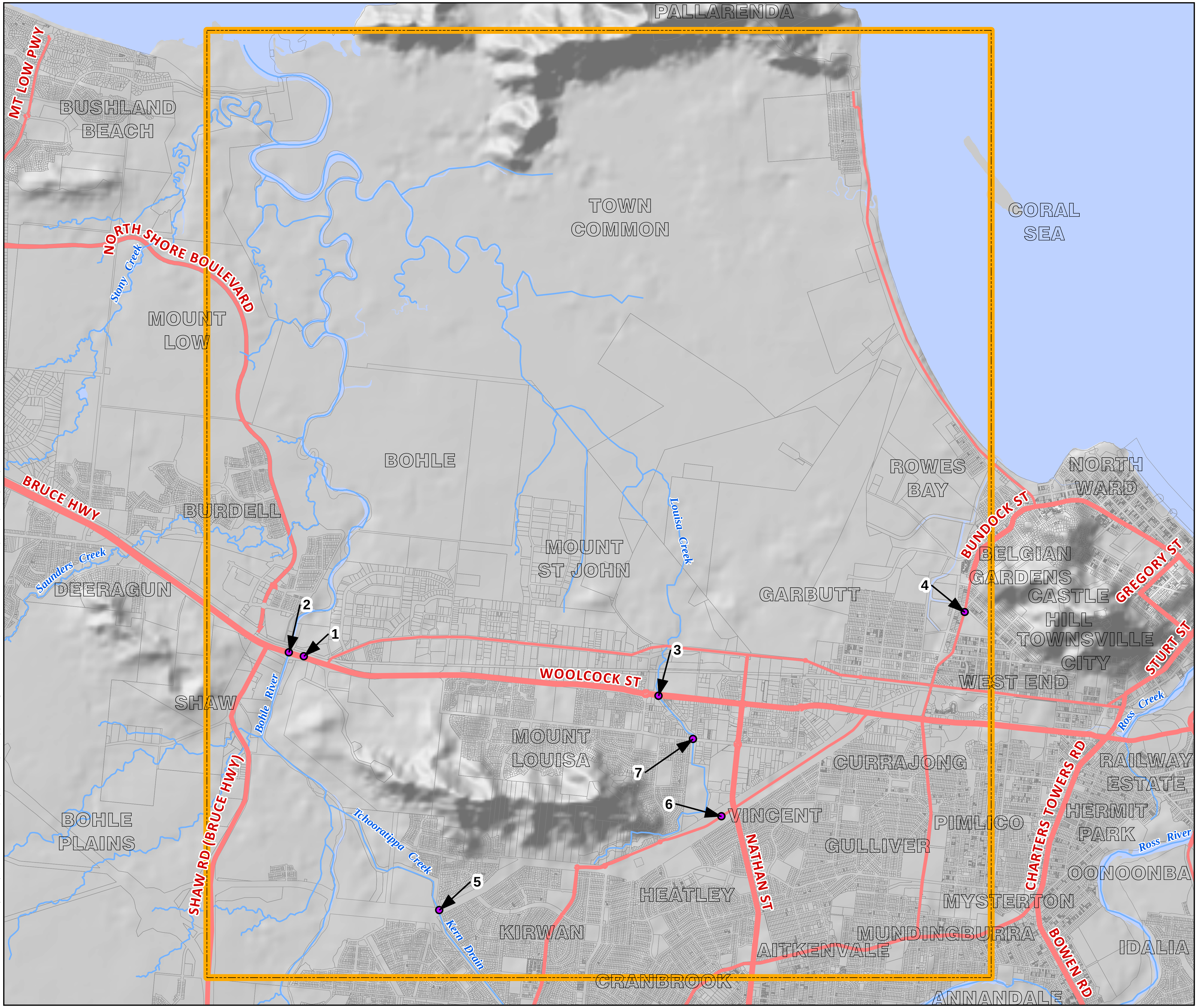
TOWNSVILLE CITY COUNCIL
LOUISA CREEK FLOOD STUDY

Location of Flooding Affecting Major Arterial Roads
Figure 4-1



Legend

- Locations Assessed
- Highways
- Main Roads
- Watercourse
- Property Boundaries
- Model Extent

0 500 1,000 2,000
Metres

1:45,000 (when printed at A3)

N

Coordinate System: GDA 1994 MGA Zone 55

Data sources:
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4.3 Sensitivity Analysis

4.3.1 Tidal Level Sensitivity

The sensitivity of the Captains Creek hydraulic model was assessed for changes in the downstream boundary condition. Figure 4-2 and Figure 4-3 show results of the sensitivity test for the 50 year and 100 year ARI 1 hour events respectively where the ocean boundary condition is increased to Highest Astronomical Tide (HAT) at 2.25 m AHD.

The results show that if the ocean boundary is increased to HAT, there is a 100 – 500 mm increase in flood depths in the lower reaches of Bohle River, Captains Creek and the Town Common floodplain which extends upstream to Ingham Road. There is also an increase in flood level greater than 0.5 m at Three Mile Creek, Pallarenda.

No additional residential properties are inundated when the ocean boundary is increase to HAT (Refer Table 4-3).

4.3.2 Climate Change (with Sea Level Rise) Sensitivity

The impact of climate change was also assessed. Figure 4-4 and Figure 4-5 show results of the climate change sensitivity test for the 50 year and 100 year ARI 24 hour events respectively where the ocean boundary is increased by 0.8 m to allow for sea level rise and the rainfall intensity is increased by 15%.

The results of the climate change sensitivity analysis showed that the urban areas experience an increase in flood depths of up to 100 mm and the Town Common floodplain experiences an increase of generally up to 250 mm. The Bohle River upstream of Bruce Highway as well Louisa Creek, Captains Creek, Kern Drain and the Kirwan - Bohle drains experience an increase in flood depths of 100 – 250 mm. There is also an increase in flood level of 0.25 m - 0.5 m at Three Mile Creek, Pallarenda.

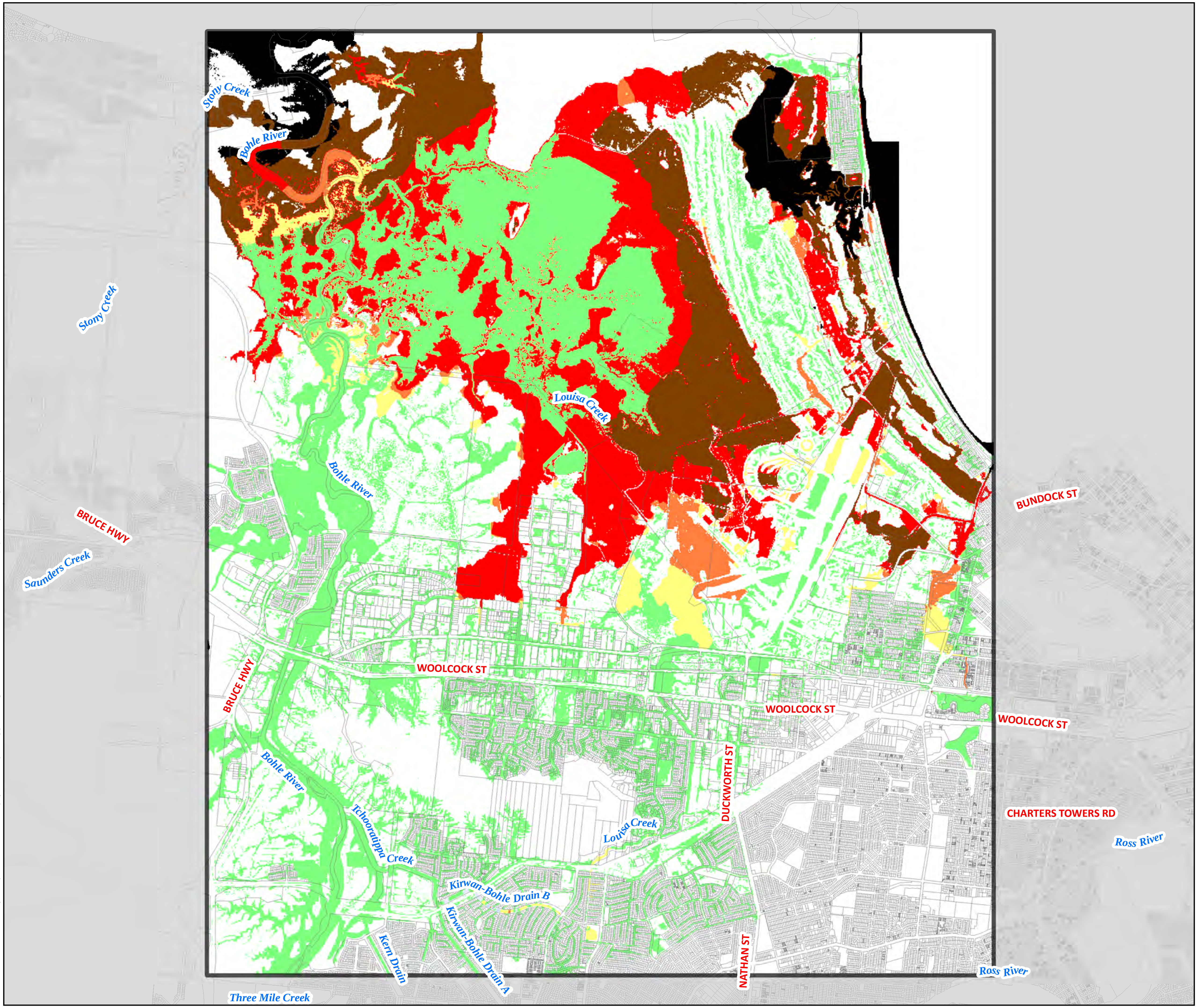
An additional 89 properties are inundated when the ocean boundary is increased by 0.8 m and the rainfall intensity is increased by 15% (Refer Table 4-3).

Table 4-3 Properties Inundated – Sensitivity Analysis

Event	Baseline Flooding	Tidal Level Sensitivity		Climate Change (with Sea Level Rise) Sensitivity	
	Properties Inundated	Properties Inundated	Additional Properties Inundated	Properties Inundated	Additional Properties Inundated
50 year ARI 1 hour duration	248	248	0	337	89
100 year ARI 1 hour duration	248	248	0	337	89

TOWNSVILLE CITY COUNCIL
LOUISA CREEK FLOOD STUDY

Tidal Boundary Sensitivity Analysis
Highest Astronomical Tide (HAT)
50 year ARI 1 hour event
Figure 4-2



Difference (m)

- Below -1
- -1 - -0.5
- -0.5 - -0.25
- -0.25 - -0.1
- -0.1 - -0.05
- -0.05 - -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.1
- 0.1 - 0.25
- 0.25 - 0.5
- Above 0.5

0 500 1,000 2,000
Metres

1:45,000 (when printed at A3)

Coordinate System: GDA 1994 MGA Zone 55

Data sources:
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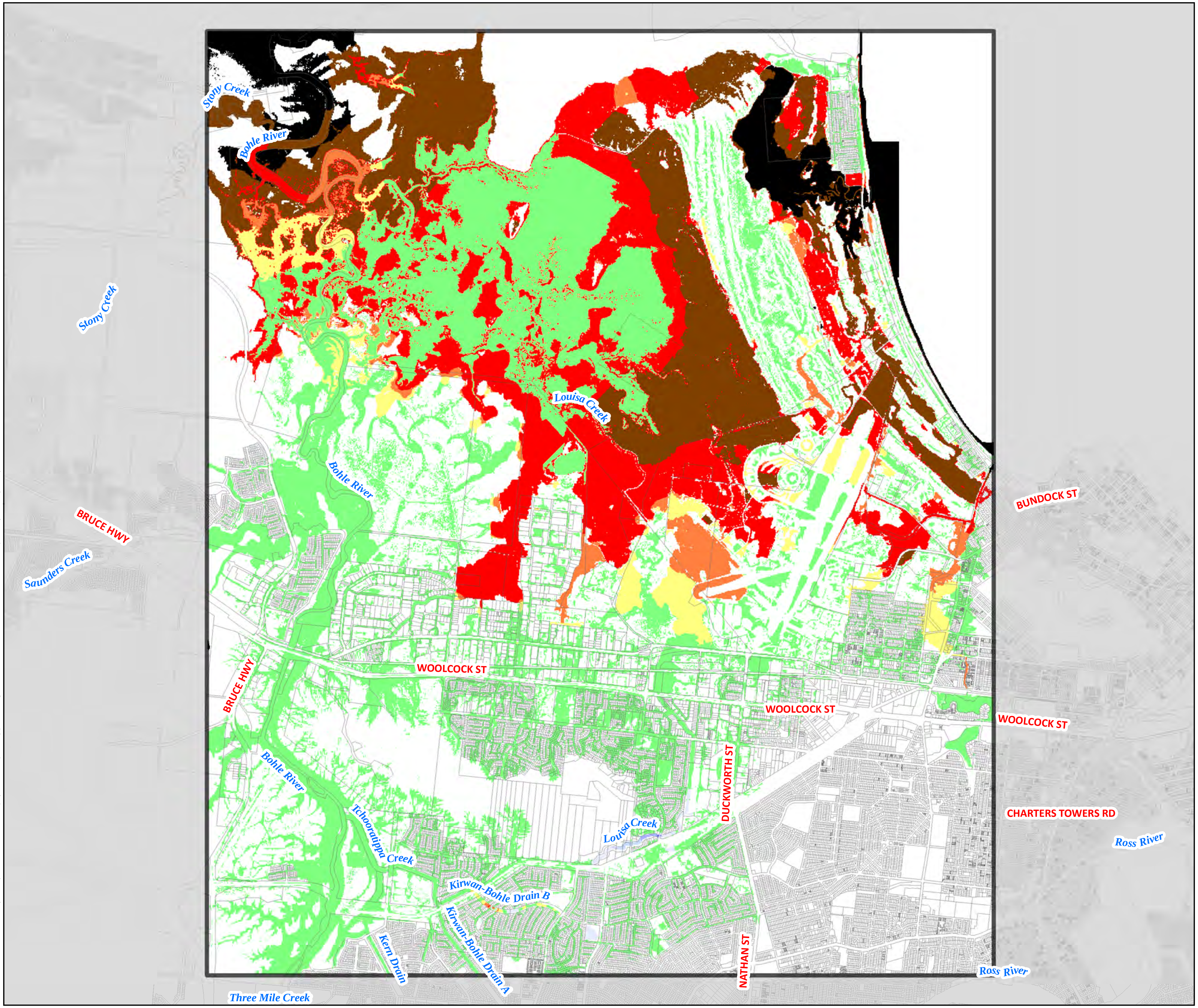

TOWNSVILLE CITY COUNCIL
LOUISA CREEK FLOOD STUDY

Tidal Boundary Sensitivity Analysis
Highest Astronomical Tide (HAT)
100 year ARI 1 hour event
Figure 4-3

Difference (m)

- Below -1
- -1 - -0.5
- -0.5 - -0.25
- -0.25 - -0.1
- -0.1 - -0.05
- -0.05 - -0.01
- -0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.1
- 0.1 - 0.25
- 0.25 - 0.5
- Above 0.5

0 500 1,000 2,000
Metres

1:45,000 (when printed at A3)

N

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Data sources:
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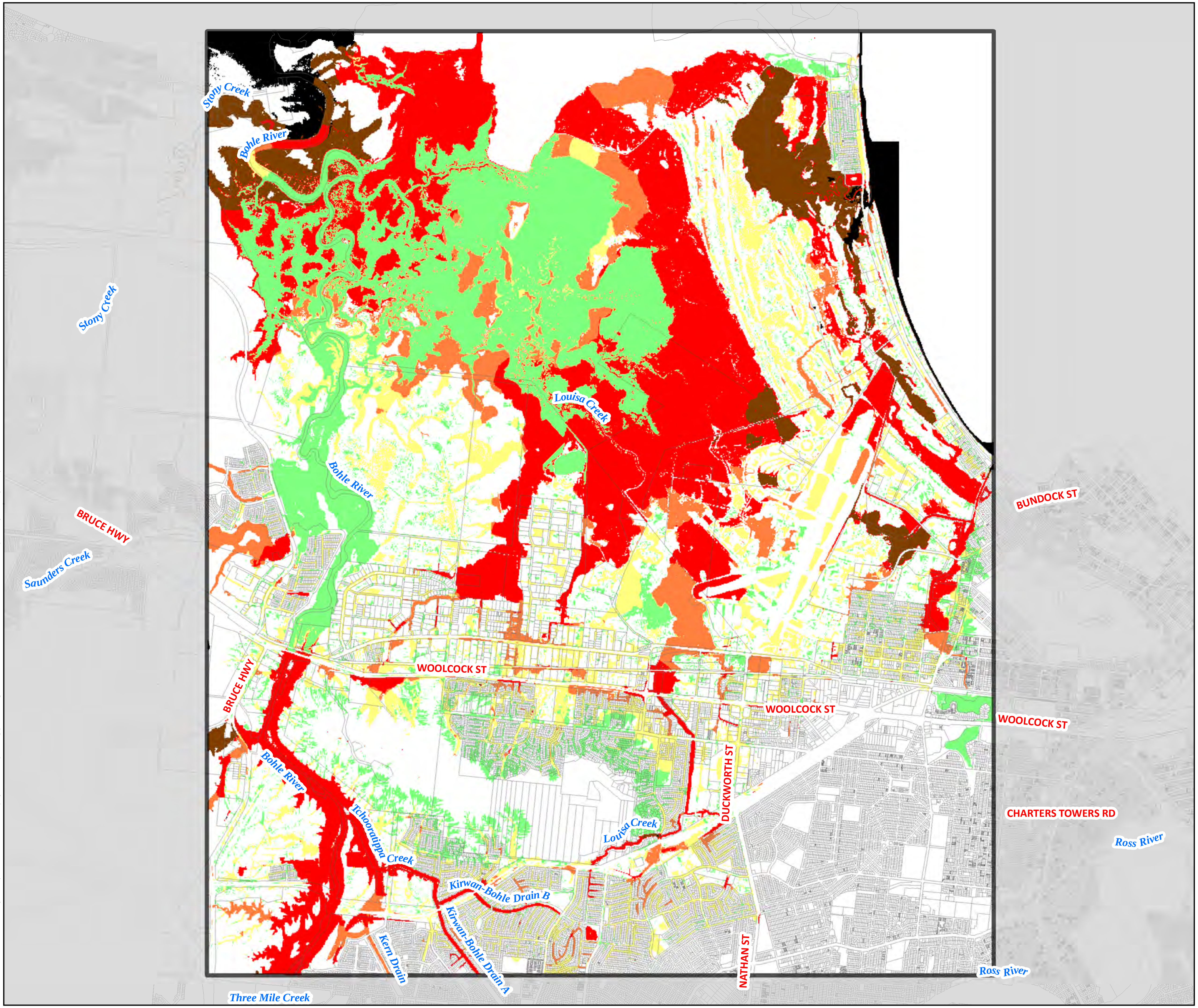
LOUISA CREEK FLOOD STUDY
Climate Change Sensitivity Analysis
0.8 m SLR on MHWS with
15% increase in rainfall intensity
50 year ARI 1 hour event
Figure 4-4



Difference (m)

Blue	Below -1
Purple	-1 - -0.5
Light purple	-0.5 - -0.25
Lavender	-0.25 - -0.1
Pale blue	-0.1 - -0.05
Very pale blue	-0.05 - -0.01
Green	-0.01 - 0.01
Yellow	0.01 - 0.05
Orange	0.05 - 0.1
Red	0.1 - 0.25
Brown	0.25 - 0.5
Black	Above 0.5

0 500 1,000 2,000
Metres

1:45,000 (when printed at A3)

N

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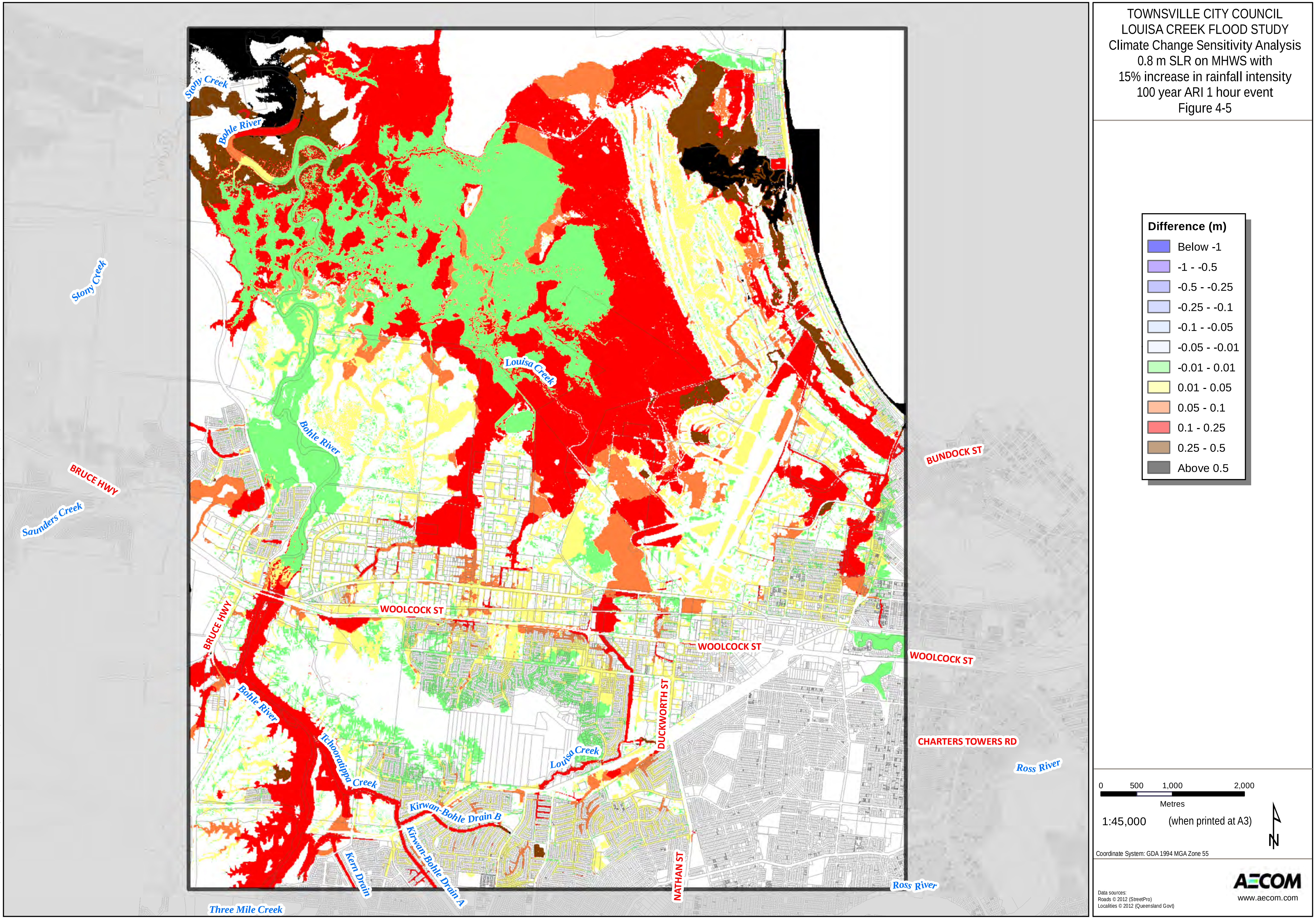
TOWNSVILLE CITY COUNCIL
LOUISA CREEK FLOOD STUDY
Climate Change Sensitivity Analysis
0.8 m SLR on MHWS with
15% increase in rainfall intensity
100 year ARI 1 hour event
Figure 4-5



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5.0 Conclusions and Recommendations

5.1 Conclusions

The following conclusions are drawn from this study:

- A hydraulic model that covers the Louisa Creek area was developed based on the previous *Blakey's Crossing Hydraulic Assessment Summary* Report (AECOM, 2013), TCC 2009 and 2012 LiDAR topography, TCC 2011 aerial photography, TCC refined XP-RAFTS hydrologic models, refined estimates of the Lakes overflows and inflows from the *Upper and Middle Bohle Flood Study* (AECOM, 2014).
- The Rain-on-Grid method was used across the majority of the urban areas assessed with the more traditional hydrologic model output method applied through rural and relatively steep areas across the model.
- The model parameters adopted for roughness as well as initial and continuing losses are in line with those used in other studies undertaken as part of the *City Wide Flood Constraints Project* in the area.
- The critical durations adopted for events up to 500 year ARI were 1 hour and 12 hours.
- The model was calibrated to the February 2014 and April 2014 rainfall events.

5.2 Recommendations

The following recommendations are made as part of this study:

- That the model is revisited when revised LiDAR data is available in order to provide a better representation of the topography across the study area.
- A stream gauge is installed within Louisa Creek to facilitate calibration of any future revisions/updates of the model.
- Local refinement of the model is undertaken if a site specific assessment of flood risk is needed.
- Explore opportunities or options to mitigate flood risk across the affected areas through the implementation of strategic large scale measures. This could include the use of flood mitigation measures at strategic locations and should be explored as part of an overall floodplain management strategy.
- That a survey of finished flood levels across areas identified as likely to be affected by flooding, is carried out/commissioned by Council to facilitate the development of suitable flood risk management strategies.

6.0 References

The following publications were used as references during the production of this study:

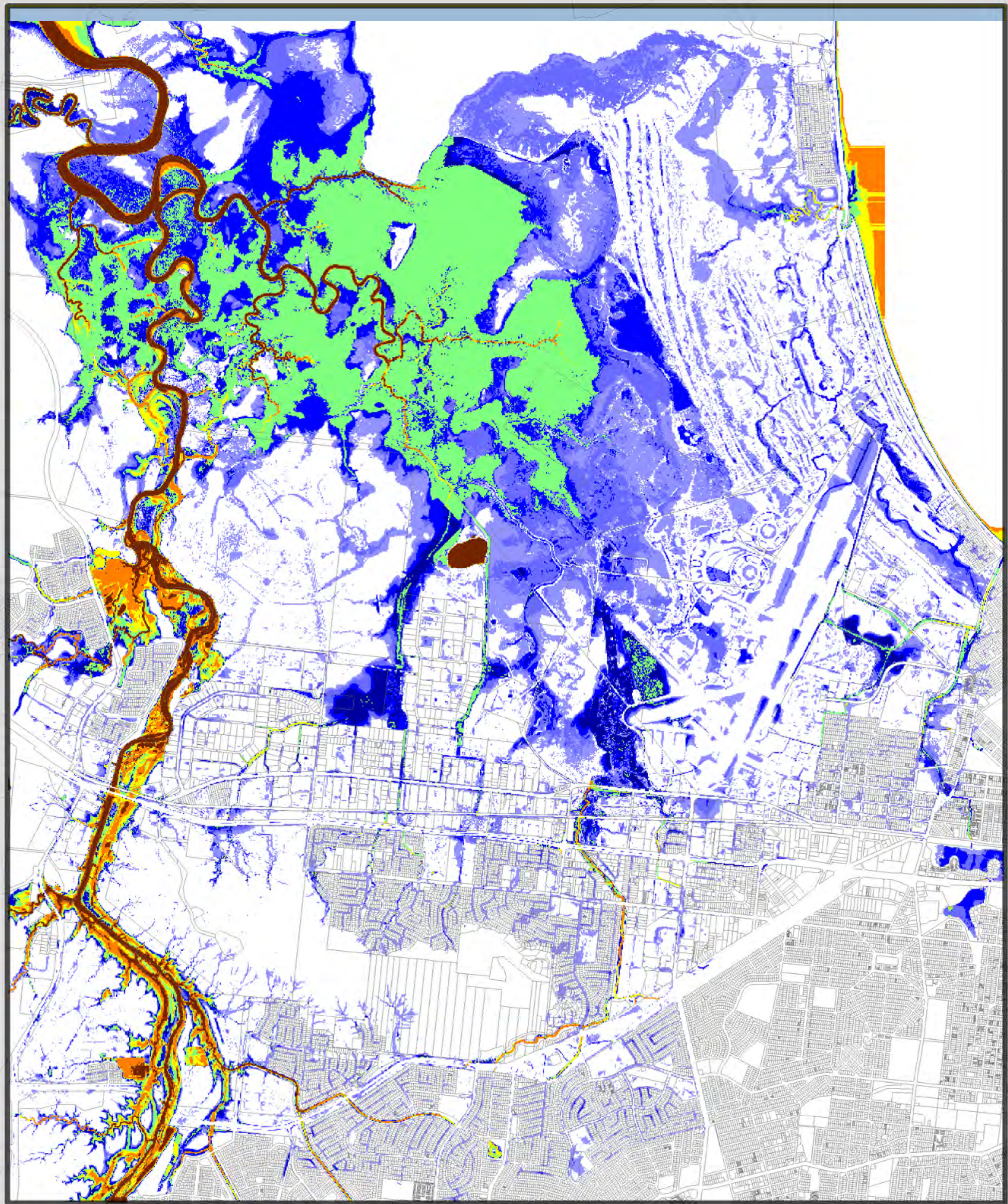
- Institution of Engineers Australia (1987) "*Australian Rainfall and Runoff, Volumes 1 and 2"*
- Chow (1959) "*Open Channel Hydraulics"*
- Townsville City Council (2010) "*Preparation of Flood Studies and Reports – Guidelines"*
- Bureau of Meteorology - Hydrometeorological Advisory Service (2003) "*The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method"*
- WP Software (1994) "*RAFTS-XP User's Manual"*
- DHI Software (2009) "*MIKE FLOOD 1D-2D Modelling User Manual"*
- Institution of Engineers Australia (2011) "*Rainfall-on-Grid Modelling - a Decade of Practice"*
- Townsville City Council (2013) "Ross River Flood Study Report"
- AECOM Australia Pty Ltd (2010) "*Bohle Plains Flood Planning Report"*
- Maunsell McIntyre Pty Ltd (2001) "*Bohle River Floodplain Management Study"*
- Townsville City Council, (2011) "*North Ward Flood Study, Base-line Flooding Assessment*"
- Townsville City Council, (2013) "*Ross Creek Flood Study, Base-line Flooding Assessment* "
- AECOM Australia Pty Ltd (2014) "*Captains Creek Flood Study"*
- AECOM Australia Pty Ltd (2014) "*Lower Bohle/Stony CreekFlood Study"*
- AECOM Australia Pty Ltd (2014) "*Upper and Middle Bohle Flood Study"*

Appendix A

Flood Maps

TOWNSVILLE CITY COUNCIL
LOUISA CREEK FLOOD STUDY

Maximum Water Depths
2 year ARI
Appendix Figure A1



Water Depths (m)

- 0 - 0.3
- 0.3 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- > 3

0 500 1,000 2,000
Metres

1:45,000 (when printed at A3)

N

Coordinate System: GDA 1994 MGA Zone 55

Data sources:
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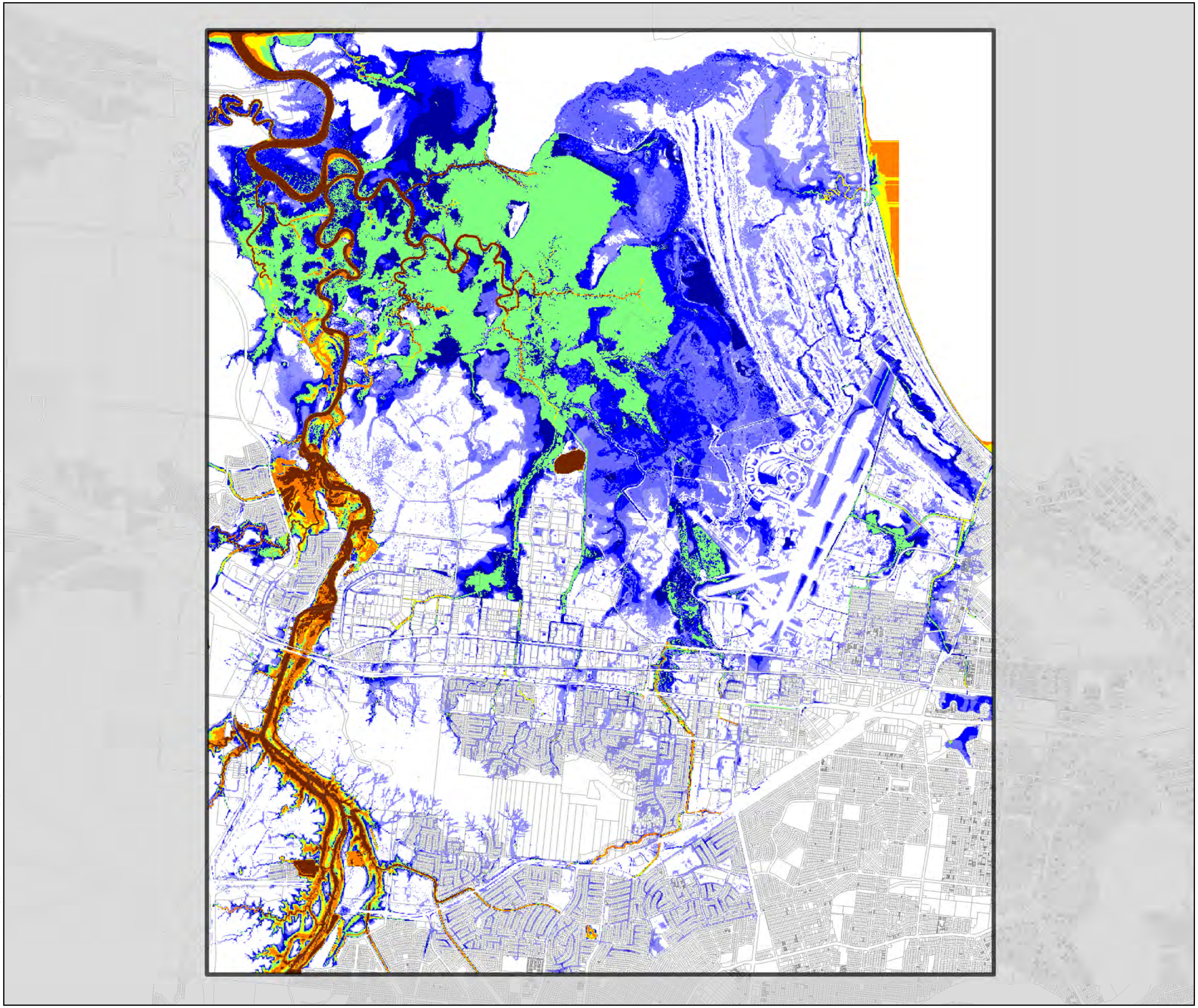

TOWNSVILLE CITY COUNCIL
LOUISA CREEK FLOOD STUDY

Maximum Water Depths
5 year ARI
Appendix Figure A2

Water Depths (m)

- 0 - 0.3
- 0.3 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- > 3

0 500 1,000 2,000
Metres

1:45,000 (when printed at A3)

N

Coordinate System: GDA 1994 MGA Zone 55

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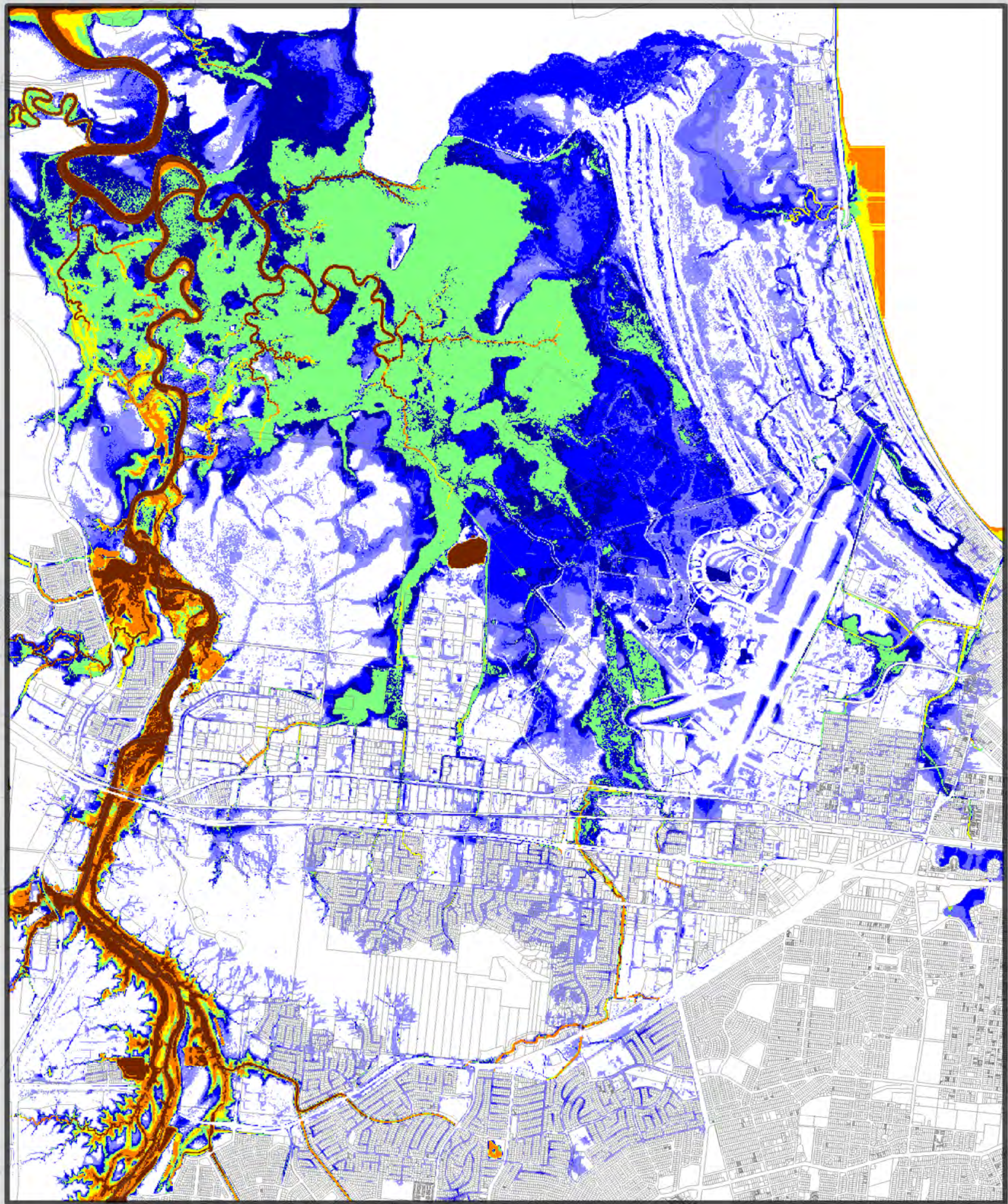
TOWNSVILLE CITY COUNCIL
LOUISA CREEK FLOOD STUDY

Maximum Water Depths
10 year ARI
Appendix Figure A3



Water Depths (m)

- 0 - 0.3
- 0.3 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- > 3

0 500 1,000 2,000
Metres

1:45,000 (when printed at A3)

N

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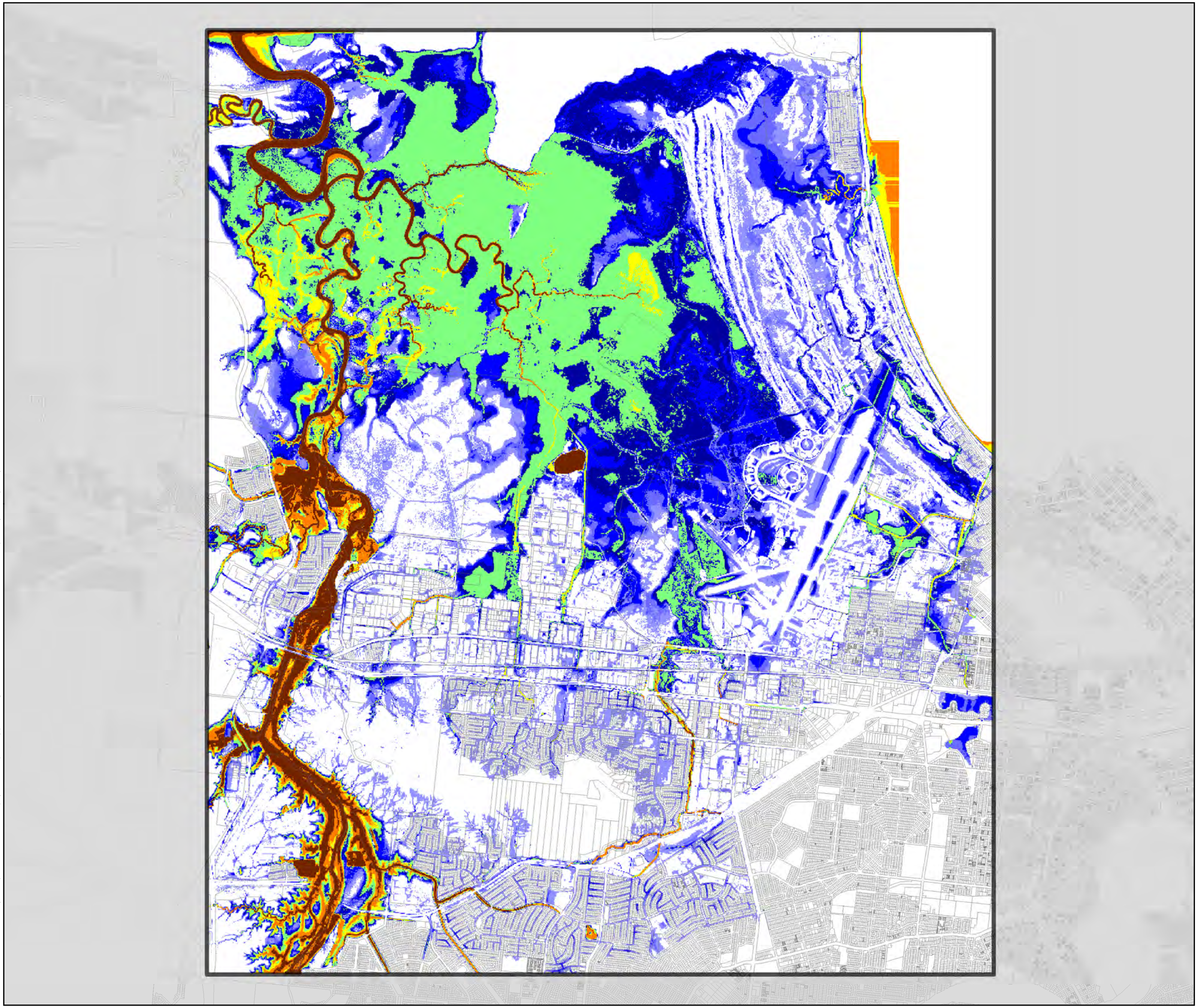
TOWNSVILLE CITY COUNCIL
LOUISA CREEK FLOOD STUDY

Maximum Water Depths
20 year ARI
Appendix Figure A4



Water Depths (m)

- 0 - 0.3
- 0.3 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- > 3

0 500 1,000 2,000
Metres

1:45,000 (when printed at A3)

N

Coordinate System: GDA 1994 MGA Zone 55

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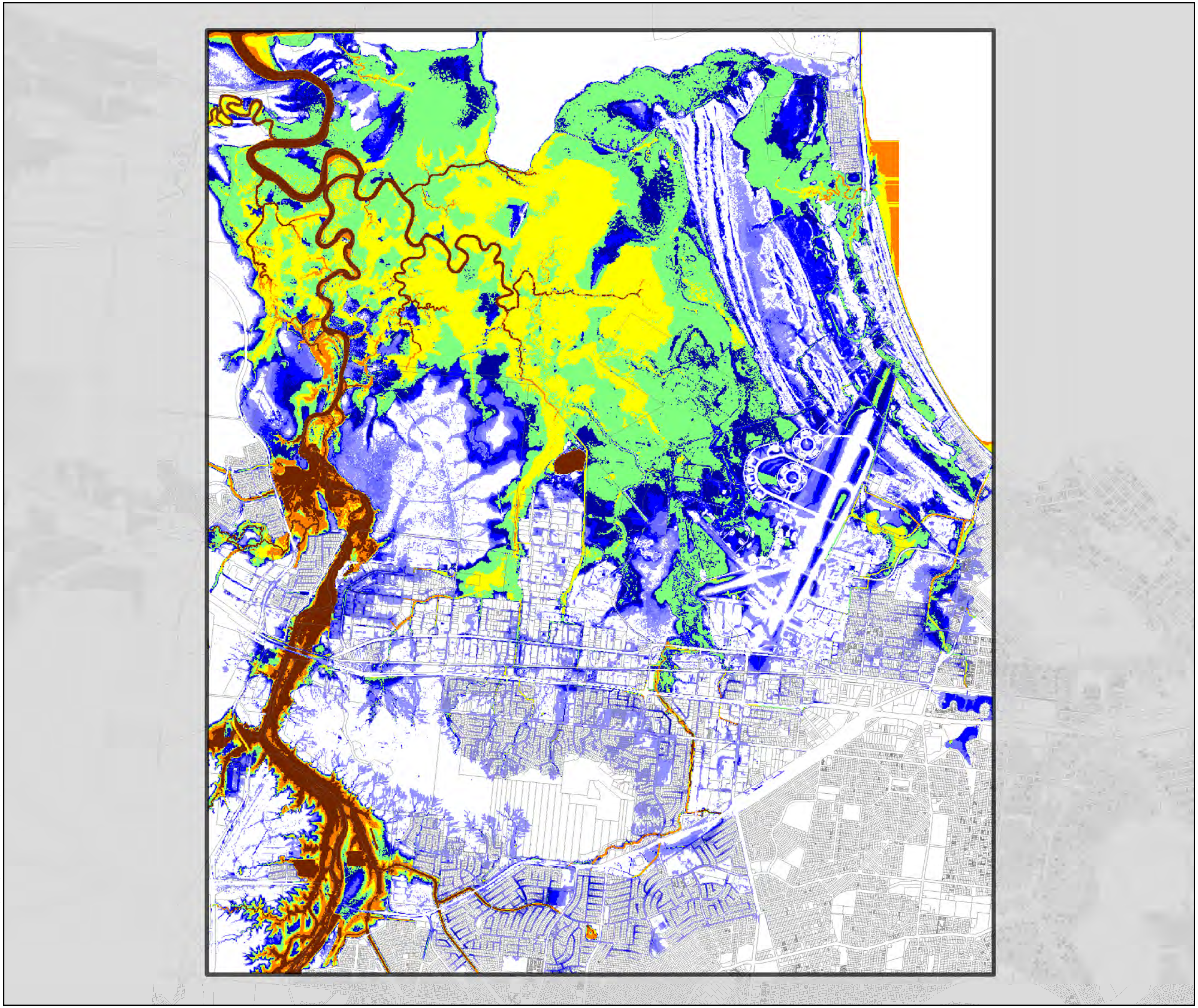

TOWNSVILLE CITY COUNCIL
LOUISA CREEK FLOOD STUDY

Maximum Water Depths
50 year ARI
Appendix Figure A5

Water Depths (m)

- 0 - 0.3
- 0.3 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- > 3

0 500 1,000 2,000
Metres

1:45,000 (when printed at A3)

N

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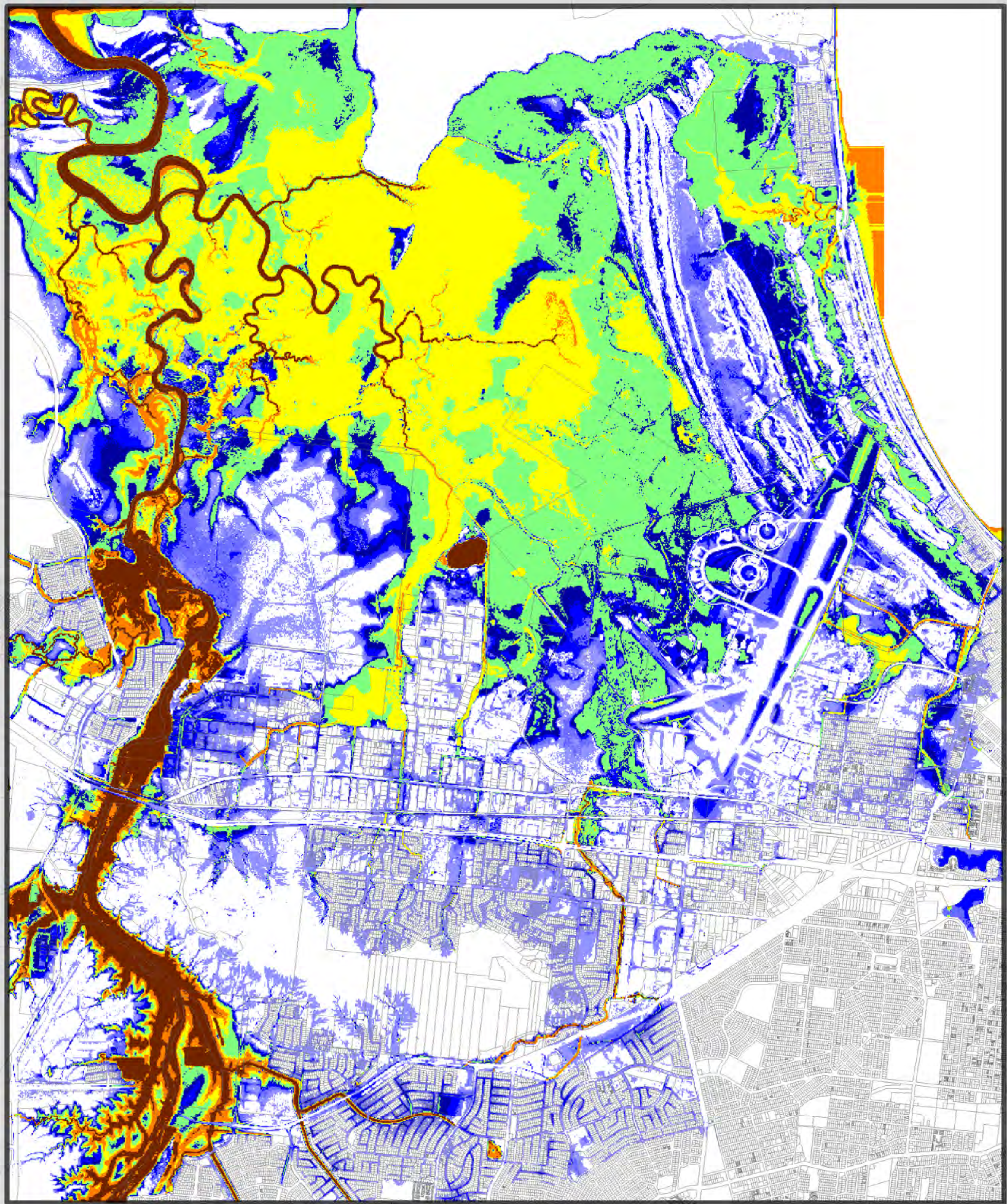
TOWNSVILLE CITY COUNCIL
LOUISA CREEK FLOOD STUDY

Maximum Water Depths
100 year ARI
Appendix Figure A6



Water Depths (m)

- 0 - 0.3
- 0.3 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- > 3

0 500 1,000 2,000
Metres

1:45,000 (when printed at A3)

N

Coordinate System: GDA 1994 MGA Zone 55

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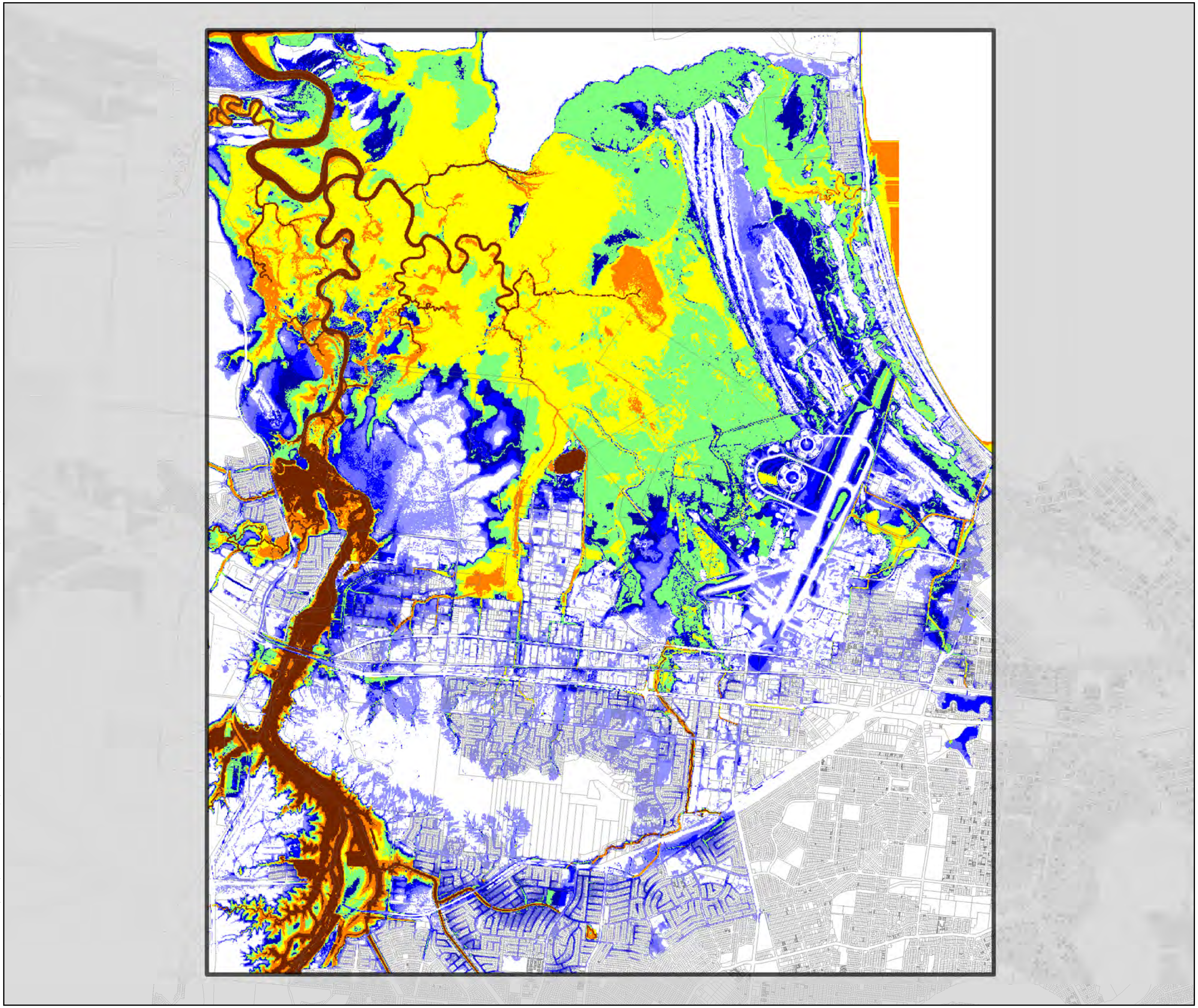

TOWNSVILLE CITY COUNCIL
LOUISA CREEK FLOOD STUDY

Maximum Water Depths
200 year ARI
Appendix Figure A7

Water Depths (m)

- 0 - 0.3
- 0.3 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- > 3

0 500 1,000 2,000
Metres

1:45,000 (when printed at A3)

N

Coordinate System: GDA 1994 MGA Zone 55

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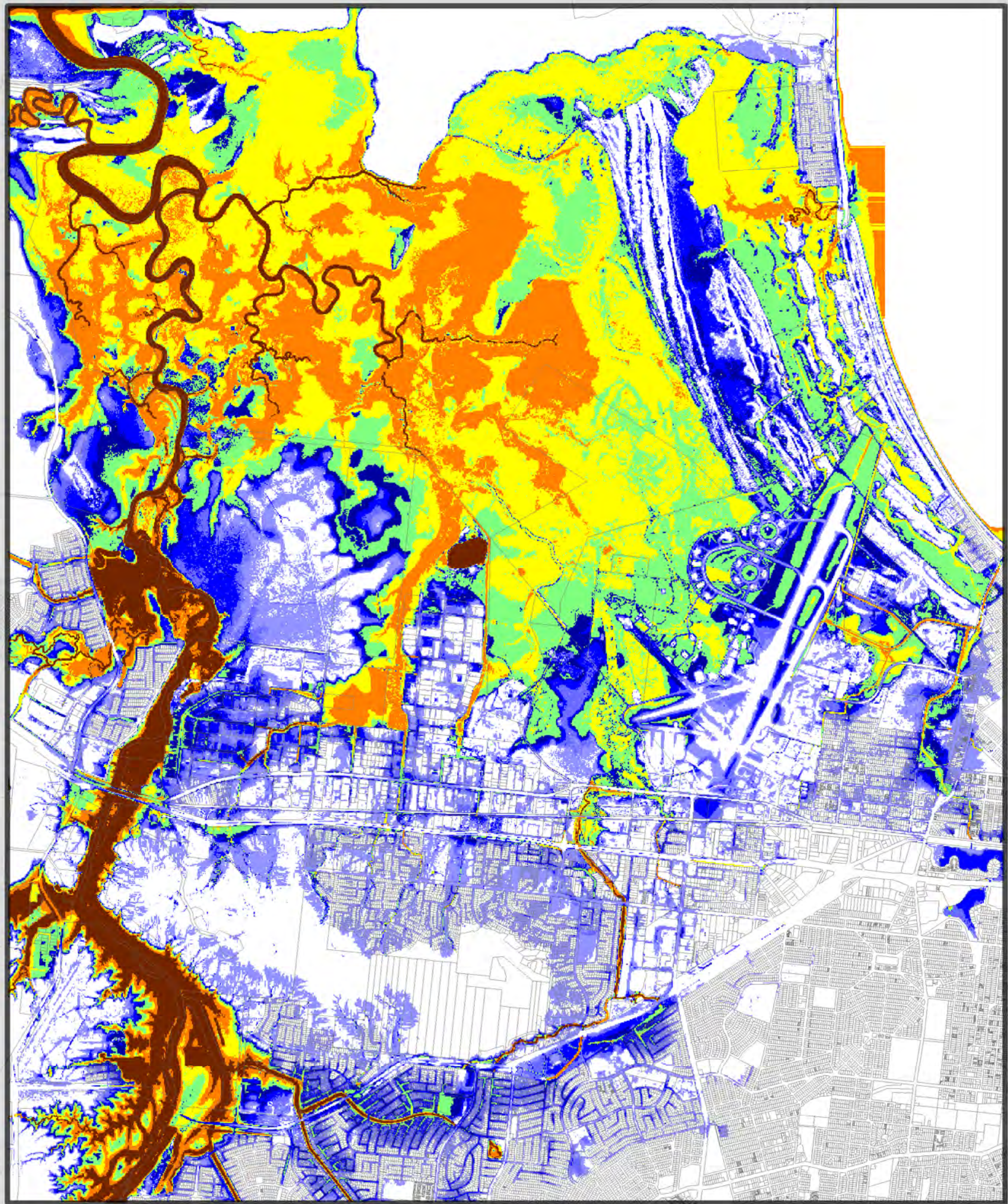
TOWNSVILLE CITY COUNCIL
LOUISA CREEK FLOOD STUDY

Maximum Water Depths
500 year ARI
Appendix Figure A8



Water Depths (m)

- 0 - 0.3
- 0.3 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- > 3

0 500 1,000 2,000
Metres

1:45,000 (when printed at A3)

N

Coordinate System: GDA 1994 MGA Zone 55

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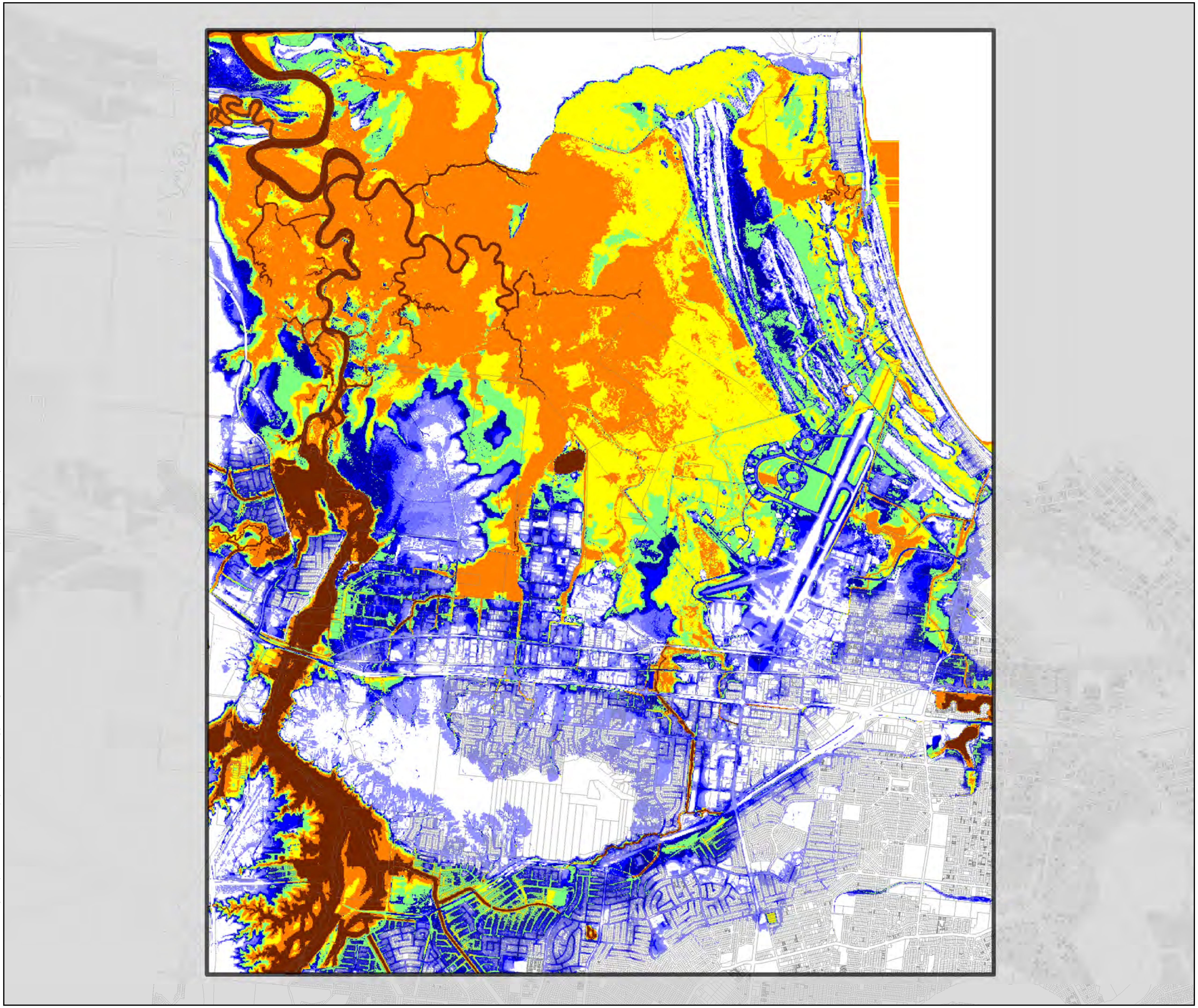
TOWNSVILLE CITY COUNCIL
LOUISA CREEK FLOOD STUDY

Maximum Water Depths
PMF
Appendix Figure A9



Water Depths (m)

- 0 - 0.3
- 0.3 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- > 3

0 500 1,000 2,000
Metres

1:45,000 (when printed at A3)

N

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