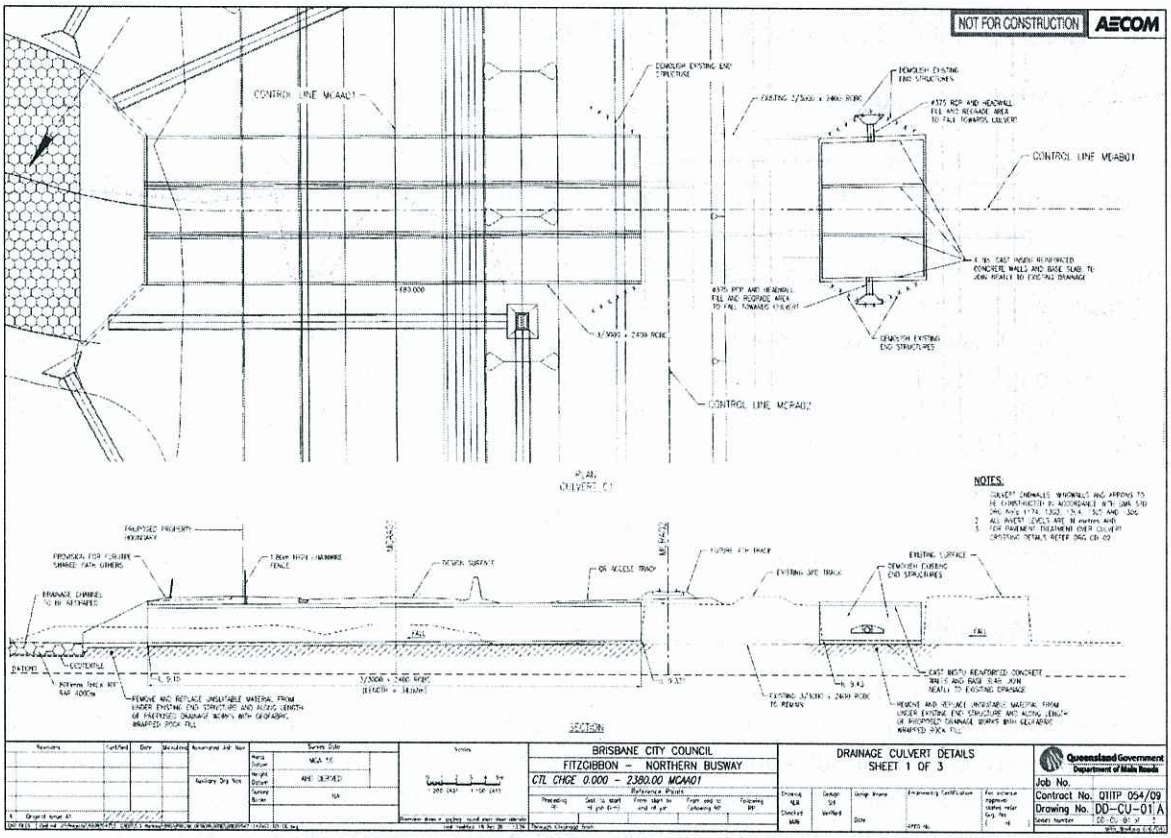


Figure 3 Long Section of Proposed Combined Railway and Busway Culverts (from AECOM)

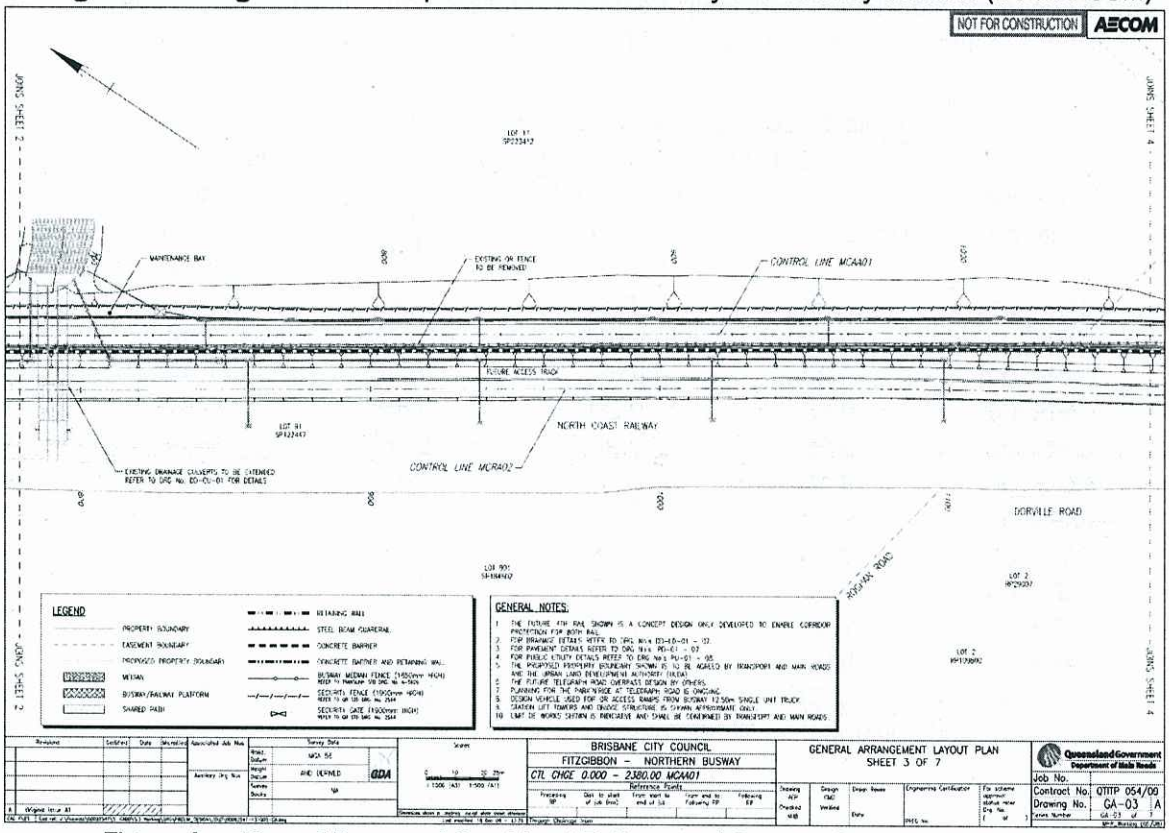


Figure 4 Plan of Proposed Combined Railway and Busway Culverts (from AECOM)

4 RESULTS OF TUFLOW FLOOD IMPACT ASSESSMENT

4.1 Without the Busway

Table 1 shows the 100 year ARI water level impacts of the proposed development along Carseldine Drain **without** the busway. Figure 1 shows the locations of the corresponding reporting locations. The results of the flood modelling show that the proposed works within the Carseldine Drain (excluding the busway) do not increase 100 year ARI water levels outside of the Fitzgibbon UDA, except between the Bill Brown Sports Fields and the Roghan Road Landfill sites. Peak flood levels between the two landfills are increased by up to 0.36 m. This water level increase does not affect any existing development. The 100 year ARI flood levels along Telegraph Road and north of the proposed development and landfill site are decreased, as shown in Figure 5. Note that peak flood levels along Cabbage Tree Creek are not increased by the proposed works along Carseldine Drain.

Figure 1 shows a long section plot comparing the 100 year ARI flood level along Carseldine Drain for undeveloped and developed conditions.

4.2 With the Busway

Table 1 shows the 100 year ARI water level impacts of the proposed development along Carseldine Drain **with** the busway. Figure 1 shows the locations of the corresponding reporting locations. It can be seen that the proposed busway will substantially reduce water levels upstream of the North Coast Railway culverts. This is because by joining the upstream and downstream railway culverts, the energy loss through these structures will be reduced. However, the discharges across the development area are increased by 8.3 m^3/s due to the reduction in storage upstream of the railway embankment. This increases water levels by up to 0.11 m through the site compared with developed conditions without the busway.

Table 1 - 100 year ARI Water Level Impacts along Carseldine Drain

Reporting Location	Q100 Peak Flood Level (m AHD)			Water Level Impact (m) (Without Busway)	Water Level Impact (m) (With Busway)
	Undeveloped	Developed (Without Busway)	Developed (With Busway)		
CARS_01	10.89	10.82	10.91	-0.07	0.02
CARS_02	9.53	10.62	10.73	1.09	1.20
CARS_03	9.24	10.31	10.36	1.07	1.12
CARS_04	9.08	9.39	9.42	0.31	0.34
CARS_05	8.58	8.94	8.95	0.36	0.37
CARS_06	9.18	8.74	8.74	-0.44	-0.44
CARS_07	9.15	8.81	8.81	-0.34	-0.34
CARS_08	9.15	8.78	8.78	-0.37	-0.37
CARS_09	7.95	7.73	7.78	-0.22	-0.17
CARS_10	7.42	7.30	7.34	-0.12	-0.08
CARS_11	5.90	5.81	5.84	-0.09	-0.06
Cars_US *	12.34	12.33	12.21	-0.01	-0.13

* Carseldine Drain Upstream of North Coast Railway Crossing

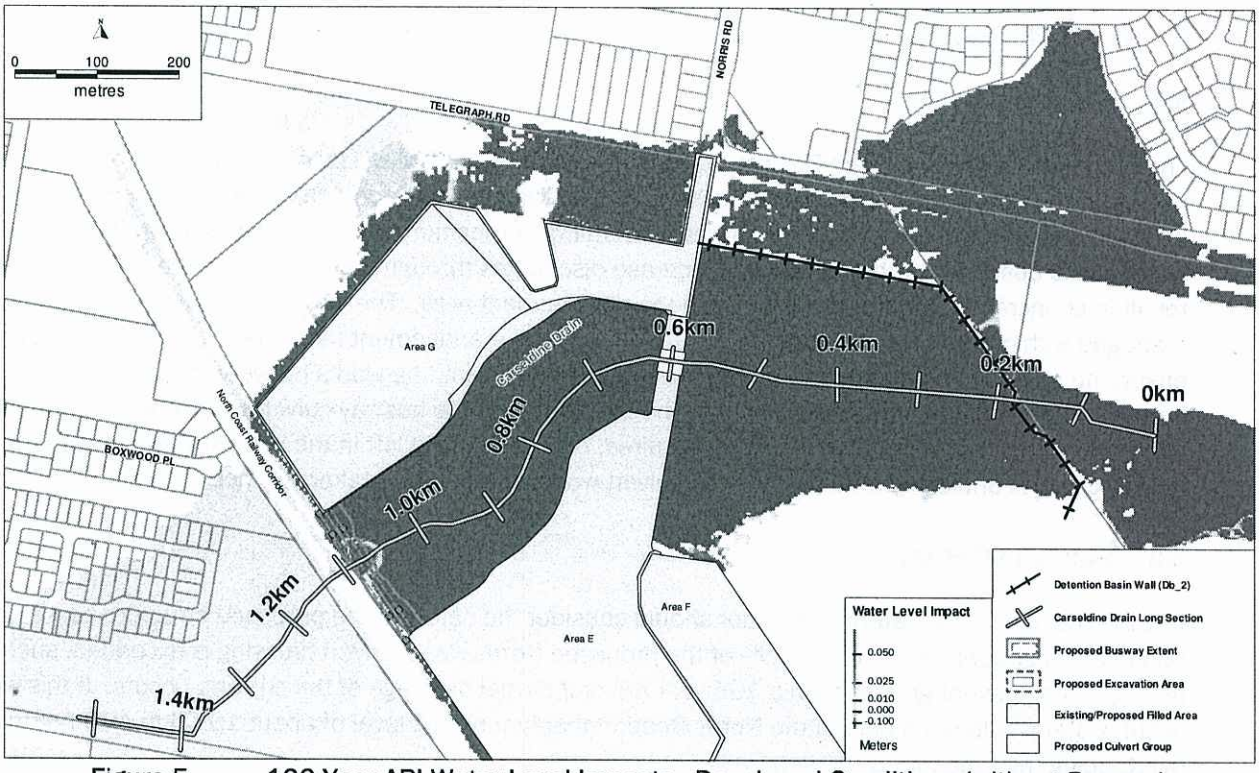


Figure 5 100 Year ARI Water Level Impacts - Developed Conditions (without Busway)

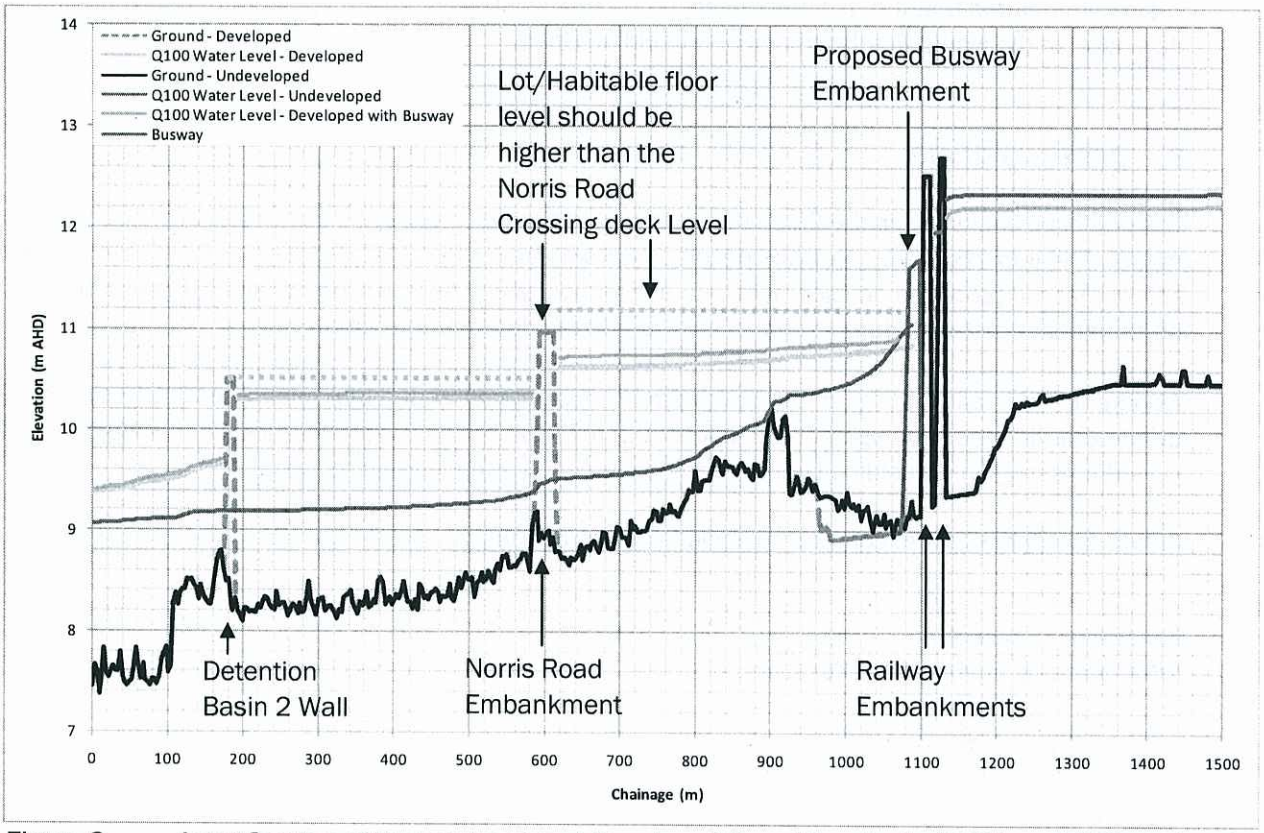


Figure 6 Long Section of Undeveloped and Developed Carseldine Drain 100 Year ARI Water Levels

5 OTHER ISSUES

5.1 Staging

The proposed Carseldine Drain Busway culverts designed by AECOM will extend from upstream of the railway to the downstream side of the Busway. The existing endwalls be demolished and new culverts installed between the upstream and downstream railway embankments. The proposed works will lower water levels upstream of the railway and increase discharges through the development area. This will result in an increase in water levels through the development area. The increase in water levels can be managed within the ULDA development with the proposed management measures. However, in order to ensure no adverse impact upstream of the railway embankment, the works between the railway embankments must be undertaken prior to the installation of the busway culverts. Otherwise, either an alternative culvert configuration would be required, or a gap should left in the busway embankment at the railway culverts until such time that the full culvert works can be undertaken at once.

5.2 Safety in Design

Detailed design of the waterway corridor should consider the safety of the proposed structure as well as potential consequences if the capacity of the proposed Norris Road culvert crossing is exceeded, such as during an flood event greater than a 100 year ARI or if partial blockage of the culverts occurs. If this were to occur, water would pond behind the Norris Road embankment to a level of about 10.96 m AHD before overtopping the road into Detention Basin 2.

It is recommended that the minimum lot levels on the development be at least 0.2 m above the minimum deck level of the Norris Road crossing of Carseldine Drain.

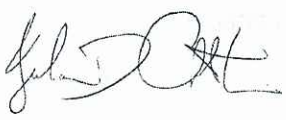
6 CONCLUSIONS

The proposed works within the Carseldine Drain were assessed using the Fitzgibbon UDA TULFOW hydraulic model. The impacts of the proposed development with and without the busway were assessed. It was shown that the proposed development with and without the busway will not adversely impact on existing development upstream, downstream or adjacent to the development area.

As part of the detailed design of the development, it is recommended that minimum floor levels of new dwellings within the development are at least 0.2 m above the minimum deck level of the Norris Road culvert crossings in Carseldine Drain in addition to flood immunity requirements.

Please do not hesitate to contact me if you have any queries.

For and on behalf of
WRM Water & Environment Pty Ltd



Julian Orth
Project Engineer

References:

WRMa (2009)	*Flood and Stormwater Management Studies for the Fitzgibbon Development Scheme*, Ref. 0541-01-G [Rev 1] dated 24 July 2009
WRMb (2009)	*Fitzgibbon Chase - Relocation of Footbridge*, Ref. 0541-01-Q dated 2 September 2009
WRMc (2009)	*Fitzgibbon Urban Development Area E1 Flood Impact Assessment and Stormwater Management Plan*, Ref. 0541-02-B [Rev 1] dated 25 November 2009
WRMa (2010)	*Fitzgibbon Urban Development Area E2 Flood Impact Assessment and Stormwater Management Plan*, Ref. 0541-02-D dated 15 January 2010
WRMb (2010)	*Revised Low Flow Pipe Invert Levels For the Proposed Roghan Road Detention Basin (DB1)*, Ref. 0541-02-F dated 8 February 2010
WRMc (2010)	Impact Assessment of the Revised Full Development Footprint and Flood mitigation infrastructure, Ref. 0541-02-G dated 10 March 2010