Appendix D
Modelling Quality Report

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Project: Regional Floodplain Database
Model Quality Report
Bribie Island (BRI)

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1 Introduction

1.1 Study objective

Moreton Bay Regional Council (MBRC) is delivering a Regional Floodplain Database (RFD) in support of their flood risk management, considering emergency response, development control, strategic landuse and infrastructure planning. The MBRC was recently formed under local government amalgamations and is responsible for Caboolture, Pine Rivers, Redcliffe and Bribie Island. The RFD project focuses on the northern sector as a key growth area for South-East Queensland.

The project is being funded by MBRC, Emergency Management Queensland (EMQ) and Emergency Management Australia (EMA) as part of the Disaster Resilience Program and will provide:

- A comprehensive and consistent description of flood behaviour across the region
- Strategies for management of any flooding problems identified
- A system/process to store and manage this information and keep it up-to-date

Stage 1 of the project was completed in July 2010 and involved a number of sub-projects. These projects delivered consistent processes and protocols for the detailed hydrologic and hydraulic model development. A key sub-project involved the development of broadscale hydrodynamic models for each minor basin to provide general understanding of flooding mechanisms and allow prioritisation of data capture.

Stage 2 (current stage) of the project involves the development of detailed hydrologic and hydraulic models for each minor basin.

Stage 3 will build on the detailed models and “add value” through assessment of flood damages and community resilience measures.

1.2 Objective of model quality report

This report describes the model setup process adopted for the detailed 5 m grid TUFLOW model of the Bribie Island (BRI) minor basin, including all the changes made to the broadscale model. It also describes the model quality and model issues for the hydrologic and hydraulic models.

2 TUFLOW model setup process

2.1 Code boundary

The code boundary was modified as per the following:

- In most areas the boundary was changed to run along the edge of the land near the land-water interface. This was done to increase stability in these areas
- In the north-western part of the model, adjacent to Wrights Creek, the boundary was changed to better match the topographic features and to reduce the modelled area in this location

In Figure 1 below, the red line shows the adopted code boundary and the blue line shows the broadscale model code boundary.

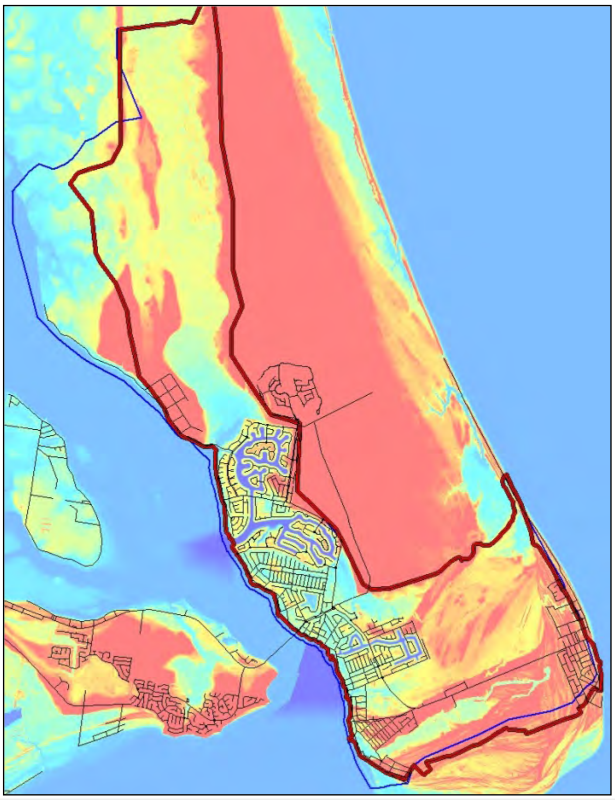

Figure 1 | Code boundary

2.2 Inflows and SA boundaries

SA boundaries were adopted based upon the final hydrography minor catchments layer provided to Aurecon on 24 February 2011. The following changes were made to this layer:

- Near the downstream boundary, the SA boundaries were modified so the most downstream catchment was not applied in the ocean
- At structures the SA boundaries were modified so they crossed the top of the structure and inflows were then applied upstream of the structure

Figure 2 below shows an example of how the SA boundaries were modified at structures. The black line represents the adopted SA boundary and the grey line represents the minor catchment definition. In this image, flow is from the bottom of the page towards the top of the page.

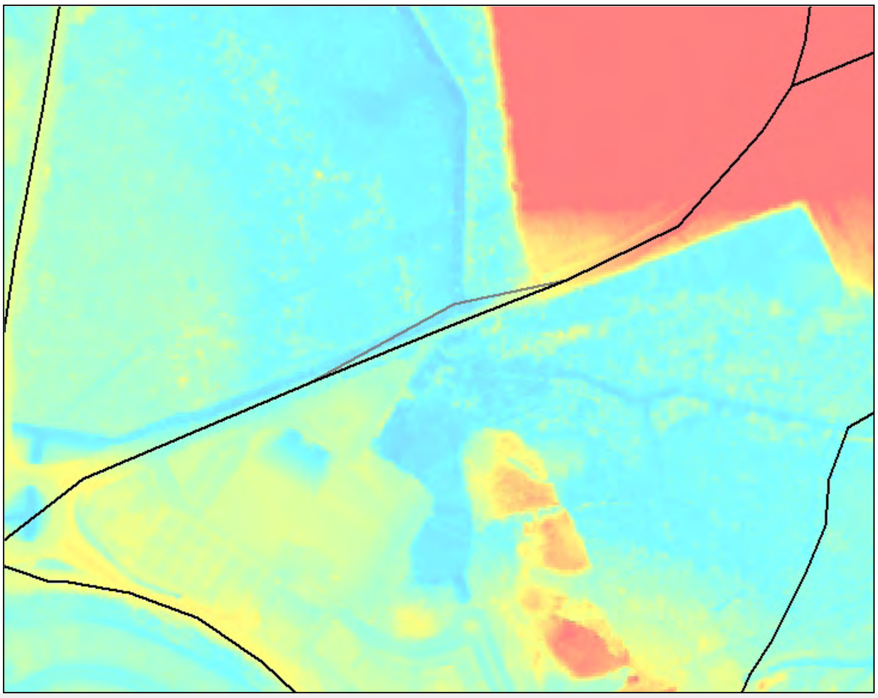

Figure 2 | SA Boundaries

2.2.1 Downstream boundaries

The downstream boundary location was modified to match the code boundary location.

Mean High Water Springs was adopted as the downstream boundary conditions. The values applied to the downstream boundaries were determined based upon the Maritime Safety Queensland Tidal Plane data. The following values were adopted:

- At Bongaree MHWS = 1.87 m and AHD = 1.10 m, therefore a MHWS value of 0.77 m AHD was adopted as the downstream boundary condition for the western model boundary (ie the Pumicestone Passage side of the model)
- At Woorim MHWS = 1.71 m and MSL = 0.93 m, therefore a MHWS value of 0.78 m AHD was adopted as the downstream boundary condition for the eastern model boundary (ie the open ocean side of the model)

2.2.2 Survey, topography and Zpoints

The Zpoints provided by WorleyParsons were used as the base Zpoints for the model. The following changes were made to the Zpoints:

- Zpoints in the area of the White Patch Esplanade crossing of Wrights Creek were based upon detailed Solander Drain survey provided by Council on 30 September 2010
- In locations where the lowest point within a SA boundary was a culvert inlet, a Zc upstream of the culvert was lowered such that this would become the initial location for SA inflow application
- It appeared that the Zpoints in some areas of Pacific Harbour were based upon a DEM in which the triangulation was not correct. In these areas Zshapes have been used to smooth out these inconsistencies
- Where required for model stability, Zlines and Zshapes have been used to lower the cells in the vicinity of culvert inlets and outlets

2.3 Materials

Materials files provided by MBRC at the outset of the project were reviewed and changes were made to these files as per Aurecon's memo to Council on 1 March 2011. Within the Bribie Island model extents, these changes were limited to revision of the footpaths layer such that these were defined over the footpath extents.

The Manning's n values associated with the materials files were also updated. The new values were those adopted during the model calibration process undertaken on a number of the other catchments within the MBRC region.

2.4 Structures

Hydraulic structures, including bridges, footbridges, culverts and trunk drains, were incorporated into the model. Appendix A presents details of all modelled structures and all other structures identified in the Data Assessment Report. Comments regarding specific structures are included in this table.

3 Quality assessment process

3.1 Hydrologic model quality

The hydrologic model quality was reviewed using the following process:

- For the 100yr 3hr and EDS runs, the peak outflow volumes and discharges and the time of peak discharge were mapped across the catchment. A visual inspection of these values was undertaken to ensure that peaks were sensible as flows moved through the system
- For the 100yr 3hr and EDS runs, a graphical review of the hydrographs throughout the system was undertaken to check that timing and volume was sensible as flows moved through the system
- It was assumed that if the 100yr 3hr and EDS runs were sensible, then the model would perform adequately for the remainder of the runs

3.2 Hydraulic model quality

The model quality was assessed using the following process:

- Review of model log to determine:
  - Whether the run was completed or unstable
  - Number of negative depths in the run
  - Whether final and peak cumulative mass error values were less than 1%
- Review of culvert discharges to determine:
  - Whether culverts were stable during the peak of the run
  - Extent of instabilities in low flows
  - Whether run duration was long enough to capture peak at all structures
- Review of water levels to determine:
  - Whether instabilities were evident (ie whether any “blow ups” existed)
  - Whether the water surface gradients were sensible throughout the system
- Where required, modifications to the models were made to reduce instabilities and the above process was repeated
  - For the culverts, it was not possible to get all culverts stable for all runs, therefore the focus was upon obtaining stability in the peak of the critical events

4 Quality assessment results

4.1 Hydrologic model quality

The hydrologic model was found to be performing well. The following Figure 3 and Figure 4 show examples of the model hydrographs within the Dux Creek part of the model. These figures show that:

- Between branches DUX_01_03276 and DUX_01_01204, the hydrograph shape stays the same, with the timing extended and the volume increased. This is the expected model response as there are no large tributaries entering the system between these two locations
- Between branch DUX_01_01204 and DUX_01_00568 there is a significant change in shape and volume which is expected as a result of the side tributary inflows
- As expected, discharges in DUX_01_00000 are approximately equal to the addition of discharges from branches DUX_01_00568 and DUX_04_00000, with a slight change in timing resulting from routing in this reach

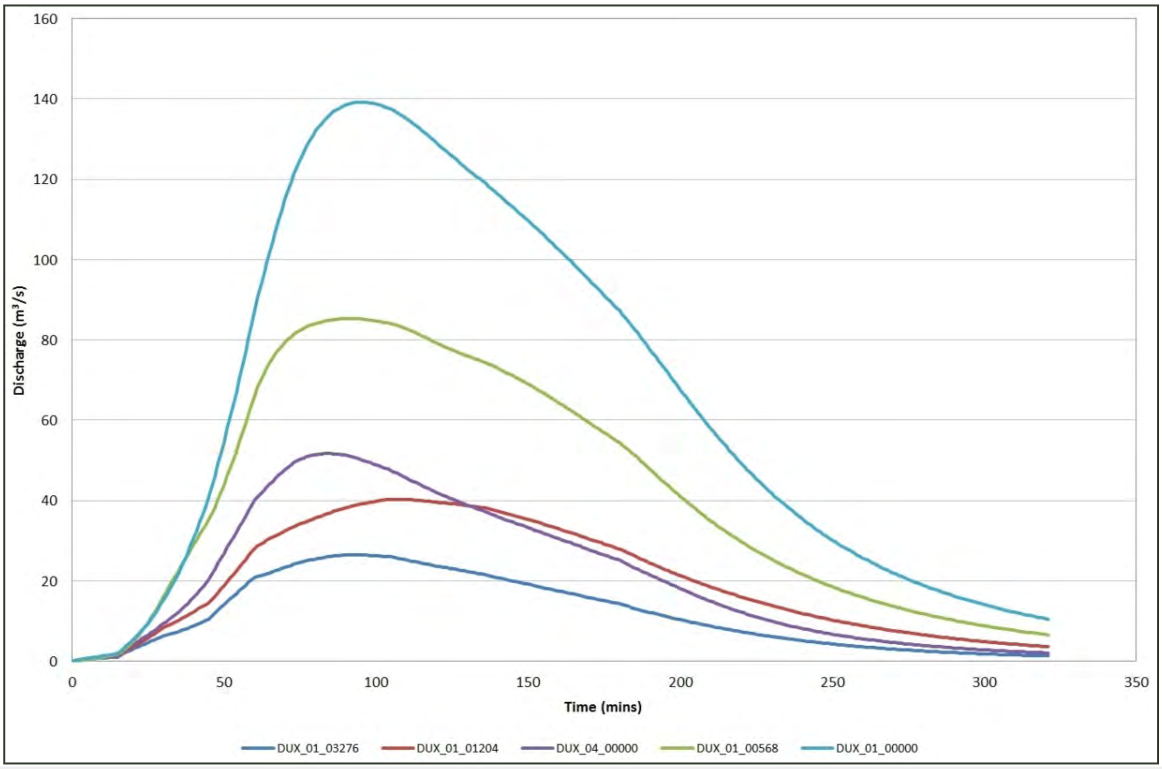

Figure 3 | WBNM 0180m Event Discharges – Dux Creek

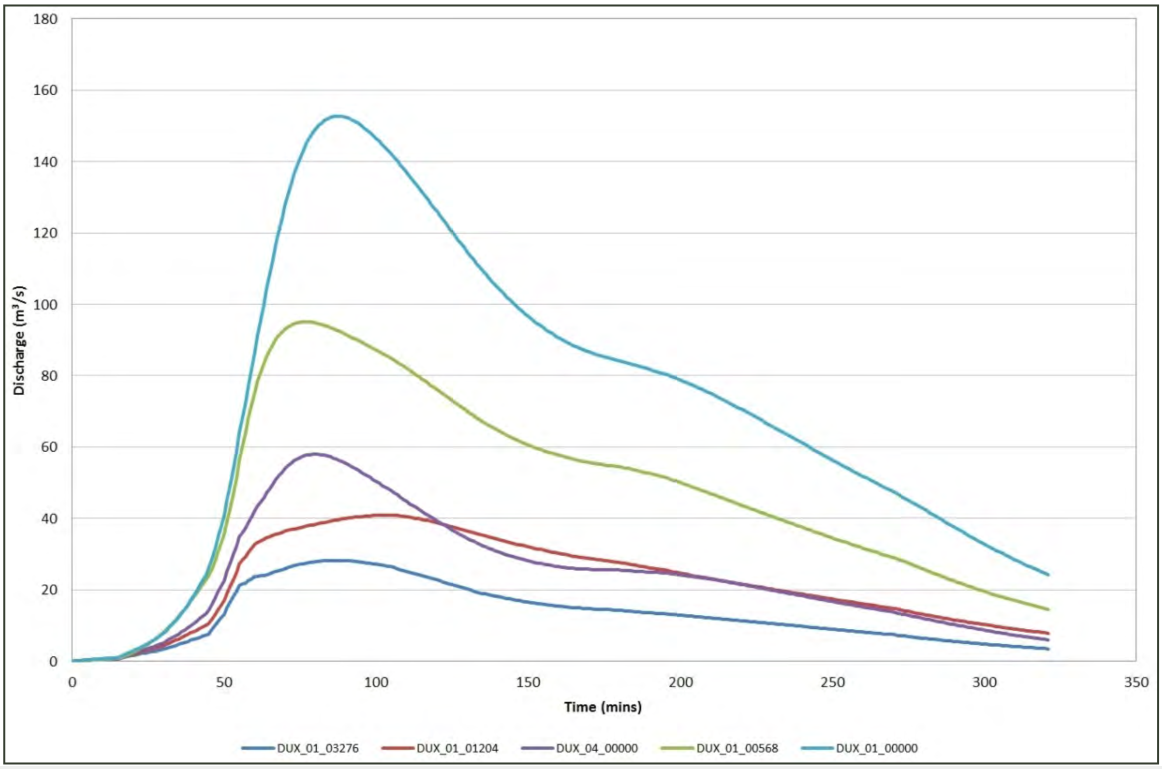

Figure 4 | WBNM EDS Event Discharges – Dux Creek

A similar process to that described in this report for Dux Creek was undertaken across the entire model area and for more frequent locations within each creek. No significant issues were found with model consistency, therefore the WBNM models were considered to be performing well.

4.2 Hydraulic model quality

Figure 6 shows areas where there are either concerns with the model results or in which future investigations and development to the models may improve the model outcomes. These are discussed further in the following sections.

4.2.1 Overall stability

The parameters which were used to assess the overall stability results are provided in the table in Appendix B. These results show that:

- No 1D negative depths occur in any of the runs
- Typically there are 0-3 2D negative depths occurring, except in the following two cases:
  - In the PMF event up to 190 2D negative depths occur, these negative depths nearly all occur at one location
  - In the S7 event (dynamic storm tide) 680 negative depths occur near the downstream boundary of the Pacific Harbour canal system
- Volume error is within ±0.1%
- Final cumulative mass error is within ±0.06% except for the 10y 4320 min event where it is -0.12%
- Peak cumulative mass error is within ±0.07% except for the 10y 4320 min event where it is -0.14%

The above parameters are all well within acceptable ranges and indicate that the model is generally performing well across all events. The biggest indicator of poor performance in the models are the negative depths in the storm tide and PMF events, however in both cases nearly all of these occur at one location and it was not considered critical that the models be rerun to fix this one issue, which has little effect on the overall model predictions.

4.2.2 Canal oscillations

Water level oscillations are evident in the Pacific Harbour canal system, as presented in Figure 5 for the EDS. These oscillations have been extensively investigated and whilst intuitively they do not seem correct, the model is performing correctly. These oscillations occur in the canal systems where there are large volumes of water connected to the ocean by comparatively small channels. Momentum builds up within the system which causes drawdown below the constant tailwater level, which in turn causes backflow into the model and this continues, decaying in amplitude. This is primarily due to the smooth Manning's n value (0.03) adopted in the canal systems.

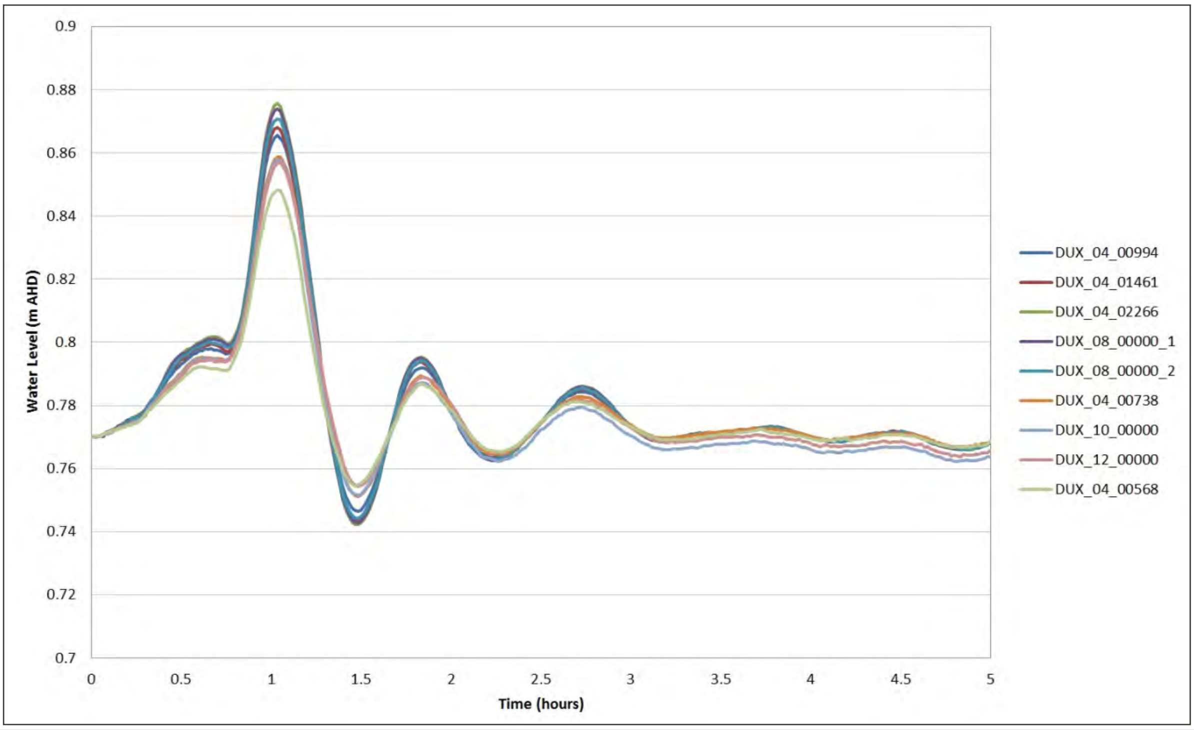

Figure 5 | Pacific Harbour canal water level oscillations

4.2.3 Structure stability

Stability of model structures was problematic and many configurations of inlet/outlet boundaries and topography were tested. The adopted configuration proved to be the most stable. There are a number of culverts in which stability was not able to be achieved for all runs and for the entire duration of the run. Through this process, the three most unstable 1D structures were converted to 2D structures to improve stability. The small channels that these structures are located in may be better represented using 1D branches.

The culvert discharge results for the EDS run are presented in Appendix C. A summary of the culvert results is as follows:

- Stability is generally increased with increased discharge, ie stability issues tend to occur with low flows
- Culvert BON_05_00000 is the most problematic culvert and is generally stable through the peak of the run but unstable in low flows. In the 1 year ARI event, this culvert is unstable throughout the entire event. The proximity of this culvert to the model boundary is most likely the cause of the instability
- Culvert BON_03_00141 is also a problematic culvert and performs similarly to BON_05_00000. On the upstream side a large inlet pit and grate direct flows into this culvert, therefore the upstream invert level is significantly lower than the surrounding topography. The instability is most likely a result of this detail
- There are a number of other culverts which are unstable in low flow conditions but which perform stably throughout the peak of the event
- Generally the culvert discharge and velocity instabilities have very little impact upon water levels both upstream and downstream of the culvert

4.2.4 Sensitivity run inundation extents

The use of SA boundaries for the application of rainfall to the model has impacted upon the location in which inflows are applied in some of the sensitivity runs. For this reason some of the runs show a reduction in flood levels and inundation extents in areas where this would not be expected to occur. To remedy this it would be necessary to rerun all the models and this was not considered prudent given that it was only discovered at a very late stage of the project. Results in these areas should be treated with caution.

4.2.5 Dynamic storm tide in canals

The Bribie Island dynamic storm tide model shows a significant amplification of water levels into the Pacific Harbour canals. This effect is likely to result from the same momentum issues which affect the canals in the static downstream tailwater condition (as discussed in Section 4.2.2) and is not likely to occur in a real storm tide event, therefore the model results for the dynamic storm tide run should be treated with caution. Sensitivity testing of the model, with the Manning's n value for waterbodies changed to 0.06 (up from 0.03) shows that this amplification can be removed from the model and sensible results can be achieved. It is recommended that further testing and analysis of this issue in the canal system be undertaken.

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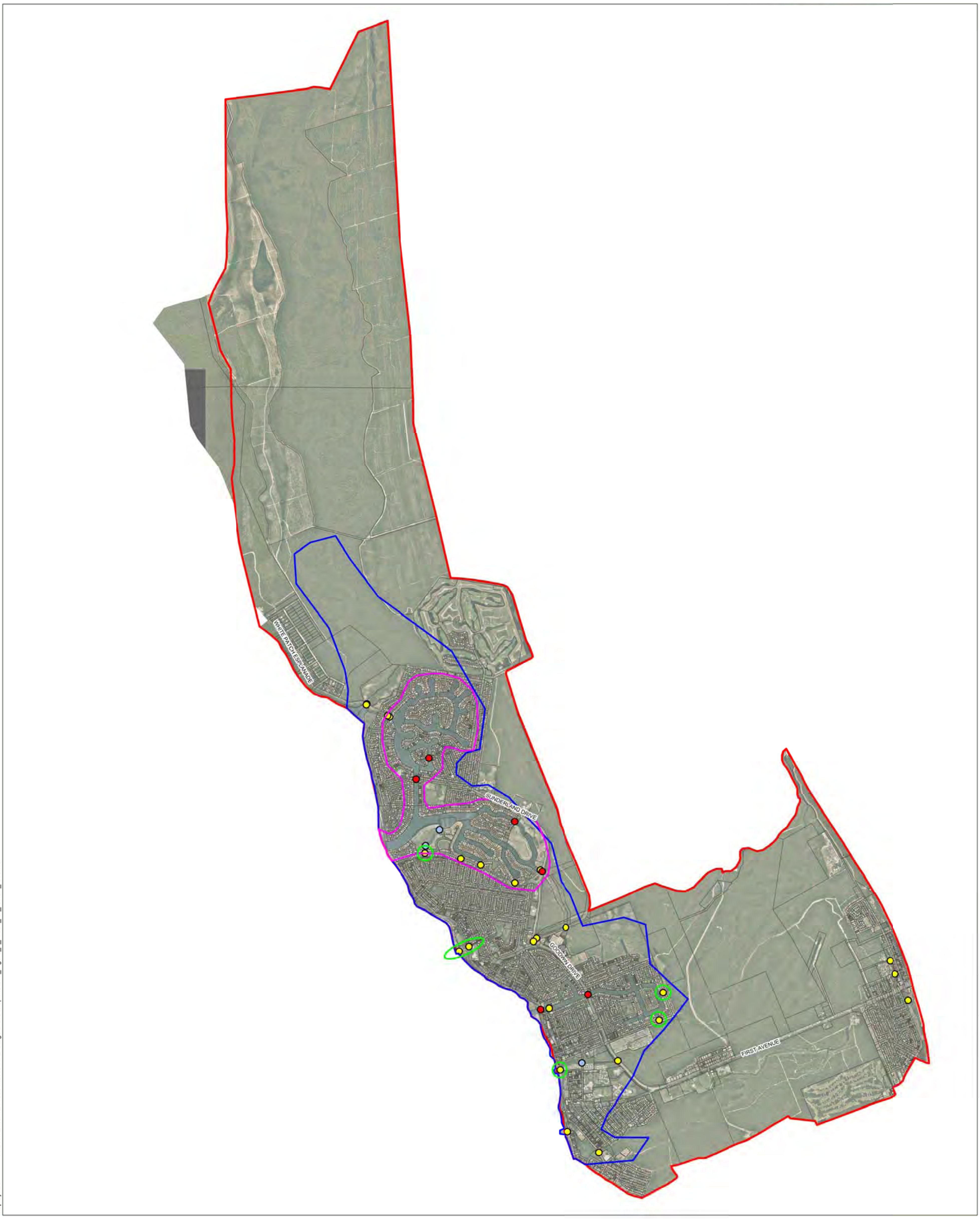


Map by: DJF P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\BRI_Figure_6_Areas_for_review_rev0.wor

Legend

Cadastre	Minor Basin Boundaries
Footbridge	Structure Stability
Bridge	Water Level Oscillations
Culvert	SA Boundary Application

Notes:

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

A3 scale 1:50,000

0 1,250 m 2,500 m

Date: 31/05/2012 Version: 0 Job No: 211090

Projection: MGA Zone 56

RFD Detailed Modelling (BRI)

Figure 6: Areas of Concern for Future TUFLOW Model Review/Upgrades

5 Conclusions

The Bribie Island detailed modelling has upgraded the 10 m grid broadscale model to a 5 m grid detailed model. This model upgrade has followed the general model setup of the Burpengary Creek (BUR) detailed model.

Changes to the model include:

- Revision of boundary conditions and their locations
- Inclusion of 5 m grid Zpoints and some minor modifications to these
- Inclusion of materials layers and some minor modifications to these
- Inclusion of structures and associated boundary conditions

The model quality has been assessed through review of the model results for both the hydrologic and hydraulic model. Key findings of the quality assessment are:

- The hydrologic model is performing well
- The hydraulic model is generally performing well, with the following issues being of note
  - Water level oscillations occur in the Pacific Harbour canals – these intuitively do not seem correct, however the situation has been reviewed in detail and the model is performing correctly. It is recommended that sensitivity testing of Manning's n values in these canals be undertaken
  - Structure stability – the stability of the structures has been problematic and whilst stability has been significantly improved, minor instabilities are still occurring at some structures, particularly in low flow conditions
  - In the sensitivity runs, water levels and inundation extents are shown to reduce in some areas as a result of SA boundaries redistributing flows across the catchments. Results in these areas should be treated with caution
  - The dynamic storm tide model results in the Pacific Harbour canal systems are not representative of the conditions which would occur in these canals during a real storm tide event. It is recommended that further sensitivity testing of Manning's n values in these canals be undertaken

Appendices

Appendix A
Modelled Structures

Structure ID	Waterway ID	Structure Type	Crossing Name	Priority*	Is Structure Modelled?	Data Availability/ Source	Comments
BON_01_00137	BON_01_00137	Bridge	Welsby Parade	A	Yes	Aurecon Survey	
BON_01_00811	BON_01_00811	Bridge	Goodwin Drive	A	Yes	MBRC Plans	
BON_09_00409	BON_09_00409	Bridge	Footpath	Not identified	Yes	Aurecon Survey	
DUX01_01826a	DUX_01_01826	Bridge	Sunderland Drive	A	Yes	No	Dimensions based on site visit. Deck level based on LiDAR
DUX_02_00701	DUX_02_00701	Bridge	Eagles Landing	A	Yes	MBRC Plans	Arch bridge, modelled in 1d
DUX_04_00568	DUX_04_00568	Bridge	Sunderland Drive	A	Yes	MBRC Plans	
DUX_04_02128	DUX_04_02128	Bridge	Quarterdeck Drive	A	Yes	MBRC Plans	Arch bridge, modelled in 1d
DUX11_00000a	DUX_11_00000	Bridge	Footpath	A	Yes	MBRC Plans	
DUX11_00000b	DUX_11_00000	Bridge	Footpath-Weir	A	Yes	MBRC Plans	
DUX_12_00000	DUX_12_00000	Bridge	Island Parade	A	Yes	Aurecon Survey	Arch bridge, modelled in 1d
N/A	WRI_05_00000	Bridge	Footpath	B	No	No	
DUX_15_00000	DUX_15_00000	Culvert	Sylvan Beach Esplanade Seawall	A	Yes	MBRC Survey	Survey ID = DUX_15_00148 Modelled as a 2D structure
DUX_15_00148	DUX_15_00148	Culvert	Sylvan Beach Esplanade	A	Yes	MBRC Survey	Survey ID = DUX_15_00148 Modelled as a 2D structure
BON_21_00037	BON_21_00037	Culvert	South Esplanade	A	Yes	MBRC Survey	Modelled as a 2D structure
01_00212	BON_01_00212	Culvert	Lock	A	Yes	No	Assumed that lock is closed. Dimensions based on site visit. Levels based on LiDAR
01_02338	BON_01_02338	Culvert	Protea Drive	A	Yes	MBRC Survey	Survey ID = BON_01_0228
03_00141	BON_03_00141	Culvert	Cotterill Avenue	A	Yes	MBRC Survey	
05_00050	BON_05_00050	Culvert	Welsby Parade	Not identified	Yes	No	Bridge but modelled as culvert. Dimensions based on site visit. Deck level based on LiDAR

Structure ID	Waterway ID	Structure Type	Crossing Name	Priority*	Is Structure Modelled?	Data Availability/ Source	Comments
09_00859	BON_09_00859	Culvert	Goodwin Drive	A	Yes	MBRC Survey	
21_00612	BON_21_00612	Culvert	Toorbul Street	A	Yes	MBRC Survey	
01_01826b	DUX_01_01826	Culvert	Footpath	Not identified	Yes	Aurecon Survey	
01_02462a	DUX_01_02462	Culvert	Sunderland Drive	A	Yes	MBRC GIS	
01_02462b	DUX_01_02462	Culvert	Sunderland Drive	A	Yes	MBRC GIS	
01_03276	DUX_01_03276	Culvert	Hornsby Road	A	Yes	MBRC Survey	
06_00000	DUX_06_00000	Culvert	Endeavour Drive	A	Yes	MBRC Survey	Survey ID = DUX_06_00227
07_00593	DUX_07_00593	Culvert	Marina Boulevard	B	Yes	MBRC Survey	
09_00488a & 09_00488b	DUX_09_00488	Culvert	Marina Boulevard	A	Yes	No	Dimensions based on site visit. Invert level based on LiDAR
11_00597a & 11_00597b	DUX_11_00597	Culvert	Marina Boulevard	B	Yes	MBRC Survey	Survey ID = DUX_11_00541
17_00109a & 17_00109b	DUX_17_00109	Culvert	Marina Boulevard	Not identified	Yes	MBRC Survey	Survey ID = DUX_09_00546
01_00429d	FRE_01_00429	Culvert	Oxley Way	A	Yes	MBRC Survey	
01_00623	FRE_01_00623	Culvert	Second Avenue	A	Yes	MBRC GIS	
01_01047	FRE_01_01047	Culvert	Third Avenue	A	Yes	MBRC Survey	
01_00227	WRI_01_00227	Culvert	White Patch Esplanade	B	Yes	MBRC Survey	
N/A	BON_13_00238	Culvert	Minor Road	B	No	No	
N/A	WRI_01_03180	Culvert	Minor Road	B	No	No	
N/A	WRI_02_00042	Culvert	White Patch Esplanade	A	No	No culvert exists	
N/A	WRI_03_00554	Culvert	Minor Road	B	No	No	

Structure ID	Waterway ID	Structure Type	Crossing Name	Priority*	Is Structure Modelled?	Data Availability/ Source	Comments
DUX15_00434a	DUX_15_00434	Trunk Drain	Eucalypt Street	A	Yes	MBRC GIS	Dimensions based on GIS. ILs based on GIS but some assumptions made
DUX15_00434b	DUX_15_00434		Eucalypt Street	A	Yes	MBRC GIS	
DUX15_00434c	DUX_15_00434		Eucalypt Street	A	Yes	MBRC GIS	
DUX15_00434d	DUX_15_00434		Eucalypt Street	A	Yes	MBRC GIS	
FRE01_00429a	FRE_01_00429	Trunk Drain	First Avenue	A	Yes	MBRC GIS	Dimensions based on site visit. ILs assumed
FRE01_00429b	FRE_01_00429		First Avenue	A	Yes	MBRC GIS	
FRE01_00429c	FRE_01_00429		First Avenue	A	Yes	MBRC GIS	

** As identified in the Data Assessment Report*

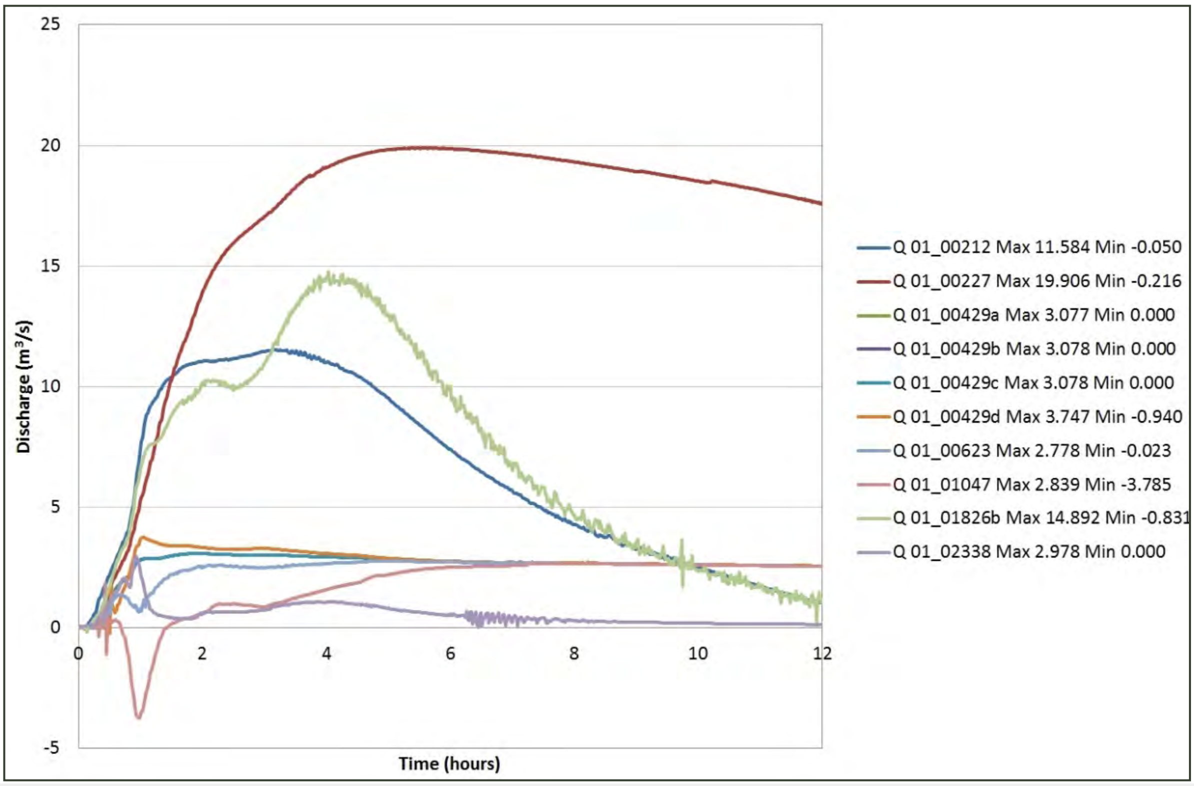
Appendix B
Overall Stability Results

Simulation	Total 1D Negative Depths	Total 2D Negative Depths	WARNINGs prior to simulation	WARNINGs during simulation	Volume Error (m3)	Final Cumulative ME	Whole Simulation Peak Cumulative ME
00001Y_0180m	0	0	9	0	-669 or 0.0%	-0.01%	-0.02% at 7.52h
00001Y_1440m	0	0	9	0	-3539 or -0.1%	-0.06%	-0.07% at 27.84h
00002Y_0180m	0	1	9	1	-1133 or 0.0%	-0.02%	-0.02% at 10.44h
00002Y_1440m	0	0	9	0	-1995 or 0.0%	-0.02%	-0.05% at 25.05h
00005Y_0180m	0	1	9	1	-1187 or 0.0%	-0.02%	-0.03% at 9.23h
00005Y_1440m	0	0	9	0	-6086 or -0.1%	-0.05%	-0.06% at 25.70h
00010Y_0010m	0	0	9	0	-642 or 0.0%	-0.02%	-0.02% at 4.85h
00010Y_0015m	0	0	9	0	-896 or 0.0%	-0.02%	-0.02% at 6.00h
00010Y_0030m	0	1	9	1	-660 or 0.0%	-0.01%	-0.02% at 6.93h
00010Y_0045m	0	0	9	0	-1011 or 0.0%	-0.02%	-0.02% at 3.86h
00010Y_0060m	0	1	9	1	-1402 or 0.0%	-0.03%	-0.03% at 7.13h
00010Y_0090m	0	0	9	0	609 or 0.0%	0.01%	0.01% at 8.63h
00010Y_0120m	0	0	8	0	-261 or 0.0%	0.00%	-0.01% at 1.59h
00010Y_0180m	0	1	9	1	229 or 0.0%	0.00%	-0.01% at 1.81h
00010Y_0270m	0	1	9	1	-601 or 0.0%	-0.01%	-0.02% at 2.98h
00010Y_0360m	0	1	9	1	782 or 0.0%	0.01%	-0.01% at 2.75h
00010Y_EDS	0	0	9	0	-7 or 0.0%	0.00%	-0.01% at 1.82h
00010Y_0540m	0	1	9	1	-2931 or 0.0%	-0.03%	-0.03% at 5.82h
00010Y_0720m	0	0	9	0	-1635 or 0.0%	-0.02%	-0.02% at 19.70h
00010Y_1080m	0	1	9	1	-1670 or 0.0%	-0.01%	-0.03% at 9.37h
00010Y_1440m	0	1	9	1	-2618 or 0.0%	-0.02%	-0.02% at 29.92h
00010Y_1800m	0	1	9	1	-5626 or 0.0%	-0.04%	-0.05% at 16.76h
00010Y_2160m	0	2	9	2	-6137 or 0.0%	-0.04%	-0.07% at 19.56h
00010Y_2880m	0	0	9	0	-11052 or -0.1%	-0.06%	-0.07% at 48.65h
00010Y_4320m	0	0	9	0	-27700 or -0.1%	-0.12%	-0.14% at 72.45h
00020Y_0180m	0	1	9	1	544 or 0.0%	0.01%	0.01% at 3.14h
00020Y_1440m	0	1	9	1	-2808 or 0.0%	-0.02%	-0.02% at 35.00h
00050Y_0180m	0	2	9	2	1666 or 0.0%	0.02%	0.02% at 4.55h
00050Y_1440m	0	0	9	0	-430 or 0.0%	0.00%	0.02% at 7.08h
00100Y_0010m	0	0	9	0	-969 or 0.0%	-0.02%	-0.02% at 5.97h
00100Y_0015m	0	1	9	1	-953 or 0.0%	-0.02%	-0.02% at 6.83h
00100Y_0030m	0	1	8	1	-346 or 0.0%	-0.01%	-0.01% at 5.40h
00100Y_0045m	0	1	9	1	-121 or 0.0%	0.00%	-0.01% at 0.77h
00100Y_0060m	0	2	9	2	498 or 0.0%	0.01%	-0.01% at 0.76h

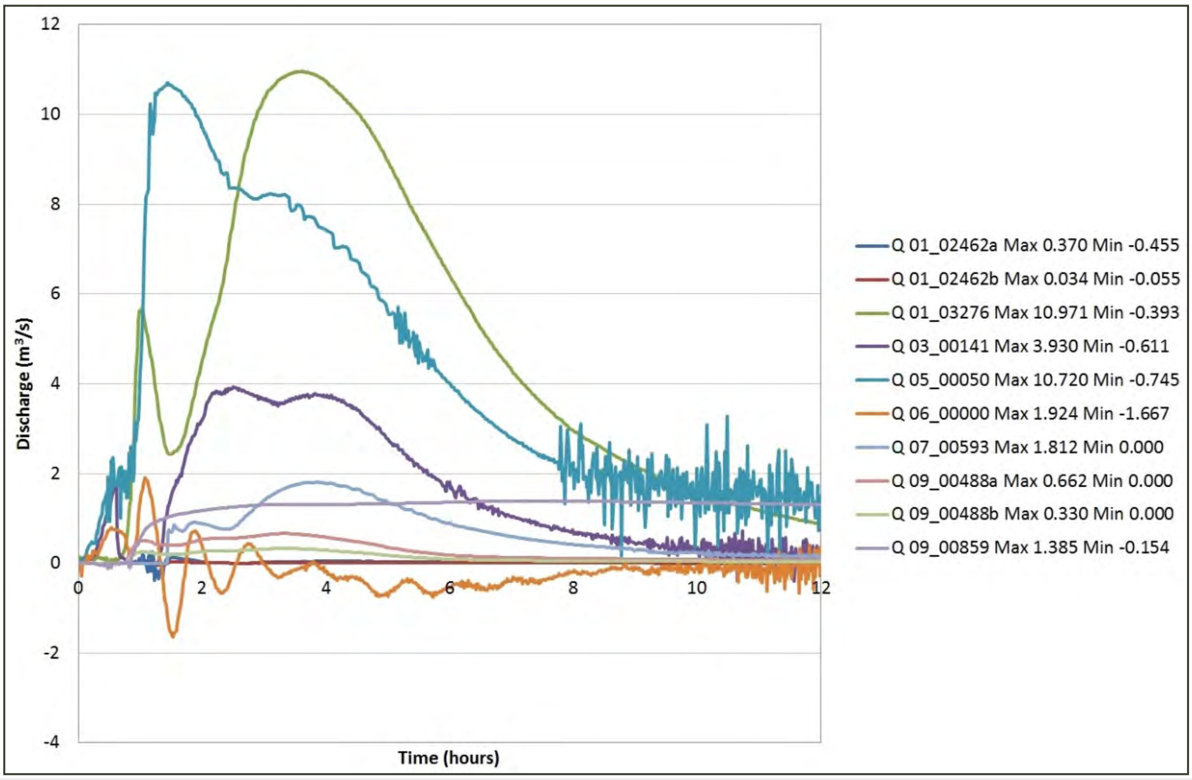
Simulation	Total 1D Negative Depths	Total 2D Negative Depths	WARNINGs prior to simulation	WARNINGs during simulation	Volume Error (m3)	Final Cumulative ME	Whole Simulation Peak Cumulative ME
00100Y_0090m	0	2	9	2	1440 or 0.0%	0.02%	0.02% at 6.63h
00100Y_0120m	0	1	9	1	1977 or 0.0%	0.02%	0.02% at 5.71h
00100Y_0180m	0	1	9	1	3106 or 0.0%	0.03%	0.03% at 5.35h
00100Y_0270m	0	2	9	2	3112 or 0.0%	0.03%	0.03% at 6.55h
00100Y_0360m	0	3	9	3	3603 or 0.0%	0.03%	0.03% at 6.55h
00100Y_0540m	0	0	9	0	3336 or 0.0%	0.02%	0.03% at 8.66h
00100Y_0720m	0	2	9	2	3507 or 0.0%	0.02%	0.03% at 8.46h
00100Y_1080m	0	2	9	2	3524 or 0.0%	0.02%	0.02% at 17.77h
00100Y_1440m	0	2	9	2	1785 or 0.0%	0.01%	0.03% at 6.65h
00100Y_01800m	0	1	9	1	1453 or 0.0%	0.01%	-0.02% at 3.82h
00100Y_2160m	0	1	9	1	-1860 or 0.0%	-0.01%	-0.03% at 25.88h
00100Y_02880m	0	1	9	1	-8865 or 0.0%	-0.03%	-0.03% at 60.00h
00100Y_4320m	0	1	9	1	-19531 or 0.0%	-0.05%	-0.05% at 78.14h
00200Y_0120m	0	2	9	2	5113 or 0.0%	0.04%	0.04% at 5.23h
00200Y_0180m	0	0	9	0	4605 or 0.0%	0.04%	0.04% at 5.99h
00200Y_0300m	0	2	9	2	7713 or 0.0%	0.05%	0.06% at 6.75h
00500Y_0120m	0	2	9	2	5643 or 0.0%	0.04%	0.04% at 5.20h
00500Y_0180m	0	2	9	2	5715 or 0.0%	0.04%	0.04% at 5.22h
00500Y_0300m	0	3	9	3	7471 or 0.0%	0.04%	0.05% at 7.11h
01000Y_0120m	0	2	9	2	3225 or 0.0%	0.02%	0.02% at 5.48h
01000Y_0180m	0	2	9	2	6989 or 0.0%	0.04%	0.05% at 5.60h
01000Y_0300m	0	2	9	2	9600 or 0.0%	0.04%	0.05% at 6.94h
02000Y_0120m	0	3	9	3	3036 or 0.0%	0.02%	0.02% at 5.97h
02000Y_0180m	0	2	9	2	4578 or 0.0%	0.02%	0.03% at 5.94h
02000Y_0300m	0	0	9	0	7562 or 0.0%	0.03%	0.04% at 7.32h
PMF_0015m	0	2	9	2	587 or 0.0%	0.00%	-0.02% at 0.93h
PMF_0030m	0	7	9	7	1126 or 0.0%	0.01%	-0.02% at 0.73h
PMF_0045m	0	10	9	10	1046 or 0.0%	0.00%	-0.02% at 0.66h
PMF_0060m	0	82	9	82	2172 or 0.0%	0.01%	-0.02% at 0.67h
PMF_0090m	0	67	9	67	-1393 or 0.0%	0.00%	-0.02% at 5.30h
PMF_0120m	0	90	9	90	-7415 or 0.0%	-0.01%	-0.03% at 6.63h
PMF_0150m	0	96	9	96	-11485 or 0.0%	-0.02%	-0.03% at 7.23h
PMF_0180m	0	122	9	122	-23100 or 0.0%	-0.04%	-0.04% at 8.27h
PMF_0240m	0	190	9	190	-37528 or -0.1%	-0.05%	-0.06% at 7.92h

Simulation	Total 1D Negative Depths	Total 2D Negative Depths	WARNINGs prior to simulation	WARNINGs during simulation	Volume Error (m3)	Final Cumulative ME	Whole Simulation Peak Cumulative ME
PMF_0300m	0	182	9	182	-47784 or -0.1%	-0.06%	-0.07% at 7.47h
PMF_0360m	0	175	9	175	-50028 or -0.1%	-0.06%	-0.06% at 8.15h
PMF_0720m_ GSDM	0	21	9	21	-15611 or 0.0%	-0.02%	-0.02% at 15.61h
PMF_1440m	0	21	9	21	11137 or 0.0%	0.01%	0.05% at 5.99h
PMF_2160m	0	19	9	19	22522 or 0.0%	0.02%	0.05% at 19.10h
PMF_2880m	0	20	9	20	25488 or 0.0%	0.02%	0.06% at 21.27h
PMF_4320m	0	19	9	19	-5943 or 0.0%	0.00%	0.05% at 8.43h
00100Y_EDS	0	3	9	3	2570 or 0.0%	0.02%	0.03% at 5.60h
00100Y_EDS_S2	0	1	9	1	1282 or 0.0%	0.01%	0.01% at 5.61h
00100Y_EDS_S3	0	0	9	0	1452 or 0.0%	0.01%	0.02% at 6.42h
00100Y_EDS_S4	0	1	9	1	4170 or 0.0%	0.03%	0.04% at 6.46h
00100Y_EDS_S5	0	0	9	0	-5037 or 0.0%	-0.04%	-0.04% at 12.00h
00100Y_EDS_S6	0	0	9	0	-6335 or 0.0%	-0.05%	-0.05% at 11.99h
00100Y_EDS_S7	0	679	9	679	-10984 or 0.0%	-0.02%	-0.07% at 22.18h
00100Y_EDS_S8	0	0	9	0	-940 or 0.0%	-0.01%	-0.01% at 6.22h
00100Y_EDS_S9	0	0	9	0	-3056 or 0.0%	-0.02%	-0.02% at 12.00h
00100Y_EDS_ S10	0	2	9	2	1865 or 0.0%	0.02%	0.02% at 11.75h
00100Y_EDS_ S11	0	3	9	3	2578 or 0.0%	0.02%	0.03% at 6.42h
00100Y_EDS_ S12	0	2	9	2	2070 or 0.0%	0.02%	0.02% at 11.63h

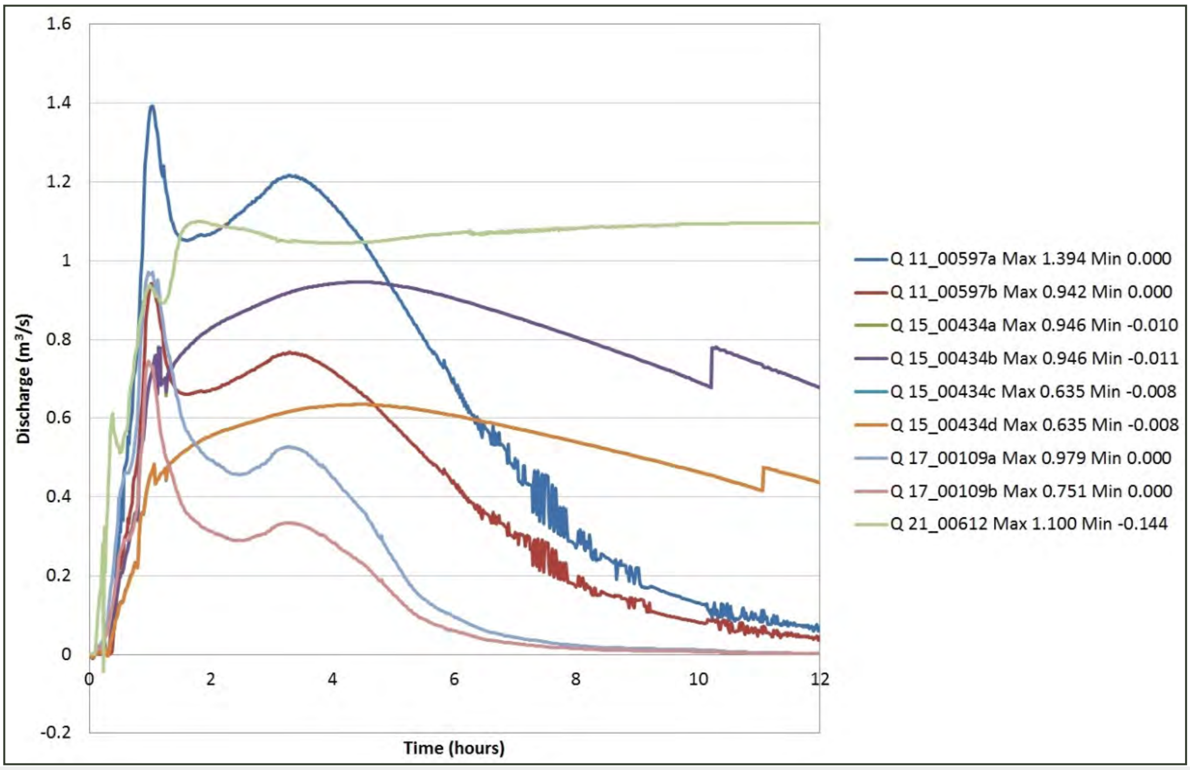
Appendix C
EDS Culvert Discharge Graphs



BRI Culvert Discharge Results



BRI Culvert Discharge Results



BRI Culvert Discharge Results

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Appendix E

Flood Maps – 100 Year ARI

Appendix E
Flood Maps – 100 Year ARI

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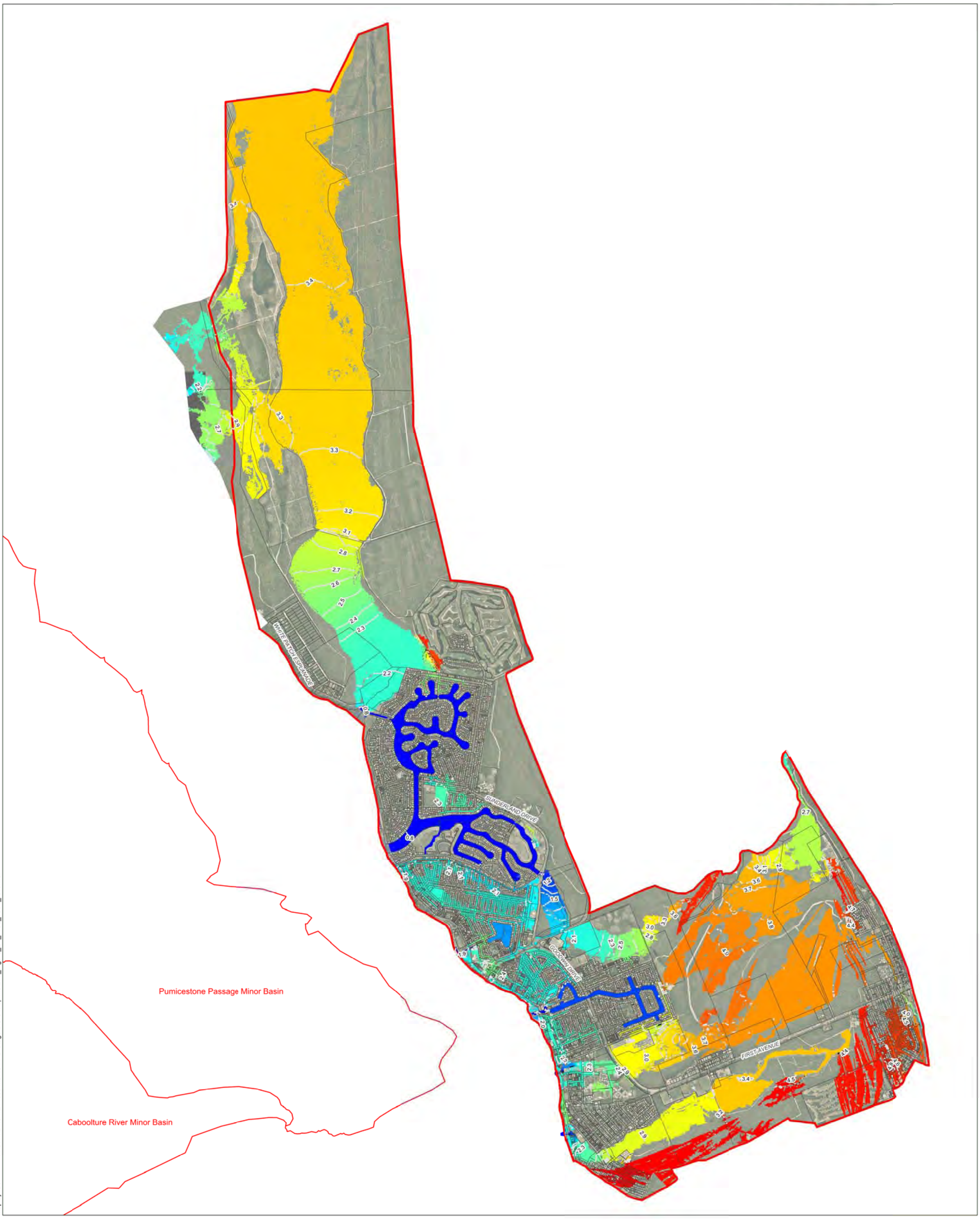


Legend

- Cadastre
- Minor Basin Boundaries
- Contour Lines (m AHD)

Flood Level (m AHD): <1.0, 2.0, 3.0, 4.0, >5.0

Notes:
This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

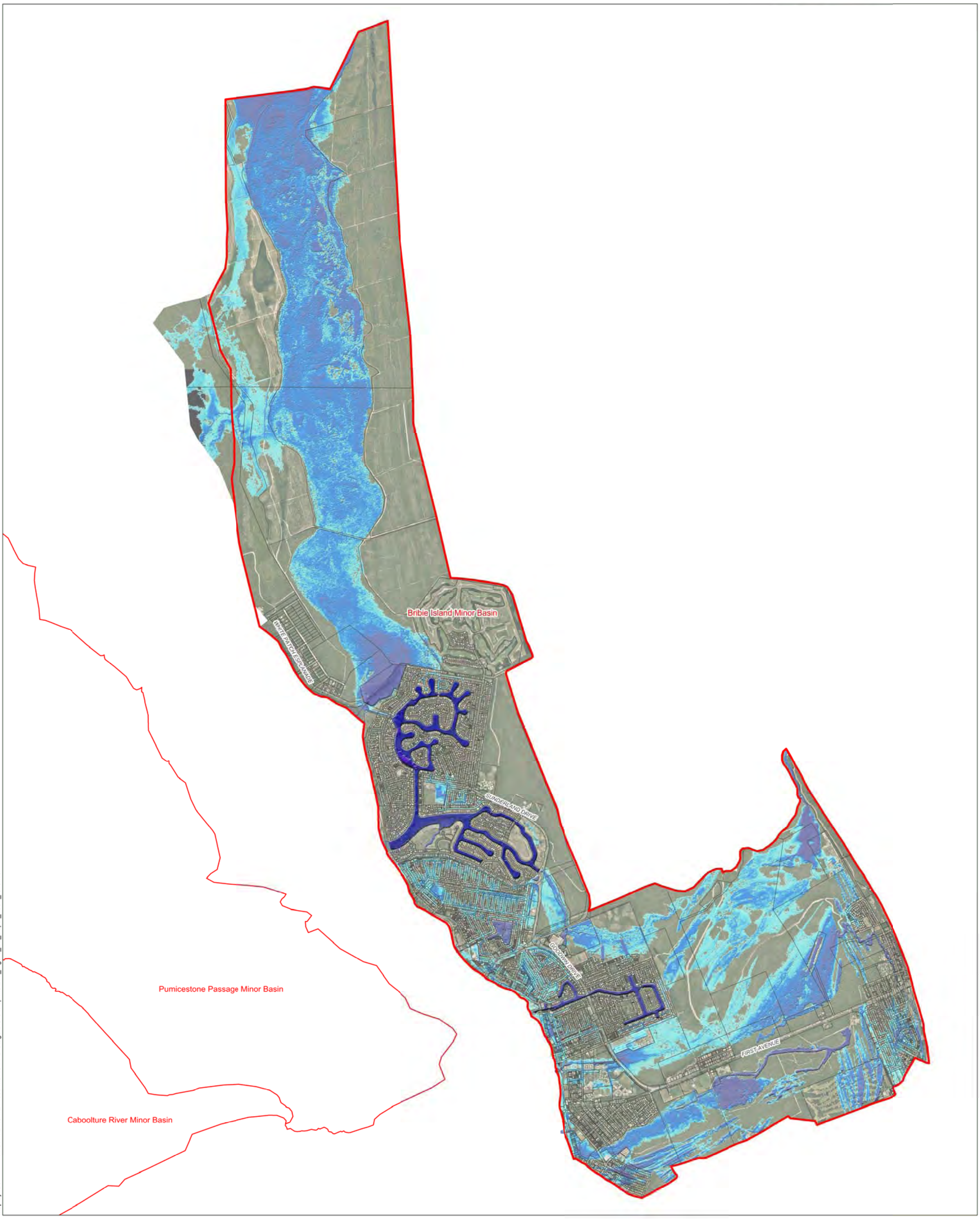
A3 scale 1:50,000
0 1,250 m 2,500 m

Date: 31/05/2012 Version: 0 Job No: 211090
Projection: MGA Zone 56

RFD Detailed Modelling (BRI)

Figure E1: Peak Flood Level Map - 100 Year ARI

aurecon



Map by: DJF   P:\SWMP\work\211090 MBRC RFD Stage 2\GIS\MapInfo\BRI_Figure_E2_Depth_100Y_rev0.wor

Legend

Cadastre

Minor Basin Boundaries

100 Year ARI Peak Flood Depth (m)

0.0 1.0 2.0 3.0 >4.0

Notes:

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

A3 scale 1:50,000

0 1,250 m 2,500 m

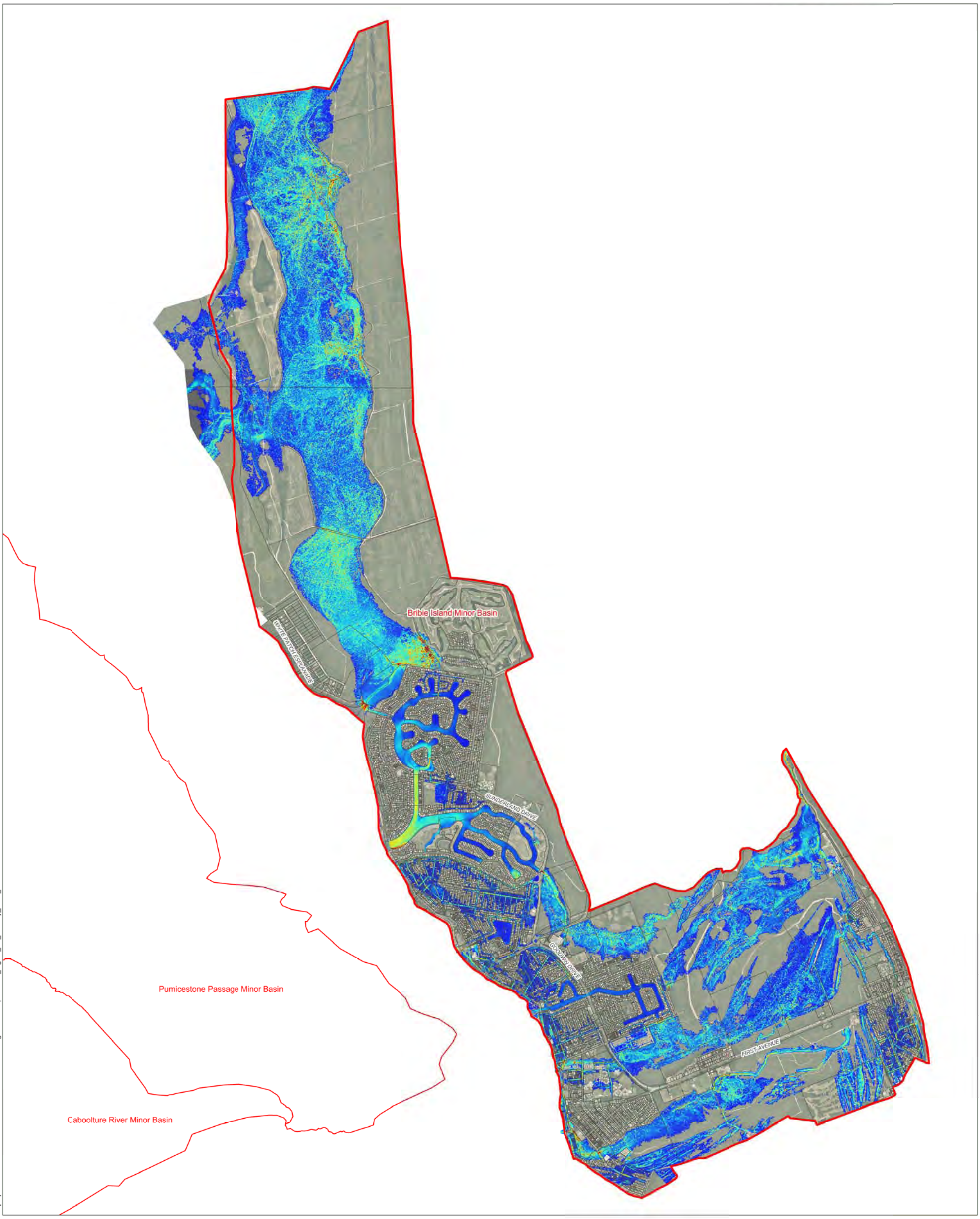
Date: 31/05/2012 Version: 0 Job No: 211090

Projection: MGA Zone 56

RFD Detailed Modelling (BRI)

Figure E2: Peak Flood Depth Map - 100 Year ARI

aurecon



Legend

Cadastre

Minor Basin Boundaries

100 Year ARI Peak Flood Velocity (m/s)

0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 >6.0

Notes:

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

A3 scale 1:50,000

0 1,250 m 2,500 m

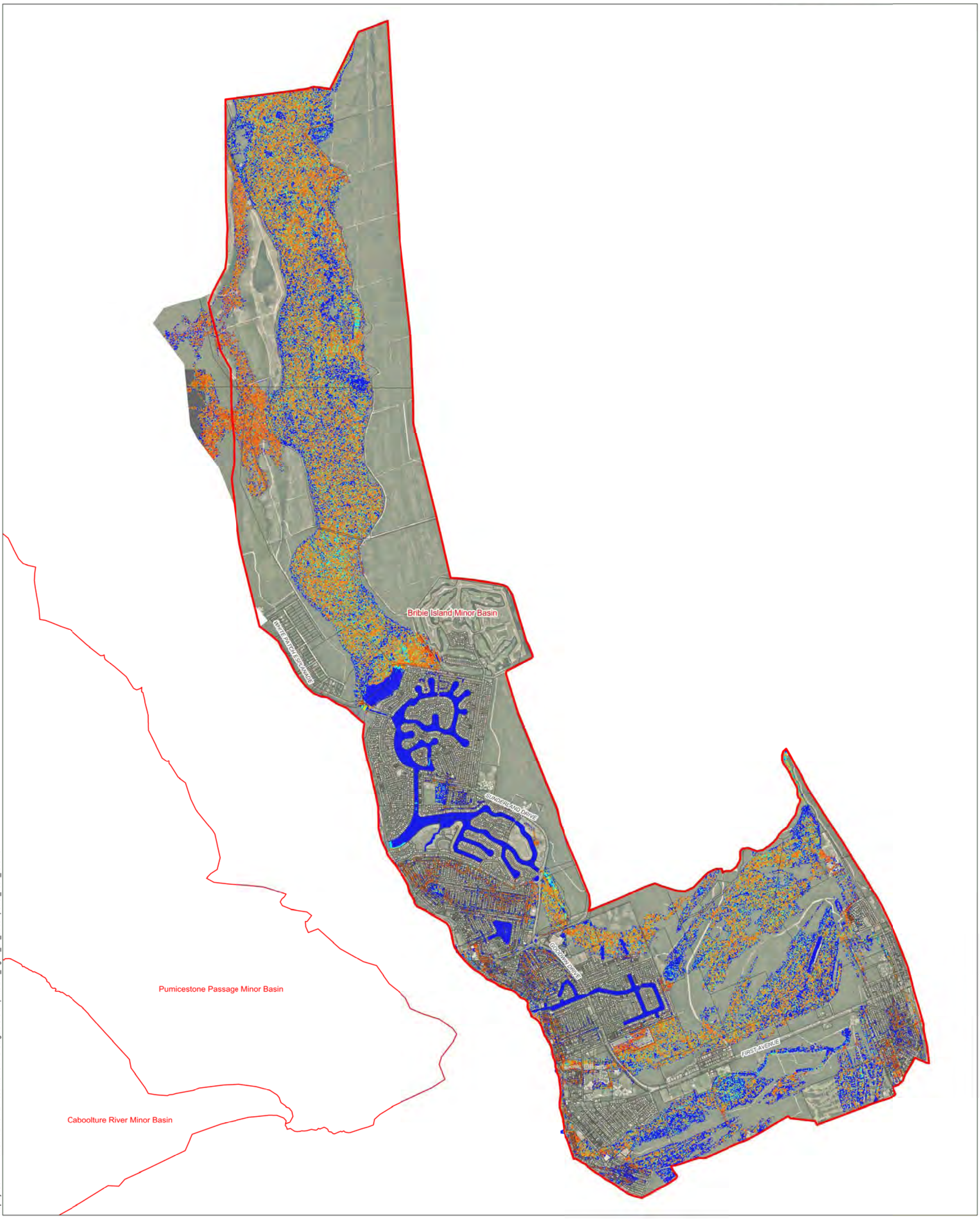
Date: 31/05/2012 Version: 0 Job No: 211090

Projection: MGA Zone 56

RFD Detailed Modelling (BRI)

Figure E3: Peak Flood Velocity Map - 100 Year ARI

aurecon



Legend

Cadastre

Minor Basin Boundaries

100 Year ARI Peak Stream Power

0 3 5 10 >500

Notes:

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

A3 scale 1:50,000

0 1,250 m 2,500 m

Date: 31/05/2012 Version: 0 Job No: 211090

Projection: MGA Zone 56

RFD Detailed Modelling (BRI)

Figure E4: Peak Flood Stream Power Map 100 Year ARI

aurecon

Map by: DJF   P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\BRI_Figure_E5_Hazard_100Y_rev0.wor

Legend

Cadastre

Minor Basin Boundaries

New South Wales Floodplain Development Manual Flood Hazard Category
100 Year ARI Event

Low Hazard
High Hazard

Notes:
This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

A3 scale 1:50,000
0   1,250 m   2,500 m

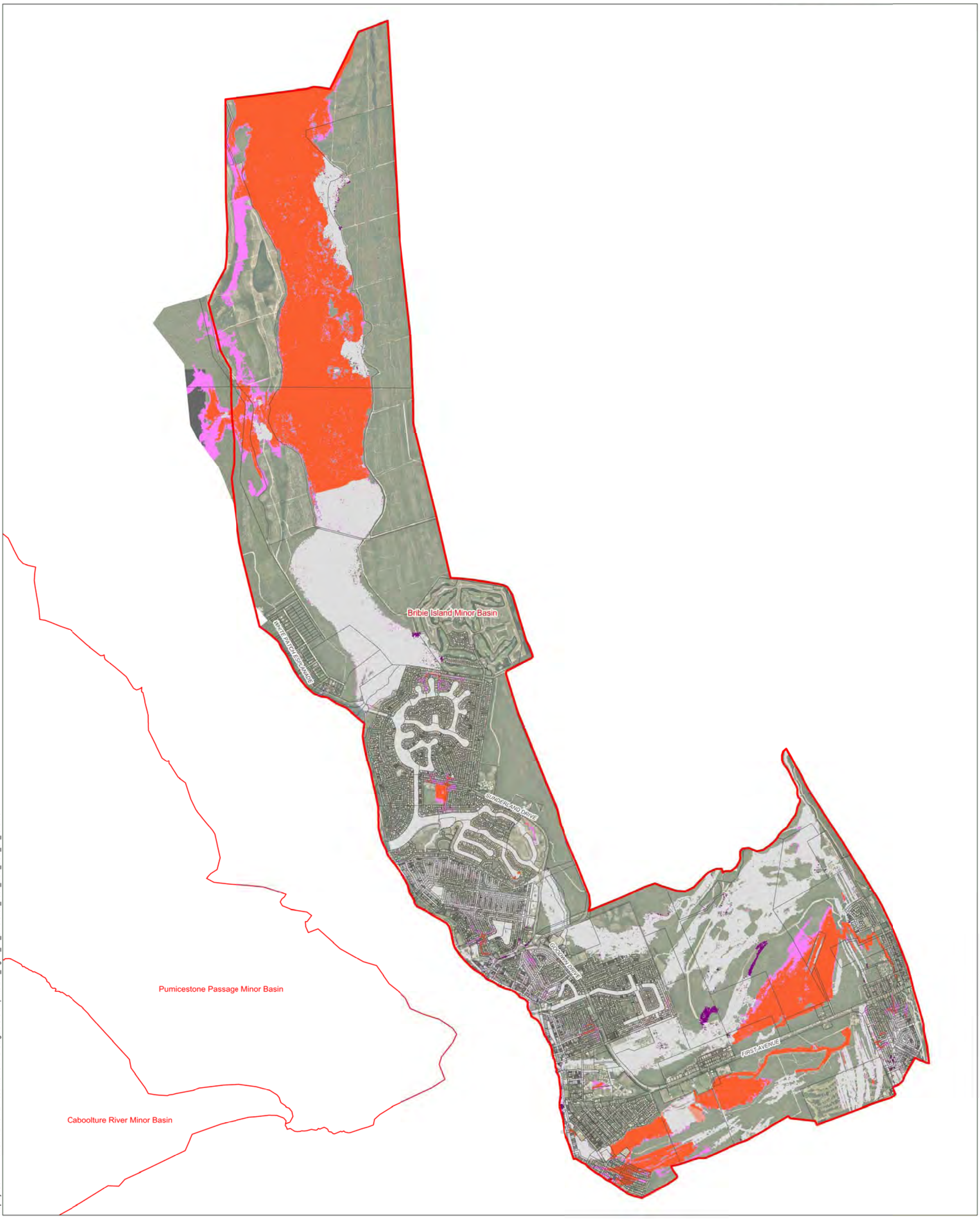
Date: 31/05/2012   Version: 0   Job No: 211090
Projection: MGA Zone 56

RFD Detailed Modelling (BRI)

Figure E5: Peak Flood Hazard Map - 100 Year ARI

Appendix F
Model Sensitivity Analysis Maps

Appendix F
Model Sensitivity Analysis Maps



Legend

Cadastre

Minor Basin Boundaries

Peak Flood Level Difference (m)

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

Notes:

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows EDS peak water level minus selected critical durations peak water level

A3 scale 1:50,000

0 1,250 m 2,500 m

Date: 31/05/2012 Version: 0 Job No: 211090

Projection: MGA Zone 56

RFD Detailed Modelling (BRI)

Figure F1: Peak Flood Level Difference between EDS and Selected Critical Storm Durations - 100 Year ARI (S1)

aurecon

Map by: DJF   P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\BRI_Figure_F2_Increased_Roughness_Impact_100Y_EDS_S2_rev0.wor

Legend

Cadastre

Minor Basin Boundaries

Peak Flood Level Difference (m)

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

Notes:

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows increase in roughness peak water level minus EDS peak water level

A3 scale 1:50,000

0   1,250 m   2,500 m

Date: 31/05/2012   Version: 0

Projection: MGA Zone 56

RFD Detailed Modelling (BRI)

Figure F2: Increase in Roughness Flood Level Impact 100 Year EDS (S2)

aurecon

Map by: DJF   P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\BRI_Figure_F3_Culvert_Blockage_100Y_EDS_S3_rev0.wor

Legend

Cadastre

Minor Basin Boundaries

Peak Flood Level Difference (m)

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

Notes:

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows structure blockage peak water level minus EDS peak water level

A3 scale 1:50,000

0 1,250 m 2,500 m

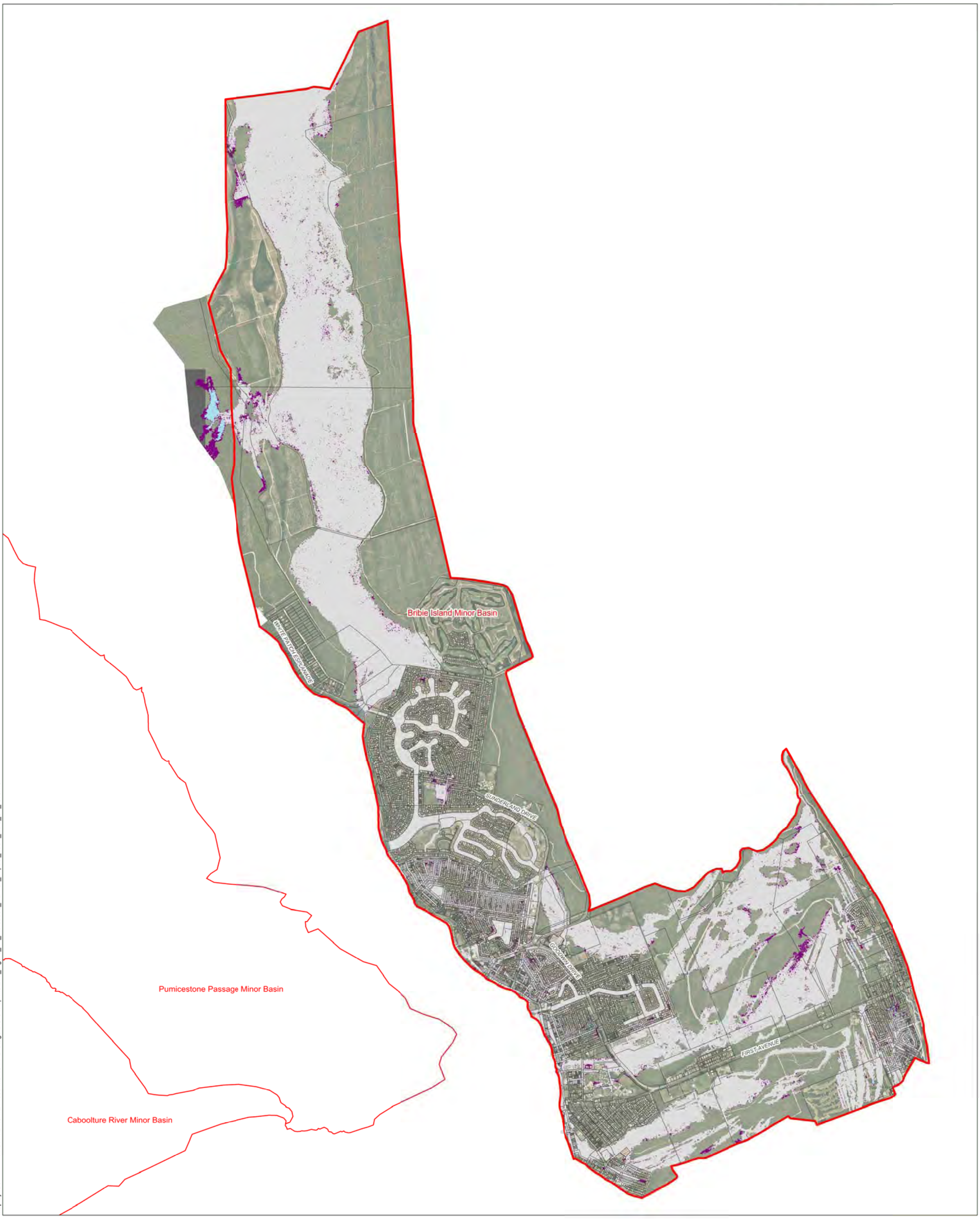
Date: 31/05/2012 Version: 0 Job No: 211090

Projection: MGA Zone 56

RFD Detailed Modelling (BRI)

Figure F3: Structure Blockage Flood Level Impact 100 Year EDS (S3)

aurecon



Map by: DJF   P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\BRI_Figure_F4_Increased_Rainfall_Impact_100Y_EDS_S4_rev0.wor

Legend

Cadastre

Minor Basin Boundaries

Peak Flood Level Difference (m)

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

Notes:

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows increase in rainfall peak water level minus EDS peak water level

A3 scale 1:50,000

0   1,250 m   2,500 m

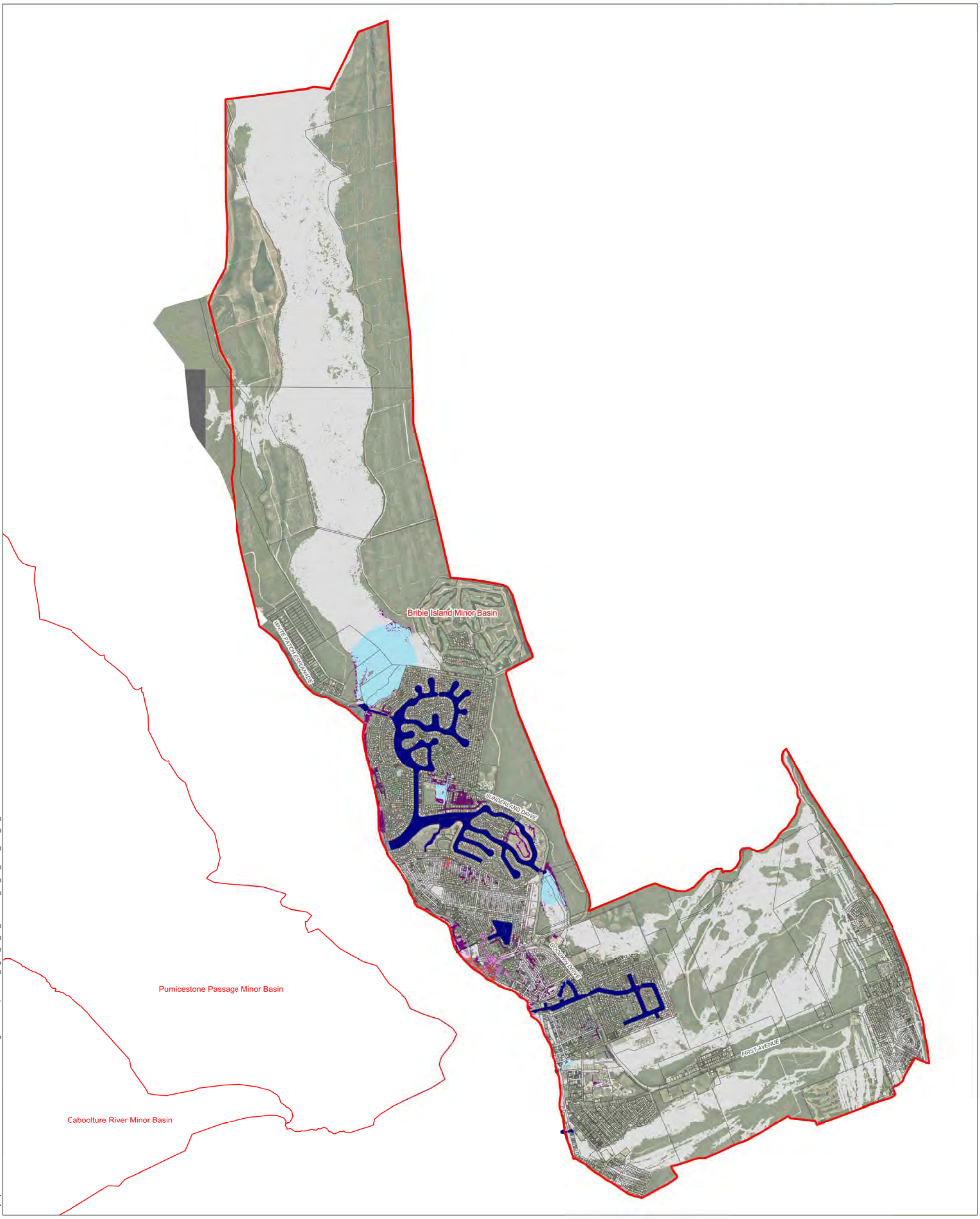
Date: 31/05/2012   Version: 0   Job No: 211090

Projection: MGA Zone 56

RFD Detailed Modelling (BRI)

Figure F4: Increase in Rainfall Flood Level Impact 100 Year EDS (S4)

aurecon



Map by: DJF   P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\BRI_Figure_F5_Dif_Increased_DS_BC_100Y_EDS_S5_rev0.wor

Legend

Cadastre

Minor Basin Boundaries

Peak Flood Level Difference (m)

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

Notes:

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows increase in downstream boundary peak water level minus EDS peak water level

A3 scale 1:50,000

0 1,250 m 2,500 m

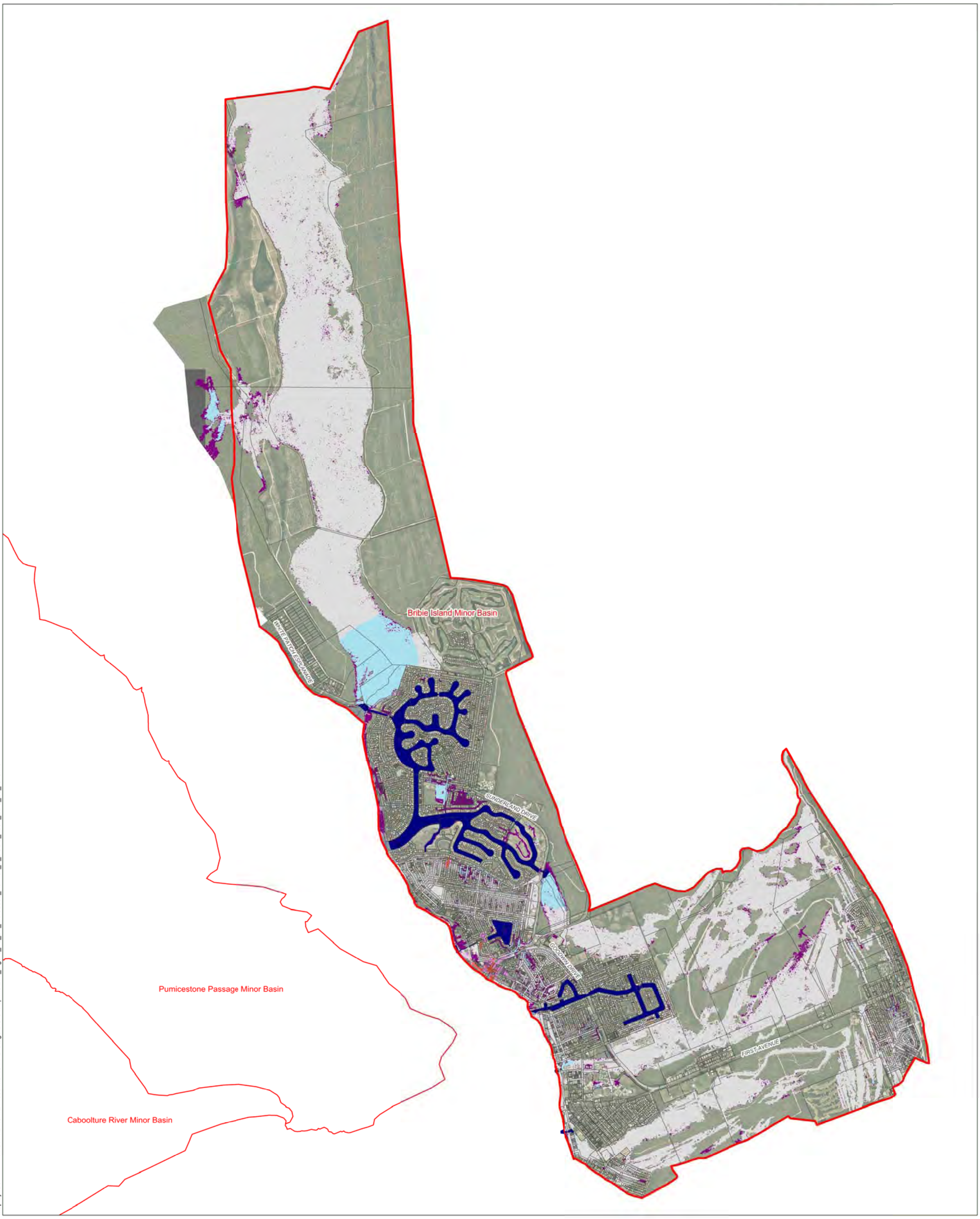
Date: 31/05/2012 Version: 0 Job No: 211090

Projection: MGA Zone 56

RFD Detailed Modelling (BRI)

Figure F5: Increase in Downstream Boundary Flood Level Impact 100 Year EDS (S5)

aurecon



Map by: DJF   P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\BRI_Figure_F6_Dif_Increased_Rainfall_&_DSBC_100Y_EDS_S6_rev0.wor

Legend

Cadastre

Minor Basin Boundaries

Peak Flood Level Difference (m)

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

Notes:

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows increase in rainfall and downstream boundary peak water level minus EDS peak water level

A3 scale 1:50,000

0   1,250 m   2,500 m

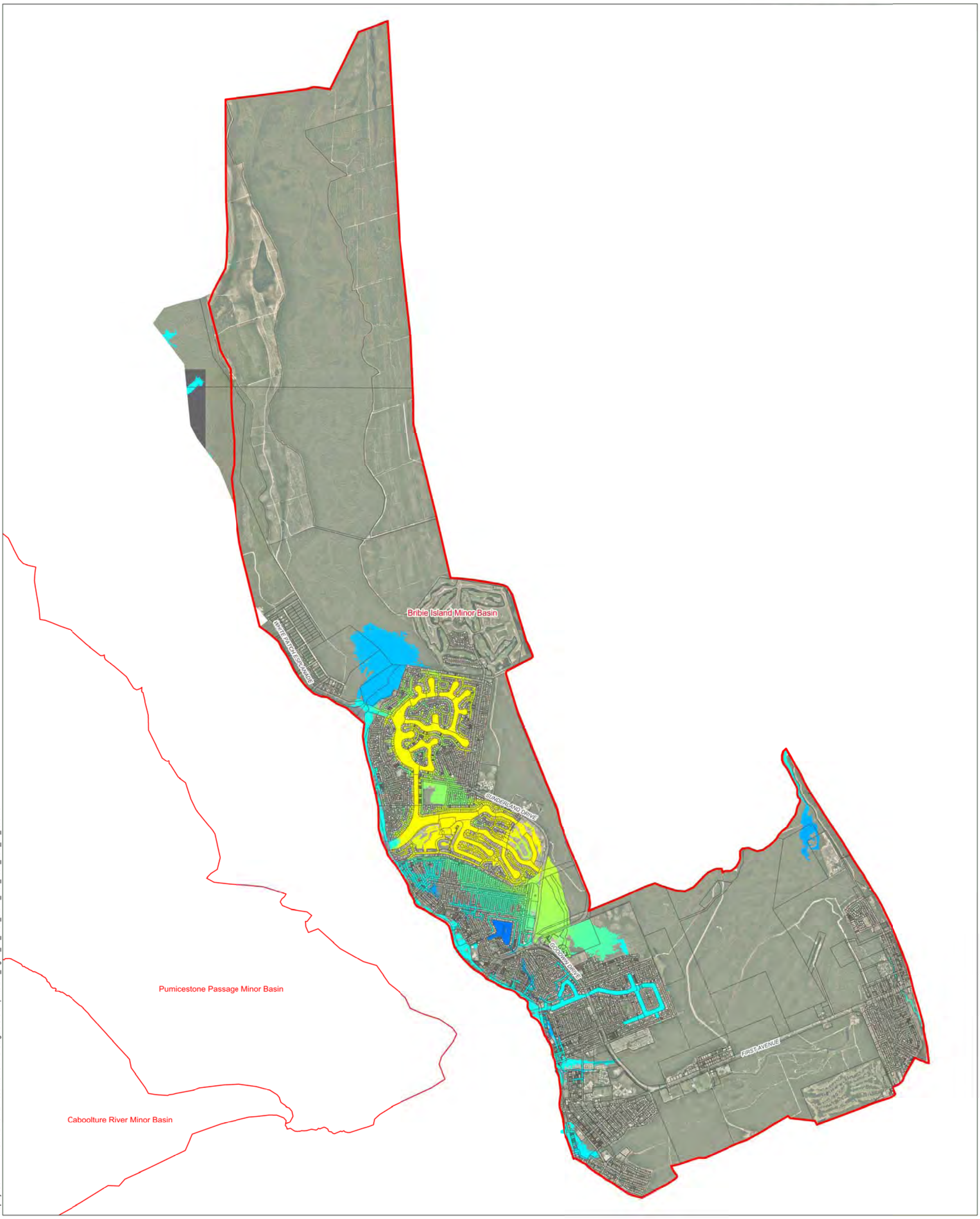
Date: 31/05/2012   Version: 0   Job No: 211090

Projection: MGA Zone 56

RFD Detailed Modelling (BRI)

Figure F6: Increase in Rainfall and Downstream Boundary Flood Level Impact 100 Year EDS (S6)

aurecon



Map by: DJF   P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\BRI_Figure_F7_WSL_Storm_Tide_100Y_EDS_S7_rev0.wor

Legend

Cadastre

Minor Basin Boundaries

Flood Level (m AHD)

<1.0 2.0 3.0 4.0 >5.0

Notes:

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

A3 scale 1:50,000

0 1,250 m 2,500 m

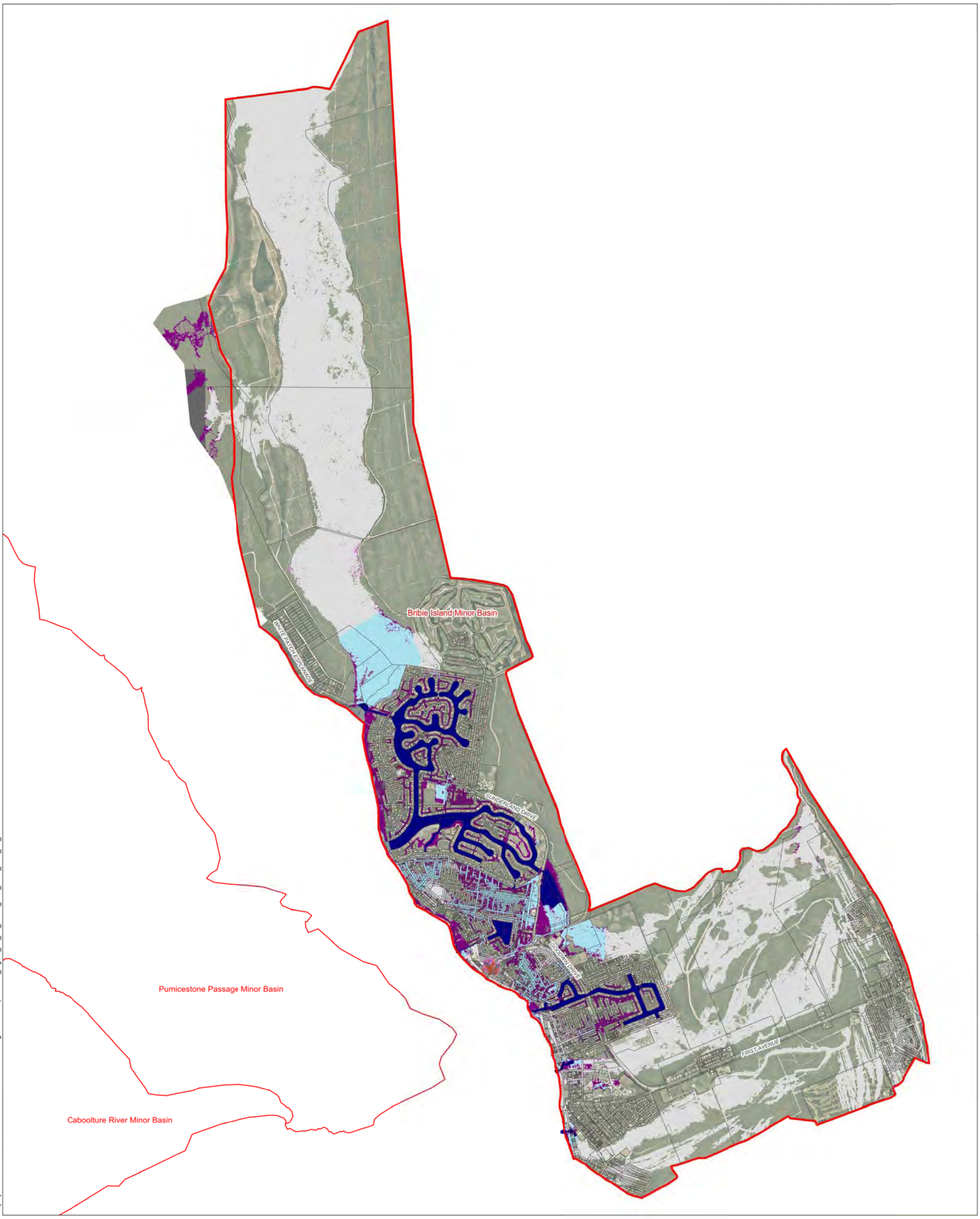
Date: 31/05/2012   Version: 0   Job No: 211090

Projection: MGA Zone 56

RFD Stage 2 Detailed Modelling

Figure F7: Dynamic Storm Tide Peak Flood Level 100 Year ARI (S7)

aurecon



Legend

- Cadastre
- Minor Basin Boundaries

Peak Flood Level Difference (m)

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

Notes:

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows static storm tide peak water level minus EDS peak water level

A3 scale 1:50,000

0 1,250 m 2,500 m

Date: 31/05/2012 Version: 0 Job No: 211090

Projection: MGA Zone 56

RFD Detailed Modelling (BRI)

Figure F8: Static Storm Tide Flood Level Impact - 100 Year EDS (S8)

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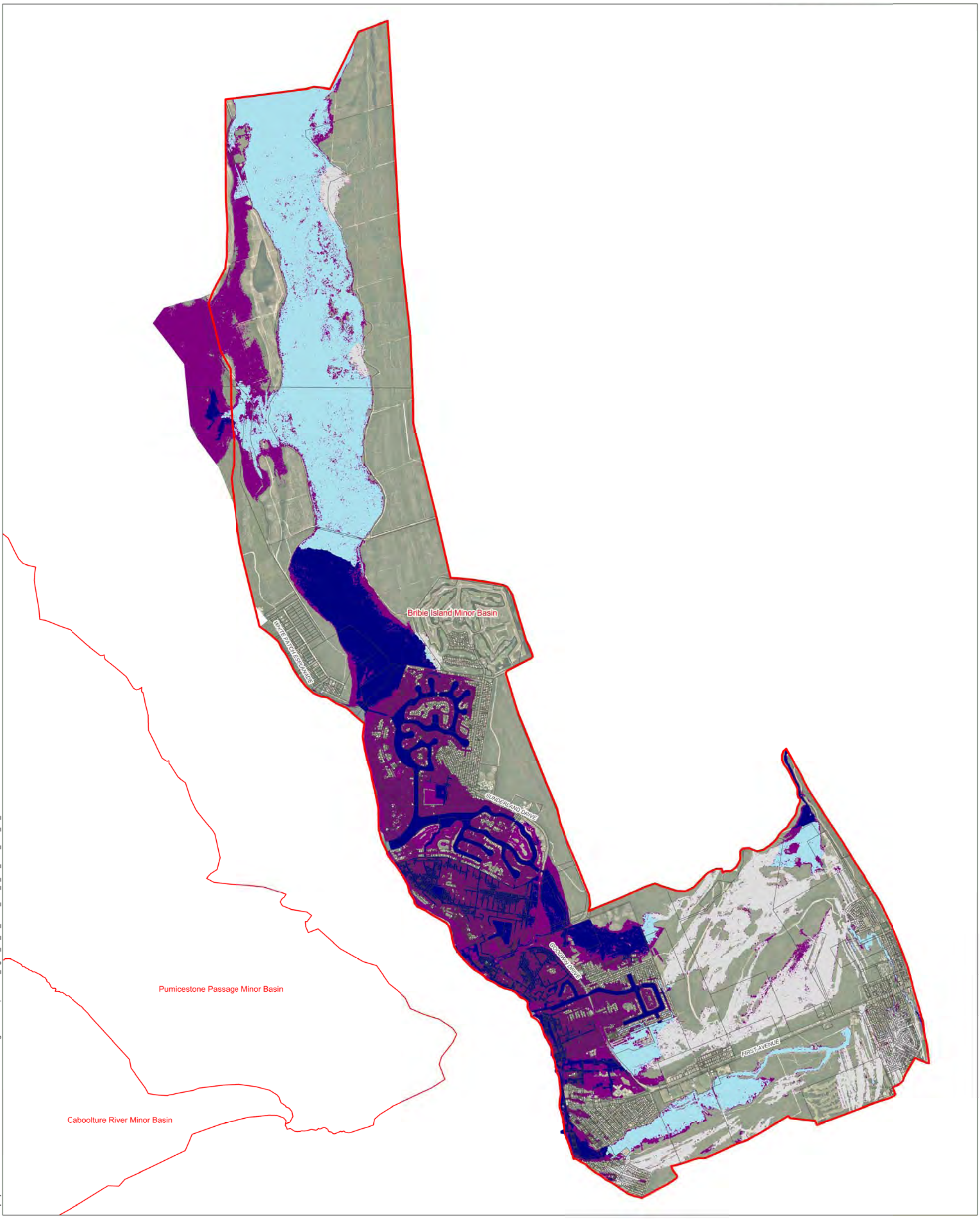

Legend

Cadastre

Minor Basin Boundaries

Peak Flood Level Difference (m)

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

Notes:

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows static storm tide and climate change peak water level minus EDS peak water level

A3 scale 1:50,000

0 1,250 m 2,500 m

Date: 31/05/2012 Version: 0 Job No: 211090

Projection: MGA Zone 56

RFD Detailed Modelling (BRI)

Figure F9: Static Storm Tide and Climate Change Flood Level Impact 100 Year EDS (S9)

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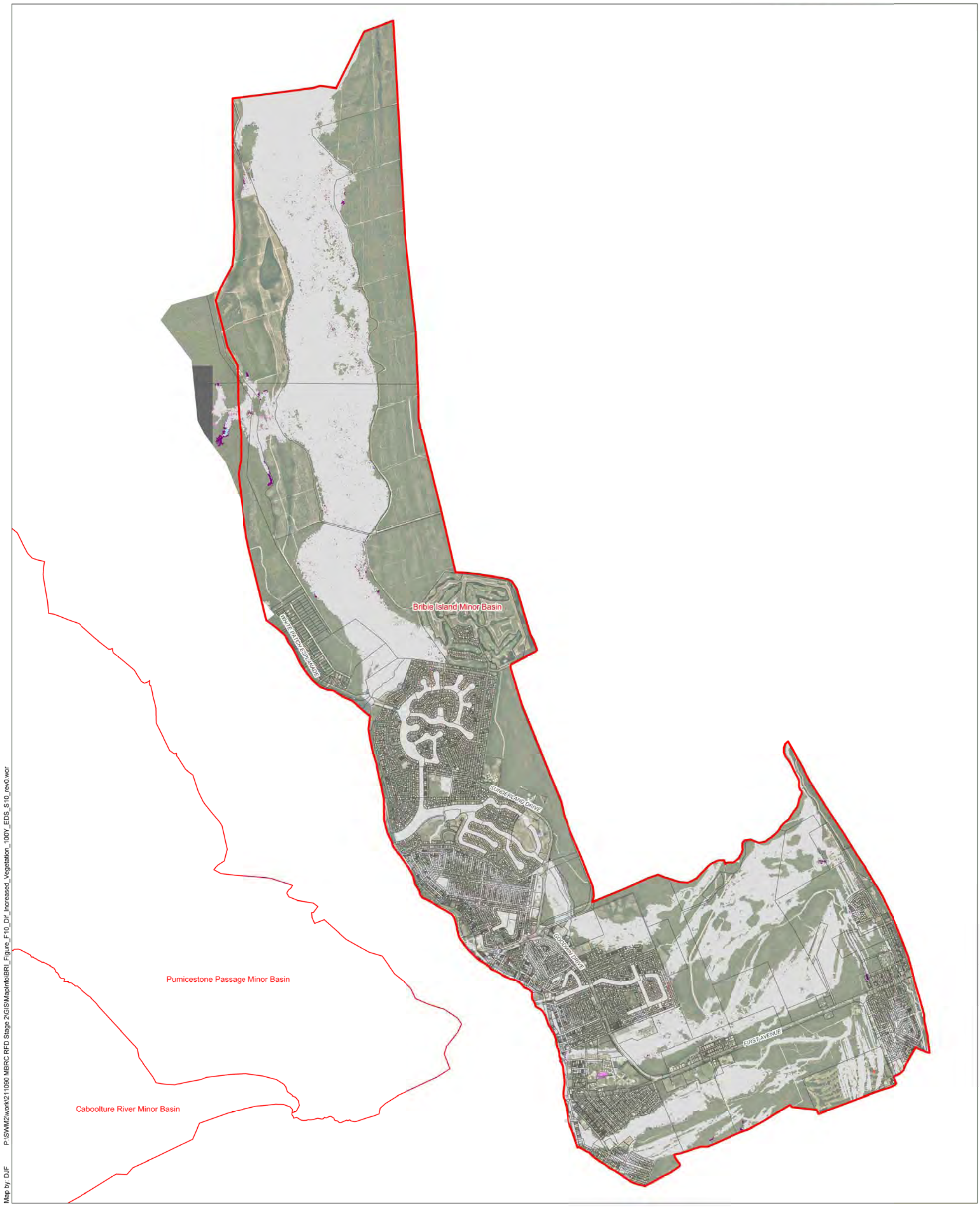

Legend

Cadastre
Minor Basin Boundaries

Peak Flood Level Difference (m)
- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

Notes:

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows increase in vegetation peak water level minus EDS peak water level

A3 scale 1:50,000

0 1,250 m 2,500 m

Date: 31/05/2012 Version: 0 Job No: 211090

Projection: MGA Zone 56

RFD Detailed Modelling (BRI)

Figure F10: Increase in Vegeation Flood Level Impact 100 Year EDS (S10)

aurecon

Map by: DJF P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\BRI_Figure_F11_Dif_Increased_Development_100Y_EDS_S11_rev0.wor

Legend

Cadastre

Minor Basin Boundaries

Peak Flood Level Difference (m)

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

Notes:

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows increase in residential development peak water level minus EDS peak water level

A3 scale 1:50,000

0 1,250 m 2,500 m

Date: 31/05/2012 Version: 0 Job No: 211090

Projection: MGA Zone 56

RFD Detailed Modelling (BRI)

Figure F11: Increase in Residential Development Flood Level Impact 100 Year EDS (S11)

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P:\SWM2\work\211090 MBRC RFD Stage 2\GIS\MapInfo\BRI_Figure_F12_Dif_Increased_Vegetation_&_Development_100Y_EDS_S12_rev0.wor

Map by: DJF

Legend

Cadastre

Minor Basin Boundaries

Peak Flood Level Difference (m)

- < -0.50
- -0.50 to -0.10
- -0.10 to 0.10
- 0.10 to 0.50
- >0.5
- Was Dry Now Wet
- Was Wet Now Dry

Notes:

This figure is based on information provided to Aurecon by Moreton Bay Regional Council (MBRC) and other parties. Although the provider of the information has not warranted the accuracy of the data and has waived liability in respect of its use, Aurecon's study was undertaken strictly on the basis that the information that has been provided is accurate, complete and adequate. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that MBRC may suffer resulting from any conclusions based on information provided to Aurecon, except to the extent that Aurecon expressly indicates in the associated report that it has verified the information to its satisfaction.

This figure shows increase in vegetation and residential development peak water level minus EDS peak water level

A3 scale 1:50,000

0 1,250 m 2,500 m

Date: 31/05/2012 Version: 0 Job No: 211090

Projection: MGA Zone 56

RFD Detailed Modelling (BRI)

Figure F12: Increase in Vegetation and Residential Development Flood Level Impact - 100 Year EDS (S12)

Appendix G
Hydrologic Modelling Details

Appendix G
Hydrologic Modelling Details

A separate report for hydrologic model establishment was not created as part of the study; therefore this section has been included to describe the process undertaken in the hydrologic modelling.

Available data

The following data was made available for the hydrologic modelling:

- Base WBNM model supplied by Andrew Wiersma on 30 March 2011. This model was supplied with notes that C-value = 1.6; ARF = 1.0 and IFD file location in all runfiles will need to be amended
- Design rain gauge locations were also supplied by Andrew Wiersma on 30 March 2011
- Guidance on how climate change modelling is to be undertaken ie IFD coefficients to be increased by 12% (as per email correspondence from Hester van Zijl on 10 April 2012)
- Future development impervious values as supplied by Hester van Zijl on 2 May 2012
- Guidance for rainfall data setup was provided in the Worley Parsons (2010) *Database Design Rainfall - Burpengary Pilot Project (Draft)* report

Methodology

Model version

WBNM version 2010_000 was used to undertake the analyses.

The TUFLOW convert_to_ts1 utility (v 2009-10-AB) was used to convert the results to TUFLOW format.

Design event modelling

A separate .wbn file was created for each duration for each event (ARI). This was done in order to create separate output files for each event, which could then be used as input to the TUFLOW hydraulic model.

Two (2) design event rain gauge locations were adopted for the BRI minor basin as per the IFD data supplied.

The model results were then converted to .ts1 files for input to TUFLOW. Zero flow values were added to the end of each hydrograph. This was done for all WBNM model results, including the extreme events, PMP events and climate change events. Only the .loc files were used as input to the TUFLOW models.

Extreme event modelling

CRC-Forge was used to provide rainfall intensities. These were calculated for each of the five rainfall gauge locations adopted for the design events. For the 0045, 0090 and 0120 minute durations, no values are provided by CRC-Forge, therefore these were linearly interpolated between the 0030, 0060 and 0180 intensities.

PMP temporal patterns were applied to the extreme events. For the 0015, 0030, 0045, 0060, 0090, 0120, 0180 and 0360 minute events the temporal pattern for the Generalised Short Duration Method (GSDM) (BoM, 2003) was adopted. For the 1440, 2160, 2880 and 4320 minute events the temporal patterns from the coastal_avm_100 storms were adopted (as per the Generalised Tropical Storm Method (GTSMR), BoM 2003).

For the 0720 minute duration, both the GSDM and GTSMR temporal patterns were analysed. For the GTSMR, the times applying to the 1440 minute duration pattern were halved to create a 0720 minute pattern.

PMP event modelling

For the PMP event, a single storm was used across the entire model extents. The temporal patterns used for the extreme events were also used for the PMP events.

The methods set out in the GSDM (BoM, 2003) were used to provide rainfall intensities for the 0015, 0030, 0045, 0060, 0120, 0150, 0180, 0240, 0300 and 0360 minute events. The GTSMR methods (BoM, 2003) were used to provide intensities for the 1440, 2160, 2880 and 4320 minute events. For the 0720 minute event, a line of best fit was applied between the short and long duration intensities and the rainfall intensity was calculated to provide the best R^2 value to this line.

Key parameters used in the PMP analysis are provided in Table G1.

Table G1 | Adopted PMP Parameters

Parameter/Method	Value
GSDM – initial depths	Rough surface for area = 1km^2
GSDM – EAF	1 as topography is below 1500m AHD
GSDM – MAF	0.85 (as per design events)
GTSMR – initial depths	Coastal summer values for area = 1km^2
GTSMR – TAF	1.505 – median value from region inspection
GTSMR – DAF	0.997 – median value from region inspection
GTSMR – EPW	88.525 – median value from region inspection

Climate change event analysis

For the climate change scenario (S4), the IFD data adopted for the design events was increased by 12%. No other changes were made to the EDS model setup.

Future landuse scenario analysis

For the future landuse scenario (S11), the revised fraction impervious values provided by MBRC were incorporated into the .wbn file. No other changes were made to the model setup.

Appendix H
Landuse Polygon Review

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Project: Moreton Bay Flood Modelling	Reference: 211090

To:	Copy:	Circulate:	Name:	Organisation:	Location/Facsimile:
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	✔		Talia Campbell	Aurecon	campbellt@ap.aurecongroup.com
From: Brandon Breen				Date: 1 March 2011	Total pages: 6

Subject: Land Use Polygon Review

Hester

We have undertaken a review of the land use polygons developed by SKM. As part of our land use review, the following land use polygon layers have been visually compared to the available aerial images:

- Roads - MBRC_DigitisedRoads_2009AerialsOnly_MGA56 and AllMBRC_Roads_Merged_MGA56
- Buildings - MBRC_Buildings_Updatedw2009Aerials_MGA56
- Footpaths - MBRC_Footpaths_Updatedw2009Aerials_MGA56
- Vegetation - MBRC_Vegetation_Existing_2009_MGA56
- Water bodies (creeks) - MBRC_Waterbodies_Creeks_2009Aerials_MGA56
- Water bodies (rivers) - MBRC_Waterbodies_Rivers_2009Aerials_MGA56
- Urban blocks - MBRC_UrbanBlock_2000SqmBlocks_MGA56

This review has shown that the above layers cover the MBRC region and have also been extended to cover the portion of the SCRC region which falls within the Pumicestone Passage minor basin.

This memo presents the findings of our review and our proposed approach in areas that discrepancies occur.

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Roads Land Use Layer

The SKM land use polygons partially include dirt roads (as shown in Figure 1 below). If the digitised road at location 1 is to be included in the roads land use layer, then in order to provide consistency throughout the model other dirt roads such as that in location 2 should also be digitised.

We think the inclusion of the dirt tracks is not likely to make a large impact on the modelling and therefore propose to provide consistency by excluding dirt roads from the modelling, rather than digitising all remaining dirt roads in the Pumicestone domain. The railway line, which has similar properties to a dirt road, has not been included in roads land use layer which suggests the dirt roads are not required.

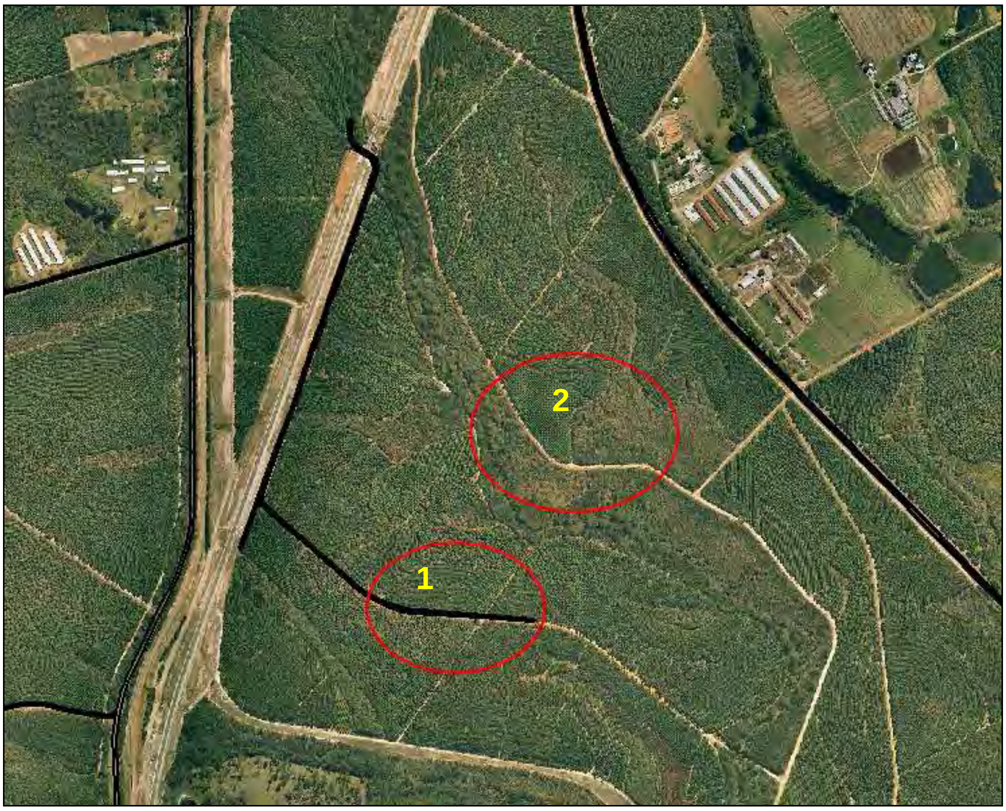

Figure 1 Example of Digitised Dirt Roads

Buildings Land Use Layer

Review of the SKM buildings land use layer shows that all buildings in the urban areas have been digitised; however there are some inconsistencies in the rural areas of the Pumicestone domain. The example in Figure 2 below shows a small cluster of buildings at location 1 have been included in the buildings layer and the larger buildings at location 2 have not been included.

We propose to add all large buildings and residential buildings into the buildings land use layer in order to provide consistency throughout the model.

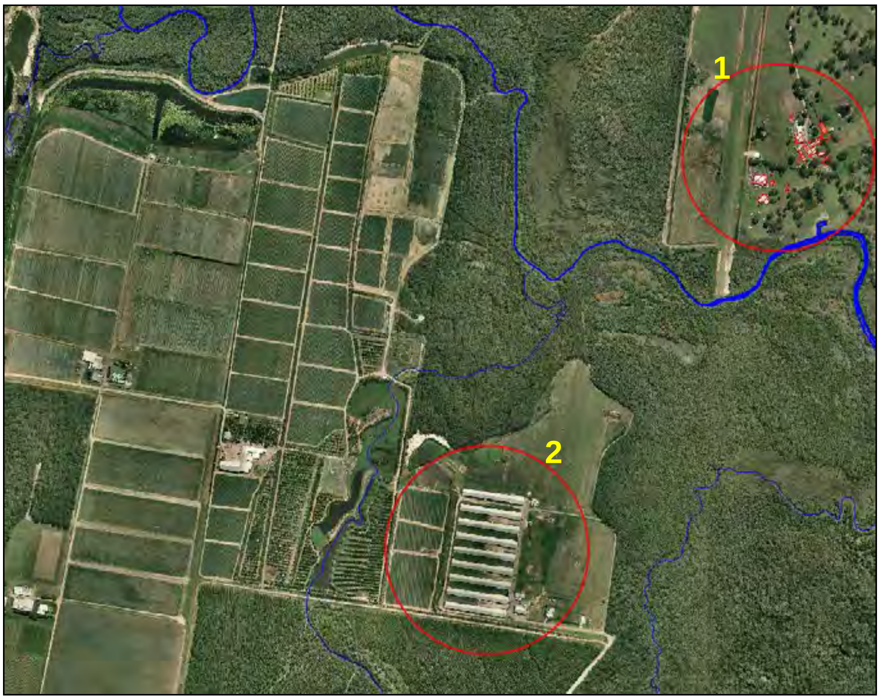

Figure 2 Example of Digitised buildings

Footpaths Land Use Layer

A review of the SKM footpaths layer has shown that they are generally well aligned and well defined. In a few locations, particularly on Bribie Island, some minor realignment, extension and addition of short sections to these polygons is proposed. We do not propose to make and any major changes to this layer. An example of minor adjustments is shown in Figure 3 with the proposed updated alignment in red.

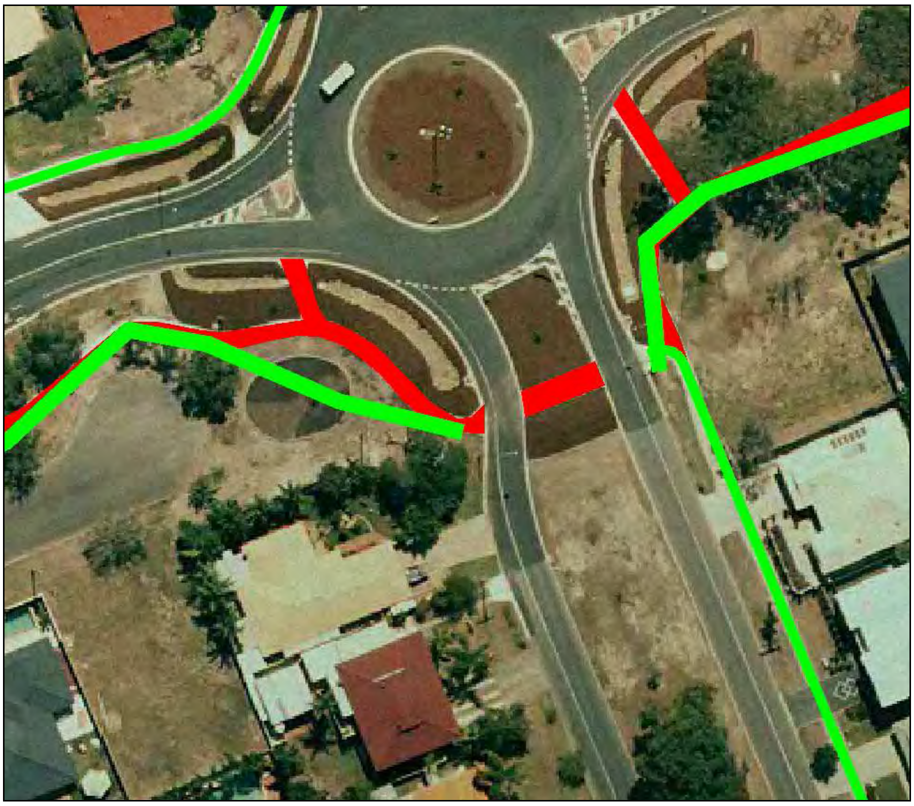

Figure 3 Example of Digitised Footpaths

Vegetation Land Use Layer

A review of the SKM land use layer found the polygons to be accurate within the MBRC region. The portion of these polygons which have been digitised in the SCRC region have not picked up all the vegetated land. We propose to maintain the existing SKM land use layer, with the additional definition of vegetation layers in the SCRC area as shown in Figure 4 below – this figure shows the areas defined by SKM (green) and the additional definition we are proposing (red).

Figure 4 Example of Digitised Vegetation

Waterbodies (Creeks)

The waterbodies (creeks) were well defined in the SKM land use layer. In the SCRC portion of the Pumicestone Passage catchment we found three waterbodies which were not included. We propose to maintain the existing SKM land use layer, with the addition of these three waterbodies in the SCRC area.

Waterbodies (Rivers)

The waterbodies (rivers) are well defined in the SKM land use layers. We do not propose to make any changes to this layer.

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Urban Blocks

A review of the urban blocks layer showed that all blocks under 2000m^2 within the MBRC region were defined. The urban blocks in the Beerburrum area were not included in this layer. We propose to maintain the existing SKM urban blocks land use layer, with the addition of urban blocks in Beerburrum (based upon cadastral data sourced from DERM on 25th February) as shown in Figure 5.

Figure 5 Example of Urban Blocks to be Included

Could you please review this memo and provide your comments regarding our proposed changes to the land use polygons?

Regards

Brandon Breen
Civil Engineer
Water

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