Oakdale South Industrial Estate

APPENDIX A
FIGURES

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Shaping the Future

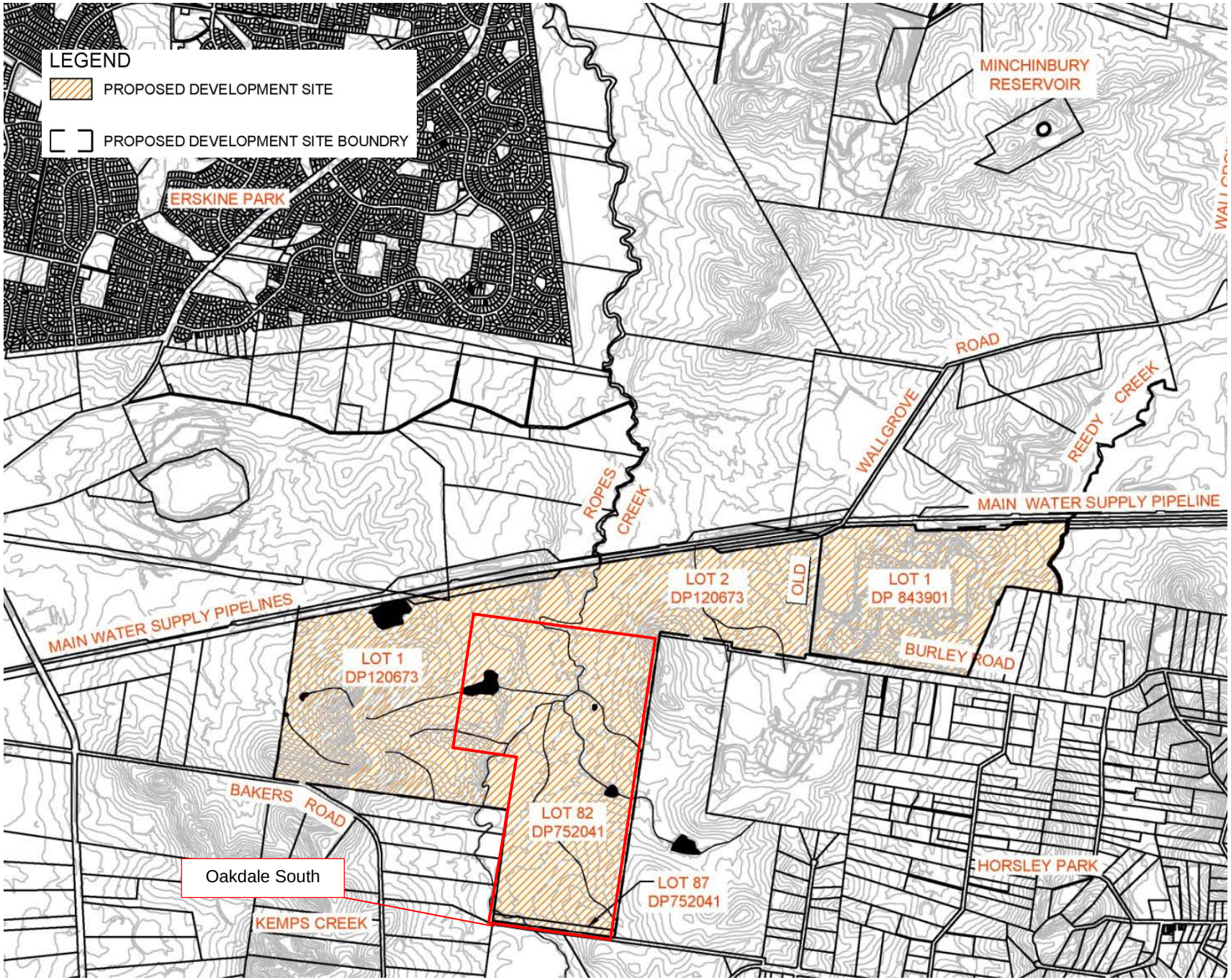

Figure 1 Location of Oakdale South Precinct (after Figure 1, GHD, 2008)

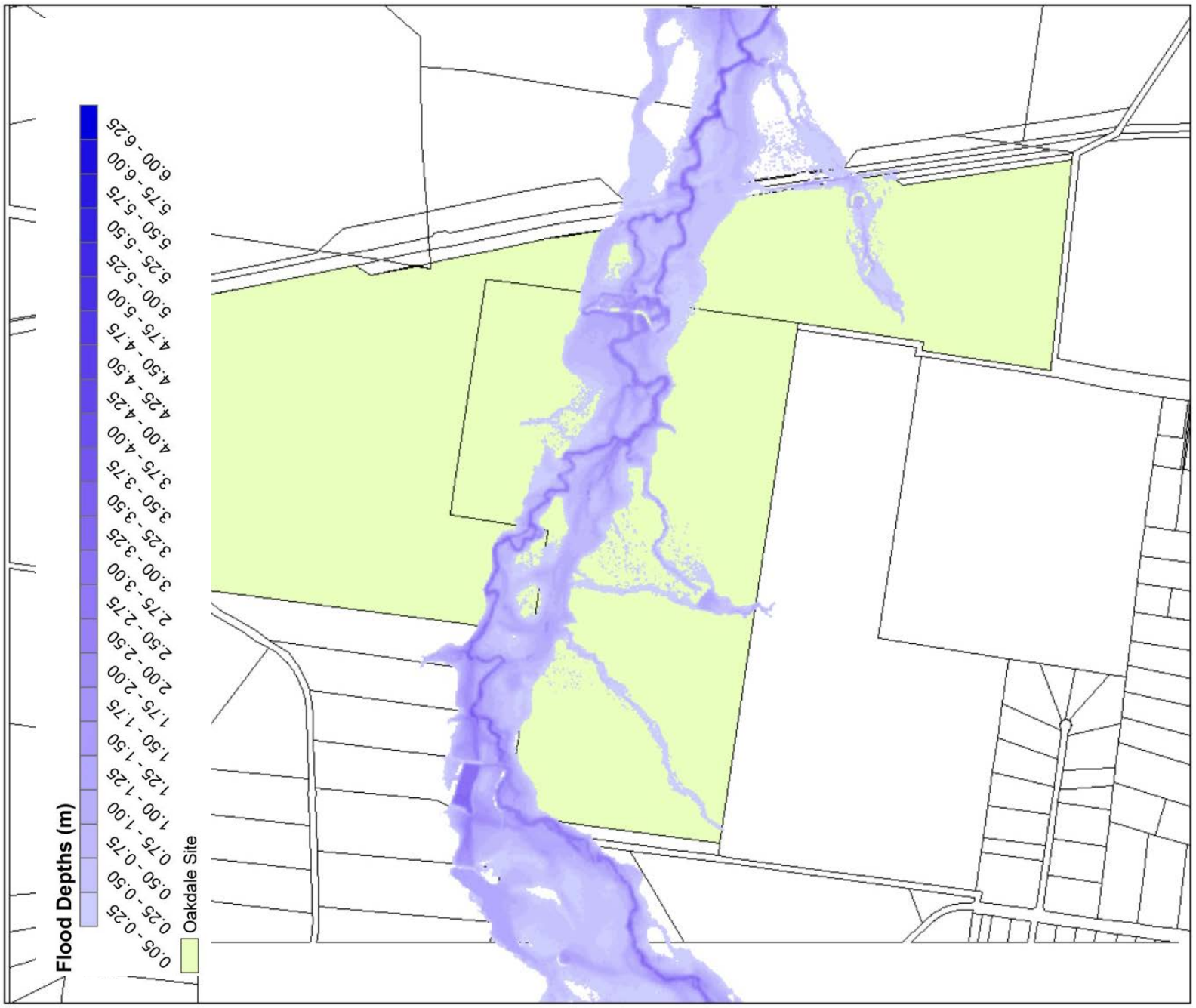

Figure 2 100 yr ARI Flood Map (Rev A, June 2007) (after GHD, 2008)

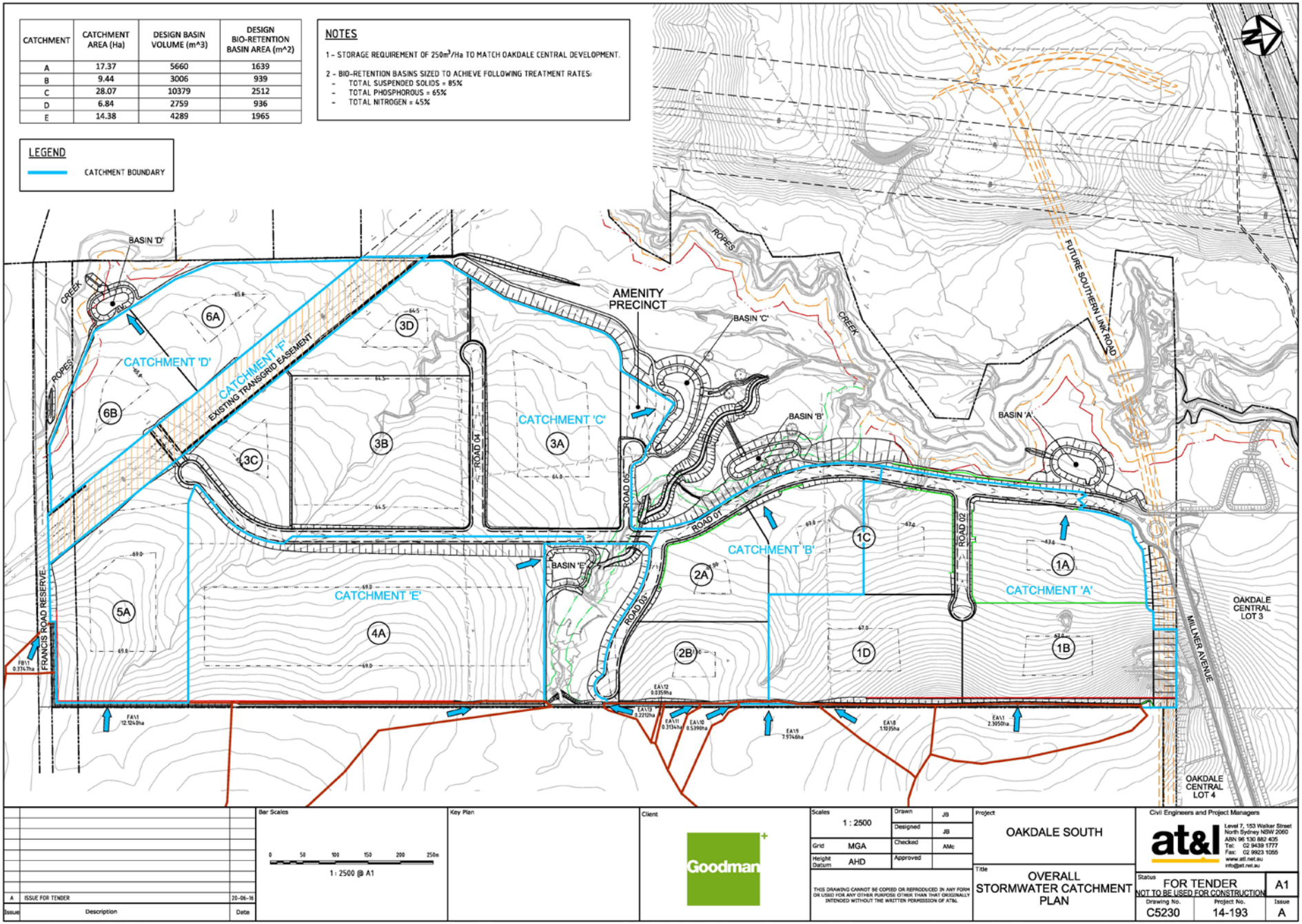

Figure 3 Concept Oakdale Industrial Estate Masterplan

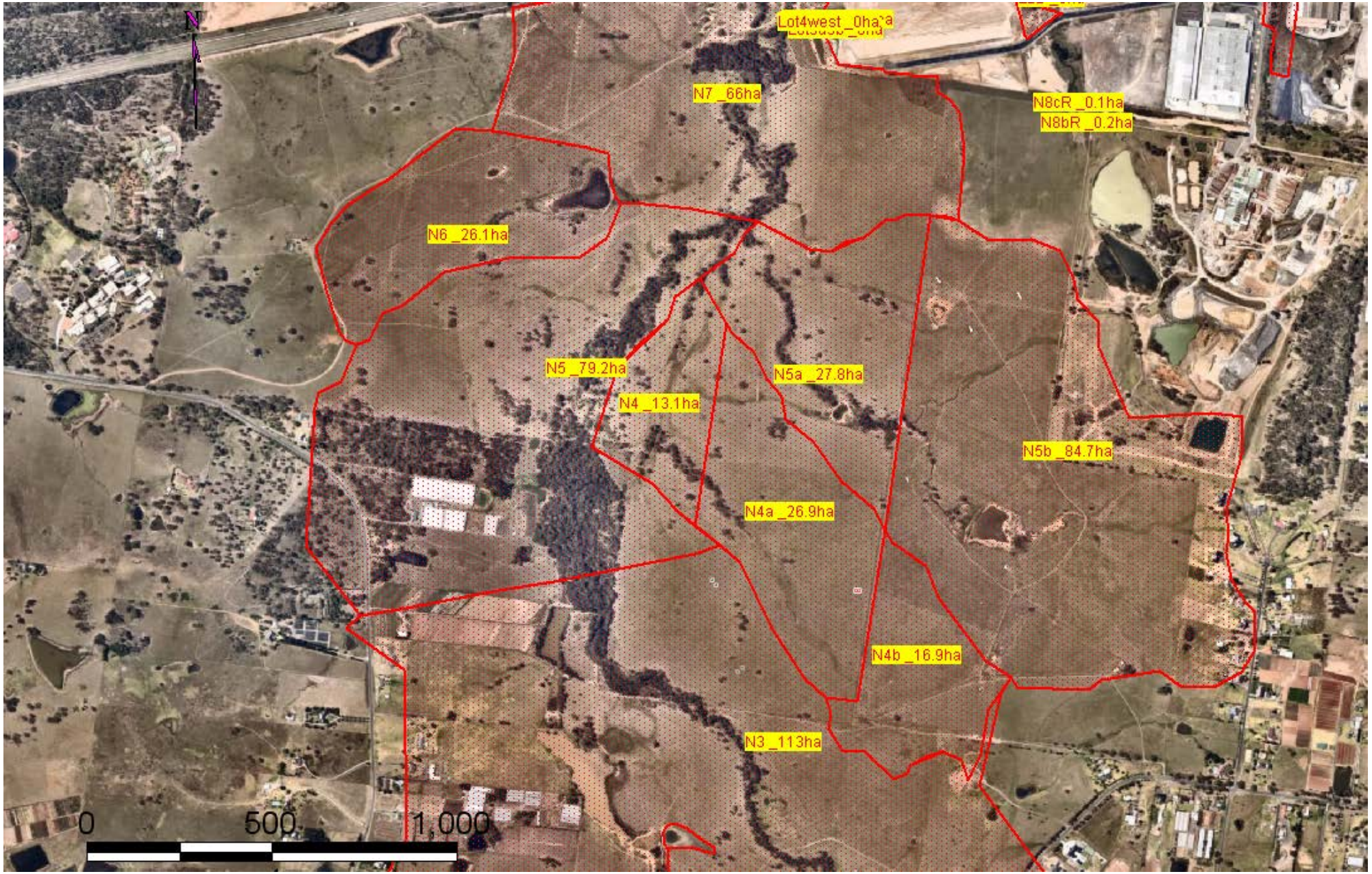

Figure 4 Subcatchment Boundaries in the vicinity of Oakdale South under Existing Conditions

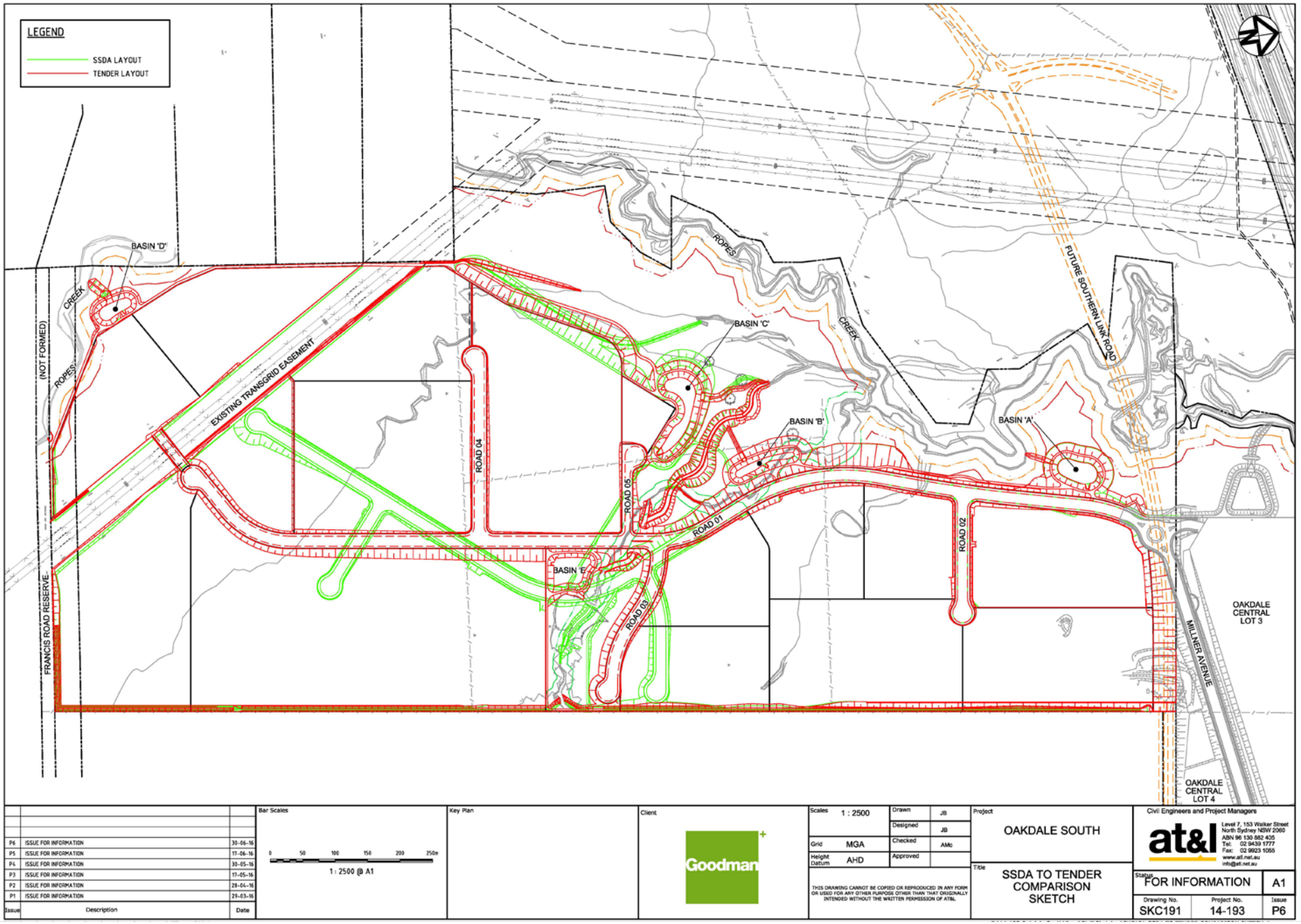

Figure 5 Subcatchment Boundaries under Future Conditions

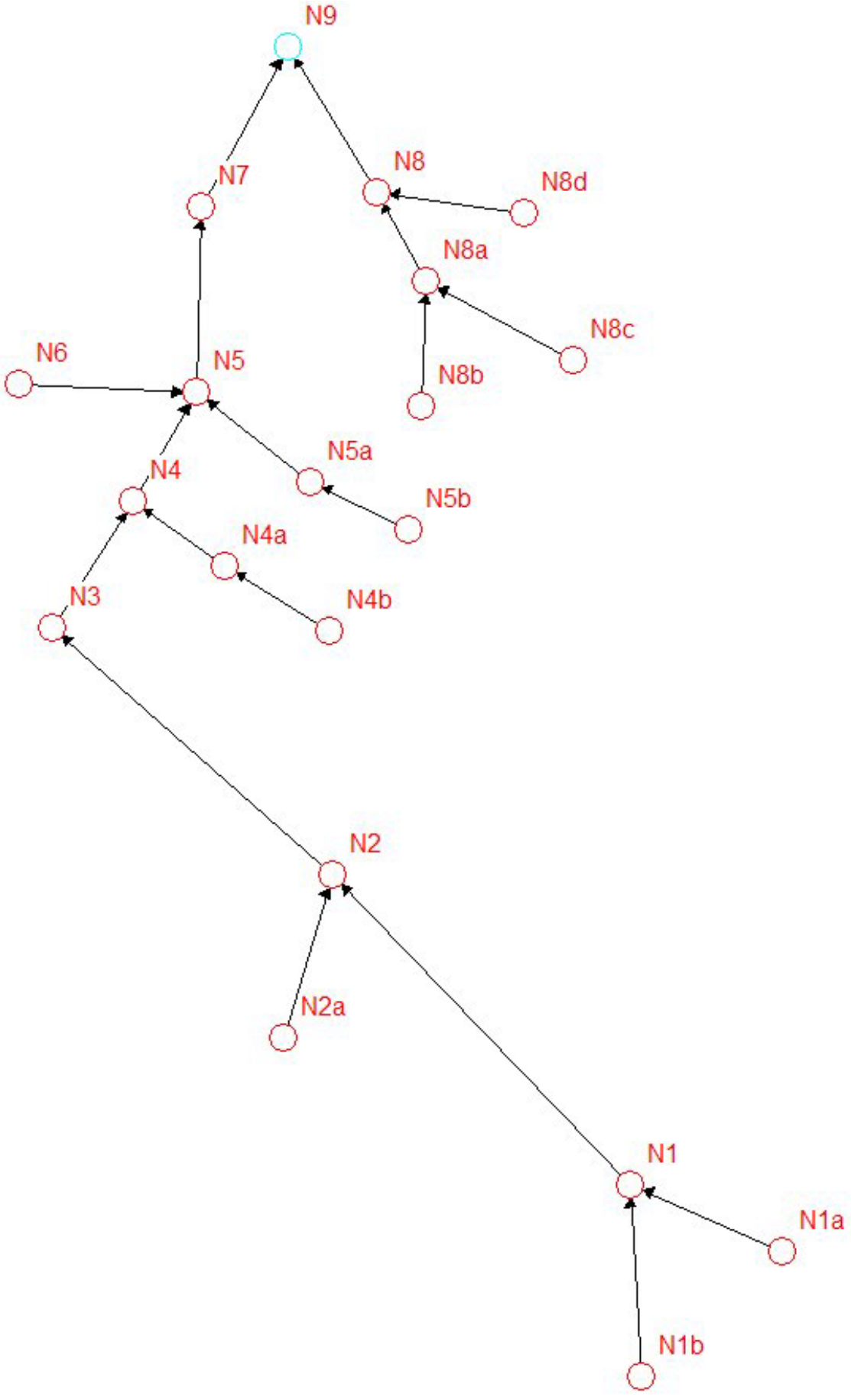

Figure 6 xprafts Link-Node Diagrams – Existing Conditions

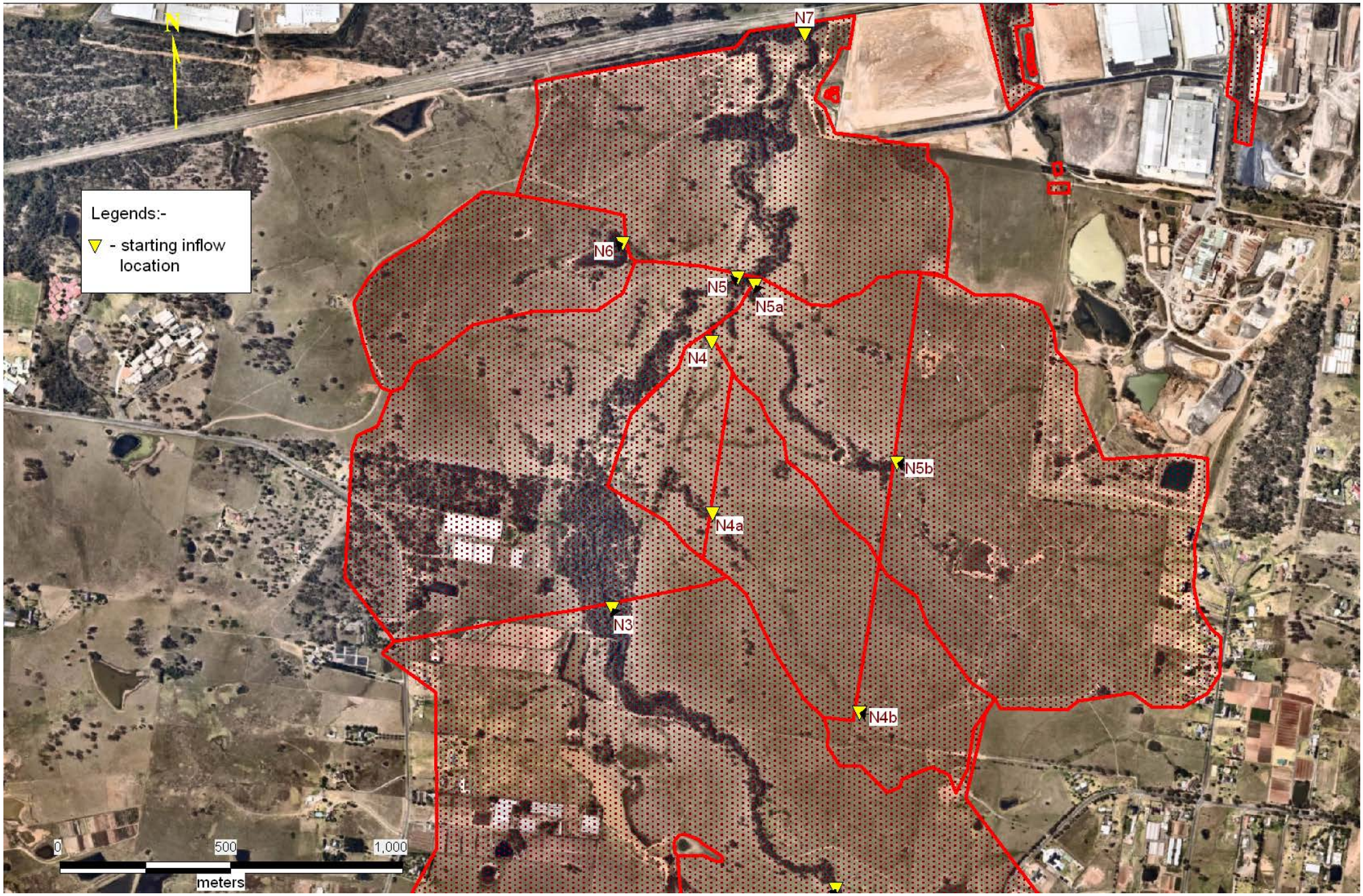

Figure 7 100 yr ARI Inflow Locations in TUFLOW Model - Existing Conditions

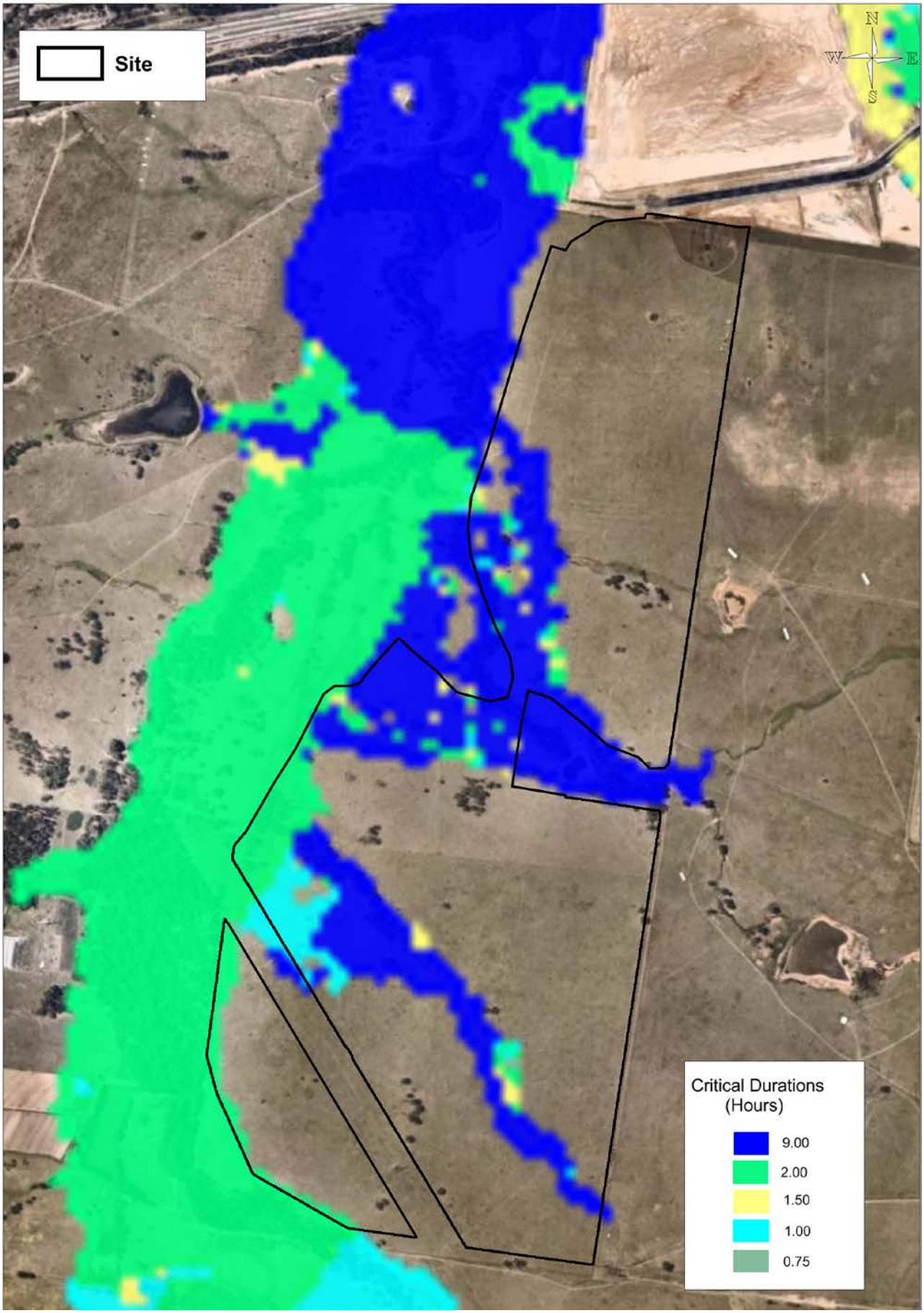

Figure 8 100 yr ARI Critical Storm Burst Durations - Existing Conditions

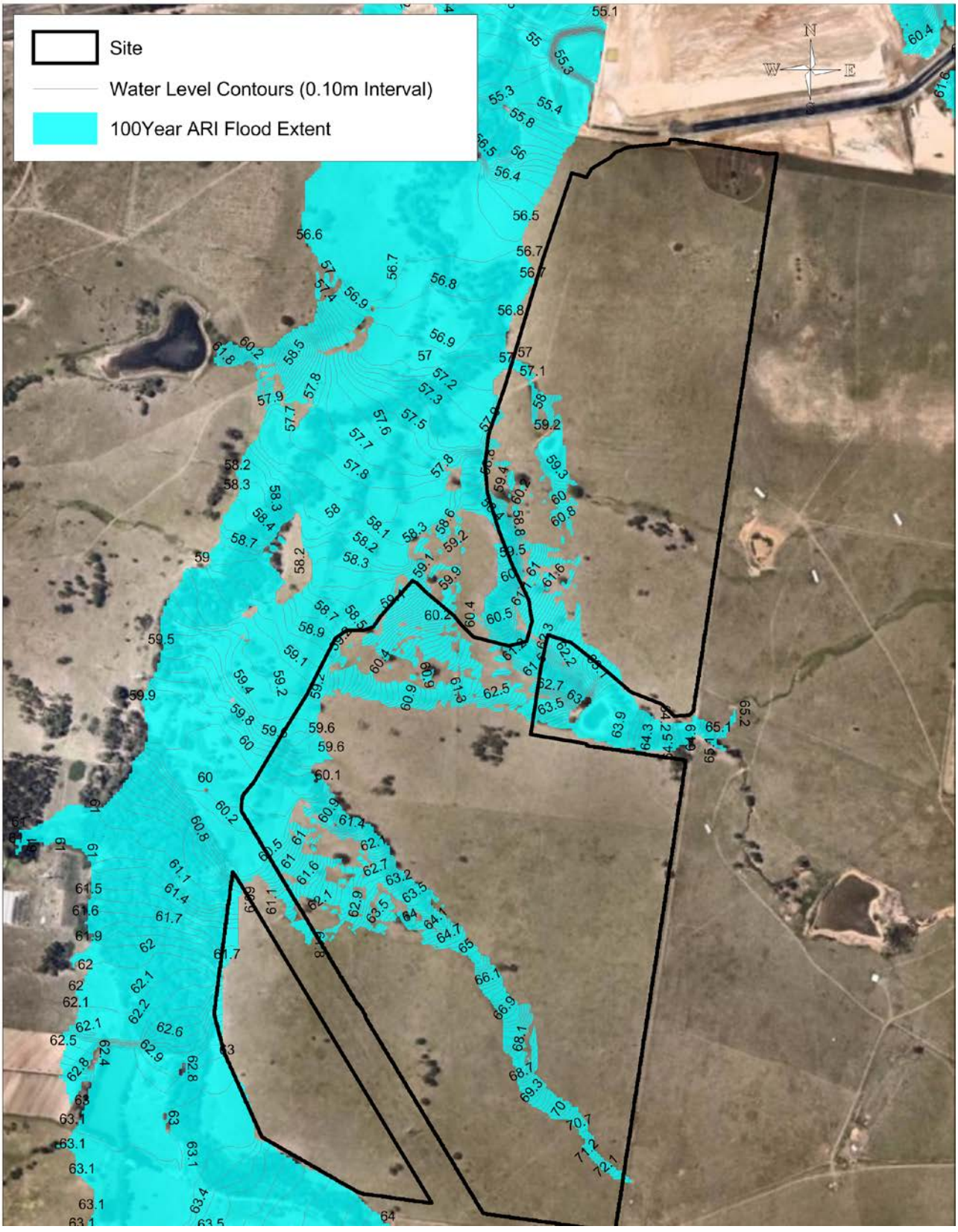

Figure 9 100 yr ARI Flood Extents and Flood Levels - Existing Conditions

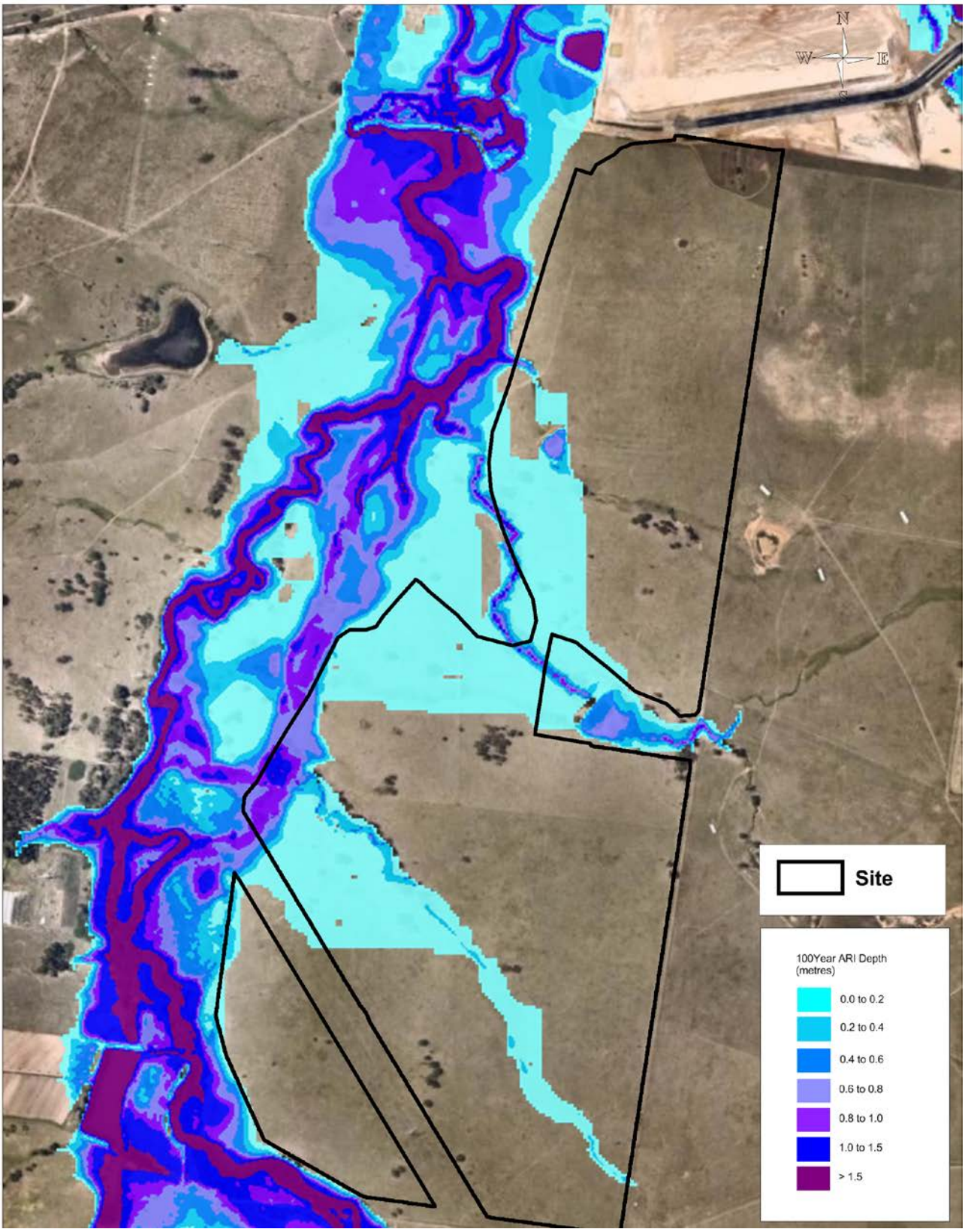

Figure 10 100 yr ARI Flood Depths - Existing Conditions

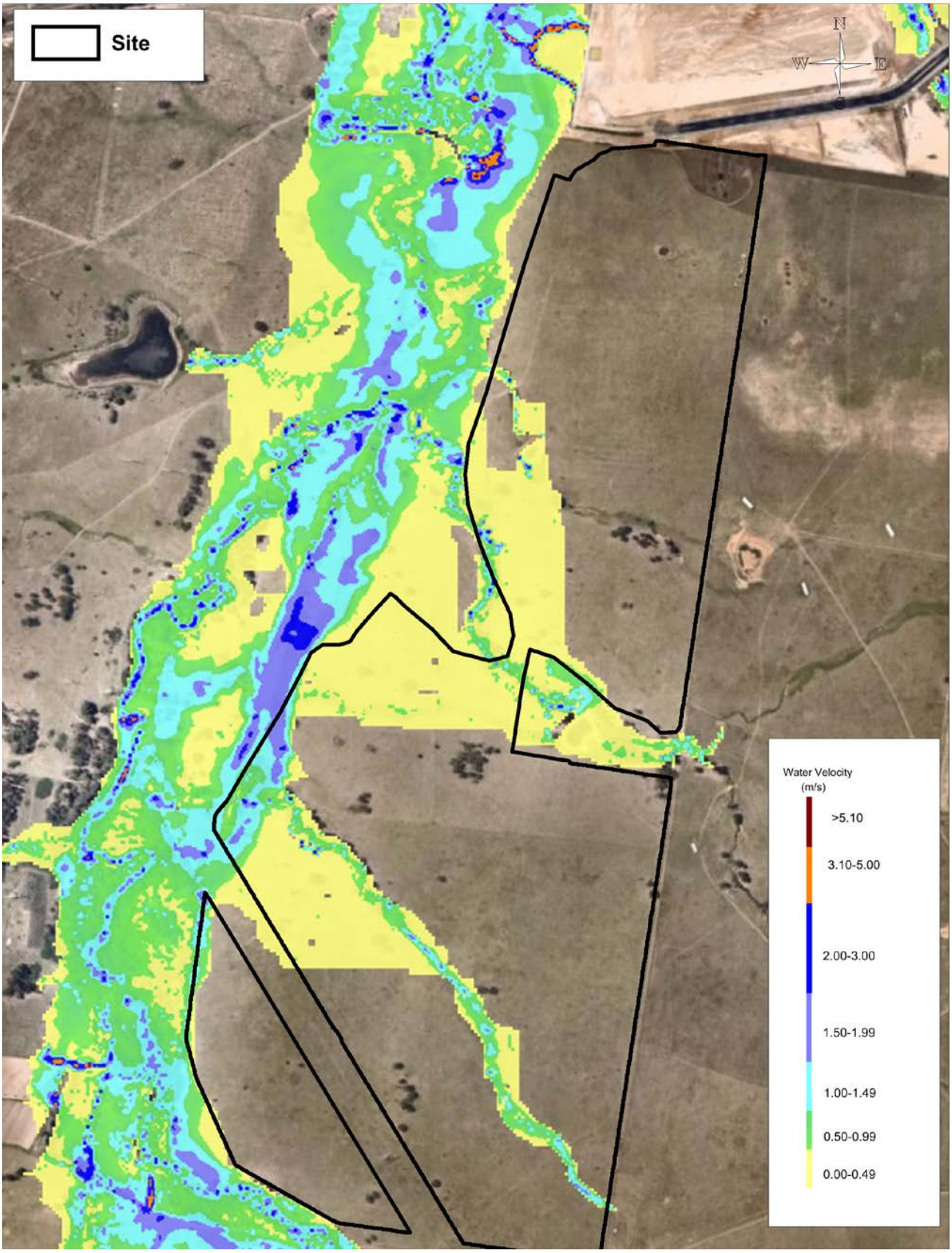

Figure 11 100 yr ARI Flood Velocities - Existing Conditions

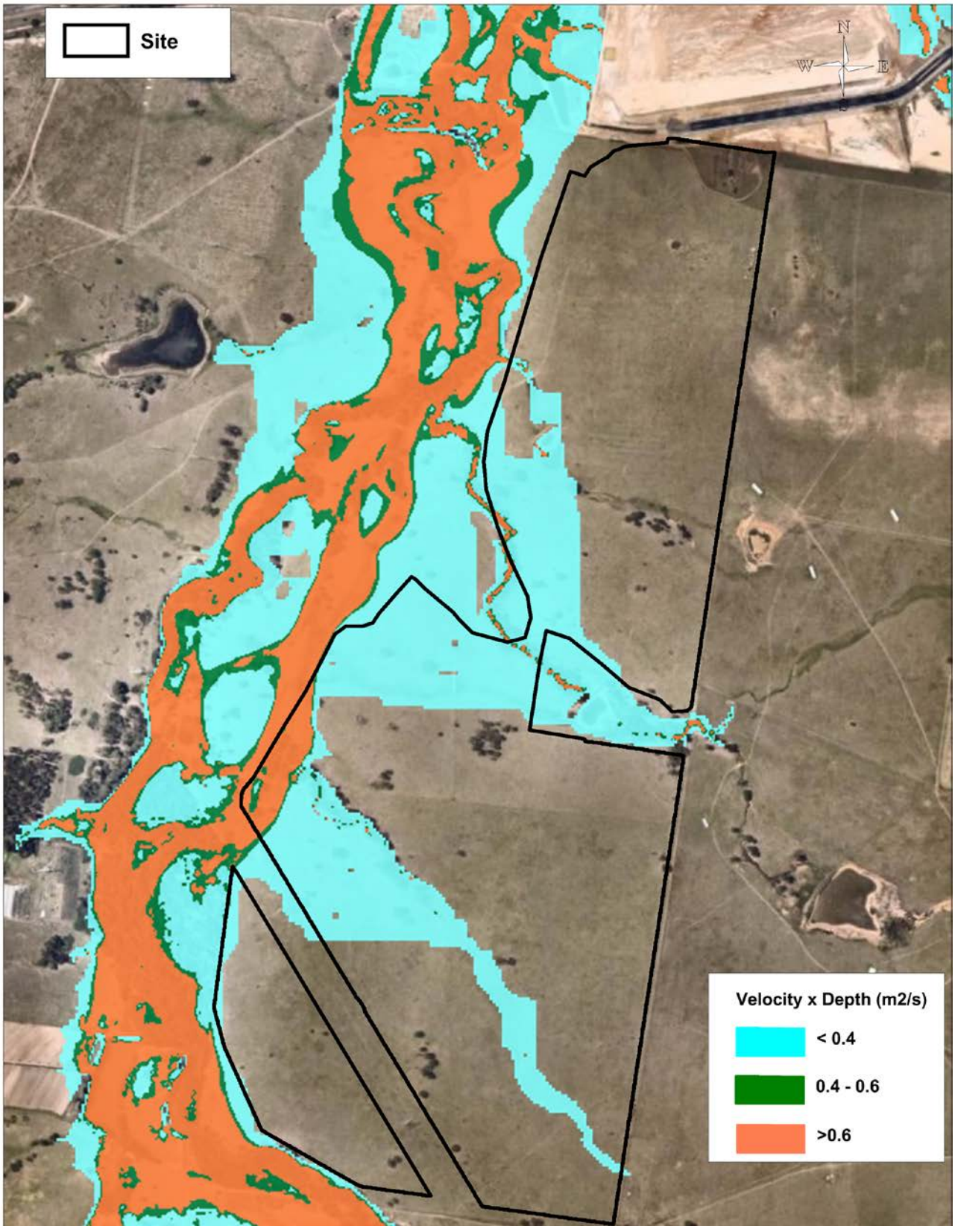

Figure 12 100 yr ARI Flood Velocity x Depth - Existing Conditions

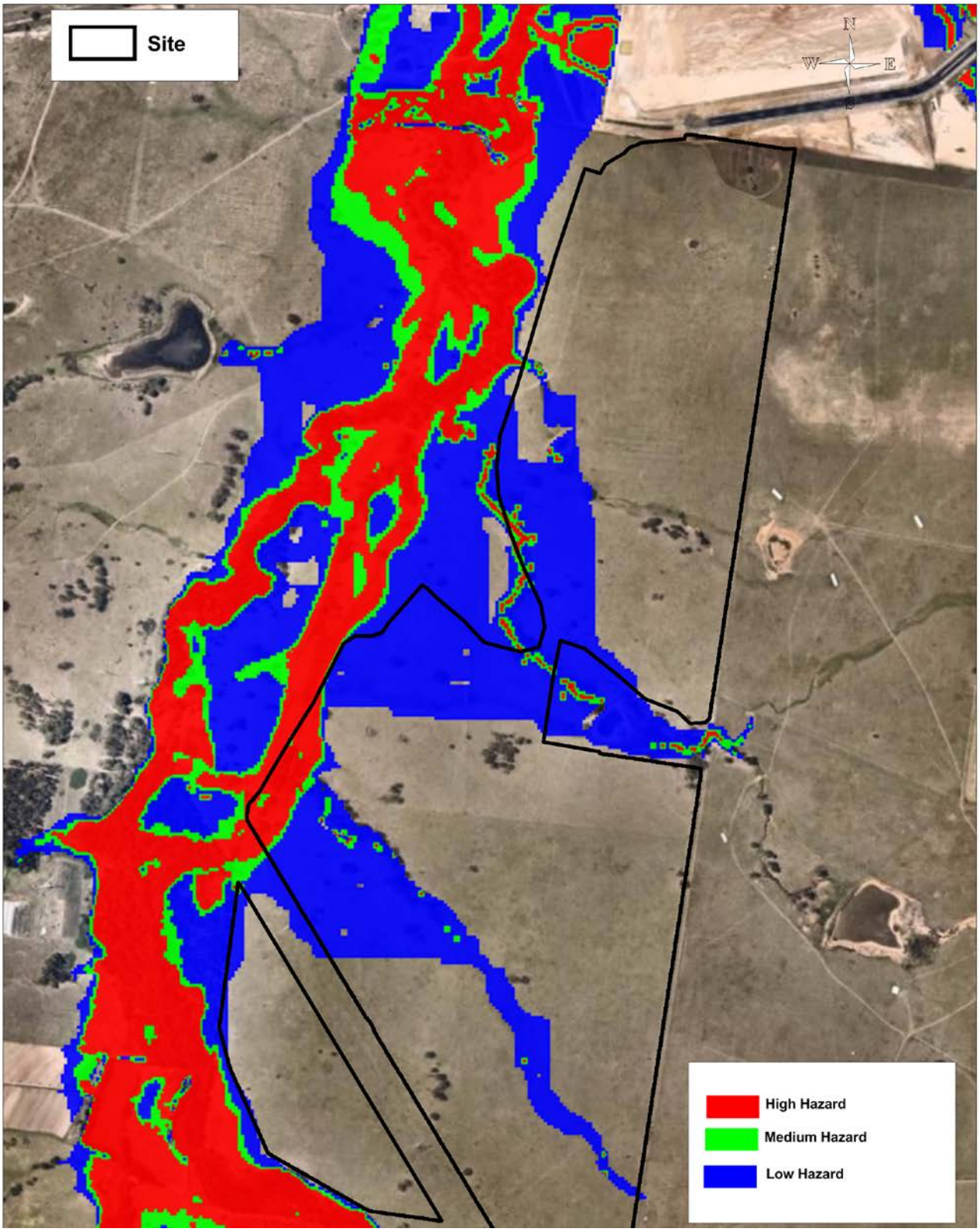

Figure 13 100 yr ARI Flood Hazards - Existing Conditions

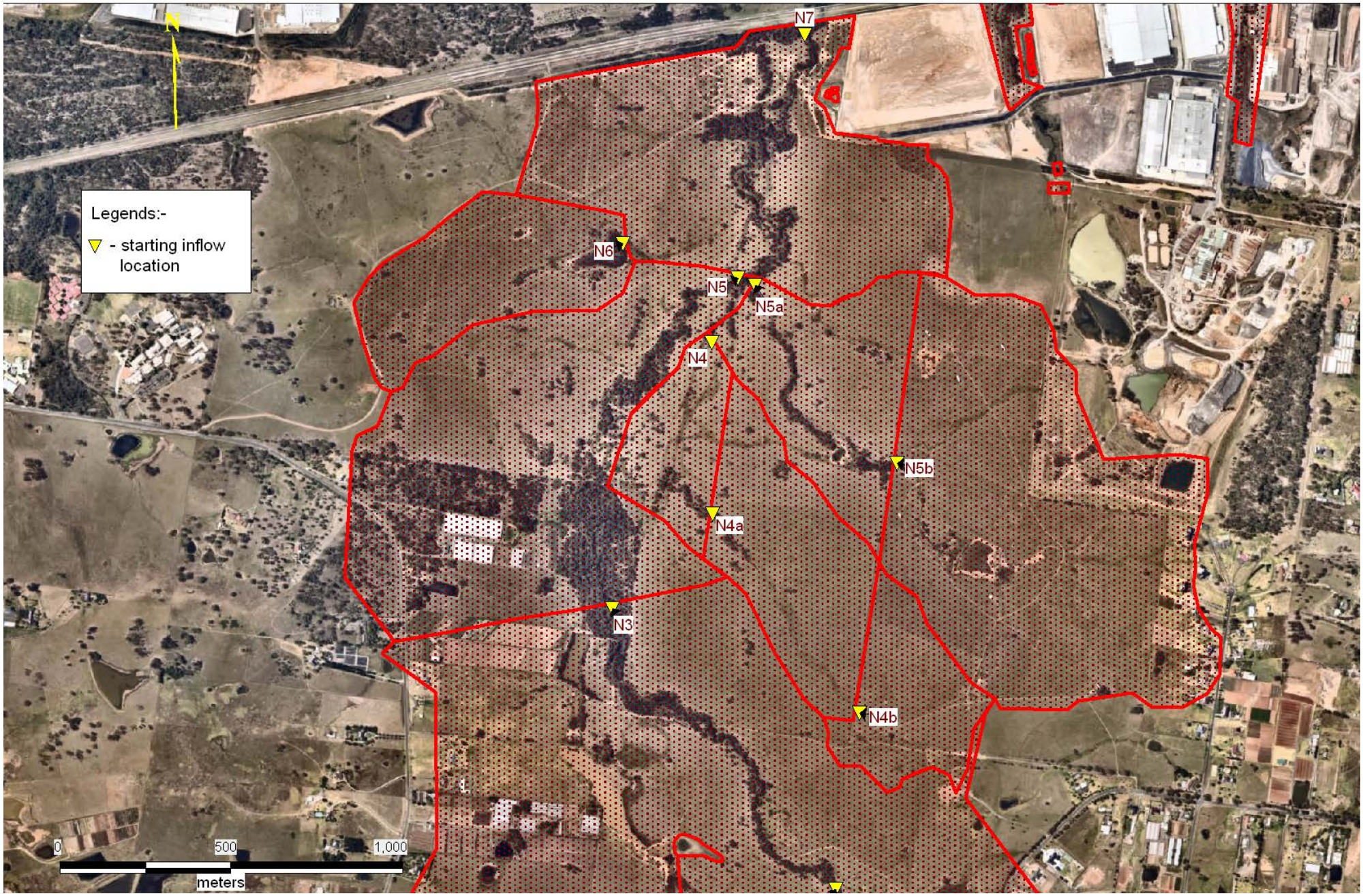

Figure 14 PMF Inflow Locations in TUFLOW Model - Existing Conditions

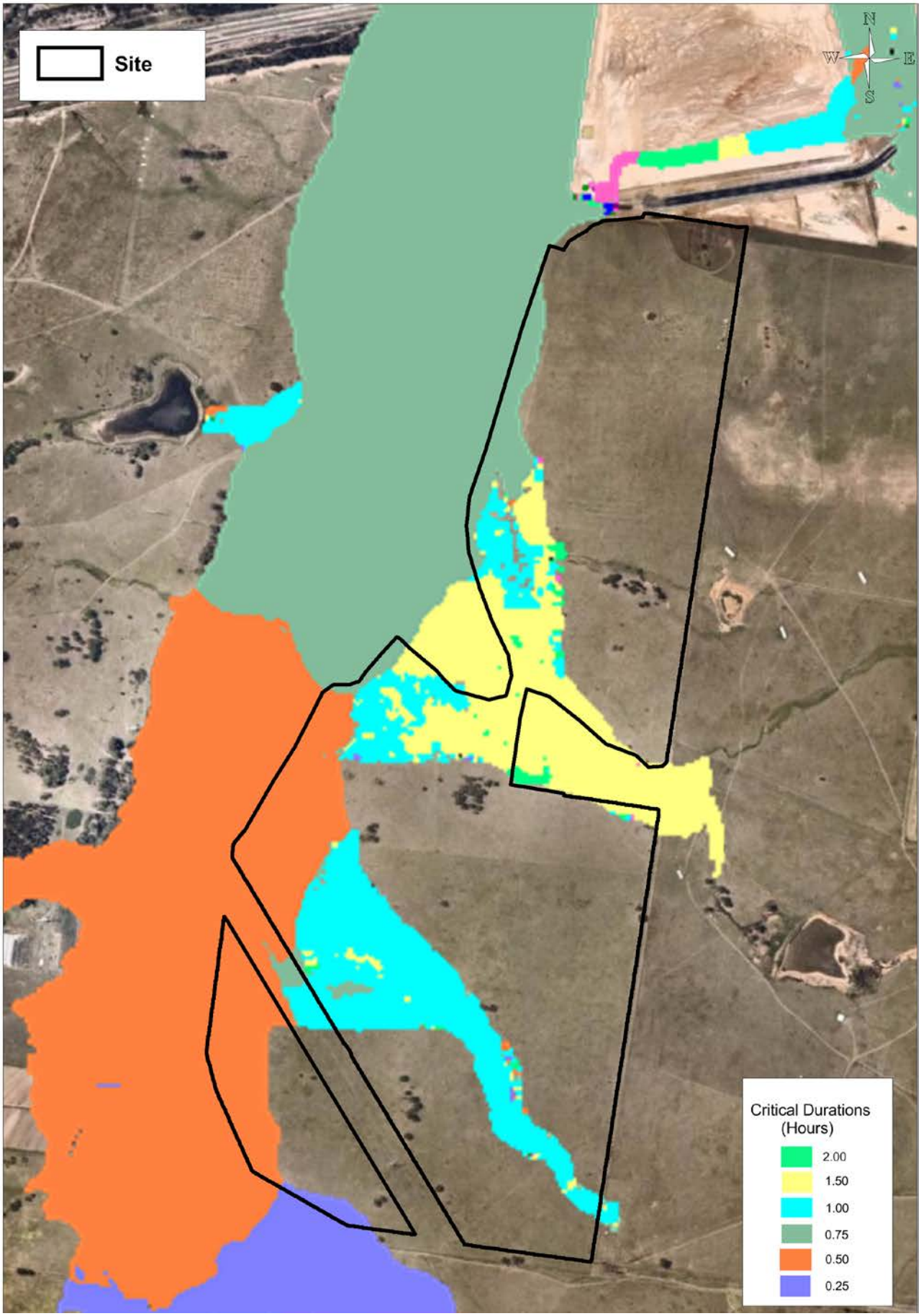

Figure 15 PMF Critical Storm Burst Durations - Existing Conditions

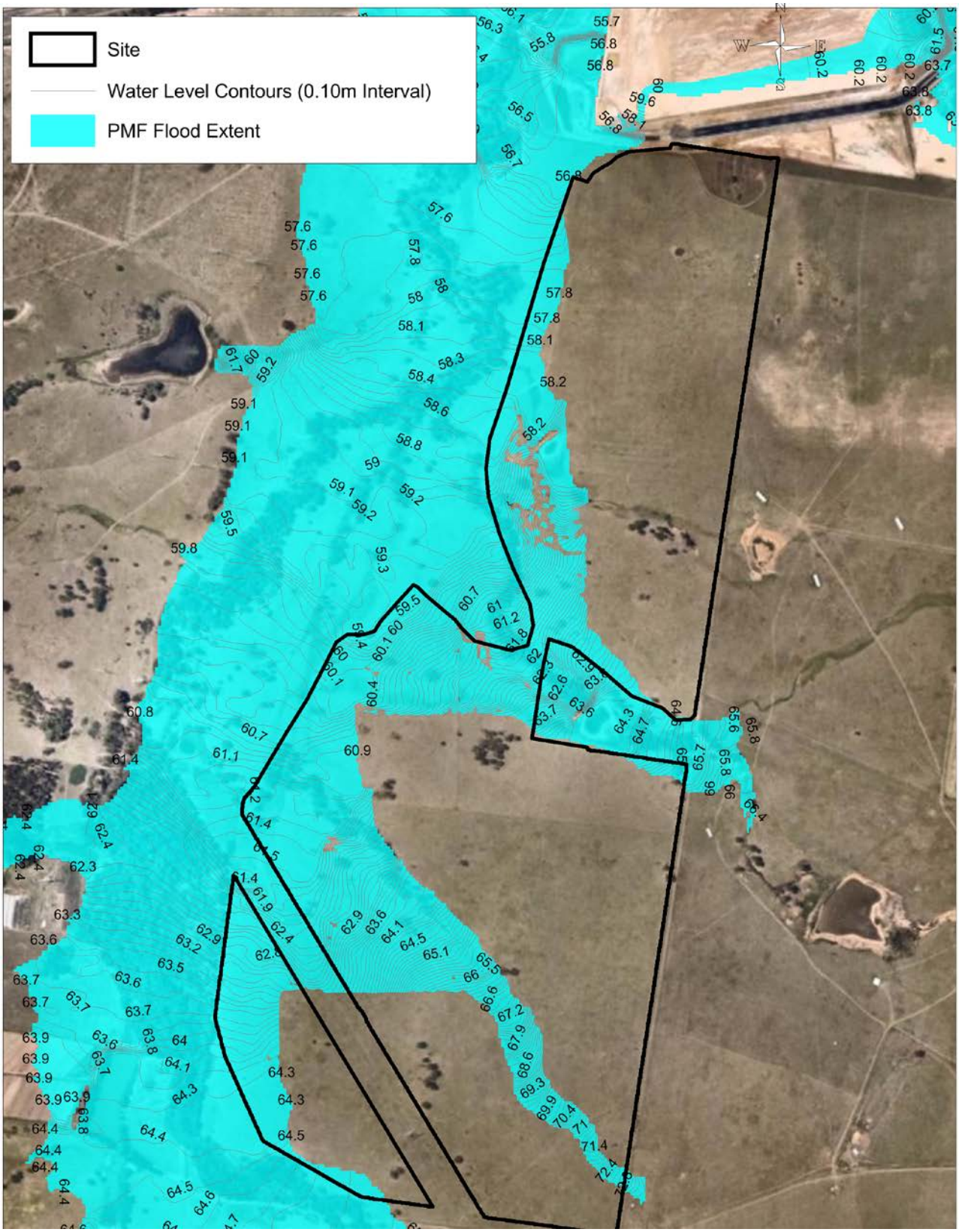

Figure 16 PMF Flood Extents and Flood Levels - Existing Conditions

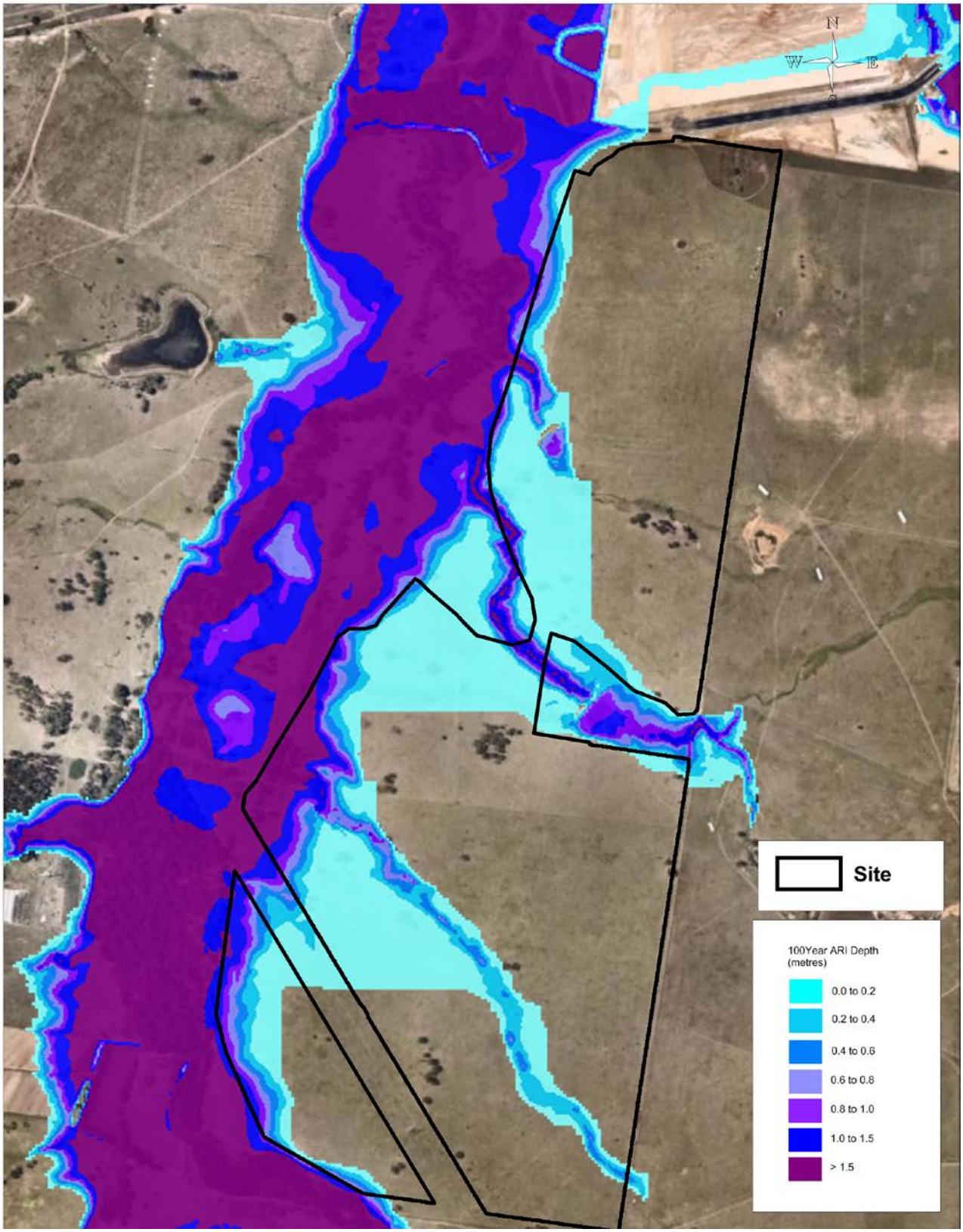

Figure 17 PMF Flood Depths - Existing Conditions

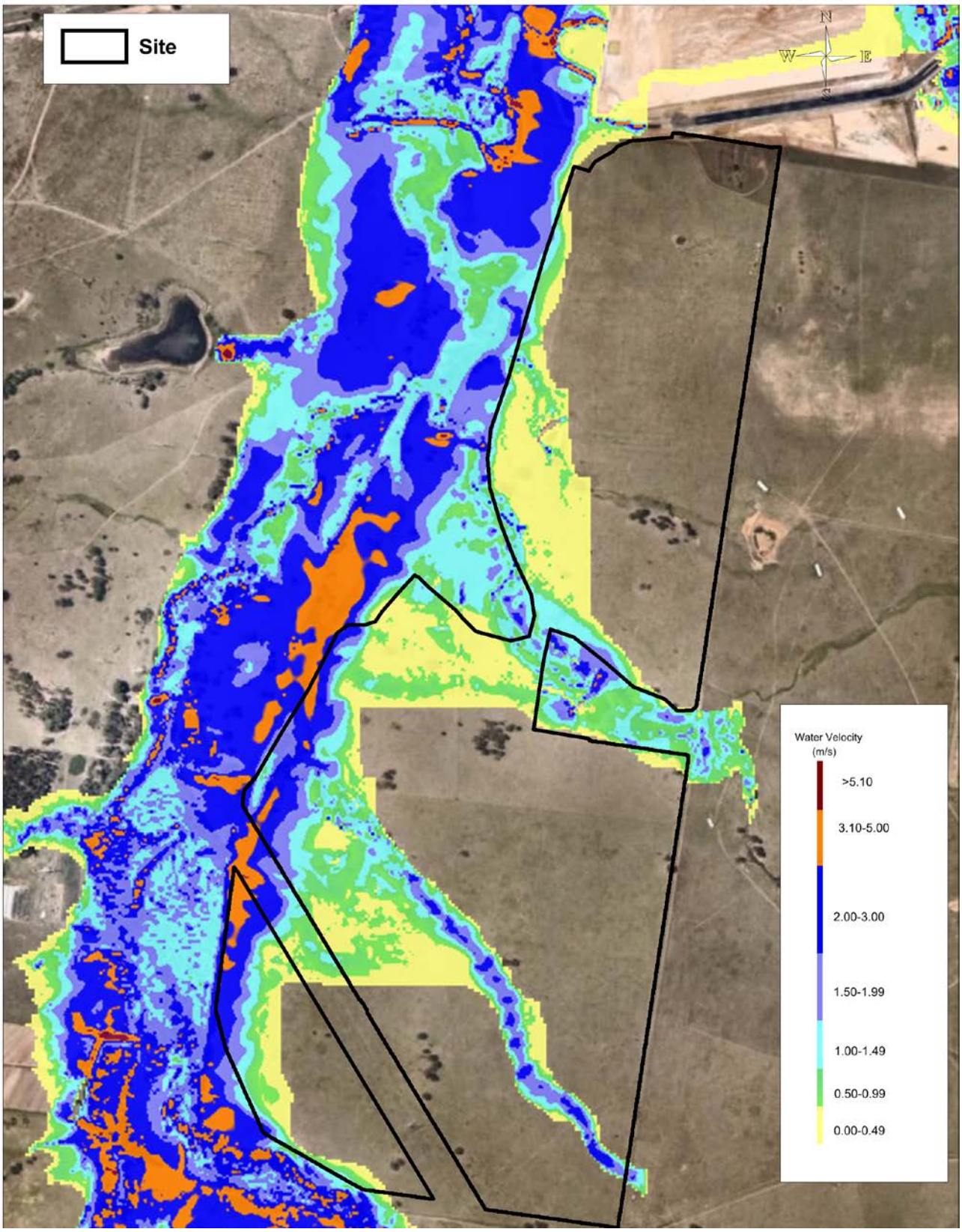

Figure 18 PMF Flood Velocities - Existing Conditions

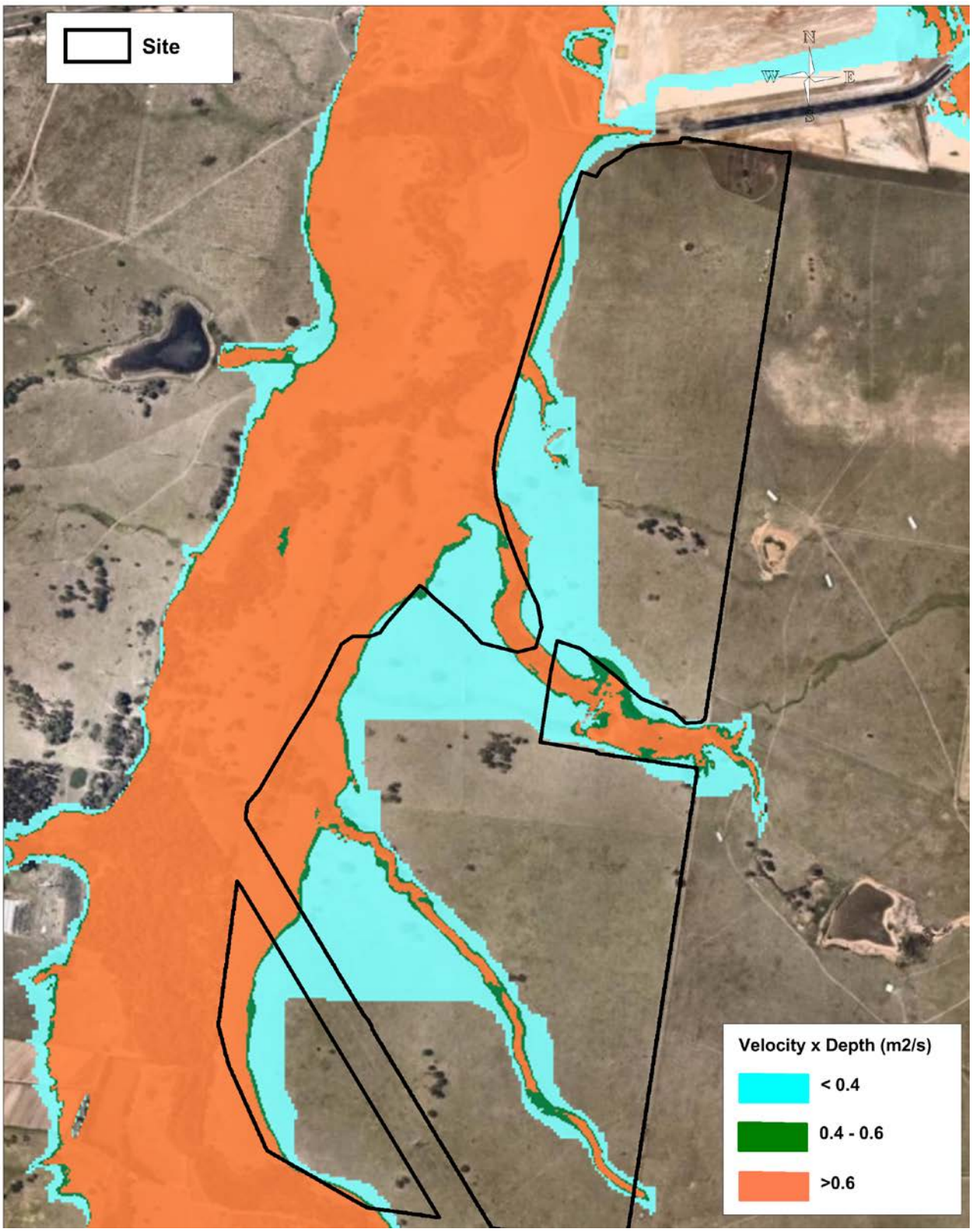

Figure 19 PMF Flood Velocity x Depth - Existing Conditions

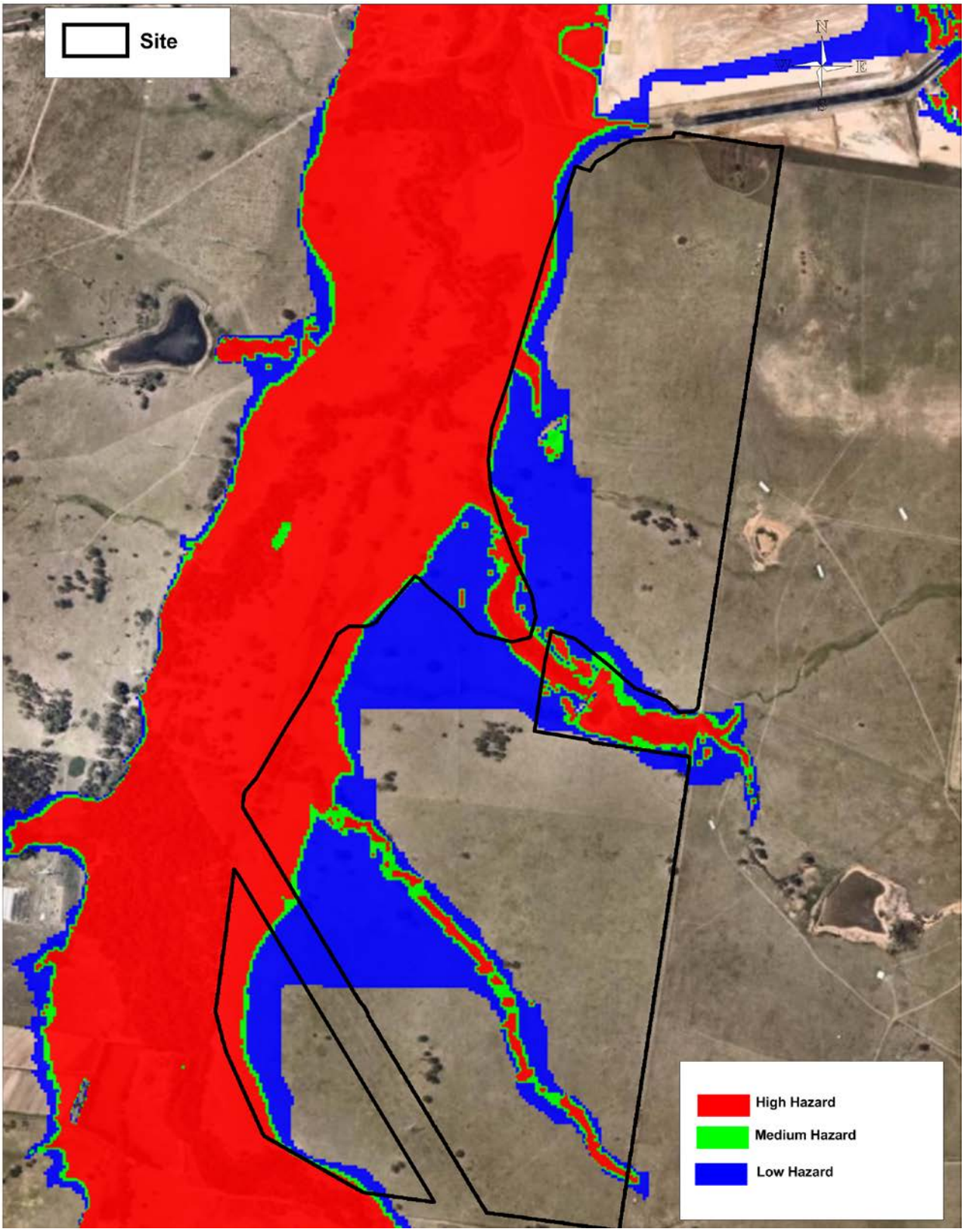

Figure 20 PMF Flood Hazards - Existing Conditions

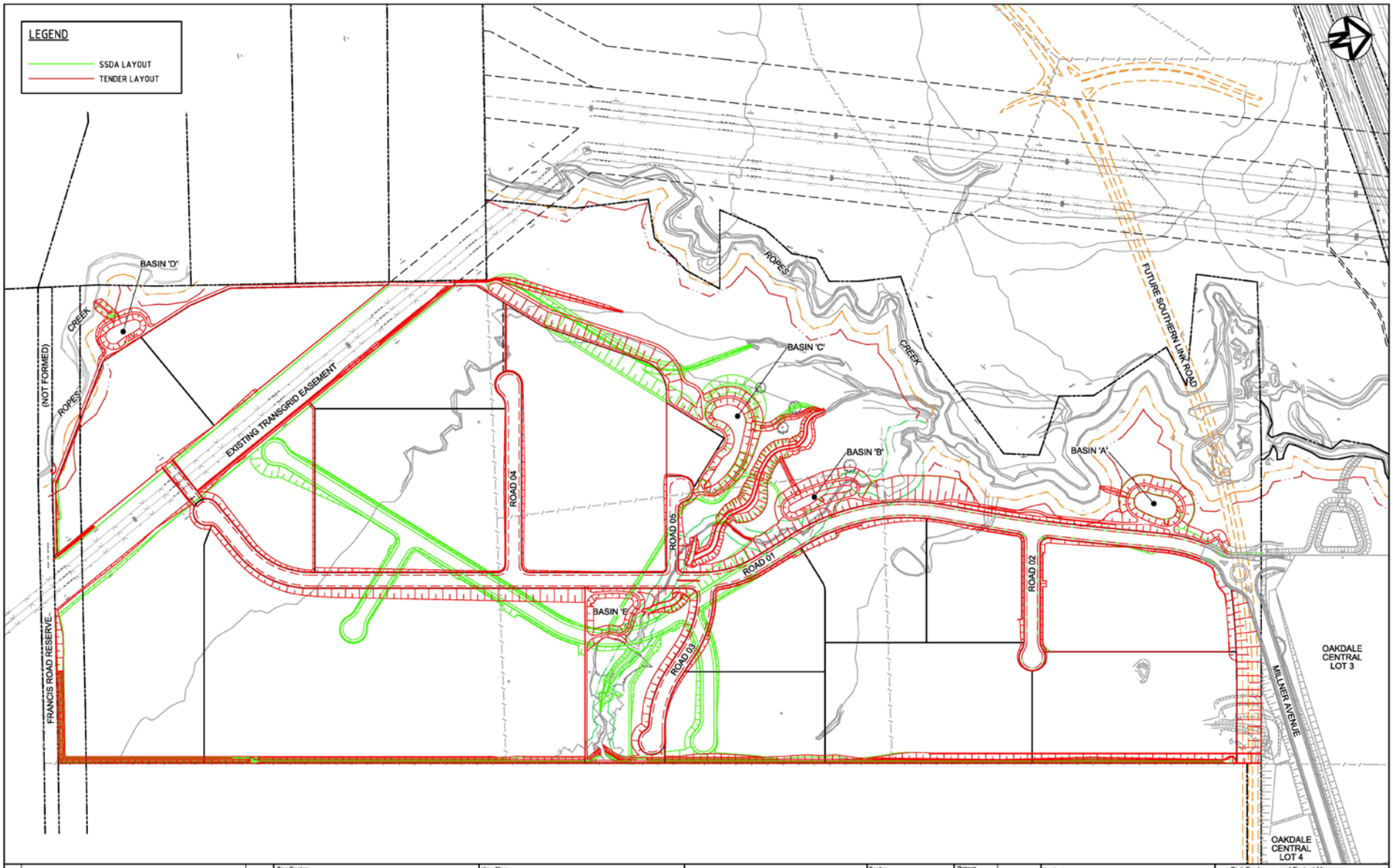

Figure 21 Proposed Development Layout for Oakdale South Estate

Figure 22 100 yr ARI Inflow Locations in TUFLOW Model - Future Conditions

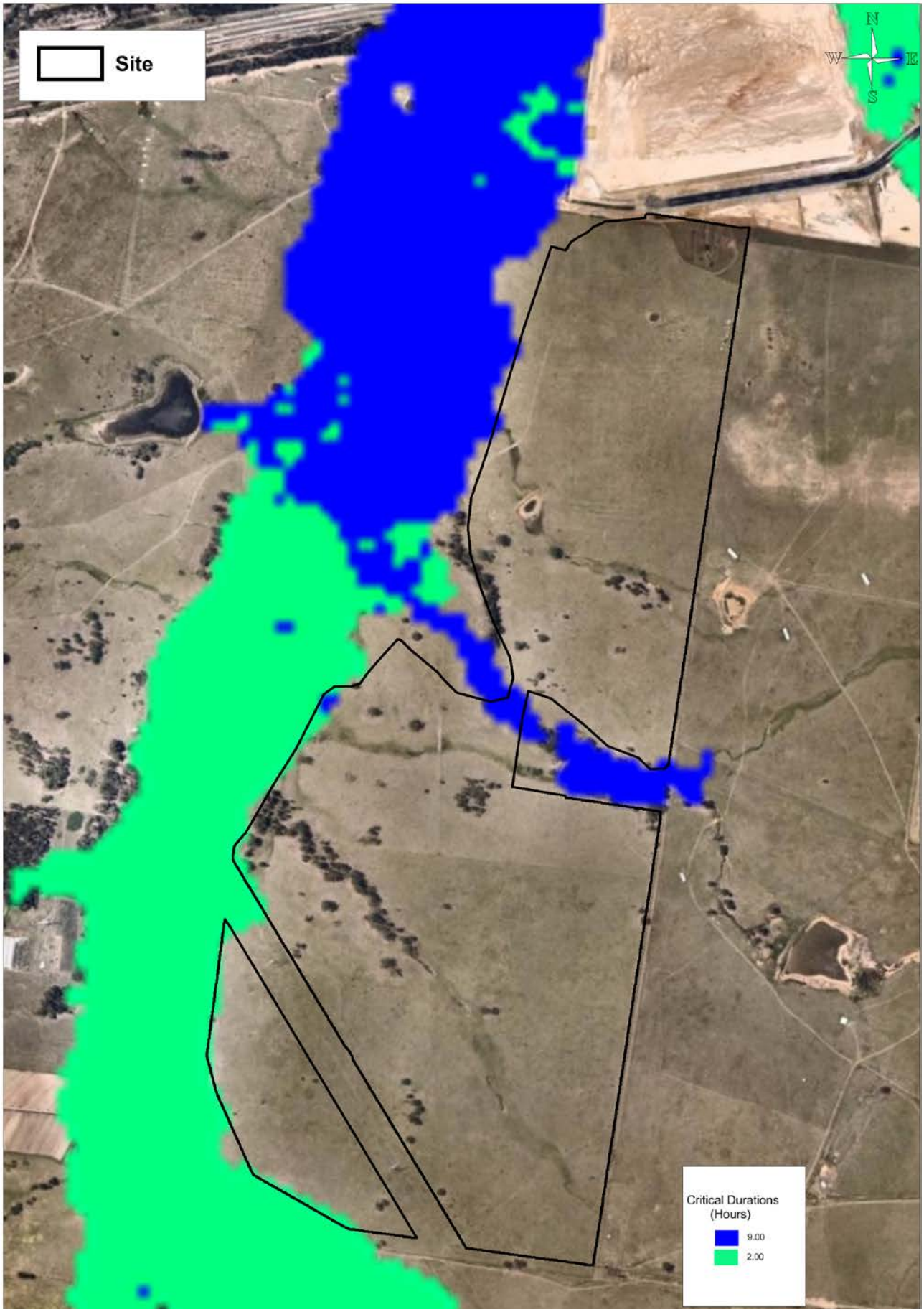

Figure 23 100 yr ARI Critical Storm Burst Durations - Future Conditions

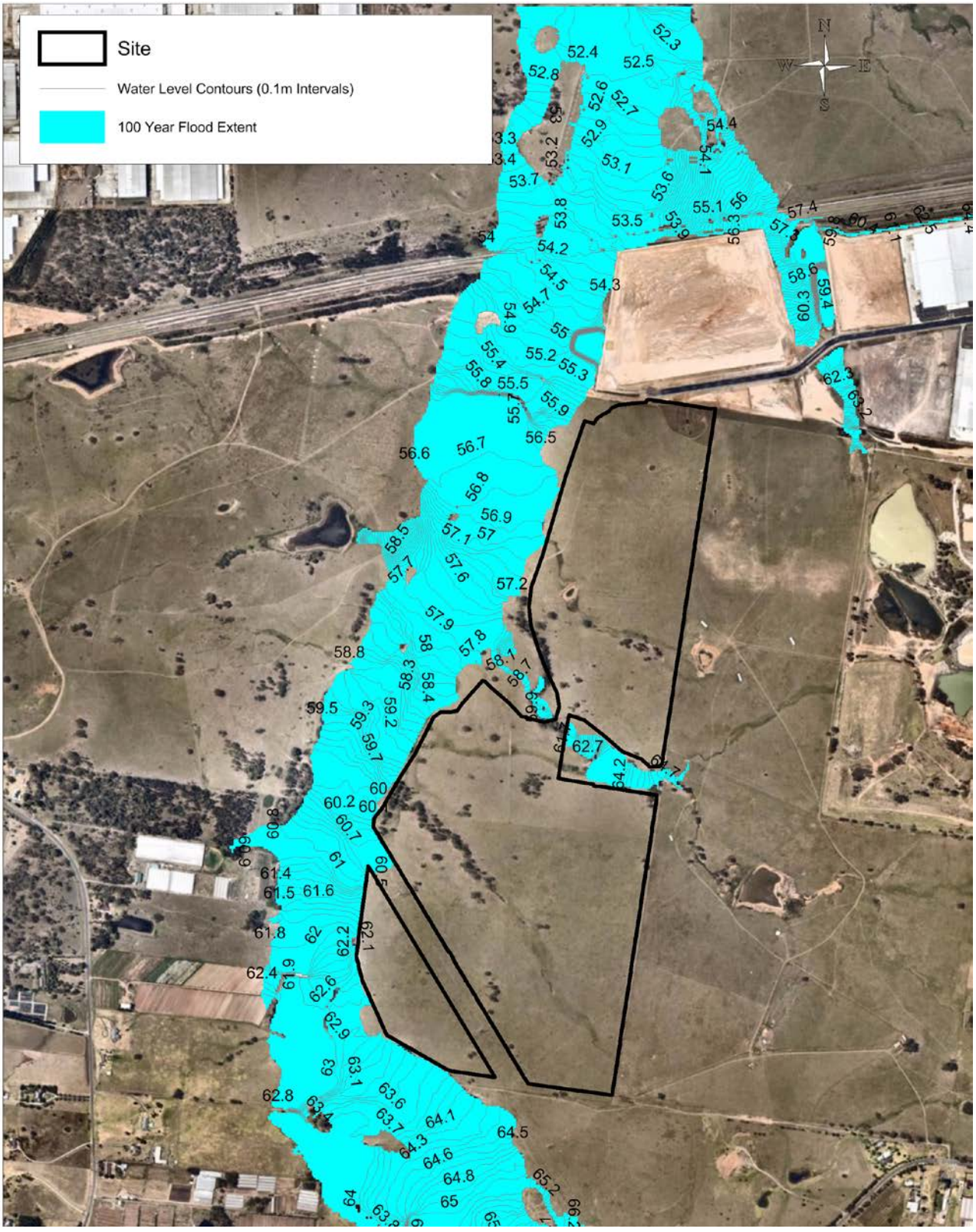

Figure 24 100 yr ARI Flood Extents and Flood Levels - Future Conditions

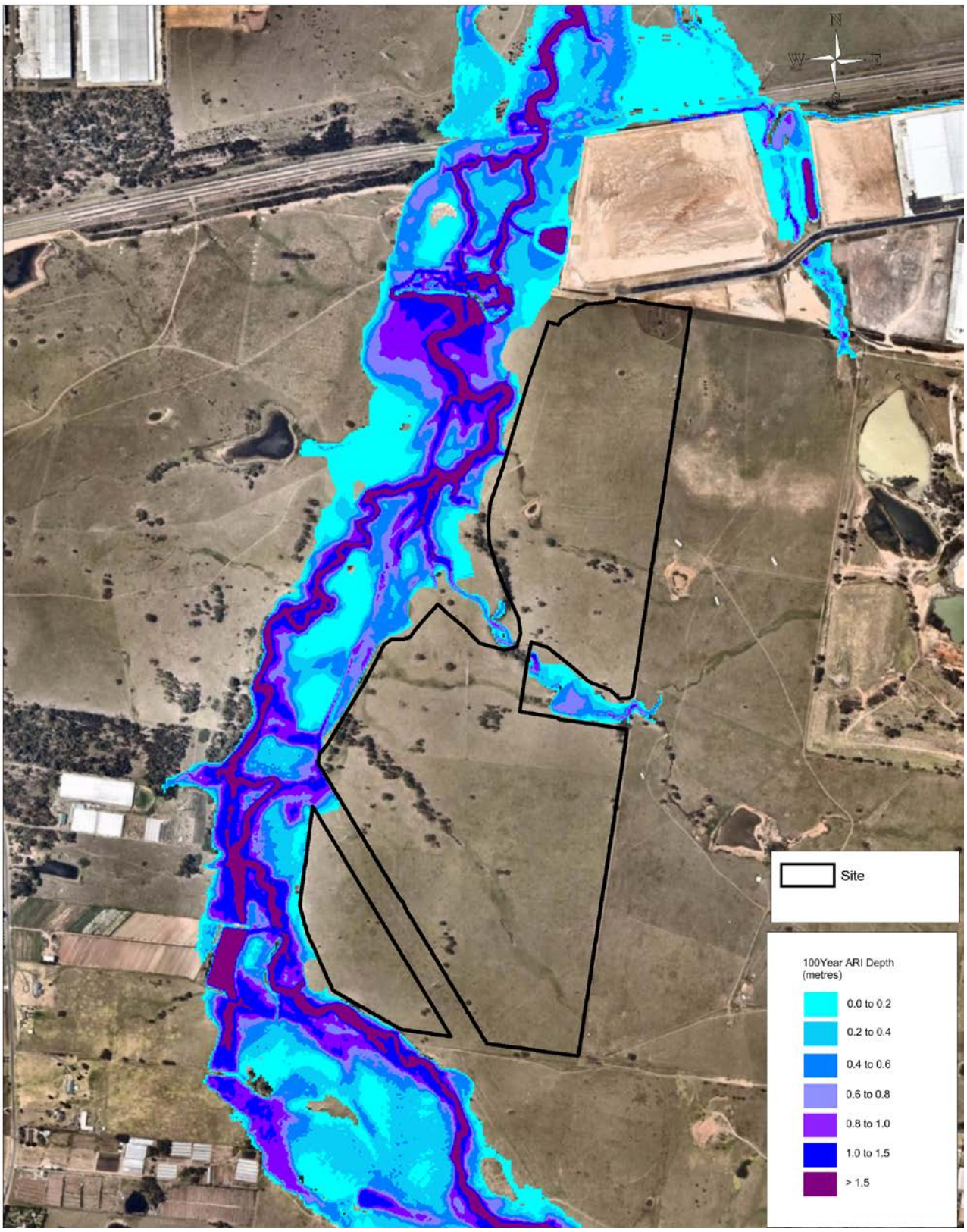

Figure 25 100 yr ARI Flood Depths - Future Conditions

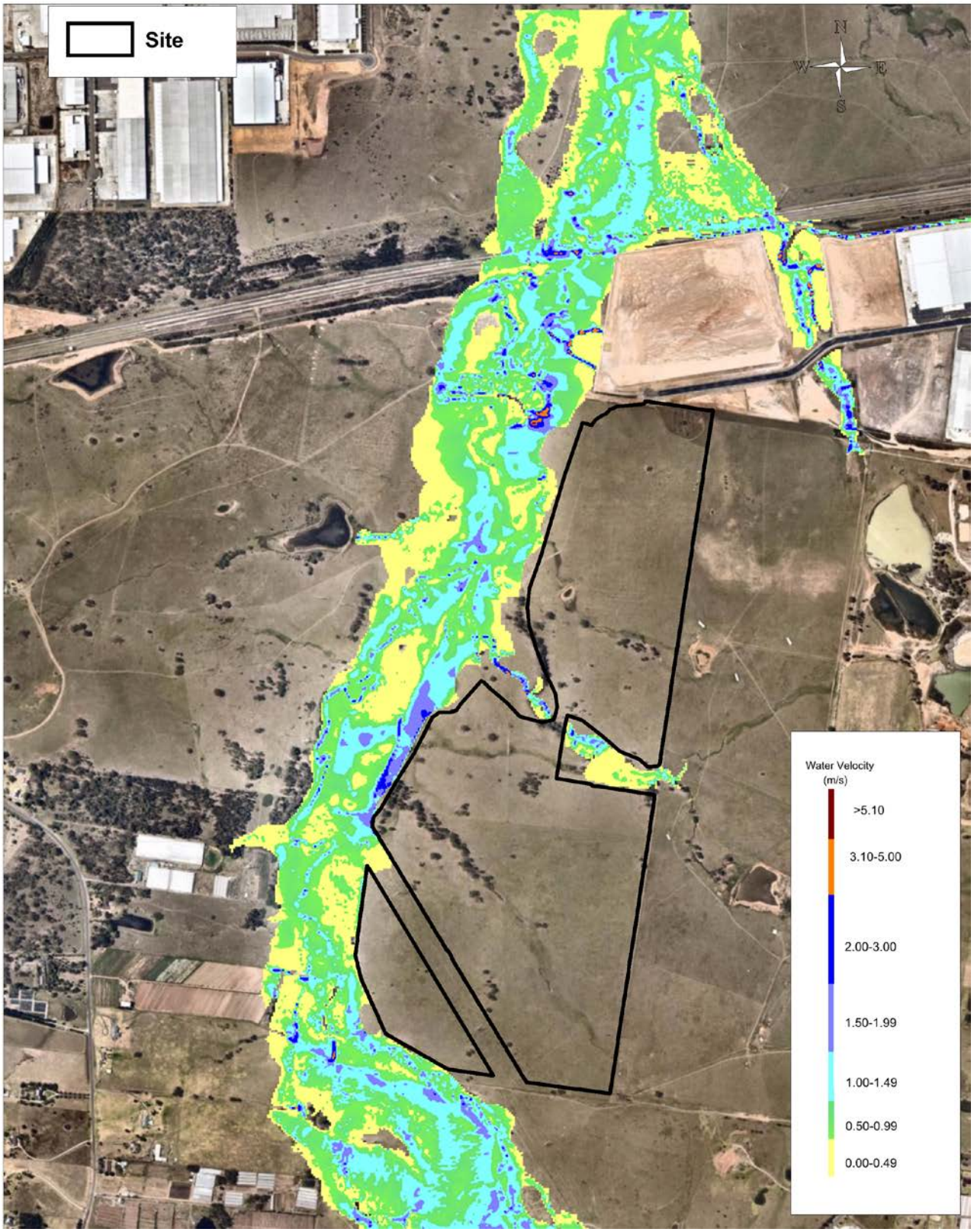

Figure 26 100 yr ARI Flood Velocities - Future Conditions

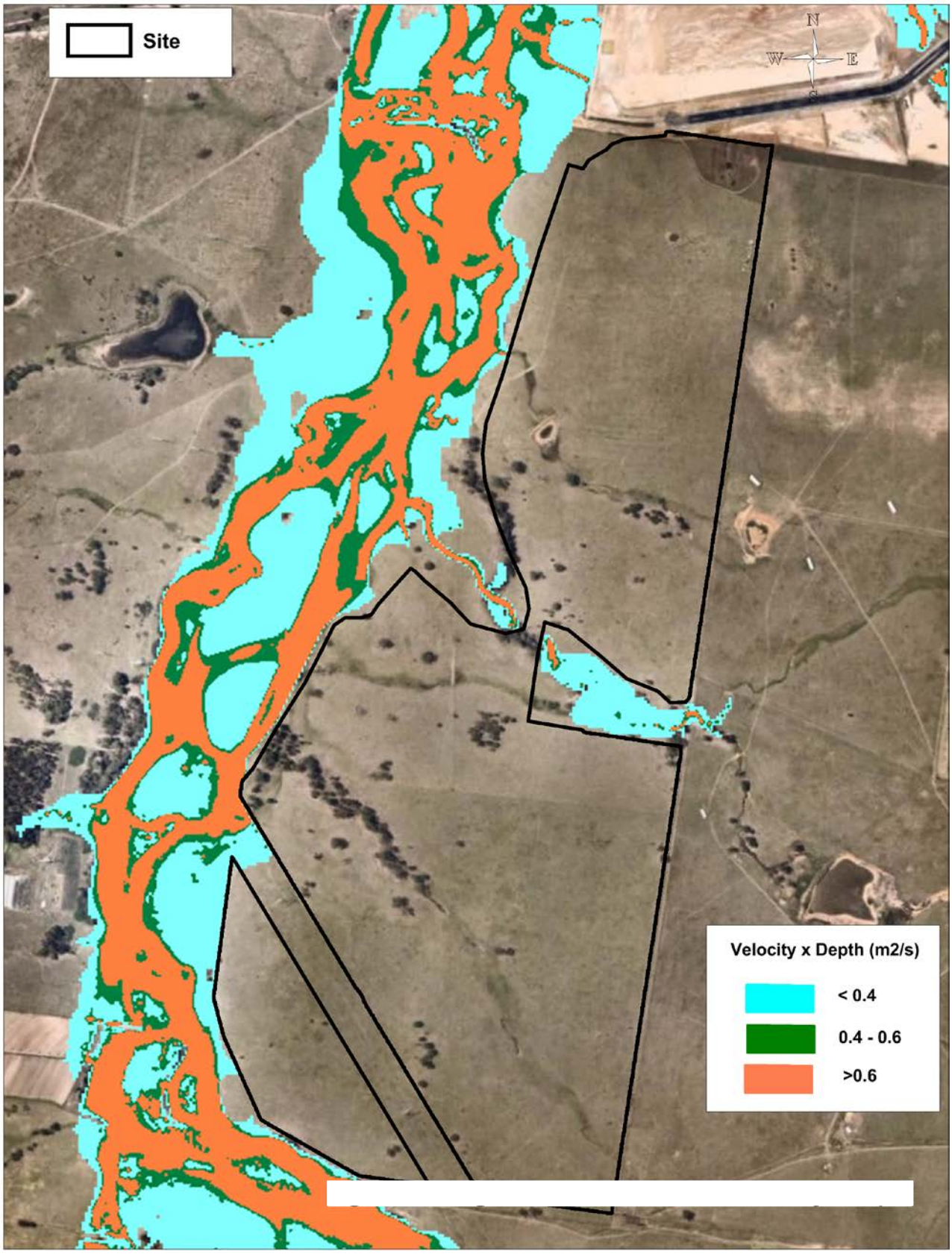

Figure 27 100 yr ARI Flood Velocity x Depth - Future Conditions

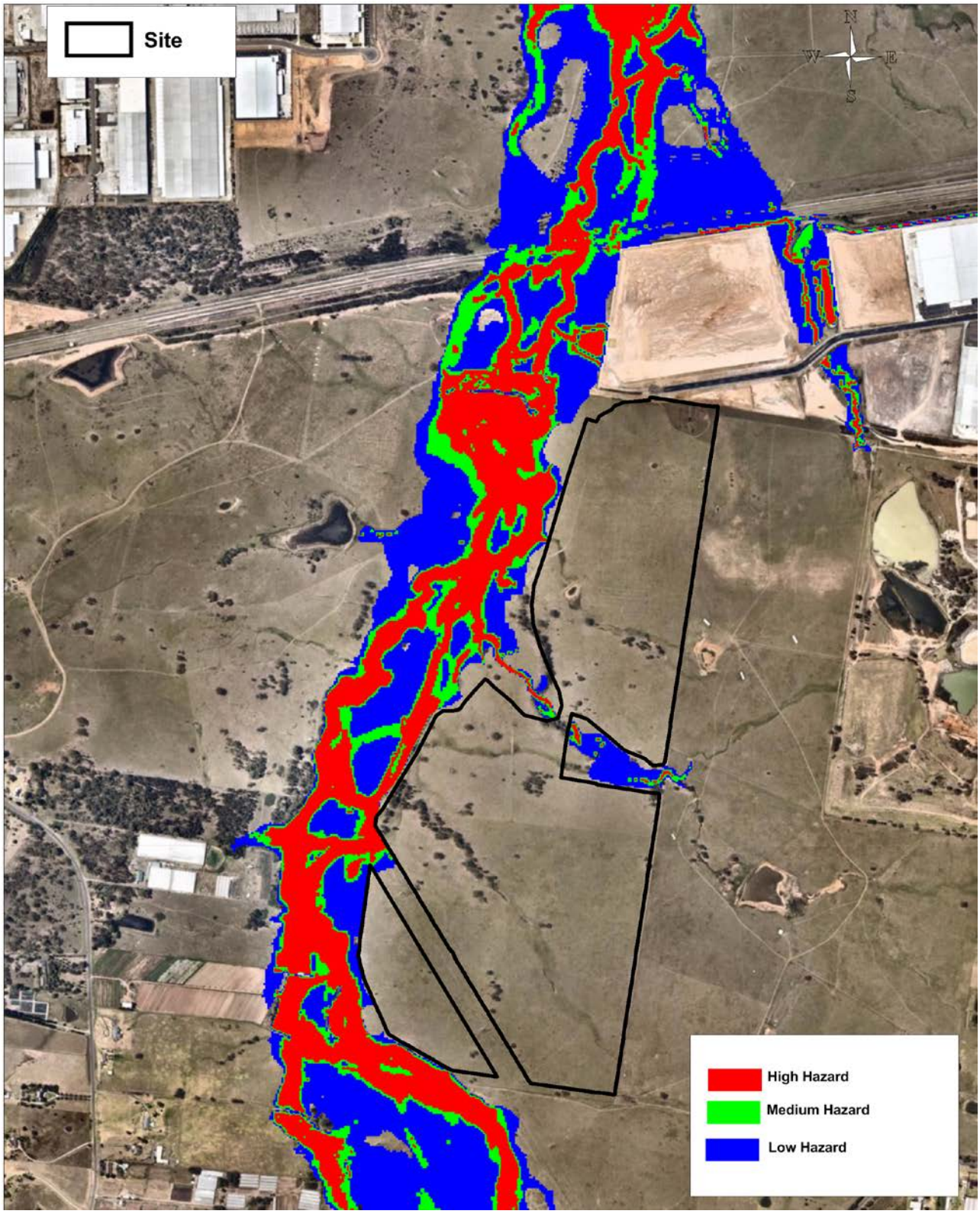

Figure 28 100 yr ARI Flood Hazards - Future Conditions

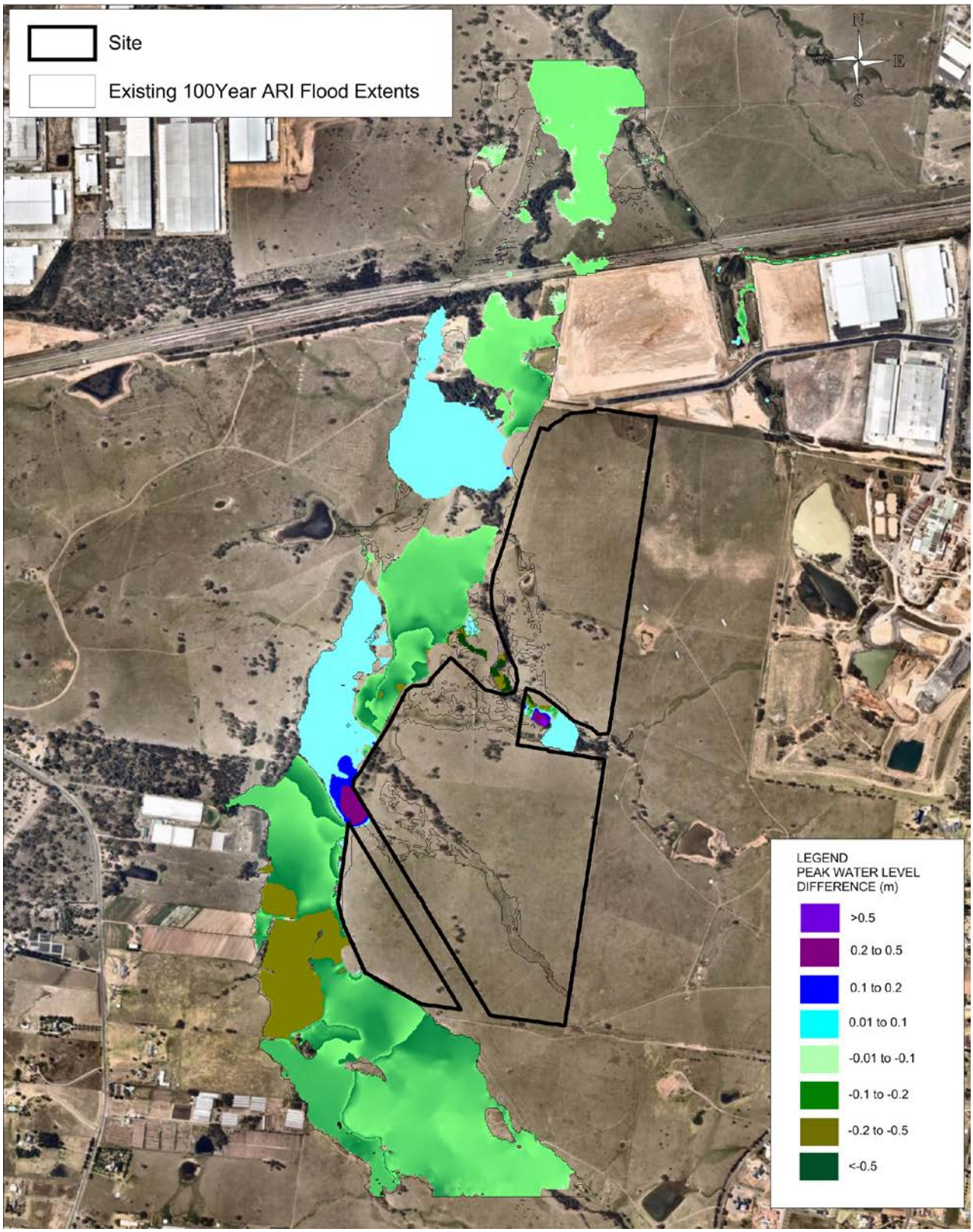

Figure 29 100 yr ARI Level Differences - (Future – Existing Conditions)

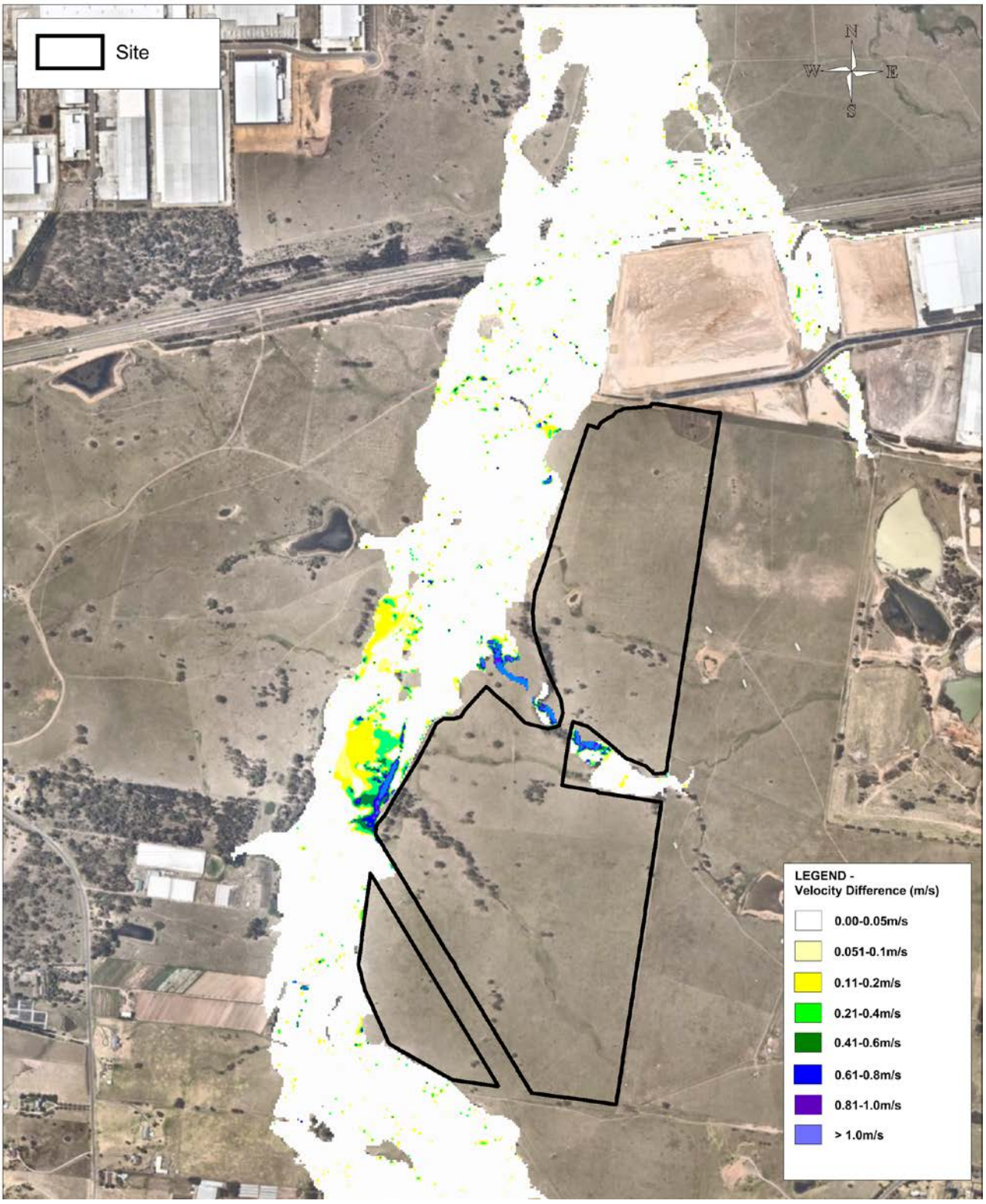

Figure 30 100 yr ARI Velocity Differences - (Future – Existing Conditions)

Figure 31 PMF Inflow Locations in TUFLOW Model - Future Conditions

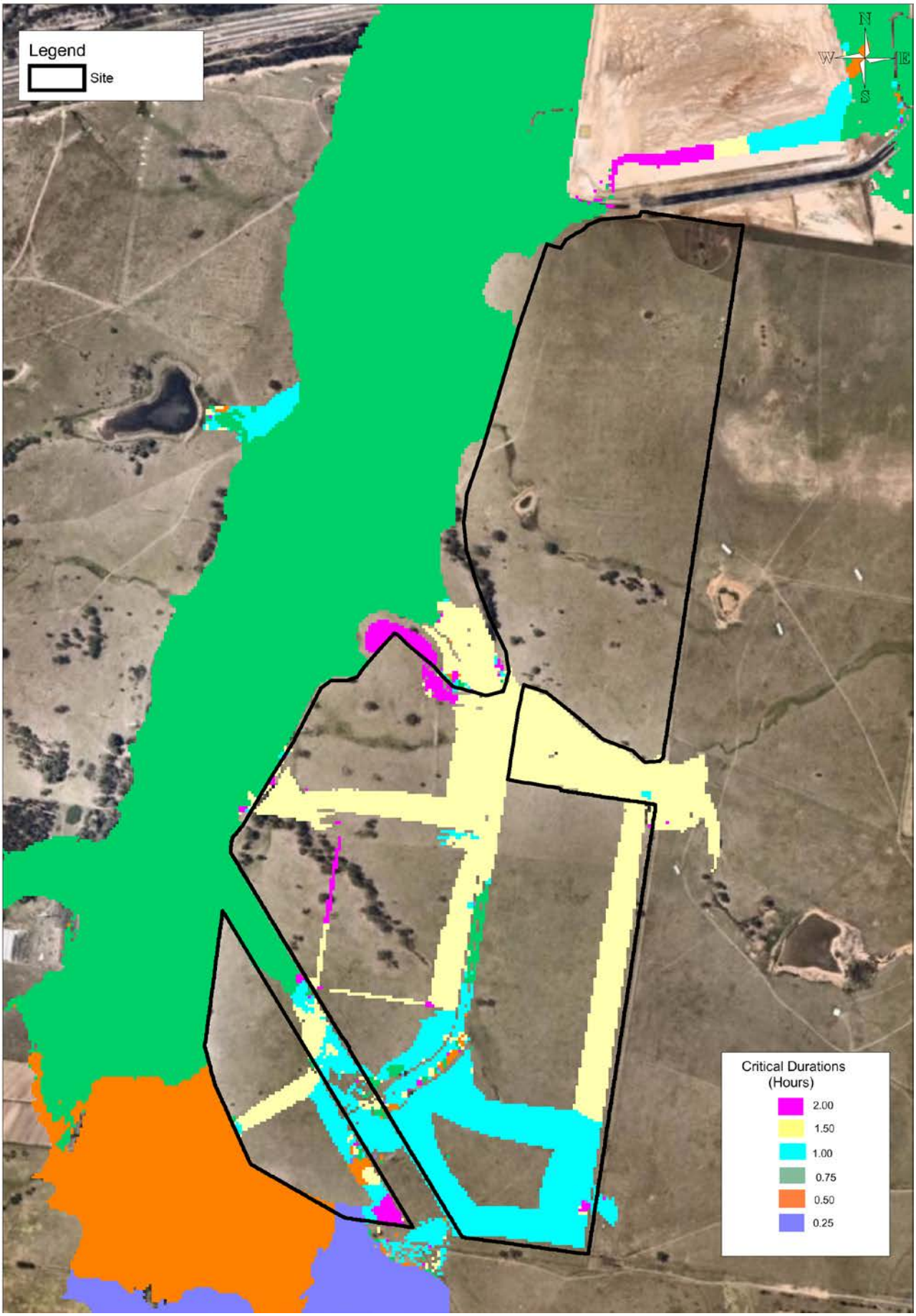

Figure 32 PMF Critical Storm Burst Durations - Future Conditions

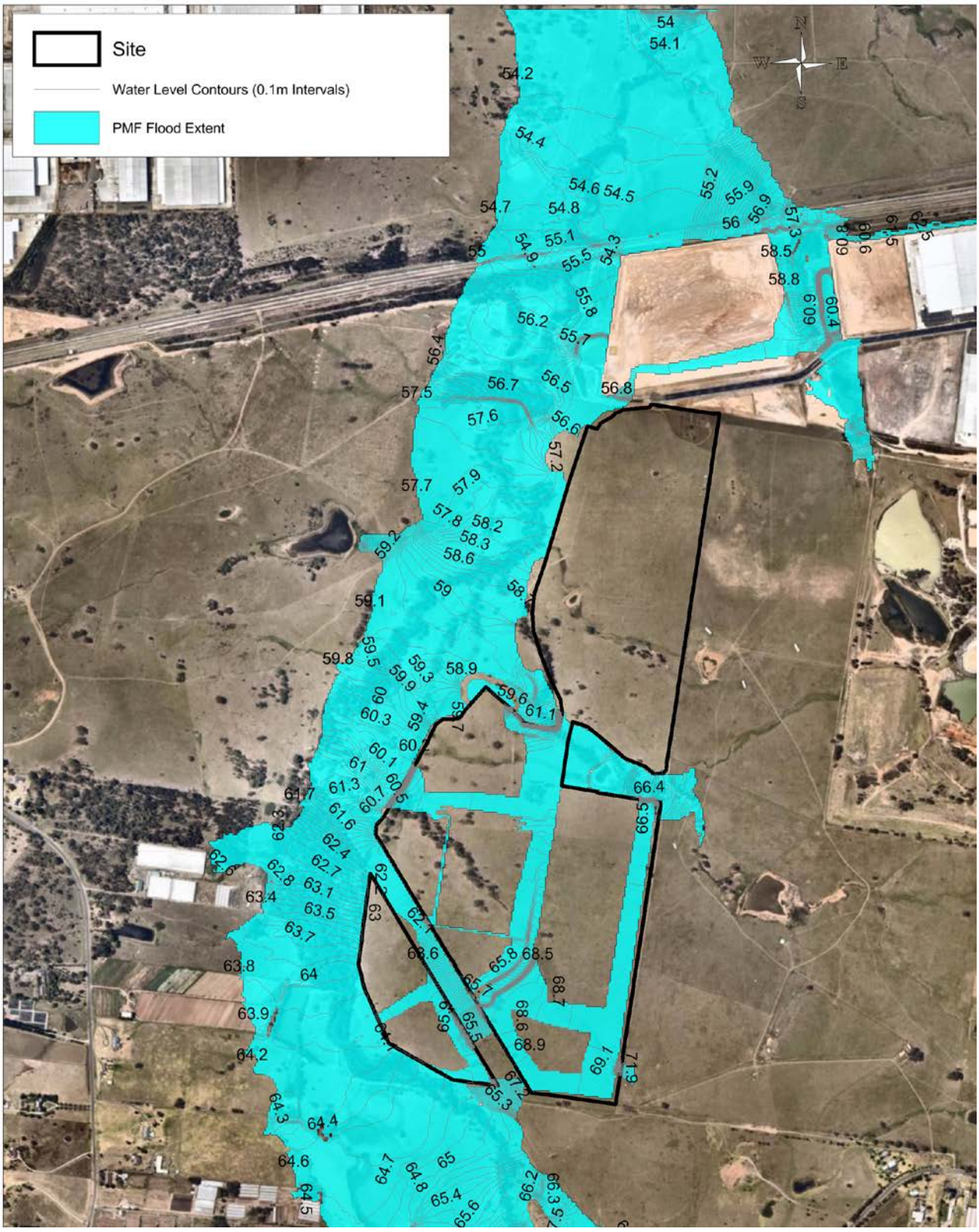

Figure 33 PMF Flood Extents and Flood Levels - Future Conditions

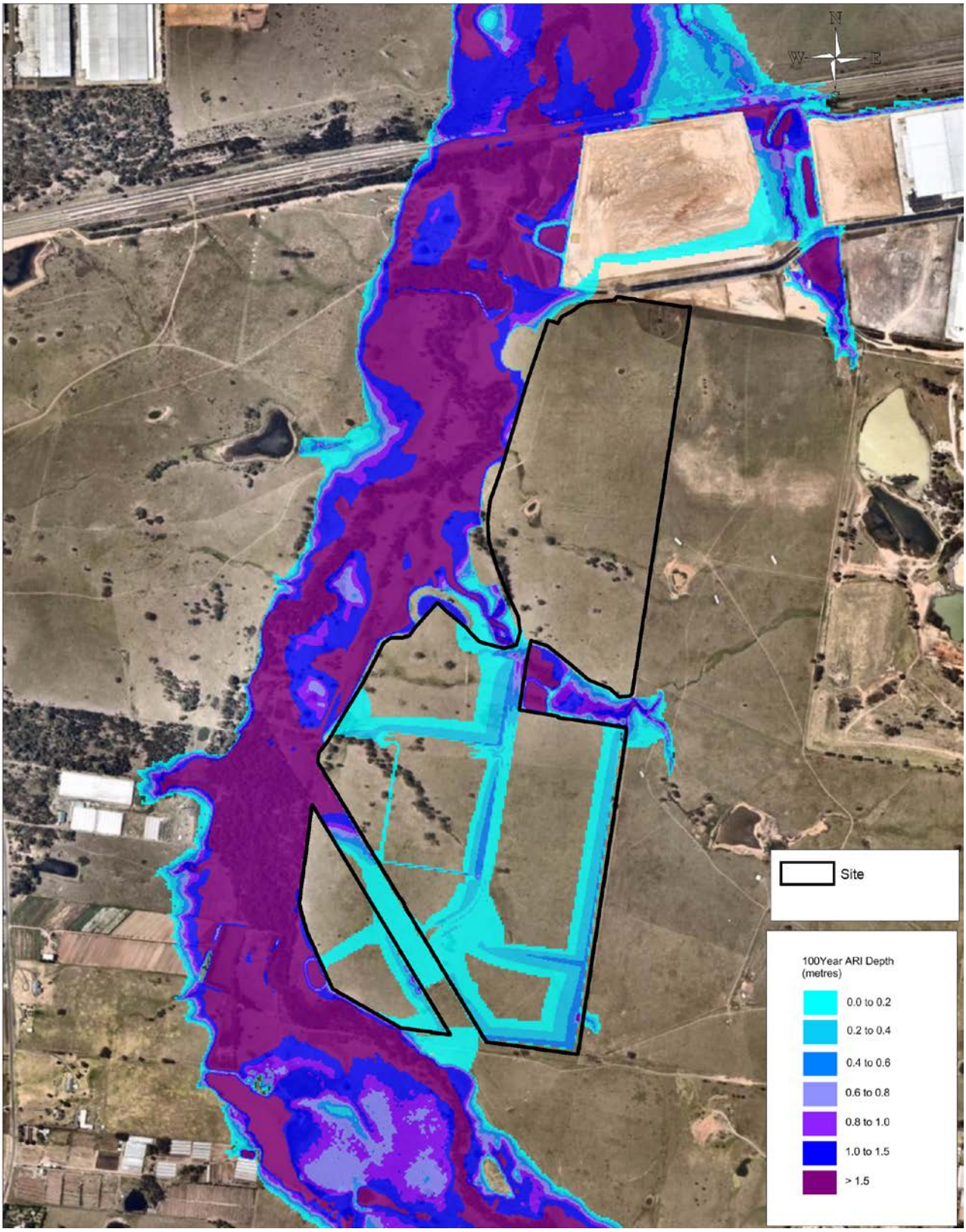

Figure 34 PMF Flood Depths - Future Conditions

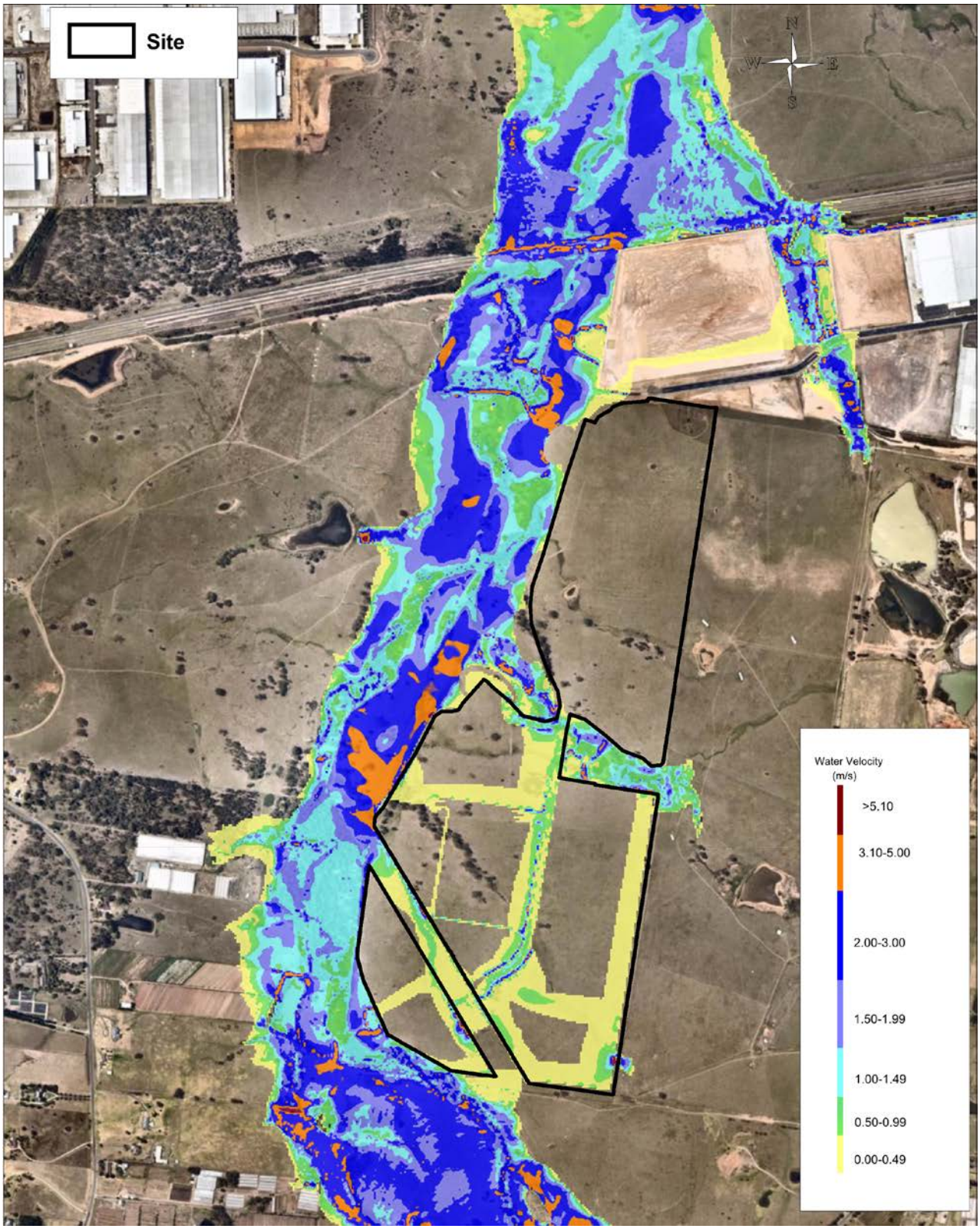

Figure 35 PMF Flood Velocities - Future Conditions

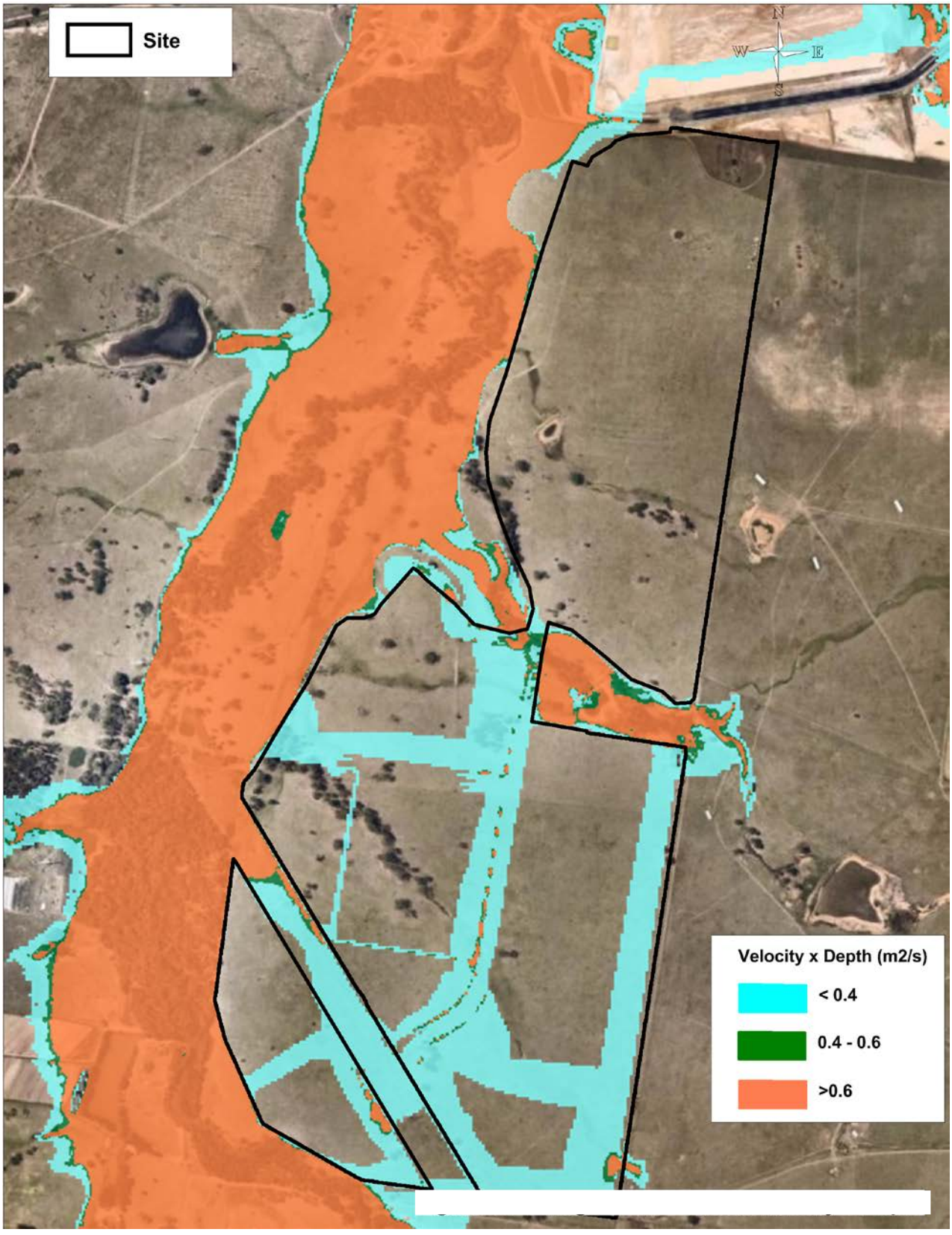

Figure36 PMF Flood Velocity x Depth - Future Conditions

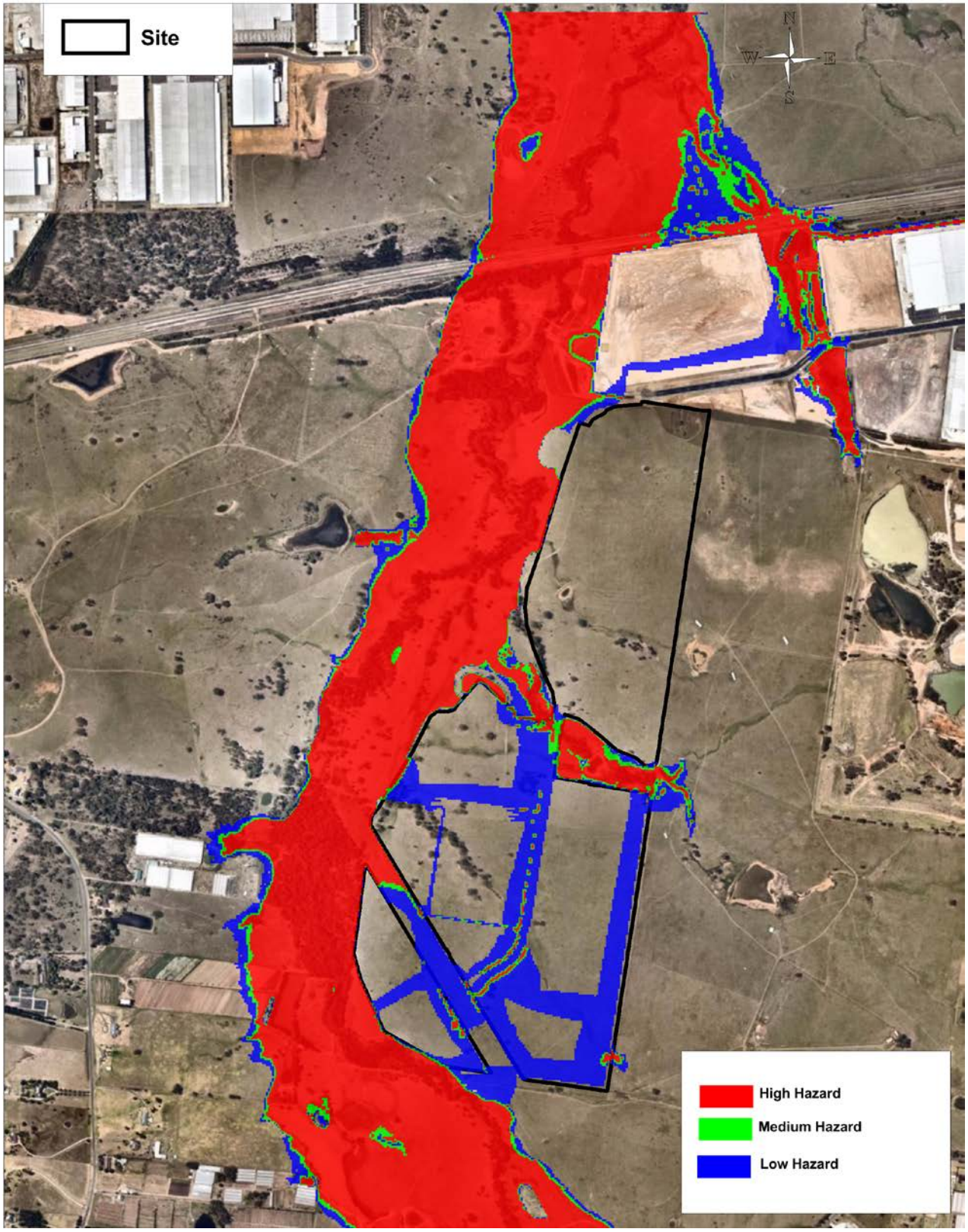

Figure 37 PMF Flood Hazards - Future Conditions

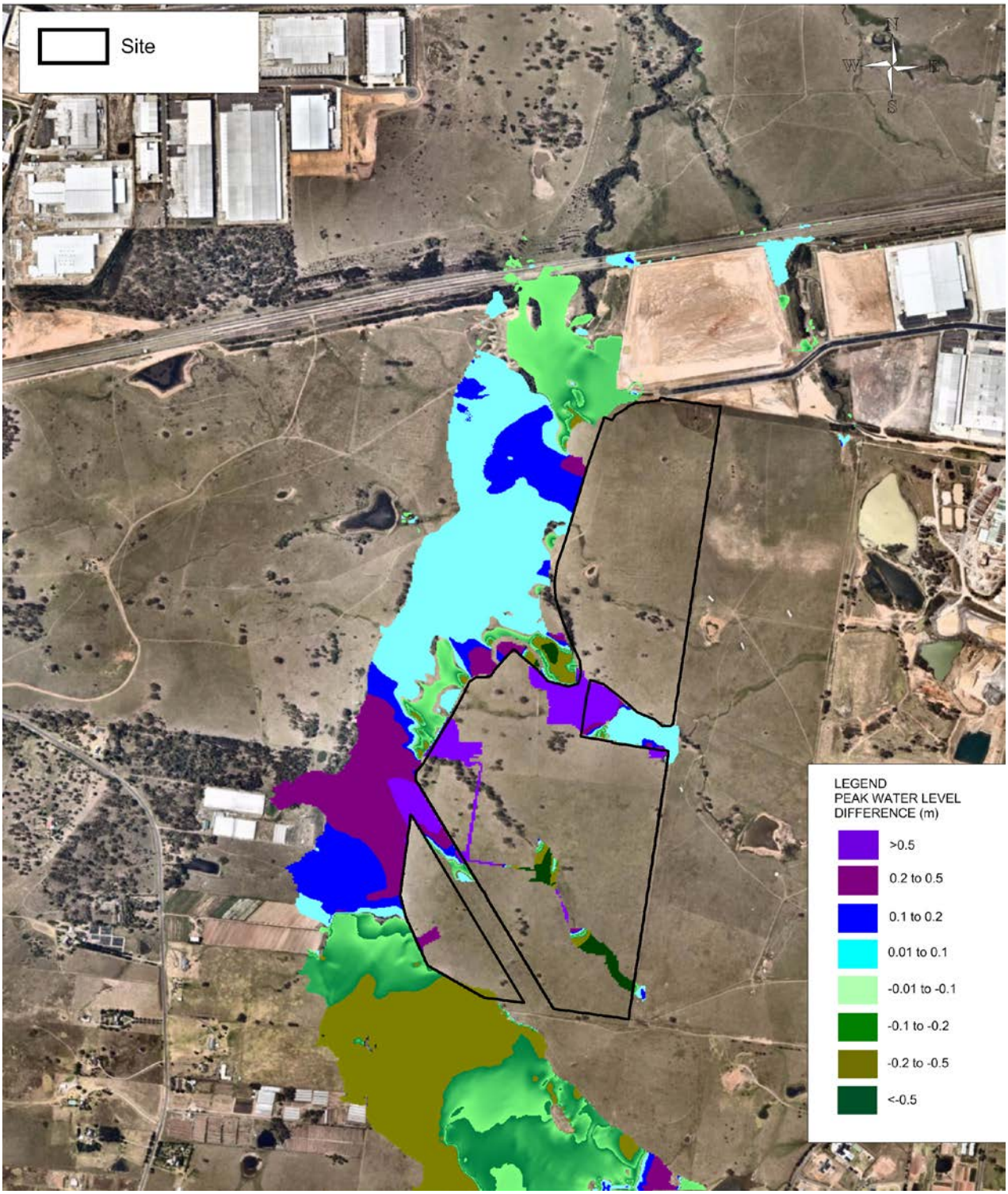

Figure 38 PMF Level Differences - (Future – Existing Conditions)

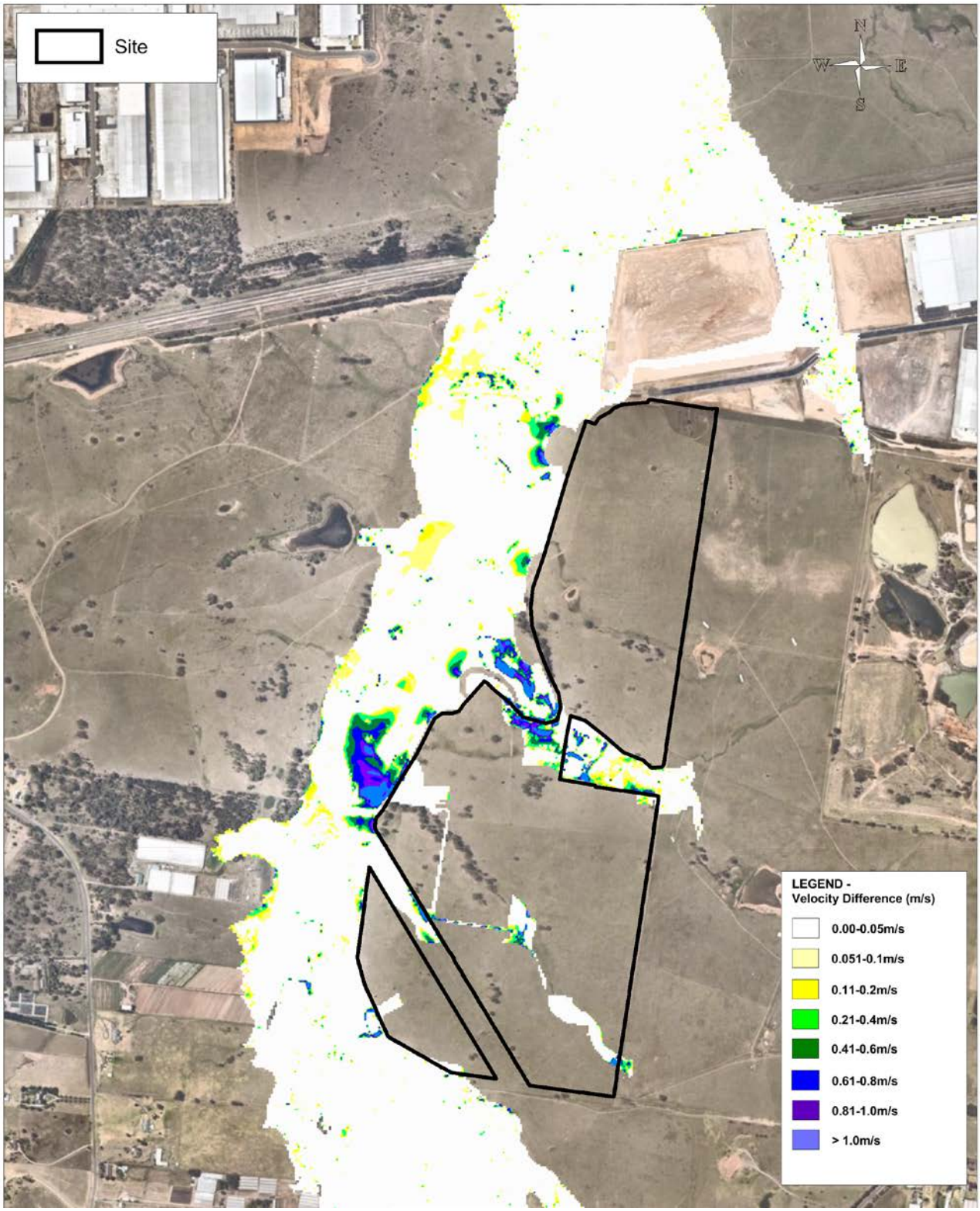

Figure 39 PMF Velocity Differences - (Future – Existing Conditions)

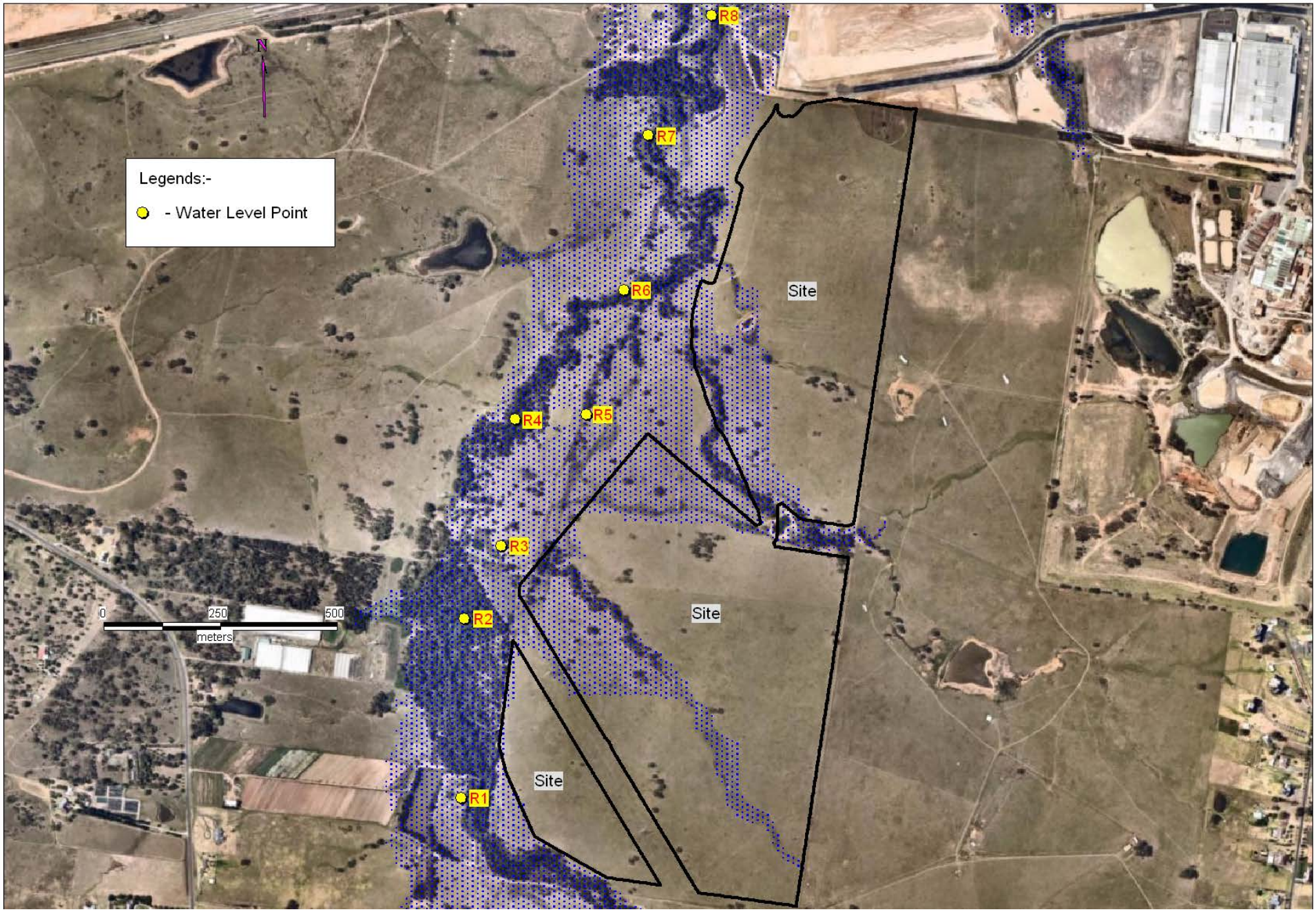

Figure 40 Reference Locations

Oakdale South Industrial Estate

APPENDIX B

ASSESSING THE IMPACT OF DEVELOPMENT CONTROLS ON DESIGN FLOWS

Cardno
Shaping the Future

B.1 Aim

For strategic planning purposes, the approach adopted by GHD when assessing Future Conditions was to assume that post-development flows would be the same as flows under Existing Conditions on the basis that retarding basins would be constructed to limit peak flows under post-development conditions to pre-development peak flows.

The accuracy of this approach was assessed by analysing a representative subcatchment in the upper Ropes Creek catchment (refer Subcatchment N5a in **Figure 4**).

B.2 Test Catchment Properties

The properties of the test catchment under Existing Conditions were:

Subcatchment area (ha)	27.81
Imperviousness	5%
Vector average slope	1.28%
Pervious area roughness	0.06
Impervious area roughness	0.025

The rainfall losses adopted by GHD were as follows:

Surface Type	Initial Loss (mm)	Continuing Loss (mm/h)
Pervious	15	2
Impervious	2.5	0

GHD adopted these losses for both 100 yr ARI and PMF assessments.

For the purposes of these assessments the same rainfall losses were adopted for the 100 yr ARI assessments. In the case of PMF assessments the following losses were adopted:

Surface Type	PMF Initial Loss (mm)	PMF Continuing Loss (mm/h)
Pervious	1	1
Impervious	0	0

The modelling approach was based on “split subcatchments”.

B.3 100 yr ARI Scenarios

Six 100 yr ARI scenarios were assessed as follows.

PreDevN5a Pre-development Conditions where the adopted imperviousness was 5%;

PDevN5a Post-development Conditions where the assumed the imperviousness is 80%;

PreDn5aAdj1 Pre-development Conditions where the pervious rainfall losses were area weighted losses under Post-development Conditions ie. initial loss = 5 mm and continuing loss = 0.4 mm/h;

PreDn5aAdj2 Pre-development Conditions where the adopted rainfall losses were area weighted losses under Post-development Conditions and the subcatchment was modelled as a lumped subcatchment with 0% imperviousness;

PDev+Bas Post-development Conditions with a basin with a volume required to contain 100 yr ARI runoff in the basin without overtopping. It was further assumed that the basin would be 1 m deep and that the rectangular slot outlet would be sized to give an outflow at 1 m depth which matches the target peak flow under Pre-development Conditions.

PDevN5aBX Post-development Conditions with the B values adjusted to approximate a basin that limits the peak outflow to the peak flow under Pre-development Conditions.

B.4 100 yr ARI Results

The peak flows were assessed for each scenario for storm burst durations from 30 minutes to 9 hours. The estimated peak outflows are summarised in **Table B.1**.

Table B.1 Estimated Peak Flows (m^3/s)

Node	Storm Burst Duration (mins)									
	30	45	60	90	120	180	270	360	540	Max
PreDevN5a	1.09	1.40	1.66	2.06	2.25	2.28	2.22	2.35	2.52	2.52
PDevN5a	10.83	9.87	10.50	11.14	10.44	6.04	5.42	4.18	3.77	11.14
PreDn5aAdj1	1.52	1.92	2.25	2.56	2.71	2.65	2.57	2.74	2.66	2.74
PreDn5aAdj2	1.40	1.91	2.25	2.57	2.70	2.66	2.56	2.71	2.62	2.71
PDev+Bas	1.63	1.97	2.15	2.25	2.35	2.26	2.23	2.41	2.56	2.56
PDevN5aBX	1.42	1.89	2.22	2.43	2.54	2.42	2.29	2.45	2.28	2.54

Table B.2 Accuracy of Estimated Peak Flows (m^3/s)

Node	Storm Burst Duration (mins)									
	30	45	60	90	120	180	270	360	540	Max
PreDevN5a	*-33%*	*-29%*	*-23%*	*-9%*	*-4%*	*1.0%*	*-0.5%*	*-2.5%*	*-1.4%*	*-1.4%*
PDevN5a	*565%*	*401%*	*389%*	*395%*	*344%*	*167%*	*143%*	*74%*	*47%*	*335%*
PreDn5aAdj1	*-7%*	*-3%*	*4.9%*	*13.8%*	*15.3%*	*17%*	*15.2%*	*13.9%*	*3.8%*	*7.0%*
PreDn5aAdj2	*-14%*	*-3%*	*4.8%*	*14.3%*	*15.1%*	*18%*	*14.8%*	*12.8%*	*2.3%*	*6.0%*
PDevN5aBX	*-13%*	*-4%*	*3.4%*	*7.8%*	*8.2%*	*7.1%*	*2.9%*	*1.7%*	*-11%*	*-0.7%*

For assessment purposes the Post-Development Conditions with a basin were adopted as the benchmark when assessing the accuracy of any alternative approach. The differences between the estimated peak flows for each scenario against the benchmark peak flows are given in **Table B.2**.

It was found that the 9 hour storm burst is critical under Pre-development Conditions and the 90 minute storm burst is critical under Post-development Conditions. With a basin in place the critical storm burst duration is 9 hours.

Figure B.1 plots and compares hydrographs generated by the 2 hour and 9 hour storm bursts under the various scenarios.

It is concluded that in relation to 100 yr ARI flooding:

(i) Adopting Pre-Development Conditions as a surrogate for Post-Development Conditions with a basin would match the peak flow to within 2% in a 9 hour storm burst but would underestimate peak flows in shorter duration storm bursts less than 2 hours duration. It would also underestimate the overall volume of runoff;

(ii) Adopting Pre-Development Conditions and adjusting the rainfall loss rates improves the estimated volume of runoff and would also match the peak flow to within 4% in a 9 hour storm burst but would overestimate peak flows in shorter duration storm bursts around 2 hours duration by up to 15%;

(iii) The approach adopted to representing the catchment with areal weighted rainfall losses had little impact on the estimated peak flows;

(iv) Increasing the BX value as a surrogate for development with a basin could match the Pre-Development peak flow but in a 2 hour storm burst and would underestimate the peak flow in a 9 hour storm burst by around 11%.

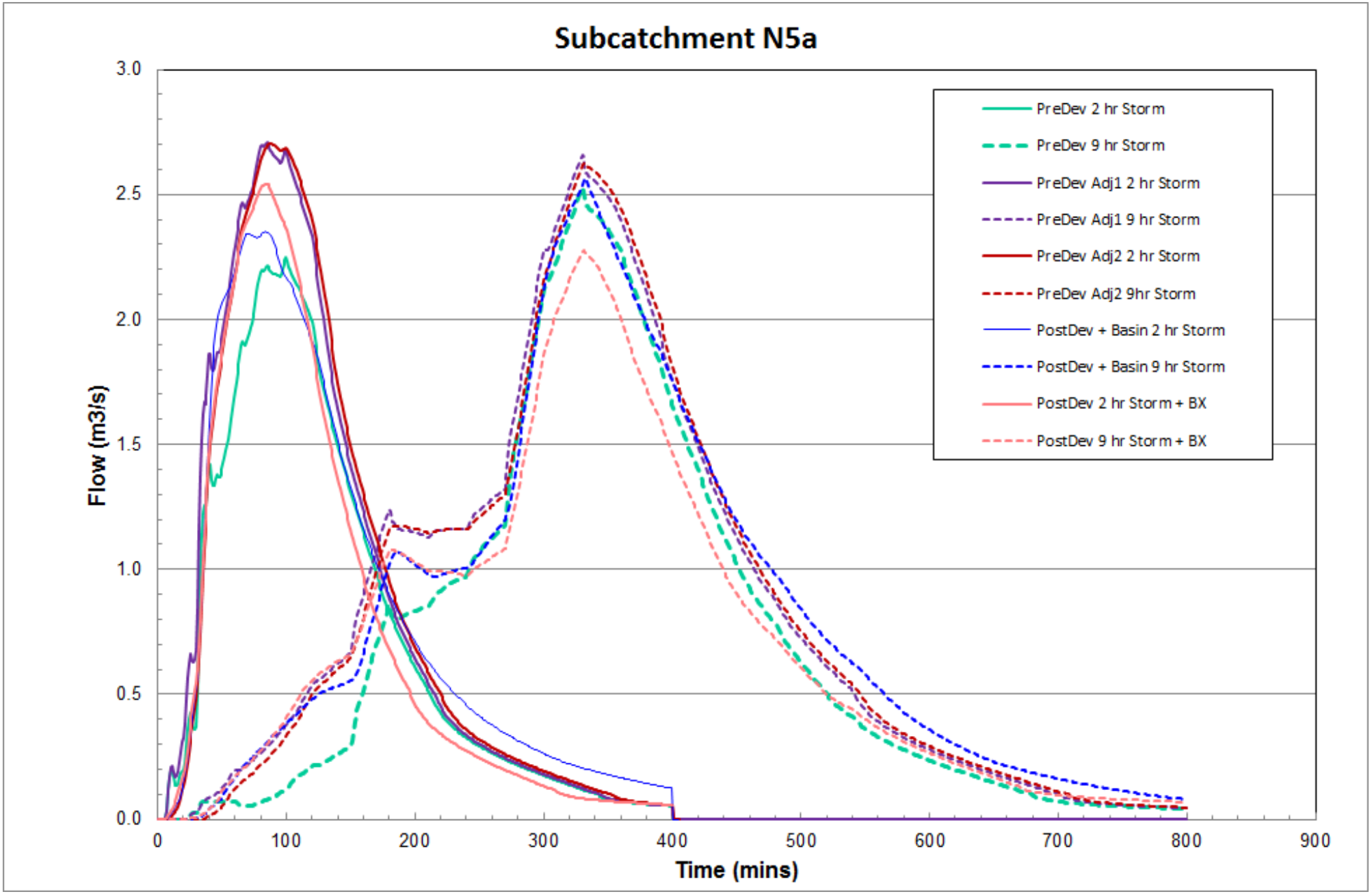

Figure B.1 Comparison of 1% AEP Outflow Hydrographs for Various Scenarios