

Flood Impact Assessment

Aspect Industrial Estate (AIE)
Modification 3

AWE200083

Prepared for
Mirvac

27 July 2022



now



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Executive Summary

The purpose of this report is to assess the impact of Modification 3 of the approved Stage 1 development for the Aspect Industrial Estate as well as Modification 3 of the approved Final Masterplan.

The concept details of Modification 3 of the final masterplan are given in **Figure 2**.

It is proposed to stage the development of the industrial estate. The concept details of the Stage 1 development of the Aspect Industrial Estate under Modification 3 are given in **Figure 3**.

The Stage 1 development responds to the flooding risks by separating upstream runoff from local internal runoff and implementing the following measures:

- (i) Capturing upstream runoff just inside the southern site boundary and conveying this via the proposed diversion line comprising a 1500 mm diameter conduit with a 1.5 m x 1.5 m RCBC road crossing to convey upstream runoff to the head of the extended riparian corridor which conveys the combined upstream runoff from the southern and eastern drainage lines to the existing Mamre Road crossing in all events up to the 100 yr ARI event; and
- (ii) Directing all runoff from within the Stage 1 development to a dual purpose basin in order to mitigate the impacts on the rate of runoff in all events up to the 100 yr ARI event and to mitigate impacts on stormwater quality. The basin has been sized on the masterplan conditions when all stages of development of the industrial estate have been completed ie. it is planned to construct the full basin under Stage 1.

The flood impact assessment was informed by the assessment of design flood levels, velocities and hazards under Benchmark Conditions as described in Cardno, 2022.

Hydrology

The hydrological assessments were undertaken previously in three phases.

In the Phase 1 the hydrological model of benchmark conditions was modified to represent the preliminary Masterplan Conditions without a Basin and with a Basin. The Phase 1 hydrological assessments are described in **Appendix A** of Cardno, 2021.

In the Phase 2 the hydrological model of benchmark conditions was modified to represent Stage 1 Conditions with a basin (sized based on the preliminary Masterplan Conditions to meet a target at Mamre Road of not exceeding the following peak flows - 2 yr ARI (12 hr) & 100 yr ARI (2 hr)– refer **Appendix A** in Cardno, 2021.

In the Phase 3 the hydrological model of benchmark conditions was modified to represent Final Masterplan Conditions with a basin sized by AT&L to meet target at Mamre Road of not exceeding the following peak flows - 2 yr ARI (36 hr) & 100 yr ARI (36 hr).

Stage 1 Conditions with a Basin under Modification 3

The 2021 Stage 1 hydrological model was updated to include the additional impervious surfaces associated with Warehouse 9. Based on the basin assessment undertaken under preliminary Masterplan conditions, the results of the ARR1987 hydrological modelling of Stage 1 Conditions under Modification 3 with an (ultimate) Basin are summarised in **Attachment C7**.

Future Masterplan Conditions with a Basin under Modification 3

The 2021 Final Masterplan hydrological model was not updated because it was determined that the overall imperviousness of the Estate under Modification 3 was within 1% of the 2021 Masterplan layout. Based on the modified basin assessment under Final Masterplan conditions, the results of the ARR1987 hydrological modelling of Final Masterplan Conditions without a Basin and with a Basin are summarised in **Attachments C8 and C9** respectively.

Stream Erosion Index

The SEI has been assessed previously at Mamre Road under preliminary Masterplan Conditions without a Basin and with a Basin based on continuous (6 minute) MUSIC modelling. It was calculated that the SEI under preliminary Masterplan Conditions without a Basin and with a Basin would be 5.65 and 1.0 respectively. It is concluded that this demonstrates the impact uncontrolled development can have on the SEI and the effectiveness of a basin which includes a control on frequent flows is able to manage the adverse impacts of development on stream forming flows.

Hydraulics

Stage 1 Conditions under Modification 3

The assessment of flooding under Stage 1 Conditions was undertaken by modifying the local TUFLOW model of Benchmark Conditions described in Cardno, 2022 to represent the planned Stage 1 earthworks and development under Modification 3.

For assessment purposes, the Scenario 2 conditions were adopted to maintain compatibility with the 2015 South Creek flooding assessments which were based on ARR1987.

Inflows to the TUFLOW model were exported from the hydrological model and input at the locations of the subcatchment outlets (nodes). Inflows to the TUFLOW model were exported from the hydrological model and input at the locations of the subcatchment outlets (nodes). Internal drainage lines and the basin were not explicitly modelled rather the outflow from the basin was input just downstream of the basin. For detailed basin outflows for various storm events, refer to the Civil Engineering report. The downstream boundary condition was a free outfall. The flood extent in South Creek was overlaid the results of the local TUFLOW model to identify where mainstream flooding takes over from overland flows.

The TUFLOW floodplain model was run for the critical storm burst durations for the 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI and PMF events.

Flood levels and extent, depths, velocities and hazards under Stage 1 Conditions are plotted for each of these events.

Final Masterplan Conditions under Modification 3

The assessment of flooding under Final Masterplan Conditions under Modification 3 was undertaken by modifying the local TUFLOW model of Benchmark Conditions described in Cardno, 2020 to represent the planned Final Masterplan earthworks and development.

The Stage 1 modelling approach was also applied to the modelling of the Final Masterplan.

The TUFLOW floodplain model was run for the critical storm burst durations for the 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI and PMF events.

Flood levels and extent, depths, velocities and hazards under Stage 1 Conditions are plotted for each of these events.

Flood Impact Assessment

Under both Stage 1 Conditions and Final Masterplan Conditions under Modification 3, flood level difference plots disclose that there are negligible adverse impacts on flood level downstream of Mamre Road in the 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI and 500 yr ARI events. There is some change in the extent of shallow inundation. In a PMF greater decreases in the flood levels are experienced downstream of Mamre Road. There are some small increases upstream of the southern boundary in an existing farm dam which it is expected would be resolved when a drainage corridor is re-established in this area.

Under both Stage 1 Conditions and Final Masterplan Conditions under Modification 3, flood velocity difference plots disclose that there are minor impacts in the watercourse downstream of Mamre Road and negligible adverse impacts on flood velocities elsewhere downstream of Mamre Road in the 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI and 500 yr ARI events. In a PMF there are localised modest increases in the flood velocities are experienced downstream of Mamre Road.

Planning Considerations

The Mamre Road Precinct DCP came into force on 19 November 2021. The compliance of Modification 3 with the considerations set out in Section 2.5 Flood Prone Land of the DCP was assessed.

It is concluded that the proposed development including Stage 1 and the Final Masterplan under Modification 3 addresses all of the relevant considerations set out in Section 2.5 Flood Prone Land of the Mamre Road Precinct DCP.

How the Stage 1 development and the Final Masterplan under Modification 3 apply the principles of the integrated water management strategy set out in Section 2.4 Integrated Water Cycle Management of the Mamre Road Precinct DCP is detailed in the related Stormwater Management Report prepared by AT&L.

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Figure F34 PMF Flood Hazards - Final Masterplan Conditions

Figure F35 PMF Level Differences - (Final Masterplan Conditions – Benchmark Conditions)

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1 Introduction

Aspect Industrial Estate (the site) is legally described as Lots 54 – 58 in DP 259135, with an area of approximately 56.3 hectares (ha). The site is located east of Mamre Road, Kemps Creek within the Penrith Local Government Area (LGA).

The site has approximately 950 m of direct frontage to Mamre Road with a proposed intersection providing vehicular access via Mamre Road to the M4 Motorway and Great Western Highway to the north and Elizabeth Drive to the south.

The site is located approximately 4km north-west of the future Western Sydney Nancy-Bird Walton Airport, 13km south-east of the Penrith CBD and 40km west of the Sydney CBD.

The Department of Planning, Industry and Environment (DPIE) rezoned Mamre Road Precinct, including the site, in June 2020 under the *State Environmental Planning Policy (Western Sydney Employment Area) 2009* (WSEA SEPP). The rezoning of this precinct responds to the demand for industrial land in Western Sydney. The site primarily zoned IN1 General Industrial with a small sliver of land zoned E2 Environmental Conservation.

1.1 Purpose of this Report

The following modifications are proposed, relating to Warehouse/Lot 6, 7, 8, 9, 10 and 11 area and Access Road 4, located at the south western portion of the AIE, as set out in the Concept Plan SSD-10448.

- Reconfiguration of the Estate layout south of Access Road 1 and west of Access Road 3 including
 - (i) Reduction in overall lot numbers across AIE from 11 to 9.
 - (ii) Relocation and shortening of Access Road 4.
 - (iii) Reconfiguration of warehouse lots 6-11 into lots 6-9.
 - (iv) New warehouse footprints and heights, hardstand locations, car parking, estate landscaping.
 - (v) Change in boundary condition to the south including orientation of warehouse hardstand for Warehouse 9 to the south rather than the north.
- Reduction in area of Lot 6 Warehouse GFA to 18,925 sqm and Lot 7 Warehouse GFA to 14,480 sqm.
- Increase in area of Lot 8 Warehouse GFA to 44,200 sqm and Lot 9 Warehouse GFA to 64,725 sqm.
- Reconfiguration of Office and Dock Office areas in accordance with the revised warehouse footprints.
- New hardstand areas along the frontages of the reconfigured lots:
 - (i) 36 m wide east of Warehouse 6,
 - (ii) 38 m wide west of Warehouse 7,
 - (iii) 38 m south of Warehouse 8, and
 - (iv) 36 m wide north and 36m south of Warehouse 9.

- Reconfiguration of carpark areas in support of the modified warehouse layout, to be reconfigured as follows:
 - (i) Warehouse 6 - 39 parking spaces across the lot's northern frontage, 34 parking spaces across the lot's southern frontage,
 - (ii) Warehouse 7 - 20 parking spaces northern frontage and 64 parking spaces across the lot's eastern frontage, within the front setback to Access Road 3,
 - (i) Warehouse 8 – 69 parking spaces across the lot's northern frontage (fronting Access Road 1) and 97 parking spaces across the lot's eastern frontage (fronting Access Road 4), and
 - (ii) Warehouse 9 - 266 parking spaces across the lot's north-eastern frontage (fronting Access Road 4).
- Revised vehicular and truck access off Access Road 1, 3 and 4 in accordance with the reconfigured lots and shortened Access Road 4.
- Change in Estate-wide impacts associated with stormwater management, traffic generation, visual impact, noise, earthworks at the boundary and landscaping.

The purpose of this report is to assess the impact of Modification 3 of the approved Stage 1 development for the Aspect Industrial Estate as well as Modification 3 of the approved Final Masterplan comprising:

The flood impact assessment was informed by the assessment of design flood levels, velocities and hazards under Benchmark Conditions as described in Cardno, 2022 (refer **Section 1.4**).

1.2 Location

The location of the Aspect Industrial Estate is indicated in **Figure 1**.

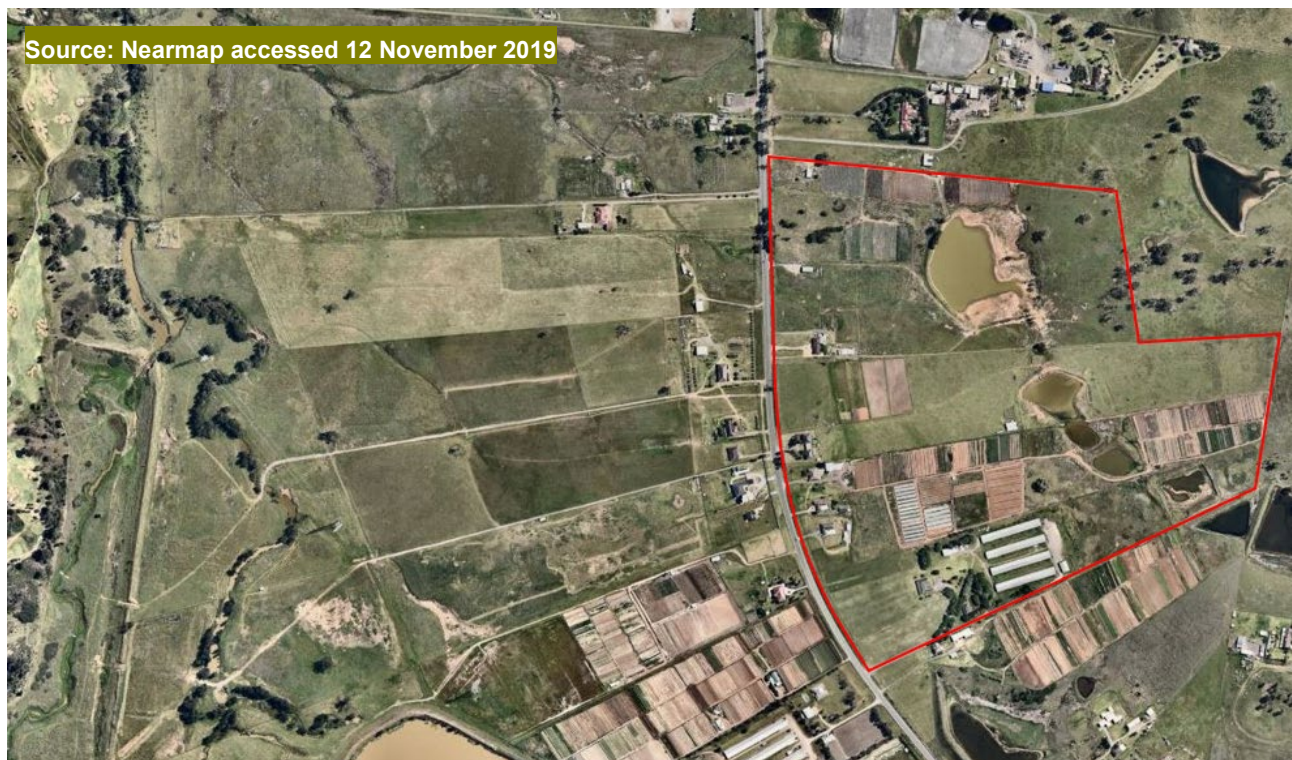


Figure 1 Location of Aspect Industrial Estate

1.3 Aspect Industrial Estate Masterplan and Staging under Modification 3

The concept details of Modification 3 of the final masterplan are given in **Figure 2**.



Figure 2 Aspect Industrial Estate Final Masterplan under Modification 3

It is proposed to stage the development of the industrial estate. The concept details of the Stage 1 development of the Aspect Industrial Estate under Modification 3 are given in **Figure 3**.

The Stage 1 development responds to the flooding risks by separating upstream runoff from local internal runoff and implementing the following measures:

- (iii) Capturing upstream runoff just inside the southern site boundary and conveying this via the proposed diversion line comprising a 1500 mm diameter conduit with a 1.5 m x 1.5 m RCBC road crossing to convey upstream runoff to the head of the extended riparian corridor which conveys the combined upstream runoff from the southern and eastern drainage lines to the existing Mamre Road crossing in all events up to the 100 yr ARI event; and
- (iv) Directing all runoff from within the Stage 1 development to a dual purpose basin in order to mitigate the impacts on the rate of runoff in all events up to the 100 yr ARI event and to mitigate impacts on stormwater quality. The basin has been sized on the masterplan conditions when all stages of development of the industrial estate have been completed ie. it is planned to construct the full basin under Stage 1.



The purpose of this report was to provide a high-level understanding of the opportunities and constraints of the site due to flooding and to inform the development of a stormwater strategy/management plan for the Aspect Industrial Estate based on an assessment of flooding under Pre-development conditions.

Hydrological modelling of the South Creek catchment was undertaken in 2015 at the catchment scale using XP-RAFTS. The hydrological model assembled by Worley Parsons in 2015 was based on ARR1987 IFD. The local catchment is located within the larger South Creek subcatchment 1.17.

A local hydrological model was created to assess runoff under benchmark conditions and to facilitate the assessment of impacts of proposed development.

An issue which was considered was whether the airspace in existing farms dams is to be included in the benchmark conditions. An initial assessment was undertaken of the regional significance or otherwise of the farm dams based on criteria formulated in the upper South Creek catchment.

It was concluded that:

- (i) The combined capacity in 8 farm dams within the local catchment is just under the criterion for classification as a regional farm dam system; and on this basis;
- (ii) the farm dams have been ignored when assessing "Benchmark Conditions".

Hydrological assessments were undertaken using both ARR1987 and ARR2019.

Design rainfall and storm burst patterns were obtained from ARR1987 for 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI and 500 yr ARI events.

The Probable Maximum Precipitation (PMP) was estimated using The Estimation of Probable Maximum Precipitation in Australia: Generalised Short – Duration Method (Bureau of Meteorology, 2003). The PMP depths were obtained for ellipses A and were applied to each subcatchment in the local model.

For the 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI and 500 yr ARI events the adopted initial rainfall loss = 15 mm and continuing rainfall loss = 1.5 mm/h. For the PMF the adopted rainfall losses were an initial loss = 1 mm and a continuing loss = 0 mm/h.

Design rainfall and storm burst patterns were obtained from ARR2019 were obtained from the ARR Data Hub for 50%, 20%, 1%, 0.5% and 0.2% AEP events.

For the for 50%, 20%, 1%, 0.5% and 0.2% AEP events the adopted initial burst rainfall loss (IL) varied while a constant continuing rainfall loss (CL) = 2.3 mm/h was adopted. The adopted average initial burst losses were as follows.

AEP	Burst IL (mm)	CL (mm/h)
50%	28.5	2.3
20%	16	2.3
10%	14	2.3
5%	13.5	2.3
2%	12	2.3
1%	10	2.3
0.5%	10	2.3
0.2%	10	2.3

The peak flows estimated at the Mamre Road crossing for the various events are summarised in **Table 1** noting that, as discussed in **Section 1.5**, that 2 yr ARI equates to 39% AEP while 5 yr ARI equates to 18% AEP.

It was noted that the:

- Critical storm burst durations for ARR2019 storm burst are all shorter than the critical storm burst durations for ARR1987 storm burst;
- The 1% AEP peak flow at Mamre Road under ARR2019 is around 11% higher than the estimated 100 yr ARI peak flow at Mamre Road under ARR1987.

Table 1 Summary of Estimated Peak Flows at Mamre Road Crossing

ARR1987 Hydrology			ARR2019 Hydrology		
ARI (yrs)	Peak Flow (m3/s)	Critical Duration (hrs)	AEP	Peak Flow (m3/s)	Critical Duration (hrs)
2	6.31	9	50%	3.23	6
5	9.09	4.5	20%	7.73	2
100	21.0	2	1%	23.3	0.75
200	24.4	2	0.50%	26.2	0.75
500	29.2	2	0.20%	30.9	0.75
PMF	162	0.75	PMF	162	0.75

It was also of interest to compare the estimated peak flows at Mamre Road under ARR1987 with the estimated peak flows in South Creek in the vicinity of the local catchment at Node 1.17 (refer Figure 10 in Cardno, 2022). The estimated peak flows at Node 1.17 are summarised in **Table 2**.

Table 2 Comparison of Estimated Peak Flows at Mamre Road and in South Creek at Node 1.17

Event	Mamre Road			South Creek (Node 1.17)		
	Storm Burst			Storm Burst		
	2 hrs	9 hrs	36 hrs	2 hrs	9 hrs	36 hrs
2 yr ARI	5.3	6.3	3.8	13.6	151	305
100 yr ARI	20.9	14.8	9.0	360	774	956

1.3.2 Hydraulics

A local TUFLOW model of the drainage lines through the site was assembled.

The Digital Elevation Model (DEM) was created by combining detailed survey and ALS data external to the site. Based on the assessment of the combined impact of the farm dams in the Mamre Road local catchment discussed in Section 3.1, the farm dams were removed from the DEM by interpolating the terrain through each of the farm dams.

The roughness zones for the floodplain are mapped in Figure 14 of Cardno, 2022.

From the detailed survey it was determined that the crossing under Mamre Road is 3 x 1.85 m x 0.77 m culverts. For assessment purposes it was assumed that this crossing would be partially blocked and that only two of the three culverts would convey floodwaters.

Inflows to the TUFLOW model were exported from the hydrological model and input at the locations of the subcatchment outlets (nodes). For assessment purposes, the Scenario 2 conditions were adopted to maintain compatibility with the 2015 South Creek flooding assessments which were based on ARR1987. A review of the vertical alignment of Mamre Road beside Subcatchment MRID2b disclosed that Mamre Road has a local crest located around 95 m north of the southwest corner of the subject property. Consequently, runoff from Subcatchment MRID2b was partitioned 50:50 based on contributing subcatchment areas with 50% of the runoff input at the northern limit of Subcatchment MRID2b and 50% input at the southwest corner of the subject property.

The downstream boundary condition was a free outfall. The flood extent in South Creek was overlaid over the results of the local TUFLOW model to identify where mainstream flooding takes over from overland flows.

The TUFLOW floodplain model was run for the critical storm burst durations for the 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI and PMF events.

Flood levels and extent, depths, velocities and hazards under Benchmark Conditions are plotted for each of these events.

1.5 Approach

The approach adopted to the hydrological and hydraulic assessments is outlined as follows.

1.4.1 Hydrology

The hydrological model assembled by Worley Parsons in 2015 was based on ARR1987 IFD. 100 yr ARI runoff in the upper South Creek catchment south of Bringelly Road has been assessed previously for 2 hour, 9 hour and 36 hour storm bursts. An assessment of the sensitivity of 100 yr ARI peak runoff to storm burst rainfall losses has also been undertaken.

It should be noted that the 2015 study identified the critical storm burst duration for South Creek downstream of Bringelly Road to be 36 hours. While any future development would be expected to have an adverse impact of peak flows in short duration storm bursts it is likely that any future development will have minimal or nil adverse or beneficial impact on peak flows in a 36 hour storm due to the duration of the storm and timing effects due to runoff from impervious areas occurring more rapidly than runoff from pervious areas.

A local hydrological model was created to assess runoff under benchmark conditions and to facilitate the assessment of impacts of proposed Stage 1 development and the Final Masterplan.

An additional assessment was undertaken using ARR2019 IFD and burst losses.

1.4.2 Hydraulics

Given that the proposed development is located in a local catchment which drains to South Creek and is located beyond the extent of the South Creek floodplain model, a local 1D/2D floodplain model was assembled to assess flooding under benchmark conditions and to facilitate the assessment of impacts of proposed development.

1.6 Terminology

Book 1, Chapter 2, Section 2.2.5. Adopted Terminology in Australian Rainfall & Runoff, 2016 describes the adopted terminology as follows:

To achieve the desired clarity of meaning, technical correctness, practicality and acceptability, the National Committee on Water Engineering has decided to adopt the terms shown in Figure 1.2.1 and the suggested frequency indicators.

Navy outline indicates preferred terminology. Shading indicates acceptable terminology which is depends on the typical use. For example, in floodplain management 0.5% AEP might be used while in dam design this event would be described as a 1 in 200 AEP.

As shown in the third column of Figure 1.2.1, the term Annual Exceedance Probability (AEP) expresses the probability of an event being equalled or exceeded in any year in percentage terms, for example, the 1% AEP design flood discharge. There will be situations where the use of percentage probability is not practicable; extreme flood probabilities associated with dam spillways are one example of a situation where percentage probability is not appropriate. In these cases, it is recommended that the probability be expressed as 1 in X AEP where $100/X$ would be the equivalent percentage probability.

Frequency Descriptor	EY	AEP (%)	AEP	ARI
			(1 in x)	
Very Frequent	12			
	6	99.75	1.002	0.17
	4	98.17	1.02	0.25
	3	95.02	1.05	0.33
	2	86.47	1.16	0.5
	1	63.21	1.58	1
Frequent	0.69	50	2	1.44
	0.5	39.35	2.54	2
	0.22	20	5	4.48
	0.2	18.13	5.52	5
	0.11	10	10	9.49
Rare	0.05	5	20	20
	0.02	2	50	50
	0.01	1	100	100
Very Rare	0.005	0.5	200	200
	0.002	0.2	500	500
	0.001	0.1	1000	1000
	0.0005	0.05	2000	2000
Extreme	0.0002	0.02	5000	5000
			↓	
			PMP/ PMPDF	

Figure 1.2.1. Australian Rainfall and Runoff Preferred Terminology

For events more frequent than 50% AEP, expressing frequency in terms of annual exceedance probability is not meaningful and misleading, as probability is constrained to a maximum value of 1.0 or 100%. Furthermore, where strong seasonality is experienced, a recurrence interval approach would also be misleading.

An example of strong seasonality is where the rainfall occurs predominately during the Summer or Winter period and as a consequence flood flows are more likely to occur during that period. Accordingly, when strong seasonality exists, calculating a design flood flow with a 3 month recurrence interval is of limited value as the expectation of the time period between occurrences will not be consistent throughout the year. For example, a flow with the magnitude of a 3 month recurrence interval would be expected to occur or be exceeded 4 times a year; however, in situations where there is strong seasonality in the rainfall, all of the occurrences are likely to occur in the dominant season.

Consequently, events more frequent than 50% AEP should be expressed as X Exceedances per Year (EY). For example, 2 EY is equivalent to a design event with a 6 month recurrence interval when there is no seasonality in flood occurrence.

The terminology adopted herein depends on the edition of Australian Rainfall and Runoff provide the IFD data. In the case of assessments based on ARR1987 the ARI terminology was adopted for design floods. In the case of assessments based on ARR2019 the AEP terminology was adopted for design floods.

2 Hydrology

Hydrological modelling of the local Mamre Road catchment under Benchmark Conditions is outlined in Section 1.3.1 and described in detail in Cardno, 2022.

The hydrological assessments were undertaken previously in three phases.

In the Phase 1 the hydrological model of benchmark conditions was modified to represent the preliminary Masterplan Conditions without a Basin and with a Basin. The Phase 1 hydrological assessments are described in **Appendix A** of Cardno, 2021.

In the Phase 2 the hydrological model of benchmark conditions was modified to represent Stage 1 Conditions with a basin (sized based on the preliminary Masterplan Conditions to meet a target at Mamre Road of not exceeding the following peak flows - 2 yr ARI (12 hr) & 100 yr ARI (2 hr)– refer Appendix A in Cardno, 2021.

In the Phase 3 the hydrological model of benchmark conditions was modified to represent Final Masterplan Conditions with a basin sized by AT&L to meet target at Mamre Road of not exceeding the following peak flows - 2 yr ARI (36 hr) & 100 yr ARI (36 hr). These modified basin properties are as follows:

ARR	Basin Footprint (m2)	Max 100 yr ARI Depth (m)	100 yr ARI Basin Volume (m3)	Max 2 yr ARI Depth (m)	2 yr ARI Basin Volume (m3)	Primary Outlet	Secondary Spillway		Indicative Embankment Crest Level above Primary Outlet IL (m)
							Width (m)	Crest Level (m)	
Basin sized to meet target at Mamre Road - 2 yr ARI (36 hr) & 100 yr ARI (36 hr)									
1987	8825	4.01	35,418	1.85	16,328	1 x 0.63m diam RCP	3.6	4	4.2

2.1 Stage 1 Conditions with a Basin

The 2021 Stage 1 hydrological model was updated to include the additional impervious surfaces associated with Warehouse 9. Based on the basin assessment undertaken under preliminary Masterplan conditions, the results of the ARR1987 hydrological modelling of Stage 1 Conditions under Modification 3 with an (ultimate) Basin are summarised in **Attachment C7**.

2.2 Final Masterplan Conditions with a Basin

The 2021 Final Masterplan hydrological model was not updated because it was determined that the overall imperviousness of the Estate under Modification 3 was within 1% of the 2021 Masterplan layout.

Based on the modified basin assessment under Final Masterplan conditions, the results of the ARR1987 hydrological modelling of Final Masterplan Conditions without a Basin and with a Basin are summarised in **Attachments C8** and **C9** respectively.

2.3 Stream Erosion Index

Given the mapping of a watercourse and a riparian buffer zone it is anticipated that the Stream Erosion Index will be of interest to Council. Council typically requires:

An assessment to show that the post development duration of stream forming flows is no greater than 3.5 times the pre-developed duration of stream forming flows.

This is interpreted to be a requirement that the Stream Erosion Index (SEI) be no greater than 3.5.

The stream erosion index is a value that can describe the impact of development on a watercourse in terms of erosion potential. It is defined as the number of occasions the Developed Conditions flow exceeds the 'stream forming flow', divided the number of occasions the Benchmark Conditions flow exceeds the 'stream forming flow'.

Stream forming flow is defined as 50% of the 2 year ARI flow under Benchmark Conditions.

The SEI has been assessed previously at Mamre Road under preliminary Masterplan Conditions without a Basin and Ultimate Conditions with a Basin based on continuous (6 minute) MUSIC modelling. It was calculated that the SEI under preliminary Masterplan Conditions without a Basin and with a Basin would be 5.65 and 1.0 respectively. It was concluded that this demonstrated the impact uncontrolled development can have on the SEI and the effectiveness of a basin which includes a control on frequent flows is able to manage the adverse impacts of development on stream forming flows.

3 Flooding Assessment

The assessments of flooding under Stage 1 Conditions and the Final Masterplan Conditions under Modification 3 are outlined as follows.

3.1 Stage 1 Conditions with a Basin under Modification 3

3.1.1 Stage 1 Model

The assessment of flooding under Stage 1 Conditions was undertaken by modifying the local TUFLOW model of Benchmark Conditions described in Cardno, 2022 to represent the planned earthworks and development as follows.

The DEM as updated based on the proposed platform levels, proposed roadworks and swales under Stage 1 Conditions (see **Figure 3**).

The basin size was based on the preliminary Masterplan Conditions to meet a target at Mamre Road of not exceeding the following peak flows - 2 yr ARI (12 hr) & 100 yr ARI (2 hr)– refer Appendix A for size and outlet details.

The adopted roughness zones under Stage 1 Conditions are mapped in **Figure 4**.

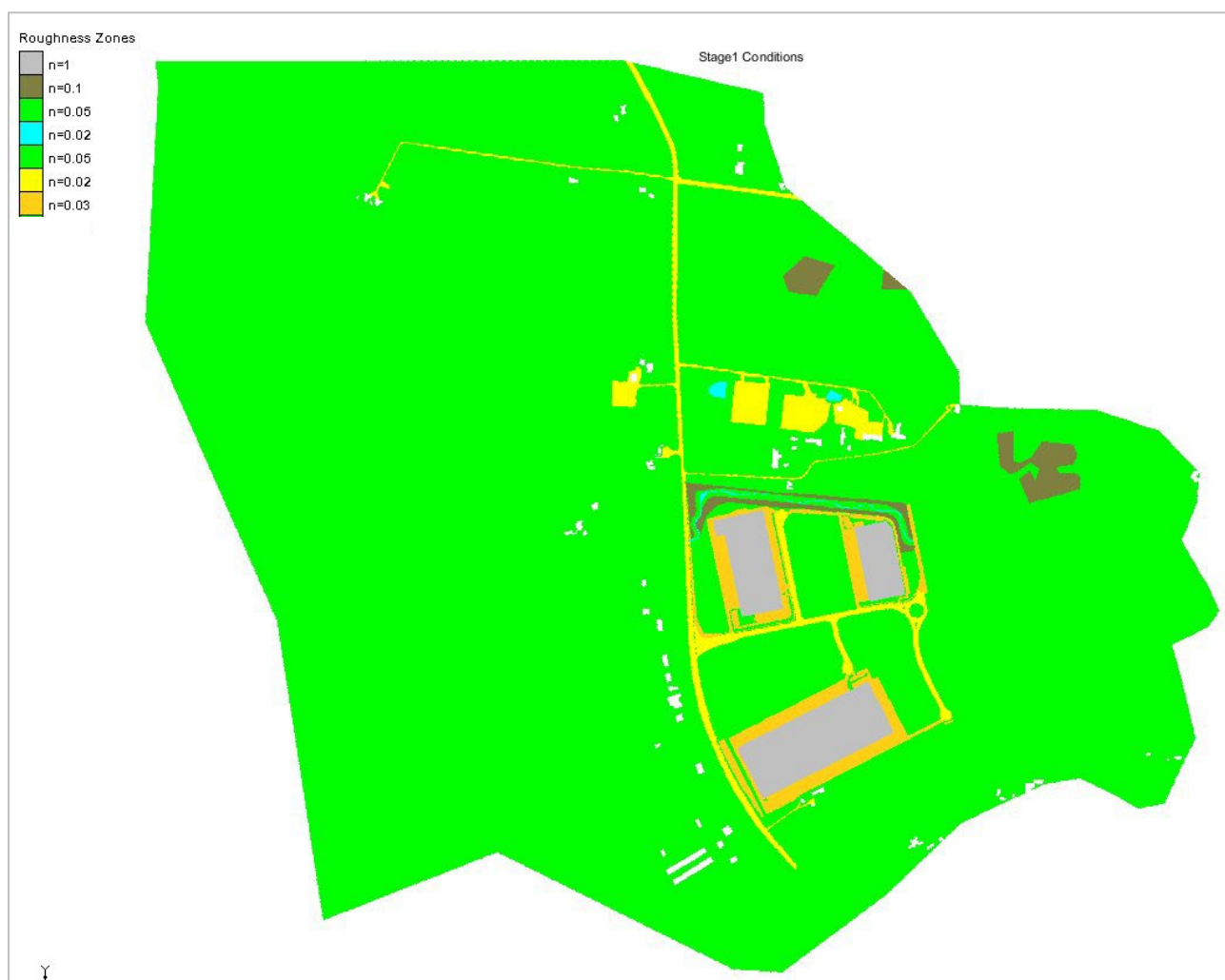


Figure 4 Aspect Industrial Estate Stage 1 Development under Modification 3

The drainage diversion line comprising a 1500 mm diameter conduit with a 1.5 m x 1.5 m RCBC road crossing to convey upstream runoff to the head of the extended riparian corridor was included in the model.

From the detailed survey it was determined previously that the crossing under Mamre Road is 3 x 1.85 m x 0.77 m culverts. For assessment purposes it was assumed that this crossing would be partially blocked and that only two of the three culverts would convey floodwaters.

For assessment purposes, the Scenario 2 inflows were adopted to maintain compatibility with the 2015 South Creek flooding assessments which were based on ARR1987.

Inflows to the TUFLOW model were exported from the hydrological model and input at the locations of the subcatchment outlets (nodes). Internal drainage lines and the basin were not explicitly modelled rather the outflow from the basin was input just downstream of the basin.

The downstream boundary condition was a free outfall. The flood extent in South Creek was overlaid over the results of the local TUFLOW model to identify where mainstream flooding takes over from overland flow flooding.

3.1.2 Results

The TUFLOW floodplain model was run for the critical storm burst durations for the 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI and PMF events (see **Appendix A**).

2 yr ARI

The estimated 2 year ARI flood levels and extent, depths and velocities and provisional flood hazard under Stage 1 Conditions are plotted in **Figures I01, I02, I03 and I04** respectively.

5 yr ARI

The estimated 5 year ARI flood levels and extent, depths, velocities and hazards under Stage 1 Conditions are plotted in **Figures I07, I08, I09 and I10** respectively.

100 yr ARI

The estimated 100 year ARI flood levels and extent, depths, velocities and hazards under Stage 1 Conditions are plotted in **Figures I013, I14, I15 and I16** respectively.

200 yr ARI

The estimated 200 year ARI flood levels and extent, depths, velocities and hazards under Stage 1 Conditions are plotted in **Figures I19, I20, I21 and I22** respectively.

500 yr ARI

The estimated 500 year ARI flood levels and extent, depths, velocities and hazards under Stage 1 Conditions are plotted in **Figures I23, I24, I25 and I26** respectively.

PMF

The estimated PMF flood levels and extent, depths, velocities and hazards under Stage 1 Conditions are plotted in **Figures I29, I30, I31 and I32** respectively.

3.2 Final Masterplan Conditions with a Basin under Modification 3

3.2.1 Final Masterplan Model

The assessment of flooding under Final Masterplan Conditions was undertaken by modifying the local TUFLOW model of Benchmark Conditions described in Cardno, 2022 to represent the planned earthworks and development as follows.

The DEM as updated based on the proposed platform levels, proposed roadworks and swales under Final Masterplan Conditions (see **Figure 2**).

The basin was sized by AT&L to meet a target at Mamre Road of not exceeding the following peak flows - 2 yr ARI (36 hr) & 100 yr ARI (36 hr).

The adopted roughness zones under Masterplan Conditions are mapped in **Figure 5**.

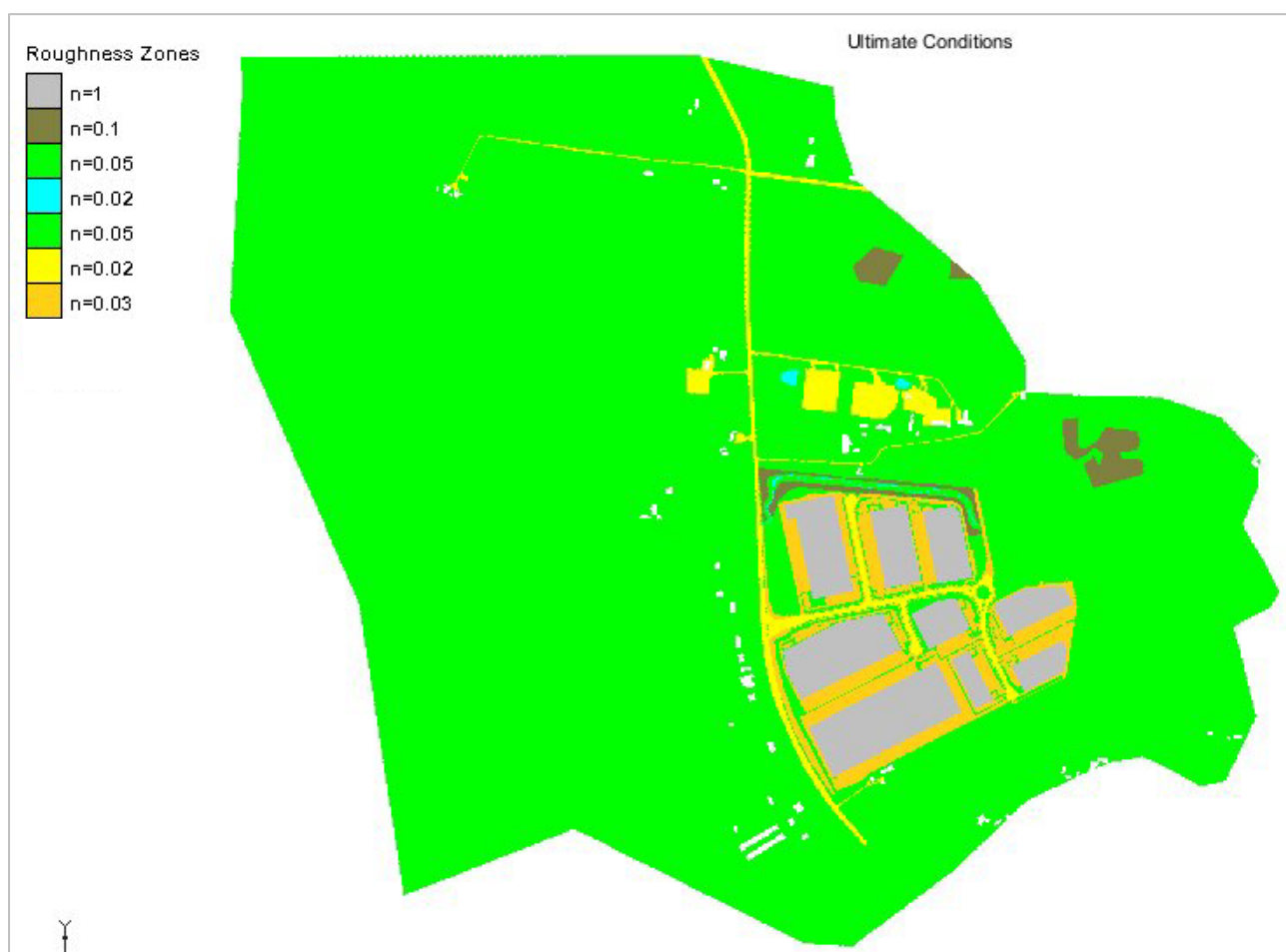


Figure 5 Aspect Industrial Estate Masterplan under Modification 3

The drainage diversion line comprising a 1500 mm diameter conduit with a 1.5 m x 1.5 m RCBC road crossing to convey upstream runoff to the head of the extended riparian corridor was included in the model.

As for Stage 1 Conditions, it was assumed that the Mamre Road crossing would be partially blocked and that only two of the three culverts would convey floodwaters.

For assessment purposes, the Scenario 2 inflows were adopted.

Inflows to the TUFLOW model were exported from the hydrological model and input at the locations of the subcatchment outlets (nodes). Internal drainage lines and the basin were not explicitly modelled rather the outflow from the basin was input just downstream of the basin.

The downstream boundary condition was a free outfall. The flood extent in South Creek was overlaid over the results of the local TUFLOW model to identify where mainstream flooding takes over from overland flow flooding.

3.2.2 Results

The TUFLOW floodplain model was run for the critical storm burst durations for the 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI and PMF events (see **Appendix B**).

2 yr ARI

The estimated 2 year ARI flood levels and extent, depths and velocities and provisional flood hazard under Stage 1 Conditions are plotted in **Figures F01, F02, F03 and F04** respectively.

5 yr ARI

The estimated 5 year ARI flood levels and extent, depths, velocities and hazards under Stage 1 Conditions are plotted in **Figures F07, F08, F09 and F10** respectively.

100 yr ARI

The estimated 100 year ARI flood levels and extent, depths, velocities and hazards under Stage 1 Conditions are plotted in **Figures F013, F14, F15 and F16** respectively.

200 yr ARI

The estimated 200 year ARI flood levels and extent, depths, velocities and hazards under Stage 1 Conditions are plotted in **Figures F19, F20, F21 and F22** respectively.

500 yr ARI

The estimated 500 year ARI flood levels and extent, depths, velocities and hazards under Stage 1 Conditions are plotted in **Figures F23, F24, F25 and F26** respectively.

PMF

The estimated PMF flood levels and extent, depths, velocities and hazards under Stage 1 Conditions are plotted in **Figures F29, F30, F31 and F32** respectively.

4 Flood Impact Assessment

The impacts of Stage 1 of the proposed Aspect Industrial Estate and of the Final Masterplan under Modification 3 are described as follows.

4.1 Flood Level Impacts

4.1.1 Stage 1 Conditions under Modification 3

The estimated impact of Stage 1 of the proposed Aspect Industrial Estate under Modification 3 on 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood levels and PMF levels (in comparison to Benchmark Conditions) are plotted in **Figures I05, I11, I17, I23, I29 and I35** respectively.

These Figures disclose negligible adverse impacts on flood level downstream of Mamre Road in the 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI and 500 yr ARI events. There is some change in the extent of shallow inundation. In a PMF greater decreases in the flood levels are experienced downstream of Mamre Road. There are some small increases upstream of the southern boundary in an existing farm dam which it is expected would be resolved when a drainage corridor is re-established in this area.

4.1.2 Final Masterplan under Modification 3

The estimated impact of the Final Masterplan on 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood levels and PMF levels (in comparison to Benchmark Conditions) are plotted in **Figures F05, F11, F17, F23, F29 and F35** respectively.

These Figures disclose negligible adverse impacts on flood level downstream of Mamre Road in the 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI and 500 yr ARI events. There is some change in the extent of shallow inundation. In a PMF greater decreases in the flood levels are experienced downstream of Mamre Road. There are some small increases upstream of the southern boundary in an existing farm dam which it is expected would be resolved when a drainage corridor is re-established in this area.

4.2 Flood Velocity Impacts

4.2.1 Stage 1 Conditions

The estimated impact of Stage 1 of the Aspect Industrial Estate on 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood velocities and PMF velocities (in comparison to Benchmark Conditions) are plotted in **Figures I06, I12, I18, I24, I30 and I36** respectively.

These Figures disclose minor impacts in the watercourse downstream of Mamre Road and negligible adverse impacts on flood velocities elsewhere downstream of Mamre Road in the 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI and 500 yr ARI events. In a PMF there are localised modest increases in the flood velocities are experienced downstream of Mamre Road.

4.2.2 Final Masterplan Model

The estimated impact of the Final Masterplan on 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood velocities and PMF velocities (in comparison to Benchmark Conditions) are plotted in **Figures F06, F12, F18, F24, F30 and F36** respectively.

These Figures disclose minor impacts in the watercourse downstream of Mamre Road and negligible adverse impacts on flood velocities elsewhere downstream of Mamre Road in the 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI and 500 yr ARI events. In a PMF there are localised modest increases in the flood velocities are experienced downstream of Mamre Road.

5 Planning Considerations

The Mamre Road Precinct DCP came into force on 19 November 2021. The compliance of Modification 3 with the considerations set out in Section 2.5 Flood Prone Land of the DCP was assessed as follows.

2.4 Integrated Water Cycle Management

The Mamre Road Precinct Flood, Riparian Corridor and Integrated Water Cycle Management Strategy (Sydney Water) describes the principles of the integrated water management strategy for the Precinct.

How the Stage 1 development and the Final Masterplan under Modification 3 apply the principles of the integrated water management strategy is detailed in the related Stormwater Management Report prepared by AT&L.

2.5 Flood Prone Land

Objectives

- a) *To ensure development in the floodplain is consistent with the NSW Flood Prone Land Policy and principles in the NSW Government Floodplain Development Manual.*
- b) *To ensure floodplain risk management minimises the potential impact of development upon the aesthetic, recreational and ecological values of waterways.*
- c) *To maintain the existing flood regime, velocities, flow conveyance and stream hydrology.*
- d) *To ensure development does not alter flood behaviour resulting in adverse impacts to surrounding properties, land uses and infrastructure.*
- e) *To enable safe occupation and evacuation of flood prone land.*
- f) *To ensure development is compatible with flood hazard and flood behaviour.*
- g) *To avoid adverse or cumulative impacts on flood behaviour and environment.*

Controls

- 1) *A comprehensive Flood Impact Risk Assessment (FIRA) (prepared by a qualified hydrologist and hydraulic engineer) is to be submitted with development applications on land identified as fully or partially flood affected. The FIRA should utilise Council's existing data and data arising from the Wianamatta (South) Creek Catchment Flood Study¹ to provide an understanding of existing flooding condition and developed conditions consistent with the requirements of the NSW Flood Prone Land Policy and Floodplain Development Manual. The FIRA shall determine:*

A comprehensive Flood Impact Assessment and Flood Risk Assessment have been prepared for Modification 3.

The FRA and FIA have been undertaken using a hydrological and floodplain model assembled for the study. The 2020 Wianamatta (South) Creek Catchment Flood Study assesses mainstream flooding only which is downstream of the project site.

¹ Advisian Pty Ltd (November 2020) Wianamatta (South) Creek Catchment Flood Study – Existing Conditions – Report. <https://flooddata.ses.nsw.gov.au/related-dataset/wianamatta-south-creek-catchment-flood-study-existing-conditions-main-report>

The level of subcatchment discretisation adopted by Advisian was far too coarse for the purpose of this assessment. For assessment purposes, the Scenario 2 conditions were adopted to maintain compatibility with the 2015 South Creek flooding assessments which were based on ARR1987. Scenario 2 initial loss = 15 mm and continuing loss = 1.5 mm/h (adopted by WMAwater, 2012 for the Upper South Creek catchment).

- *Flood behaviour for existing and developed scenarios for the full range of flooding including the 5% Annual Exceedance Probability (AEP), 1% AEP, 0.5% AEP, 0.2% AEP and Probable Maximum Flood (PMF);*

2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI and 500 yr ARI events and PMF events have been assessed.

- *Flood Function (floodways, flood fringe and flood storage areas);*

Flood function has not been mapped for overland flowpaths through the project site. It is unclear if this applies to an overland flow FIRA.

- *Flood Hazard; and*

The flood hazards under Benchmark Conditions are mapped for 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood levels and PMF in the 2022 FRA Report.

The flood hazards under Stage 1 and Masterplan Conditions under Modification 3 are mapped for 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood levels and PMF in this Report.

- *Flood constraints, including evacuation constraints (if applicable).*

A Flood Emergency Response Plan (FERP) for the construction phase of the Aspect Industrial Estate development has been prepared separately. It describes:

- Flood behaviour on the site in floods up to a Probable Maximum Flood (PMF) at different stages of the site development,
- A Flood Emergency Response Plan for the construction phase, including:
 - Flood risks both on the project site and external to the project site;
 - Evacuation strategy, measures, procedures and plan; and
 - A FloodSafe Plan

2) *The FIRA shall adequately demonstrate to the satisfaction of the consent authority that:*

- *Development will not increase flood hazard, flood levels or risk to other properties;*

The flood levels, velocities and hazards assessed under Benchmark Conditions under Modification 3 for 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood levels and PMF are mapped in the 2022 FRA Report.

The flood levels, velocities and hazards assessed under Stage 1 and Masterplan Conditions under Modification 3 for 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood levels and PMF are mapped in this Report.

All these Figures disclose negligible adverse impacts on flood level downstream of Mamre Road in the 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI and 500 yr ARI events. In a PMF greater decreases in the flood levels are experienced downstream of Mamre Road.

Under both Stage 1 Conditions and Final Masterplan Conditions, flood velocity difference plots disclose negligible adverse impacts of Stage 1 development on flood velocities downstream of Mamre Road in the 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI and 500 yr ARI events. In a PMF modest increases in the flood velocities are experienced downstream of Mamre Road.

- *Development has incorporated measures to manage risk to life from flooding;*

Under Masterplan Conditions all flows up to the 200 yr ARI are conveyed through the project site without interacting with proposed warehouses.

- *For development located within the PMF, an Emergency Response Plan is in place;*

This requirement is noted notwithstanding the project site is higher than the Kemps Ck / South Ck PMF levels. A Flood Emergency Response Plan (FERP) for the construction phase of the Aspect Industrial Estate development has been prepared separately.

- *Structures, building materials and stormwater controls are structurally adequate to deal with PMF flow rates and velocities (including potential flood debris);*

While requirement is noted the project site is not subject to mainstream PMF flooding from Kemps Creek or South Creek. The project site is partially inundated by overland flows in a local maximised PMF (not the catchment-wide PMF which gives flows far lower than the local maximised PMF overland flows).

- *Development siting and layout maintains personal safety during the full range of floods and is compatible with the flood constraints and potential risk;*

The flood modelling has informed the site layout and platform levels.

- *The impacts of sea level rise and climate change on flood behaviour has been considered;*

Sea level rise is not a relevant consideration. The 200 yr ARI and 500 yr ARI floods are surrogates for 100 yr ARI floods with climate change rainfall increases under RCP4.5 and RCP8.5 conditions.

- *Development considers Construction of Buildings in Flood Hazard Areas and accompanying handbook developed by the Australian Building Codes Board (2012); and*

Noted.

- *Fencing does not impede the flow of flood waters/overland flow paths.*

There is no fencing proposed across the swale/riparian corridor located along the eastern and northern boundary of the project site

Flood Constraints

- 3) *New development in floodways, flood fringe and/or flood storages or in high hazard areas in the 1% AEP flood event considering climate change is not permitted.*

The project site is higher than the Kemps Ck / South Ck PMF levels and accordingly no development is proposed in mainstream floodways, flood storage or flood fringe areas. Flood function not mapped for overland flowpaths through the project site.

Under Masterplan Conditions all flows up to the 200 yr ARI are conveyed through the project site without interacting with proposed warehouses. The 200 yr ARI flood is a surrogates for 100 yr ARI floods with climate change rainfall increase under RCP4.5 conditions.

- 4) *Development applications are to consider the depth and nature of flood waters, whether the area forms flood storage, the nature and risk posed to the development by flood waters, the velocity of floodwaters and the speed of inundation, and whether the development lies in an area classed as a 'floodway', 'flood fringe area' or 'flood storage area'.*

Flood function not mapped for overland flowpaths through the project site.

Under Masterplan Conditions all flows up to the 200 yr ARI are conveyed through the project site without interacting with proposed warehouses.

Subdivision

- 5) *Subdivision of land below the flood planning level will generally not be supported.*

The proposed platform levels comply with the requirement

- 6) *Subdivision must comply with Designing safer subdivisions guidance on subdivision design in flood prone areas 2007 (Hawkesbury-Nepean Floodplain Management Steering Committee).*

The subdivision guidance relates to development on the mainstream Hawkesbury –Nepean floodplain. The project site is higher than the Kemps Ck / South Ck PMF levels.

New Development

- 7) *Finished floor levels shall be at 0.5m above the 1% AEP flood.*

It is expected that new development will comply with this requirement.

- 8) *Flood safe access and emergency egress shall be provided to all new and modified developments consistent with the local flood evacuation plan, in consultation with Council and the State Emergency Services (SES).*

This requirement is noted notwithstanding the project site is higher than the Kemps Ck / South Ck PMF levels. A Flood Emergency Response Plan (FERP) for the construction phase of the Aspect Industrial Estate development has been prepared separately.

Storage of Potential Pollutants

- 9) *Potential pollutants stored or detained on-site (such as on-site effluent treatment plants, pollutant stores or on-site water treatment facilities) shall be stored above the 1% AEP flood. Details must be provided as part of any development application.*

Overland Flow Flooding

- 10) *Development should not obstruct overland flow paths. Development is required to demonstrate that any overland flow is maintained for the 1% AEP overland flow with consideration for failsafe of flows up to the PMF.*

The flood levels, velocities and hazards assessed under Benchmark Conditions for 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood levels and PMF are mapped in the 2022 FRA Report.

The flood levels, velocities and hazards assessed under Stage 1 and Masterplan Conditions under Modification 3 for 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood levels and PMF are mapped in this Report.

All these Figures disclose negligible adverse impacts on flood level downstream of Mamre Road in the 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI and 500 yr ARI events. In a PMF greater decreases in the flood levels are experienced downstream of Mamre Road.

Under both Stage 1 Conditions and Final Masterplan Conditions under Modification 3, flood velocity difference plots disclose negligible adverse impacts of Stage 1 development on flood velocities downstream of Mamre Road in the 2 yr ARI, 5 yr ARI, 100 yr ARI, 200 yr ARI and 500 yr ARI events. In a PMF modest increases in the flood velocities are experienced downstream of Mamre Road

- 11) *Where existing natural streams do not exist, naturalised drainage channels are encouraged to ensure overland flows are safely conveyed via vegetated trunk drainage channels with 1% AEP capacity plus 0.5 m freeboard. Any increase in peak flow must be offset using on- site stormwater detention (OSD) basins.*

A naturalised drainage channel is proposed to convey runoff along the eastern and northern boundary to the existing drainage crossing at Mamre Road. A basin is proposed to achieve no increase in peak flow from development within the Estate up to the 1% AEP event.

- 12) *OSD is to be accommodated on-lot, within the development site, or at the subdivision or estate level, unless otherwise provided at the catchment level to the satisfaction of the relevant consent authority.*

A major OSD basin is incorporated into the proposed development

- 13) *Stormwater basins are to be located above the 1% AEP.*

This is detailed in the related Stormwater Management Report prepared by AT&L.

- 14) *Post-development flow rates from development sites are to be the same or less than pre-development flow rates for the 50% to 1% AEP events.*

This is detailed in the related Stormwater Management Report prepared by AT&L.

- 15) *OSD must be sized to ensure no increase in 50% and 1% AEP peak storm flows at the Precinct boundary or at Mamre Road culverts. OSD design shall compensate for any local roads and/or areas within the development site that does not drain to OSD.*

This is detailed in the related Stormwater Management Report prepared by AT&L.

Filling of Land At or Below the Flood Planning Level

- 16) *Earthworks up to the PMF must meet the requirements of Clauses 33H and 33J of the WSEA SEPP as well as Sections 2.5 and 4.4 of this DCP.*

The project site is higher than the Kemps Ck / South Ck PMF levels and accordingly no filling is proposed within the mainstream PMF.

How the proposed Stage 1 development and the Final Masterplan address the primary considerations set out in 33I Development on flood prone land under Part 6 Miscellaneous provisions in the WSEA (SEPP) is outlined in the 2021 FIA. Considerations under 33H in the WSEA (SEPP) have been addressed by others.

- 17) *Filling of floodways and/or critical flood storage areas in the 1% AEP flood will not be permitted. Filling of other land at or below the 1% AEP is also discouraged, but will be considered in exceptional circumstances where:*

- *The below criteria have been addressed in detail in the supporting FIRA;*
- *The purpose for which the filling is to be undertaken is adequately justified;*
- *Flood levels are not increased by more than 10mm on surrounding properties;*
- *Downstream velocities are not increased by more than 10%;*
- *Flows are not redistributed by more than 15%;*
- *The cumulative effects of filling proposals is fully assessed over the floodplain;*

- *There are alternative opportunities for flood storage;*
- *The development potential of surrounding properties is not adversely affected;*
- *The flood liability of buildings on surrounding properties is not increased;*
- *No local drainage flow/runoff problems are created; and*
- *The filling does not occur within the drip line of existing trees.*

The project site is higher than the Kemps Ck / South Ck PMF levels and accordingly no development is proposed in mainstream floodways or critical flood storage areas in the 1% AEP as mapped in the 2020 Wianamatta (South) Creek Catchment Flood Study. The criteria are not applicable.

It is concluded that the proposed development including Stage 1 and the Final Masterplan under Modification 3 addresses all of the considerations set out under Section 2.5 of the Mamre Road

6 References

- Advisian Pty Ltd (2020) Wianamatta (South) Creek Catchment Flood Study – Existing Conditions – Report, November, <https://flooddata.ses.nsw.gov.au/related-dataset/wianamatta-south-creek-catchment-flood-study-existing-conditions-main-report>
- Cardno (2022) “Flood Risk Assessment, Aspect Industrial Estate (AIE)”, *Final Report*, Version 6C, prepared for Mirvac, 33 pp + Apps.
- NSW Government (2005). *Floodplain Development Manual, The management of flood liable land*, April, 29 pp + Apps
- Sydney Water (2020) “Mamre Road Flood, Riparian Corridor and Integrated Water Cycle Management Strategy”, *Final Report*, October, 61 pp + Apps
- Worley Parsons (2015) “Updated South Creek Flood Study”, *Final Report*, 2 Vols, prepared for Penrith City Council, acting in association with Liverpool, Blacktown and Fairfield City Councils, 74 pp + Apps.

APPENDIX A

STAGE 1 FIGURES



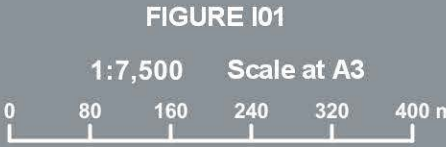
now



Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
2 Year ARI
Flood Extents & Flood Levels

- Legend**
- Base**
- South Creek Flood Study (2015)
100yr ARI Flood Extent
 - Study Area
 - 0.5m Water Level Contour (mAHD)
 - Flood Extent





Flood Risk Assessment Aspect Industrial Estate (AIE)

Stage 1 Conditions
2 Year ARI
Flood Depths

Legend

- Base**
- South Creek Flood Study (2015)
100yr ARI Flood Extent
 - Study Area
- Flood Depth (m)**
- 0.00 to 0.10
 - 0.10 to 0.30
 - 0.30 to 0.50
 - 0.50 to 0.70
 - 0.70 to 1.00
 - 1.00 to 1.50
 - > 1.50

FIGURE I02

1:7,500 Scale at A3
0 80 160 240 320 400 m

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
2 Year ARI
Flood Velocities

Legend

Base

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Flood Velocity (m/s)

- 0.00 to 0.50
- 0.50 to 1.00
- 1.00 to 1.50
- 1.50 to 2.00
- 2.00 to 3.00
- > 3.00

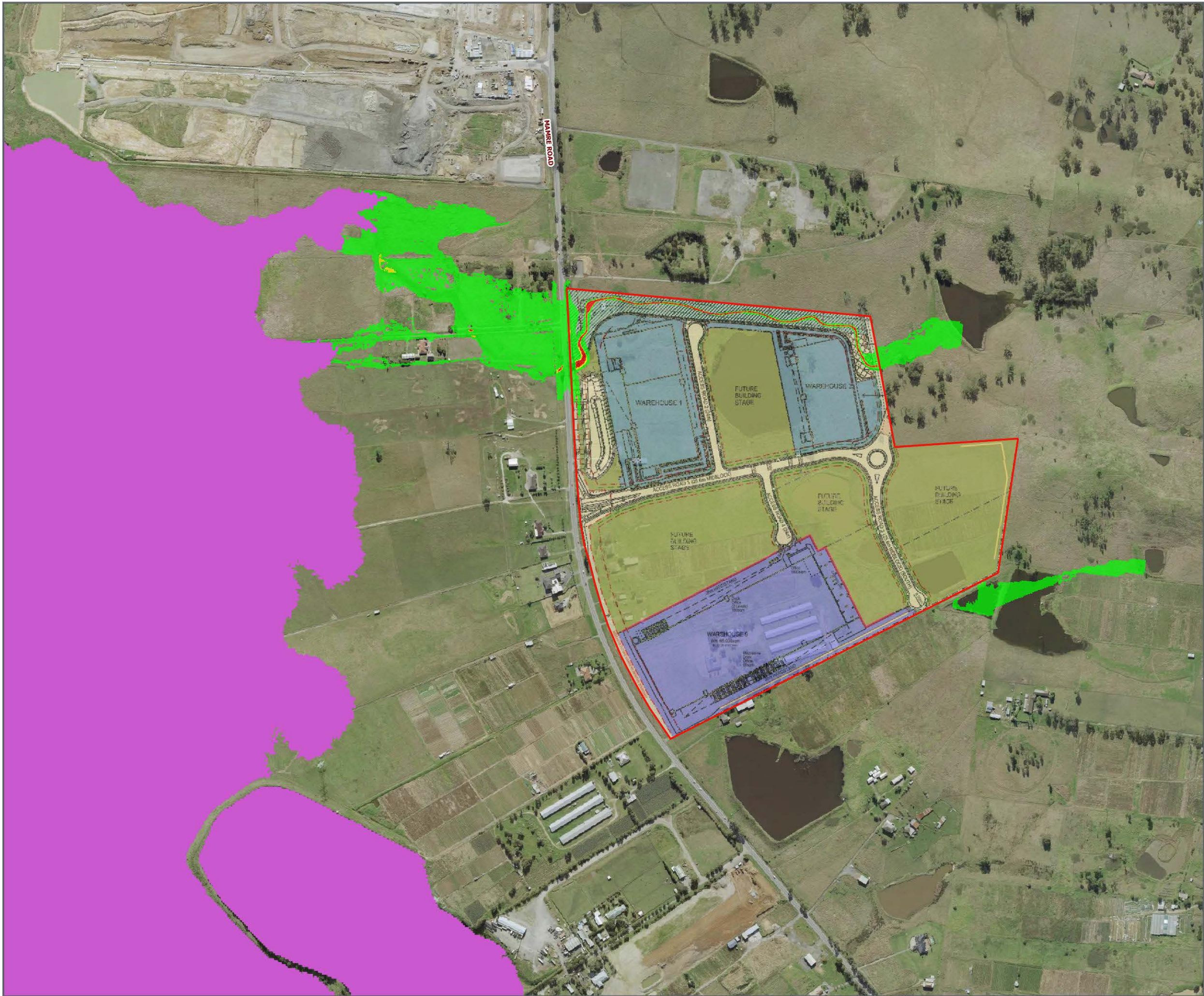
FIGURE I03

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz



Flood Risk Assessment Aspect Industrial Estate (AIE)

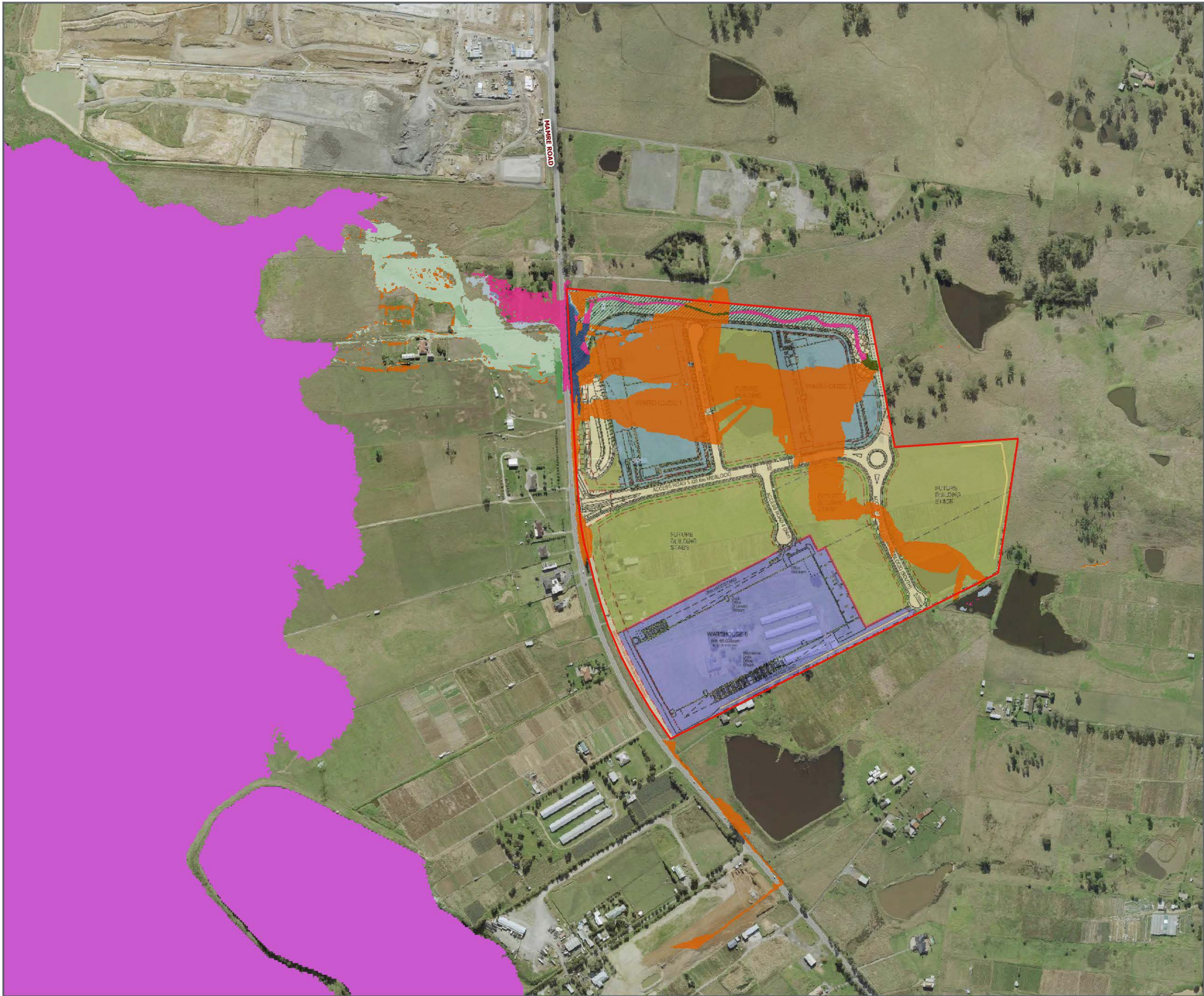
Stage 1 Conditions
2 Year ARI
Flood Hazard

Legend

- Base**
- South Creek Flood Study (2015)
100yr ARI Flood Extent
 - Study Area
- Flood Hazard**
- Low
 - Transitional
 - High

FIGURE I04

1:7,500 Scale at A3
0 80 160 240 320 400 m



Flood Risk Assessment Aspect Industrial Estate (AIE)

Stage 1 Conditions – Benchmark Conditions
2 Year ARI
Water Level Differences

Legend

Base

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Wet & Dry Analysis

Was Wet, Now Dry

Was Dry, Now Wet

Water Level Difference (m)

< -0.50

-0.50 to -0.20

-0.20 to -0.10

-0.10 to -0.05

-0.05 to -0.01

-0.01 to 0.01

0.01 to 0.05

0.05 to 0.10

0.10 to 0.20

0.20 to 0.50

> 0.50

FIGURE I05

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions – Benchmark Conditions
2 Year ARI
Velocity Differences

Legend

Base

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Velocity Difference (m/s)

- < -0.50
- 0.50 to -0.20
- 0.20 to -0.10
- 0.10 to -0.05
- 0.05 to -0.01
- 0.01 to 0.01
- 0.01 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.50
- > 0.50

FIGURE I06

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Stage 1 Conditions
5 Year ARI
Flood Extents & Flood Levels

Legend

- Base
- South Creek Flood Study (2015)
100yr ARI Flood Extent
 - Study Area
 - 0.5m Water Level Contour (mAHD)
 - Flood Extent

FIGURE I07

1:7,500 Scale at A3
0 80 160 240 320 400 m

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
5 Year ARI
Flood Depths

Legend

Base

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Flood Depth (m)

- 0.00 to 0.10
- 0.10 to 0.30
- 0.30 to 0.50
- 0.50 to 0.70
- 0.70 to 1.00
- 1.00 to 1.50
- > 1.50

FIGURE I08

1:7,500 Scale at A3

0 80 160 240 320 400 m



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
5 Year ARI
Flood Velocities

Legend

Base

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Flood Velocity (m/s)

0.00 to 0.50

0.50 to 1.00

1.00 to 1.50

1.50 to 2.00

2.00 to 3.00

> 3.00

FIGURE I09

1:7,500 Scale at A3

0 80 160 240 320 400 m



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
5 Year ARI
Flood Hazard

Legend

Base

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Flood Hazard

Low

Transitional

High

FIGURE I10

1:7,500 Scale at A3

0 80 160 240 320 400 m



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions – Benchmark Conditions
5 Year ARI
Water Level Differences

Legend

Base

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Wet & Dry Analysis

Was Wet, Now Dry

Was Dry, Now Wet

Water Level Difference (m)

< -0.50

-0.50 to -0.20

-0.20 to -0.10

-0.10 to -0.05

-0.05 to -0.01

-0.01 to 0.01

0.01 to 0.05

0.05 to 0.10

0.10 to 0.20

0.20 to 0.50

> 0.50

FIGURE I11

1:7,500 Scale at A3

0 80 160 240 320 400 m



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions – Benchmark Conditions
5 Year ARI
Velocity Differences

Legend

Base

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Velocity Difference (m/s)

- < -0.50
- 0.50 to -0.20
- 0.20 to -0.10
- 0.10 to -0.05
- 0.05 to -0.01
- 0.01 to 0.01
- 0.01 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.50
- > 0.50

FIGURE I12

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
100 Year ARI
Flood Extents & Flood Levels

Legend

- Base
- South Creek Flood Study (2015)
100yr ARI Flood Extent
 - Study Area
 - 0.5m Water Level Contour (mAHD)
 - Flood Extent

FIGURE I13

1:7,500 Scale at A3



Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
100 Year ARI
Flood Depths

Legend

Base

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Flood Depth (m)

- 0.00 to 0.10
- 0.10 to 0.30
- 0.30 to 0.50
- 0.50 to 0.70
- 0.70 to 1.00
- 1.00 to 1.50
- > 1.50

FIGURE I14

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
100 Year ARI
Flood Velocities

Legend

Base

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Flood Velocity (m/s)

0.00 to 0.50

0.50 to 1.00

1.00 to 1.50

1.50 to 2.00

2.00 to 3.00

> 3.00

FIGURE I15

1:7,500 Scale at A3

0 80 160 240 320 400 m



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Stage 1 Conditions
100 Year ARI
Flood Hazard

Legend

Base

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Flood Hazard

Low

Transitional

High

FIGURE I16

1:7,500 Scale at A3

0 80 160 240 320 400 m



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions – Benchmark Conditions
100 Year ARI
Water Level Differences

Legend

Base

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Wet & Dry Analysis

Was Wet, Now Dry

Was Dry, Now Wet

Water Level Difference (m)

< -0.50

-0.50 to -0.20

-0.20 to -0.10

-0.10 to -0.05

-0.05 to -0.01

-0.01 to 0.01

0.01 to 0.05

0.05 to 0.10

0.10 to 0.20

0.20 to 0.50

> 0.50

FIGURE I17

1:7,500 Scale at A3

0 80 160 240 320 400 m



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Stage 1 Conditions – Benchmark Conditions
100 Year ARI
Velocity Differences

Legend

- Base**
- South Creek Flood Study (2015)
100yr ARI Flood Extent
 - Study Area
- Velocity Difference (m/s)**
- < -0.50
 - 0.50 to -0.20
 - 0.20 to -0.10
 - 0.10 to -0.05
 - 0.05 to -0.01
 - 0.01 to 0.01
 - 0.01 to 0.05
 - 0.05 to 0.10
 - 0.10 to 0.20
 - 0.20 to 0.50
 - > 0.50

FIGURE I18
1:7,500 Scale at A3
0 80 160 240 320 400 m

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
200 Year ARI
Flood Extents & Flood Levels

Legend

- Base
- South Creek Flood Study (2015)
200yr ARI Flood Extent
 - Study Area
 - 0.5m Water Level Contour (mAHD)
 - Flood Extent

FIGURE I19

1:7,500 Scale at A3



Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
200 Year ARI
Flood Depths

Legend

Base

South Creek Flood Study (2015)
200yr ARI Flood Extent

Study Area

Flood Depth (m)

- 0.00 to 0.10
- 0.10 to 0.30
- 0.30 to 0.50
- 0.50 to 0.70
- 0.70 to 1.00
- 1.00 to 1.50
- > 1.50

FIGURE I20

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
200 Year ARI
Flood Velocities

Legend

Base

South Creek Flood Study (2015)
200yr ARI Flood Extent

Study Area

Flood Velocity (m/s)

0.00 to 0.50
0.50 to 1.00
1.00 to 1.50
1.50 to 2.00
2.00 to 3.00
> 3.00

FIGURE I21

1:7,500 Scale at A3

0 80 160 240 320 400 m



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
200 Year ARI
Flood Hazard

Legend

Base

South Creek Flood Study (2015)
200yr ARI Flood Extent

Study Area

Flood Hazard

Low

Transitional

High

FIGURE I22

1:7,500 Scale at A3

0 80 160 240 320 400 m



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions – Benchmark Conditions
200 Year ARI
Velocity Differences

Legend

Base

South Creek Flood Study (2015)
200yr ARI Flood Extent

Study Area

Velocity Difference (m/s)

- < -0.50
- 0.50 to -0.20
- 0.20 to -0.10
- 0.10 to -0.05
- 0.05 to -0.01
- 0.01 to 0.01
- 0.01 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.50
- > 0.50

FIGURE I24

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
500 Year ARI
Flood Extents & Flood Levels

Legend

Base

- South Creek Flood Study (2015)
500yr ARI Flood Extent
- Study Area
- 0.5m Water Level Contour (mAHD)
- Flood Extent

FIGURE I25

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatlW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
500 Year ARI
Flood Depths

Legend

Base

South Creek Flood Study (2015)
500yr ARI Flood Extent

Study Area

Flood Depth (m)

- 0.00 to 0.10
- 0.10 to 0.30
- 0.30 to 0.50
- 0.50 to 0.70
- 0.70 to 1.00
- 1.00 to 1.50
- > 1.50

FIGURE I26

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
500 Year ARI
Flood Velocities

Legend

Base

South Creek Flood Study (2015)
500yr ARI Flood Extent

Study Area

Flood Velocity (m/s)

- 0.00 to 0.50
- 0.50 to 1.00
- 1.00 to 1.50
- 1.50 to 2.00
- 2.00 to 3.00
- > 3.00

FIGURE I27

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Stage 1 Conditions
500 Year ARI
Flood Hazard

Legend

Base

South Creek Flood Study (2015)
500yr ARI Flood Extent

Study Area

Flood Hazard

Low

Transitional

High

FIGURE I28

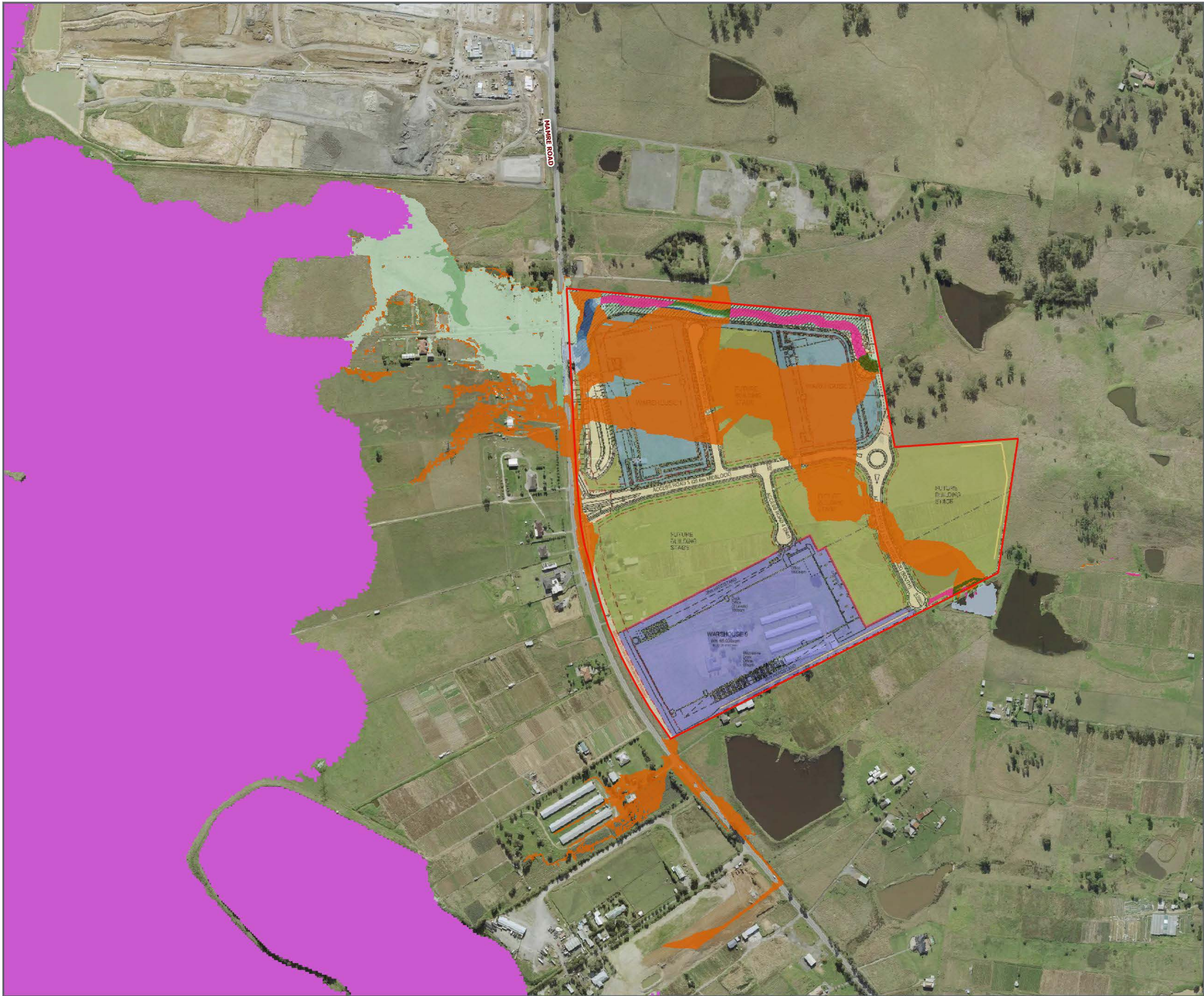
1:7,500 Scale at A3

0 80 160 240 320 400 m



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Stage 1 Conditions – Benchmark Conditions
500 Year ARI
Water Level Differences

Legend

Base

South Creek Flood Study (2015)
500yr ARI Flood Extent

Study Area

Wet & Dry Analysis

Was Wet, Now Dry

Was Dry, Now Wet

Water Level Difference (m)

< -0.50

-0.50 to -0.20

-0.20 to -0.10

-0.10 to -0.05

-0.05 to -0.01

-0.01 to 0.01

0.01 to 0.05

0.05 to 0.10

0.10 to 0.20

0.20 to 0.50

> 0.50

FIGURE I29

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Stage 1 Conditions – Benchmark Conditions
500 Year ARI
Velocity Differences

Legend

- Base**
- South Creek Flood Study (2015)
500yr ARI Flood Extent
 - Study Area
- Velocity Difference (m/s)**
- < -0.50
 - 0.50 to -0.20
 - 0.20 to -0.10
 - 0.10 to -0.05
 - 0.05 to -0.01
 - 0.01 to 0.01
 - 0.01 to 0.05
 - 0.05 to 0.10
 - 0.10 to 0.20
 - 0.20 to 0.50
 - > 0.50

FIGURE I30
1:7,500 Scale at A3
0 80 160 240 320 400 m

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
PMF
Flood Extents & Flood Levels

Legend

Base

- South Creek Flood Study (2015)
PMF Flood Extent
- Study Area
- 0.5m Water Level Contour (mAHD)
- Flood Extent

FIGURE I31

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
PMF
Flood Depths

Legend

Base

South Creek Flood Study (2015)
PMF Flood Extent

Study Area

Flood Depth (m)

- 0.00 to 0.10
- 0.10 to 0.30
- 0.30 to 0.50
- 0.50 to 0.70
- 0.70 to 1.00
- 1.00 to 1.50
- > 1.50

FIGURE I32

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
PMF
Flood Velocities

Legend

Base

South Creek Flood Study (2015)
PMF Flood Extent

Study Area

Flood Velocity (m/s)

0.00 to 0.50

0.50 to 1.00

1.00 to 1.50

1.50 to 2.00

2.00 to 3.00

> 3.00

FIGURE I33

1:7,500 Scale at A3

0 80 160 240 320 400 m



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions
PMF
Flood Hazard

Legend

Base

South Creek Flood Study (2015)
PMF Flood Extent

Study Area

Flood Hazard

Low

Transitional

High

FIGURE I34

1:7,500 Scale at A3

0 80 160 240 320 400 m



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions – Benchmark Conditions
PMF
Water Level Differences

Legend

Base

South Creek Flood Study (2015)
PMF Flood Extent

Study Area

Wet & Dry Analysis

Was Wet, Now Dry

Was Dry, Now Wet

Water Level Difference (m)

< -0.50

-0.50 to -0.20

-0.20 to -0.10

-0.10 to -0.05

-0.05 to -0.01

-0.01 to 0.01

0.01 to 0.05

0.05 to 0.10

0.10 to 0.20

0.20 to 0.50

> 0.50

FIGURE I35

1:7,500 Scale at A3

0 80 160 240 320 400 m



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Stage 1 Conditions – Benchmark Conditions
PMF
Velocity Differences

Legend

Base

South Creek Flood Study (2015)
PMF Flood Extent

Study Area

Velocity Difference (m/s)

- < -0.50
- 0.50 to -0.20
- 0.20 to -0.10
- 0.10 to -0.05
- 0.05 to -0.01
- 0.01 to 0.01
- 0.01 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.50
- > 0.50

FIGURE I36

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-24 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

APPENDIX B

MASTERPLAN FIGURES



now



Flood Risk Assessment
Aspect Industrial Estate
(AIE)

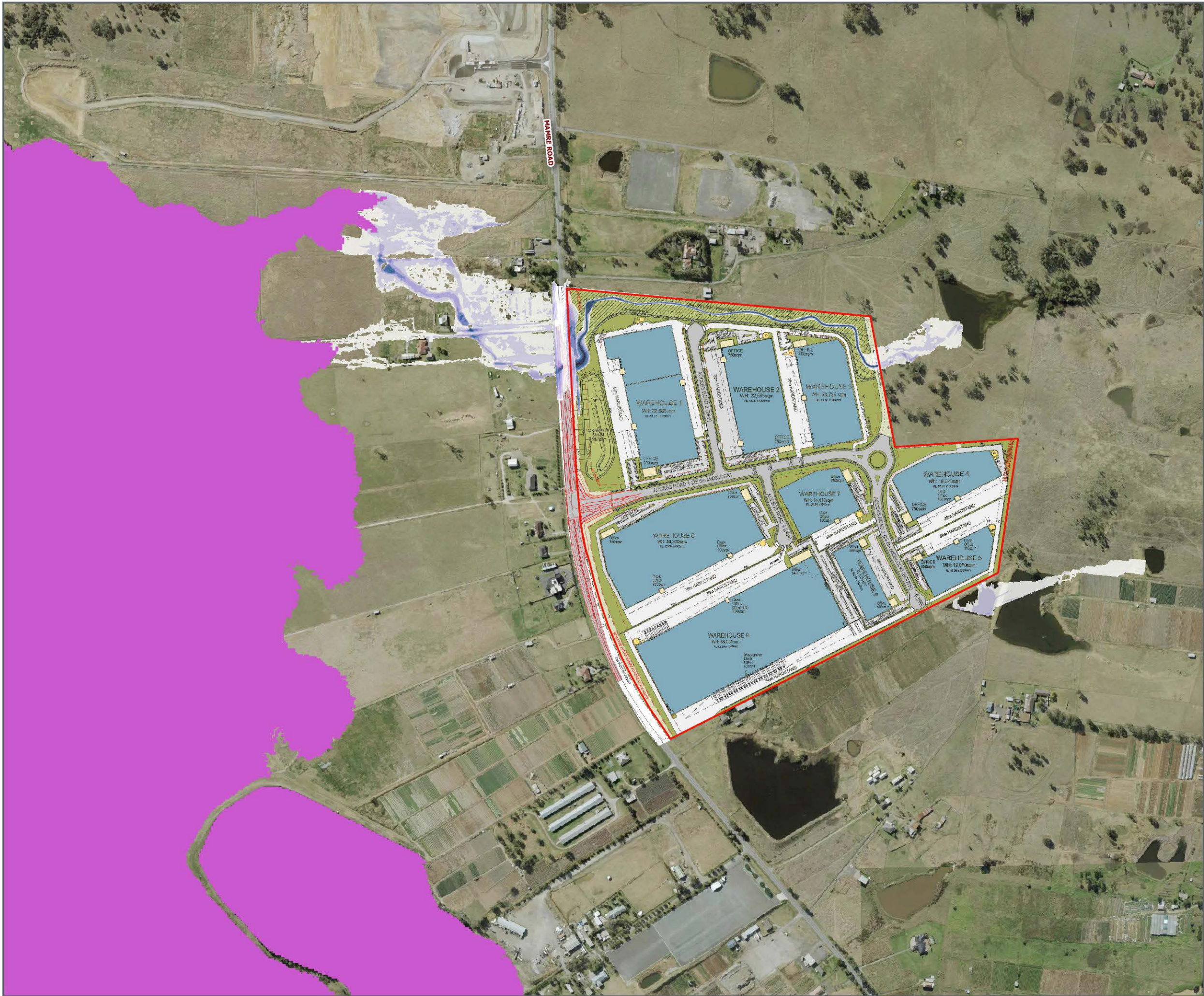
Final Masterplan Conditions
2 Year ARI
Flood Extents & Flood Levels

- Legend**
- South Creek Flood Study (2015)
100yr ARI Flood Extent
 - Study Area
 - 0.5m Water Level Contour (mAHD)
 - Flood Extent

FIGURE F01

1:7,500 Scale at A3





Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions
2 Year ARI
Flood Depths

Legend

 South Creek Flood Study (2015)
100yr ARI Flood Extent

 Study Area

Flood Depth (m)

-  0.00 to 0.10
-  0.10 to 0.30
-  0.30 to 0.50
-  0.50 to 0.70
-  0.70 to 1.00
-  1.00 to 1.50
-  > 1.50

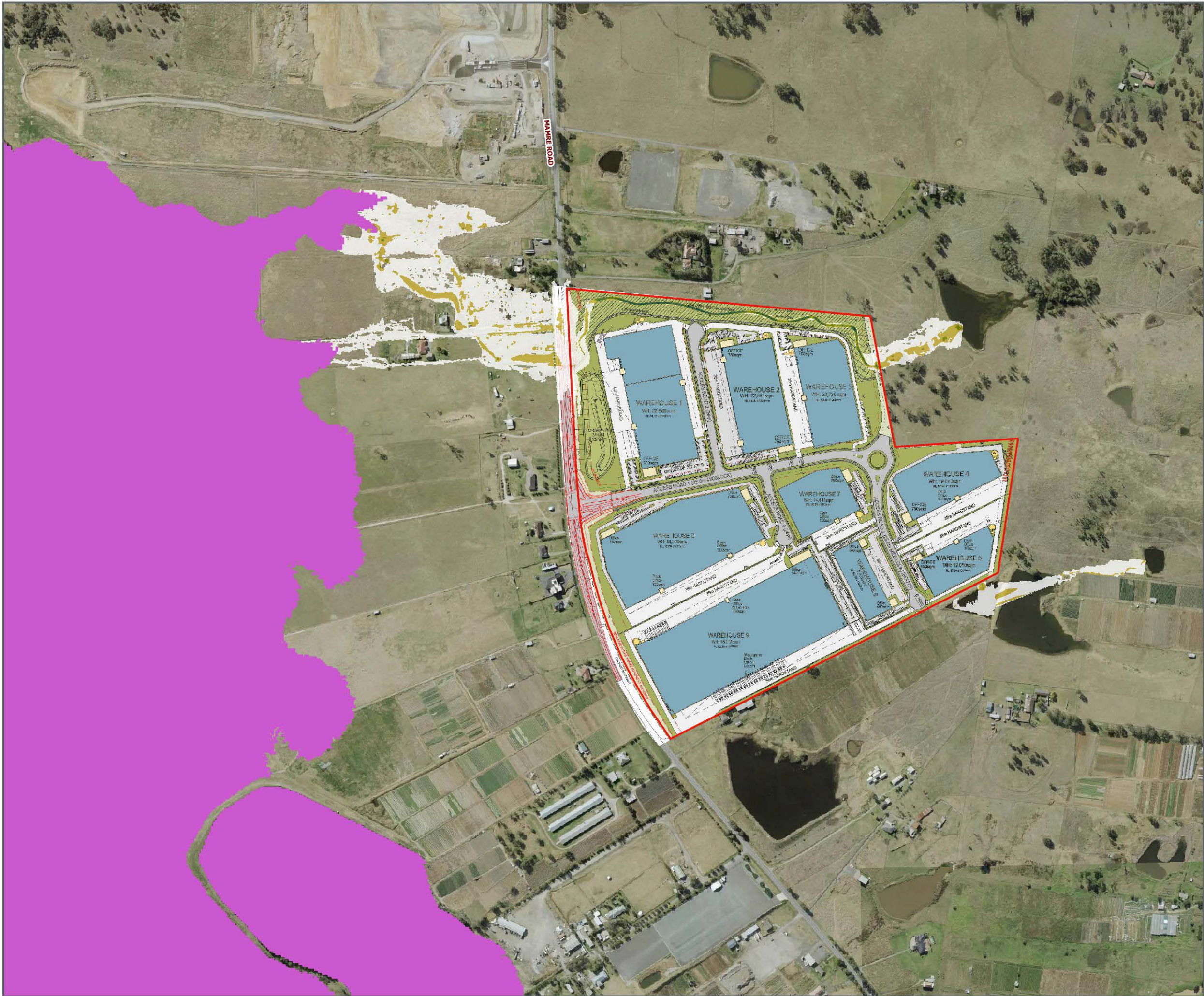
FIGURE F02

1:7,500 Scale at A3



Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions
2 Year ARI
Flood Velocities

Legend

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Flood Velocity (m/s)

0.00 to 0.50

0.50 to 1.00

1.00 to 1.50

1.50 to 2.00

2.00 to 3.00

> 3.00

FIGURE F03

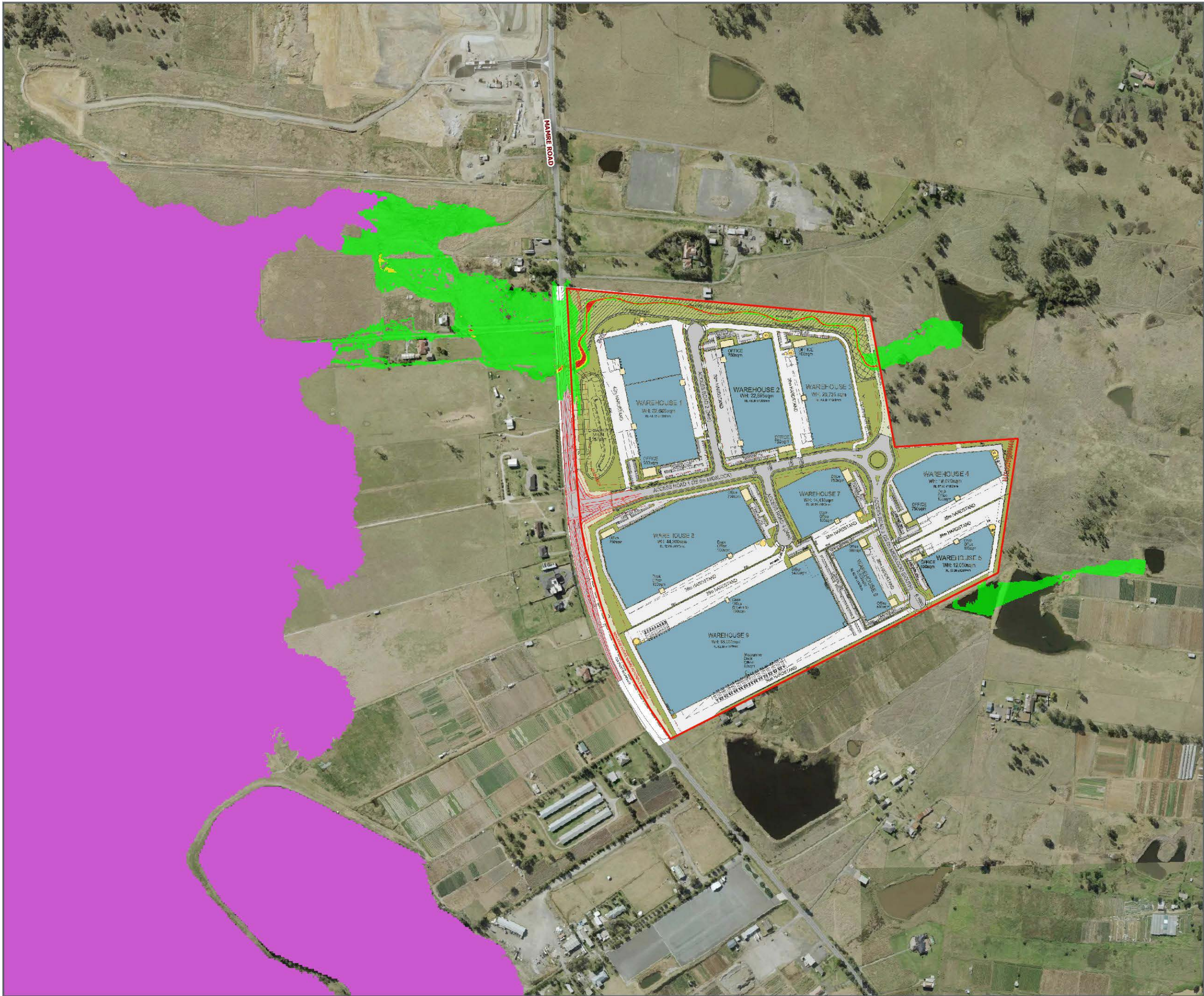
1:7,500 Scale at A3

0 80 160 240 320 400 m



Cardno now Stantec

Map Produced by Cardno Now Stantec (N&W&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions
2 Year ARI
Flood Hazard

Legend

- South Creek Flood Study (2015)
100yr ARI Flood Extent
- Study Area
- Flood Hazard
 - Low
 - Transitional
 - High

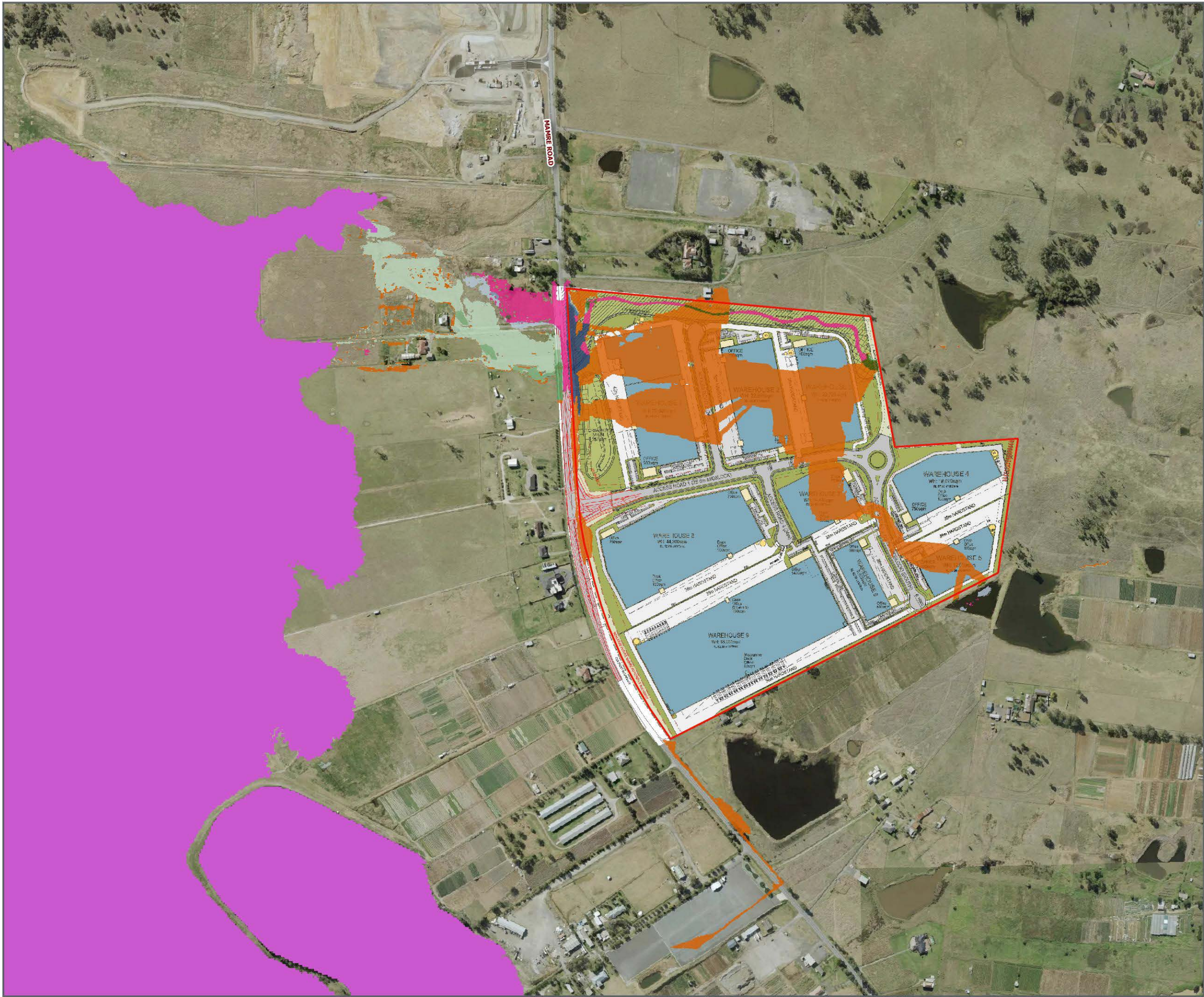
FIGURE F04

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (N&W&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions – Benchmark
Conditions
2 Year ARI
Water Level Differences

Legend

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Wet & Dry Analysis

Was Wet, Now Dry

Was Dry, Now Wet

Water Level Difference (m)

< -0.50

-0.50 to -0.20

-0.20 to -0.10

-0.10 to -0.05

-0.05 to -0.01

-0.01 to 0.01

0.01 to 0.05

0.05 to 0.10

0.10 to 0.20

0.20 to 0.50

> 0.50

FIGURE F05

1:7,500 Scale at A3



Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Final Masterplan Conditions – Benchmark
Conditions
2 Year ARI
Velocity Differences

Legend

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Velocity Difference (m/s)

- < -0.50
- 0.50 to -0.20
- 0.20 to -0.10
- 0.10 to -0.05
- 0.05 to -0.01
- 0.01 to 0.01
- 0.01 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.50
- > 0.50

FIGURE F06

1:7,500 Scale at A3



Cardno now Stantec

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Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Final Masterplan Conditions
5 Year ARI
Flood Extents & Flood Levels

- Legend**
- South Creek Flood Study (2015)
100yr ARI Flood Extent
 - Study Area
 - 0.5m Water Level Contour (mAHD)
 - Flood Extent

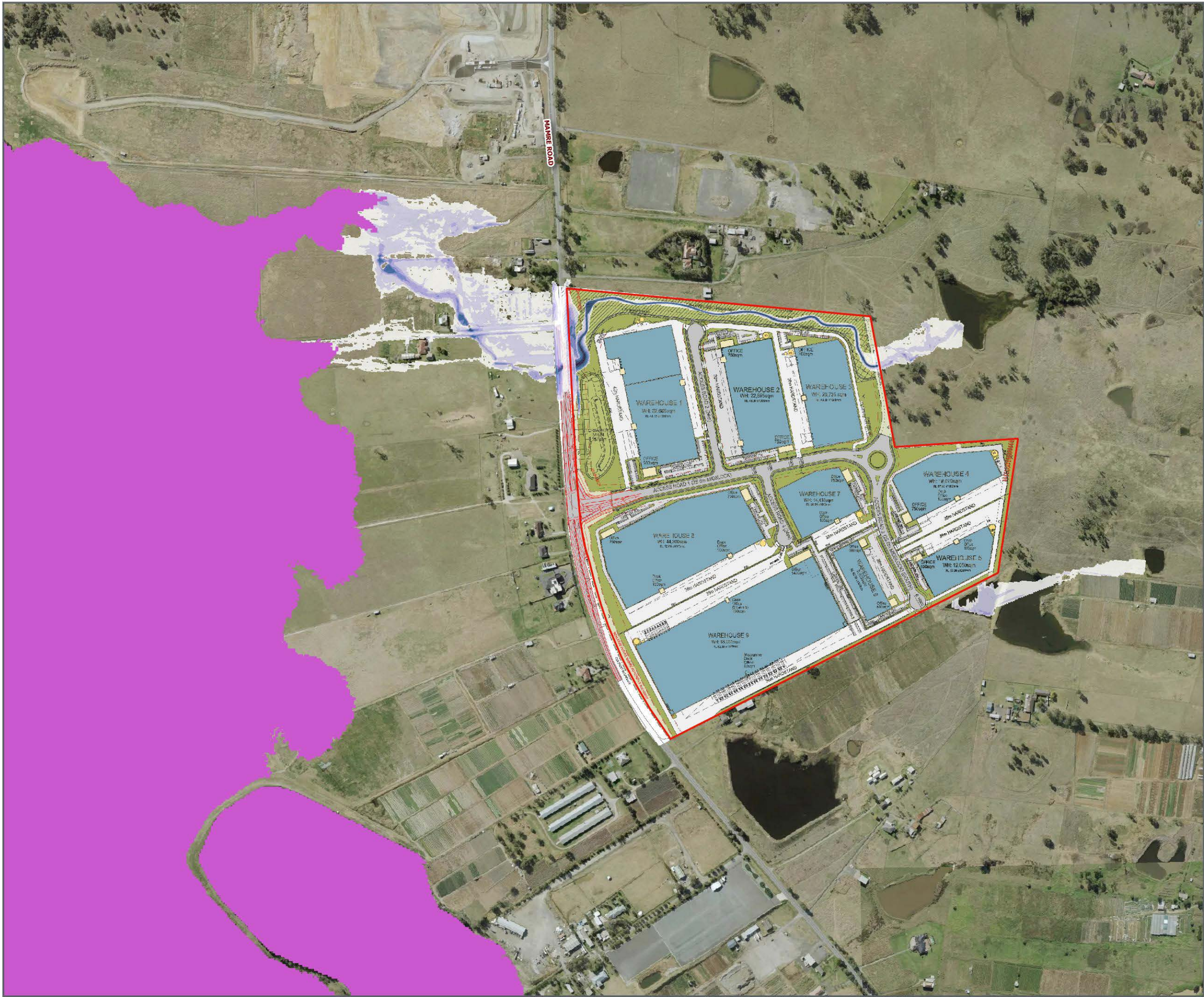
FIGURE F07

1:7,500 Scale at A3

0 80 160 240 320 400 m

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions
5 Year ARI
Flood Depths

Legend

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Flood Depth (m)

0.00 to 0.10

0.10 to 0.30

0.30 to 0.50

0.50 to 0.70

0.70 to 1.00

1.00 to 1.50

> 1.50

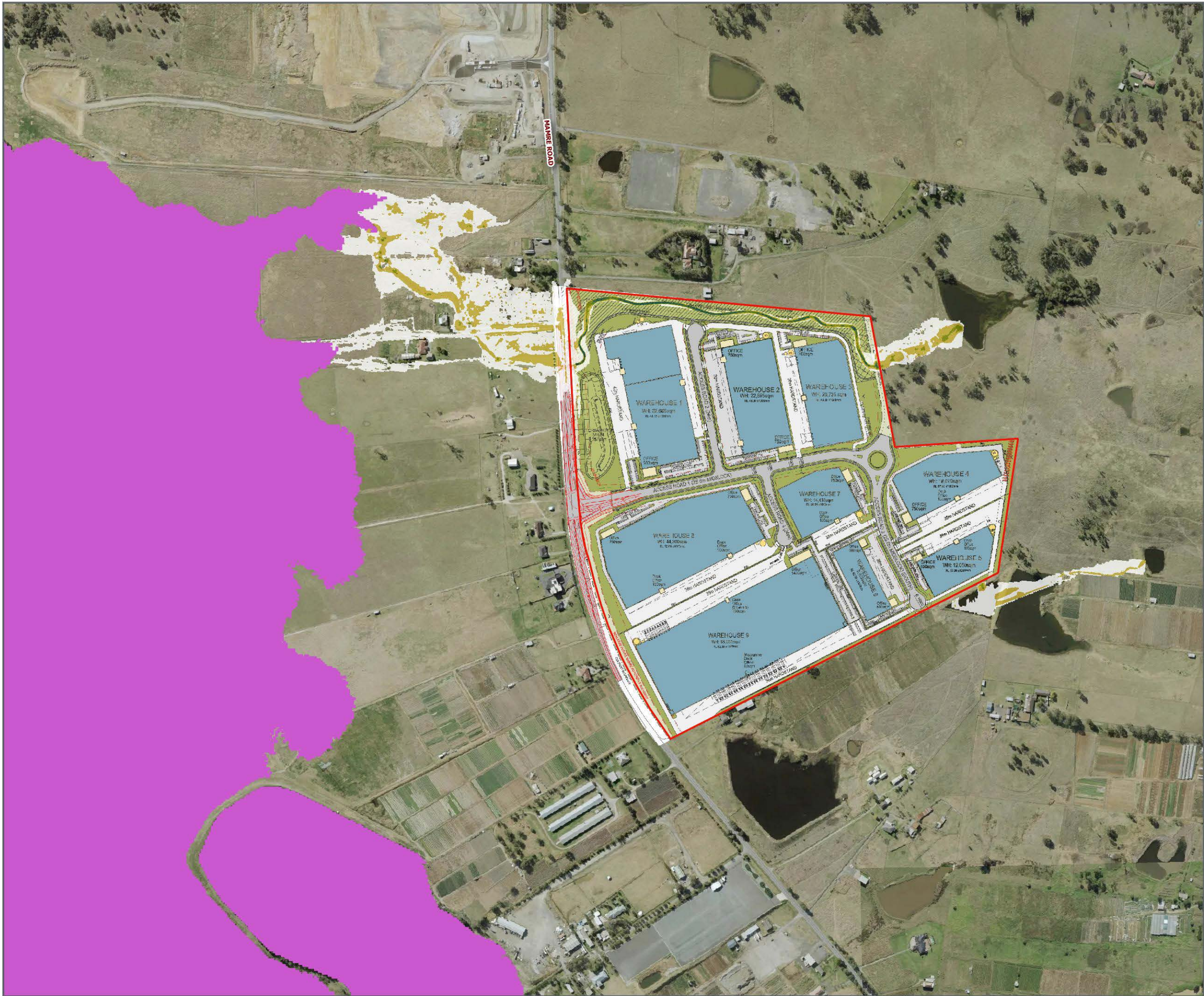
FIGURE F08

1:7,500 Scale at A3



Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions
5 Year ARI
Flood Velocities

Legend

 South Creek Flood Study (2015)
100yr ARI Flood Extent

 Study Area

Flood Velocity (m/s)

 0.00 to 0.50

 0.50 to 1.00

 1.00 to 1.50

 1.50 to 2.00

 2.00 to 3.00

 > 3.00

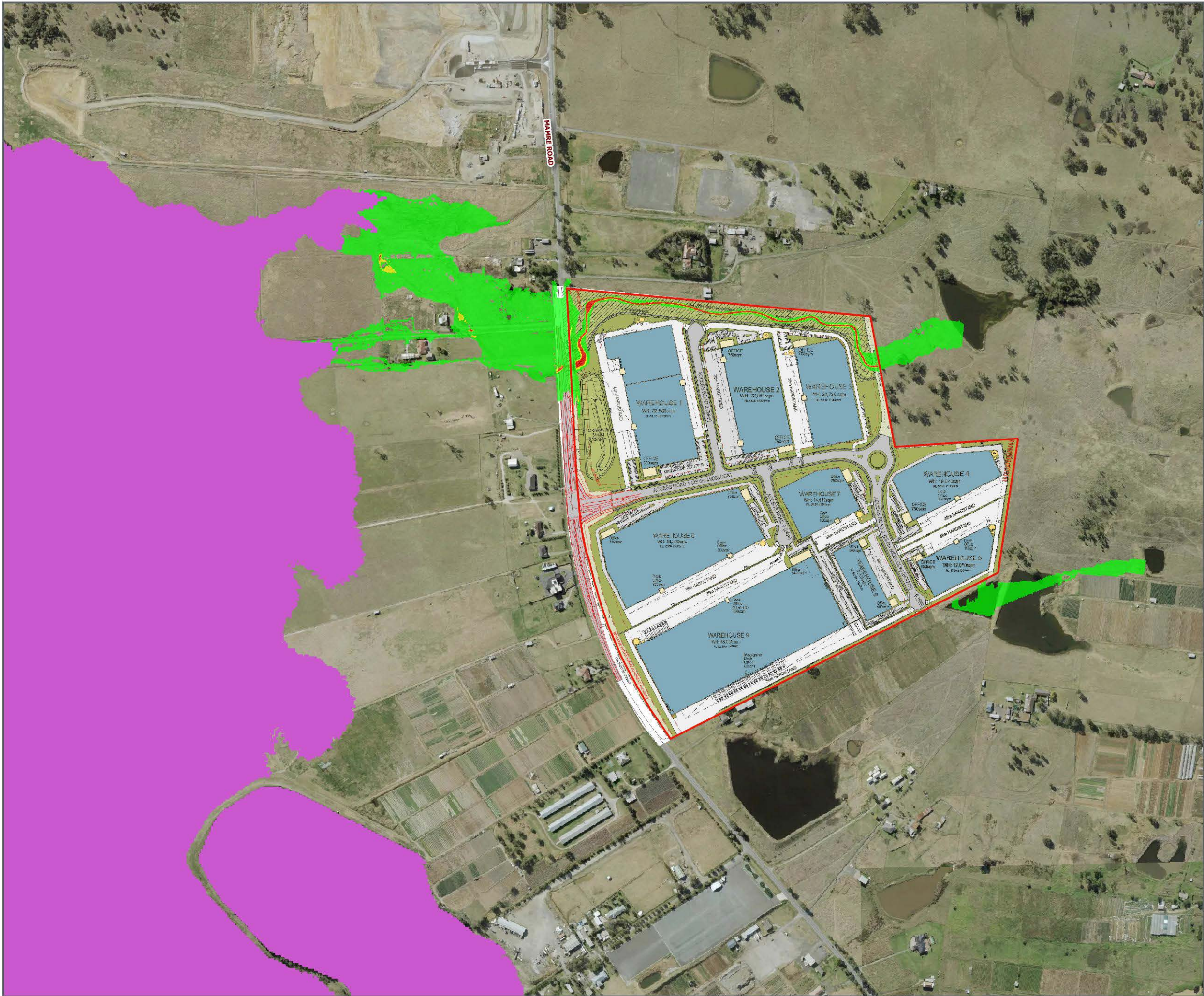
FIGURE F09

1:7,500 Scale at A3



Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions
5 Year ARI
Flood Hazard

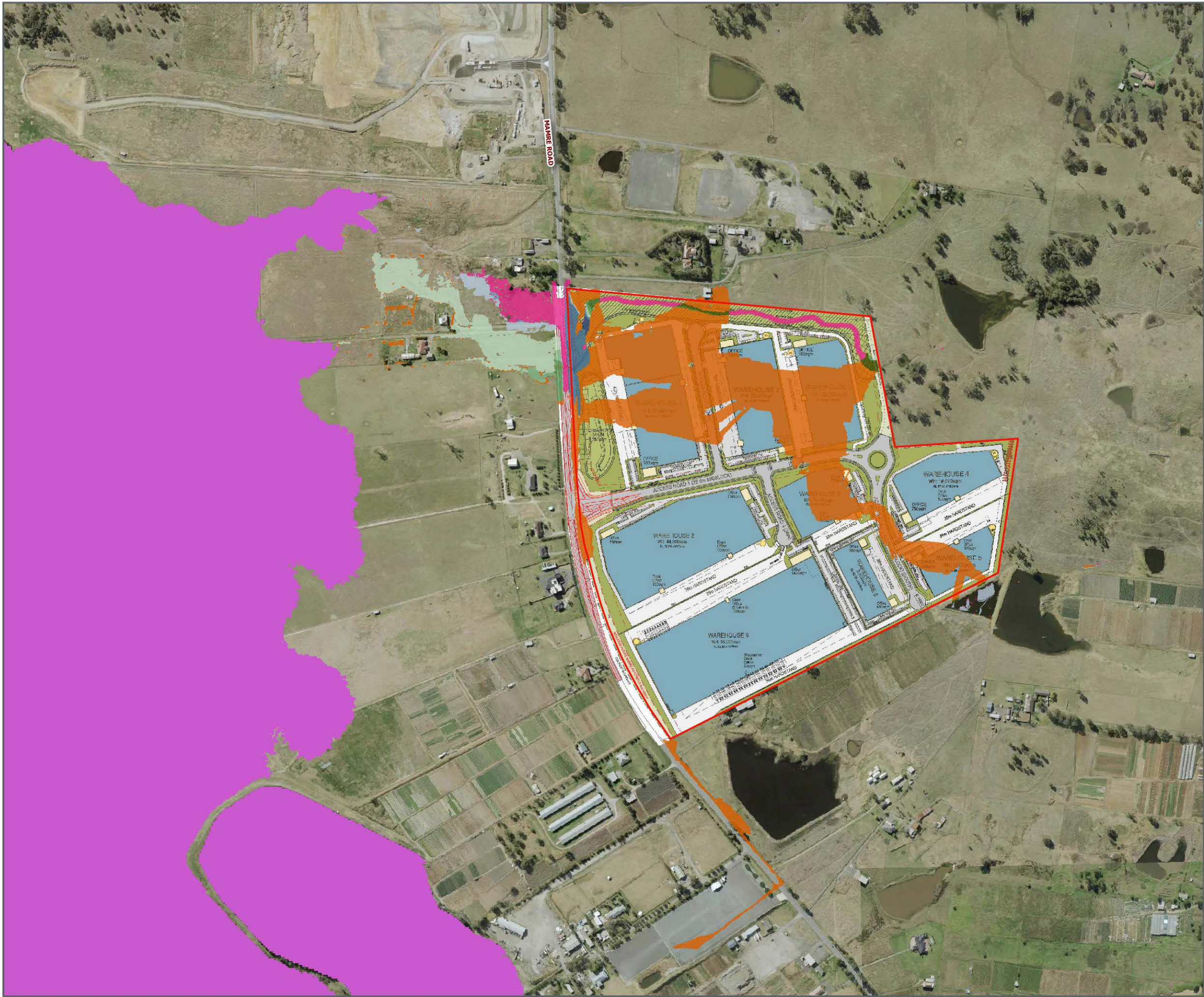
Legend

- South Creek Flood Study (2015)
100yr ARI Flood Extent
- Study Area
- Flood Hazard
 - Low
 - Transitional
 - High

FIGURE F10

1:7,500 Scale at A3

0 80 160 240 320 400 m



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions – Benchmark
Conditions
5 Year ARI
Water Level Differences

Legend

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Wet & Dry Analysis

Was Wet, Now Dry

Was Dry, Now Wet

Water Level Difference (m)

< -0.50

-0.50 to -0.20

-0.20 to -0.10

-0.10 to -0.05

-0.05 to -0.01

-0.01 to 0.01

0.01 to 0.05

0.05 to 0.10

0.10 to 0.20

0.20 to 0.50

> 0.50

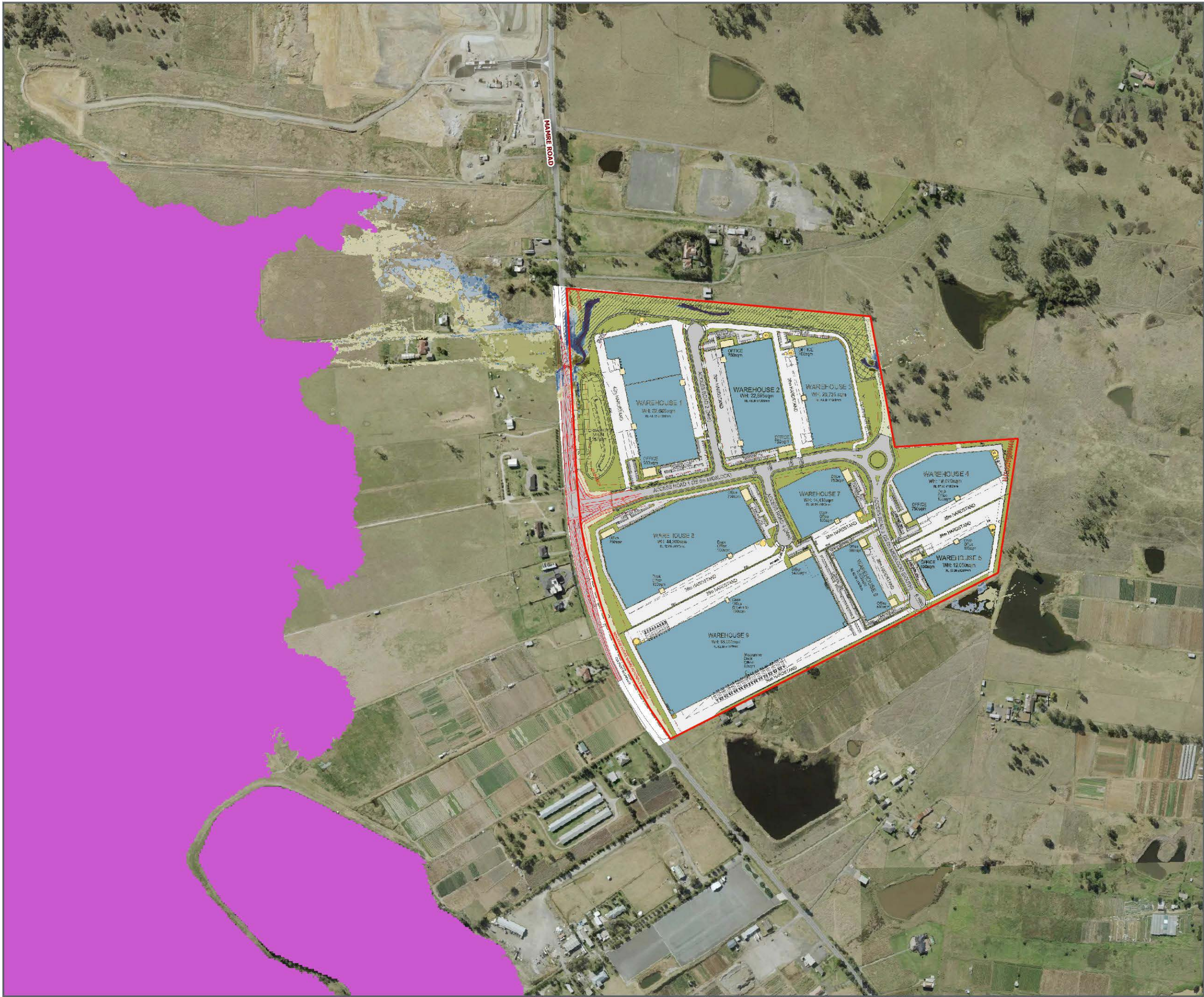
FIGURE F11

1:7,500 Scale at A3



Map Produced by Cardno Now Stantec (NatW&E)
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Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions – Benchmark
Conditions
5 Year ARI
Velocity Differences

Legend

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Velocity Difference (m/s)

< -0.50

-0.50 to -0.20

-0.20 to -0.10

-0.10 to -0.05

-0.05 to -0.01

-0.01 to 0.01

0.01 to 0.05

0.05 to 0.10

0.10 to 0.20

0.20 to 0.50

> 0.50

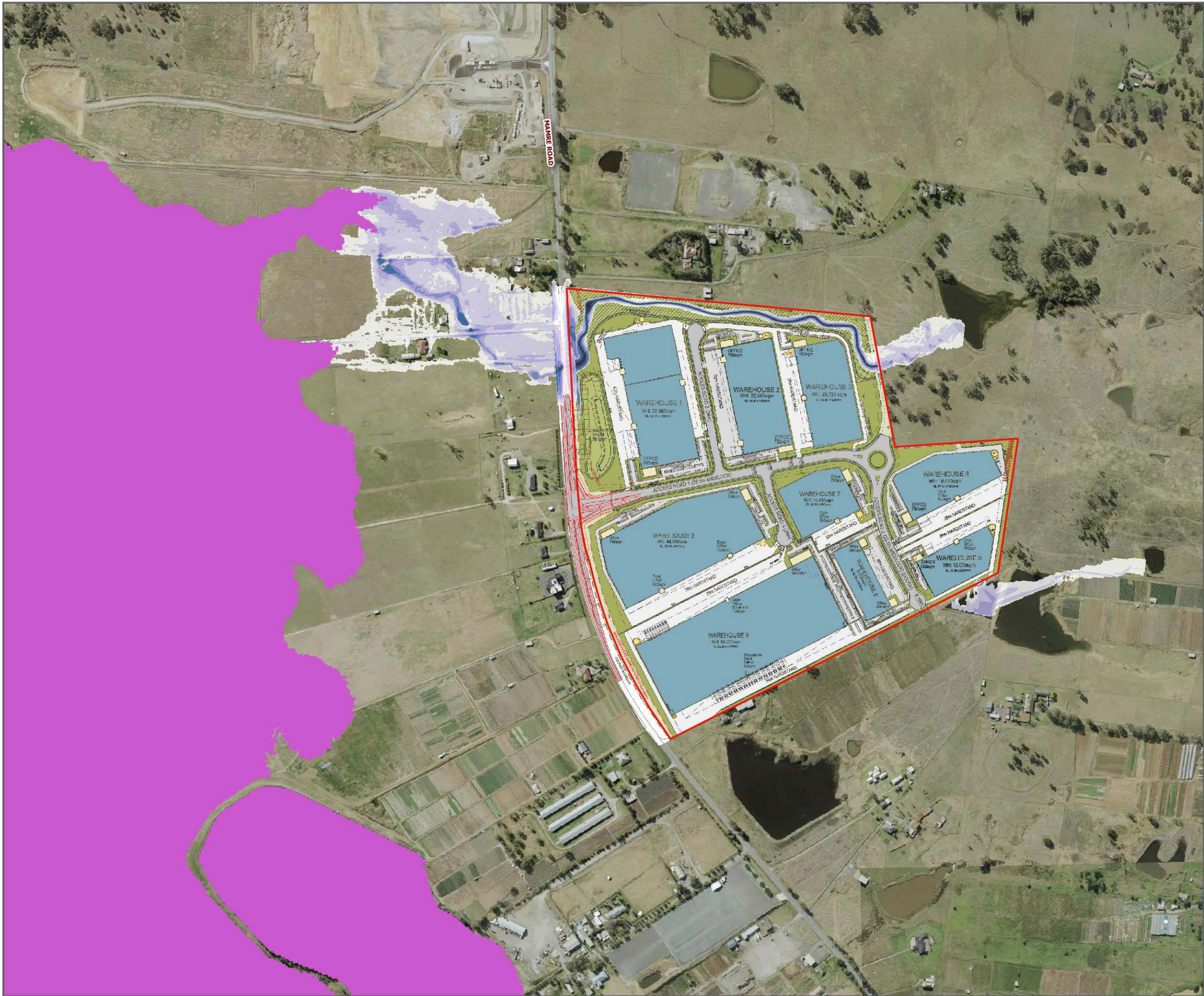
FIGURE F12

1:7,500 Scale at A3



 now 

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions
100 Year ARI
Flood Depths

Legend

 South Creek Flood Study (2015)
100yr ARI Flood Extent

 Study Area

Flood Depth (m)

 0.00 to 0.10

 0.10 to 0.30

 0.30 to 0.50

 0.50 to 0.70

 0.70 to 1.00

 1.00 to 1.50

 > 1.50

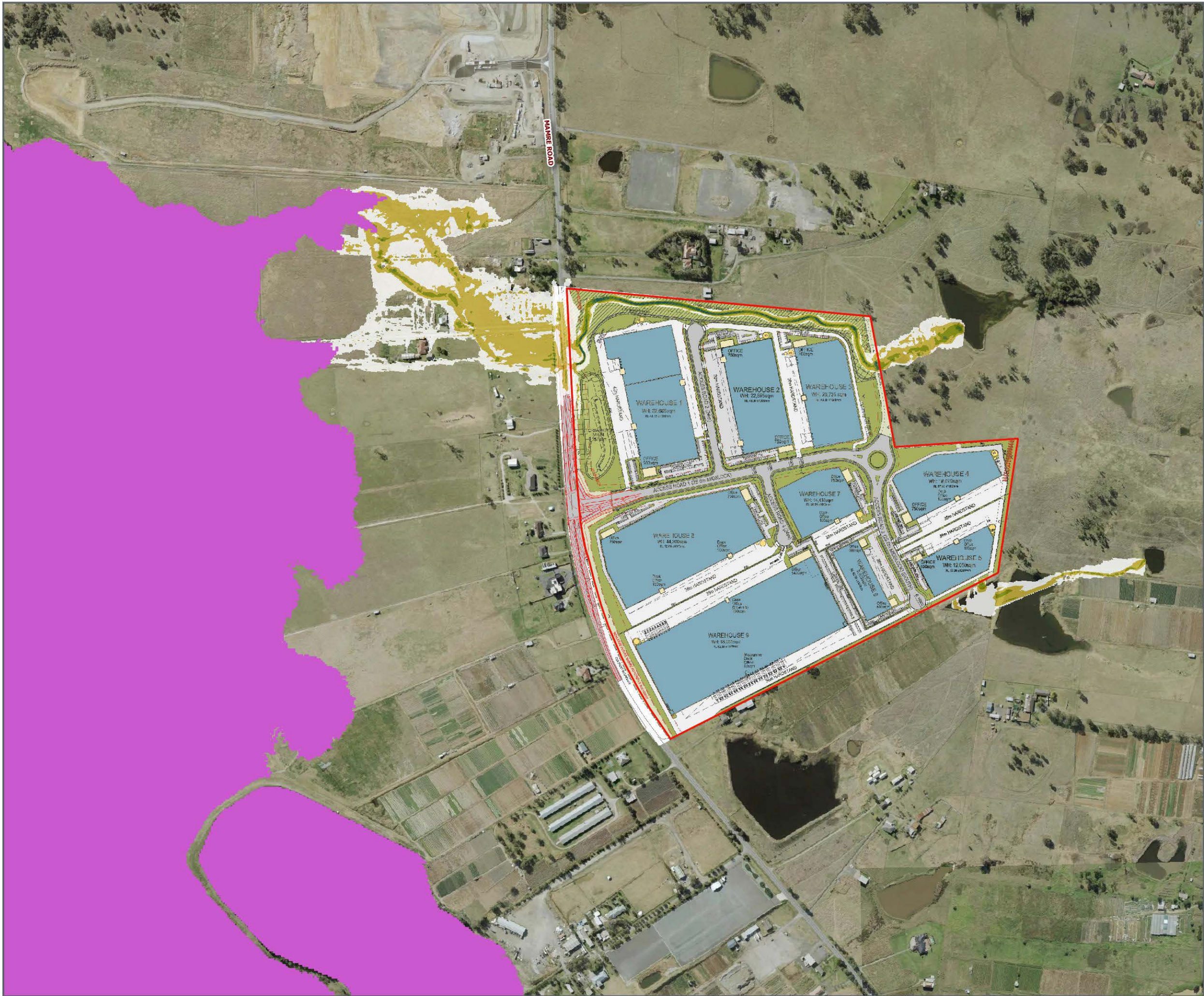
FIGURE F14

1:7,500 Scale at A3



Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions
100 Year ARI
Flood Velocities

Legend

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Flood Velocity (m/s)

0.00 to 0.50

0.50 to 1.00

1.00 to 1.50

1.50 to 2.00

2.00 to 3.00

> 3.00

FIGURE F15

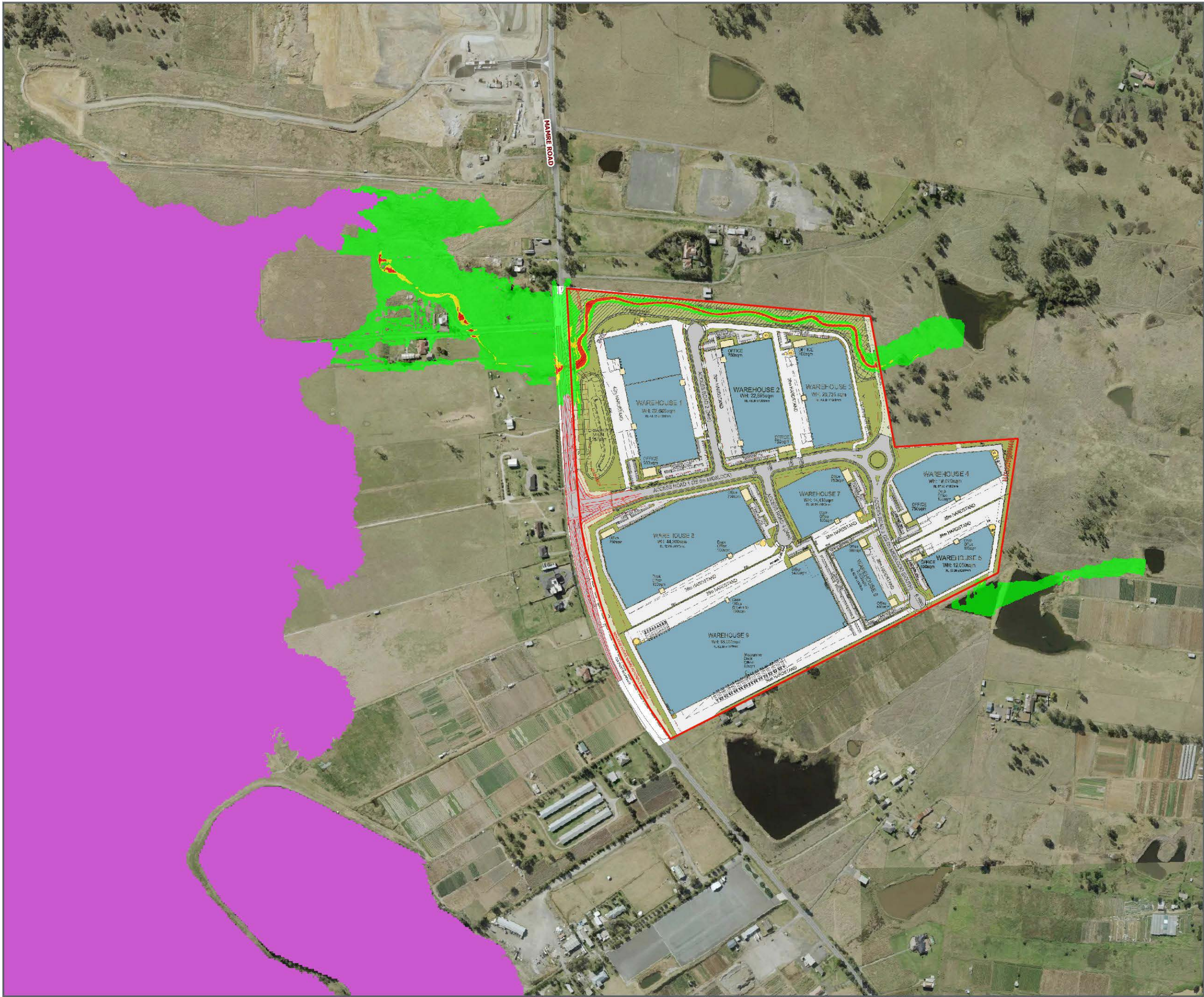
1:7,500 Scale at A3

0 80 160 240 320 400 m



Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions
100 Year ARI
Flood Hazard

Legend

- South Creek Flood Study (2015)
100yr ARI Flood Extent
- Study Area
- Flood Hazard
 - Low
 - Transitional
 - High

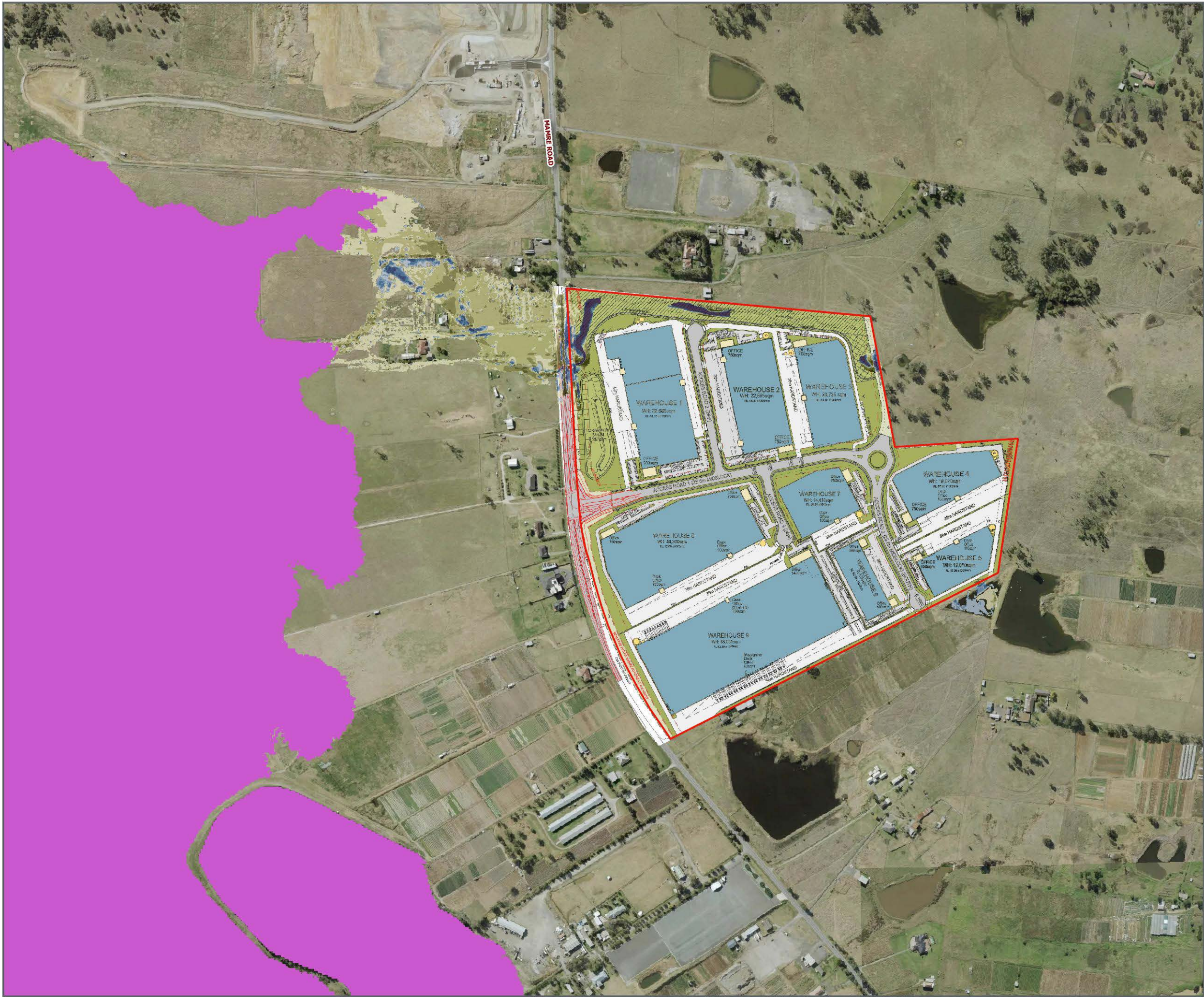
FIGURE F16

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions – Benchmark
Conditions
100 Year ARI
Velocity Differences

Legend

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Velocity Difference (m/s)

- < -0.50
- 0.50 to -0.20
- 0.20 to -0.10
- 0.10 to -0.05
- 0.05 to -0.01
- 0.01 to 0.01
- 0.01 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.50
- > 0.50

FIGURE F18

1:7,500 Scale at A3





Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions
200 Year ARI
Flood Extents & Flood Levels

Legend

- South Creek Flood Study (2015)
200yr ARI Flood Extent
- Study Area
- 0.5m Water Level Contour (mAHD)
- Flood Extent

FIGURE F19

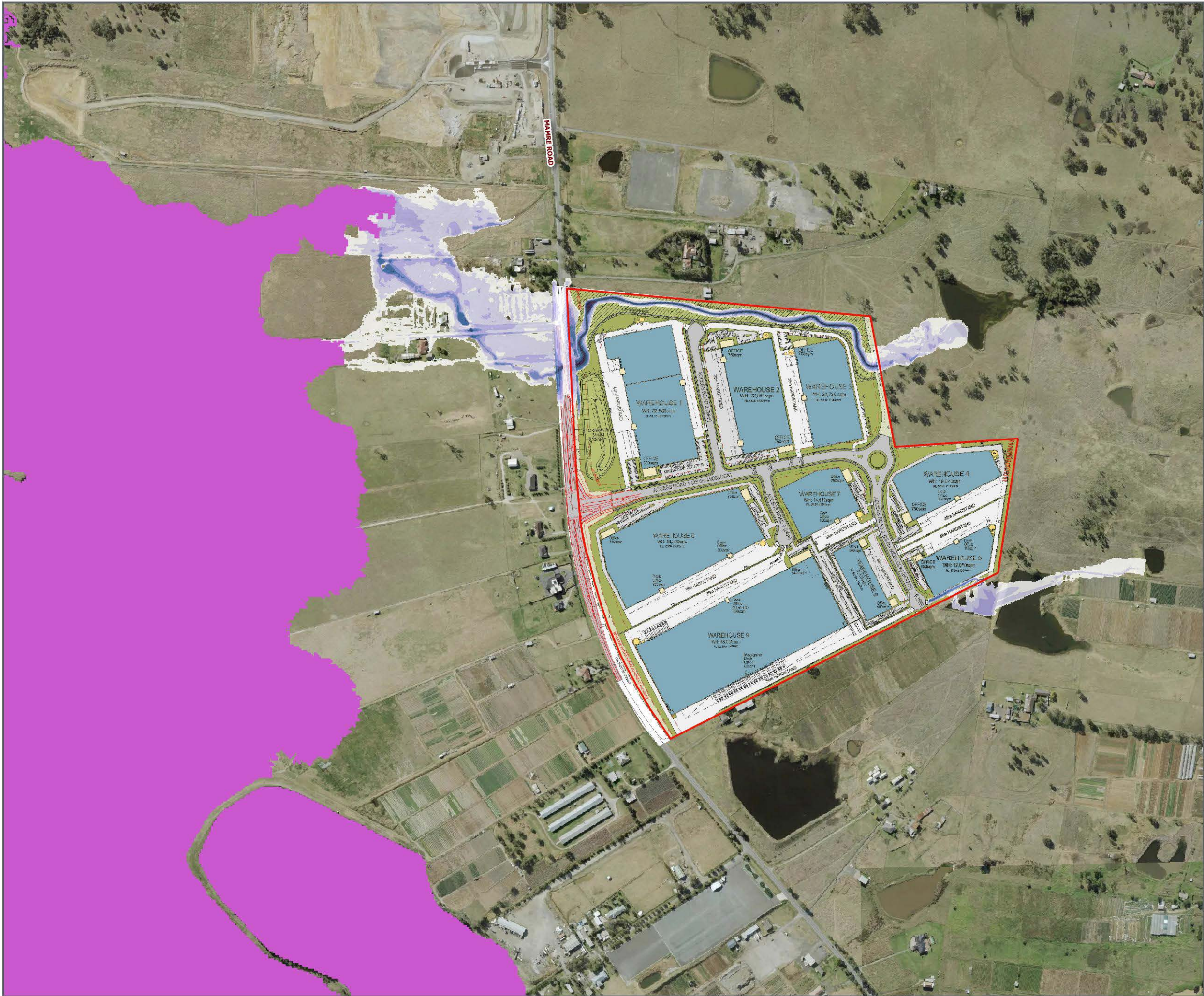
1:7,500 Scale at A3

0 80 160 240 320 400 m



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions
200 Year ARI
Flood Depths

Legend

 South Creek Flood Study (2015)
200yr ARI Flood Extent

 Study Area

Flood Depth (m)

 0.00 to 0.10

 0.10 to 0.30

 0.30 to 0.50

 0.50 to 0.70

 0.70 to 1.00

 1.00 to 1.50

 > 1.50

FIGURE F20

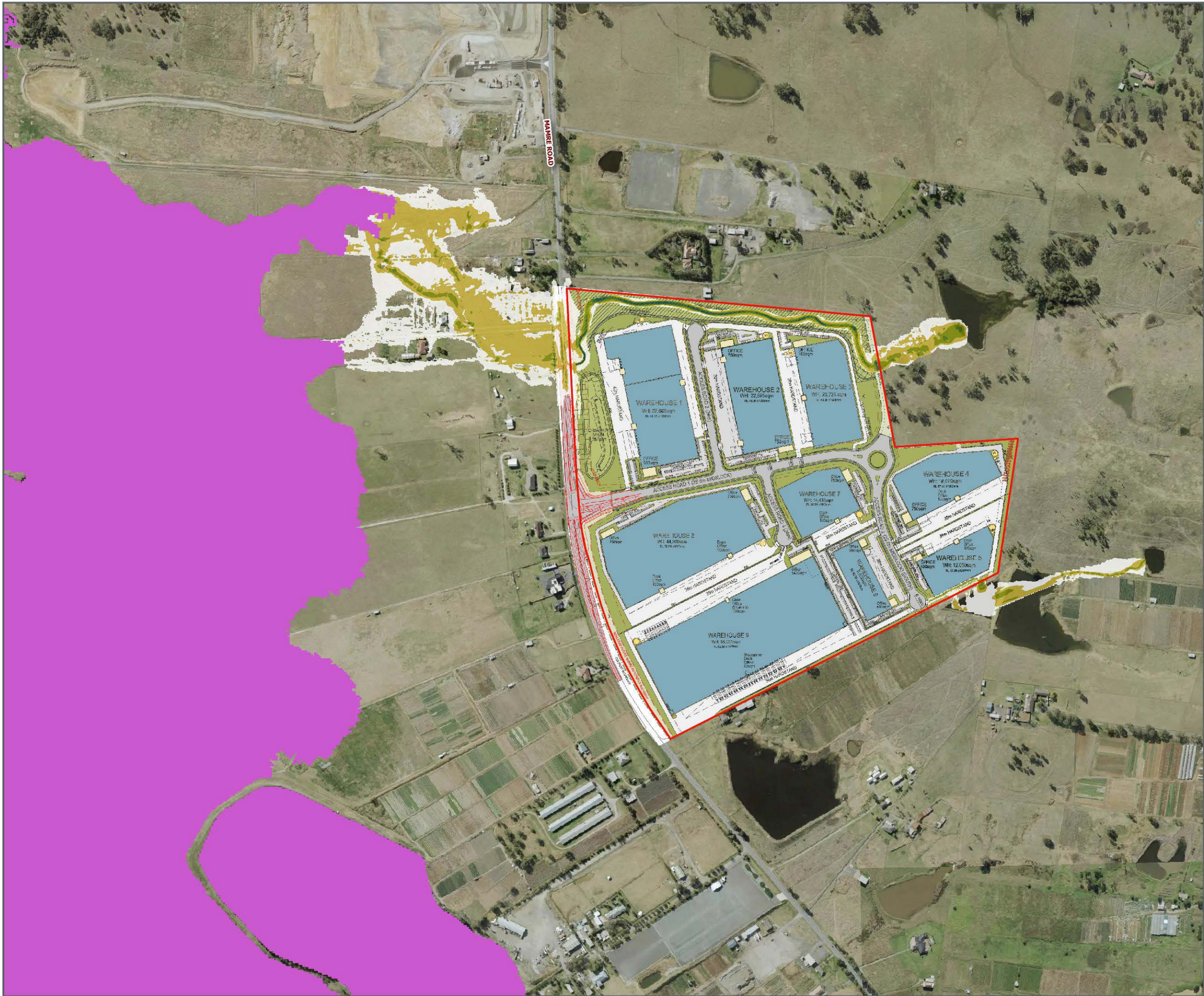
1:7,500 Scale at A3

0 80 160 240 320 400 m



Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions
200 Year ARI
Flood Velocities

Legend

South Creek Flood Study (2015)
200yr ARI Flood Extent

Study Area

Flood Velocity (m/s)

0.00 to 0.50

0.50 to 1.00

1.00 to 1.50

1.50 to 2.00

2.00 to 3.00

> 3.00

FIGURE F21

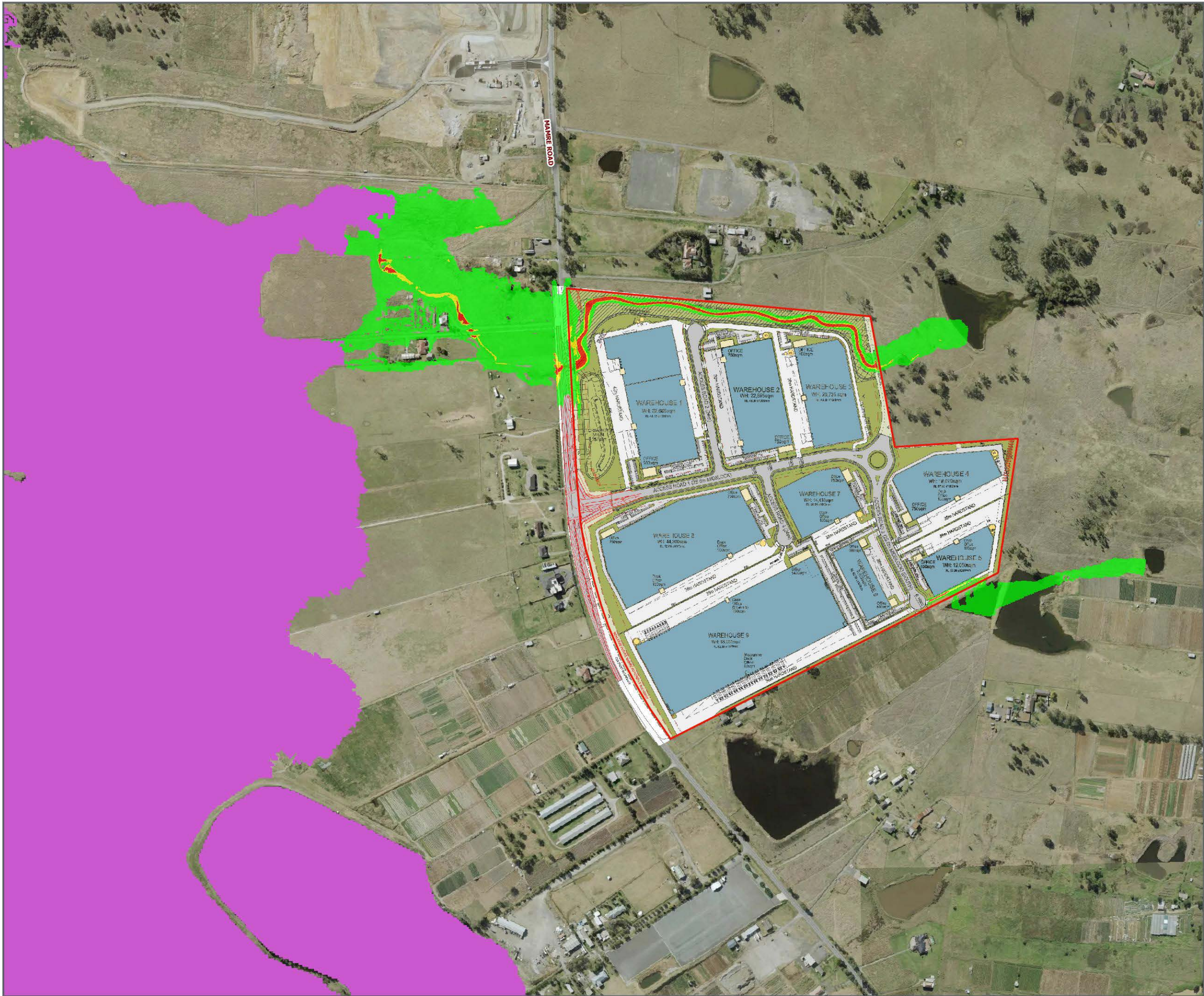
1:7,500 Scale at A3

0 80 160 240 320 400 m



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions
200 Year ARI
Flood Hazard

Legend

South Creek Flood Study (2015)
200yr ARI Flood Extent

Study Area

Flood Hazard

Low

Transitional

High

FIGURE F22

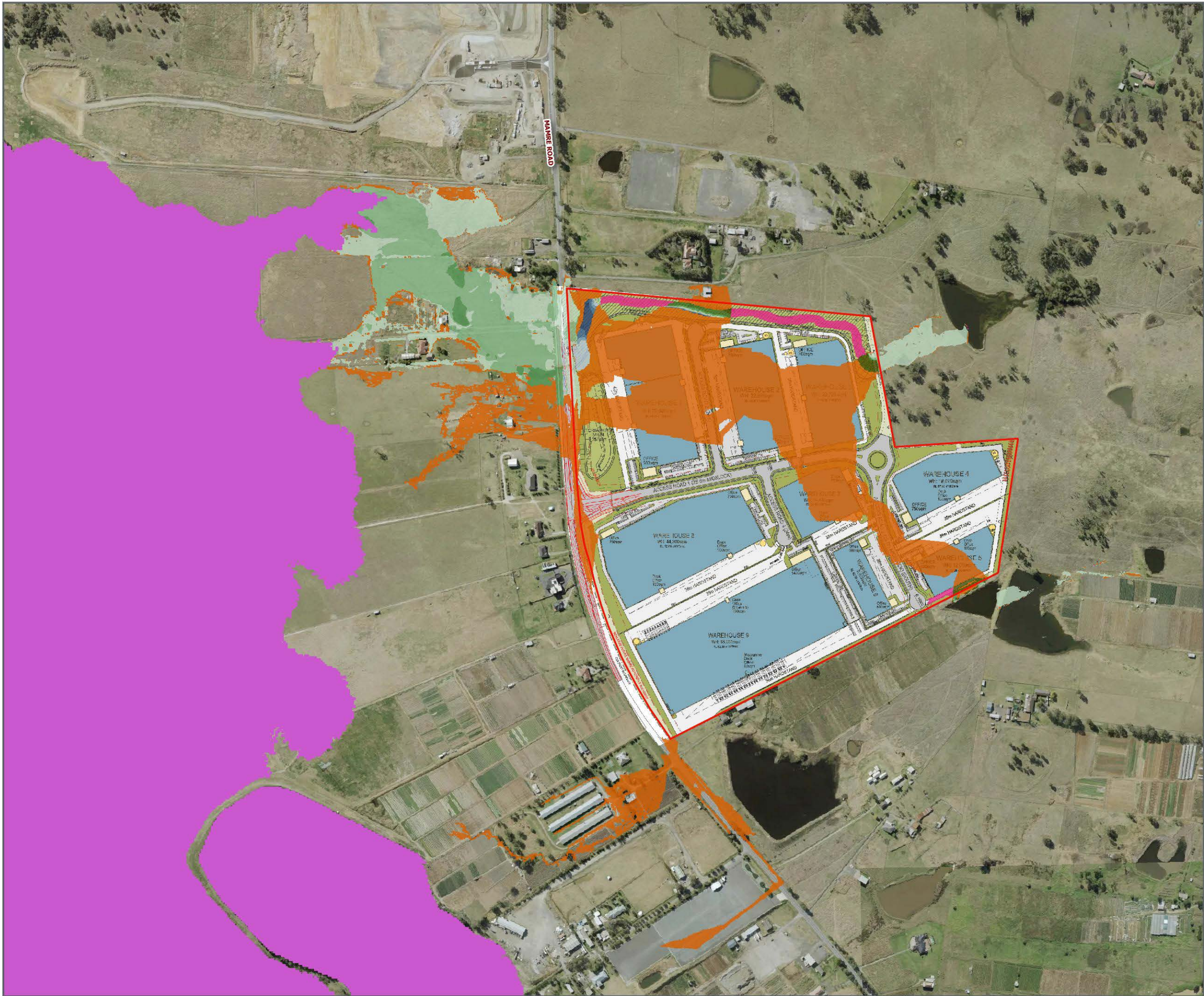
1:7,500 Scale at A3

0 80 160 240 320 400 m



Cardno now Stantec

Map Produced by Cardno Now Stantec (N&W&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions – Benchmark
Conditions
200 Year ARI
Water Level Differences

Legend

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Wet & Dry Analysis

Was Wet, Now Dry

Was Dry, Now Wet

Water Level Difference (m)

< -0.50

-0.50 to -0.20

-0.20 to -0.10

-0.10 to -0.05

-0.05 to -0.01

-0.01 to 0.01

0.01 to 0.05

0.05 to 0.10

0.10 to 0.20

0.20 to 0.50

> 0.50

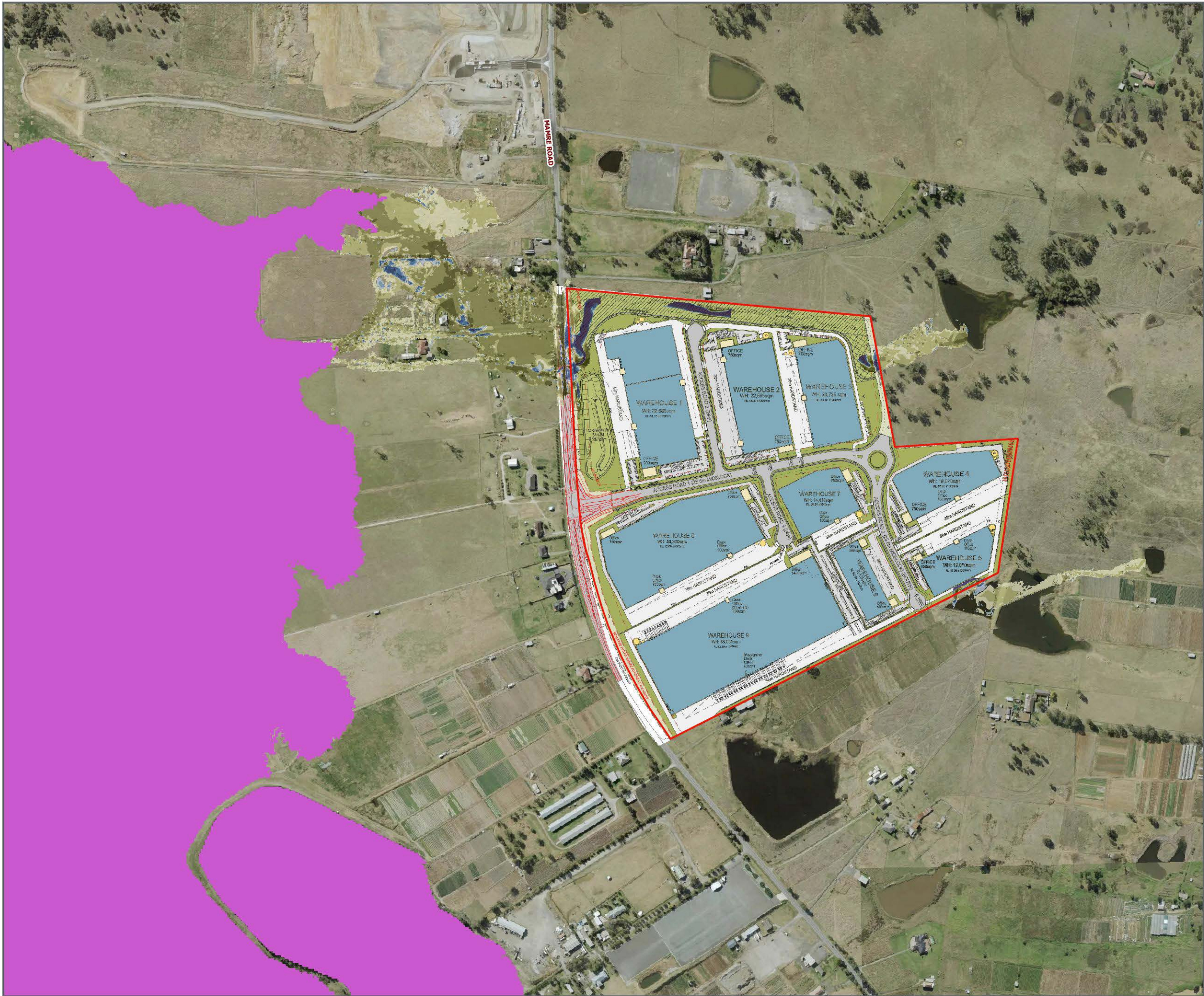
FIGURE F23

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions – Benchmark
Conditions
200 Year ARI
Velocity Differences

Legend

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Velocity Difference (m/s)

- < -0.50
- 0.50 to -0.20
- 0.20 to -0.10
- 0.10 to -0.05
- 0.05 to -0.01
- 0.01 to 0.01
- 0.01 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.50
- > 0.50

FIGURE F24

1:7,500 Scale at A3



Cardno now **Stantec**

Map Produced by Cardno Now Stantec (NatlW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions
500 Year ARI
Flood Extents & Flood Levels

Legend

- South Creek Flood Study (2015)
500yr ARI Flood Extent
- Study Area
- 0.5m Water Level Contour (mAHD)
- Flood Extent

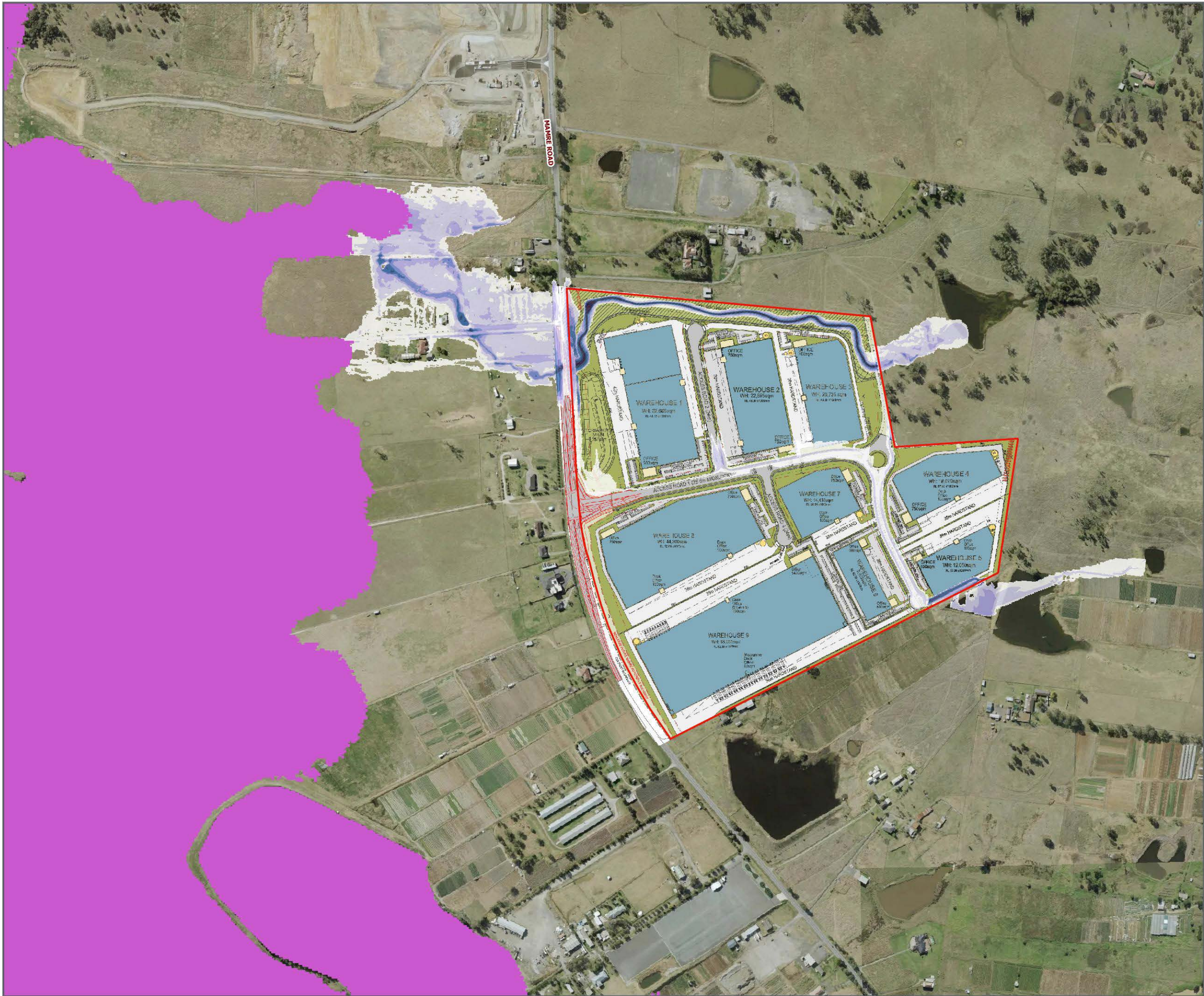
FIGURE F25

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions
500 Year ARI
Flood Depths

Legend

South Creek Flood Study (2015)
500yr ARI Flood Extent

Study Area

Flood Depth (m)

- 0.00 to 0.10
- 0.10 to 0.30
- 0.30 to 0.50
- 0.50 to 0.70
- 0.70 to 1.00
- 1.00 to 1.50
- > 1.50

FIGURE F26

1:7,500 Scale at A3



Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Final Masterplan Conditions
500 Year ARI
Flood Velocities

Legend

South Creek Flood Study (2015)
500yr ARI Flood Extent

Study Area

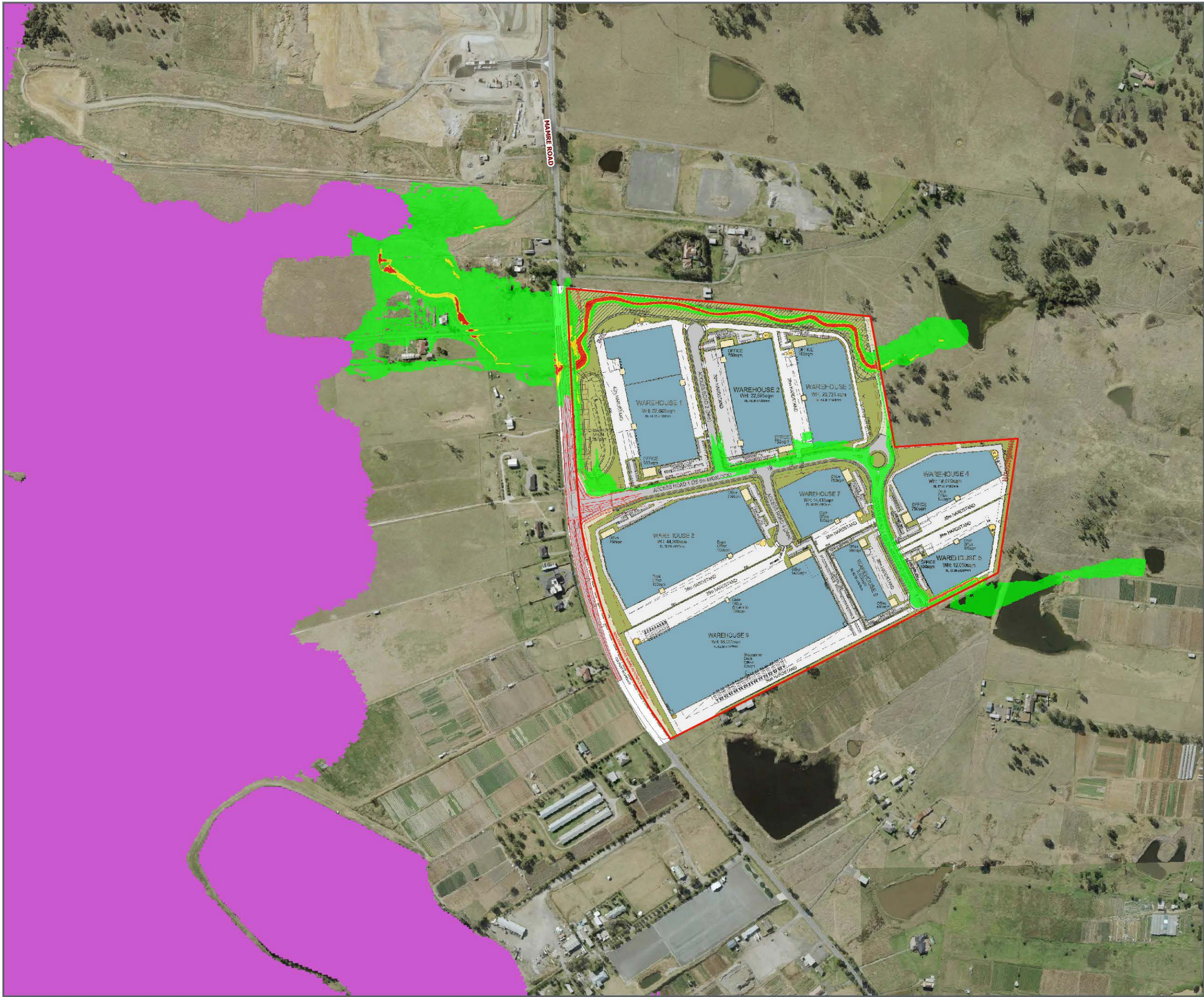
Flood Velocity (m/s)

- 0.00 to 0.50
- 0.50 to 1.00
- 1.00 to 1.50
- 1.50 to 2.00
- 2.00 to 3.00
- > 3.00

FIGURE F27

1:7,500 Scale at A3





Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions
500 Year ARI
Flood Hazard

Legend

South Creek Flood Study (2015)
500yr ARI Flood Extent

Study Area

Flood Hazard

Low

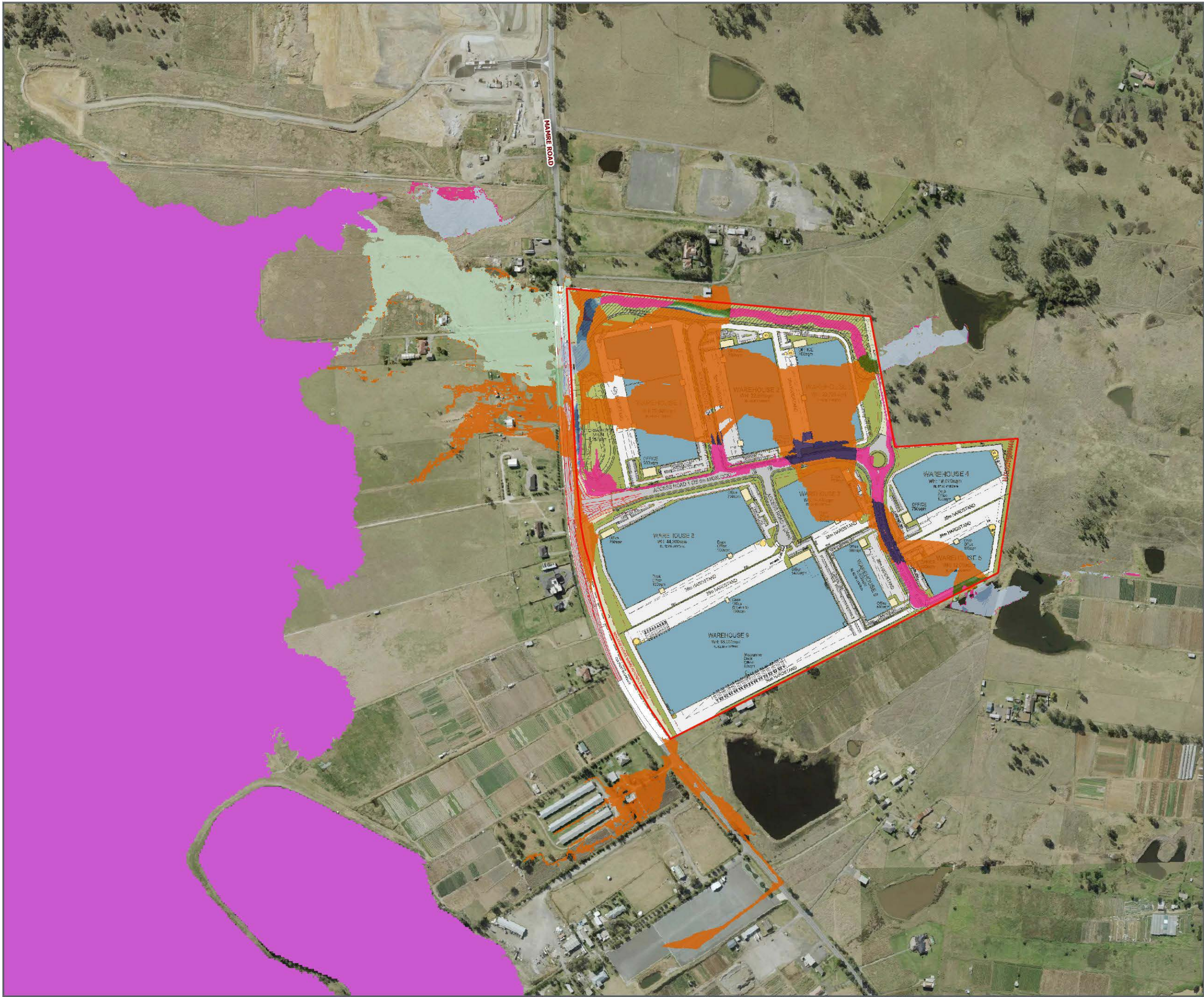
Transitional

High

FIGURE F28

1:7,500 Scale at A3

0 80 160 240 320 400 m



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions – Benchmark
Conditions
500 Year ARI
Water Level Differences

Legend

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Wet & Dry Analysis

Was Wet, Now Dry

Was Dry, Now Wet

Water Level Difference (m)

< -0.50

-0.50 to -0.20

-0.20 to -0.10

-0.10 to -0.05

-0.05 to -0.01

-0.01 to 0.01

0.01 to 0.05

0.05 to 0.10

0.10 to 0.20

0.20 to 0.50

> 0.50

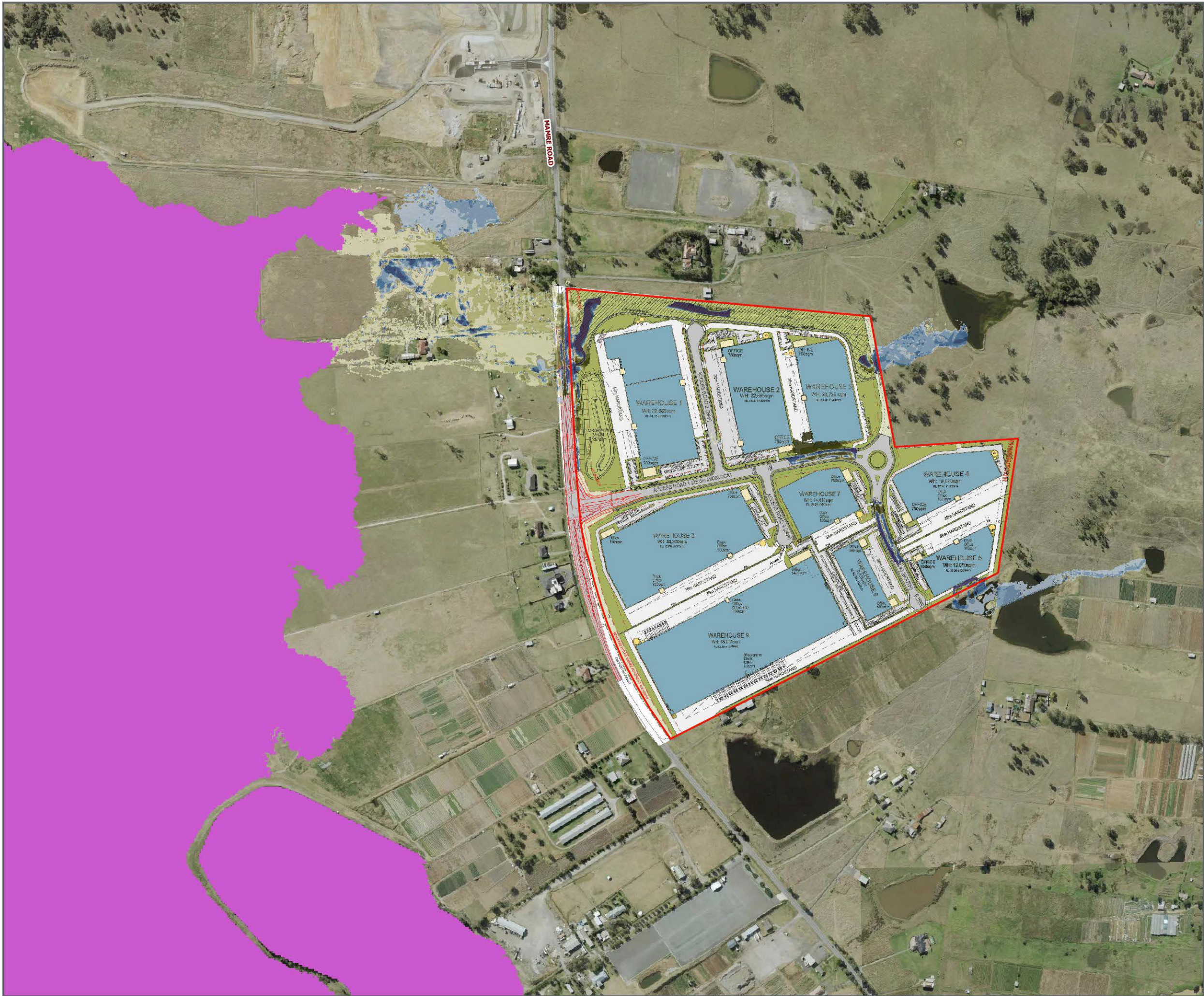
FIGURE F29

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz



Flood Risk Assessment Aspect Industrial Estate (AIE)

Final Masterplan Conditions – Benchmark
Conditions
500 Year ARI
Velocity Differences

Legend

South Creek Flood Study (2015)
100yr ARI Flood Extent

Study Area

Velocity Difference (m/s)

< -0.50

-0.50 to -0.20

-0.20 to -0.10

-0.10 to -0.05

-0.05 to -0.01

-0.01 to 0.01

0.01 to 0.05

0.05 to 0.10

0.10 to 0.20

0.20 to 0.50

> 0.50

FIGURE F30

1:7,500 Scale at A3



 now 

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Final Masterplan Conditions
PMF
Flood Extents & Flood Levels

- Legend
- South Creek Flood Study (2015)
PMF Flood Extent
 - Study Area
 - 0.5m Water Level Contour (mAHD)
 - Flood Extent



Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Final Masterplan Conditions
PMF
Flood Depths

Legend

South Creek Flood Study (2015)
PMF Flood Extent

Study Area

Flood Depth (m)

- 0.00 to 0.10
- 0.10 to 0.30
- 0.30 to 0.50
- 0.50 to 0.70
- 0.70 to 1.00
- 1.00 to 1.50
- > 1.50

FIGURE F32

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (N&W&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Final Masterplan Conditions
PMF
Flood Velocities

Legend

South Creek Flood Study (2015)
PMF Flood Extent

Study Area

Flood Velocity (m/s)

- 0.00 to 0.50
- 0.50 to 1.00
- 1.00 to 1.50
- 1.50 to 2.00
- 2.00 to 3.00
- > 3.00

FIGURE F33

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Final Masterplan Conditions
PMF
Flood Hazard

Legend

- South Creek Flood Study (2015)
PMF Flood Extent
- Study Area
- Flood Hazard
 - Low
 - Transitional
 - High

FIGURE F34

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (N&W&E)
Date: 2022-6-17 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Final Masterplan Conditions – Benchmark
Conditions
PMF
Water Level Differences

Legend

South Creek Flood Study (2015)
PMF Flood Extent

Study Area

Wet & Dry Analysis

Was Wet, Now Dry

Was Dry, Now Wet

Water Level Difference (m)

< -0.50

-0.50 to -0.20

-0.20 to -0.10

-0.10 to -0.05

-0.05 to -0.01

-0.01 to 0.01

0.01 to 0.05

0.05 to 0.10

0.10 to 0.20

0.20 to 0.50

> 0.50

FIGURE F35

1:7,500 Scale at A3

0 80 160 240 320 400 m



Cardno now Stantec

Map Produced by Cardno Now Stantec (NatW&E)
Date: 2022-6-22 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qgz

Flood Risk Assessment
Aspect Industrial Estate
(AIE)

Final Masterplan Conditions – Benchmark
Conditions
PM F
Velocity Differences

Legend

South Creek Flood Study (2015)
PMF Flood Extent

Study Area

Velocity Difference (m/s)

- < -0.50
- 0.50 to -0.20
- 0.20 to -0.10
- 0.10 to -0.05
- 0.05 to -0.01
- 0.01 to 0.01
- 0.01 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.50
- > 0.50

FIGURE F36

1:7,500 Scale at A3



Cardno now Stantec

Map Produced by Cardno Now Stantec (N&W&E)
Date: 2022-6-22 | Project: AWE200063
Coordinate System: MGA Zone 56
Map: Figure generation_20220615.qcz

APPENDIX C

SUMMARIES OF HYDROLOGICAL RESULTS



now



AWE200083 Aspect Industrial Estate ARR1987 Hydrology

MRd Peak Flow (m3/s)	Basin sized to meet target at Mamre Road - 2 yr ARI (12 hr) & 100 yr ARI (2 hr)											
	Storm Burst Duration (mins)											
	30	45	60	90	120	180	270	360	540	720	1440	2160
2 yr ARI												
PreDev	2.01	3.56	4.39	4.85	5.25	5.07	5.30	5.74	6.31	6.27	4.76	3.84
PostDev No Basin	10.97	10.27	9.57	9.43	10.92	6.71	6.69	6.56	7.16	7.63	5.47	4.32
PostDev With Basin	3.15	4.52	5.26	5.43	5.72	5.49	5.85	5.98	6.19	6.27	4.93	4.14
PostDev+Basin - PreDev	1.14	0.96	0.87	0.58	0.48	0.42	0.54	0.23	-0.12	0.00	0.16	0.30
5 yr ARI												
PreDev	4.85	6.82	7.98	8.26	8.60	7.99	9.09	8.71	8.61	8.56	6.54	5.29
PostDev No Basin	14.36	13.40	12.89	13.25	14.72	9.33	10.79	9.80	9.70	10.26	7.39	5.85
PostDev With Basin	5.79	7.35	8.32	8.43	8.77	7.84	8.84	8.28	8.09	8.20	6.50	5.50
PostDev+Basin - PreDev	0.94	0.53	0.34	0.17	0.17	-0.15	-0.25	-0.43	-0.53	-0.36	-0.04	0.21
100 yr ARI												
PreDev	14.99	17.83	19.91	19.98	20.96	16.35	18.68	16.76	14.77	14.54	11.10	9.03
PostDev No Basin	23.21	22.29	24.13	25.85	26.66	18.74	21.06	18.50	16.14	16.90	12.29	9.81
PostDev With Basin	14.59	17.67	19.70	19.60	20.37	15.46	18.27	15.77	14.31	14.44	10.83	9.03
PostDev+Basin - PreDev	-0.40	-0.16	-0.21	-0.38	-0.59	-0.89	-0.41	-1.00	-0.46	-0.11	-0.27	0.00

Basin sized to meet target at Mamre Road - 2 yr ARI (36 hr) & 100 yr ARI (36 hr)												
2 yr ARI												
PreDev	2.01	3.56	4.39	4.85	5.25	5.07	5.30	5.74	6.31	6.27	4.76	3.84
PostDev No Basin	10.97	10.27	9.57	9.43	10.92	6.71	6.69	6.56	7.16	7.63	5.47	4.32
PostDev With Basin	1.90	3.04	3.63	3.79	4.04	3.91	4.21	4.35	4.70	4.77	3.69	3.11
PostDev+Basin - PreDev	-0.11	-0.52	-0.76	-1.05	-1.21	-1.15	-1.09	-1.39	-1.61	-1.49	-1.07	-0.73
5 yr ARI												
PreDev	4.85	6.82	7.98	8.26	8.60	7.99	9.09	8.71	8.61	8.56	6.54	5.29
PostDev No Basin	14.36	13.40	12.89	13.25	14.72	9.33	10.79	9.80	9.70	10.26	7.39	5.85
PostDev With Basin	4.04	5.38	6.21	6.32	6.63	5.80	6.74	6.29	6.31	6.36	4.93	4.35
PostDev+Basin - PreDev	-0.81	-1.44	-1.77	-1.95	-1.97	-2.19	-2.35	-2.42	-2.31	-2.21	-1.61	-0.94
100 yr ARI												
PreDev	14.99	17.83	19.91	19.98	20.96	16.35	18.68	16.76	14.77	14.54	11.10	9.03
PostDev No Basin	23.21	22.29	24.13	25.85	26.66	18.74	21.06	18.50	16.14	16.90	12.29	9.81
PostDev With Basin	11.15	13.14	14.62	14.71	15.39	11.66	13.76	12.15	12.78	12.78	10.15	9.04
PostDev+Basin - PreDev	-3.85	-4.69	-5.29	-5.27	-5.57	-4.69	-4.92	-4.62	-1.99	-1.76	-0.94	0.01

AWE200083 Aspect Industrial Estate ARR12019 Hydrology

MRd Peak Flow (m3/s)	Basin sized to meet target at Mamre Road - 50% AEP (6 hr) & 1% AEP (45 mins)											
	Storm Burst Duration (mins)											
	15	20	25	30	45	60	90	120	180	270	360	540
50% AEP												
PreDev		0.00	0.00	0.00	0.00	0.00	0.29	1.00	1.99	2.72	3.23	2.91
PostDev No Basin		9.99	9.48	9.03	8.58	7.22	5.70	5.87	4.40	4.60	4.89	4.22
PostDev With Basin		0.45	0.48	0.51	0.57	0.60	0.93	1.65	2.34	2.84	3.16	2.80
PostDev+Basin - PreDev		0.45	0.48	0.51	0.57	0.60	0.65	0.65	0.35	0.11	-0.07	-0.11
20% AEP												
PreDev				4.91	6.57	7.28	7.41	7.73	6.74	6.21	6.01	
PostDev No Basin				12.91	12.36	12.20	11.16	11.20	8.85	8.25	7.95	
PostDev With Basin				0.81	2.13	3.27	4.33	5.33	5.60	5.62	6.08	
PostDev+Basin - PreDev				-4.10	-4.44	-4.00	-3.09	-2.40	-1.14	-0.59	0.06	
1% AEP												
PreDev					23.32	22.57	19.03	18.68	15.16	12.72	13.67	11.07
PostDev No Basin		19.10	21.12	22.07	30.47	28.50	24.24	23.92	18.63	15.65	16.19	13.29
PostDev With Basin		17.91	20.54	21.59	22.89	21.87	18.65	19.50	15.73	13.35	15.03	12.10
PostDev+Basin - PreDev		-1.19	-0.59	-0.47	-0.43	-0.70	-0.38	0.82	0.57	0.63	1.36	1.04

ARR	Basin Footprint (m2)	Max 1% AEP Depth (m)	1% AEP Basin Volume (m3)	Max 50% AEP Depth (m)	50% AEP Basin Volume (m3)	Primary Outlet	Secondary Spillway Width (m)	Spillway Crest Level (m)	Embankment Crest Level above Primary Outlet IL (m)
Basin sized to meet target at Mamre Road - 2 yr ARI (12 hr) & 100 yr ARI (2 hr)									
1987	8000	2.94	23,500	1.41	11,250	3 x 0.6m diam RCPs	3	2.3	3.2
Basin sized to meet target at Mamre Road - 2 yr ARI (36 hr) & 100 yr ARI (36 hr)									
1987	8000	5.36	42,900	3.06	24,500	1 x 0.5m diam RCP	0.5	3.00	5.6
Basin sized to meet target at Mamre Road - 50% AEP (6 hr) & 1% AEP (45 mins)									
2019	8000	3.58	28,710	2.12	16,820	1 x 0.5m diam RCP	3	2.5	3.9

Attachment C0

Based on the Preliminary Masterplan

AWE200083 Aspect Industrial Estate ARR1987 Hydrology

Benchmark Conditions

Attachment C1

Updated PMF

2 yr ARI	ARR	Edition	1987	Pervious Area Losses				Source:	2012 Upper South Creek Flood Study (WMAwater)					
				Initial Burst Loss (mm)		15		BX	1.3					
				Continuing (mm/h)		1.5		Roughness	0.025					
ARI (yrs)	2	2	2	2	2	2	2	2	2	2	2	2		
Subcatchment ID	Storm Burst Duration (mins)												Peak Flow (m3/s)	Critical Duration (hrs)
	30	45	60	90	120	180	270	360	540	720	1440	2160		
N5	0.62	1.20	1.49	1.64	1.77	1.63	1.77	1.81	1.89	1.97	1.39	1.07	1.97	12.0
N1	0.46	0.90	1.16	1.32	1.42	1.34	1.38	1.54	1.61	1.66	1.22	0.95	1.66	12.0
N2	0.72	1.31	1.60	1.76	1.90	1.79	1.93	2.02	2.13	2.21	1.60	1.25	2.21	12.0
S1	0.10	0.14	0.17	0.18	0.20	0.14	0.16	0.14	0.12	0.12	0.08	0.06	0.20	2.0
S2	0.35	0.60	0.72	0.82	0.88	0.85	0.88	0.98	1.02	1.08	0.78	0.61	1.08	12.0
S3	0.56	0.91	1.06	1.07	1.16	1.12	1.28	1.25	1.35	1.43	1.01	0.79	1.43	12.0
MRID3	0.14	0.27	0.34	0.38	0.41	0.38	0.40	0.43	0.45	0.47	0.34	0.26	0.47	12.0
MRID2a	0.28	0.54	0.72	0.82	0.88	0.85	0.85	0.99	1.03	1.06	0.78	0.62	1.06	12.0
Junc	0.98	1.70	2.05	2.25	2.43	2.34	2.49	2.65	2.81	2.92	2.12	1.67	2.92	12.0
MRID1	0.15	0.29	0.42	0.57	0.64	0.70	0.68	0.76	0.97	0.88	0.75	0.67	0.97	9.0
N3	0.17	0.30	0.36	0.36	0.38	0.34	0.44	0.39	0.40	0.41	0.27	0.21	0.44	4.5
N4	0.05	0.08	0.10	0.10	0.10	0.09	0.11	0.10	0.10	0.10	0.07	0.05	0.11	4.5
N34	0.22	0.38	0.46	0.46	0.48	0.43	0.55	0.49	0.50	0.51	0.34	0.26	0.55	4.5
MRd	2.01	3.56	4.39	4.85	5.25	5.07	5.30	5.74	6.31	6.27	4.76	3.84	6.31	9.0
MRID2b	0.24	0.35	0.40	0.42	0.46	0.31	0.42	0.39	0.35	0.35	0.22	0.17	0.46	2.0
DSMRd	2.66	4.66	5.89	6.35	6.90	6.70	7.02	7.58	8.35	7.95	6.24	5.07	8.35	9.0

200 yr ARI	ARR Edition	1987			Pervious Area Losses			Source:	2012 Upper South Creek Flood Study (WMAwater)						Updated 7/11
					Initial Burst Loss (mm)		15	BX	1.3						
					Continuing (mm/h)		1.5	Roughness	0.025						
ARI (yrs)	200	200	200	200	200	200	200	200	200	200	200	200			
Subcatchment ID	Storm Burst Duration (mins)												Peak Flow (m3/s)	Critical Duration (hrs)	
	30	45	60	90	120	180	270	360	540	720	1440	2160			
N5	6.39	7.09	7.85	7.77	8.23	6.29	6.65	5.72	4.91	5.03	3.53	2.78	8.23	2.0	
N1	4.97	5.74	6.28	6.20	6.41	5.00	5.72	4.88	4.17	4.32	3.12	2.47	6.41	2.0	
N2	6.70	7.59	8.36	8.28	8.77	6.76	7.49	6.46	5.56	5.68	4.10	3.25	8.77	2.0	
S1	0.72	0.66	0.78	0.80	0.76	0.52	0.45	0.33	0.29	0.29	0.19	0.15	0.80	1.5	
S2	3.15	3.61	3.95	3.91	4.19	3.21	3.63	3.13	2.69	2.78	2.01	1.60	4.19	2.0	
S3	4.28	4.75	5.34	5.57	5.86	4.46	4.68	4.11	3.53	3.64	2.59	2.06	5.86	2.0	
MRID3	1.45	1.64	1.80	1.78	1.86	1.44	1.59	1.37	1.17	1.21	0.86	0.68	1.86	2.0	
MRID2a	3.05	3.60	3.92	3.87	3.97	3.13	3.66	3.11	2.67	2.78	2.03	1.61	3.97	2.0	
Junc	8.63	9.88	10.88	10.92	11.58	8.86	9.82	8.53	7.35	7.49	5.47	4.35	11.58	2.0	
MRID1	1.71	2.36	2.73	2.90	3.01	2.78	2.77	2.87	2.67	2.58	2.10	1.82	3.01	2.0	
N3	1.48	1.59	1.80	1.82	1.94	1.51	1.37	1.16	1.00	1.01	0.68	0.54	1.94	2.0	
N4	0.39	0.41	0.46	0.48	0.51	0.39	0.35	0.29	0.25	0.25	0.17	0.13	0.51	2.0	
N34	1.87	2.00	2.26	2.29	2.45	1.90	1.71	1.45	1.25	1.26	0.85	0.67	2.45	2.0	
MRd	17.78	20.76	23.18	23.25	24.45	19.09	21.14	18.83	16.50	16.21	12.39	10.08	24.45	2.0	
MRID2b	1.57	1.56	1.90	2.07	2.05	1.46	1.26	0.95	0.83	0.83	0.55	0.43	2.07	1.5	
DSMRd	21.90	26.46	29.55	29.77	31.18	24.91	27.14	24.30	21.56	20.88	16.38	13.30	31.18	2.0	

5 yr ARI	ARR Edition	1987	Pervious Area Losses					Source:	2012 Upper South Creek Flood Study (WMAwater)					
			Initial Burst Loss (mm)					BX	1.3					
			Continuing (mm/h)					Roughness	0.025					
ARI (yrs)	5	5	5	5	5	5	5	5	5	5	5	5		
Subcatchment ID	Storm Burst Duration (mins)												Peak Flow (m3/s)	Critical Duration (hrs)
	30	45	60	90	120	180	270	360	540	720	1440	2160		
N5	1.61	2.36	2.74	2.78	2.89	2.49	3.12	2.75	2.57	2.68	1.89	1.47	3.12	4.5
N1	1.19	1.83	2.14	2.25	2.39	2.14	2.45	2.29	2.19	2.28	1.66	1.30	2.45	4.5
N2	1.79	2.54	2.92	2.96	3.10	2.79	3.34	3.02	2.90	3.01	2.18	1.71	3.34	4.5
S1	0.20	0.23	0.30	0.36	0.37	0.26	0.25	0.18	0.16	0.16	0.10	0.08	0.37	2.0
S2	0.83	1.16	1.34	1.38	1.48	1.36	1.55	1.44	1.40	1.47	1.07	0.84	1.55	4.5
S3	1.29	1.65	1.89	1.97	2.14	1.75	2.12	1.89	1.85	1.94	1.38	1.08	2.14	4.5
MRID3	0.35	0.53	0.62	0.64	0.68	0.60	0.71	0.65	0.61	0.64	0.46	0.36	0.71	4.5
MRID2a	0.72	1.12	1.32	1.41	1.51	1.36	1.51	1.46	1.40	1.46	1.08	0.85	1.51	4.5
Junc	2.36	3.27	3.75	3.80	3.99	3.67	4.30	3.96	3.84	3.97	2.90	2.29	4.30	4.5
MRID1	0.39	0.63	0.83	1.01	1.11	1.09	1.05	1.23	1.36	1.26	1.06	0.94	1.36	4.5
N3	0.42	0.56	0.65	0.66	0.69	0.51	0.69	0.61	0.54	0.55	0.37	0.28	0.69	2.0
N4	0.11	0.15	0.17	0.17	0.18	0.14	0.17	0.16	0.14	0.14	0.09	0.07	0.18	2.0
N34	0.54	0.71	0.81	0.83	0.87	0.65	0.86	0.76	0.68	0.69	0.46	0.35	0.87	2.0
MRd	4.85	6.82	7.98	8.26	8.60	7.99	9.09	8.71	8.61	8.56	6.54	5.29	9.09	4.5
MRID2b	0.51	0.59	0.72	0.78	0.84	0.62	0.65	0.53	0.46	0.46	0.30	0.23	0.84	2.0
DSMRd	6.26	8.78	10.52	11.09	11.70	10.31	11.61	11.48	11.37	10.90	8.59	6.98	11.70	2.0

500 yr ARI	ARR Edition	1987		Pervious Area Losses				Source:	2012 Upper South Creek Flood Study (WMAwater)					
				Initial Burst Loss (mm)				BX	1.3					
				Continuing (mm/h)				Roughness	0.025					
ARI (yrs)	500	500	500	500	500	500	500	500	500	500	500	500		
Subcatchment ID	Storm Burst Duration (mins)												Peak Flow (m3/s)	Critical Duration (hrs)
	30	45	60	90	120	180	270	360	540	720	1440	2160		
N5	7.72	8.43	9.40	9.25	9.86	7.60	7.59	6.52	5.61	5.72	4.02	3.18	9.86	2.0
N1	6.11	6.84	7.50	7.42	7.74	6.01	6.54	5.58	4.77	4.93	3.56	2.82	2.31	2.0
N2	8.13	9.03	9.99	9.90	10.51	8.19	8.57	7.38	6.35	6.47	4.67	3.71	0.61	2.0
S1	0.88	0.78	0.90	0.92	0.87	0.58	0.51	0.37	0.32	0.32	0.22	0.17	2.92	2.0
S2	3.84	4.31	4.72	4.75	5.07	3.90	4.16	3.59	3.08	3.18	2.29	1.82	7.74	2.0
S3	5.16	5.64	6.35	6.66	7.00	5.36	5.36	4.70	4.03	4.14	2.96	2.35	10.51	2.0
MRID3	0.88	0.78	0.90	0.92	0.87	0.58	0.51	0.37	0.32	0.32	0.22	0.17	0.92	1.5
MRID2a	3.84	4.31	4.72	4.75	5.07	3.90	4.16	3.59	3.08	3.18	2.29	1.82	5.07	2.0
Junc	5.16	5.64	6.35	6.66	7.00	5.36	5.36	4.70	4.03	4.14	2.96	2.35	7.00	2.0
MRID1	1.77	1.96	2.15	2.13	2.25	1.73	1.82	1.56	1.34	1.37	0.98	0.78	2.25	2.0
N3	1.78	1.88	2.12	2.18	2.31	1.78	1.56	1.31	1.14	1.14	0.78	0.61	4.78	2.0
N4	0.46	0.48	0.55	0.58	0.61	0.46	0.40	0.33	0.29	0.29	0.19	0.15	13.88	2.0
N34	2.15	2.91	3.30	3.48	3.61	3.28	3.31	3.30	3.05	2.97	2.42	2.08	3.61	2.0
MRd	21.60	24.83	27.70	27.85	29.24	22.93	24.42	21.60	18.85	18.48	14.15	11.52	29.24	2.0
MRID2b	1.93	1.89	2.26	2.38	2.35	1.66	1.43	1.07	0.94	0.93	0.62	0.49	2.38	1.5
DSMRd	26.48	31.53	35.07	35.34	36.93	29.57	31.65	27.77	24.57	23.86	18.71	15.19	36.93	2.0

100 yr ARI	ARR Edition	1987	Pervious Area Losses					Source:	2012 Upper South Creek Flood Study (WMAwater)					
			Initial Burst Loss (mm)					BX	1.3					
			Continuing (mm/h)					Roughness	0.025					
ARI (yrs)	100	100	100	100	100	100	100	100	100	100	100	100		
Subcatchment ID	Storm Burst Duration (mins)												Peak Flow (m3/s)	Critical Duration (hrs)
	30	45	60	90	120	180	270	360	540	720	1440	2160		
N5	5.39	6.10	6.75	6.70	7.03	5.37	5.95	5.12	4.40	4.51	3.17	2.49	7.03	2.0
N1	4.15	4.95	5.40	5.34	5.47	4.29	5.09	4.34	3.73	3.87	2.80	2.22	5.47	2.0
N2	5.65	6.54	7.18	7.13	7.50	5.75	6.66	5.77	4.98	5.09	3.68	2.91	7.50	2.0
S1	0.59	0.56	0.69	0.72	0.69	0.47	0.41	0.30	0.26	0.26	0.17	0.13	0.72	1.5
S2	2.64	3.11	3.38	3.34	3.56	2.71	3.23	2.79	2.41	2.50	1.81	1.43	3.56	2.0
S3	3.65	4.09	4.61	4.79	5.05	3.81	4.17	3.67	3.16	3.26	2.33	1.84	5.05	2.0
MRID3	1.21	1.41	1.55	1.53	1.59	1.23	1.43	1.22	1.04	1.08	0.77	0.61	1.59	2.0
MRID2a	2.54	3.09	3.37	3.34	3.39	2.70	3.24	2.76	2.39	2.49	1.82	1.44	3.39	2.0
Junc	7.29	8.49	9.33	9.34	9.90	7.54	8.71	7.61	6.58	6.72	4.90	3.90	9.90	2.0
MRID1	1.40	1.98	2.33	2.49	2.59	2.42	2.38	2.55	2.39	2.29	1.87	1.62	2.59	2.0
N3	1.26	1.37	1.56	1.56	1.67	1.29	1.22	1.04	0.90	0.91	0.61	0.48	1.67	2.0
N4	0.33	0.36	0.40	0.41	0.44	0.34	0.31	0.26	0.23	0.23	0.15	0.12	0.44	2.0
N34	1.58	1.72	1.97	1.97	2.11	1.63	1.53	1.30	1.13	1.13	0.77	0.60	2.11	2.0
MRd	14.99	17.83	19.91	19.98	20.96	16.35	18.68	16.76	14.77	14.54	11.10	9.03	20.96	2.0
MRID2b	1.32	1.33	1.65	1.82	1.83	1.31	1.13	0.86	0.75	0.75	0.49	0.39	1.83	2.0
DSMRd	18.62	22.74	25.54	25.78	26.99	21.53	23.78	21.70	19.34	18.69	14.67	11.91	26.99	2.0

PMF	Pervious Area Losses								Source: 2012 Upper South Creek Flood Study (WMAwater)	
	Initial Burst Loss (mm)								BX	1.3
	Continuing (mm/h)								Roughness	0.025
ARI (yrs)	Storm Burst Duration (mins)								Peak Flow (m3/s)	Critical Duration (hrs)
Subcatchment ID	15	30	45	60	90	120	180	240		
N5	45.96	51.94	49.34	46.22	39.78	34.88	27.86	23.97	51.94	0.50
N1	35.06	43.31	42.02	39.60	34.43	30.81	24.56	20.99	43.31	0.25
N2	52.02	58.51	56.37	52.90	45.80	40.73	32.51	27.81	58.51	0.25
S1	4.41	3.63	3.10	2.74	2.32	2.07	1.68	1.42	4.41	0.25
S2	26.10	28.80	27.71	25.86	22.48	20.03	15.95	13.61	28.80	0.50
S3	35.65	37.06	35.61	33.40	29.01	25.78	20.50	17.50	37.06	0.50
MRID3	11.43	12.74	12.09	11.31	9.72	8.55	6.83	5.85	12.74	0.25
MRID2a	24.13	28.59	27.67	25.92	22.56	20.21	16.12	13.75	28.59	0.50
Junc	69.25	76.73	74.60	70.06	61.02	54.27	43.38	37.02	76.73	0.50
MRID1	13.66	21.25	24.27	24.62	22.80	21.24	17.61	15.20	24.62	0.50
N3	11.97	11.29	10.41	9.37	7.85	6.84	5.55	4.81	11.97	0.50
N4	3.10	2.84	2.60	2.35	1.95	1.71	1.39	1.21	3.10	0.50
N34	15.05	14.13	13.01	11.71	9.80	8.55	6.94	6.02	15.05	0.75
MRd	134.66	157.38	162.19	155.94	137.58	124.06	100.10	85.11	162.19	0.75
MRID2b	12.23	10.11	8.87	7.77	6.49	5.75	4.74	4.06	12.23	0.25
DSMRd	148.06	183.47	202.02	198.42	177.74	162.23	131.83	111.84	202.02	0.75

Attachment C2

[illegible]

water)

[illegible]

water)

Subcatchment ID	ARI (yrs)	Continuing (mm/h)								Roughness		Peak Flow (m3/s)	Critical Duration (hrs)
										0.025			
		15	30	45	60	90	120	180	240				
N5												0.00	0.5
N1												0.00	0.5
N2												0.00	0.5
N3												0.00	0.3
N4												0.00	0.3
N34												0.00	0.3
S1												0.00	0.3
S2												0.00	0.5
S3												0.00	0.5
MRID3												0.00	0.3
MRID2												0.00	0.3
Junc2												0.00	0.3
MRID1												0.00	0.5
Junc												0.00	0.3
Dummy1												0.00	0.5
MRIDBas												0.00	0.3
MRd												0.00	0.5
DSMRd												0.00	0.5

AWE200083 Aspect Industrial Estate ARR1987 Hydrology

Basin sized to meet target at Mamre Road - 2 yr ARI (12 hr) & 100 yr ARI (2 hr)

2 yr ARI	ARR Edition	1987	Pervious Area Losses		15	Source:	2012 Upper South Creek Flood Study (WMAwater)						
			Initial Burst Loss (mm)	Continuing (mm/h)	1.5	BX Roughness	1.3	0.025					
ARI (yrs)	2	2	2	2	2	2	2	2	2	2	2		
Subcatchment ID	30	45	60	90	120	180	270	360	540	720	1440	2160	
N5	0.59	1.18	1.46	1.60	1.76	1.61	1.75	1.81	1.88	1.98	1.39	1.07	1.98
N1	0.43	0.87	1.14	1.29	1.38	1.31	1.35	1.54	1.60	1.66	1.21	0.95	1.66
N2	1.18	2.13	2.60	2.76	2.96	2.85	3.12	3.23	3.45	3.59	2.59	2.03	3.59
N3	0.16	0.28	0.34	0.35	0.37	0.34	0.42	0.38	0.39	0.40	0.27	0.21	0.42
N4	0.04	0.07	0.09	0.09	0.09	0.09	0.11	0.10	0.10	0.10	0.07	0.05	0.11
N34	1.37	2.44	2.99	3.11	3.34	3.22	3.54	3.62	3.90	3.99	2.91	2.29	3.99
S1	0.10	0.14	0.16	0.18	0.19	0.13	0.16	0.14	0.12	0.12	0.08	0.06	0.19
S2	0.33	0.57	0.71	0.80	0.86	0.84	0.86	0.97	1.02	1.08	0.78	0.61	1.08
S3	0.53	0.86	1.04	1.06	1.15	1.11	1.24	1.24	1.34	1.41	1.01	0.79	1.43
MRID3	1.83	1.66	1.77	1.88	1.79	0.96	0.85	0.64	0.57	0.57	0.38	0.29	1.88
MRID2	5.52	4.97	5.31	5.62	5.34	2.87	2.54	1.92	1.72	1.72	1.13	0.88	5.62
Jun2c	7.35	6.62	7.05	7.47	7.10	3.83	3.39	2.56	2.29	2.30	1.50	1.17	7.47
MRID1	5.44	4.88	5.18	5.50	5.18	2.83	2.50	1.85	1.67	1.68	1.11	0.86	5.50
Jun2c	0.53	0.86	1.04	1.06	1.15	1.11	1.24	1.24	1.34	1.43	1.01	0.79	1.43
Dummy1													
MRIDBas	10.97	10.27	9.44	9.18	10.77	6.62	5.84	4.35	3.95	3.97	2.61	2.03	10.97
MRd	3.15	4.52	5.26	5.43	5.72	5.49	5.85	5.98	6.19	6.27	4.93	4.14	6.27
DSMRd	3.73	5.63	6.70	6.99	7.34	7.01	7.52	7.69	8.01	7.96	6.25	5.20	8.01
Peak Inflow (m3/s)	10.97	10.27	9.44	9.18	10.77	6.62	5.84	4.35	3.95	3.97	2.61	2.03	10.97
Peak Outflow (m3/s)	1.91	2.15	2.29	2.32	2.39	2.27	2.34	2.36	2.38	2.29	2.02	1.85	
Max Vol (m3)	8.811	9.956	10.705	10.882	11.247	10.624	10.962	11.085	11.196	10.718	9.312	8.536	11.247
Max Stage (m)	1.10	1.24	1.34	1.36	1.41	1.33	1.37	1.39	1.40	1.34	1.16	1.07	1.41

5 yr ARI

ARR Edition	1987	Pervious Area Losses		15	Source:	2012 Upper South Creek Flood Study (WMAwater)						
		Initial Burst Loss (mm)	Continuing (mm/h)	1.5	BX Roughness	1.3	0.025					
ARI (yrs)	5	5	5	5	5	5	5	5	5	5	5	
Subcatchment ID	30	45	60	90	120	180	270	360	540	720	1440	2160
N5	1.58	2.32	2.71	2.73	2.88	2.48	3.06	2.73	2.56	2.66	1.89	1.47
N1	1.17	1.81	2.13	2.23	2.37	2.14	2.41	2.27	2.19	2.27	1.66	1.30
N2	2.99	4.13	4.79	4.87	5.11	4.46	5.29	4.85	4.74	4.88	3.55	2.79
N3	0.40	0.55	0.63	0.64	0.66	0.50	0.68	0.60	0.54	0.55	0.37	0.28
N4	0.11	0.14	0.16	0.17	0.18	0.13	0.17	0.15	0.14	0.14	0.09	0.07
N34	3.39	4.65	5.45	5.55	5.87	4.97	5.94	5.48	5.34	5.41	3.98	3.14
S1	0.20	0.22	0.29	0.34	0.36	0.25	0.34	0.16	0.16	0.10	0.08	0.36
S2	0.81	1.16	1.32	1.35	1.46	1.34	1.52	1.42	1.39	1.46	1.07	0.84
S3	1.26	1.63	1.88	1.92	2.11	1.72	2.08	1.85	1.83	1.93	1.38	1.08
MRID3	2.39	2.15	2.32	2.46	2.34	1.27	1.13	0.86	0.75	0.75	0.50	0.39
MRID2	7.20	6.46	6.92	7.36	7.03	3.81	3.39	2.55	2.25	2.26	1.49	1.17
Jun2c	9.59	8.62	9.23	9.82	9.37	5.08	4.52	3.41	3.00	3.01	1.99	1.56
MRID1	7.11	6.36	6.79	7.22	6.85	3.72	3.29	2.47	2.19	2.20	1.46	1.15
Jun2c	1.26	1.63	1.88	1.92	2.11	1.72	2.08	1.85	1.83	1.93	1.38	1.08
Dummy1												
MRIDBas	14.35	13.37	12.36	12.07	14.17	8.69	7.71	5.83	5.17	5.20	3.45	2.71
MRd	5.79	7.35	8.32	8.43	8.77	7.84	8.84	8.28	8.09	8.20	6.50	5.50
DSMRd	7.24	9.52	10.93	11.15	11.85	10.07	11.58	10.91	10.58	10.57	8.31	6.95
Peak Inflow (m3/s)	14.35	13.37	12.36	12.07	14.17	8.69	7.71	5.83	5.17	5.20	3.45	2.71
Peak Outflow (m3/s)	2.45	2.72	2.87	2.92	2.99	2.87	2.90	2.94	2.91	2.79	2.52	2.36
Max Vol (m3)	11.610	13.234	14.275	14.607	15.115	14.292	14.483	14.772	14.564	13.698	12.034	11.083
Max Stage (m)	1.45	1.65	1.78	1.83	1.89	1.79	1.81	1.85	1.82	1.71	1.50	1.39

100 yr ARI

ARR Edition	1987	Pervious Area Losses		15	Source:	2012 Upper South Creek Flood Study (WMAwater)						
		Initial Burst Loss (mm)	Continuing (mm/h)	1.5	BX Roughness	1.3	0.025					
ARI (yrs)	100	100	100	100	100	100	100	100	100	100	100	
Subcatchment ID	30	45	60	90	120	180	270	360	540	720	1440	2160
N5	5.34	6.05	6.68	6.60	6.95	5.30	5.93	5.11	4.36	4.49	3.17	2.49
N1	4.04	4.91	5.33	5.27	5.37	4.20	5.06	4.30	3.70	3.84	2.80	2.22
N2	9.16	10.50	11.62	11.75	12.33	9.38	10.70	9.27	8.06	8.21	5.99	4.75
N3	1.23	1.35	1.55	1.53	1.65	1.26	1.22	1.04	0.90	0.91	0.61	0.48
N4	0.31	0.34	0.39	0.39	0.42	0.32	0.31	0.26	0.22	0.22	0.15	0.12
N34	10.20	11.77	13.17	13.29	13.95	10.64	11.93	10.41	9.07	9.13	6.72	5.35
S1	0.58	0.55	0.68	0.72	0.69	0.47	0.61	0.47	0.30	0.26	0.17	0.13
S2	2.63	3.06	3.31	3.26	3.45	2.67	3.20	2.77	2.41	2.49	1.81	1.43
S3	3.65	4.04	4.53	4.71	4.94	3.79	4.13	3.64	3.16	3.26	2.33	1.84
MRID3	3.74	3.46	3.74	3.97	3.77	2.11	1.86	1.38	1.20	1.20	0.81	0.64
MRID2	11.23	10.41	11.17	11.82	11.25	6.21	5.53	4.12	3.60	3.60	2.43	1.93
Jun2c	14.96	13.86	14.90	15.78	14.98	8.32	7.40	5.50	4.80	4.80	3.23	2.57
MRID1	11.07	10.26	10.93	11.54	10.96	6.02	5.35	4.01	3.50	3.51	2.38	1.89
Jun2c	3.65	4.04	4.53	4.71	4.94	3.79	4.13	3.64	3.16	3.26	2.33	1.84
Dummy1												
MRIDBas	22.92	21.71	20.10	19.51	22.87	14.14	12.60	9.47	8.27	8.29	5.61	4.46
MRd	14.59	17.67	19.70	19.60	20.37	15.46	18.27	15.77	14.31	14.44	10.83	9.03
DSMRd	18.96	23.00	25.80	25.58	26.61	20.07	23.45	20.29	18.37	18.30	11.48	9.61
Peak Inflow (m3/s)	22.92	21.71	20.10	19.51	22.87	14.14	12.60	9.47	8.27	8.29	5.61	4.46
Peak Outflow (m3/s)	4.40	5.90	6.56	6.37	6.58	6.07	6.34	5.96	5.79	5.31	4.13	3.70
Max Vol (m3)	20.565	22.666	23.459	23.238	23.483	22.874	23.197	22.529	22.526	21.904	20.107	19.248
Max Stage (m)	2.57	2.83	2.93	2.90	2.94	2.86	2.90	2.84	2.82	2.74	2.51	2.41

Post-Development with Basin Conditions

Basin sized to meet target at Mamre Road - 2 yr ARI (36 hr) & 100 yr ARI (36 hr)

2 yr ARI	ARR Edition		1987		Pervious Area Losses				15		Source:		2012 Upper South Creek Flood Study (WMAwater)			
					Initial Burst Loss (mm)				1.5		BX		1.3			
					Continuing (mm/h)						Roughness		0.025			
ARI (yrs)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Subcatchment ID	30	45	60	90	120	180	270	360	540	720	1440	2160	Peak Flow (m3/s)	Critical Duration (hrs)		
N5																
N1	0.43	0.87	1.14	1.29	1.38	1.31	1.35	1.54	1.60	1.66	1.21	0.95	1.66	12.0		
N2	1.18	2.13	2.60	2.78	2.96	2.85	3.12	3.23	3.45	3.59	2.59	2.03	3.59	12.0		
N3	0.16	0.28	0.34	0.35	0.37	0.34	0.42	0.38	0.39	0.40	0.27	0.21	0.42	4.5		
N4	0.04	0.07	0.09	0.09	0.09	0.09	0.11	0.10	0.10	0.10	0.07	0.05	0.11	4.5		
N34	1.37	2.44	2.99	3.11	3.34	3.22	3.54	3.62	3.90	3.99	2.91	2.29	3.99	12.0		
S1	0.10	0.14	0.16	0.18	0.19	0.13	0.16	0.14	0.12	0.12	0.08	0.06	0.19	2.0		
S2	0.33	0.57	0.71	0.80	0.86	0.84	0.86	0.97	1.02	1.08	0.78	0.61	1.08	12.0		
S3	0.53	0.86	1.04	1.06	1.15	1.11	1.24	1.24	1.34	1.43	1.01	0.79	1.43	12.0		
MRID3	1.83	1.66	1.77	1.88	1.79	0.96	0.85	0.64	0.57	0.57	0.38	0.29	1.88	1.5		
MRID2	5.52	4.97	5.31	5.62	5.34	2.87	2.54	1.92	1.72	1.72	1.13	0.88	5.62	1.5		
Jun2c	7.35	6.62	7.05	7.47	7.10	3.83	3.39	2.56	2.29	2.30	1.50	1.17	7.47	1.5		
MRID1	5.44	4.88	5.18	5.50	5.18	2.83	2.50	1.85	1.67	1.68	1.11	0.86	5.50	1.5		
Jun2c	0.53	0.86	1.04	1.06	1.15	1.11	1.24	1.24	1.34	1.43	1.01	0.79	1.43	12.0		
Dummy1																
MRIDBas	10.97	10.27	9.44	9.18	10.77	6.62	5.84	4.35	3.95	3.97	2.61	2.03	10.97	0.5		
MRd	1.90	3.04	3.63	3.79	4.04	3.91	4.21	4.35	4.70	4.77	3.69	3.11	4.77	12.0		
DSMRd																
Peak Inflow (m3/s)	10.97	10.27	9.44	9.18	10.77	6.62	5.84	4.35	3.95	3.97	2.61	2.03	10.97			
Peak Outflow (m3/s)	0.53	0.61	0.66	0.71	0.75	0.78	0.81	0.83	0.89	0.90	0.87	0.95	0.87			
Max Vol (m3)	10,384	12,439	13,984	15,730	16,942	18,364	19,353	20,326	22,660	23,142	21,623	24,505	24,505			
Max Stage (m)	1.30	1.55	1.75	1.97	2.12	2.30	2.42	2.54	2.83	2.89	2.70	3.06	3.06			

AWE200083 Aspect Industrial Estate ARR2019 Hydrology

50% AEP	ARR	Edition	2019	Pervious Area Losses				Source:	2012 Upper South Creek Flood Study (WMawater)					
				Initial Burst Loss (mm)				BX	1.3					
				Continuing (mm/h)				Roughness	0.025					
AEP	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	Critical
Subcatchment ID	Storm Burst Duration (mins)												Peak Flow (m3/s)	Duration (hrs)
	15	20	25	30	45	60	90	120	180	270	360	540		
N5				0.00	0.00	0.00	0.08	0.31	0.67	0.88	1.03	0.90	1.03	6.0
N1				0.00	0.00	0.00	0.06	0.22	0.52	0.71	0.83	0.76	0.83	6.0
N2				0.00	0.00	0.00	0.10	0.36	0.73	0.97	1.14	1.02	1.14	6.0
S1				0.00	0.00	0.00	0.02	0.06	0.07	0.08	0.09	0.07	0.09	6.0
S2				0.00	0.00	0.00	0.05	0.18	0.34	0.46	0.54	0.49	0.54	6.0
S3				0.00	0.00	0.00	0.08	0.28	0.49	0.64	0.75	0.67	0.75	6.0
MRID3				0.00	0.00	0.00	0.02	0.07	0.15	0.20	0.24	0.21	0.24	6.0
MRID2a				0.00	0.00	0.00	0.04	0.14	0.32	0.44	0.52	0.48	0.52	6.0
Junc				0.00	0.00	0.00	0.14	0.48	0.94	1.27	1.50	1.34	1.50	6.0
MRID1				0.00	0.00	0.00	0.02	0.07	0.18	0.31	0.40	0.40	0.40	6.0
N3				0.00	0.00	0.00	0.02	0.08	0.16	0.20	0.23	0.19	0.23	6.0
N4				0.00	0.00	0.00	0.01	0.02	0.04	0.05	0.06	0.05	0.06	6.0
N34				0.00	0.00	0.00	0.03	0.11	0.20	0.25	0.29	0.24	0.29	6.0
MRd				0.00	0.00	0.00	0.29	1.00	1.99	2.72	3.23	2.91	3.23	6.0
MRID2b				0.00	0.00	0.00	0.04	0.12	0.17	0.20	0.23	0.19	0.23	6.0
DSMRd				0.00	0.00	0.00	0.40	1.35	2.64	3.62	4.26	3.82	4.26	6.0

20% AEP	ARR	Edition	2019	Pervious Area Losses				Source:	2012 Upper South Creek Flood Study (WMawater)						
				Initial Burst Loss (mm)				16	BX	1.3					
				Continuing (mm/h)				2.3	Roughness	0.025					
AEP	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%		
Subcatchment ID	Storm Burst Duration (mins)												Peak Flow (m3/s)	Critical Duration (hrs)	
	15	20	25	30	45	60	90	120	180	270	360	540			
N5				1.58	2.24	2.47	2.45	2.48	2.09	1.92	1.86	1.60	2.48	2.00	
N1				1.16	1.67	1.92	2.03	2.00	1.75	1.59	1.56	1.33	2.03	1.50	
N2				1.81	2.44	2.71	2.70	2.75	2.35	2.16	2.10	1.79	2.75	2.00	
S1				0.24	0.25	0.25	0.20	0.23	0.16	0.15	0.15	0.11	0.25	0.75	
S2				0.87	1.13	1.28	1.30	1.32	1.13	1.04	1.01	0.86	1.32	2.00	
S3				1.37	1.69	1.84	1.76	1.84	1.53	1.42	1.36	1.15	1.84	1.00	
MRID3				0.35	0.49	0.56	0.57	0.57	0.49	0.45	0.44	0.38	0.57	1.50	
MRID2a				0.70	1.01	1.18	1.27	1.26	1.11	1.01	0.99	0.85	1.27	1.50	
Junc				2.41	3.18	3.51	3.49	3.63	3.09	2.85	2.75	2.34	3.63	2.00	
MRID1				0.38	0.55	0.68	0.85	0.95	0.93	0.87	0.85	0.75	0.95	2.00	
N3				0.43	0.56	0.59	0.54	0.57	0.44	0.41	0.40	0.34	0.59	1.00	
N4				0.12	0.15	0.15	0.14	0.15	0.11	0.11	0.10	0.09	0.15	1.00	
N34				0.54	0.71	0.74	0.68	0.71	0.56	0.52	0.50	0.43	0.74	1.00	
MRd				4.91	6.57	7.28	7.41	7.73	6.74	6.21	6.01	5.13	7.73	2.00	
MRID2b				0.57	0.63	0.63	0.53	0.58	0.42	0.41	0.39	0.30	0.63	0.75	
DSMRd				6.38	8.44	9.29	9.57	10.08	8.78	8.10	7.83	6.67	10.08	2.00	

1% AEP	ARR	Edition	2019		Pervious Area Losses				Source:	2012 Upper South Creek Flood Study (WMAwater)						
					Initial Burst Loss (mm)				10	BX	1.3					
					Continuing (mm/h)				2.3	Roughness	0.025					
AEP	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%			
Subcatchment ID	Storm Burst Duration (mins)													Peak Flow (m3/s)	Critical Duration (hrs)	
	15	20	25	30	45	60	90	120	180	270	360	540				
N5		6.69	7.59	7.90	7.93	7.35	6.02	5.92	4.77	3.93	4.07	3.34	7.93	0.75		
N1		4.94	5.72	6.16	6.45	6.10	4.99	4.96	3.99	3.30	3.48	2.83	6.45	0.75		
N2		7.34	8.05	8.33	8.55	8.09	6.72	6.61	5.33	4.39	4.64	3.77	8.55	0.75		
S1		0.78	0.75	0.72	0.62	0.57	0.47	0.45	0.34	0.31	0.26	0.20	0.78	0.33		
S2		3.46	3.80	3.97	4.11	3.90	3.25	3.20	2.58	2.12	2.26	1.83	4.11	0.75		
S3		5.19	5.47	5.52	5.53	5.20	4.43	4.29	3.43	2.81	2.99	2.41	5.53	0.75		
MRID3		1.47	1.69	1.79	1.84	1.73	1.41	1.40	1.13	0.93	0.97	0.79	1.84	0.75		
MRID2a		2.98	3.47	3.78	4.04	3.85	3.17	3.15	2.53	2.11	2.23	1.81	4.04	0.75		
Junc		9.51	10.37	10.73	11.11	10.62	8.80	8.68	6.98	5.79	6.13	4.98	11.11	0.75		
MRID1		1.61	1.89	2.12	2.62	2.85	2.84	2.66	2.26	1.90	2.11	1.76	2.85	1.00		
N3		1.75	1.86	1.81	1.74	1.59	1.32	1.28	1.00	0.84	0.84	0.69	1.86	0.42		
N4		0.47	0.49	0.47	0.45	0.41	0.34	0.33	0.26	0.22	0.21	0.17	0.49	0.42		
N34		2.22	2.34	2.28	2.18	2.00	1.66	1.60	1.26	1.06	1.05	0.86	2.34	0.42		
MRd		19.10	21.12	22.07	23.32	22.57	19.03	18.68	15.16	12.72	13.67	11.07	23.32	0.75		
MRID2b		2.02	1.93	1.85	1.66	1.52	1.29	1.19	0.93	0.82	0.74	0.57	2.02	0.33		
DSMRd		23.47	25.85	27.09	29.14	28.71	24.47	24.04	19.53	16.60	17.77	14.37	29.14	0.75		

Attachment C4

Updated PMF

0.5% AEP		ARR Edition		2019		Pervious Area Losses			Source:		2012 Upper South Creek Flood Study (WMAwater)					Updated 11/11	
						Initial Burst Loss (mm)			BX		1.3						
						Continuing (mm/h)			Roughness		0.025						
AEP		0.5%		0.5%		0.5%		0.5%		0.5%		0.5%		0.5%		0.5%	
Subcatchment ID		Storm Burst Duration (mins)												Peak Flow (m3/s)		Critical Duration (hrs)	
		15		20		25		30		45		60		90		120	
		180		270		360		540									
N5		6.13	7.70	8.64	8.91	8.87	8.17	6.70	6.55	5.26	4.33	4.40		8.91	0.50		
N1		4.50	5.70	6.55	7.00	7.25	6.81	5.56	5.50	4.42	3.64	3.76		7.25	0.75		
N2		6.90	8.38	9.13	9.40	9.59	9.01	7.47	7.31	5.88	4.84	5.02		9.59	0.75		
S1		0.87	0.86	0.82	0.79	0.69	0.62	0.52	0.49	0.37	0.34	0.28		0.87	0.25		
S2		3.33	3.95	4.32	4.50	4.63	4.35	3.61	3.55	2.85	2.33	2.44		4.63	0.75		
S3		5.10	5.87	6.16	6.20	6.19	5.81	4.92	4.76	3.78	3.10	3.23		6.20	0.50		
MRID3		1.34	1.69	1.93	2.03	2.07	1.92	1.57	1.55	1.24	1.02	1.05		2.07	0.75		
MRID2a		2.72	3.45	3.98	4.31	4.55	4.31	3.53	3.50	2.81	2.32	2.42		4.55	0.75		
Junc		9.09	10.83	11.74	12.11	12.48	11.85	9.79	9.61	7.70	6.39	6.63		12.48	0.75		
MRID1		1.46	1.86	2.18	2.45	3.01	3.25	3.17	2.96	2.49	2.10	2.29		3.25	1.00		
N3		1.65	1.99	2.08	2.02	1.93	1.77	1.47	1.41	1.10	0.93	0.91		2.08	0.42		
N4		0.45	0.53	0.54	0.52	0.50	0.45	0.38	0.36	0.28	0.24	0.23		0.54	0.42		
N34		2.10	2.53	2.62	2.54	2.43	2.23	1.85	1.77	1.38	1.17	1.14		2.62	0.42		
MRd		18.09	21.74	23.91	24.91	26.23	25.23	21.17	20.72	16.76	14.02	14.79		26.23	0.75		
MRID2b		2.14	2.24	2.14	2.06	1.84	1.68	1.42	1.32	1.02	0.91	0.80		2.24	0.33		
DSMRd		22.29	26.54	29.09	30.48	32.69	32.10	27.14	26.63	21.54	18.29	19.20		32.69	0.75		

0.2% AEP	ARR Edition	2019			Pervious Area Losses				Source:	2012 Upper South Creek Flood Study (WMAwater)					
					Initial Burst Loss (mm)		10		BX	1.3					
					Continuing (mm/h)		2.3		Roughness	0.025					
AEP	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%		
Subcatchment ID	Storm Burst Duration (mins)													Peak Flow (m3/s)	Critical Duration (hrs)
	15	20	25	30	45	60	90	120	180	270	360	540			
N5	7.62	9.46	10.42	10.57	10.37	9.51	7.82	7.57	6.03	5.02	5.03	4.14	10.57	0.50	
N1	5.60	7.03	7.98	8.39	8.52	7.94	6.49	6.35	5.09	4.21	4.30	3.53	8.52	0.75	
N2	8.48	10.17	10.94	11.15	11.26	10.48	8.70	8.44	6.76	5.60	5.73	4.68	11.26	0.75	
S1	1.01	0.99	0.95	0.91	0.79	0.71	0.59	0.56	0.42	0.39	0.32	0.24	1.01	0.25	
S2	4.07	4.79	5.21	5.38	5.46	5.08	4.21	4.10	3.29	2.69	2.79	2.27	5.46	0.75	
S3	6.19	7.03	7.31	7.32	7.25	6.78	5.72	5.50	4.34	3.58	3.69	2.99	7.32	0.50	
MRID3	1.67	2.08	2.34	2.42	2.42	2.24	1.83	1.78	1.43	1.18	1.20	0.99	2.42	0.75	
MRID2a	3.38	4.26	4.87	5.19	5.36	5.04	4.11	4.04	3.24	2.69	2.76	2.26	5.36	0.75	
Junc	11.14	13.09	14.05	14.41	14.67	13.82	11.40	11.11	8.85	7.39	7.58	6.17	14.67	0.75	
MRID1	1.82	2.30	2.68	3.00	3.67	3.89	3.70	3.44	2.87	2.43	2.65	2.19	3.89	1.00	
N3	2.03	2.40	2.46	2.37	2.25	2.06	1.71	1.63	1.26	1.08	1.04	0.84	2.46	0.42	
N4	0.55	0.64	0.64	0.61	0.57	0.53	0.44	0.41	0.32	0.28	0.26	0.21	0.64	0.33	
N34	2.59	3.04	3.09	2.98	2.82	2.59	2.15	2.04	1.58	1.35	1.30	1.06	3.09	0.42	
MRd	22.10	26.26	28.64	29.62	30.86	29.52	24.66	23.98	19.29	16.23	16.92	13.72	30.86	0.75	
MRID2b	2.54	2.59	2.49	2.39	2.12	1.93	1.63	1.51	1.16	1.05	0.91	0.70	2.59	0.33	
DSMRd	26.96	31.76	34.53	36.06	38.33	37.56	31.43	30.70	24.76	21.14	21.92	17.79	38.33	0.75	

PMF	Pervious Area Losses								Source: 2012 Upper South Creek Flood Study (WMAwater)		
	Initial Burst Loss (mm)								1	BX	1.3
	Continuing (mm/h)								0	Roughness	0.025
ARI (yrs)	Storm Burst Duration (mins)								Peak Flow (m3/s)	Critical Duration (hrs)	
Subcatchment ID											
	15	30	45	60	90	120	180	240			
N5	45.96	51.94	49.34	46.22	39.78	34.88	27.86	23.97	51.94	0.50	
N1	35.06	43.31	42.02	39.60	34.43	30.81	24.56	20.99	43.31	0.25	
N2	52.02	58.51	56.37	52.90	45.80	40.73	32.51	27.81	58.51	0.25	
S1	4.41	3.63	3.10	2.74	2.32	2.07	1.68	1.42	4.41	0.25	
S2	26.10	28.80	27.71	25.86	22.48	20.03	15.95	13.61	28.80	0.50	
S3	35.65	37.06	35.61	33.40	29.01	25.78	20.50	17.50	37.06	0.50	
MRID3	11.43	12.74	12.09	11.31	9.72	8.55	6.83	5.85	12.74	0.25	
MRID2a	24.13	28.59	27.67	25.92	22.56	20.21	16.12	13.75	28.59	0.50	
Junc	69.25	76.73	74.60	70.06	61.02	54.27	43.38	37.02	76.73	0.50	
MRID1	13.66	21.25	24.27	24.62	22.80	21.24	17.61	15.20	24.62	0.50	
N3	11.97	11.29	10.41	9.37	7.85	6.84	5.55	4.81	11.97	0.50	
N4	3.10	2.84	2.60	2.35	1.95	1.71	1.39	1.21	3.10	0.50	
N34	15.05	14.13	13.01	11.71	9.80	8.55	6.94	6.02	15.05	0.75	
MRd	134.66	157.38	162.19	155.94	137.58	124.06	100.10	85.11	162.19	0.75	
MRID2b	12.23	10.11	8.87	7.77	6.49	5.75	4.74	4.06	12.23	0.25	
DSMRd	148.06	183.47	202.02	198.42	177.74	162.23	131.83	111.84	202.02	0.75	

50% AEP	ARR Edition	2019	Pervious Area Losses				Source: BX		2012 Upper South Creek Flood Study (WMAwater)				0.5% AEP	ARR Edition	2019	Pervious Area Losses				Source: BX		2012 Upper South Creek Flood Study (WMAwater)				0.5% AEP	ARR Edition	2019	Pervious Area Losses				Source: BX		2012 Upper South Creek Flood Study (WMAwater)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
			Initial Burst Loss (mm)				28.5		BX		1.3							Initial Burst Loss (mm)				10		BX		1.3							Initial Burst Loss (mm)				2.3		BX		0.025																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
			Continuing (mm/h)				2.3		Roughness		0.025							Continuing (mm/h)				2.3		Roughness		0.025							Continuing (mm/h)				2.3		Roughness		0.025																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
AEP Subcatchment ID	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	Peak Flow (m3/s)	Critical Duration (hrs)	AEP Subcatchment ID	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	Peak Flow (m3/s)	Critical Duration (hrs)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	Storm Burst Duration (mins)																	Storm Burst Duration (mins)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				</

Basin sized to meet target at Mamre Road - 2 yr ARI (12 hr) & 100 yr ARI (2 hr)

50% AEP	ARR Edition	2019	Pervious Area Losses				Source: 2012 Upper South Creek Flood Study (WMAwater)							
			Initial Burst Loss (mm)				BX 1.3							
			Continuing (mm/h)				Roughness 0.025							
AEP	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	
Subcatchment ID	Storm Burst Duration (mins)												Peak Flow (m3/s)	Critical Duration (hrs)
	15	20	25	30	45	60	90	120	180	270	360	540		
N5		0.00	0.00	0.00	0.00	0.00	0.12	0.44	0.83	1.04	1.21	1.01	1.21	6.0
N1		0.00	0.00	0.00	0.00	0.00	0.09	0.32	0.66	0.85	0.99	0.85	0.99	6.0
N2		0.00	0.00	0.00	0.00	0.00	0.26	0.87	1.47	1.89	2.18	1.86	2.18	6.0
N3		0.00	0.00	0.00	0.00	0.00	0.03	0.12	0.19	0.23	0.26	0.22	0.26	6.0
N4		0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.06	0.07	0.06	0.07	6.0
N34		0.00	0.00	0.00	0.00	0.00	0.30	0.99	1.65	2.12	2.44	2.08	2.44	6.0
S1		0.00	0.00	0.00	0.00	0.00	0.03	0.07	0.08	0.08	0.09	0.07	0.09	6.0
S2		0.00	0.00	0.00	0.00	0.00	0.08	0.25	0.42	0.55	0.64	0.55	0.64	6.0
S3		0.00	0.00	0.00	0.00	0.00	0.12	0.38	0.59	0.76	0.87	0.74	0.87	6.0
MRID3		1.73	1.61	1.56	1.33	1.25	0.97	1.07	0.61	0.55	0.53	0.39	1.73	0.3
MRID2		5.15	4.79	4.66	4.00	3.74	2.91	3.20	1.82	1.65	1.59	1.16	5.15	0.3
Junc2		6.86	6.36	6.19	5.33	4.98	3.88	4.26	2.42	2.20	2.12	1.55	6.86	0.3
MRID1		5.06	4.64	4.54	3.95	3.61	2.86	3.14	1.79	1.63	1.56	1.14	5.06	0.3
Junc		0.00	0.00	0.00	0.00	0.00	0.12	0.38	0.59	0.76	0.87	0.74	0.87	6.0
Dummy														
MRIDBas		9.99	9.48	9.03	8.58	7.22	5.70	5.87	4.20	3.82	3.66	2.68	9.99	0.3
MRd		0.45	0.48	0.51	0.57	0.60	0.93	1.65	2.34	2.84	3.16	2.80	3.16	6.0
DSMRd		0.45	0.48	0.51	0.57	0.60	0.93	1.65	2.34	2.84	3.16	2.80	3.16	6.0
Peak Inflow (m3/s)														
Peak Outflow (m3/s)														
Max Vol (m3)														
Max Stage (m)														

	ARR Edition	2019	Pervious Area Losses				Source: 2012 Upper South Creek Flood Study (WMAwater)							
			Initial Burst Loss (mm)				BX 1.3							
			Continuing (mm/h)				Roughness 0.025							
AEP	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	
Subcatchment ID	Storm Burst Duration (mins)												Peak Flow (m3/s)	Critical Duration (hrs)
	15	20	25	30	45	60	90	120	180	270	360	540		
N5														
N1														
N2														
N3														
N4														
N34														
S1														
S2														
S3														
MRID3														
MRID2														
Junc2														
MRID1														
Junc														
Dummy														
MRIDBas														
MRd														
DSMRd														
Peak Inflow (m3/s)														
Peak Outflow (m3/s)														
Max Vol (m3)														
Max Stage (m)														

20% AEP	ARR Edition	2019	Pervious Area Losses				Source: 2012 Upper South Creek Flood Study (WMAwater)							
			Initial Burst Loss (mm)				BX 1.3							
			Continuing (mm/h)				Roughness 0.025							
AEP	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	
Subcatchment ID	Storm Burst Duration (mins)												Peak Flow (m3/s)	Critical Duration (hrs)
	15	20	25	30	45	60	90	120	180	270	360	540		
N5	0.00	0.00	0.00	0.06	0.60	1.15	1.74	2.05	1.97	1.80	1.91		2.05	2.0
N1	0.00	0.00	0.00	0.05	0.44	0.84	1.34	1.65	1.64	1.50	1.60		1.65	2.0
N2	0.00	0.00	0.00	0.14	1.24	2.23	3.03	3.63	3.52	3.27	3.46		3.63	2.0
N3	0.00	0.00	0.00	0.02	0.16	0.31	0.41	0.47	0.41	0.39	0.40		0.47	2.0
N4	0.00	0.00	0.00	0.01	0.05	0.08	0.11	0.12	0.11	0.10	0.10		0.12	2.0
N34	0.00	0.00	0.00	0.16	1.41	2.52	3.37	4.05	3.93	3.66	3.87		4.05	2.0
S1	0.00	0.00	0.00	0.01	0.12	0.18	0.17	0.20	0.14	0.13	0.13		0.20	2.0
S2	0.00	0.00	0.00	0.04	0.36	0.64	0.89	1.07	1.05	0.98	1.03		1.07	2.0
S3	0.00	0.00	0.00	0.06	0.56	0.99	1.26	1.48	1.39	1.31	1.38		1.48	2.0
MRID3	2.67	2.44	2.27	2.20	1.87	1.75	1.36	1.47	0.85	0.76	0.73		2.67	0.3
MRID2	7.88	7.27	6.74	6.52	5.59	5.21	4.06	4.39	2.53	2.26	2.17		7.88	0.3
Junc2	10.54	9.70	8.99	8.71	7.43	6.92	5.41	5.83	3.37	3.02	2.89		10.54	0.3
MRID1	7.78	7.16	6.62	6.43	5.51	5.07	3.97	4.31	2.47	2.22	2.12		7.78	0.3
Junc	0.00	0.00	0.00	0.06	0.56	0.99	1.26	1.48	1.39	1.31	1.38		1.48	2.0
Dummy														
MRIDBas	12.44	14.20	13.43	12.76	11.98	10.02	7.90	8.05	5.81	5.21	4.99		14.20	0.3
MRd	0.54	0.60	0.63	0.81	2.13	3.27	4.33	5.33	5.60	5.62	6.08		6.08	6.0
DSMRd	0.54	0.60	0.63	0.87	2.69	4.27	5.73	6.99	7.23	7.21	7.73		7.73	6.0
Peak Inflow (m3/s)														
Peak Outflow (m3/s)														
Max Vol (m3)														
Max Stage (m)														

	ARR Edition	2019	Pervious Area Losses				Source: 2012 Upper South Creek Flood Study (WMAwater)							
			Initial Burst Loss (mm)				BX 1.3							
			Continuing (mm/h)				Roughness 0.025							
AEP	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	
Subcatchment ID	Storm Burst Duration (mins)												Peak Flow (m3/s)	Critical Duration (hrs)
	15	20	25	30	45	60	90	120	180	270	360	540		
N5														
N1														
N2														
N3														
N4														
N34														
S1														
S2														
S3														
MRID3														
MRID2														
Junc2														
MRID1														
Junc														
Dummy														
MRIDBas														
MRd														
DSMRd														
Peak Inflow (m3/s)														
Peak Outflow (m3/s)														
Max Vol (m3)														
Max Stage (m)														

1% AEP	ARR Edition	2019	Pervious Area Losses						Source:	2012 Upper South Creek Flood Study (WMAwater)					
			Initial Burst Loss (mm)						BX	1.3					
			Continuing (mm/h)						Roughness	0.025					
AEP	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%		
Subcatchment ID	Storm Burst Duration (mins)													Peak Flow (m3/s)	Critical Duration (hrs)
	15	20	25	30	45	60	90	120	180	270	360	540			
N5		9.21	9.72	9.47	9.07	8.32	6.90	6.66	5.22	4.40	4.36	3.56	9.72	0.42	
N1		6.98	7.69	7.73	7.54	6.91	5.71	5.56	4.43	3.68	3.74	3.07	7.73	0.50	
N2		15.11	16.10	16.04	15.88	14.73	12.23	11.97	9.42	7.94	8.01	6.52	16.10	0.42	
N3		2.22	2.17	2.08	1.94	1.77	1.50	1.40	1.09	0.94	0.89	0.71	2.22	0.33	
N4		0.58	0.56	0.54	0.49	0.45	0.38	0.36	0.28	0.24	0.22	0.18	0.58	0.33	
N34		16.39	17.25	17.12	17.26	16.10	13.49	13.16	10.46	8.87	8.95	7.27	17.26	0.75	
S1		0.85	0.80	0.77	0.66	0.59	0.49	0.48	0.35	0.33	0.27	0.20	0.85	0.33	
S2		4.60	4.94	4.96	4.84	4.46	3.71	3.61	2.85	2.37	2.42	1.97	4.96	0.50	
S3		6.49	6.66	6.58	6.37	5.90	4.97	4.79	3.78	3.14	3.18	2.57	6.66	0.42	
MRID3		4.50	4.02	3.79	3.12	2.87	2.53	2.51	1.63	1.53	1.30	0.95	4.50	0.33	
MRID2		13.38	11.97	11.29	9.27	8.51	7.51	7.48	4.86	4.54	3.90	2.86	13.38	0.33	
Junc2		17.85	15.99	15.08	12.39	11.37	10.02	9.97	6.49	6.07	5.20	3.81	17.85	0.33	
MRID1		13.07	11.70	11.03	9.03	8.30	7.35	7.33	4.74	4.42	3.81	2.79	13.07	0.33	
Junc		6.49	6.66	6.58	6.37	5.90	4.97	4.79	3.78	3.14	3.18	2.57	6.66	0.42	
Dummy		0.09	0.57	0.92	0.51	0.43	0.04	0.19	0.00	0.00	0.00	0.00	0.92	0.50	
MRIDBas		25.37	24.53	23.00	20.01	18.25	15.61	15.35	11.12	10.36	8.95	6.58	25.37	0.33	
MRd		17.91	20.54	21.59	22.89	21.87	18.65	19.50	15.73	13.35	15.03	12.10	22.89	0.75	
DSMRd		23.31	26.56	28.09	29.42	28.31	23.83	24.82	19.86	16.89	18.95	15.29	29.42	0.75	
Peak Inflow (m3/s)															
Peak Outflow (m3/s)															
Max Vol (m3)															
Max Stage (m)															

2 yr ARI	ARR Edition	1987			Pervious Area Losses			15			Source: 2012 Upper South Creek Flood Study (WMAwater)			1.3					
					Initial Burst Loss (mm)			1.5			BX			0.025					
					Continuing (mm/h)						Roughness								
ARI (yrs)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Subcatchment ID	Storm Burst Duration (mins)																Peak Flow (m3/s)	Critical Duration (hrs)	
	30	45	60	90	120	180	270	360	540	720	1440	2160							
N5	0.62	1.20	1.49	1.64	1.77	1.63	1.77	1.81	1.89	1.97	1.39	1.07	1.97	12.0					
N1	0.46	0.90	1.16	1.32	1.42	1.34	1.38	1.54	1.61	1.66	1.22	0.95	1.66	12.0					
N2	1.39	2.46	2.97	3.15	3.36	3.23	3.54	3.63	3.88	3.98	2.89	2.26	3.98	12.0					
N3	0.17	0.30	0.36	0.36	0.38	0.34	0.44	0.39	0.40	0.41	0.27	0.21	0.44	4.5					
N4	0.05	0.08	0.10	0.10	0.10	0.09	0.11	0.10	0.10	0.10	0.07	0.05	0.11	4.5					
N34	1.54	2.69	3.27	3.45	3.70	3.56	3.87	3.97	4.31	4.31	3.19	2.52	4.31	12.0					
S1	0.10	0.14	0.17	0.18	0.20	0.14	0.16	0.14	0.12	0.12	0.08	0.06	0.20	2.0					
S2	0.35	0.60	0.72	0.82	0.88	0.85	0.88	0.98	1.02	1.08	0.78	0.61	1.08	12.0					
S3	0.56	0.91	1.06	1.07	1.16	1.12	1.28	1.25	1.35	1.43	1.01	0.79	1.43	12.0					
MRID3	0.13	0.24	0.31	0.34	0.37	0.34	0.36	0.39	0.40	0.42	0.30	0.23	0.42	12.0					
MRID2b	0.87	0.78	0.86	0.96	0.86	0.53	0.57	0.63	0.70	0.75	0.55	0.46	0.96	1.5					
Junc2	1.39	2.46	2.97	3.15	3.36	3.23	3.54	3.63	3.88	3.98	2.89	2.26	3.98	12.0					
MRID1	3.04	2.49	3.39	3.31	3.22	2.02	1.77	1.39	1.36	1.40	0.95	0.76	3.39	1.0					
MRID1b	1.10	0.98	1.04	1.11	1.03	0.59	0.52	0.40	0.39	0.40	0.27	0.22	1.11	1.5					
Junc1	0.69	1.15	1.36	1.40	1.51	1.46	1.64	1.62	1.75	1.80	1.30	1.02	1.80	12.0					
MRID2a	0.85	0.77	0.84	0.92	0.84	0.50	0.48	0.51	0.64	0.66	0.51	0.44	0.92	1.5					
Stage1	0.20	0.33	0.46	0.59	0.68	0.77	0.81	0.84	0.98	0.95	0.95	0.99	0.99	36.0					
Node6	1.69	1.50	1.62	1.79	1.63	1.01	1.02	1.13	1.34	1.39	1.06	0.89	1.79	1.5					
MRIDBas	3.31	3.46	3.80	4.44	3.64	2.64	2.38	2.05	2.37	2.57	1.94	1.64	4.44	1.5					
MRd	1.74	2.95	3.64	3.92	4.20	4.08	4.32	4.56	5.09	5.06	3.98	3.37	5.09	9.0					
DSMRd	2.29	3.88	4.94	5.31	5.67	5.45	5.80	6.18	6.87	6.47	5.22	4.43	6.87	9.0					
Peak Inflow (m3/s)	3.31	3.45	3.80	4.44	3.64	2.64	2.38	2.05	2.37	2.57	1.94	1.64							
Peak Outflow (m3/s)	0.20	0.33	0.46	0.59	0.68	0.77	0.81	0.84	0.98	0.95	0.95	0.99							
Max Vol (m3)	4,818	6,234	7,188	8,573	9,610	10,803	11,436	11,945	14,359	13,841	13,731	14,478	14,478	36					
Max Stage (m)	0.55	0.71	0.81	0.97	1.09	1.22	1.30	1.35	1.63	1.57	1.56	1.64	2	36					

200 yr ARI	ARR Edition	1987		Pervious Area Losses					Source:		2012 Upper South Creek Flood Study (WMAwater)												
									15	BX	1.3												
									1.5	Roughness	0.025												
	ARI (yrs)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	Critical Duration (hrs)
Subcatchment ID		Storm Burst Duration (mins)											Peak Flow (m3/s)										
		30	45	60	90	120	180	270	360	540	720	1440	2160										
N5		6.39	7.09	7.85	7.77	8.23	6.29	6.65	5.72	4.91	5.03	3.53	2.78	8.23	2.0								
N1		4.97	5.74	6.28	6.20	6.41	5.00	5.72	4.88	4.17	4.32	3.12	2.47	6.41	2.0								
N2		12.20	13.71	15.25	15.43	16.15	12.44	13.52	11.57	10.03	10.19	7.44	5.91	16.15	2.0								
N3		1.48	1.59	1.80	1.82	1.94	1.51	1.37	1.16	1.00	1.01	0.68	0.54	1.94	2.0								
N4		0.39	0.41	0.46	0.48	0.51	0.39	0.35	0.29	0.25	0.25	0.17	0.13	0.51	2.0								
N34		12.95	14.69	16.50	16.66	17.46	13.59	14.57	12.70	11.05	10.95	8.18	6.58	17.46	2.0								
S1		0.72	0.66	0.78	0.80	0.76	0.52	0.45	0.33	0.29	0.29	0.19	0.15	0.80	1.5								
S2		3.15	3.61	3.95	3.91	4.19	3.21	3.63	3.13	2.69	2.78	2.01	1.60	4.19	2.0								
S3		4.28	4.75	5.34	5.57	5.86	4.46	4.68	4.11	3.53	3.64	2.59	2.06	5.86	2.0								
MRID3		1.32	1.48	1.63	1.62	1.70	1.31	1.42	1.22	1.05	1.08	0.76	0.60	1.70	2.0								
MRID2b		2.41	1.99	2.60	2.98	2.59	2.04	2.32	2.06	1.80	1.93	1.44	1.17	2.98	1.5								
Junc2		12.20	13.71	15.25	15.43	16.15	12.44	13.52	11.57	10.03	10.19	7.44	5.91	16.15	2.0								
MRID1		7.48	6.04	8.12	7.89	7.67	5.06	4.57	3.70	3.25	3.33	2.34	1.88	8.12	1.0								
MRID1b		2.53	2.32	2.52	2.68	2.52	1.44	1.31	1.05	0.93	0.96	0.68	0.55	2.68	1.5								
Junc1		5.57	6.17	6.96	7.18	7.53	5.76	6.06	5.27	4.55	4.56	3.34	2.66	7.53	2.0								
MRID2a		2.23	1.89	2.35	2.64	2.35	1.80	1.91	1.77	1.67	1.77	1.36	1.15	2.64	1.5								
Stage1		1.06	1.25	1.38	1.53	1.63	2.13	2.46	2.64	3.84	3.34	3.44	3.27	3.84	9.0								
Node6		4.49	3.75	4.78	5.42	4.84	3.80	4.16	3.74	3.41	3.67	2.79	2.32	5.42	1.5								
MRIDBas		8.51	8.93	9.33	10.61	8.73	6.72	7.43	6.54	6.07	6.49	4.97	4.19	10.61	1.5								
MRd		13.86	15.74	17.58	17.76	18.55	14.59	15.75	13.90	12.76	12.55	9.81	9.45	18.55	2.0								
DSMRd		17.47	20.66	23.16	23.35	24.36	19.67	20.77	18.69	17.05	16.30	13.19	11.84	24.36	2.0								
Peak Inflow (m3/s)		8.51	8.93	9.33	10.61	8.73	6.72	7.43	6.54	6.07	6.49	4.97	4.19										
Peak Outflow (m3/s)		1.06	1.25	1.38	1.53	1.63	2.13	2.46	2.64	3.84	3.34	3.44	3.27										
Max Vol (m3)		15,951	20,058	23,263	27,467	30,501	33,155	33,766	34,063	35,740	35,102	35,231	34,999	35,740	9								
Max Stage (m)		1.81	2.27	2.64	3.11	3.46	3.76	3.83	3.86	4.05	3.98	3.99	3.97	4.05	9								

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Final Masterplan No Basin

Attachment C8

(refer Attachment B2 for Preliminary Masterplan No Basin)

2 yr ARI	ARR Edition	1987	Pervious Area Losses		Initial Burst Loss (mm)		Continuing (mm/h)		Source:	2012 Upper South Creek Flood Study (WMAwater)					
					15		1.5		BX	1.3					
									Roughness	0.025					
ARI (yrs)	2	2	2	2	2	2	2	2	2	2	2	2	2	Peak Flow (m3/s)	Critical Duration (hrs)
Subcatchment ID	Storm Burst Duration (mins)														
	30	45	60	90	120	180	270	360	540	720	1440	2160			
N5	0.62	1.20	1.49	1.64	1.77	1.63	1.77	1.81	1.89	1.97	1.39	1.07	1.97	12.0	
N1	0.46	0.90	1.16	1.32	1.42	1.34	1.38	1.54	1.61	1.66	1.22	0.95	1.66	12.0	
N2	1.57	2.43	2.93	3.15	3.39	3.18	3.51	3.62	3.86	4.06	2.92	2.29	4.06	12.0	
N3	0.17	0.30	0.36	0.36	0.38	0.34	0.44	0.39	0.40	0.41	0.27	0.21	0.44	4.5	
N4	0.05	0.08	0.10	0.10	0.10	0.09	0.11	0.10	0.10	0.10	0.07	0.05	0.11	4.5	
N34	1.75	2.67	3.29	3.49	3.73	3.53	3.94	3.97	4.29	4.40	3.22	2.54	4.40	12.0	
S1	0.10	0.14	0.17	0.18	0.20	0.14	0.16	0.14	0.12	0.12	0.08	0.06	0.20	2.0	
S2	0.35	0.60	0.72	0.82	0.88	0.85	0.88	0.98	1.02	1.08	0.78	0.61	1.08	12.0	
S3	0.56	0.91	1.06	1.07	1.16	1.12	1.28	1.25	1.35	1.43	1.01	0.79	1.43	12.0	
MRID3	1.54	1.39	1.49	1.58	1.50	0.82	0.73	0.57	0.51	0.51	0.33	0.26	1.58	1.5	
MRID2a	3.05	2.73	2.90	3.08	2.90	1.59	1.41	1.04	0.94	0.95	0.63	0.49	3.08	1.5	
MRID2b	2.76	2.49	2.66	2.83	2.68	1.46	1.29	0.99	0.93	0.94	0.63	0.49	2.83	1.5	
Junc2	1.57	2.43	2.93	3.15	3.39	3.18	3.51	3.62	3.86	4.06	2.92	2.29	4.06	12.0	
MRID1	3.04	2.49	3.39	3.31	3.22	2.02	1.77	1.39	1.35	1.40	0.95	0.76	3.39	1.0	
MRID1b	1.10	0.98	1.04	1.11	1.03	0.59	0.52	0.40	0.39	0.40	0.27	0.22	1.11	1.5	
Junc1	1.54	1.39	1.49	1.58	1.51	1.41	1.64	1.61	1.73	1.85	1.33	1.04	1.85	12.0	
Stage1	6.59	6.86	6.46	6.95	6.44	4.15	4.17	3.34	3.16	3.24	2.19	1.74	6.95	1.5	
Node6	5.63	4.95	5.18	5.49	5.17	3.04	2.69	2.03	1.87	1.89	1.25	0.98	5.63	0.5	
MRIDBas	6.59	6.86	6.46	6.95	6.44	4.15	4.17	3.34	3.16	3.24	2.19	1.74	6.95	0.5	
MRd	8.34	8.37	8.53	9.18	8.59	5.98	6.64	6.41	7.21	7.00	5.31	4.28	9.18	1.5	
DSMRd	8.95	8.96	9.72	10.54	9.94	7.49	8.26	8.20	9.07	8.97	6.70	5.35	10.54	9.0	

5 yr ARI	ARR Edition	1987	Pervious Area Losses		Initial Burst Loss (mm)		Continuing (mm/h)		Source:	2012 Upper South Creek Flood Study (WMAwater)					
					15		1.5		BX	1.3					
									Roughness	0.025					
ARI (yrs)	5	5	5	5	5	5	5	5	5	5	5	5	5	Peak Flow (m3/s)	Critical Duration (hrs)
Subcatchment ID	Storm Burst Duration (mins)														
	30	45	60	90	120	180	270	360	540	720	1440	2160			
N5	1.61	2.36	2.74	2.78	2.89	2.49	3.12	2.75	2.57	2.68	1.89	1.47	3.12	4.5	
N1	1.19	1.83	2.14	2.25	2.39	2.14	2.45	2.29	2.19	2.28	1.66	1.30	2.45	4.5	
N2	3.27	4.61	5.30	5.44	5.61	4.99	5.98	5.42	5.25	5.51	3.99	3.13	5.98	4.5	
N3	0.42	0.56	0.65	0.66	0.69	0.51	0.69	0.61	0.54	0.55	0.37	0.28	0.69	4.5	
N4	0.11	0.15	0.17	0.17	0.18	0.13	0.17	0.15	0.14	0.14	0.09	0.07	0.18	2.0	
N34	3.62	5.04	5.83	6.05	6.27	5.48	6.54	6.00	5.82	5.94	4.38	3.49	6.54	4.5	
S1	0.20	0.23	0.30	0.36	0.37	0.26	0.25	0.18	0.16	0.16	0.10	0.08	0.37	2.0	
S2	0.83	1.16	1.34	1.38	1.48	1.36	1.55	1.44	1.40	1.47	1.07	0.84	1.55	4.5	
S3	1.29	1.65	1.89	1.97	2.14	1.75	2.12	1.89	1.85	1.94	1.38	1.08	2.14	2.0	
MRID3	2.02	1.82	1.96	2.10	1.99	1.11	1.00	0.76	0.67	0.64	0.44	0.34	2.10	1.5	
MRID2a	3.99	3.56	3.81	4.05	3.83	2.09	1.85	1.39	1.24	1.24	0.83	0.65	4.05	1.5	
MRID2b	3.61	3.23	3.49	3.72	3.52	1.94	1.74	1.36	1.23	1.24	0.83	0.65	3.72	1.5	
Junc2	3.27	4.61	5.30	5.44	5.61	4.99	5.98	5.42	5.25	5.51	3.99	3.13	5.98	4.5	
MRID1	4.07	3.27	4.47	4.35	4.25	2.70	2.39	1.91	1.80	1.85	1.28	1.02	4.47	1.0	
MRID1b	1.45	1.28	1.38	1.48	1.38	0.78	0.69	0.54	0.51	0.53	0.37	0.30	1.48	1.5	
Junc1	2.02	2.09	2.39	2.50	2.60	2.20	2.67	2.40	2.35	2.50	1.81	1.43	2.67	4.5	
Stage1	8.68	9.04	8.59	9.16	8.60	5.54	5.60	4.51	4.17	4.27	2.92	2.32	9.16	1.5	
Node6	7.39	6.47	6.85	7.28	6.85	4.03	3.58	2.74	2.46	2.48	1.66	1.31	7.39	0.5	
MRIDBas	8.68	9.04	8.59	9.16	8.60	5.54	5.60	4.51	4.17	4.27	2.92	2.32	9.16	1.5	
MRd	11.64	11.28	12.27	13.45	12.50	9.06	10.25	9.96	9.72	9.42	7.20	5.81	13.45	1.5	
DSMRd	13.23	12.84	14.80	16.20	15.26	11.26	13.22	12.63	12.21	12.09	9.10	7.28	16.20	1.5	

100 yr ARI	ARR Edition	1987	Pervious Area Losses		Initial Burst Loss (mm)		Continuing (mm/h)		Source:	2012 Upper South Creek Flood Study (WMAwater)					
					15		1.5		BX	1.3					
									Roughness	0.025					
ARI (yrs)	100	100	100	100	100	100	100	100	100	100	100	100	100	Peak Flow (m3/s)	Critical Duration (hrs)
Subcatchment ID	Storm Burst Duration (mins)														
	30	45	60	90	120	180	270	360	540	720	1440	2160			
N5	5.39	6.10	6.75	6.70	7.03	5.37	5.95	5.12	4.40	4.51	3.17	2.49	7.03	2.0	
N1	4.15	4.95	5.40	5.34	5.47	4.29	5.09	4.34	3.73	3.87	2.80	2.22	5.47	2.0	
N2	10.22	11.54	12.80	12.97	13.32	10.34	11.96	10.31	8.90	9.24	6.70	5.32	13.32	2.0	
N3	1.26	1.37	1.56	1.56	1.67	1.29	1.22	1.04	0.90	0.91	0.61	0.48	1.67	2.0	
N4	0.33	0.36	0.40	0.41	0.44	0.34	0.31	0.26	0.23	0.23	0.15	0.12	0.44	2.0	
N34	10.90	12.50	14.00	14.10	14.53	11.39	12.90	11.38	9.88	9.94	7.37	5.92	14.53	2.0	
S1	0.59	0.56	0.69	0.72	0.69	0.47	0.41	0.30	0.26	0.26	0.17	0.13	0.72	1.5	
S2	2.64	3.11	3.38	3.34	3.56	2.71	3.23	2.79	2.41	2.50	1.81	1.43	3.56	2.0	
S3	3.65	4.09	4.61	4.79	5.05	3.81	4.17	3.67	3.16	3.26	2.33	1.84	5.05	2.0	
MRID3	3.20	2.93	3.22	3.45	3.27	1.86	1.64	1.22	1.07	1.06	0.71	0.57	3.45	1.5	
MRID2a	6.21	5.75	6.14	6.49	6.16	3.40	3.02	2.27	1.98	1.99	1.35	1.07	6.49	1.5	
MRID2b	5.69	5.22	5.68	6.05	5.71	3.26	2.94	2.28	1.99	2.00	1.36	1.08	6.05	1.5	
Junc2	10.22	11.54	12.80	12.97	13.32	10.34	11.96	10.31	8.90	9.24	6.70	5.32	13.32	1.5	
MRID1	6.72	5.44	7.33	7.11	6.92	4.53	4.09	3.31	2.93	3.01	2.10	1.69	7.33	2.0	
MRID1b	2.29	2.10	2.27	2.41	2.27	1.30	1.17	0.94	0.84	0.87	0.61	0.49	2.41	9.0	
Junc1	4.58	5.04	5.65	5.84	5.87	4.61	5.32	4.58	3.98	4.17	3.03	2.41	5.87	1.0	
Stage1	14.48	15.18	14.52	15.07	14.47	9.35	9.45	7.66	6.75	6.89	4.80	3.85	15.18	2.00	
Node6	11.68	10.54	11.27	11.94	11.23	6.64	5.95	4.54	3.96	3.98	2.71	2.15	11.94	2.0	
MRIDBas	14.48	15.18	14.52	15.07	14.47	9.35	9.45	7.66	6.75	6.89	4.80	3.85	15.18	0.8	
MRd	21.9	20.6	24.3	26.9	25.0	19.7	20.6	18.4	16.3	15.7	12.1	9.8	26.91	1.5	
DSMRd	27.32	26.20	31.07	33.35	31.70	24.62	26.53	22.87	20.36	20.23	15.26	12.26	33.35	1.5	

200 yr ARI	ARR Edition	1987		Pervious Area Losses				Source:	2012 Upper South Creek Flood Study (WMAwater)						
				Initial Burst Loss (mm)		15		BX	1.3						
				Continuing (mm/h)		1.5		Roughness	0.025						
ARI (yrs)	2	2	2	2	2	2	2	2	2	2	2	2	2	Critical	
Subcatchment ID	Storm Burst Duration (mins)												Peak Flow (m3/s)	Duration (hrs)	
	30	45	60	90	120	180	270	360	540	720	1440	2160			
N5	6.39	7.09	7.85	7.77	8.23	6.29	6.65	5.72	4.91	5.03	3.53	2.78	8.23	2.0	
N1	4.97	5.74	6.28	6.20	6.41	5.00	5.72	4.88	4.17	4.32	3.12	2.47	6.41	2.0	
N2	12.02	13.36	14.87	15.00	15.49	12.02	13.46	11.57	9.94	10.29	7.46	5.94	15.49	2.0	
N3	1.48	1.59	1.80	1.82	1.94	1.51	1.37	1.16	1.00	1.01	0.68	0.54	1.94	2.0	
N4	0.39	0.41	0.46	0.48	0.51	0.39	0.35	0.29	0.25	0.25	0.17	0.13	0.51	2.0	
N34	12.79	14.46	16.27	16.26	16.82	13.18	14.52	12.75	11.03	11.06	8.21	6.61	16.82	2.0	
S1	0.72	0.66	0.78	0.80	0.76	0.52	0.45	0.33	0.29	0.29	0.19	0.15	0.80	1.5	
S2	3.15	3.61	3.95	3.91	4.19	3.21	3.63	3.13	2.69	2.78	2.01	1.60	4.19	2.0	
S3	4.28	4.75	5.34	5.57	5.86	4.46	4.68	4.11	3.53	3.64	2.59	2.06	5.86	2.0	
MRID3	3.55	3.25	3.58	3.83	3.63	2.07	1.82	1.35	1.18	1.18	0.79	0.63	3.83	1.5	
MRID2a	6.86	6.35	6.78	7.17	6.81	3.76	3.35	2.51	2.19	2.20	1.49	1.19	7.17	1.5	
MRID2b	6.29	5.77	6.28	6.70	6.33	3.63	3.26	2.52	2.19	2.21	1.51	1.20	6.70	1.5	
Junc2	12.02	13.36	14.87	15.00	15.49	12.02	13.46	11.57	9.94	10.29	7.46	5.94	15.49	2.0	
MRID1	7.48	6.04	8.12	7.89	7.67	5.05	4.57	3.69	3.25	3.33	2.34	1.88	8.12	1.0	
MRID1b	2.53	2.32	2.51	2.67	2.52	1.44	1.30	1.04	0.93	0.96	0.68	0.55	2.67	1.5	
Junc1	5.35	5.80	6.58	6.74	6.78	5.34	6.00	5.14	4.43	4.64	3.37	2.69	6.78	2.0	
Stage1	16.07	16.85	16.14	16.71	16.09	10.41	10.50	8.51	7.47	7.62	5.32	4.27	16.85	0.8	
Node6	12.93	11.66	12.49	13.25	12.45	7.36	6.59	5.02	4.38	4.40	3.00	2.39	13.25	1.5	
MRIDBas	16.07	16.85	16.14	16.71	16.09	10.41	10.50	8.51	7.47	7.62	5.32	4.27	16.85	0.8	
Mrd	24.94	23.33	27.80	30.73	28.58	22.62	23.35	20.56	18.09	17.47	13.46	10.88	30.73	1.5	
DSMRd	31.33	30.03	35.56	38.01	36.24	28.16	29.98	25.45	22.61	22.49	16.99	13.66	38.01	1.5	

Ultimate Basin sized to meet target at Mamre Road - 2 yr ARI (36 hr) & 100 yr ARI (36 hr)

5 yr ARI	ARR Edition	1987	Previous Area Losses		Initial Burst Loss (mm)		Source:		2012 Upper South Creek Flood Study (WMAwater)	
							BX	1.3		
							Roughness	0.025		
ARI (yrs)	0	1	5	5	5	5	5	5	5	5
Subcatchment ID	Storm Burst Duration (mins)									
	30	45	60	90	120	180	270	360	540	720
	150	240	1440	2160	1440	2160	1440	2160	1440	2160
	Peak Flow (m³/s)									
	Critical Duration (hrs)									
N5	1.58	2.32	2.71	2.73	2.88	2.48	3.06	2.73	2.56	2.66
N1	1.17	1.81	2.13	2.23	2.37	2.14	2.41	2.27	2.19	2.27
N2	2.99	4.13	4.79	4.87	5.11	4.46	5.29	4.85	4.74	4.88
N3	0.40	0.55	0.63	0.64	0.66	0.50	0.68	0.60	0.54	0.55
N4	0.11	0.14	0.16	0.17	0.18	0.13	0.17	0.15	0.14	0.14
N34	3.39	4.65	5.45	5.55	5.87	4.97	5.94	5.48	5.34	5.41
S1	0.20	0.22	0.29	0.34	0.36	0.25	0.24	0.18	0.16	0.10
S2	0.81	1.16	1.32	1.35	1.46	1.34	1.52	1.42	1.39	1.46
S3	1.26	1.65	1.88	1.92	2.11	1.72	2.08	1.95	1.93	1.98
MRD3	2.39	2.15	2.32	2.46	2.34	2.22	1.33	0.86	0.75	0.50
MRD1	3.98	3.55	3.79	4.03	3.82	2.08	1.84	1.37	1.23	1.25
MRD2b	3.61	3.23	3.47	3.71	3.52	1.93	1.74	1.35	1.22	1.24
JunC2	3.19	4.53	5.27	5.38	5.57	4.96	5.91	5.36	5.24	5.49
MRD1	4.05	3.26	4.46	4.34	4.24	2.69	2.38	1.89	1.78	1.84
MRD1a	1.45	1.28	1.38	1.47	1.37	0.77	0.69	0.53	0.52	0.53
JunC1	2.02	2.05	2.36	2.44	2.56	2.18	2.65	2.36	2.33	2.49
Stage1	0.73	0.87	0.96	1.05	1.10	1.16	1.18	1.21	1.32	1.29
Nod6	7.36	6.47	6.80	7.22	6.80	4.01	3.57	2.72	2.48	1.86
MRD1a	8.62	9.01	8.51	9.15	8.51	5.51	5.55	4.46	4.15	2.91
MRD1	4.23	5.74	6.84	6.84	7.10	6.40	7.36	6.89	6.94	7.04
DSMRd	7.24	9.52	10.93	11.15	11.65	10.07	11.58	10.91	10.58	10.57
Peak Inflow (m³/s)	8.62	9.01	8.51	9.15	8.51	5.51	5.55	4.46	4.15	4.25
Peak Outflow (m³/s)	0.73	0.87	0.96	1.05	1.10	1.16	1.18	1.21	1.32	1.29
Max Vol (m³)	10,325	12,372	13,915	15,662	16,803	17,974	18,395	19,149	21,765	21,045
Max Stage (m)	1.17	1.40	1.58	1.77	1.90	2.04	2.08	2.17	2.47	2.38

AN/4 Hydrology/Hydraulics\XPRAFTS\Aspect Rafts\xprafts Results v4.xlsx

Final Masterplan with Basin Conditions

500 yr ARI	ARR Edition	1987	Initial Area Losses Partial Burst Loss (mm)				Source BX	2012 Upper South Creek Flood Study (WMAwater)			
			Continuing (mm/h)				1.3	Roughness			
ARI (yrs)	5	5	5	5	5	5	5	5	5	5	5
Subcatchment ID	Storm Burst Duration (mins)										
	30	45	60	90	120	180	270	360	540	720	1440
	Peak Flow (m ³ /s)										
	Critical Duration (hrs)										
N5	7.72	8.43	9.40	9.25	9.86	7.60	7.59	6.52	5.61	5.72	4.02
N1	6.11	6.84	7.50	7.42	7.74	6.01	6.54	5.58	4.77	4.93	3.56
N2	14.48	15.89	17.79	17.81	18.45	14.32	15.46	13.25	11.73	11.72	8.50
N3	1.78	1.88	2.12	2.18	2.31	1.78	1.56	1.31	1.14	0.78	0.61
N4	0.46	0.46	0.55	0.63	0.68	0.46	0.40	0.33	0.29	0.20	0.15
N34	15.55	17.17	19.34	19.22	19.95	15.61	16.69	14.57	12.58	12.58	9.36
S1	0.88	0.78	0.90	0.92	0.87	0.58	0.51	0.37	0.32	0.32	0.17
S2	3.84	4.31	4.72	4.75	5.07	3.90	4.16	3.59	3.08	3.18	2.29
S3	7.16	5.64	6.35	6.66	7.00	5.36	5.36	4.70	4.03	4.14	2.96
MRD03	4.07	3.67	4.08	4.08	4.12	3.34	2.95	2.52	1.33	1.33	0.73
MRD1	7.15	7.17	7.65	8.09	7.69	4.22	3.79	2.83	2.47	2.48	1.69
MRD2b	7.12	6.52	7.12	7.59	7.18	4.14	3.71	2.85	2.48	2.50	1.71
JunC2	14.48	15.89	17.79	17.81	18.45	14.32	15.46	13.25	11.35	11.72	8.50
JunC1	6.51	6.85	9.20	8.95	8.70	5.73	5.23	4.20	3.68	3.77	2.65
MRD1b	2.82	2.86	2.85	2.85	2.85	1.64	1.48	1.19	1.05	1.09	0.73
JunC1	8.48	8.89	7.83	7.98	8.05	6.35	5.88	5.08	5.28	5.84	3.06
Stage1	1.40	1.58	1.70	2.80	3.53	3.39	3.97	3.89	5.97	4.75	4.53
Node6	14.63	13.20	14.18	15.05	14.12	8.37	7.48	5.67	4.95	4.97	3.40
MRD2b	19.23	19.12	18.36	18.65	18.86	11.86	11.95	9.59	8.45	8.61	6.04
MRd	16.87	18.62	20.83	20.75	21.49	17.04	18.27	16.13	17.71	17.13	13.66
DSMRd	21.51	25.21	27.48	27.22	28.12	23.00	24.21	21.62	22.43	20.67	15.24
Peak Inflow (m ³ /s)	16.87	18.62	20.83	20.75	21.49	17.04	18.27	16.13	17.71	17.13	13.66
Peak Outflow (m ³ /s)	14.92	13.20	14.18	15.05	14.12	8.37	7.48	5.67	4.95	4.97	3.40
Max Vol (m3)	23,878	28,903	32,644	36,005	37,047	37,636	37,607	37,510	38,801	38,523	38,268
Max Stage (m)	2.71	3.27	3.70	3.74	4.08	4.20	4.26	4.26	4.51	4.36	3.44

(refer Attachment B3 for Preliminary Masterplan with Basin)

B9 FM Basin ARR1987