APPENDIX D

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DISCLAIMER

BMT WBM

Technical Note

From:	Richard Sharpe	To:	Moreton Bay Regional Council
Date:	15 June 2012	CC:	
Subject:	Modelling Quality Report; Caboolture		

1 Background

As part of Moreton Bay Regional Council's (MBRC) Regional Floodplain Database (RFD) project, a detailed TUFLOW model of the Caboolture catchment has been developed. This technical note has been prepared to demonstrate that the Caboolture model has been reviewed, and that the model performance is suitable for the intended use and that the sensibility of the results has been checked.

2 Model Development Process

The following procedure has been implemented in the development of the model:

1 A site visit was undertaken prior to commencing development of the model to gain an appreciation for the catchment;

2 An infrastructure assessment was undertaken. A report was produced from this assessment and submitted to MBRC for their consideration on structure data requirements. This approach ensured that sufficient data was captured for the level of accuracy required from the model;

3 The catchment delineation used in the hydrology was reviewed. This review indicated that the catchment delineation was suitable;

4 A draft TUFLOW model was developed, focussing on the 100 year ARI flood event, and submitted to MBRC for review (on 21st July 2011);

5 MBRC provided feedback from their review of the TUFLOW model on 28th July and 11th August 2011. Alterations following this review are discussed later in this note;

6 A final model was developed and used to simulate all the design and sensitivity events; and

7 Further checking was undertaken to ensure that the model was suitable for simulating the full range of flood events.

Throughout model development, model stability, warnings messages and mass errors were monitored to ensure that the model performance was acceptable. Careful attention was provided to ensuring that flow through the 1D structure elements in the model was stable, as well as flow across the floodplain in the 2D domain.

3 Model Amendments – Post Draft Model Review

Various enhancements were recommended by both BMT WBM and MBRC following the development of the draft model. The following changes were implemented:

1 Changes made to some structures, as per Council's correspondence (28th July 2011, 11th August 2011 and 24th October 2011).

2 Gully/River lines were added, particularly in the steep upper catchment, to increase the stability of the model.

3 For an area of instability in the upper catchment, an interpolated z-point patch has been applied to smooth the topography.

4 The Caboolture weir has been added into the model. The weir has been represented as a z-line for the weir crest, and a z-shape to represent the structure downstream of the crest. For stability, the slope of the downstream face of the weir was given a stepped profile. The materials layer in this area has been adjusted to represent the weir bed and banks.

5 The materials layer has been adjusted along the Caboolture River banks in a steep area of the model to increase the stability of the model.

6 In some areas, the z-points weren't adequately representing the topography of the area. Z-shapes have been added in these areas to ensure that these features are adequately represented.

7 Additional survey data was used to update the details on some culvert structures.

4 Additional Amendments

Additional amendments were necessary for simulating the extreme events. The extent of the active 2D domain was further extended to ensure that the PMF flows were fully captured.

5 Model Performance

The following model performance checks have been undertaken:

- Stability of flow through key structures (e.g. Figure 5-1) was checked during model development. The arrangement of SX connections, structures and embankments has been edited to ensure that stable peak flows have been achieved where necessary;
- Stability of overland flow hydrographs were checked at several locations in the floodplain; (e.g. Figure 5-2);
- TUFLOW warning messages have been minimised. A few negative depth warning messages remain in parts of the catchment. But these are localised and limited to short time periods in the overall simulation; and
- Mass balance errors have been minimised. Mass balance errors range from -0.1% to 0.1% for most events, with up to -0.3% for the PMF.

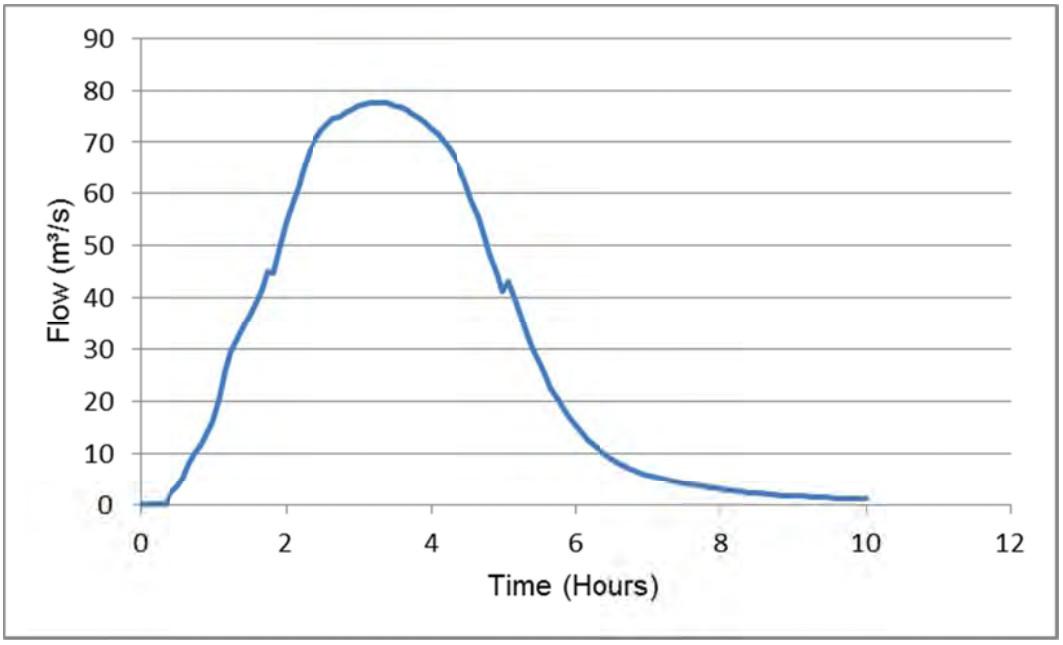


Figure 5-1: Flow through Culvert ID GYM01_04853 at Bruce Highway (100 year ARI; 3 hour storm duration)

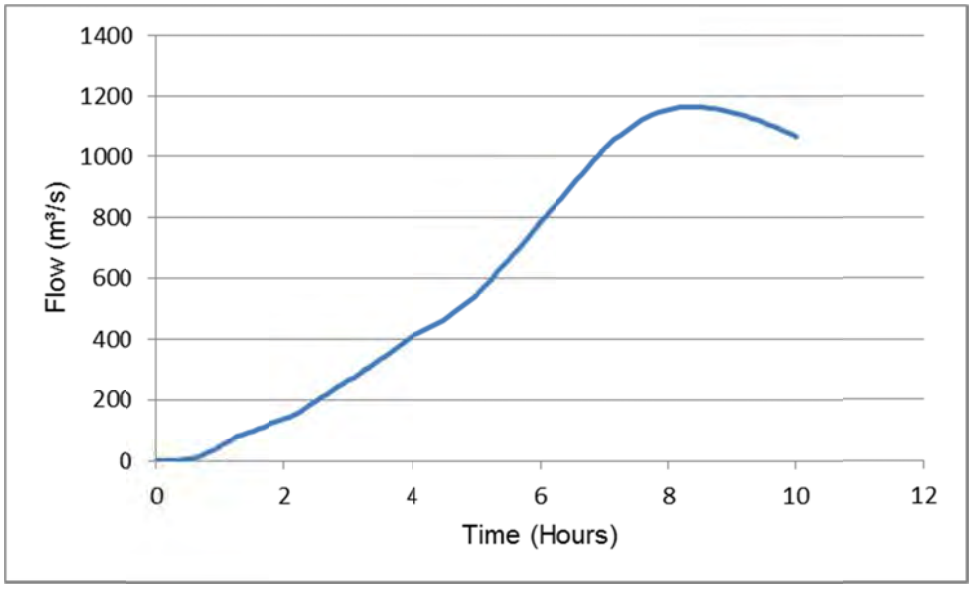


Figure 5-2: Overland Flow Hydrograph at the Downstream End near Harvey Ware Park (100 year ARI; 3 hour storm duration)

6 Downstream Boundary Sensitivity Analysis Anomaly

An anomaly has been detected for climate change scenario S5 (increased sea level). The results of this sensitivity analysis show a decrease in levels near the downstream boundary, highlighted in red in Figure 6-1. This decrease in flood level is incorrect, and has occurred due to the structure of the model.

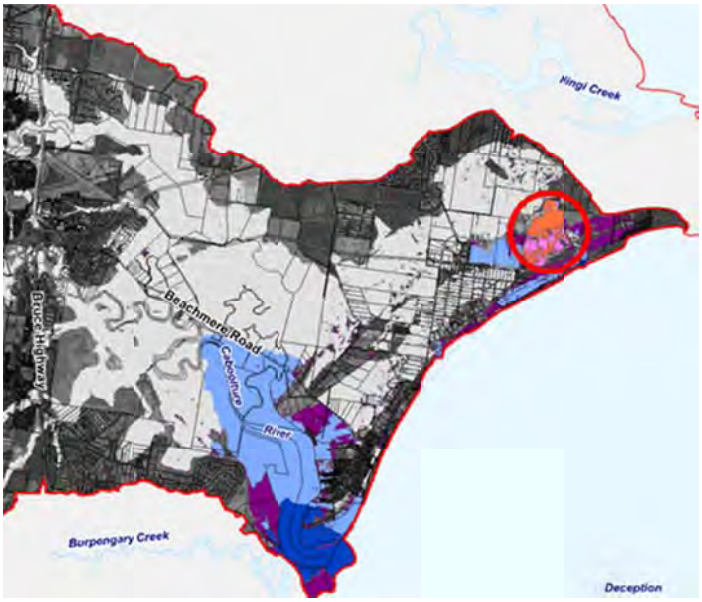


Figure 6-1: Area Showing Decrease in Flood Level Due to Sea Level Rise (Circled)

This decrease in peak flood level is an artefact of the SA polygon network used to define inflow locations in the model; specifically at SA polygon GOD_09_00000. In the base case, the flow for this SA polygon is spread over all wet cells in the subcatchment, which is primarily towards the upper part of the subcatchment (see Figure 6-2).

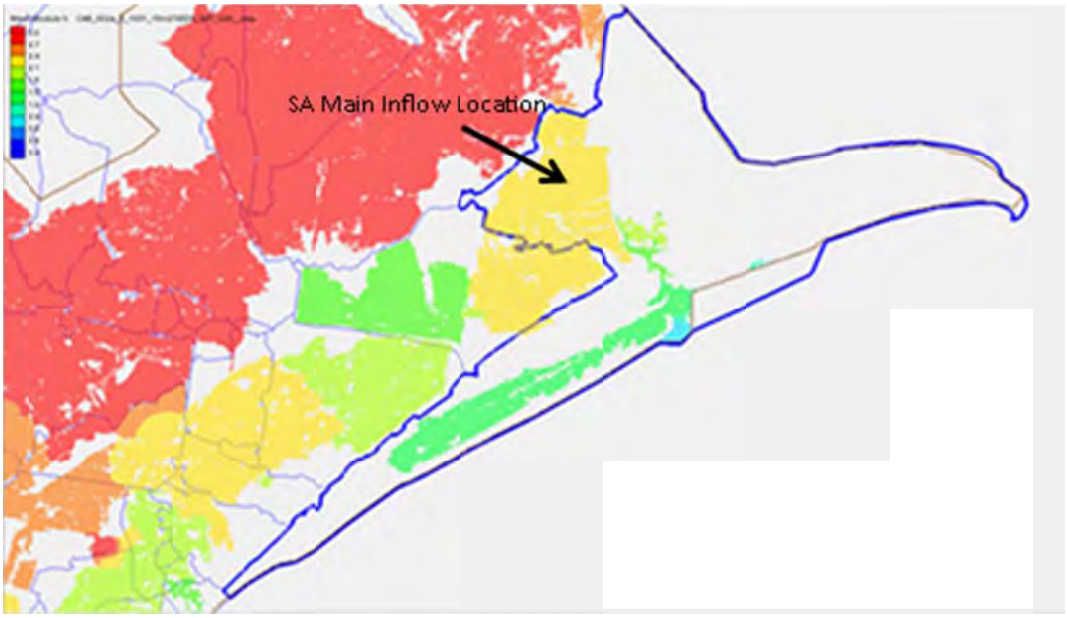


Figure 6-2: Base Case 100 Year EDS Peak Flood Level and SA Polygon GOD_09_00000

However, in the climate change scenario (S5), there is more wet cells closer to the downstream boundary due to the increased water level in the downstream boundary conditions. As a consequence, the flow from the SA polygon is spread over a wider area in the model. In particular, more flow from SA polygon GOD_09_00000 is being spread over the downstream portion of the subcatchment (see Figure 6-3).

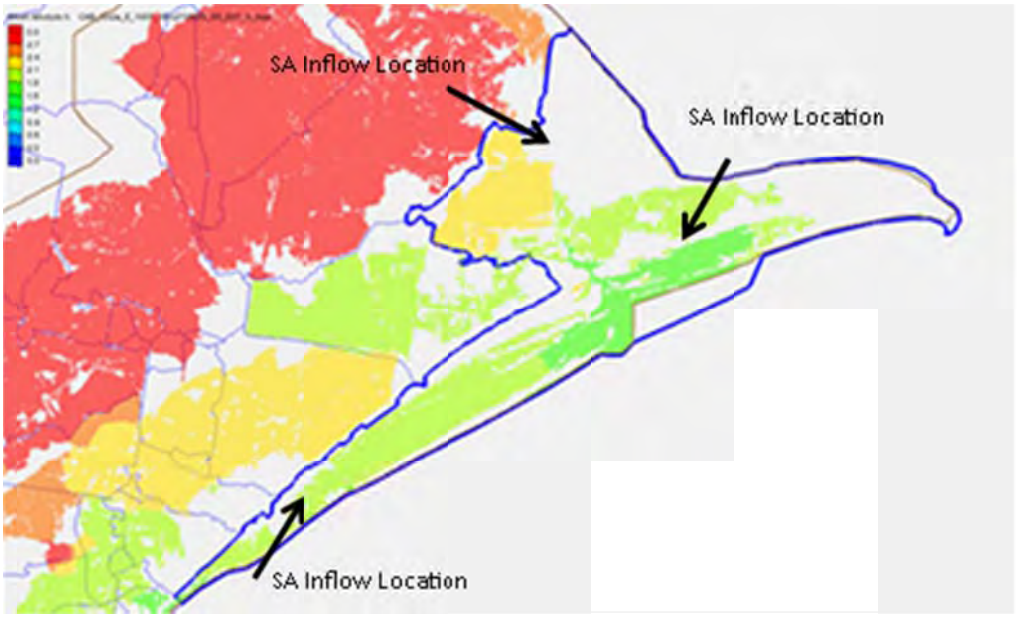


Figure 6-3: Increased Sea Level 100 Year EDS Peak Flood Level and SA Polygon GOD_09_00000

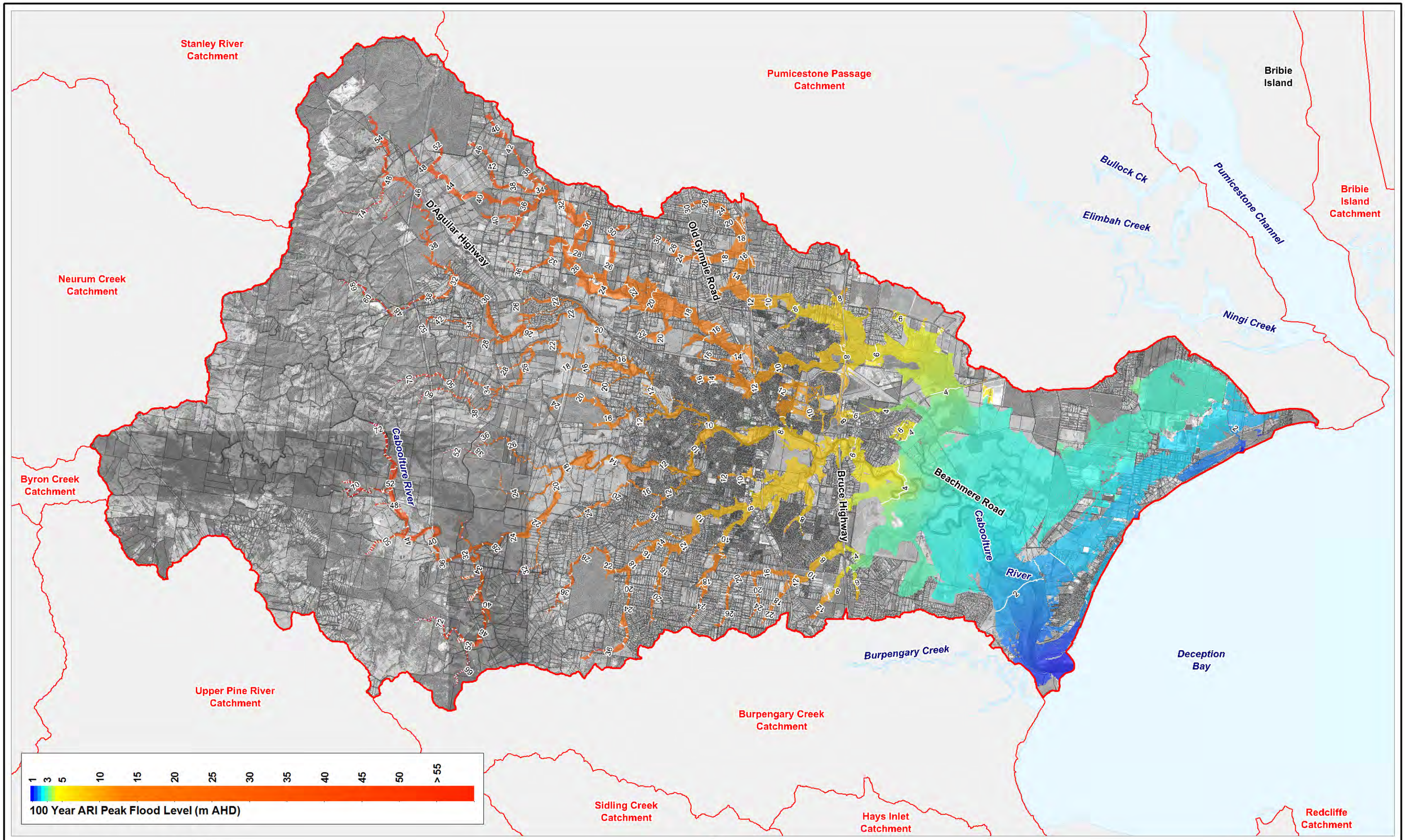
In the base case, the downstream areas were drier. Therefore more flow was apportioned to the upper part of the SA polygon. This resulted in more flow spilling into the area to the west of SA polygon GOD_09_00000 in the existing model, which accounts for the decrease in flood levels highlighted in Figure 6-1. In reality, however, an increase in sea levels will not reduce flood levels in this area.

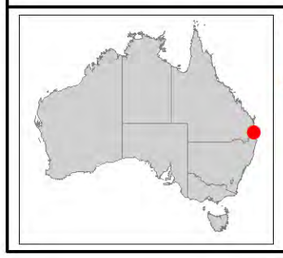
7 Conclusion

The Caboolture model has been developed with due consideration given to ensuring the quality of the model. The model has been reviewed internally and externally by MBRC. Amendments have been made in light of these reviews, and the overall model performance is suitable for the intended use of the model.

If the model is to be used to undertake sensitivity analysis on the downstream boundary, it should be noted that the current schematisation of the SA polygons should be altered. This is to avoid the issue discussed in Section 6, whereby increased sea levels incorrectly lead to reduced peak flood levels.

APPENDIX E





LEGEND

- Caboolture Catchment Boundary
- Contour Lines [Labelled with 100 Year ARI Peak Flood Level (m AHD)]
- Cadastral Boundaries

Title:

Peak Flood Level Map – 100 Year ARI

Figure: **E1**

Rev: **A**

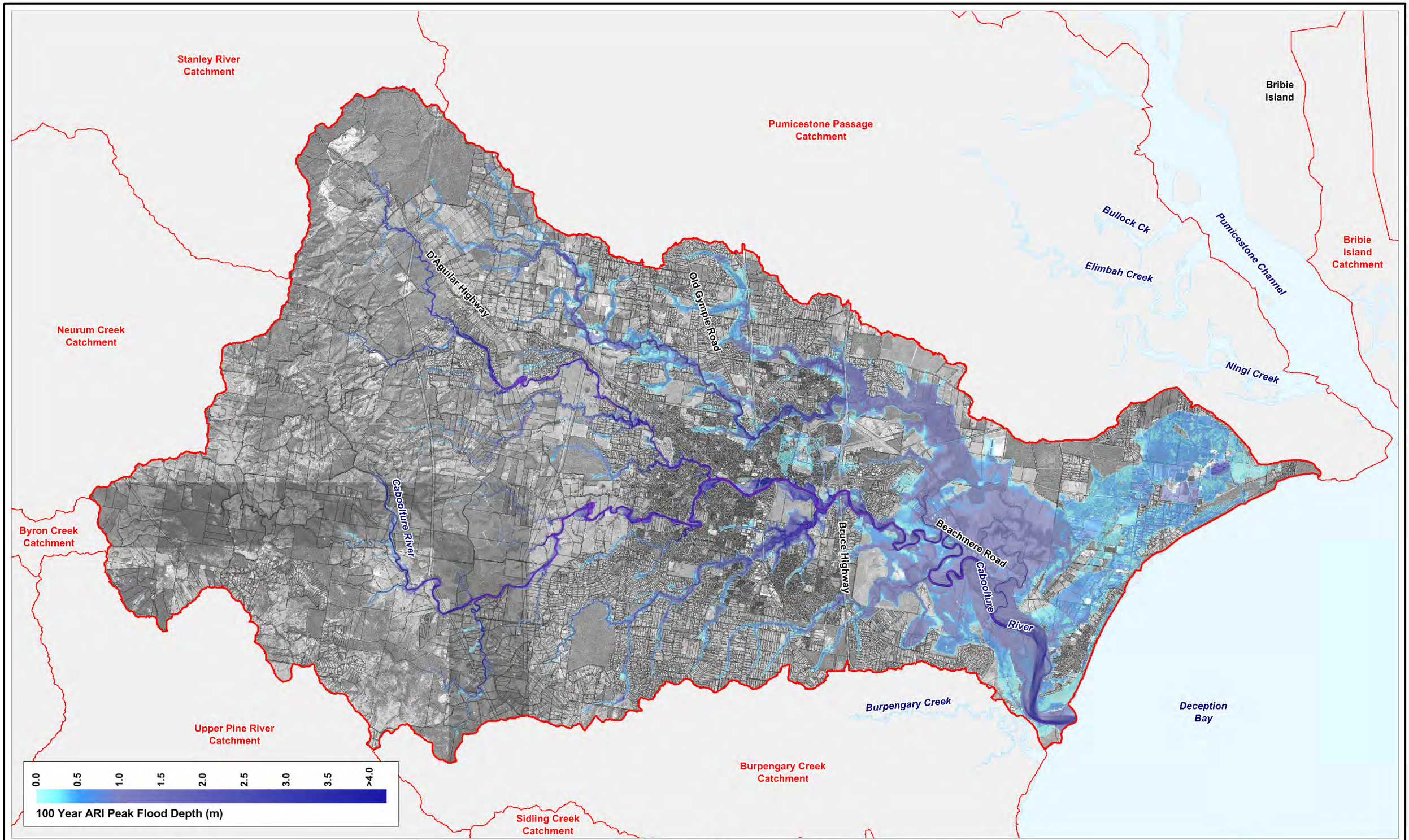
N

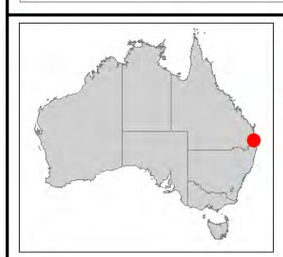
0km 3 6

Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath : I:\B18104_I_BRH Moreton Bay AK\DRG\Caboolture_Report\FLD_006_120601_Peak Flood Level 100Year ARI.WOR





LEGEND

Caboolture Catchment Boundary

Cadastral Boundaries

Title:

Peak Flood Depth Map – 100 Year ARI

Figure: **E2**

Rev: **A**

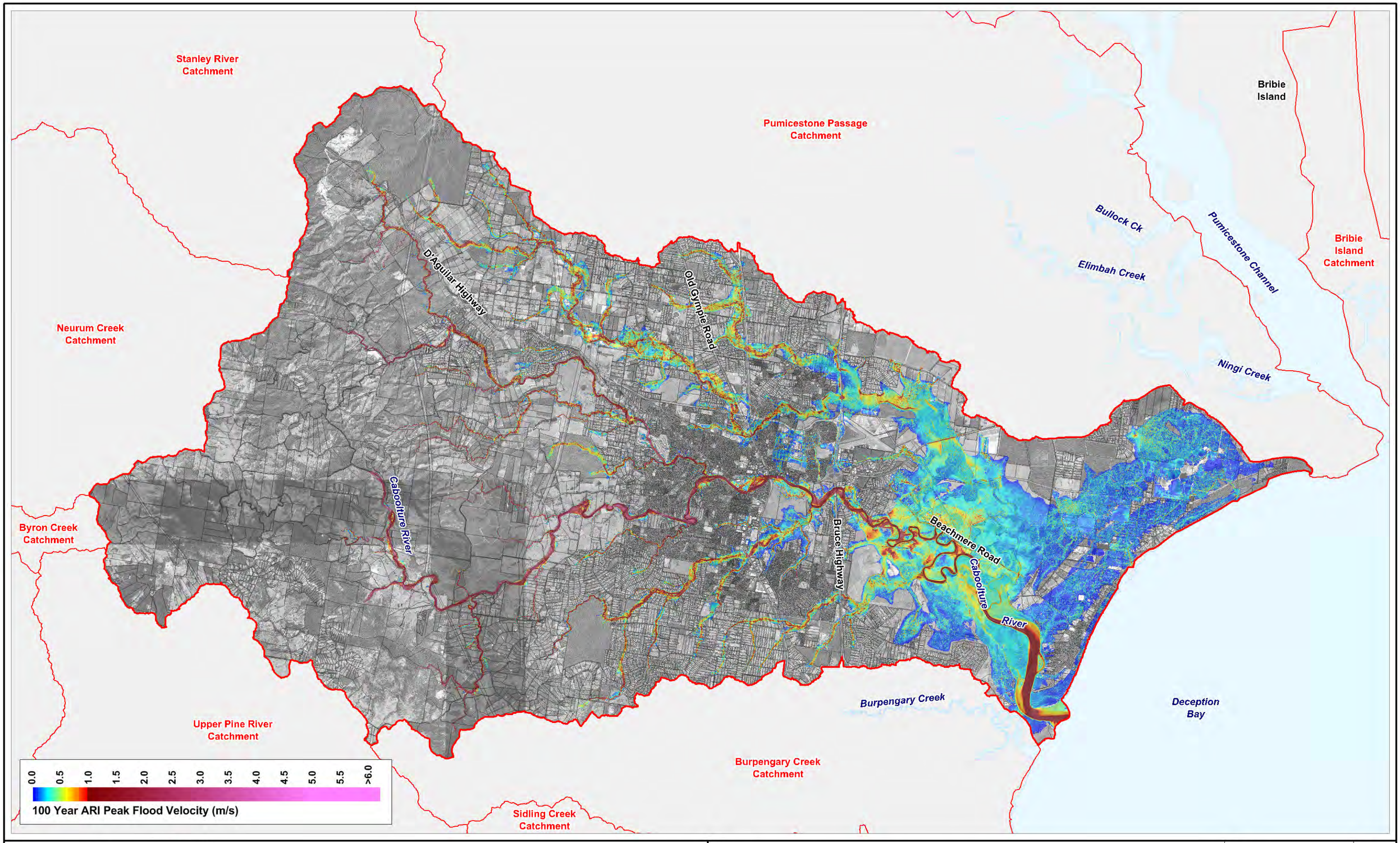
N

0km 3 6

Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath : I:\B18104_I_BRH Moreton Bay AK\DRG\Caboolture_Report\FLD_007_120601_Peak Flood Depth 100Year ARI.WOR



LEGEND

Caboolture Catchment Boundary

Cadastral Boundaries

Title:

Peak Flood Velocity Map – 100 Year ARI

Figure: **E3**

Rev: **A**

N

0km 3 6

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : I:\B18104_I_BRH Moreton Bay AK\DRG\Caboolture_Report\FLD_008_120601_Peak Flood Velocity 100Year ARI.WOR

Stanley River Catchment

Pumicestone Passage Catchment

Bribie Island

Bullock Ck

Pumicestone Channel

Bribie Island Catchment

Elimbah Creek

Neurum Creek Catchment

D'Aguilar Highway

Old Gympie Road

Ningi Creek

Caboolture River

Byron Creek Catchment

Bruce Highway

Beachmere Road

Caboolture River

Burpengary Creek

Deception Bay

Upper Pine River Catchment

Burpengary Creek Catchment

Sidling Creek Catchment

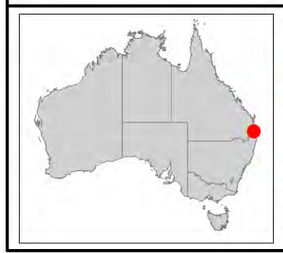
Hays Inlet Catchment

Redcliffe Catchment

0 1 2 3 4 5 6 7 8 9 >10

0 50 100 150 200 250 300 350 400 450 >500

100 Year ARI Peak Flood Stream Power



LEGEND

Caboolture Catchment Boundary

Cadastral Boundaries

Note:
Stream power is a function of velocity and bed shear stress.

Title:

Peak Flood Stream Power Map – 100 Year ARI

Figure: **E4**

Rev: **A**

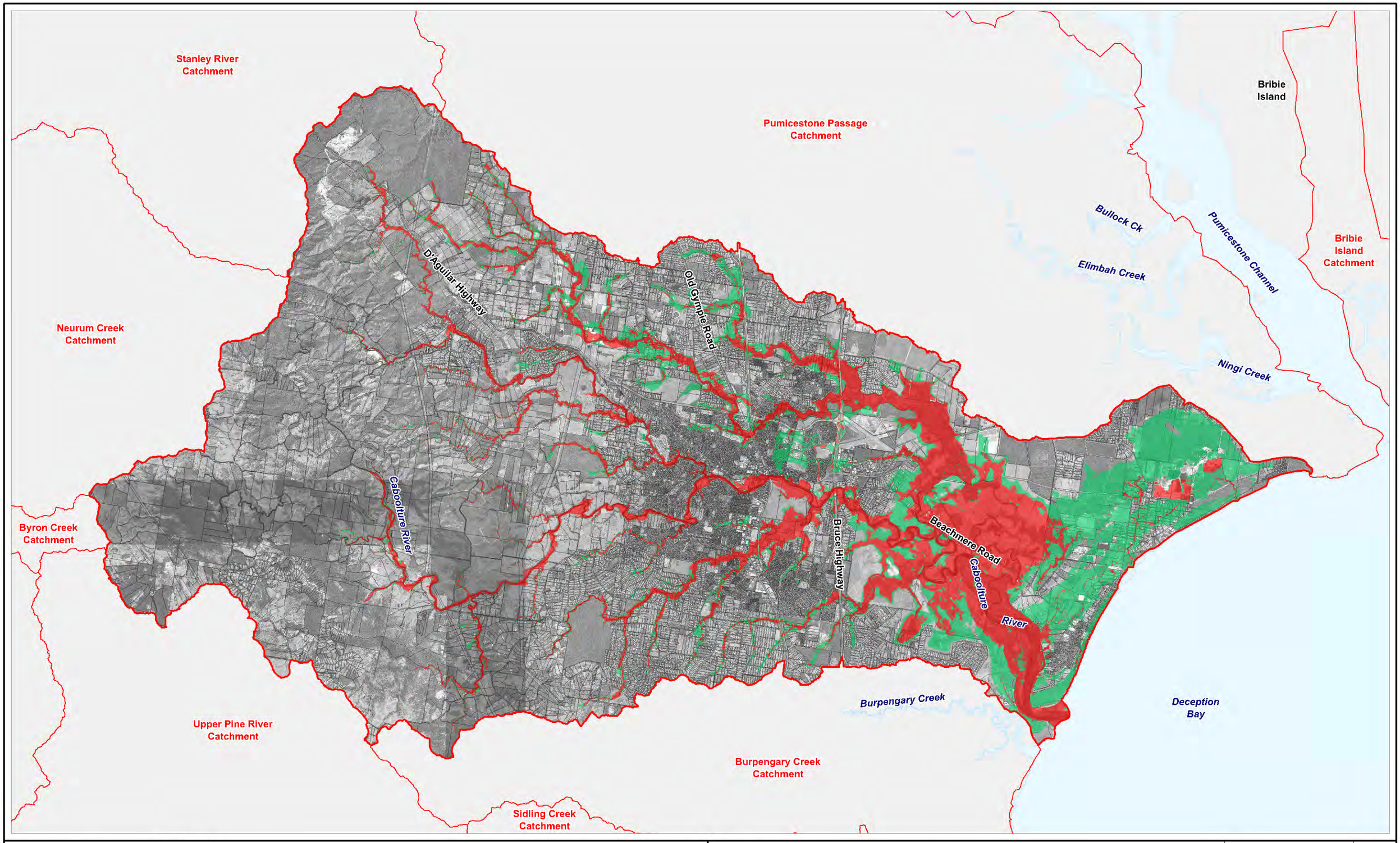
N

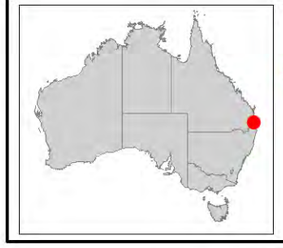
0km 3 6

Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath : I:\B18104_I_BRH Moreton Bay AK\DRG\Caboolture_Report\FLD_009_120601_Peak Flood Stream Power 100Year ARI.WOR





LEGEND

Caboolture Catchment Boundary

Cadastral Boundaries

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

Low Hazard

High Hazard

Title:

Peak Flood Hazard Map – 100 Year ARI

Figure: **E5**

Rev: **A**

N

0km 3 6

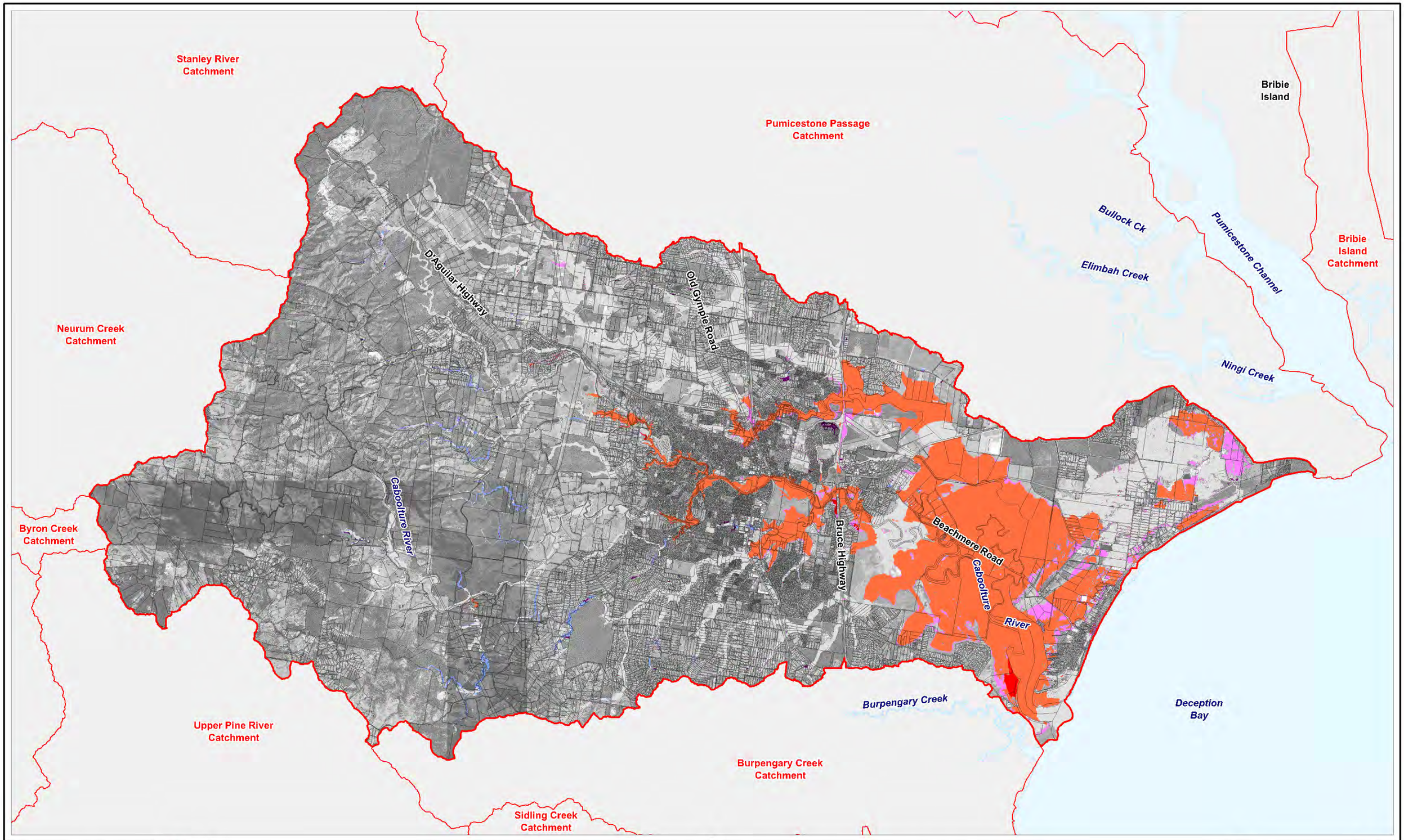
Approx. Scale

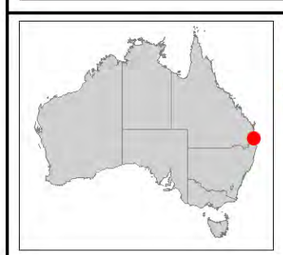
BMT WBM

www.bmtwbm.com.au

Filepath : I:\B18104_I_BRH Moreton Bay AK\DRG\Caboolture_Report\FLD_010_120601_Peak Flood Hazard 100Year ARI.WOR

APPENDIX F





LEGEND

Caboolture Catchment Boundary

Cadastral Boundaries

Difference in Peak Levels (m)

- < -0.5
- -0.5 to -0.1
- -0.1 to 0.1
- 0.1 to 0.5
- > 0.5
- Was dry now wet
- Was wet now dry

Title:

100 Year EDS Minus 100 Year 3 Hour, 6 Hour and 12 Hour Storm

Figure: **F1**

Rev: **A**

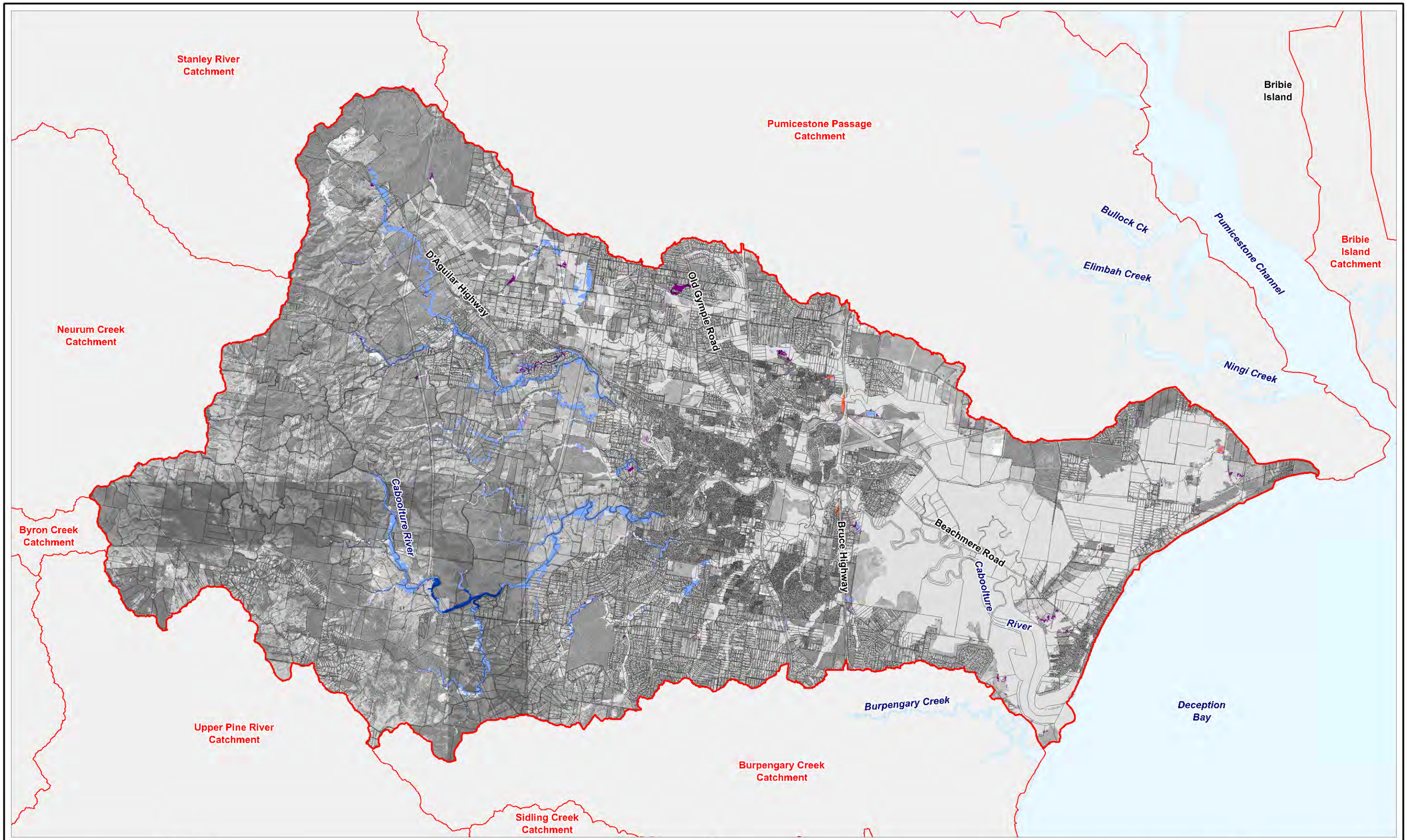
N

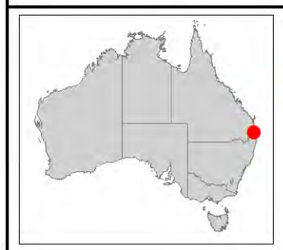
0km 3 6

Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath : I:\B18104_I_BRH Moreton Bay AK\DRG\Caboolture_Report\FLD_011_120601_S1 Flood Level Diff Bet EDS and Selected Critical Storm Durations 100Year Event.WOR





LEGEND

Caboolture Catchment Boundary

Cadastral Boundaries

Difference in Peak Levels (m)

- < -0.5
- -0.5 to -0.1
- -0.1 to 0.1
- 0.1 to 0.5
- > 0.5
- Was dry now wet
- Was wet now dry

Title:

Increased Roughness Scenario (S2) Minus 100 Year EDS

Figure: **F2**

Rev: **A**

N

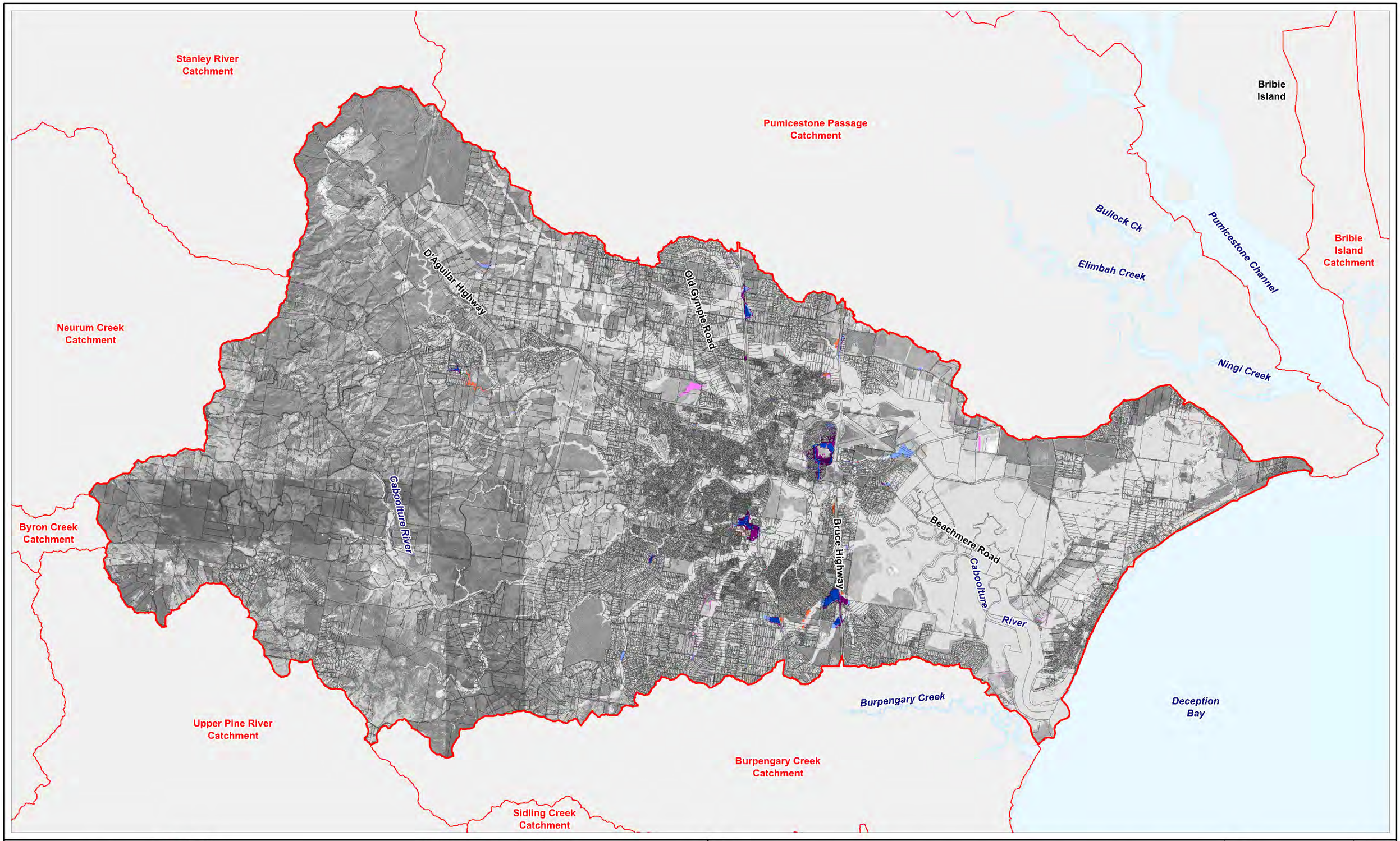
0km 3 6

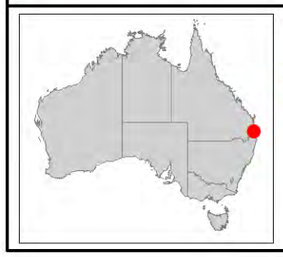
Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : I:\B18104_I_BRH Moreton Bay AK\DRG\Caboolture_Report\FLD_012_120523_Increase in Roughness Flood Level Impact 100Year EDS.WOR





LEGEND

Caboolture Catchment Boundary

Cadastral Boundaries

Difference in Peak Levels (m)

- < -0.5
- -0.5 to -0.1
- -0.1 to 0.1
- 0.1 to 0.5
- > 0.5
- Was dry now wet
- Was wet now dry

Title:

Culvert Blockage Scenario (S3) Minus 100 Year EDS

Figure: **F3**

Rev: **A**

N

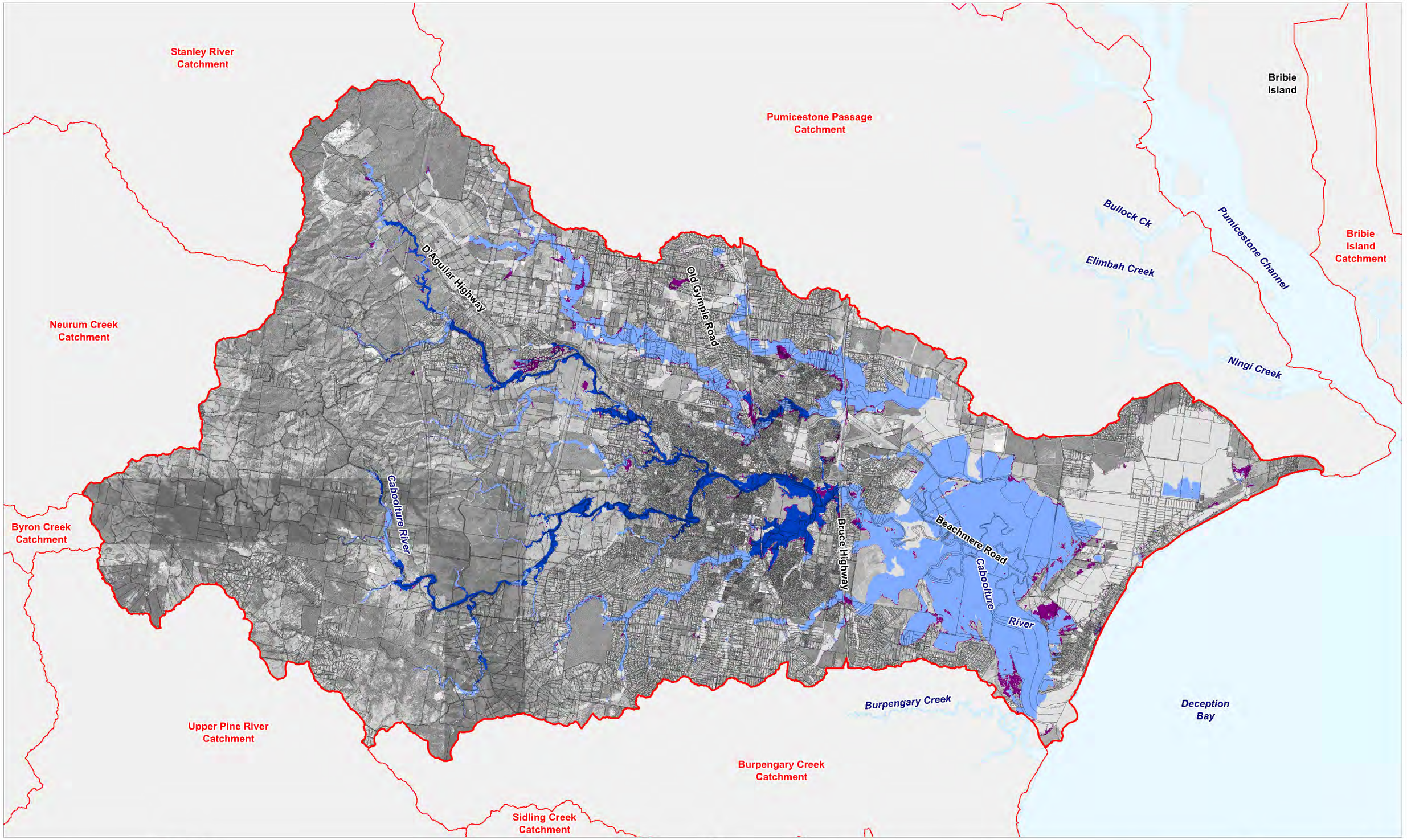
0km 3 6

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : I:\B18104_I_BRH Moreton Bay AK\DRG\Caboolture_Report\FLD_013_120523_Structure Blockage Flood Level Impact 100Year EDS.WOR



LEGEND

Caboolture Catchment Boundary

Cadastral Boundaries

Difference in Peak Levels (m)

- < -0.5
- -0.5 to -0.1
- -0.1 to 0.1
- 0.1 to 0.5
- > 0.5
- Was dry now wet
- Was wet now dry

Title:

Increased Rainfall Scenario (S4) Minus 100 Year EDS

Figure: **F4**

Rev: **A**

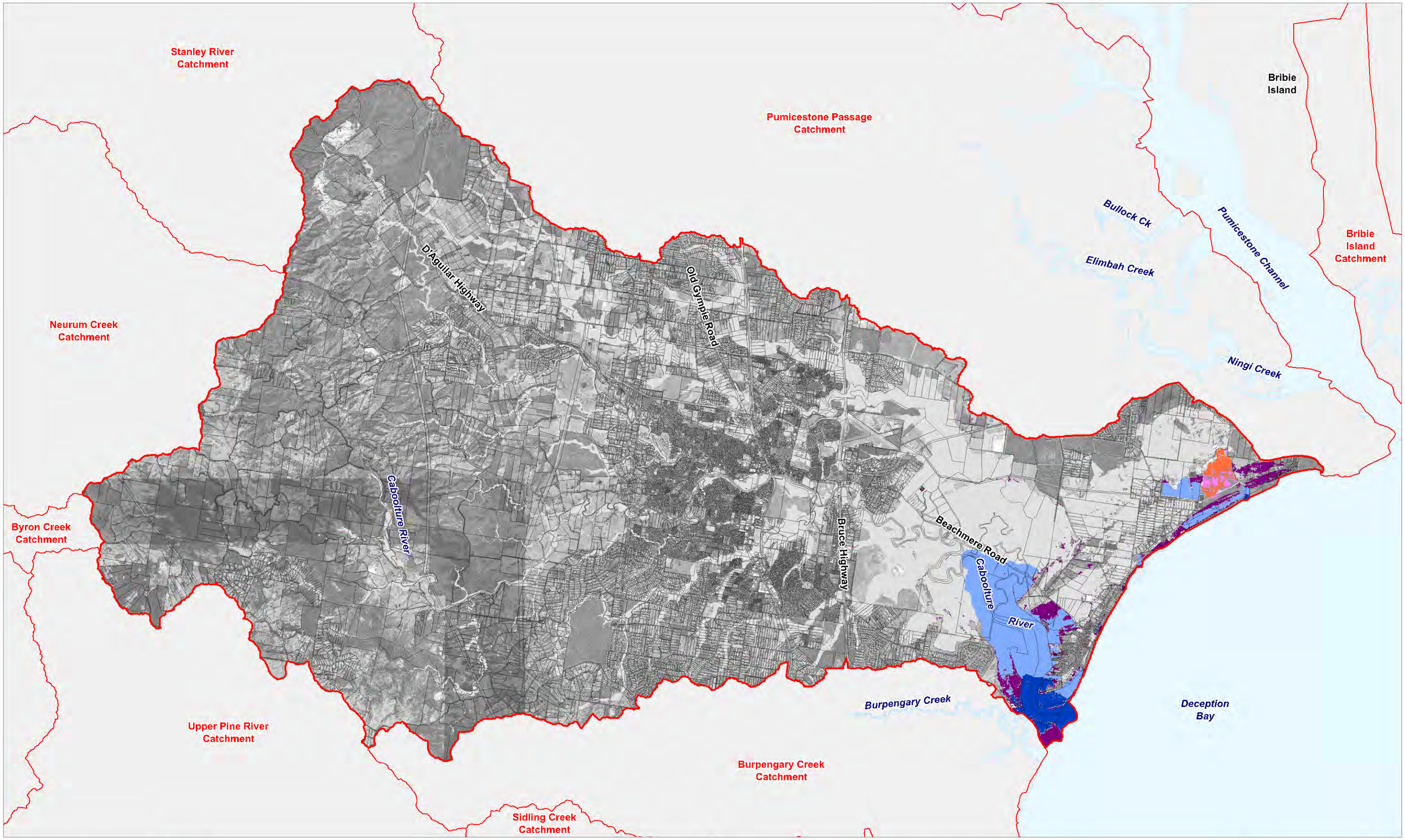
N

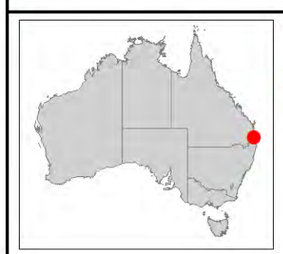
0km 3 6

Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath : I:\B18104_I_BRH Moreton Bay AK\DRG\Caboolture_Report\FLD_014_120523_Increase in Rainfall Flood Level Impact 100Year EDS.WOR





LEGEND

Caboolture Catchment Boundary

Cadastral Boundaries

Difference in Peak Levels (m)

- < -0.5
- -0.5 to -0.1
- -0.1 to 0.1
- 0.1 to 0.5
- > 0.5
- Was dry now wet
- Was wet now dry

Title:

Increased Downstream Boundary Scenario (S5) Minus 100 Year EDS

Figure: **F5**

Rev: **A**

N

0km 3 6

Approx. Scale

BMT WBM
www.bmtwbm.com.au

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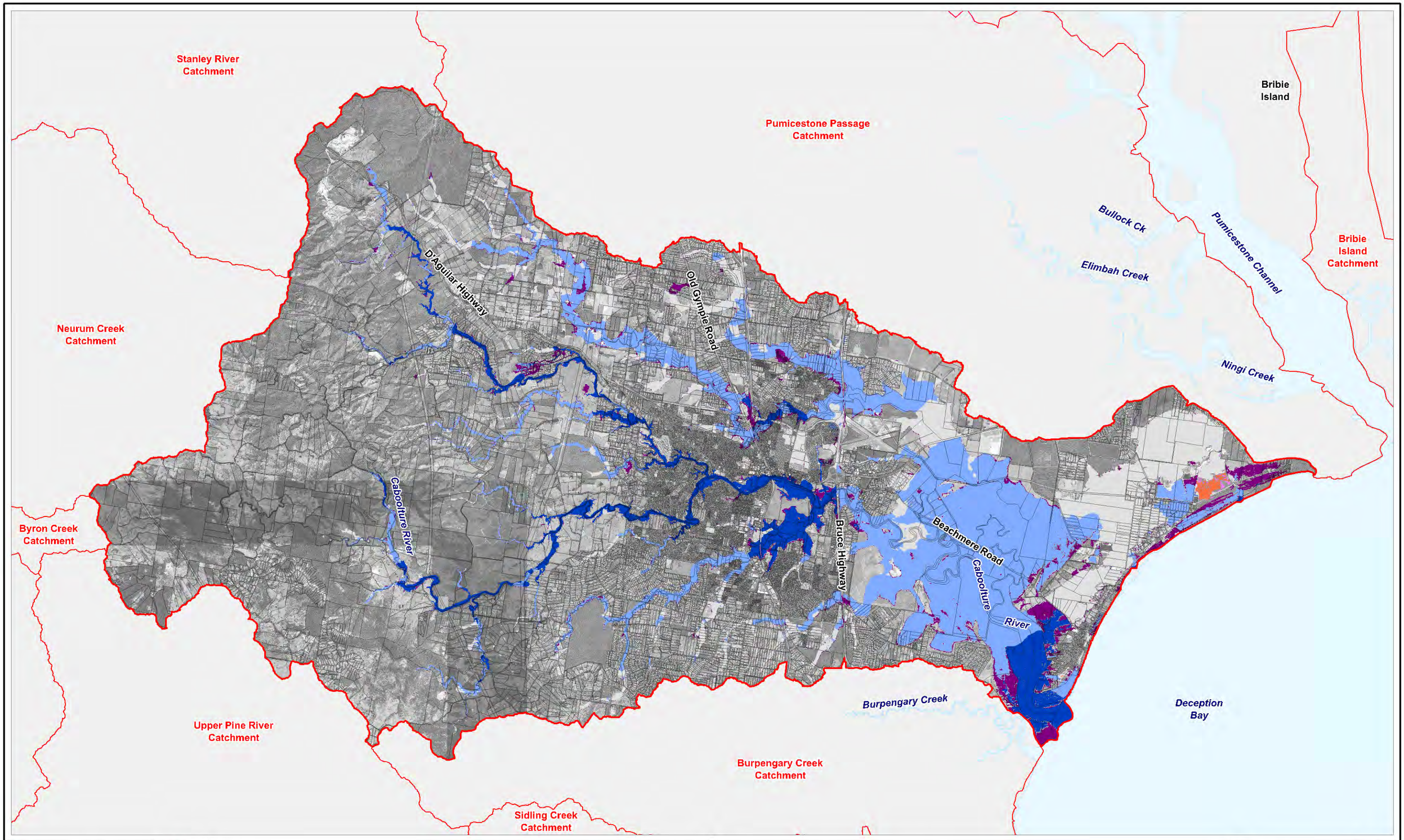

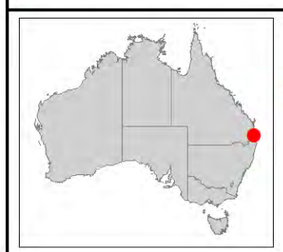

LEGEND

Caboolture Catchment Boundary

Cadastral Boundaries

Difference in Peak Levels (m)

- < -0.5
- -0.5 to -0.1
- -0.1 to 0.1
- 0.1 to 0.5
- > 0.5
- Was dry now wet
- Was wet now dry

Title:

Increased Downstream Boundary and Rainfall Scenario (S6) Minus 100 Year EDS

Figure: **F6**

Rev: **A**

N

0km 3 6

Approx. Scale

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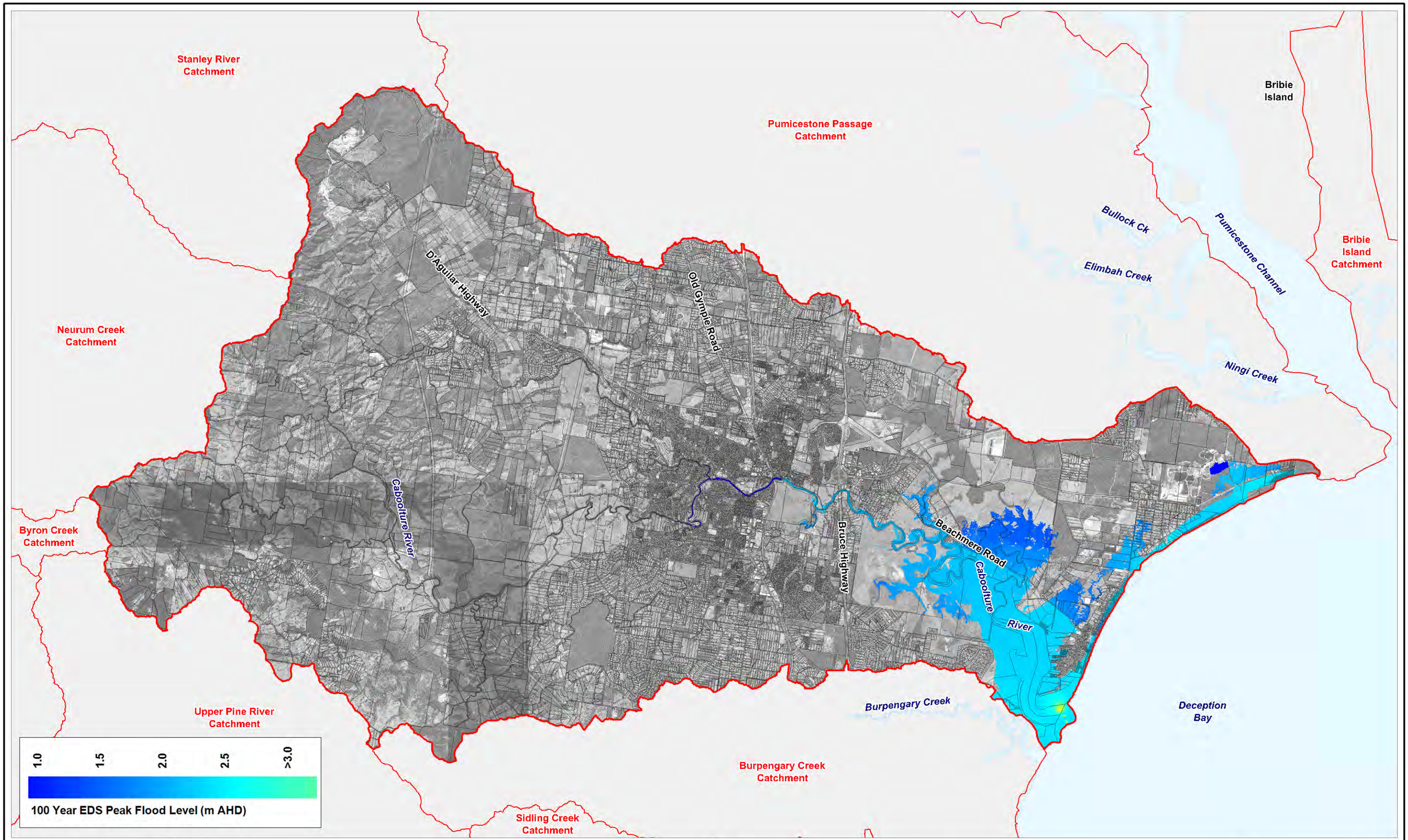
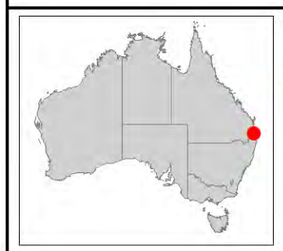
Filepath : I:\B18104_I_BRH Moreton Bay AK\DRG\Caboolture_Report\FLD_016_120523_Increase in Rainfall and Downstream Bdy Flood Level Impact 100Year EDS.WOR





LEGEND

Caboolture Catchment Boundary

Cadastral Boundaries

Title:

Dynamic Storm Tide Peak Flood Level – 100 Year EDS (S7)

Figure: **F7**

Rev: **A**

N

0km 3 6

Approx. Scale

BMT WBM

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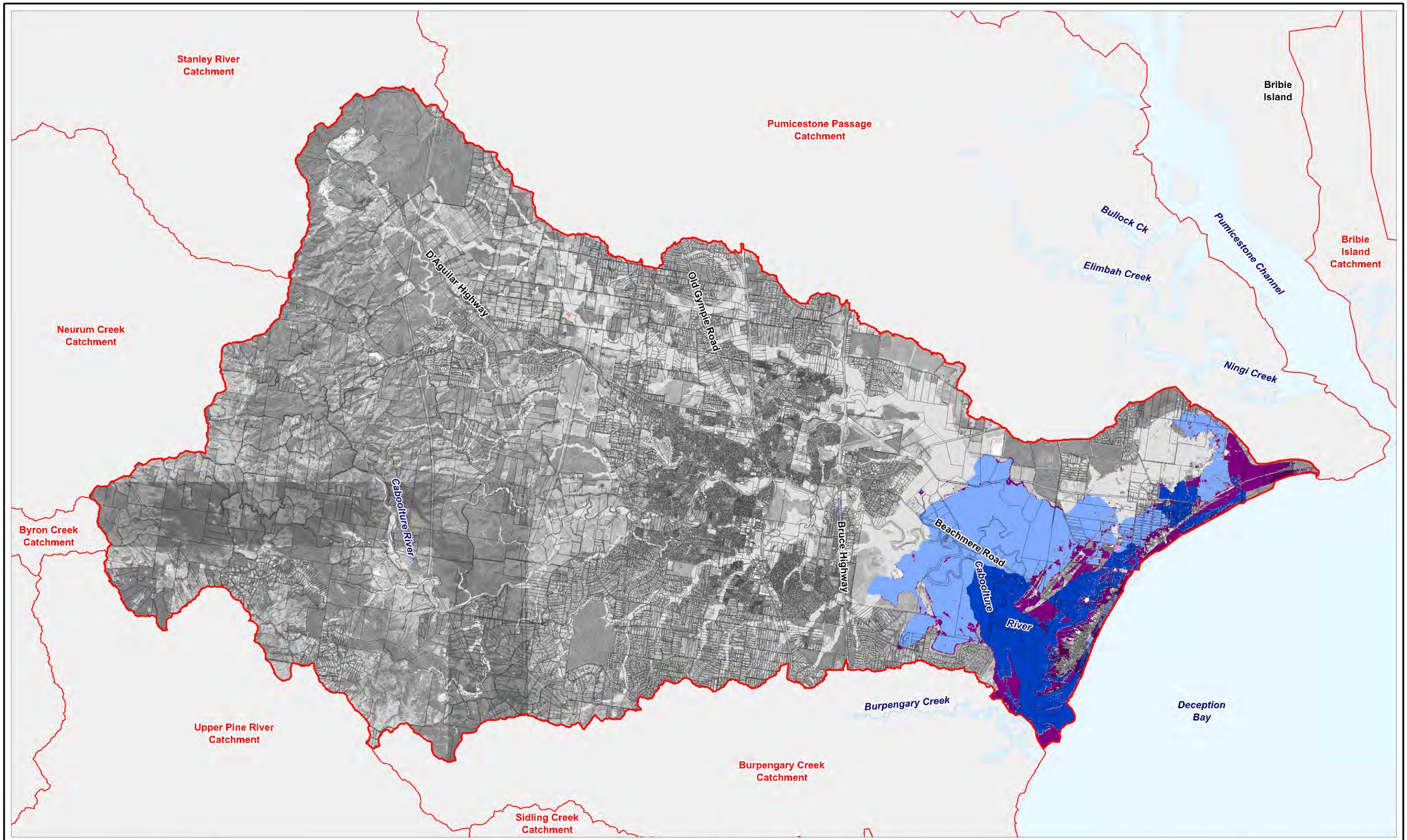
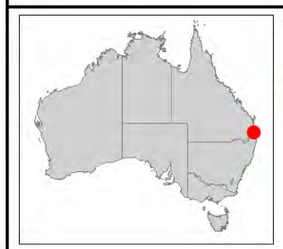
Filepath : I:\B18104_I_BRH Moreton Bay AK\DRG\Caboolture_Report\FLD_017_120523_Dynamic Storm Tide Peak Flood Level 100Year EDS.wor





LEGEND

Caboolture Catchment Boundary

Cadastral Boundaries

Difference in Peak Levels (m)

- < -0.5
- -0.5 to -0.1
- -0.1 to 0.1
- 0.1 to 0.5
- > 0.5
- Was dry now wet
- Was wet now dry

Title:

Static Storm Tide Scenario (S8) Minus 100 Year EDS

Figure: **F8**

Rev: **A**

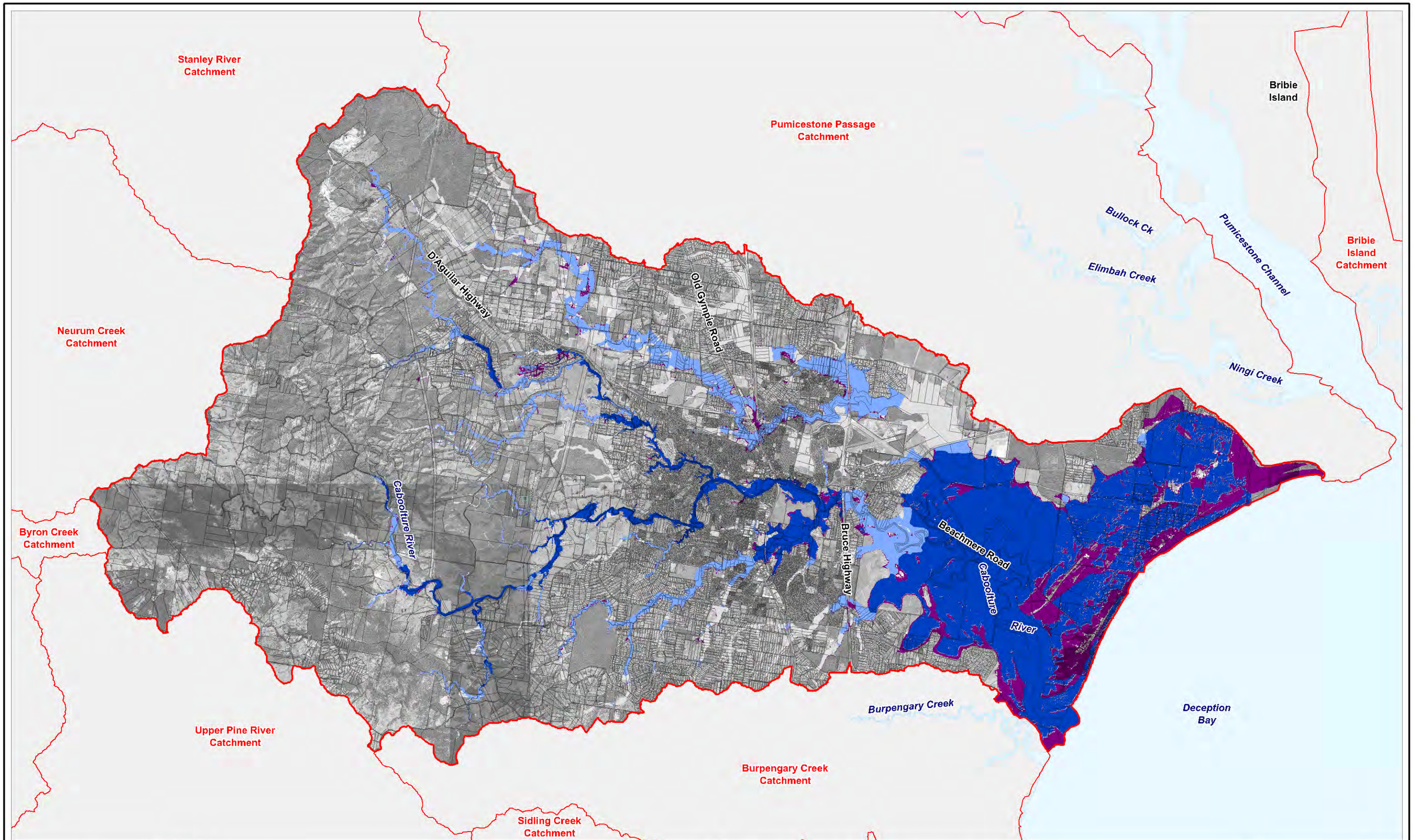
N

0km 3 6

Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath : I:\B18104_I_BRH Moreton Bay AK\DRG\Caboolture_Report\FLD_018_120523_Static Storm Tide Flood Level Impact 100Year EDS.WOR



LEGEND

Caboolture Catchment Boundary

Cadastral Boundaries

Difference in Peak Levels (m)

- < -0.5
- -0.5 to -0.1
- -0.1 to 0.1
- 0.1 to 0.5
- > 0.5
- Was dry now wet
- Was wet now dry

Title:

Static Storm Tide, Increased Rainfall and Sea Level Rise Scenario (S9) Minus 100 Year EDS

Figure: **F9**

Rev: **A**

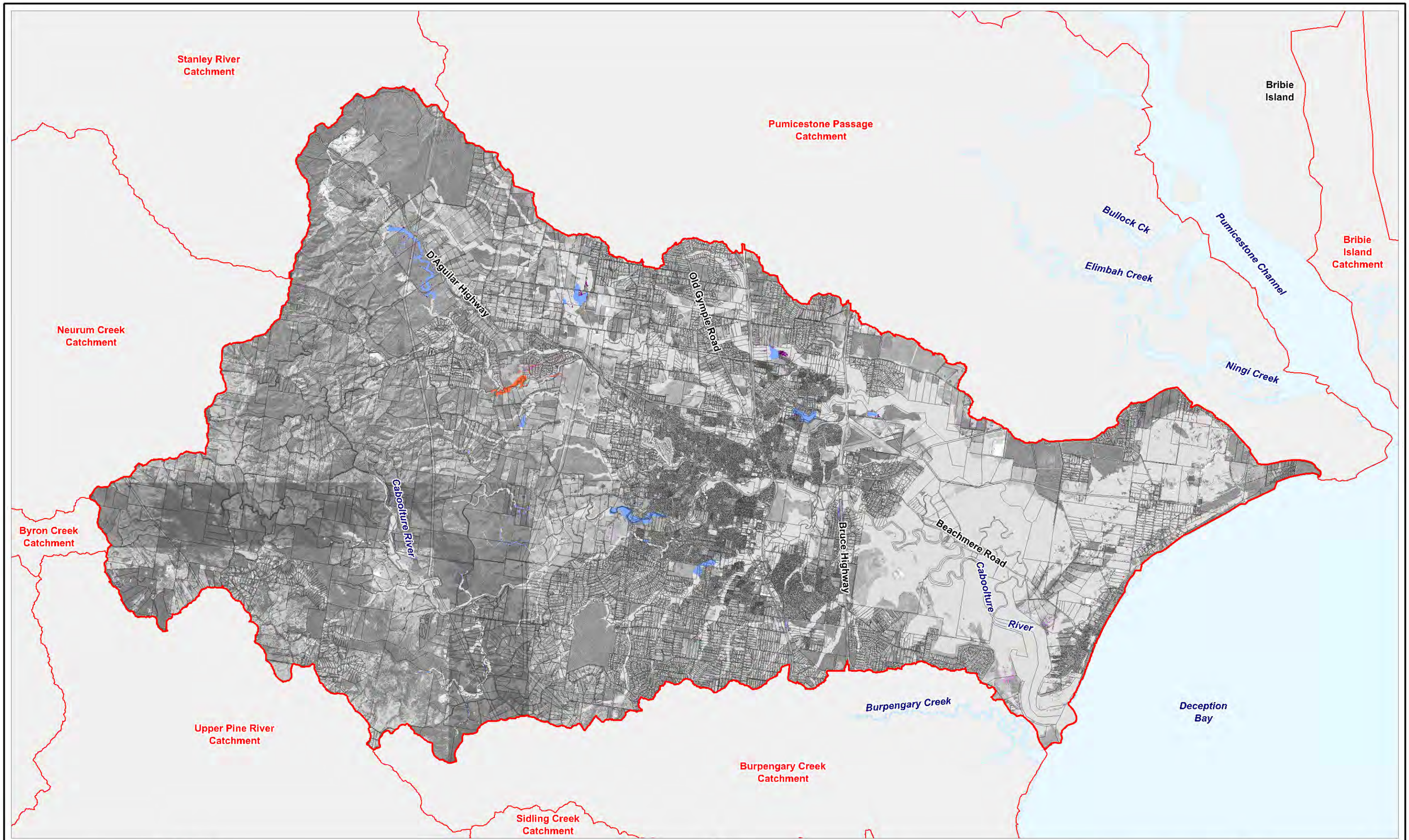
N

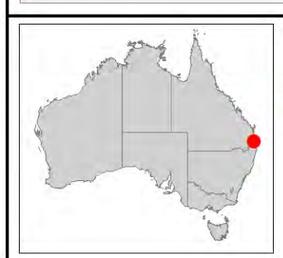
0km 3 6

Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath : I:\B18104_I_BRH Moreton Bay AK\DRG\Caboolture_Report\FLD_019_120523_Static Storm Tide and Climate Change Flood Level Impact 100Year EDS.WOR





LEGEND

Caboolture Catchment Boundary

Cadastral Boundaries

Difference in Peak Levels (m)

- < -0.5
- -0.5 to -0.1
- -0.1 to 0.1
- 0.1 to 0.5
- > 0.5
- Was dry now wet
- Was wet now dry

Title:

Increased Vegetation Scenario (S10) Minus 100 Year EDS

Figure: **F10**

Rev: **A**

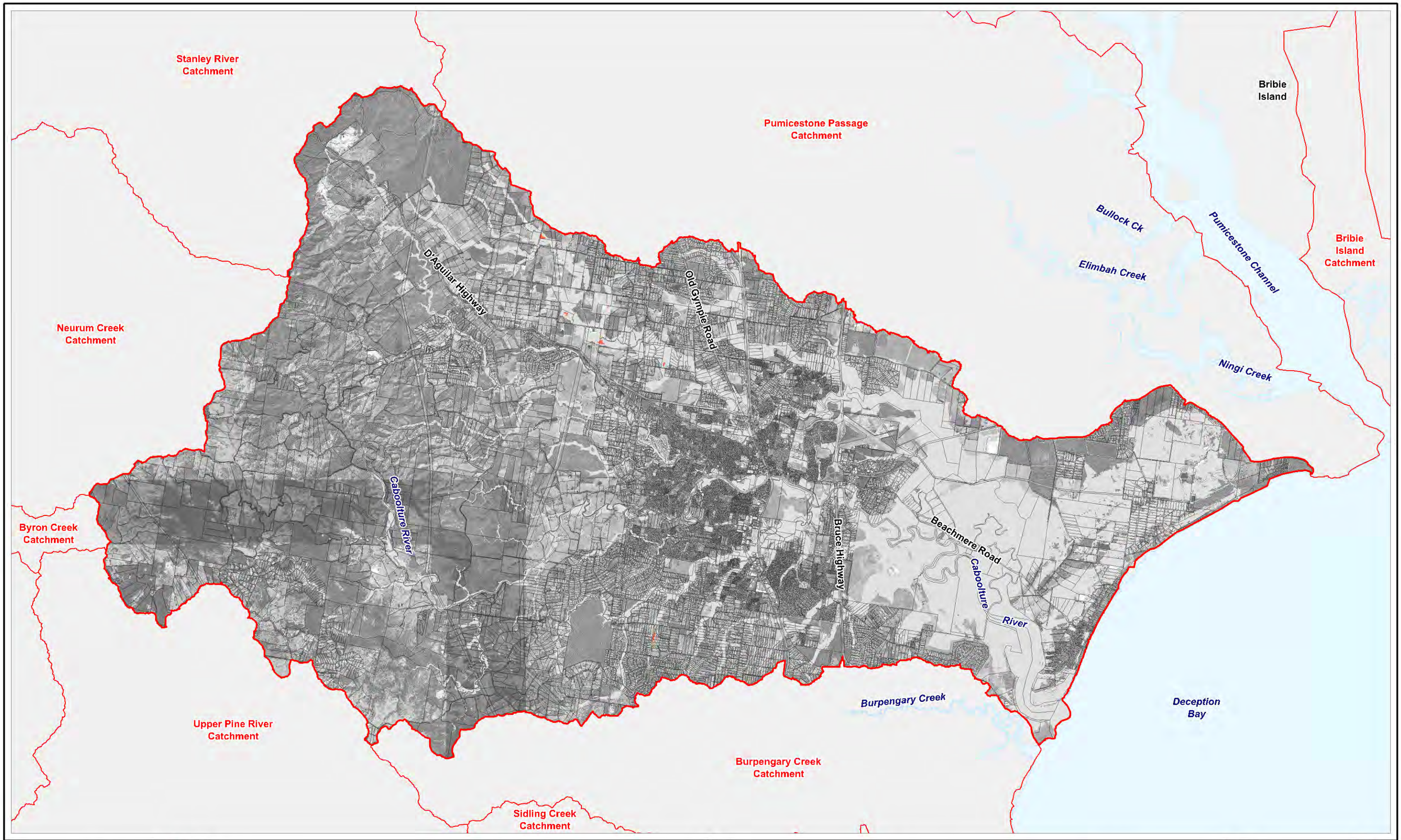
N

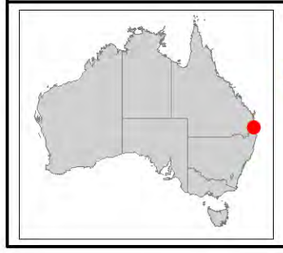
0km 3 6

Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath : I:\B18104_I_BRH Moreton Bay AK\DRG\Caboolture_Report\FLD_020_120523_Increase in Vegetation Flood Level Impact 100Year EDS.WOR





LEGEND

Caboolture Catchment Boundary

Cadastral Boundaries

Difference in Peak Levels (m)

- < -0.5
- -0.5 to -0.1
- -0.1 to 0.1
- 0.1 to 0.5
- > 0.5
- Was dry now wet
- Was wet now dry

Title:

Increased Residential Development Scenario (S11) Minus 100 Year EDS

Figure: **F11**

Rev: **A**

N

0km 3 6

Approx. Scale

BMT WBM
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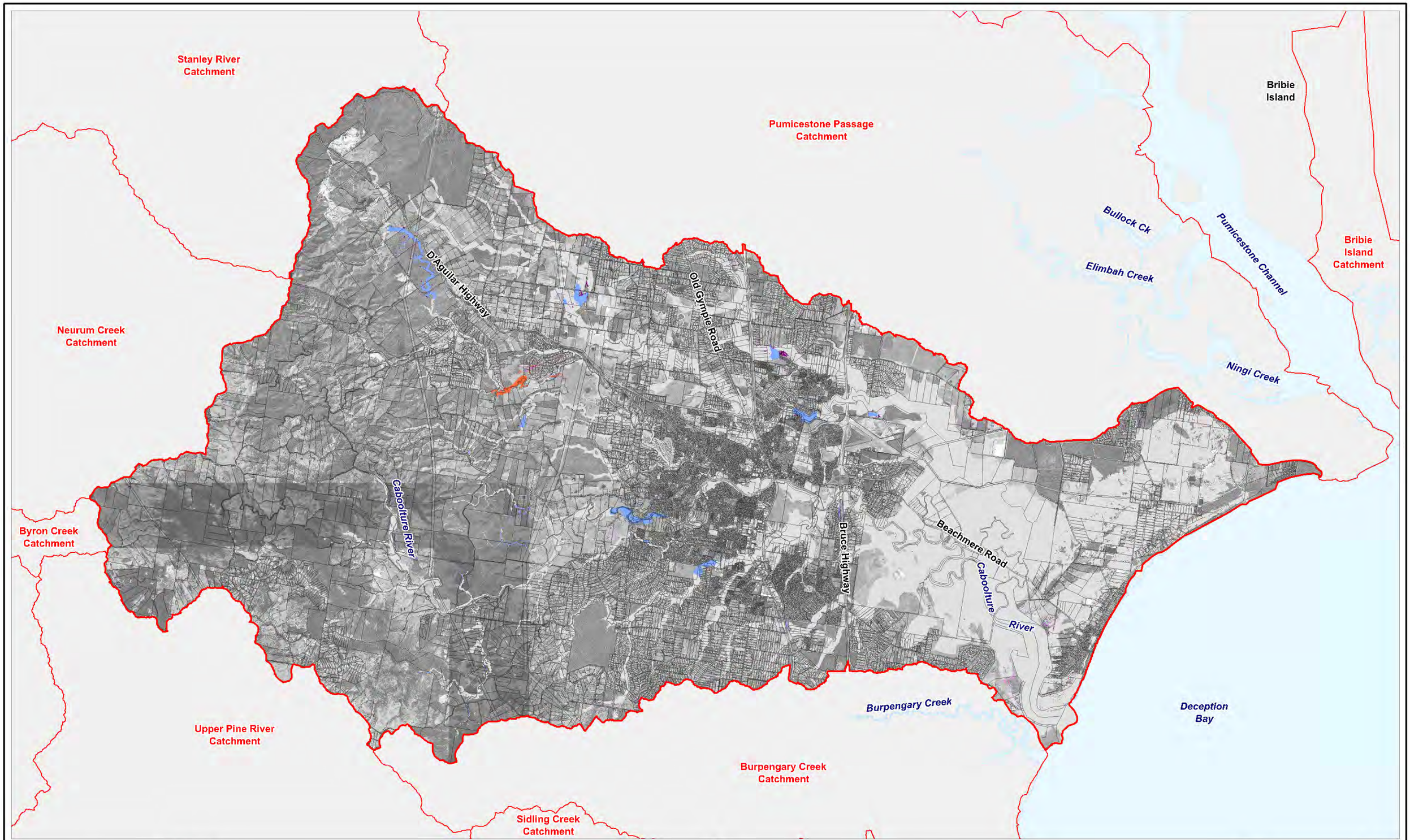
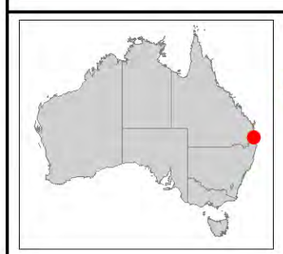
Filepath : I:\B18104_I_BRH Moreton Bay AK\DRG\Caboolture_Report\FLD_021_120523_Increase in Residential Development Flood Level Impact 100Year EDS.WOR





LEGEND

Caboolture Catchment Boundary

Cadastral Boundaries

Difference in Peak Levels (m)

- < -0.5
- -0.5 to -0.1
- -0.1 to 0.1
- 0.1 to 0.5
- > 0.5
- Was dry now wet
- Was wet now dry

Title:

Increased Residential Development and Vegetation Scenario (S12) Minus 100 Year EDS

Figure: **F12**

Rev: **A**

N

0km 3 6

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : I:\B18104_I_BRH Moreton Bay AK\DRG\Caboolture_Report\FLD_022_120523_Increase in Veg and Residential Development Flood Level Impact 100Year EDS.WOR

Moreton Bay Regional Council

Emergency Management EMQ Queensland

Australian Goverment
Attorney-General's Department
Emergency Management Australia

Queensland Government