southeast
engineering+environmental
PO Box 96 Moruya NSW 2537
Tel. 02 44744 439 - Mbl. 0450 154 441

20 September 2019

Adnan Voloder

Boral Land & Property Group
PO Box 6041
North Ryde NSW 2113

Re: DPIE Submissions for proposed Modification 2 of the Dunmore lakes Sand Project – Email from Boral 14/08/2019

Background

DPIE and Shellharbour Council have provided submissions regarding the proposed Modification 2 of the Dunmore Lakes Sand Project. This submissions relate to water quality and flooding issues addressed in the Surface Water Assessment prepared by Southeast Engineering and Environmental. (Table 1).

Table 1 Summary of submission issues and response.

Party	Issue outlined in submission.	Response
DPIE (29/07/19)	*Consideration to be given to dam break scenarios.*	A risk assessment and consequence category has been estimated for the Stage 5A embankment, and D1 form submitted to DSC. Preliminary consequence category for both sunny day and flood failure are low to very low. Awaiting response from DSC. Refer to attached email correspondence and D1 form.
	Quantification of changes in flood levels under the different ARI events;	The 5, 20, 100 year ARI and PMF events have been modelled for the existing and proposed conditions for both Stage 5A and 5B. Key impacts are: • For 5A, a 16mm increase over Riverside Drive in the 5 year ARI event and smaller increases in other events. Refer to Appendix A. • For 5B, no impacts beyond the site boundary. Approximately 45mm increase in flood height for the 100 year ARI event at the southern end of the bunded dredge pond. A large (1.6m/s) increase in flood velocity over the dredge pond spillway will occur in a PMF event. Appendix A contains comparison of pre and post flood characteristics. Refer to sections 3 and 4 of the Surface Water Assessment for more detail.
	Identification of any new areas that would be subject to flooding;	Refer to flood mapping provided in Appendix A. These include Figures 41 – 44 which show the extent of flooding for the 5, 20, 100 ARI and PMF events. The largest changes are within the proposed basins, this is due to the starting conditions of the model runs which start with the ponds overflowing slightly. Beyond the basins the largest change in extents is associated with the 5year ARI event, refer to figure 37 which shows the largest change in depth to the west of Stage 5A of between 40-50mm. Figure 41 shows the associated slight change in extents. For the large events changes to flood extents are confined to the pond areas and are due to the aforementioned model starting conditions.
	Discussion of the impact of any introduced hardstand areas	The hardstand (carpark) area proposed to the north of the Stage 5B dredge pond is located above the PMF flood level at approximately 5.5m AHD. The PMF peak flood level is 5.2m AHD. The introduced hardstand area has no impact on flooding.
	Discussion of potential flood impacts having regard to any applicable Council requirements.	Updated flood modelling has been undertaken making use of a hydrologic and hydraulic model commissioned by Kiama Municipal Council for the proposed Minnamurra River shared user pathway. The model assumes 100% blockage at Riverside Drive. Model background and

		assumptions used can be found in *Flood and Coastal Study, Stage 2 Report, Minnamurra River Boardwalk* (Cardno, 2019). Spillway design will be undertaken to accommodate 100 year ARI and PMF flood depths and velocities. Water levels within bunded areas will generally be similar to adjacent water levels though ground water or flood flow overtopping impacts. Periods of difference in water level between dredge ponds and outer environment will be limited as ponds will be emptied to allow for dredge operations to resume. *Shellharbour Council DCP.* *A9.6 – Filling of Floodprone land* *a. There is no significant increase in flood levels up to the PMF event.* Refer to figures in Appendix A. Largest change is increase in the 5 year ARI event by 50mm over rural land to the west, and 16mm increase in flood level over the Riverside Drive in the 5 year ARI event. Smaller changes for larger events. Not significant in the context of change in height and land use. *b. There is no significant impacts upon flood behaviour on other properties* As outlined in the Surface Water Assessment and this letter, changes in flood height, extents and velocities are not significant. *c. There is no increase in risk to life up to the PMF event* The largest change in flood behaviour over land where people are likely to be located is a 16mm increase in flood level over Riverside Drive in the 5 year ARI event. Changes to flood level in this area for larger events are negligible. Refer to sections 3.0 and 4.0 of the SWA (Version F) for detail on the updated flood modelling, and Appendix A of this letter for flood modelling results.
Shellharbour Council (Appendix 1, 09/08/19) .	1. Hazard maps for the PMF missing.	Pre and post development maps for the PMF hazard attached (Fig 45 and 46).
	2. Vehicle stability assessment	Car park above PMF level.
	3. Vehicles as nuisance in PMF event	Car park above PMF level.

<table>
<tr><td></td><td>4. Spillway to be designed to pass PMF event</td><td>Will be incorporated into detailed design as required.</td></tr>
<tr><td></td><td>5. Are there Flood modelling results to support comment that the proposal, upon completion of rehabilitation activities, will result in no increase in flooding in downstream and upstream flood levels.
Embankment break risk assessment recommended. Risks considered and managed. Referral to DSC to determine if should be prescribed under the Dam Safety Act.</td><td>5A will be rehabilitated to replicate existing surface levels, as such pre development flood levels and flood behaviour will be replicated.

A risk assessment and consequence category has been estimated for the Stage 5A embankment, and D1 form submitted to DSC. Preliminary consequence category for both sunny day and flood failure are low to very low. Awaiting response from DSC. Refer to attached email correspondence and D1 form.</td></tr>
<tr><td></td><td>6. Freeboard required. Proposed freeboard of 100mm is suitable.</td><td>Freeboard of 100mm will be provided as part of detailed design.</td></tr>
<tr><td></td><td>7. Losses used in the hydrological modelling not included in the report.</td><td>Hydrological modlleing undertaken by Cardno as part of the Flooding and Coastal Study Stage 2 Report Minnamurra River Boardwalk (Cardno, 2019). Values used in that model provided below.
3.4.3 Adopted Hydrological Parameters for Design Storm
Adopted hydrological parameters are shown in Table 3-4. These parameters were then used to simulate design storms.
Table 3-4 Adopted WBNM parameters
<table>
<tr><th>Parameter</th><th>Values</th></tr>
<tr><td>Initial loss (pervious surface)</td><td>0 mm</td></tr>
<tr><td>Initial loss (impervious surface)</td><td>0 mm</td></tr>
<tr><td>Continuing loss (pervious surface)</td><td>2.0 mm/hr</td></tr>
<tr><td>C (Catchment Lag parameter)</td><td>1.3</td></tr>
<tr><td>Impervious Lag</td><td>0.1</td></tr>
<tr><td>Stream Lag</td><td>1.0</td></tr>
</table></td></tr>
</table>

<table>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td>8. …there is no evidence of blockage scenario in the report prepared by the consultant.</td><td>Hydraulic modelling undertaken by Cardno based on existing model prepared for the Flooding and Coastal Study Stage 2 Report Minnamurra River Boardwalk (Cardno, 2019) As is outlined in section 4.1.3 of that report, the culverts beneath the Princes Highway and the Southern Railway line were included in the model, as were the bridges across the Minnamurra River. The culverts beneath Riverside Drive adjacent to the Dunmore House entrance were not included, therefore were assumed be 100% blocked for the purposes of modelling.</td></tr>
<tr><td></td><td>9. Mannings roughness to be provided.</td><td>Table of mannings roughness from section 4.1.4 in Flooding and Coastal Study Stage 2 Report Minnamurra River Boardwalk (Cardno, 2019) outlined below and attached.
4.1.4 Roughness
Manning's roughness values were applied to the model based on aerial imagery, LEP zoning and Cadastre boundaries. The roughness values adopted in the model are presented in Table 4-1. The delineation of the materials in the TUFLOW model is shown in Figure 4-2. The default material type applies to all other area of the model not delineated in the figure below as passive material.
Table 4-1 Adopted roughness values
<table><tr><th>Surface Type</th><th>Manning's n Value</th></tr><tr><td>Pasture (Default Value)</td><td>0.05</td></tr><tr><td>Road</td><td>0.025</td></tr><tr><td>Vegetation</td><td>0.08</td></tr><tr><td>Creek</td><td>0.03</td></tr><tr><td>Water body</td><td>0.06</td></tr><tr><td>Urban block</td><td>0.1</td></tr></table></td></tr>
<tr><td></td><td>10. Approximation of invert levels</td><td>Invert levels used in model were based on dimensions collected in a site inspection as part of in Flooding and Coastal Study Stage 2 Report Minnamurra River Boardwalk (Cardno, 2019) (Section 4.3.1) and ALS data of surface levels at the culvert entrance and exits. Site inspections confirmed that there are no significant level changes between the adjacent surface and the culvert inverts themselves, therefore the ALS levels were assumes as proxies for invert levels. The modelling purpose is to provide an impact assessment between existing and proposed conditions, the structure details are maintained between the two scenarios. Any minor changes to invert levels are unlikely to affect flood levels in the events modelled or the impacts stated in the report.</td></tr>
</table>

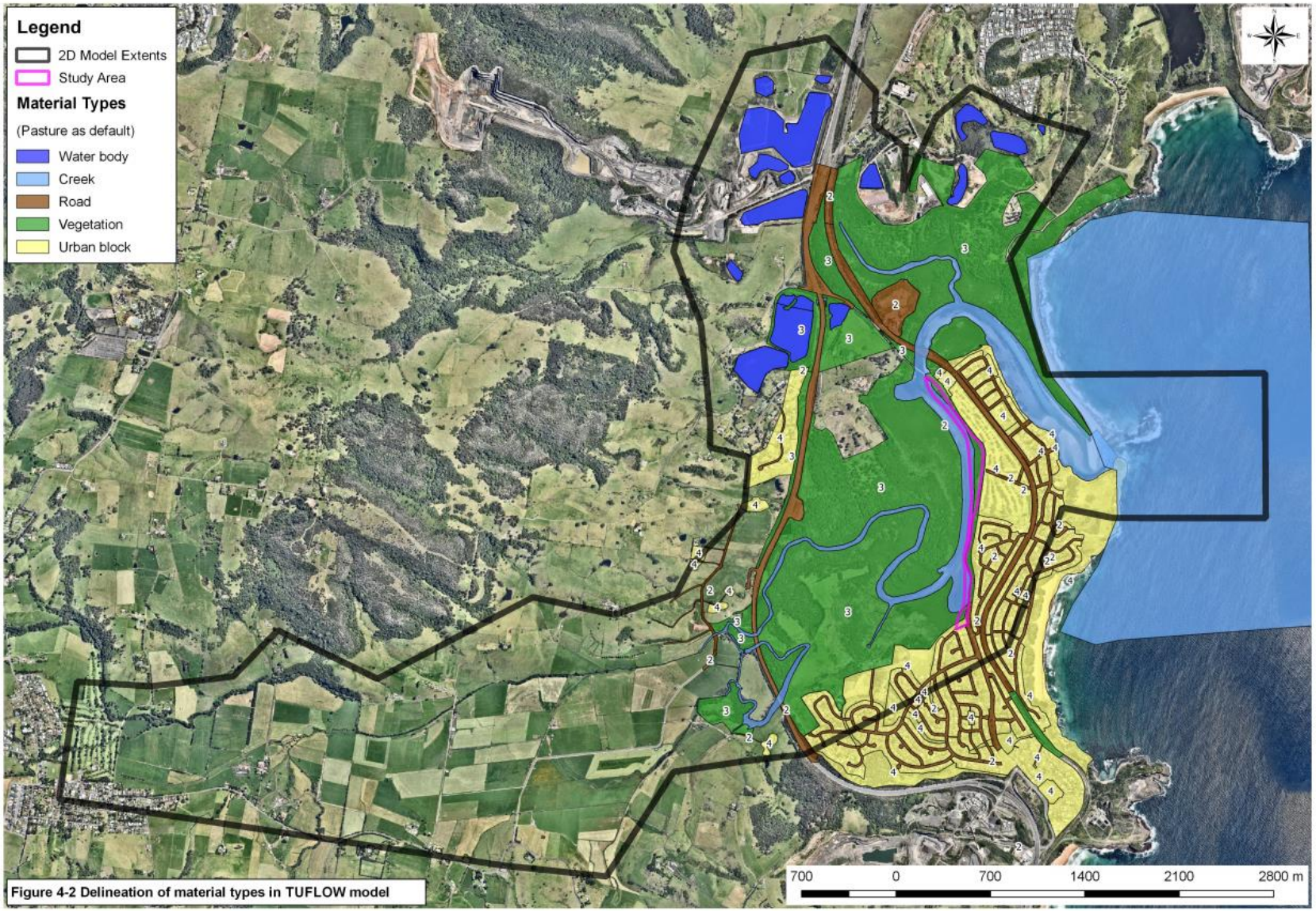


Figure 4-2 Delineation of material types in TUFLOW model

Please contact the undersigned if you have any questions regarding this letter.

Yours sincerely,

Lachlan Bain
Environmental Engineer BEng (Env) MEM.

APPENDIX A

Lachlan Bain <lachlan@south-east.com.au>
to Heather, Adnan

Sep 11, 2019, 11:54 AM (6 days ago)

Hi Heather,

Regarding 5B, Council submissions have not raised any concerns about this in relation to Dam saftety.
In the event of bund failure for 5B, flows discharge into the Minnamurra River estuary. The outlflow from a failed bund is small in relation to natural flood flows.
Peak flow (total discharge over 5 mins) = 74000sqm x 2m/5min = 493cumecs.
This is less than the 1 in 5 year ARI peak flow for this part of the Minamurra River, therefore there are no people at risk should failure occur. (recreation areas, roads and housing well above the 5 year ARI flood level).
The Princes Highway is located above the PMF flood level, therefore there are no impacts on the highway should failure occur.

Regarding 5A. Please find the D1 form attached. At the moment I dont have the ANCOLD Guidelines on Consequence Categories. My estimates for Severity of Damage and Loss (Minor, med, Major or Catastrophic) are based on a comparison with Appendix A of DSC3A. Assumed at Minor to medium.

For the SDCC (no flooding), I have classified the Stage 5A pond as Very Low as water levels will be below the surrounding ground level (at natural Groundwater level), therefore in event of embankment failure flow out would be zero to minimal.

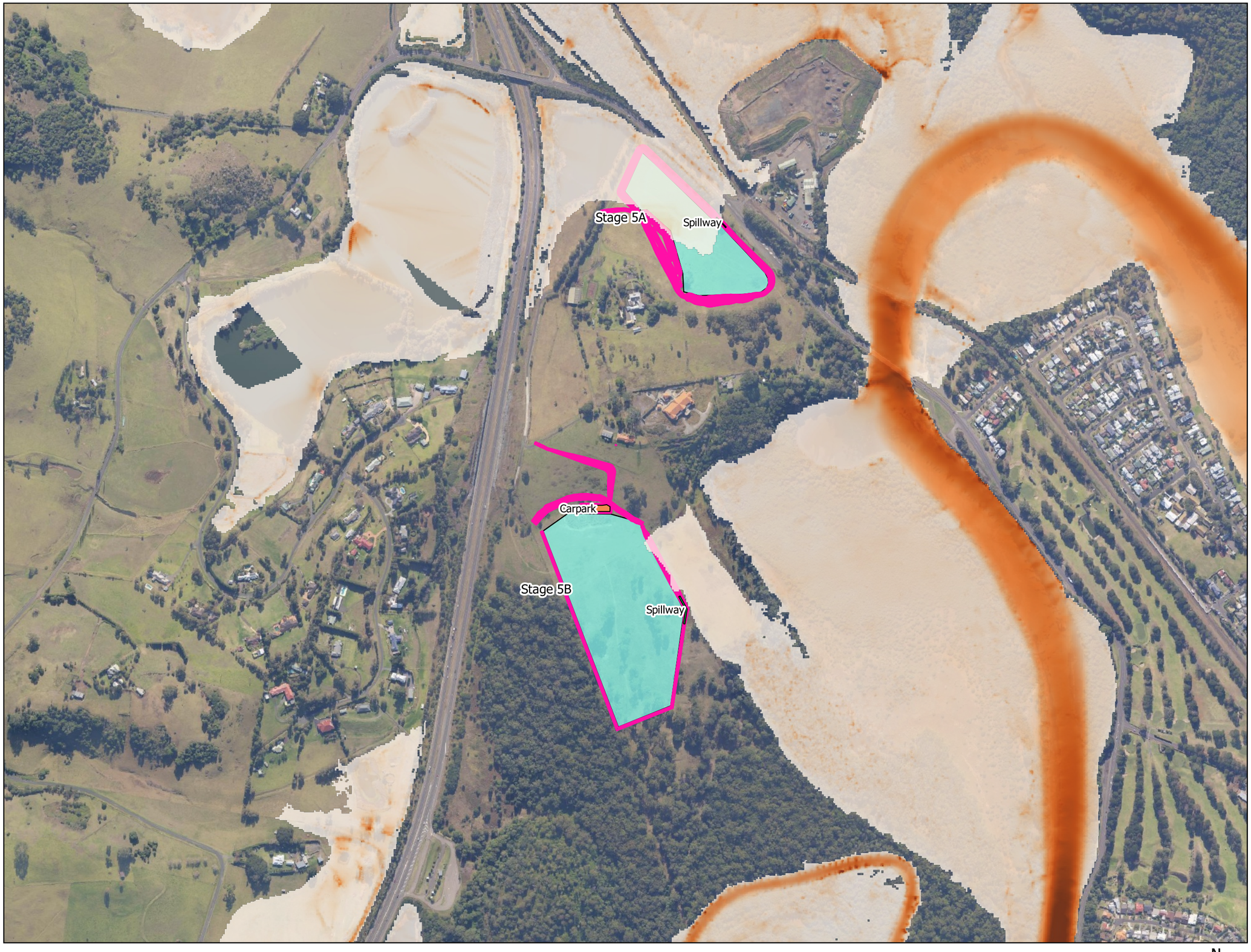
For the flood consequence, I have listed the adjacent peak flow rate for the PMF and 100 year event as the basin itself is off line. I have used the DSO-99-06 to estimate the PLL. I have assumed 5 people on the section of road that will be inundated (the low point on Riverside Drive) and applied the appropriate fatality rate (0.015), assuming 15-60 minute warning and vague understanding of flood severity, although this is probably more at the precise end, and Low severity. Flow VD is probably around 2.5 to 3 m2/s over the road. (assumes spread over a 50m low point in the road).

This equates to a PLL of <0.1, and from that a Low to Very Low Consequence category.
Once flows from dam failure reach the Minamurra River, they will have spread and will be confined within the River.

Given that an event >100 year ARI flood is required to fill the bunded area of Stage 5A, and that Riverside Drive is overtopped in around a 20 year ARI flood. Riverside Drive is likely to be closed in the event of a flood that overtops the Stage 5A bund. In the event of a flood, road closure could be maintained until water levels in the bunded area at safe levels.

I have attached a screen shot showing the 1% AEP flood extents for Rocklow Creek and the Minnamurra River.

Happy to chat if more information is required.



Legend

Dredge pond bunds and earthworks

5y ARI max velocity (m/s)

- 0.0157
- 0.274
- 0.532
- 0.79
- 1.05
- 1.31
- 1.56
- 1.8
- 2

0 100 200 300 400 m

N

FIG 1. 5y ARI Max velocity, existing conditions.

18/07/2019

southeast
engineering+environmental

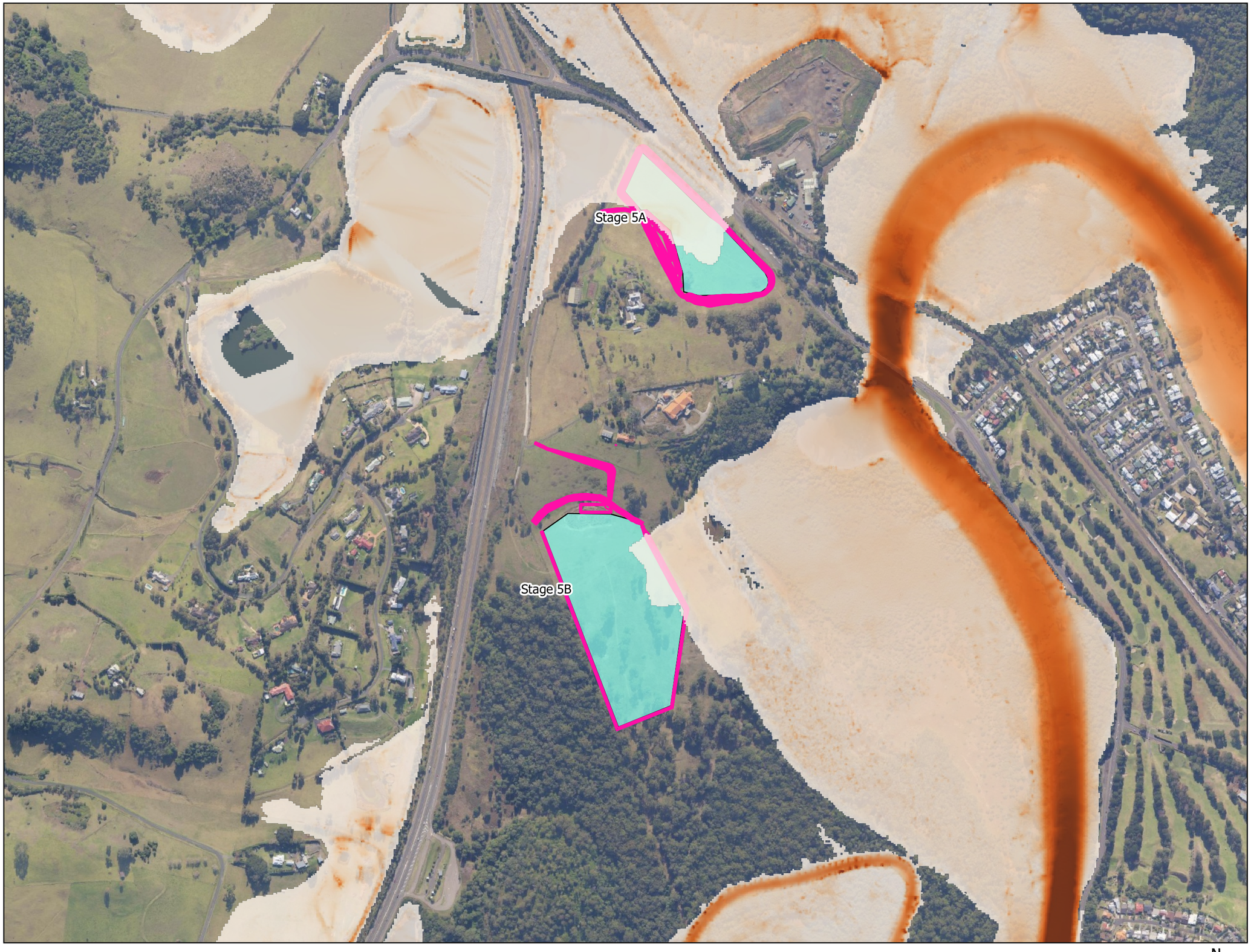


FIG 2. 20y ARI Max velocity, existing conditions.

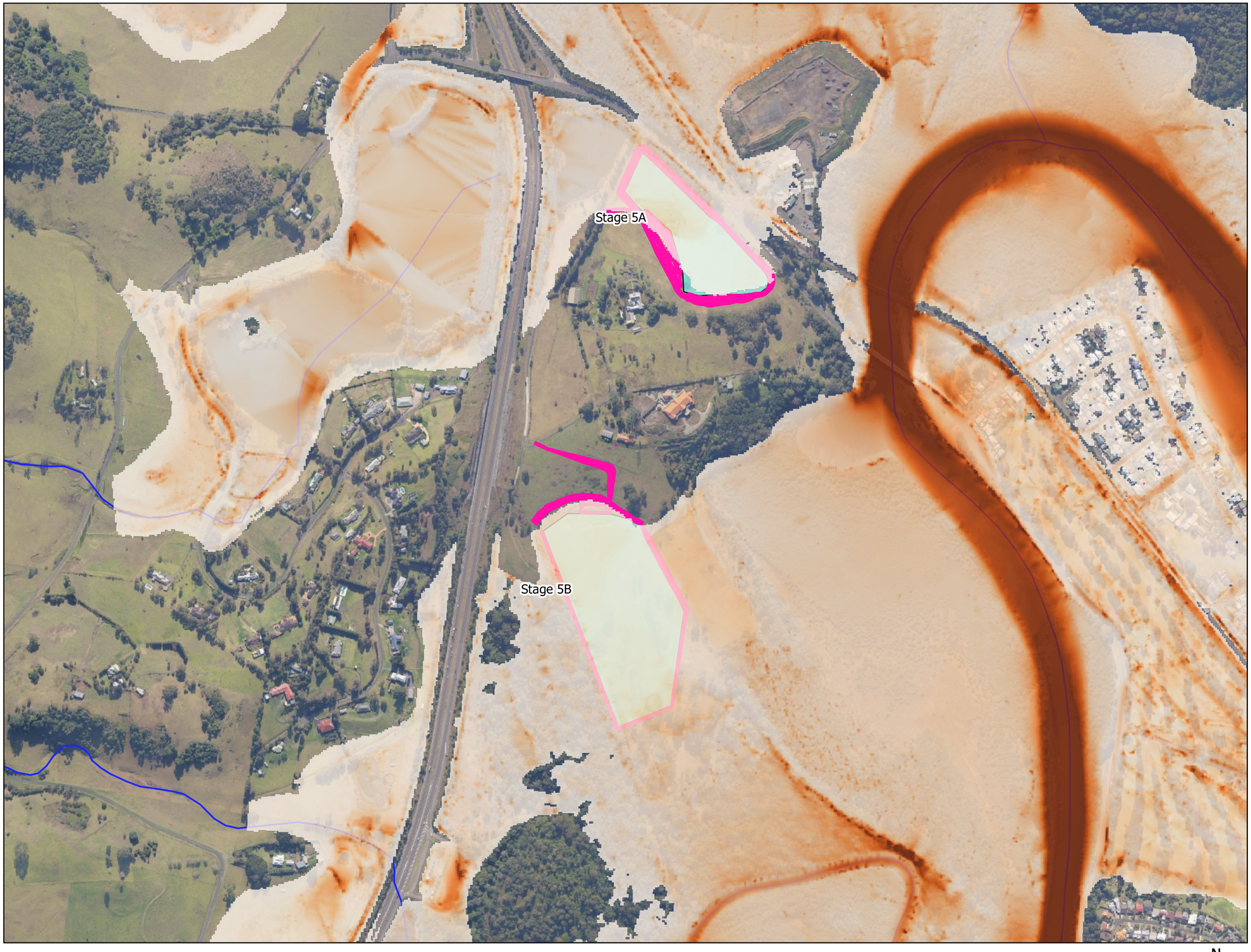
18/07/2019

southeast
engineering+environmental

FIG 3. 100y ARI Max velocity, existing conditions.

18/07/2019

southeast
engineering+environmental



Legend

Dredge pond bunds and earthworks

PMF Max velocity (m/s)

- 0.0157
- 0.274
- 0.532
- 0.79
- 1.05
- 1.31
- 1.56
- 1.8
- 2

0 100 200 300 400 m

N

FIG 4. PMF Max velocity, existing conditions.

18/07/2019

southeast
engineering+environmental

Legend

Dredge pond bunds and earthworks

Flood dpeth (m)

0.144
1.41
2.68
3.95
5.22

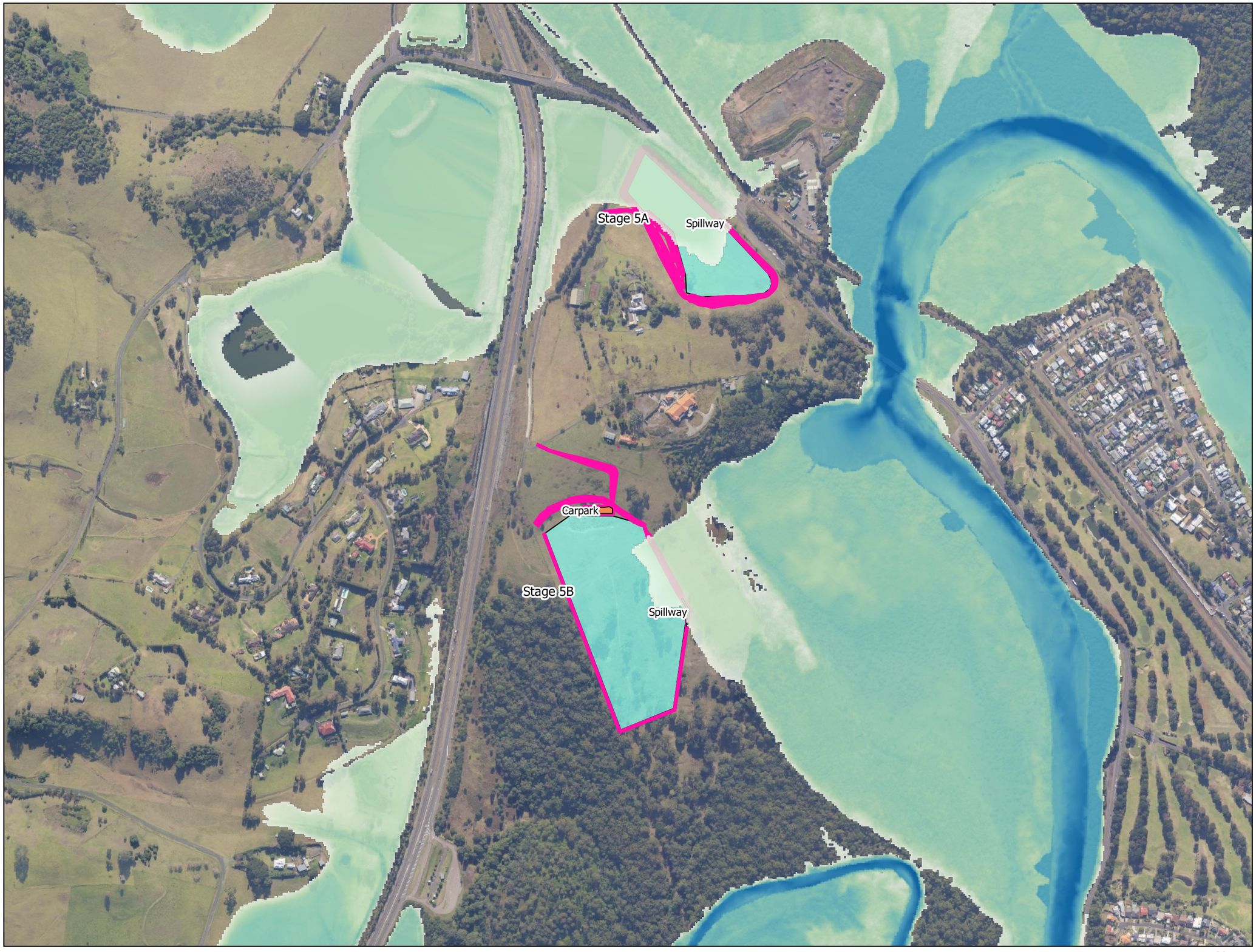
0 100 200 300 400 m

N

FIG 5. 5y ARI Flood depth, existing conditions.

18/07/2019

southeast
engineering+environmental



Legend

Dredge pond bunds and earthworks

Flood dpeth (m)

0.144
1.41
2.68
3.95
5.22

0 100 200 300 400 m

N

FIG 6. 20y ARI Flood depth, existing conditions.

18/07/2019

southeast
engineering+environmental

Legend

Dredge pond bunds and earthworks

Flood dpeth (m)

0.144
1.41
2.68
3.95
5.22

0 100 200 300 400 m

N

FIG 7. 100y ARI Flood depth, existing conditions.

18/07/2019

southeast
engineering+environmental

Legend

Dredge pond bunds and earthworks

Flood dpeth (m)

0.144
1.41
2.68
3.95
5.22

0 100 200 300 400 m

N

FIG 8. PMF Flood depth, existing conditions.

18/07/2019

southeast
engineering+environmental

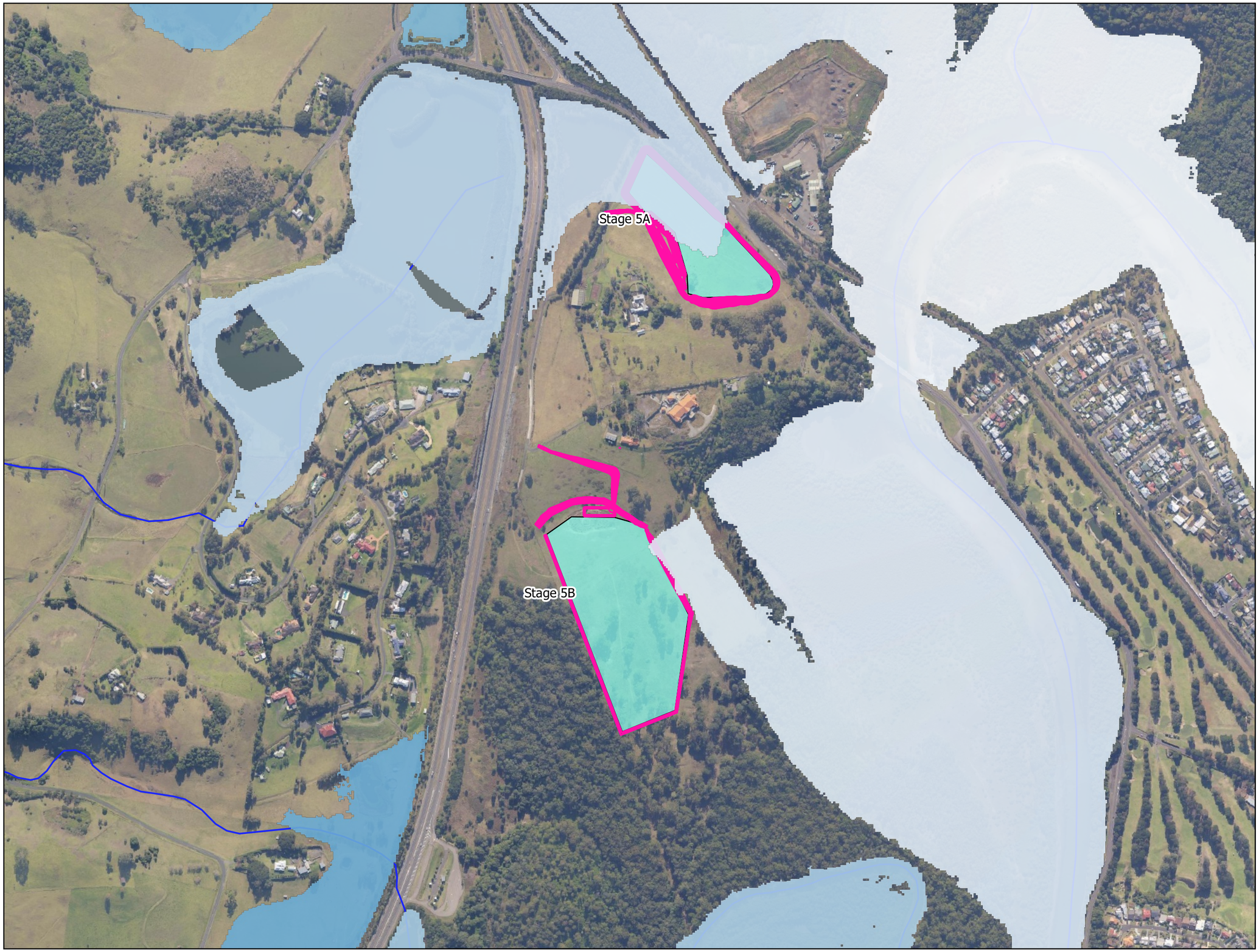


FIG 9. 5y ARI Flood height, existing conditions.

18/07/2019

southeast
engineering+environmental

Legend

Dredge pond bunds and earthworks

20y ARI Flood level (m AHD)

- 2
- 2.39
- 2.78
- 3.17
- 3.56
- 3.95
- 4.34
- 4.7
- 5

0 100 200 300 400 m

N

FIG 10. 20y ARI Flood height, existing conditions.

18/07/2019

southeast
engineering+environmental

Legend

Dredge pond bunds and earthworks

Flood level (m AHD)

- 2
- 2.39
- 2.78
- 3.17
- 3.56
- 3.95
- 4.34
- 4.7
- 5

0 100 200 300 400 m

N

FIG 11. 100y ARI Flood height, existing conditions.

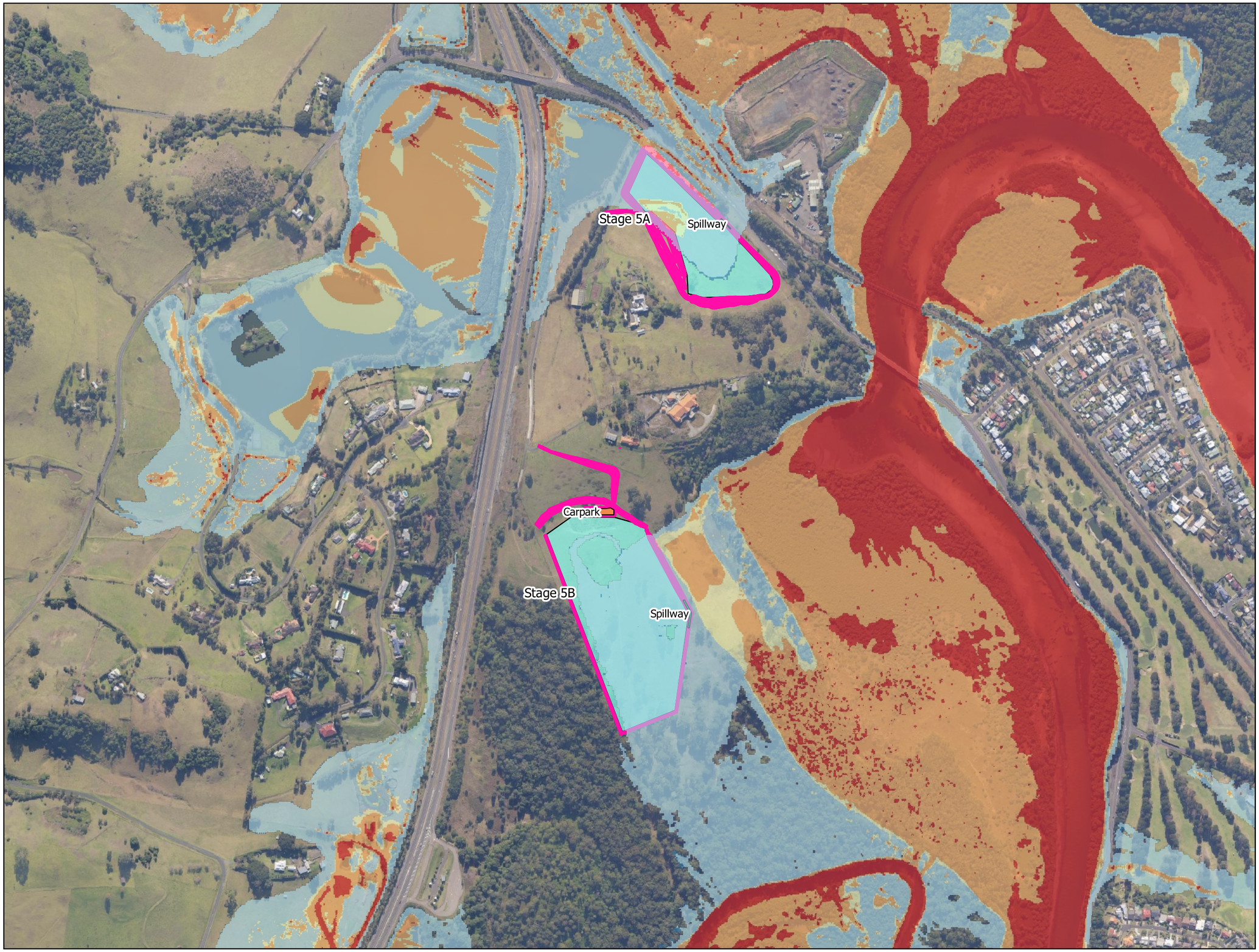
18/06/2019

southeast
engineering+environmental

FIG 12. PMF Flood height, existing conditions.

18/07/2019

southeast
engineering+environmental



Legend

Dredge pond bunds and earthworks

100y VD

- <= 0
- 0 - 0.3
- 0.3 - 0.4
- 0.4 - 1
- > 1

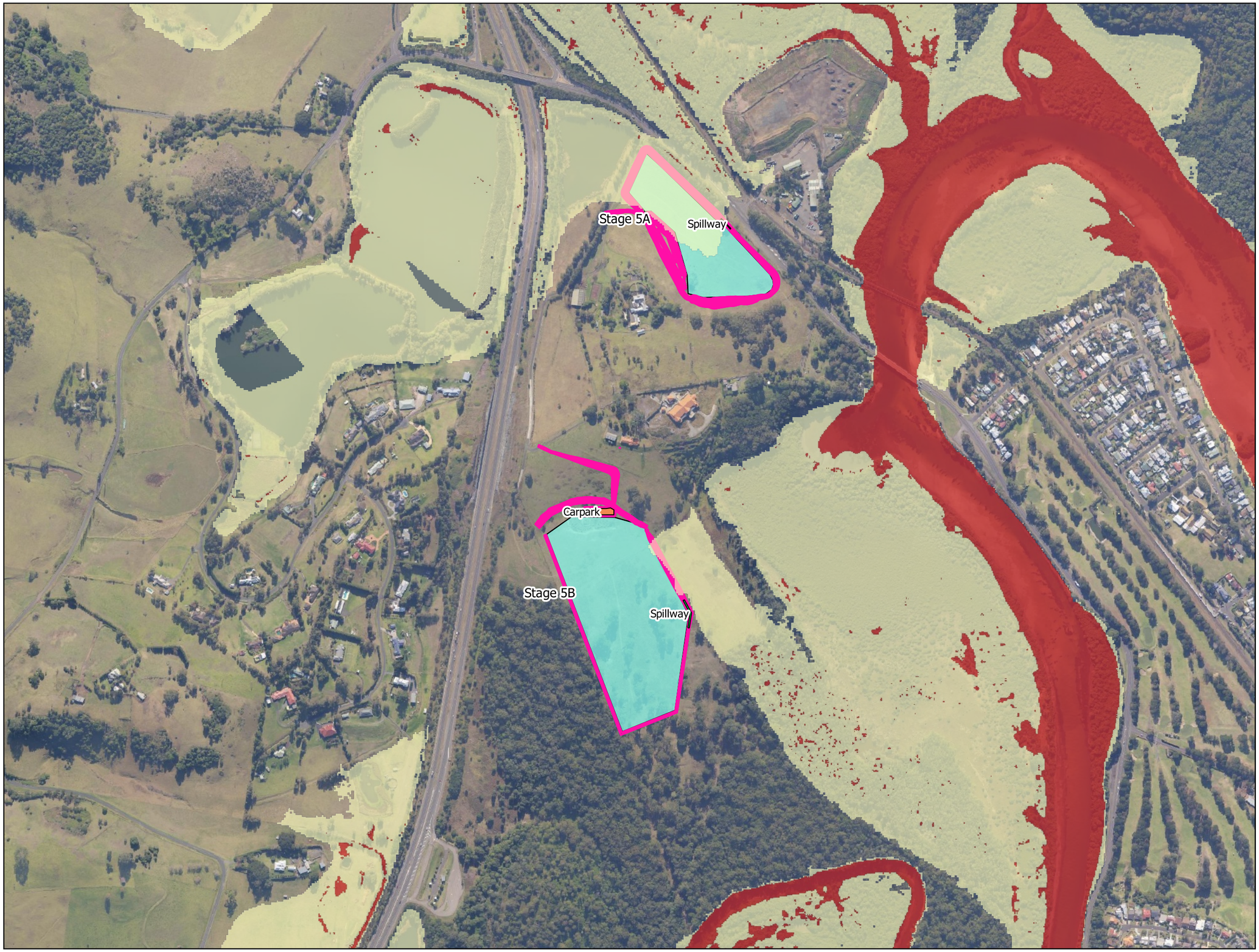
0 100 200 300 400 m

N

FIG 13. 100y ARI VD, existing conditions.

18/06/2019

southeast
engineering+environmental



Legend

Dredge pond bunds and earthworks

Flood Hazard (VD<0.55=Low)

Low

High

0 100 200 300 400 m

N

FIG 14. 5y ARI flood hazard, existing conditions.

18/07/2019

southeast
engineering+environmental

Legend

Dredge pond bunds and earthworks

Flood Hazard (VD<0.55=Low)

Low

High

0 100 200 300 400 m

N

FIG 15. 20y ARI flood hazard, existing conditions.

18/07/2019

southeast
engineering+environmental

Legend

Dredge pond bunds and earthworks

Flood Hazard (VD<0.55=Low)

Low

High

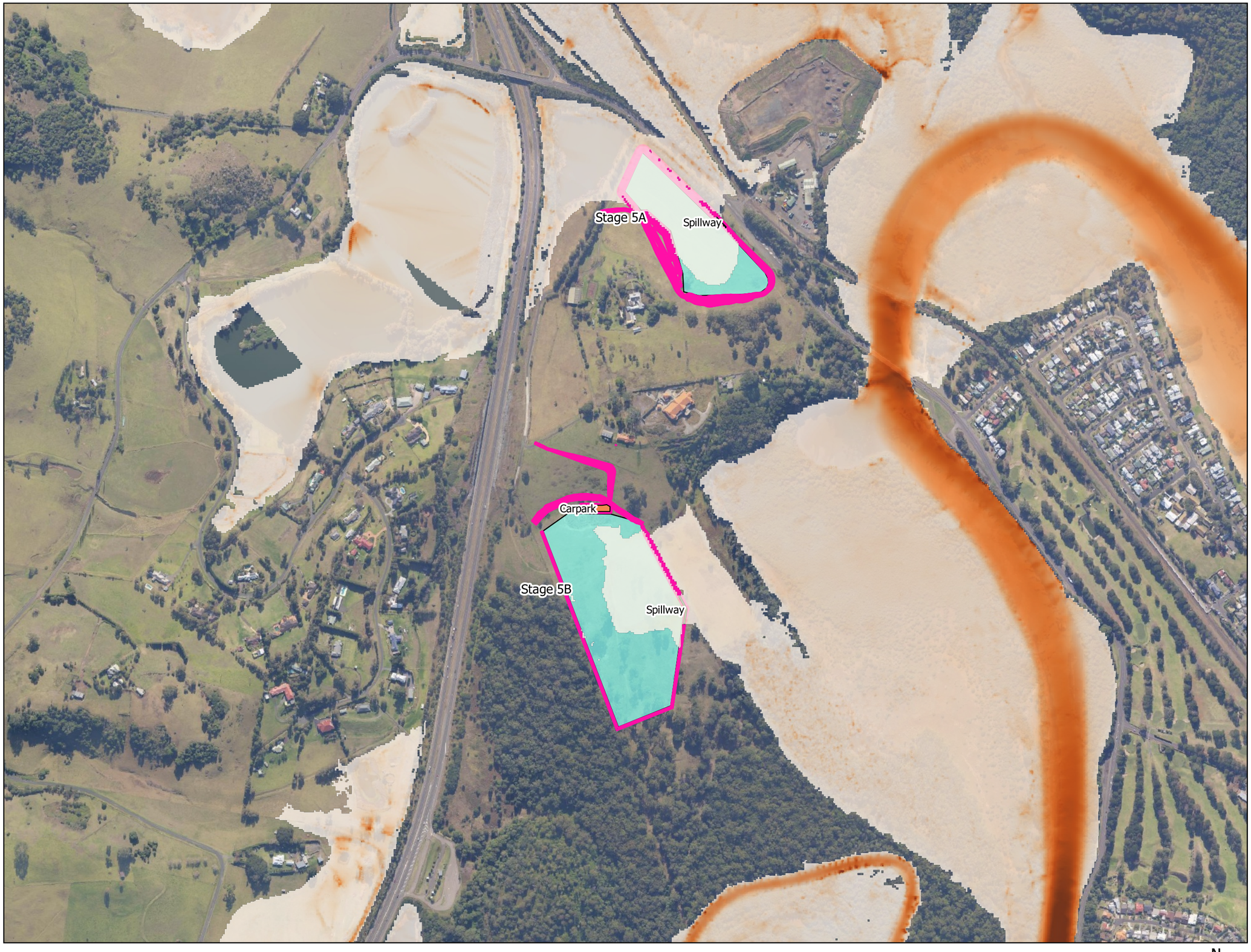
0 100 200 300 400 m

N

FIG 16. 100y ARI flood hazard, existing conditions.

18/07/2019

southeast
engineering+environmental



Legend

Dredge pond bunds and earthworks

5y ARI max velocity (m/s)

- 0.0157
- 0.274
- 0.532
- 0.79
- 1.05
- 1.31
- 1.56
- 1.8
- 2

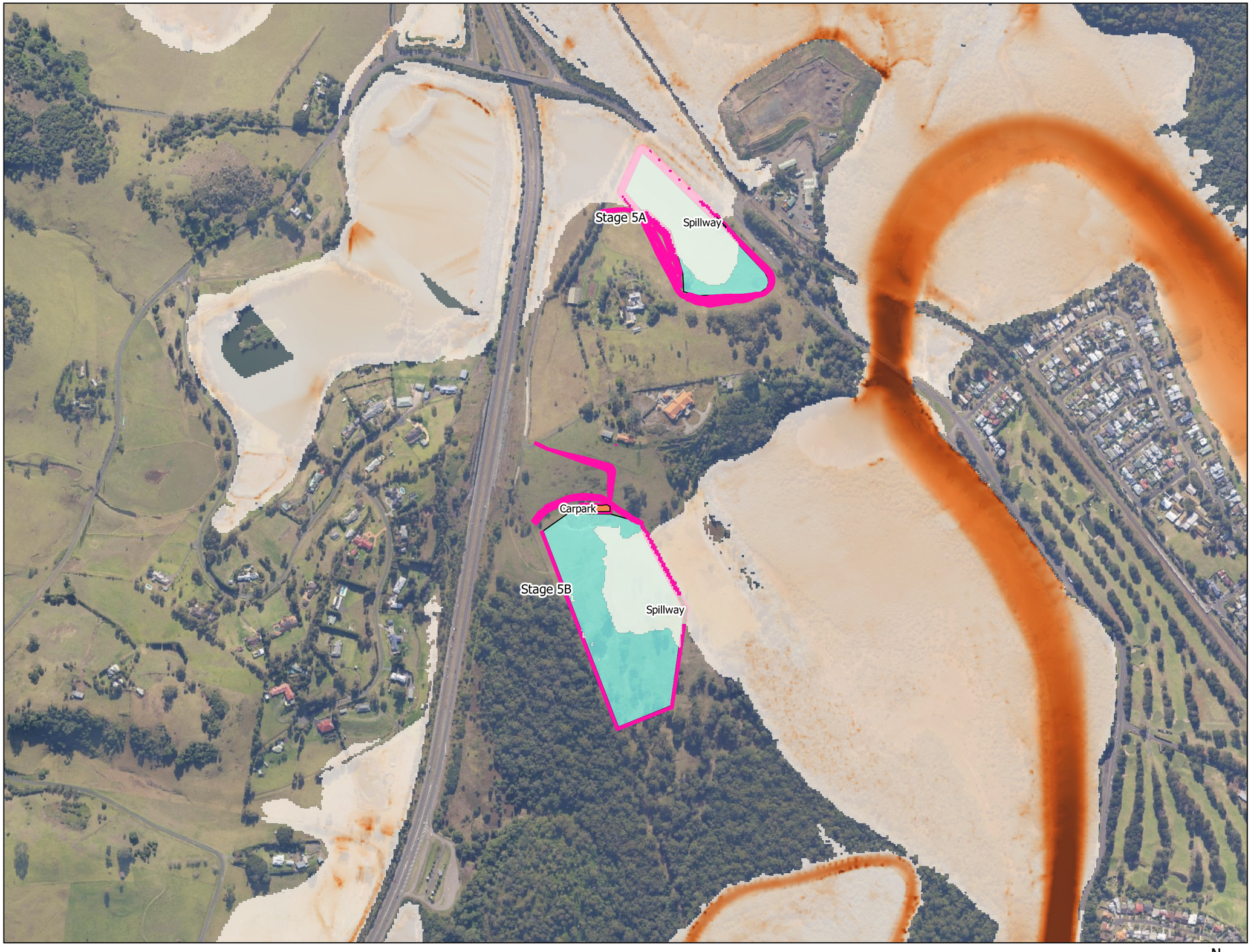
0 100 200 300 400 m

N

FIG 17. 5y ARI Max velocity, proposed conditions.

18/07/2019 Note: Flows within basin a function of model start conditions for basins above spillway for model stability.

southeast
engineering+environmental



Legend

Dredge pond bunds and earthworks

Max velocity (m/s)

- 0.0157
- 0.274
- 0.532
- 0.79
- 1.05
- 1.31
- 1.56
- 1.8
- 2

0 100 200 300 400 m

N

FIG 18. 20y ARI Max velocity, proposed conditions.

18/07/2019 Note: Flows within basin a function of model start conditions for basins above spillway for model stability.

southeast
engineering+environmental

FIG 19. 100y ARI Max velocity, proposed conditions.

18/07/2019 Note: Flows within basin a function of model start conditions with basin water level above spillway for model stability.

southeast
engineering+environmental

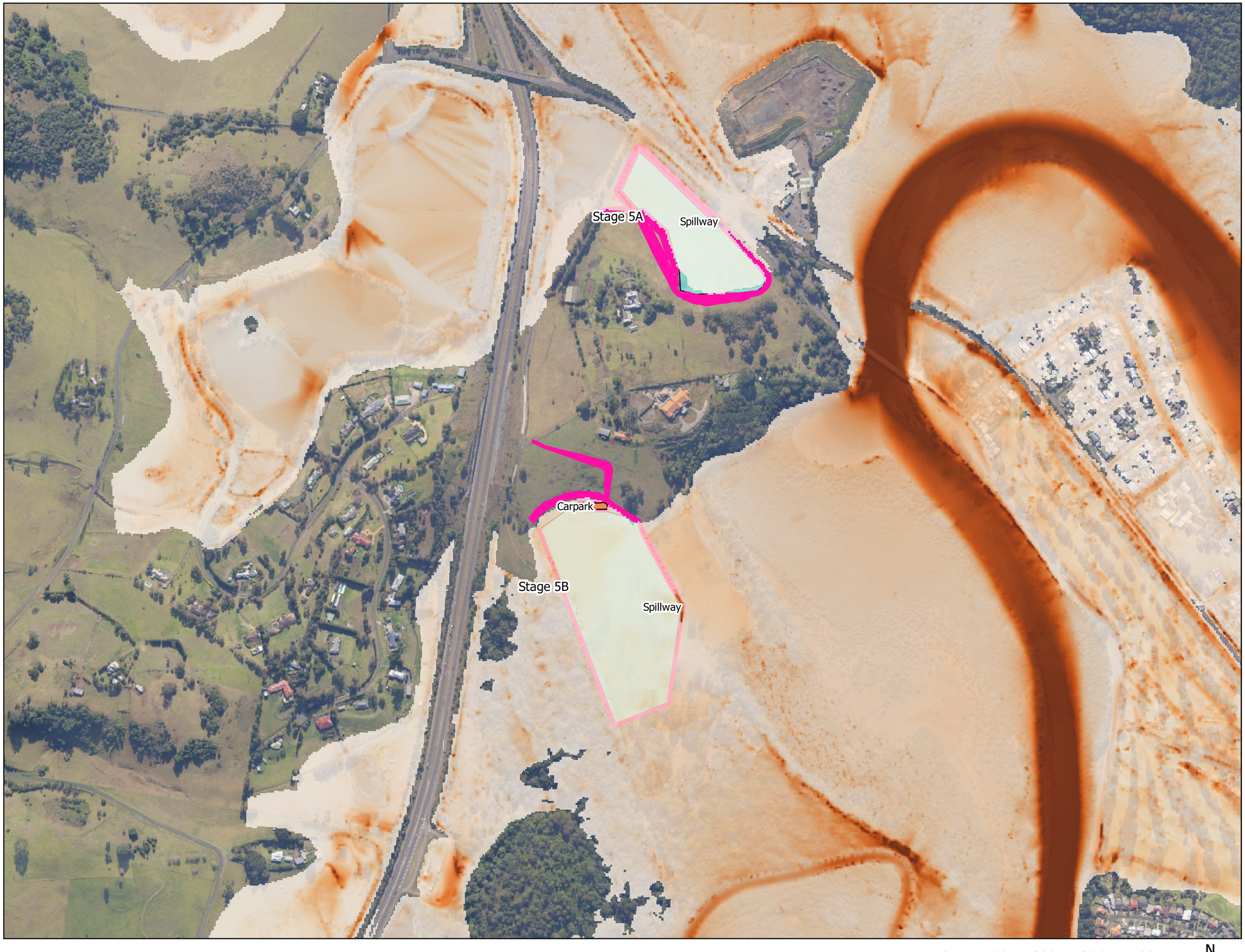


FIG 20. PMF Max velocity, proposed conditions.

18/07/2019 Note: Flows within basin a function of model start conditions with basin water level above spillway for model stability.

southeast
engineering+environmental

Legend

Dredge pond bunds and earthworks

Flood depth (m)

0.144
1.41
2.68
3.95
5.22

0 100 200 300 400 m

N

FIG 21. 5y ARI Flood depth, proposed conditions.

18/07/2019 Note: Flows within basin a function of model start conditions with basin water level above spillway for model stability.

southeast
engineering+environmental

Legend

Dredge pond bunds and earthworks

Flood depth (m)

0.144
1.41
2.68
3.95
5.22

0 100 200 300 400 m

N

FIG 22. 20y ARI Flood depth, proposed conditions.

18/07/2019 Note: Flows within basin a function of model start conditions with basin water level above spillway for model stability.

southeast
engineering+environmental

Legend

Dredge pond bunds and earthworks

Flood depth (m)

0.144
1.41
2.68
3.95
5.22

0 100 200 300 400 m

N

FIG 23. 100y ARI Flood depth, proposed conditions.

18/07/2019 Note: Flows within basin a function of model start conditions with basin water level above spillway for model stability.

southeast
engineering+environmental

Legend

Dredge pond bunds and earthworks

Flood depth (m)

0.144
1.41
2.68
3.95
5.22

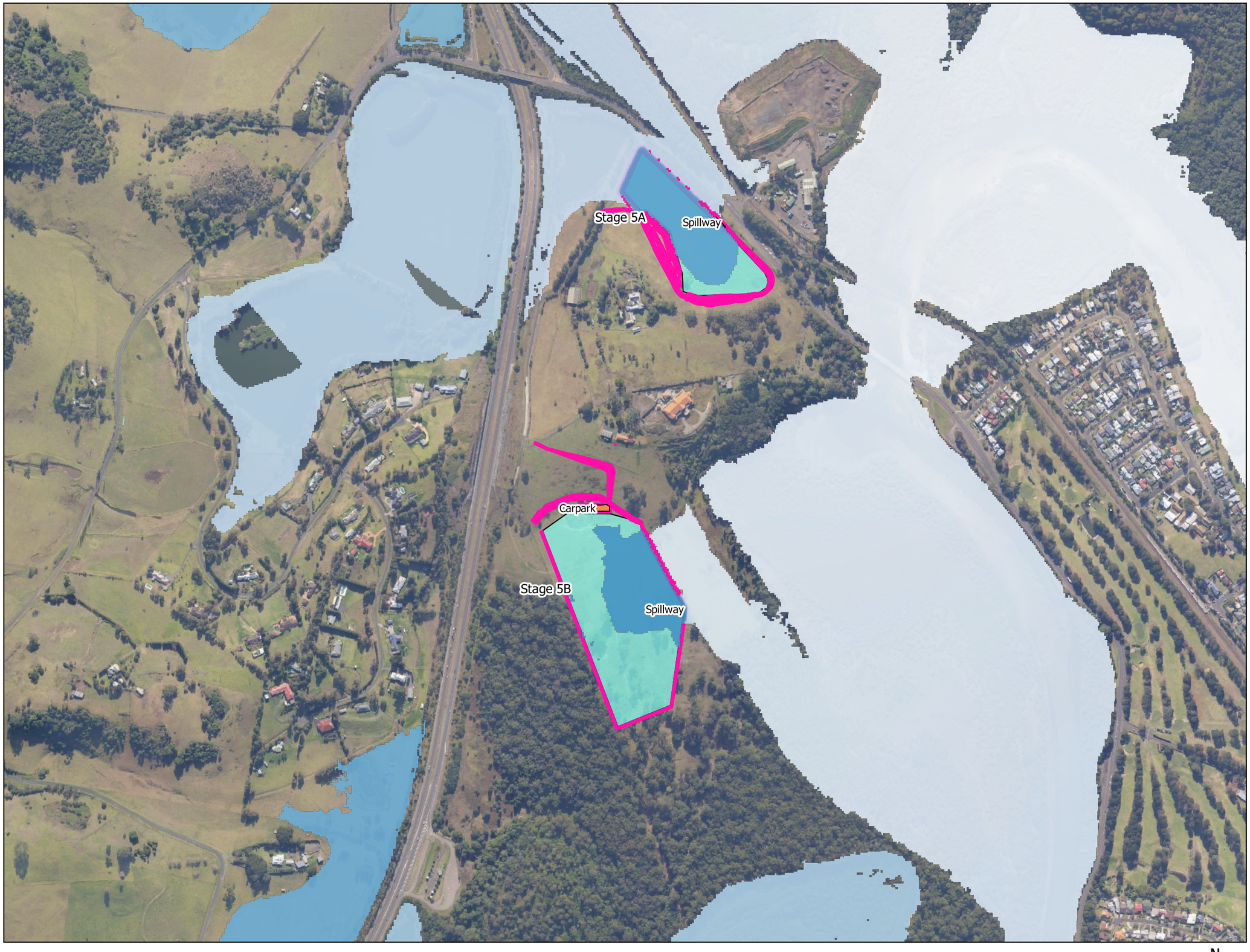
0 100 200 300 400 m

N

FIG 24. PMF Flood depth, proposed conditions.

18/07/2019 Note: Flows within basin a function of model start conditions with basin water level above spillway for model stability.

southeast
engineering+environmental



Legend

Dredge pond bunds and earthworks

Flood level (m AHD)

- 2
- 2.39
- 2.78
- 3.17
- 3.56
- 3.95
- 4.34
- 4.7
- 5

0 100 200 300 400 m

N

FIG 25. 5y ARI Flood height, proposed conditions.

18/07/2019 Note: Flows within basin a function of model start conditions with basin water level above spillway for model stability.

southeast
engineering+environmental

Legend

Dredge pond bunds and earthworks

Flood level (m AHD)

- 2
- 2.39
- 2.78
- 3.17
- 3.56
- 3.95
- 4.34
- 4.7
- 5

0 100 200 300 400 m

N

FIG 26. 20y ARI Flood height, proposed conditions.

18/07/2019 Note: Flows within basin a function of model start conditions with basin water level above spillway for model stability.

southeast
engineering+environmental

Legend

Dredge pond bunds and earthworks

Flood level (m AHD)

- 2
- 2.39
- 2.78
- 3.17
- 3.56
- 3.95
- 4.34
- 4.7
- 5

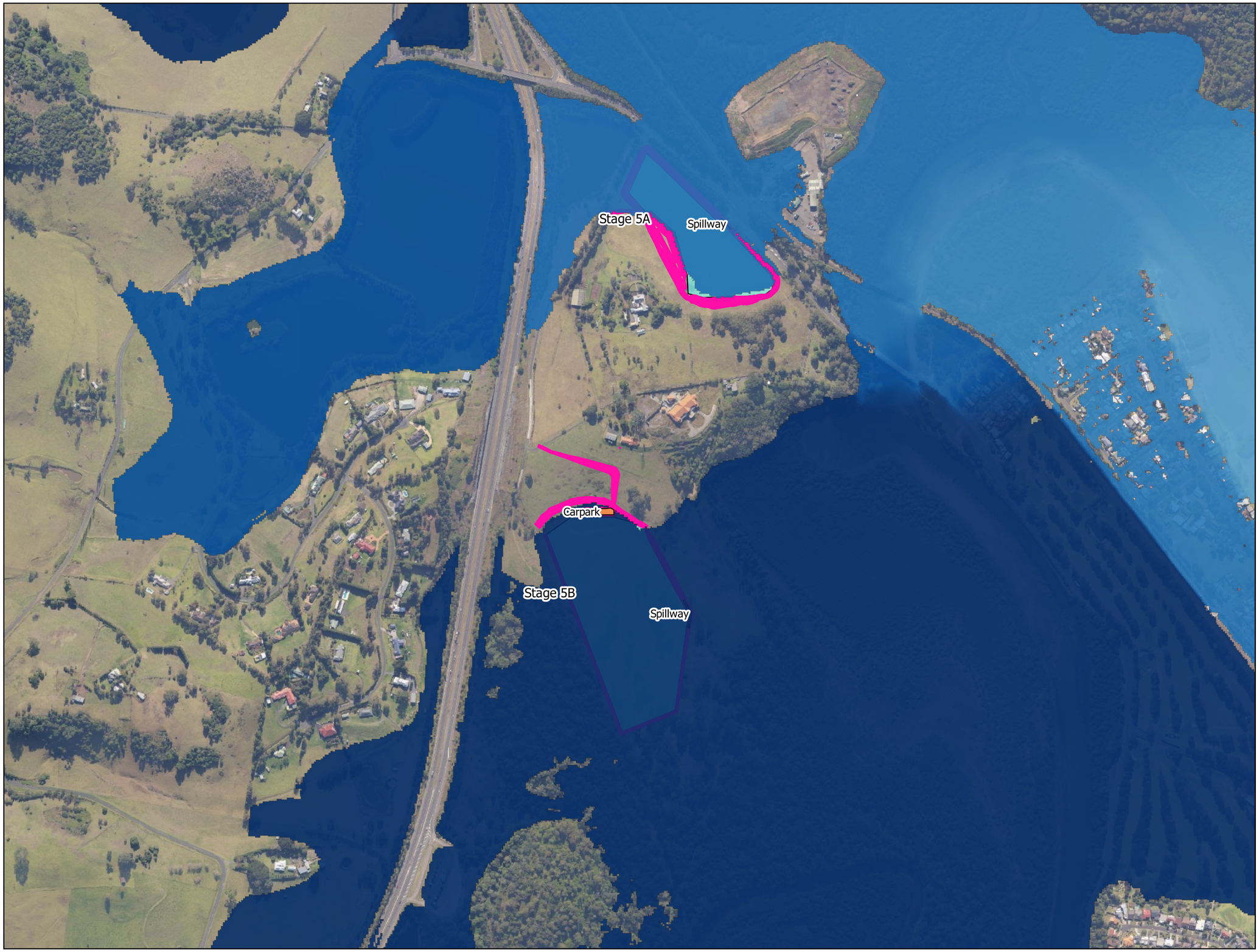
0 100 200 300 400 m

N

FIG 27. 100y ARI Flood height, proposed conditions.

18/07/2019 Note: Flows within basin a function of model start conditions with basin water level above spillway for model stability.

southeast
engineering+environmental



Legend

Dredge pond bunds and earthworks

Flood level (m AHD)

- 2
- 2.39
- 2.78
- 3.17
- 3.56
- 3.95
- 4.34
- 4.7
- 5

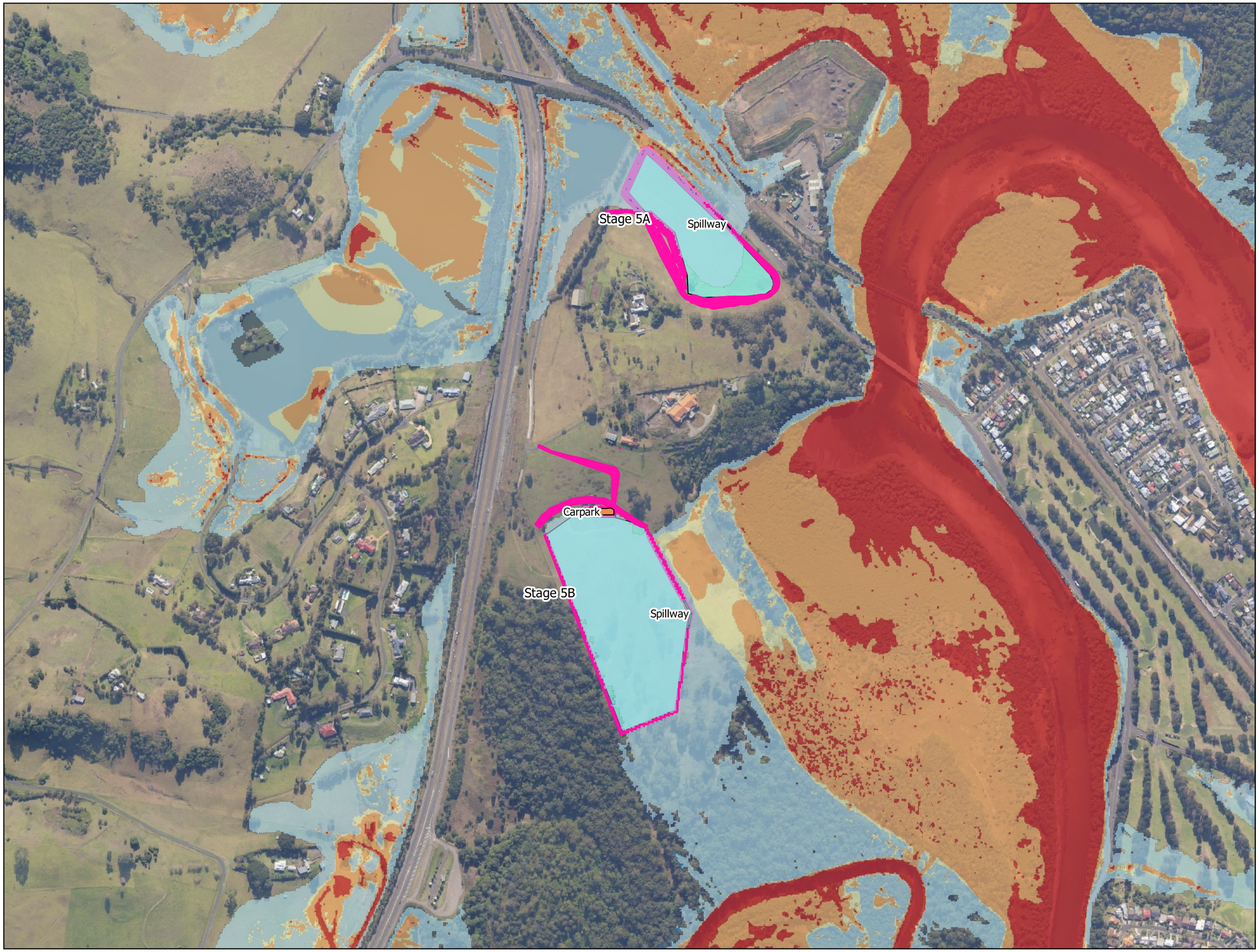
0 100 200 300 400 m

N

FIG 28. PMF Flood height, proposed conditions.

18/07/2019 Note: Flows within basin a function of model start conditions with basin water level above spillway for model stability.

southeast
engineering+environmental



Legend

Dredge pond bunds and earthworks

100y VD

- <= 0
- 0 - 0.3
- 0.3 - 0.4
- 0.4 - 1
- > 1

0 100 200 300 400 m

N

FIG 29. 100y ARI VD, existing conditions.

18/07/2019 Note: Flows within basin a function of model start conditions with basin water level above spillway for model stability.

southeast
engineering+environmental

Legend

Dredge pond bunds and earthworks

Flood Hazard (VD<0.55=Low)

Low

High

0 100 200 300 400 m

N

FIG 30. 5y ARI flood hazard, proposed conditions.

18/07/2019 Note: Flows within basin a function of model start conditions with basin water level above spillway for model stability.

southeast
engineering+environmental

Legend

Dredge pond bunds and earthworks

Flood Hazard (VD<0.55=Low)

Low

High

0 100 200 300 400 m

N

FIG 31. 20y ARI flood hazard, proposed conditions.

18/07/2019 Note: Flows within basin a function of model start conditions with basin water level above spillway for model stability.

southeast
engineering+environmental

Legend

Dredge pond bunds and earthworks

Flood Hazard (VD<0.55=Low)

Low

High

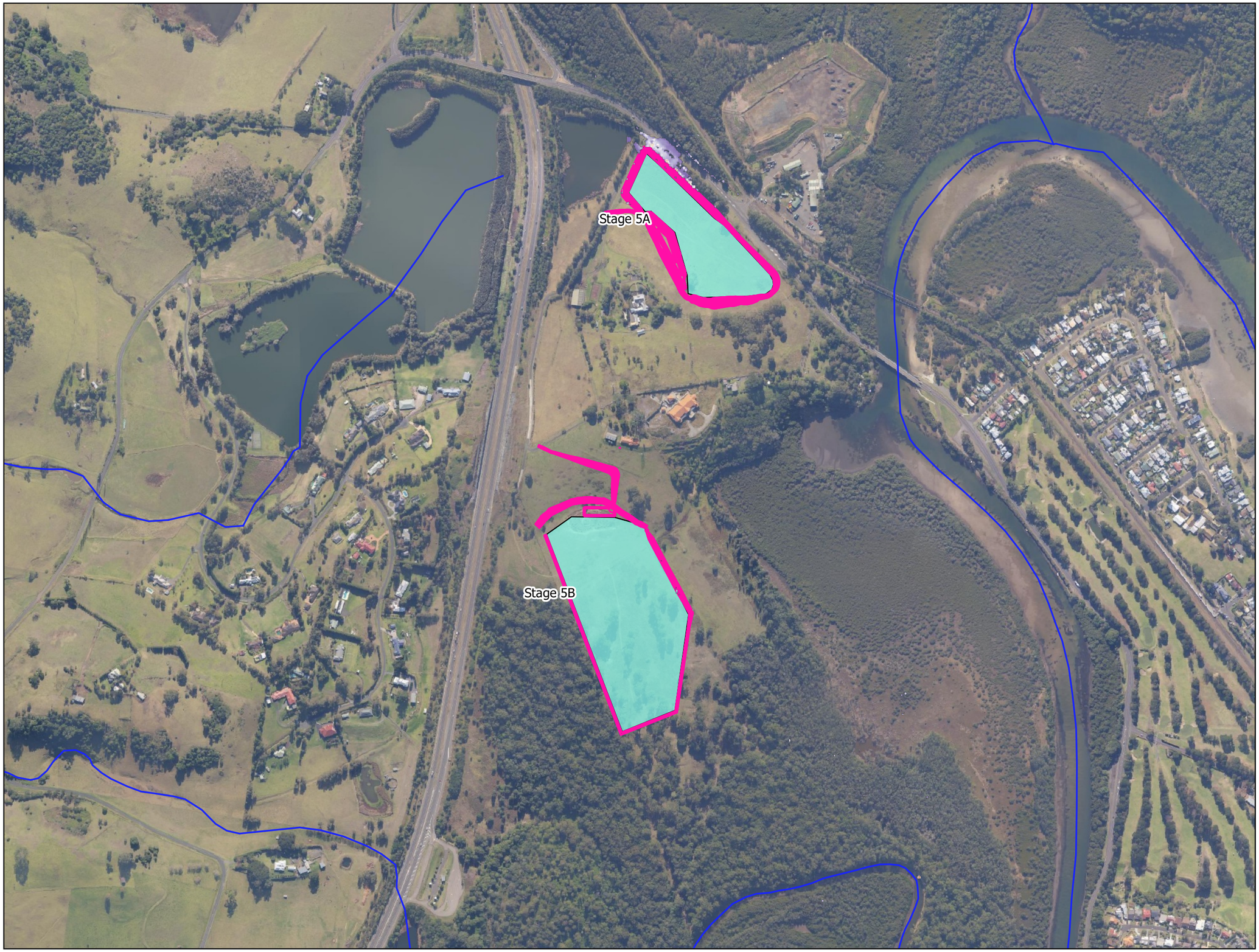
0 100 200 300 400 m

N

FIG 32. 100y ARI flood hazard, proposed conditions.

18/07/2019 Note: Flows within basin a function of model start conditions with basin water level above spillway for model stability.

southeast
engineering+environmental



Legend

Dredge pond bunds and earthworks

Max velocity difference (m/s)

0

0.125

0.25

0.375

0.5

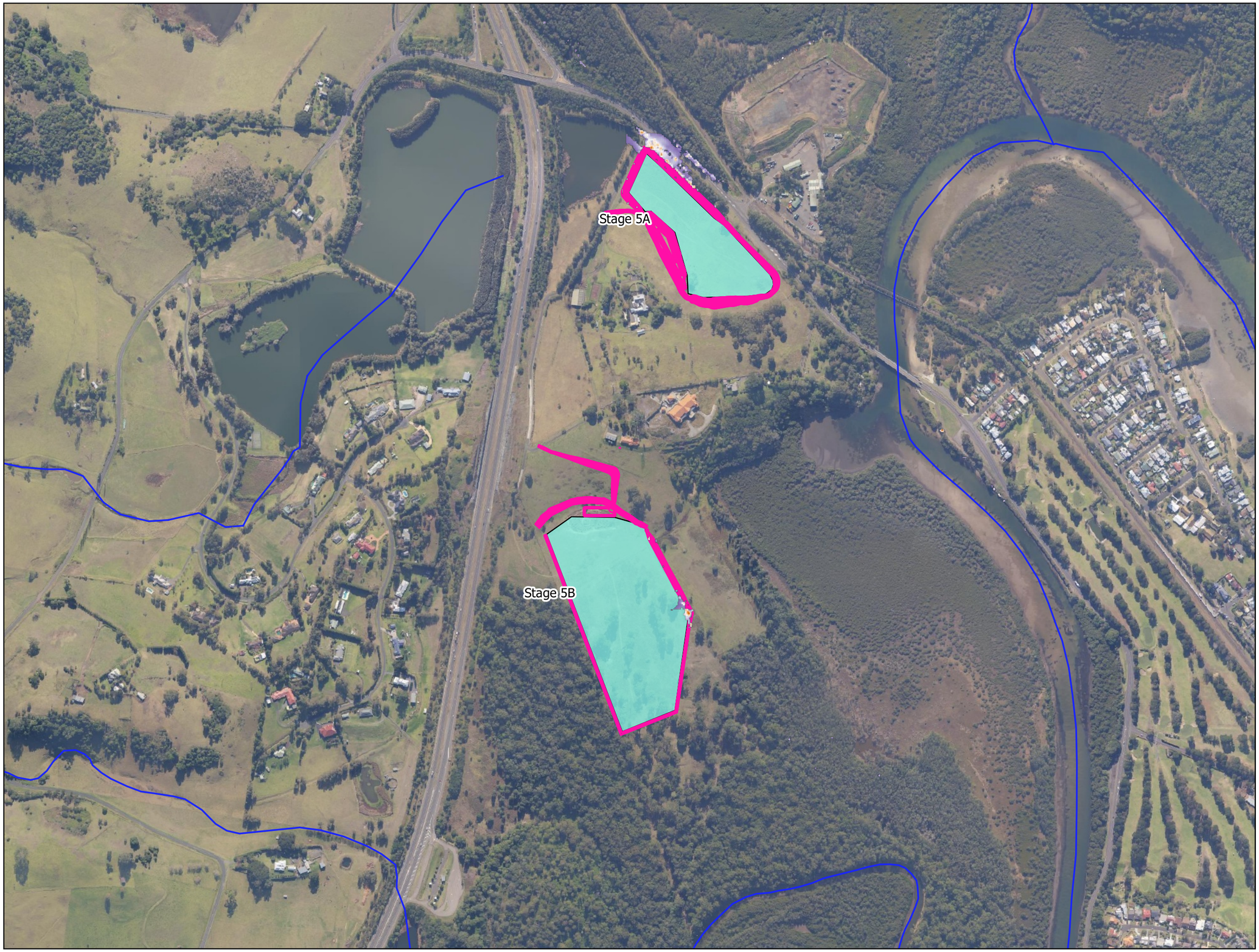
0 100 200 300 400 m

N

FIG 33. 5y ARI Max velocity difference

18/07/2019

southeast
engineering+environmental



Legend

Dredge pond bunds and earthworks

Max velocity difference (m/s)

0

0.125

0.25

0.375

0.5

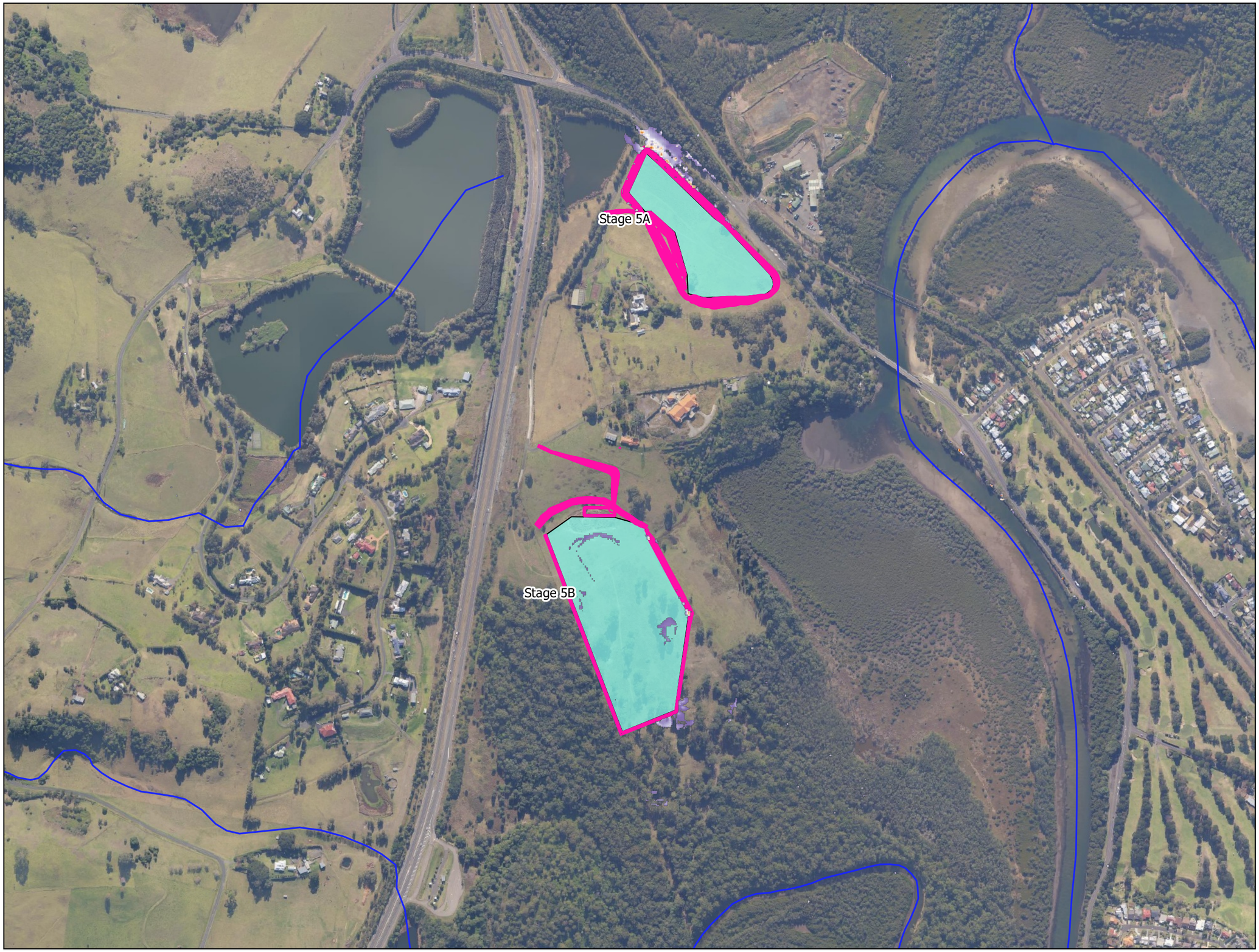
0 100 200 300 400 m

N

FIG 34. 20y ARI Max velocity difference

18/07/2019

southeast
engineering+environmental



Legend

Dredge pond bunds and earthworks

Max velocity difference (m/s)

0

0.125

0.25

0.375

0.5

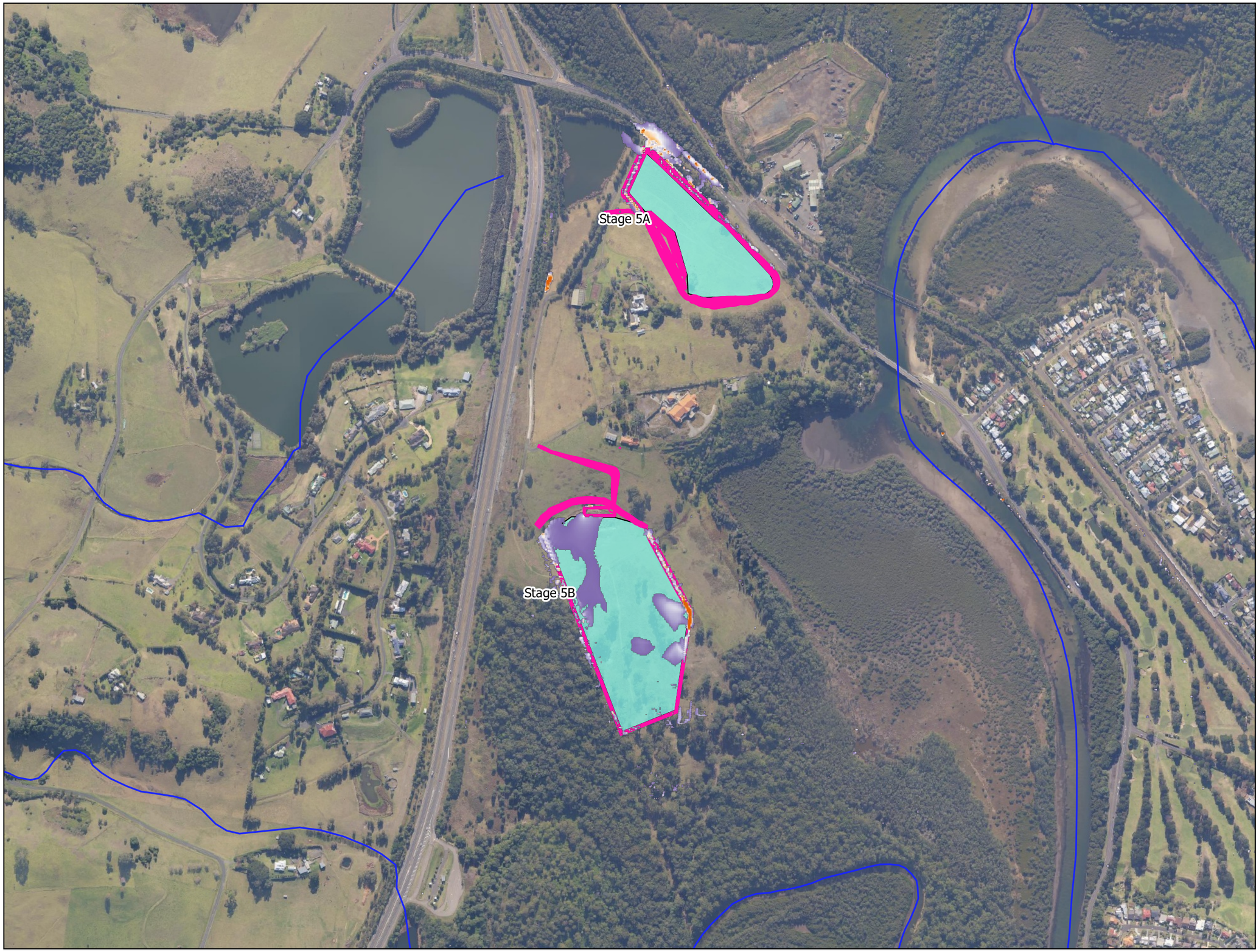
0 100 200 300 400 m

N

FIG 35. 100y ARI Max velocity difference

18/07/2019

southeast
engineering+environmental



Legend

Dredge pond bunds and earthworks

Max velocity difference (m/s)

0

0.125

0.25

0.375

0.5

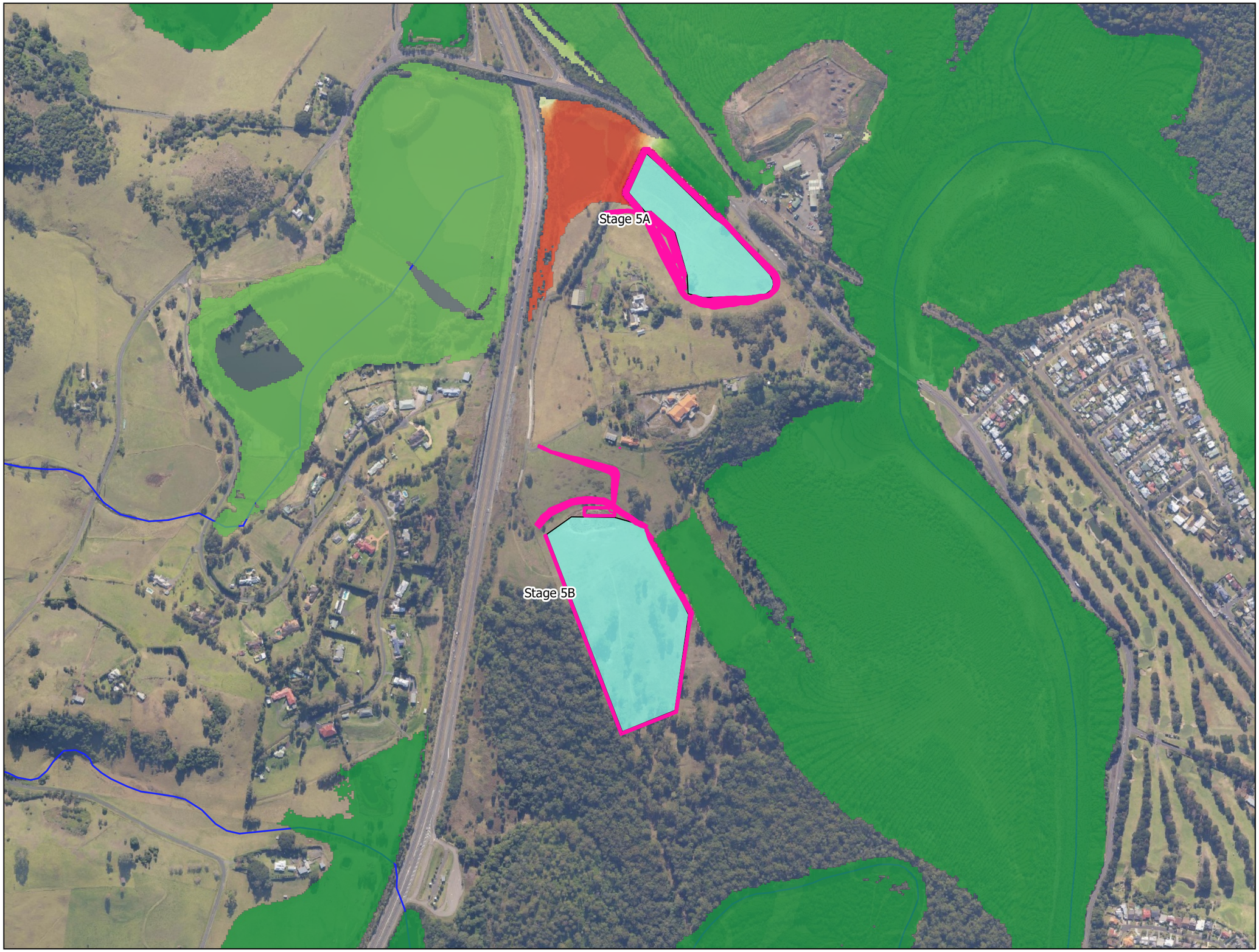
0 100 200 300 400 m

N

FIG 36. PMF Max velocity difference

18/07/2019

southeast
engineering+environmental



Legend

Dredge pond bunds and earthworks

Flood height difference (m)

0

0.0125

0.025

0.0375

0.05

0 100 200 300 400 m

N

FIG 37. 5y ARI Flood height difference

18/07/2019

southeast
engineering+environmental

Legend

Dredge pond bunds and earthworks

Flood height difference (m)

0

0.0125

0.025

0.0375

0.05

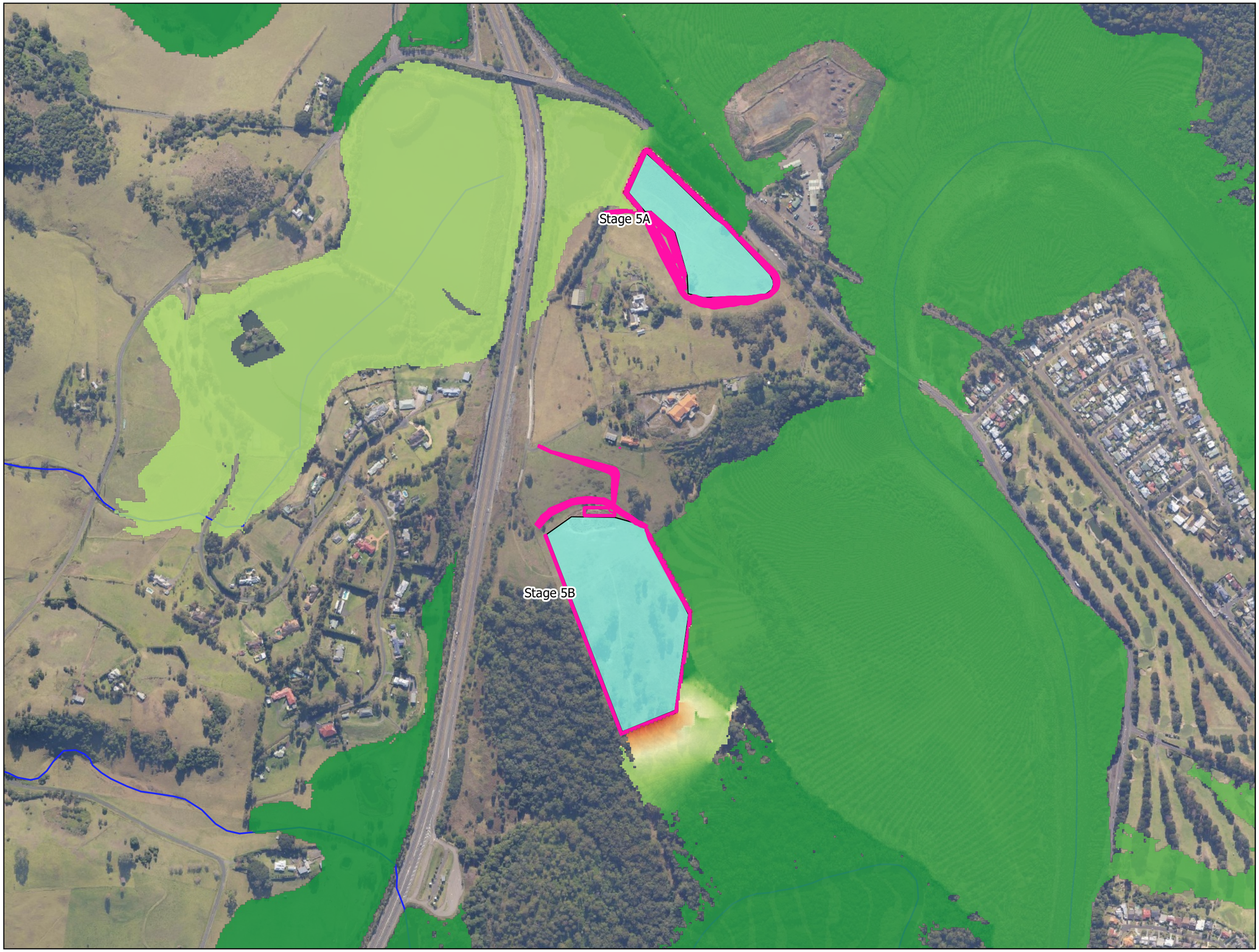
0 100 200 300 400 m

N

FIG 38. 20y ARI Flood height difference

18/07/2019

southeast
engineering+environmental



Legend

Dredge pond bunds and earthworks

Flood height difference (m)

0

0.0125

0.025

0.0375

0.05

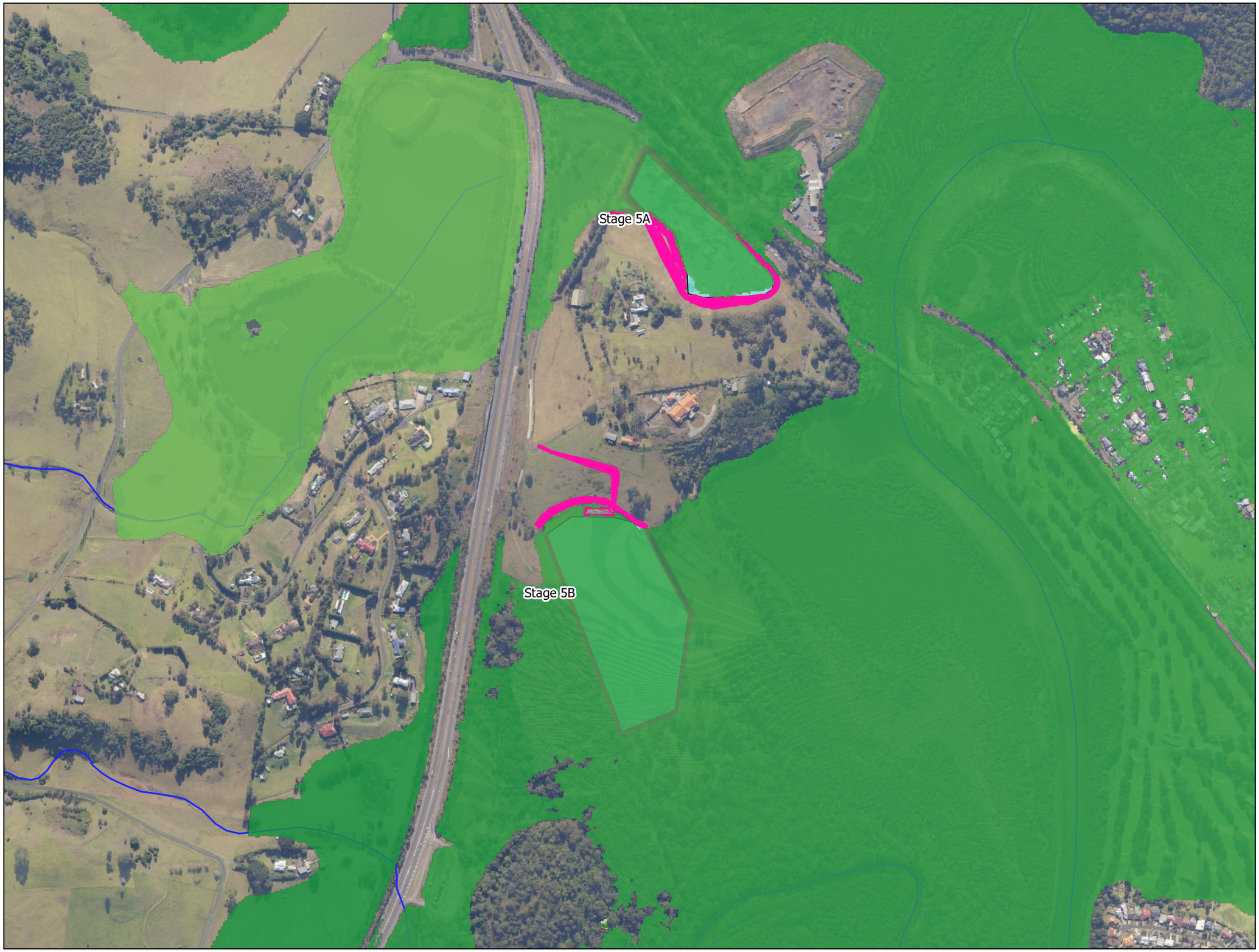
0 100 200 300 400 m

N

FIG 39. 100y ARI Flood height difference

18/07/2019

southeast
engineering+environmental



Legend

Dredge pond bunds and earthworks

Flood height difference (m)

0

0.0125

0.025

0.0375

0.05

0 100 200 300 400 m

N

FIG 40. PMF Flood height difference

18/07/2019

southeast
engineering+environmental

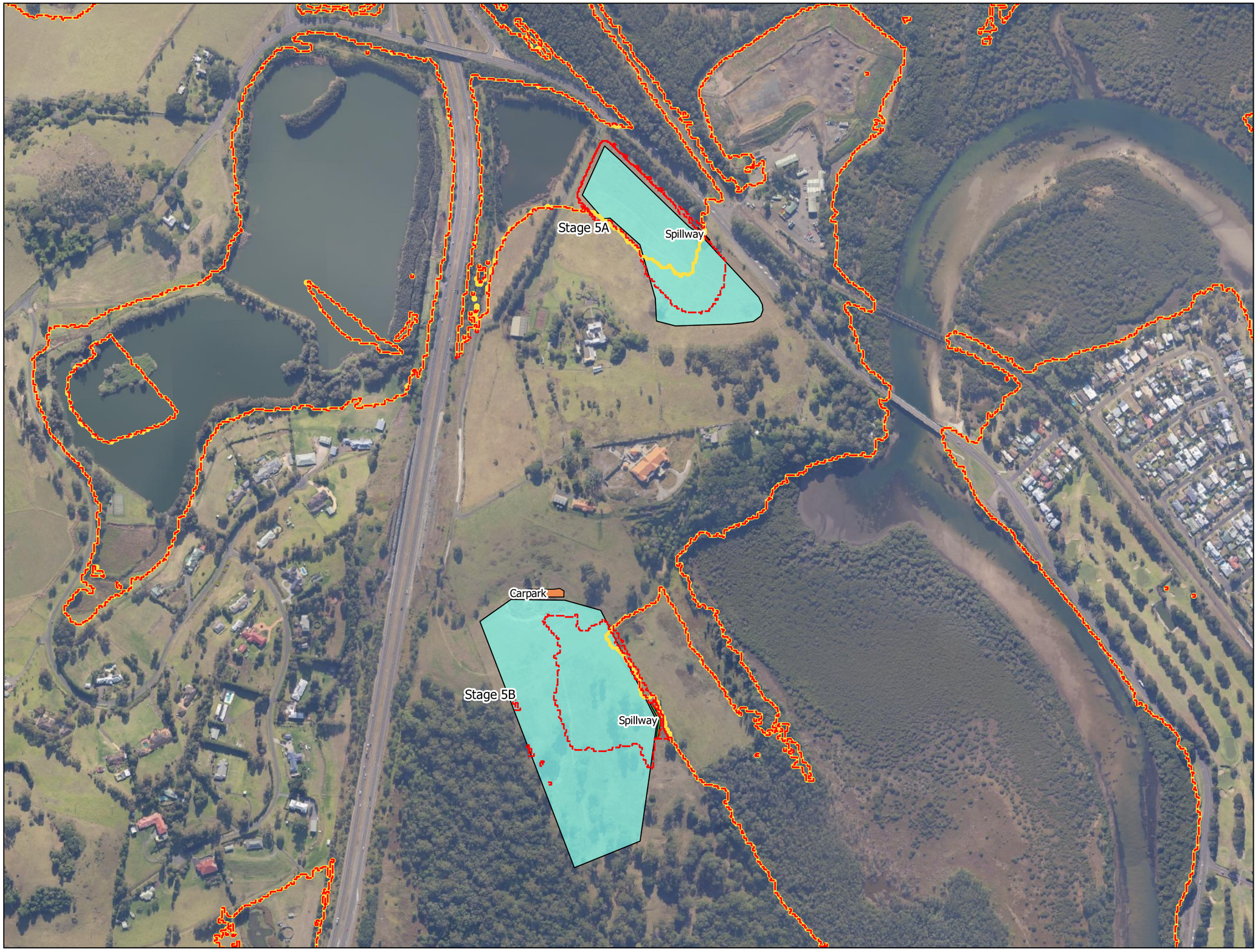
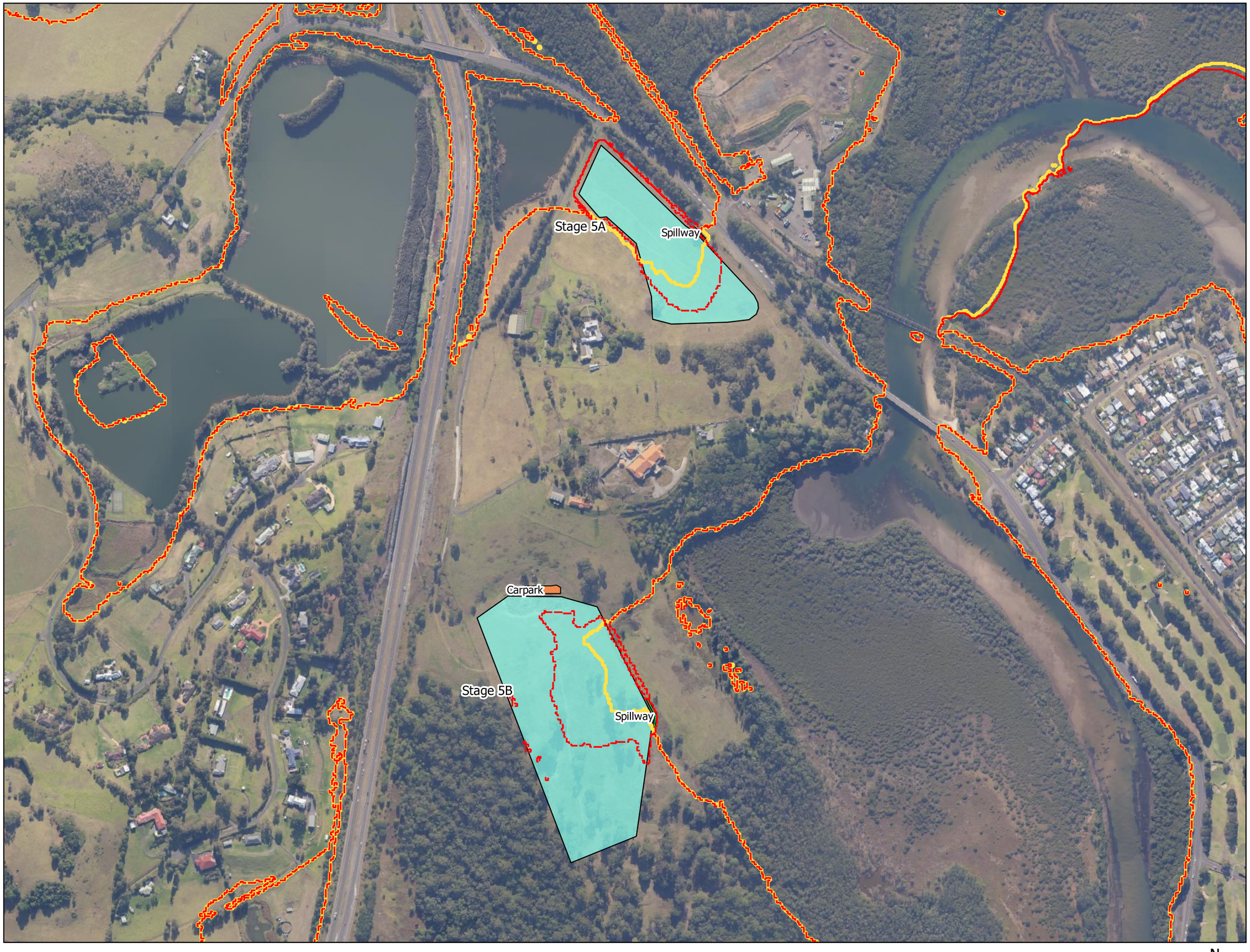


FIG 41. 5y ARI Flood extents pre and post.

18/07/2019

southeast
engineering+environmental



Legend

Existing_flood_extents

Proposed flood_extents

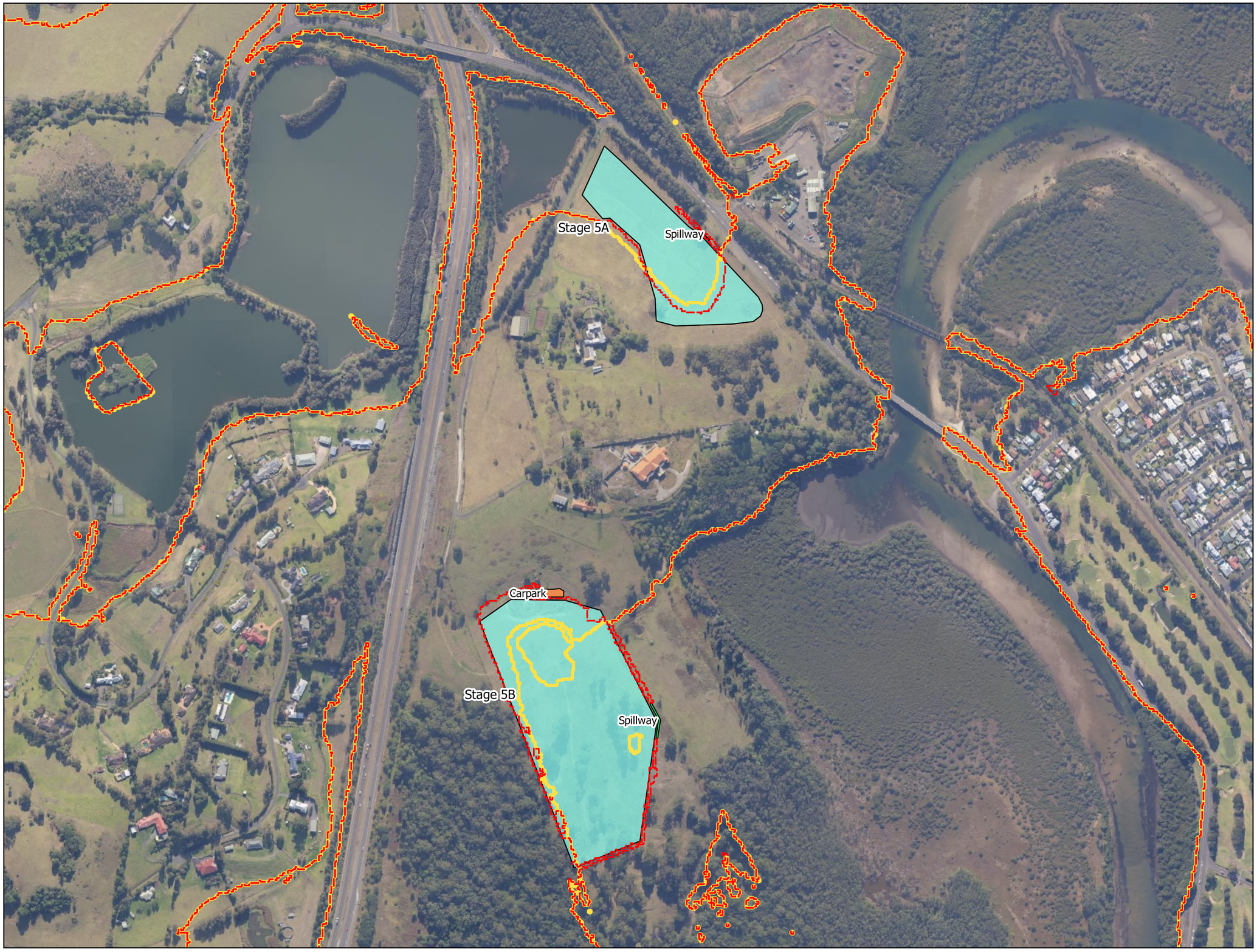
0 100 200 300 400 m

N

FIG 42. 20y ARI Flood extents pre and post.

18/07/2019

southeast
engineering+environmental



Legend

Existing_flood_extents

Proposed flood_extents

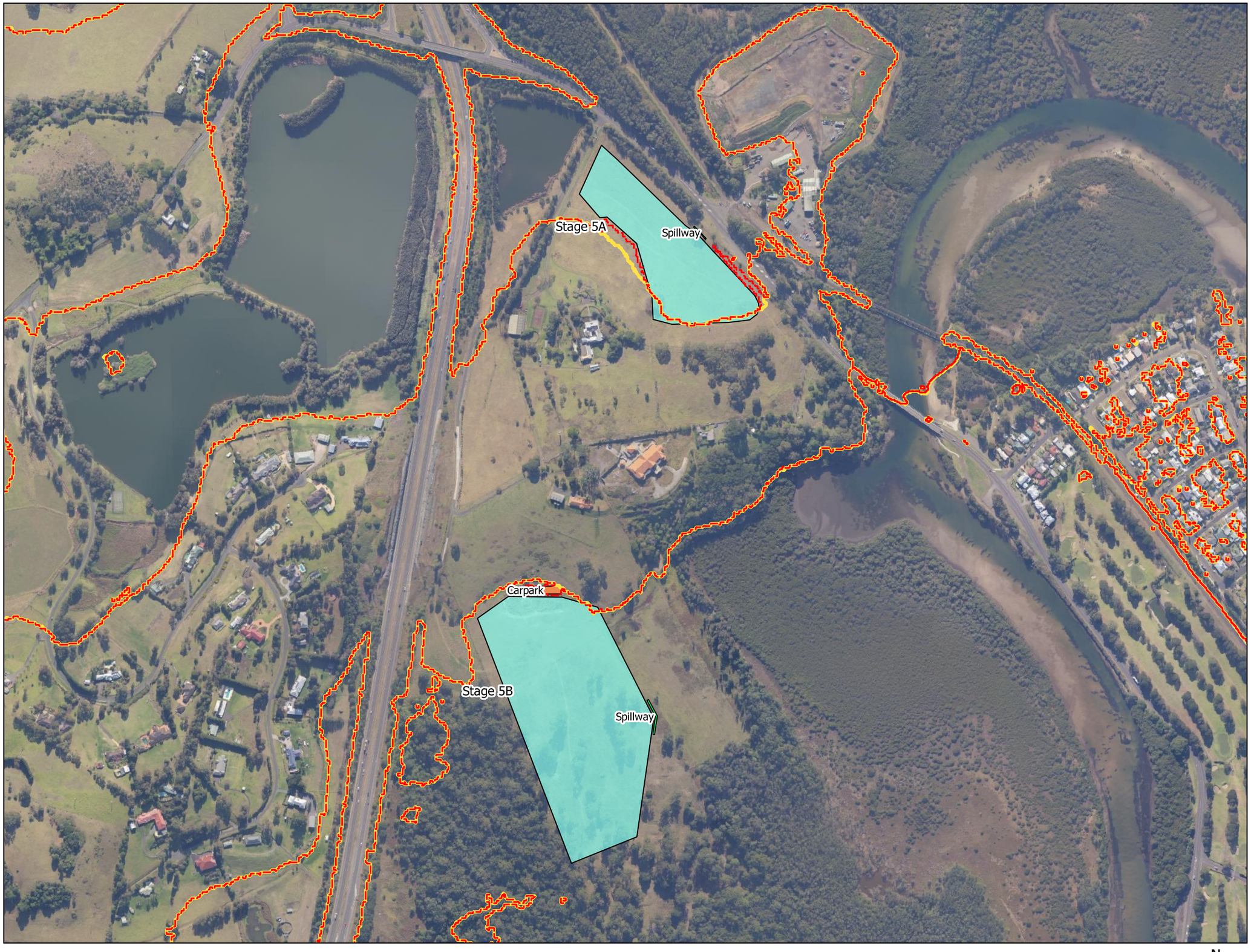
0 100 200 300 400 m

N

FIG 43. 100y ARI Flood extents pre and post.

18/07/2019

southeast
engineering+environmental



Legend

Existing_flood_extents

Proposed flood_extents

0 100 200 300 400 m

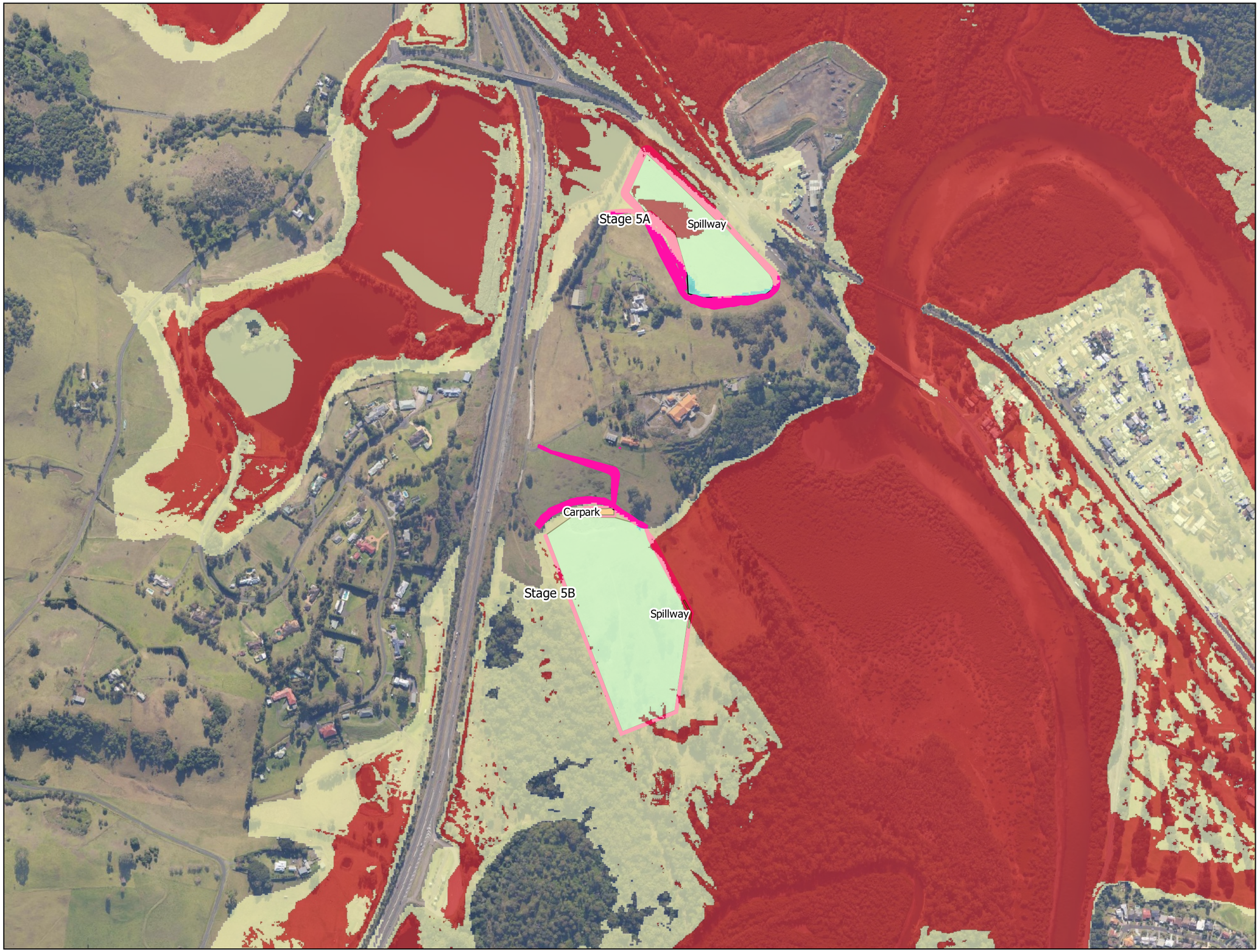
N

FIG 44. PMF Flood extents pre and post.

18/07/2019

southeast

engineering+environmental



Legend

Dredge pond bunds and earthworks

Flood Hazard (VD<0.55=Low)

Low

High

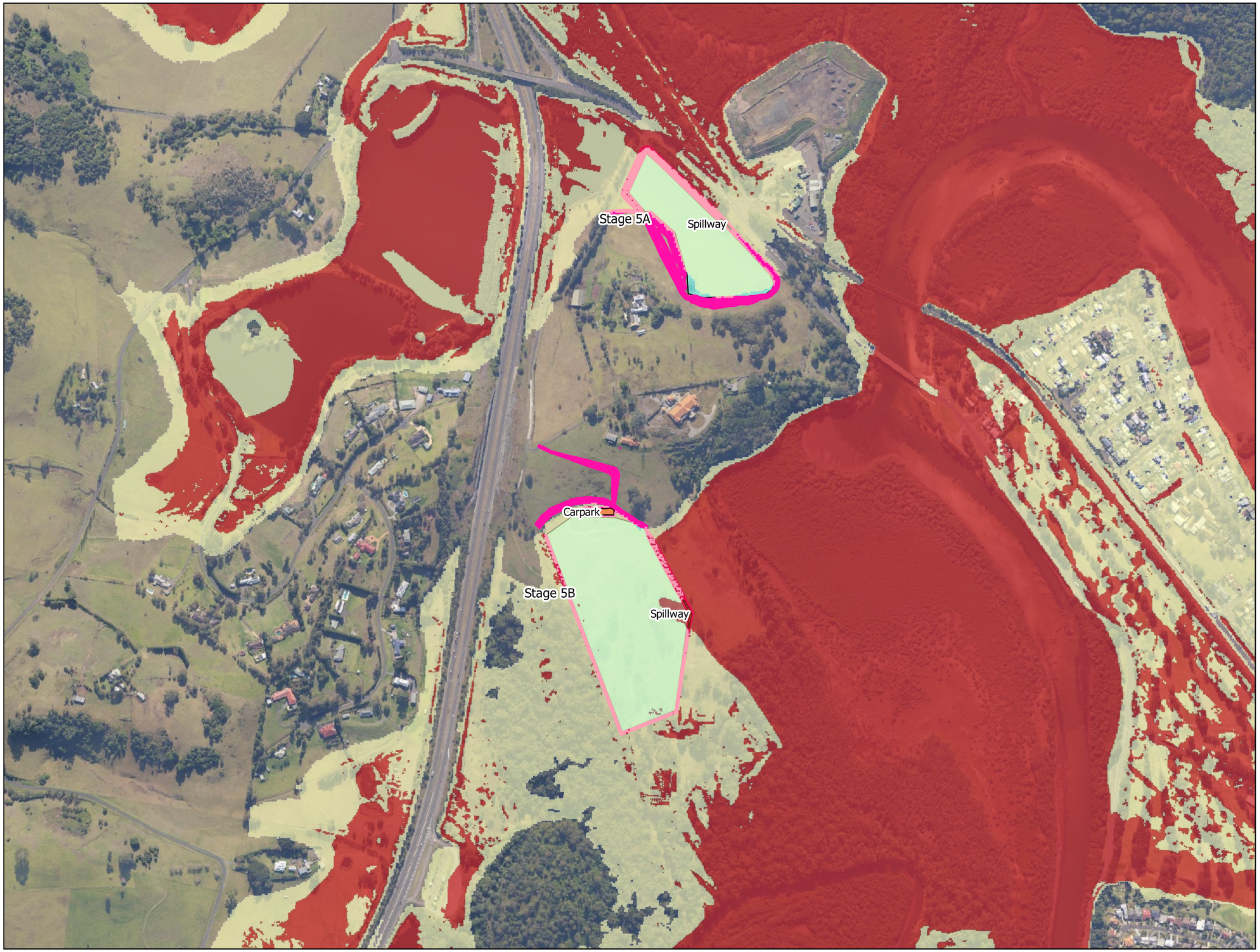
0 100 200 300 400 m

N

FIG 45. PMF flood hazard, existing conditions.

17/09/2019 Note: Flows within basin a function of model start conditions with basin water level above spillway for model stability.

southeast
engineering+environmental



Legend

Dredge pond bunds and earthworks

Flood Hazard (VD<0.55=Low)

Low

High

0 100 200 300 400 m

N

FIG 46. PMF flood hazard, proposed conditions.

17/09/2019 Note: Flows within basin a function of model start conditions with basin water level above spillway for model stability.

southeast
engineering+environmental