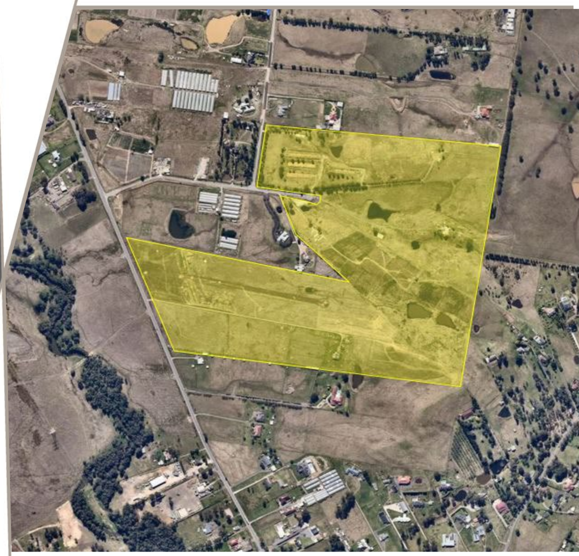
Flood Impact Assessment

Westlink Industrial Estate – Stage 1
290-308 Aldington Road, Kemps Creek

304600730



Prepared for
ESR Investment Management 1 Pty Ltd

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Executive Summary

The purpose of this report is to assess the impact of Stage 1 of the Masterplan for the development of 290-308 Aldington Road, 59-62 Abbotts Road, and 63 Abbotts Road, Kemps Creek.

The concept details of Stage 1 of the Masterplan for Westlink Industrial Estate, Kemps Creek 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 2 are given in **Figure 3.**

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 local hydrological model created to assess runoff under Benchmark Conditions was adjusted to represent Stage 1 Conditions. The adopted imperviousness for the proposed development was 90%.

Stage 1 Conditions

The approach proposed by AT&L to mitigate the impact of the Stage 1 development is to construct a basin as set out in **Figure 2.**

The Site Storage Requirements for 2 yr ARI and 100 yr ARI events determined for Aspect Industrial Estate were applied to the catchment draining to the basin located in Stage 1 and gave an estimate of the required basin storage as detailed in **Table 1**. The concept basin SSR and PSD was determined under ARR1987.

The results of the ARR1987 hydrological modelling of Stage 1 Conditions without the Basin are summarised in **Appendix B**.

Hydraulics

Masterplan Conditions

The DEM as updated based on the proposed platform levels, proposed roadworks, basin and swales under Stage 1 Conditions as provided by AT&L.

The basin was included in the TUFLOW model as was tall pipe drainage lines. Benchmark conditions were adopted external to the Stage 1 development.

The roughness zones for the floodplain are mapped in **Figure 4**.

The TUFLOW floodplain model was run for the critical storm burst durations for the 20yr 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

The plots of flood level difference disclose minor adverse impacts on flood levels downstream of the outfall of the Stage 1 drainage line in the 20yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI and PMF events. The degree of impact progressively reduces as the severity of flooding increases such that in the 500 yr ARI event the extent of impacts is substantially reduced in area. The impacts occur on agricultural lands only.

Likewise, the plots of flood velocity differences disclose minor adverse impacts on flood velocities downstream of the outfall of the Stage 1 drainage line in the 20yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI and PMF events. The degree of impact varies with the severity of flooding. The impacts occur on agricultural lands only.

The flood impact assessment has been undertaken on the basis of currently available information downstream of the development in Abbotts Road and Aldington Road. We understand that the future upgrade to Abbotts Road and Aldington Road will include an upgrade to drainage to accommodate outflows from the Westlink Stage 1 development. When Westlink Stage 1 is to be built, there will either be an existing pipe to connect into to contain the entirety of the 20 yr ARI flows, or an outlet swale must be maintained in the Abbotts Road reserve to convey at least the 20 yr ARI flows to the Mamre Rd culverts until the pipes are built. Noting that the impacts are greatest in the 20 yr ARI storm, and minimal in the larger floods and the PMF, the flooding impacts of concern will be reduced or removed by these pipes or swales.

Planning Considerations

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

It is concluded that the proposed development under the Masterplan addresses all of the considerations set out under Section 2.5 of the Mamre Road DCP.

How the Stage 1 of the Masterplan applies 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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1 Introduction

As described, in part, in the Westlink Industrial Estate EIS (Ethos Urban, 2021):

> *ESR's vision for the site involves the delivery of a high-quality industrial estate at 290-308 Aldington Road, 59-62 Abbotts Road, and 63 Abbotts Road, Kemps Creek that integrates with and supports the establishment and transition of the Mamre Road Precinct into a new warehousing industrial hub and contributes to the overall provision of in-demand industrial land in Western Sydney. ……*
>
> *The site is located within the suburb of Kemps Creek, within the Penrith Local Government Area (LGA). It forms part of the Mamre Road Precinct, which sits within both the Western Sydney Employment Area and Western Sydney Aerotropolis. ……..*
>
> *The site is located approximately 60km west of the Sydney CBD and 20km south east of the Penrith CBD. It is partially located along Aldington Road, and the Abbotts Road cul-de-sac. Both Aldington and Abbotts Road connects to Mamre Road, which is a major corridor providing vehicular access to the M4 and M7 motorways, and The Northern Road corridor (A9). This allows easy and efficient freight access to Greater Sydney*

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 is zoned IN1 General Industrial with limited area zones E2 Environmental Conservation and SP2 Infrastructure.

Following site preparation works, it is envisioned that Westlink is to be constructed in multiple stages. This will enable the orderly development of the site and minimise construction impacts on surrounding sensitive receivers (Ethos Urban, 2021).

Stage 1 construction works will involve the construction of the internal road network, warehouse 1 on the northern part of the site within the proposed Lot 1 including its associated site landscaping and vehicular parking, warehouse 4 on the middle part of the site and the detention basin sized for ultimate conditions.

The remaining aspects of the proposed development will be constructed in two further stages as the uptake of industrial floor space requires.

1.1 Purpose of this Report

The purpose of this report is to assess the impact of Stage 1 of the Masterplan for the development of 290-308 Aldington Road, 59-62 Abbotts Road, and 63 Abbotts Road, Kemps Creek. 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 proposed Westlink Industrial Estate is indicated in **Figure 1**.

1.3 Stage 1 of the Masterplan

The concept details of Stage 1 of the Masterplan for Westlink Industrial Estate are given in **Figure 2**.

Figure 1 Location of the Project Site (Source: nearmap, accessed 6 September 2022)

Figure 2 Stage 1 of the Masterplan for Westlink Industrial Estate

1.4 2022 Flood Risk Assessment

The purpose of this report is 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 proposed warehouses based on an assessment of flooding under pre-development conditions on 290-308 Aldington Road, 59-62 Abbotts Road, and 63 Abbotts Road, Kemps Creek.

1.4.1 Hydrology

The 2015 South Creek flood study identified the critical storm burst duration for mainstream flooding in South Creek downstream of Bringelly Road to be 36 hours and for the lower reach of Kemps Creek up to 600 m downstream of Elizabeth drive. 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.

The hydrological model assembled by WorleyParsons in 2015 and updated by Advisian in 2020 was based on ARR1987 IFD. Consequently, a local hydrological model was created to assess runoff under benchmark conditions and to facilitate the assessment of impacts of proposed development based on ARR1987 IFD.

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 are to be included in the benchmark conditions. An initial assessment was undertaken of the regional significance or otherwise of the farm dams in the Aspect Industrial Estate catchment 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".

Based on the conclusions of the assessment of farm dams in the Aspect Industrial Estate (AIE) catchment, farm dams have been ignored when assessing "Benchmark Conditions".

Design rainfall and storm burst patterns were obtained from ARR1987 for 20 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.

1.4.2 Hydraulics

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

The Digital Elevation Model (DEM) was created by combining available survey and ALS data.

The roughness zones for the floodplain are mapped in **Figure 8**.

Existing local drainage crossings of Mamre Road were also included in the floodplain model based on supplied survey.

Inflows to the TUFLOW model were exported from the hydrological model and input at the locations of the subcatchment outlets (nodes). 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 20 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.

1.5.1 Hydrology

The hydrological model assembled by WorleyParsons in 2015 and updated by Advisian in 2020 was based on ARR1987 IFD. Consequently, a local hydrological model was created to assess runoff under Stage 1 conditions and to facilitate the assessment of impacts of proposed development based on ARR1987 IFD.

1.5.2 Hydraulics

Given that the proposed development is located in a local catchment which drains to Kemps 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 Stage 1 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 (1 in x)	ARI
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 design floods. In the case of assessments based on ARR2019 the AEP terminology was adopted 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 now Stantec, 2022. This local hydrological model of benchmark conditions was adjusted to represent Stage 1 Conditions as follows.

The subcatchment boundaries and the link-node layout of the local XP-RAFTS model are given in **Figure 3**.

2.1 Basin Strategy

The approach proposed by AT&L to mitigate the impact of the Stage 1 development is to construct a basin as set out in **Figure 2.**

2.2 Concept Sizing of a Basin

In Section 6.4.2 Detention Strategy of Sydney Water, 2020:

It is recommended that each industrial lot implements on-site stormwater detention as prescribed by Table 6.

Table 6 OSD requirements on industrial lots within Mamre Road Precinct

Zone	50% AEP SSR (m^3/ha)	50% AEP PSD (l/s/ha)	1% AEP SSR inclusive of 50% AEP SSR (m^3/ha)	1% AEP PSD (l/s/ha)
East Catchments draining towards Ropes Creek	190	40	393	150
North Catchment draining towards WaterNSW Warragamba Pipeline	190	40	393	150
West Catchments draining towards Ropes Creek	190	40	393	150

A detailed assessment of the size of basin needed to mitigate the impact of development on 2 yr ARI and 100 yr ARI runoff from the nearby 56 ha Aspect Industrial Estate is described by Cardno, 2020a. This estate is of comparable size to the section of the 200 Aldington Road Industrial Estate which drains to Kemps Creek.

The concept sizing of a basin for Aspect Industrial Estate was undertaken for ARR1987 conditions. A similar concept sizing of a basin to mitigate the impact of development on 50% AEP and 1% AEP runoff from the Aspect Industrial Estate was undertaken for ARR2019 conditions.

The basin assessments included.

- An ARR1987 assessment which targeted the 2yr ARI (12 hour) and 100 yr ARI (2 hour) peak flows under benchmark conditions in the local catchment draining to South Creek; and
- An ARR2019 assessment which targeted the 50%AEP (6 hour) and 1% AEP (45 minutes) peak flows under benchmark conditions in the local catchment draining to South Creek.

The Site Storage Requirements for 2 yr ARI and 100 yr ARI events determined for Aspect Industrial Estate were applied to the catchment draining to the basin located in Stage 1 and gave an estimate of the required basin storage as detailed in **Table 1**. The concept basin SSR and PSD was determined under ARR1987.

Table 1 Indicative Basin SSR and PSD Values

	Aspect Industrial Estate Area (ha)	55.9							
	Aspect Industrial Estate	SSR (m3)		SSR (m3/ha)		PSD (m3/s)		PSD L/s/ha)	
ARR		2 yr ARI/ 50% AEP	100 yr ARI/ 1% AEP	2 yr ARI/ 50% AEP	100 yr ARI/ 1% AEP	2 yr ARI/ 50% AEP	100 yr ARI/ 1% AEP	2 yr ARI/ 50% AEP	100 yr ARI/ 1% AEP
1987	2 yr ARI (12 hr) & 100 yr ARI (2 hr)	11,250	23,500	201	420	2.39	6.58	42.8	117.7
1987	2 yr ARI (36 hr) & 100 yr ARI (36 hr)	24,500	42,900	438	767				
2019	50% AEP (6 hr) & 1% AEP (45 mins)	16,820	28,710	301	514				

	ESR Industrial Estate Area (ha)	32.69							
	ESR Industrial Estate	SSR (m3)		SSR (m3/ha)		PSD (m3/s)		PSD L/s/ha)	
ARR		2 yr ARI/ 50% AEP	100 yr ARI/ 1% AEP	2 yr ARI/ 50% AEP	100 yr ARI/ 1% AEP	2 yr ARI/ 50% AEP	100 yr ARI/ 1% AEP	2 yr ARI/ 50% AEP	100 yr ARI/ 1% AEP
1987	2 yr ARI (12 hr) & 100 yr ARI (2 hr)	6,579	13,743	201	420	1.40	3.85	42.8	117.7

2.3 Hydrological Modelling

A local hydrological model was created to assess runoff under Stage 1 conditions and to facilitate the assessment of impacts of proposed development. The subcatchment boundaries and the link-node layout of the local XP-RAFTS model are given in **Figure 3**.

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 PMP depths were generated using the procedures built into XP-RAFTS which estimate PMP depths in accordance with in The Estimation of Probable Maximum Precipitation in Australia: Generalised Short – Duration Method (Bureau of Meteorology, 2003). The PMP depths for the local catchment (which would fall wholly within Ellipse A) were as follows:

Duration (mins)	Ellipse A Depth (mm)	Ellipse A Intensity (mm/h)
15	243	972
30	347	694
45	437	583
60	507	507
90	622	415
120	716	358
180	847	282
240	950	238

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.

The results of the ARR1987 hydrological modelling are summarised in **Appendix B.**

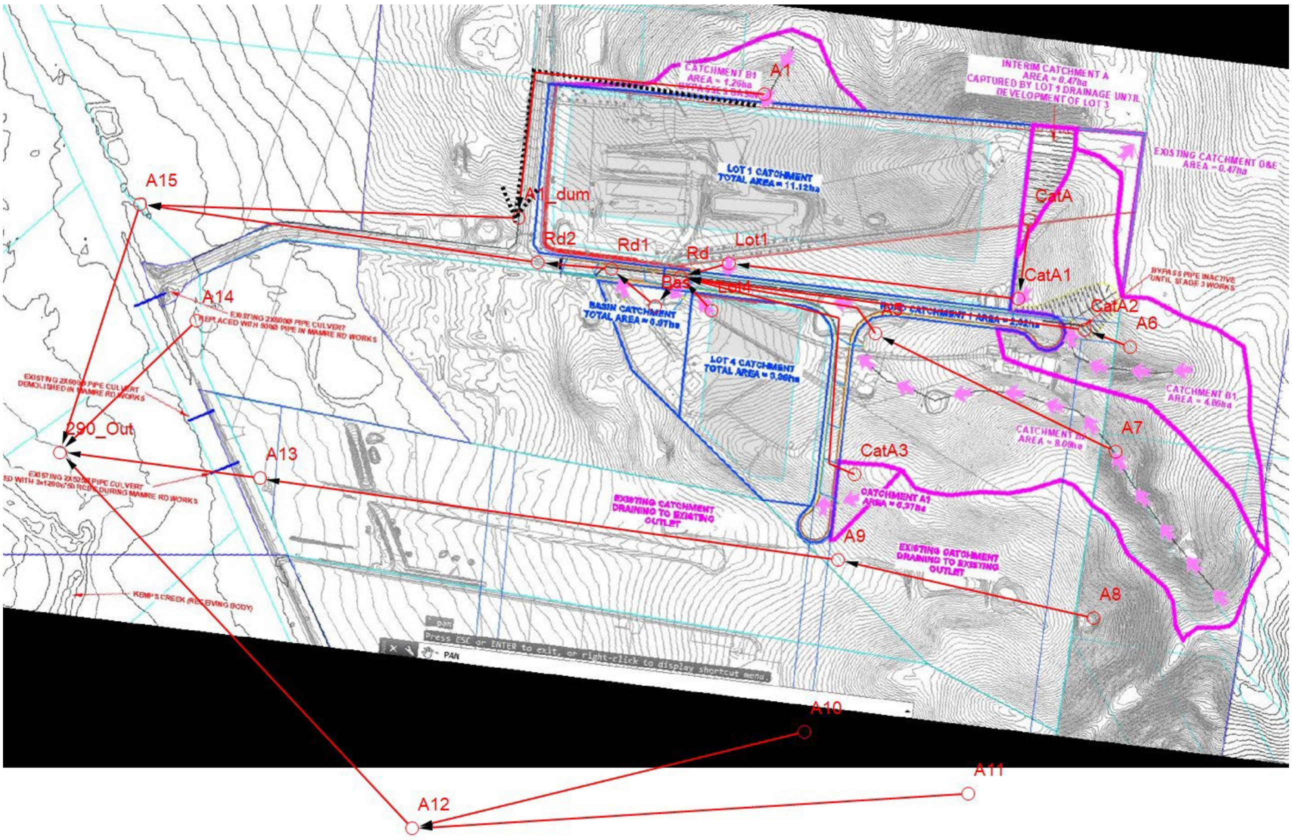


Figure 3 XP-RAFTS Subcatchment Layout for Stage 1 of the Westlink Industrial Estate

3 Flooding Assessment

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

The DEM as updated based on the proposed platform levels, proposed roadworks, basin and swales under Stage 1 Conditions as provided by AT&L.

The basin was included in the TUFLOW model as was tall pipe drainage lines. Benchmark conditions were adopted external to the Stage 1 development.

The roughness zones for the floodplain are mapped in **Figure 4**.

Figure 4 Adopted Roughness Zones under Stage 1 Conditions

Existing local drainage crossings of Mamre Road were also included in the floodplain model based on supplied survey.

Inflows to the TUFLOW model were exported from the hydrological model and input at the locations of the subcatchment outlets (nodes). 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.

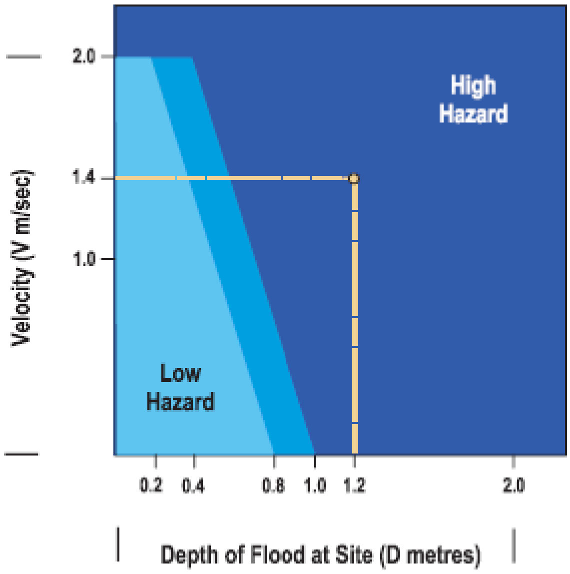
3.1 Stage 1 Conditions

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.

3.1.1 20 yr ARI

The estimated 20 year ARI flood levels and extent, depths and velocities under Stage 1 Conditions are plotted in **Figures F1, F2** and **F3** respectively.

Experience from studies of floods throughout NSW and elsewhere has allowed authorities to develop methods of assessing the hazard to life and property on floodplains. This experience has been used in developing the NSW Floodplain Development Manual to provide guidelines for managing this hazard. These guidelines are shown schematically below.



Provisional Hazard Categories (after Figure L2, NSW Government, 2005)

To use the diagram, it is necessary to know the average depth and velocity of floodwaters at a given location. If the product of depth and velocity exceeds a critical value (as shown below), the flood flow will create a high hazard to life and property.

There will probably be danger to persons caught in the floodwaters, and possible structural damage. Evacuation of persons would be difficult. By contrast, in low hazard areas people and their possessions can be evacuated safely by trucks. Between the two categories a transition zone is defined in which the degree of hazard is dependent on site conditions and the nature of the proposed development.

This calculation leads to a provisional hazard rating. The provisional hazard rating may be modified by consideration of effective flood warning times, the rate of rise of floodwaters, duration of flooding and ease or otherwise of evacuation in times of flood. The estimated 2 year ARI provisional flood hazard under Benchmark Conditions are plotted in **Figure F4**.

3.1.2 100 yr ARI

The estimated 100 year ARI flood levels and extent, depths, velocities and hazards under Benchmark Conditions are plotted respectively in **Figures F7, F8, F9** and **F10**.

3.1.3 200 yr ARI

The estimated 200 year ARI flood levels and extent, depths, velocities and hazards under Benchmark Conditions are plotted respectively in **Figures F13, F14, F15** and **F16**.

3.1.4 500 yr ARI

The estimated 500 year ARI flood levels and extent, depths, velocities and hazards under Benchmark Conditions are plotted respectively in **Figures F19, F20, F21** and **F22.**

3.1.5 PMF

The estimated PMF levels and extent, depths, velocities and hazards under Benchmark Conditions are plotted respectively in **Figures F25, F26, F27** and **F28**.

4 Flood Impact Assessment

The impacts of Stage 1 of the Westlink Industrial Estate, Kemps Creek are summarised as follows.

4.1 Flood Level Impacts

The estimated impact of the Masterplan on 20 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 F5, F11, F17, F23** and **F29** respectively.

These Figures disclose minor adverse impacts on flood levels downstream of the outfall of the Stage 1 drainage line in the 20yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI and PMF events. The degree of impact progressively reduces as the severity of flooding increases such that in the 500 yr ARI event the extent of impacts is substantially reduced in area. The impacts occur on agricultural lands only.

4.2 Flood Velocity Impacts

The estimated impact of the Masterplan on 20 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 F6, F12, F18, F24** and **F30** respectively.

Likewise, these Figures disclose minor adverse impacts on flood velocities downstream of the outfall of the Stage 1 drainage line in the 20yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI and PMF events. The degree of impact varies with the severity of flooding. The impacts occur on agricultural lands only.

4.3 Discussion

The flood impact assessment has been undertaken on the basis of currently available information downstream of the development in Abbotts Road and Aldington Road. We understand that the future upgrade to Abbotts Road and Aldington Road will include an upgrade to drainage to accommodate outflows from the Westlink Stage 1 development. When Westlink Stage 1 is to be built, there will either be an existing pipe to connect into to contain the entirety of the 20 yr ARI flows, or an outlet swale must be maintained in the Abbotts Road reserve to convey at least the 20 yr ARI flows to the Mamre Rd culverts until the pipes are built. Noting that the impacts are greatest in the 20 yr ARI storm, and minimal in the larger floods and the PMF, the flooding impacts of concern will be reduced or removed by these pipes or swales.

5 Planning Considerations

The Mamre Road Precinct DCP came into force on 19 November 2021. The compliance of Stage 1 of the Westlink Industrial Estate 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 Stage 1 of the Masterplan applies 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 Study[1] 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 (FIA) and Flood Risk Assessment (FRA) have been prepared for Stage 1 of the Westlink Industrial Estate, Kemps Creek.

[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 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.

The level of subcatchment discretisation adopted by Advisian was far too coarse for the purpose of this assessment. For assessment purposes, the hydrological modelling approach which was adopted is compatible with the 2015 South Creek flooding assessments which were based on ARR1987. The adopted initial loss = 15 mm and continuing loss = 1.5 mm/h were the same as 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);*

  20 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 20 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood levels and PMF in the 2022 FRA Report.

  The flood hazards under Masterplan Conditions are mapped for 20 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).*

  The flood constraints within the subject property and adjacent to the property have been assessed in this report.

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 for 20 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 Conditions for 20 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood levels and PMF are mapped in this Report.

  These Figures disclose minor adverse impacts on flood levels downstream of the outfall of the Stage 1 drainage line in the 20yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI and PMF events. The degree of impact progressively reduces as the severity of flooding increases such that in the 500 yr ARI event the extent of impacts is substantially reduced in area. The impacts occur on agricultural lands only.

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

  Under Stage 1 Conditions all flows up to the 500 yr ARI are conveyed through the Stage 1 development 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 Creek / South Creek PMF levels. A Flood Emergency Response Plan (FERP) can be prepared if needed to respond to flood risk in extreme floods approaching the PMF.

- *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 overland flowpaths.

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 Creek / South Creek 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 Stage 1 Conditions all flows up to the 500 yr ARI are conveyed through the subject property without interacting with proposed warehouses. The 500 yr ARI flood is a surrogate for 100 yr ARI floods with climate change rainfall increase under RCP8.5 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 was not mapped for overland flowpaths through the project site. Under Stage 1 Conditions all flows up to the 500 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 Creek / South Creek 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 Creek / South Creek PMF levels. A Flood Emergency Response Plan (FERP) can be prepared if needed to respond to flood risk in extreme floods approaching the PMF.

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 20 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 Masterplan Conditions for 20 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood levels and PMF are mapped in this Report.

    These Figures disclose minor adverse impacts on flood levels downstream of the outfall of the Stage 1 drainage line in the 20yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI and PMF events. The degree of impact progressively reduces as the severity of flooding increases such that in the 500 yr ARI event the extent of impacts is substantially reduced in area. The impacts occur on agricultural lands only.

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 basin is proposed in Stage 1 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.*

    The OSD basin is incorporated into the proposed development.

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

    The subject property is higher than the Kemps Creek / South Creek PMF levels. Consequently, the basins are located outside of the mainstream flood extents. The stormwater basins are intended to reduce peak outflows from developed lots to no greater than existing conditions in events from 50% AEP up to 1% AEP.

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 consideration has informed the sizing of the basin undertaken 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 consideration has informed the sizing of the basin undertaken by AT&L

Filling of Land At or Below the Flood Planning Level

16) E*arthworks 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 Creek / South Creek PMF levels and accordingly no filling is proposed within the mainstream PMF.

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 Creek / South Creek 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 under Stage 1 of the Masterplan addresses all of the considerations set out under Section 2.5 of the Mamre Road DCP.

6 References

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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

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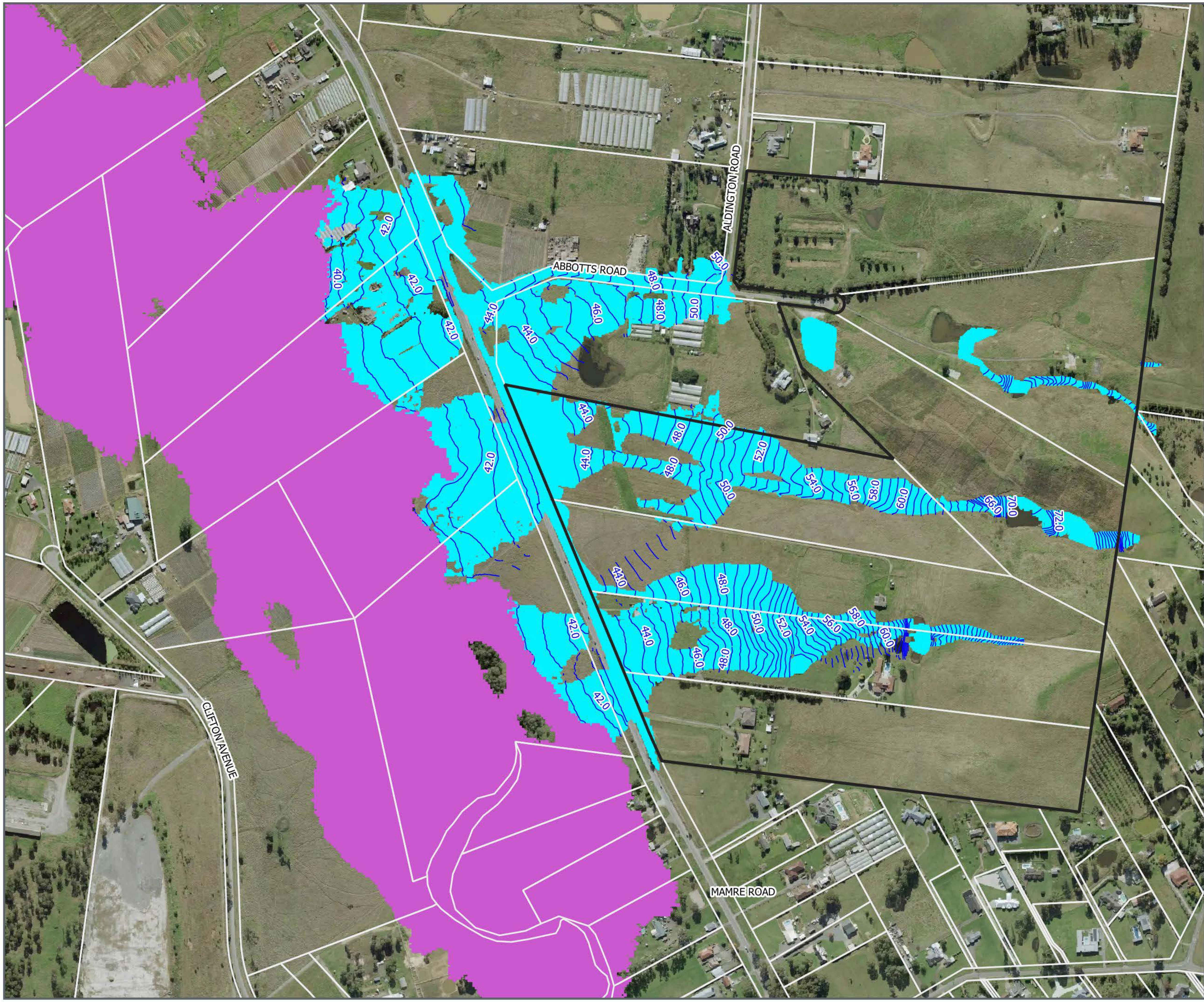

Flood Risk Assessment
Westlink Industrial Estate

Stage 1 Proposed Less Existing
20 Year ARI
Flood Extents & Flood Levels

Legend

- Site Boundary
- Cadastre
- South Creek Flood Study (2015) 100yr ARI Flood Extent
- 0.5m Water Level Contour (mAHD)
- Flood Extent

FIGURE F1

1:6,000 Scale at A3

0 80 160 240 320 m

Cardno now Stantec

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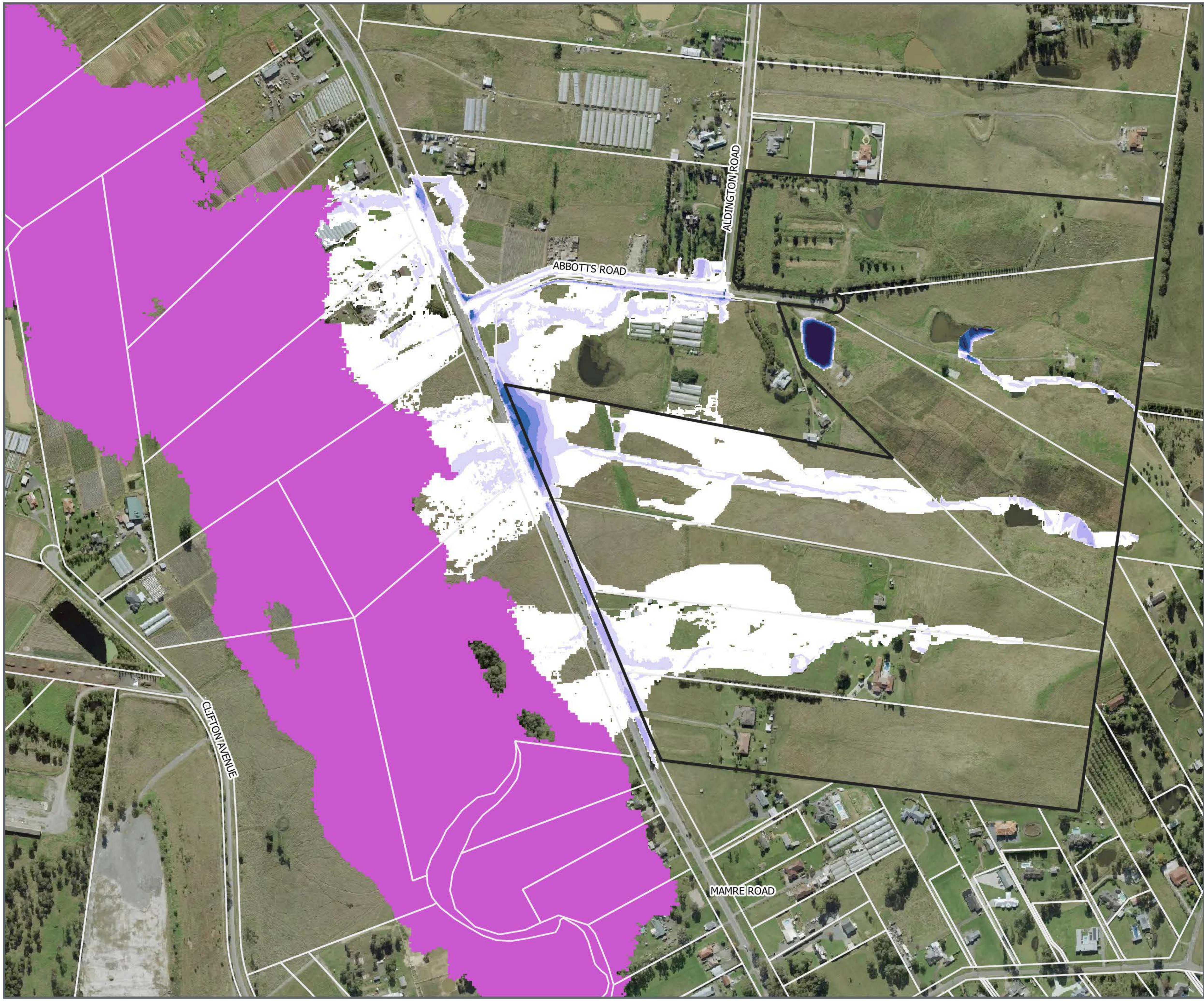
Map: 304600730_Figures.qgz



Flood Risk Assessment
Westlink Industrial Estate

Stage 1 Proposed Less Existing
20 Year ARI
Flood Depths

Legend

- Site Boundary
- Cadastre
- South Creek Flood Study (2015) 100yr ARI Flood Extent

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 F2

1:6,000 Scale at A3

0 80 160 240 320 m

Map Produced by Cardno Now Stantec (Nat W&E)
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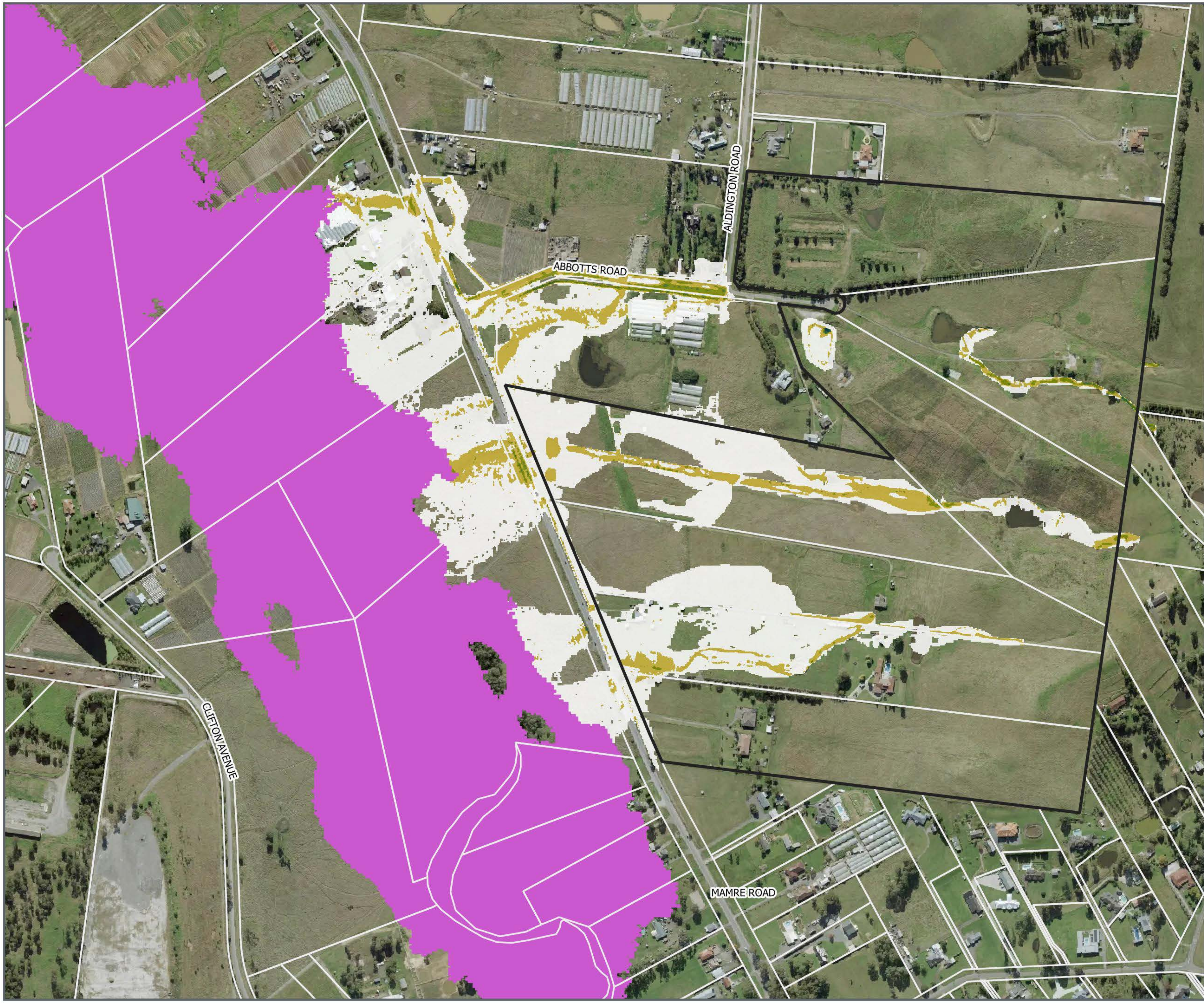
Map: 304600730_Figures.qgz



Flood Risk Assessment
Westlink Industrial Estate

Stage 1 Proposed Less Existing
20 Year ARI
Flood Velocities

Legend

- Site Boundary
- Cadastre
- South Creek Flood Study (2015) 100yr ARI Flood Extent

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 F3

1:6,000 Scale at A3

0 80 160 240 320 m

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Flood Risk Assessment Westlink Industrial Estate

Stage 1 Proposed Less Existing
20 Year ARI
Flood Hazard

Legend

- Site Boundary
- Cadastre
- South Creek Flood Study (2015) 100yr ARI Flood Extent

Flood Hazard

- Low
- Transitional
- High

FIGURE F4

1:6,000 Scale at A3

0 80 160 240 320 m

Cardno now Stantec

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Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz

Flood Risk Assessment Westlink Industrial Estate

Stage 1 Proposed Less Existing
20 Year ARI
Water Level Difference

Legend

Site Boundary

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 F5

1:6,000 Scale at A3

0 80 160 240 320 m

Map Produced by Cardno Now Stantec (Nat W&E)
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Coordinate System: MGA Zone 56
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Flood Risk Assessment
Westlink Industrial Estate

Stage 1 Proposed Less Existing
20 Year ARI
Velocity Difference

Legend

Site Boundary

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 F6

1:6,000 Scale at A3

0 80 160 240 320 m

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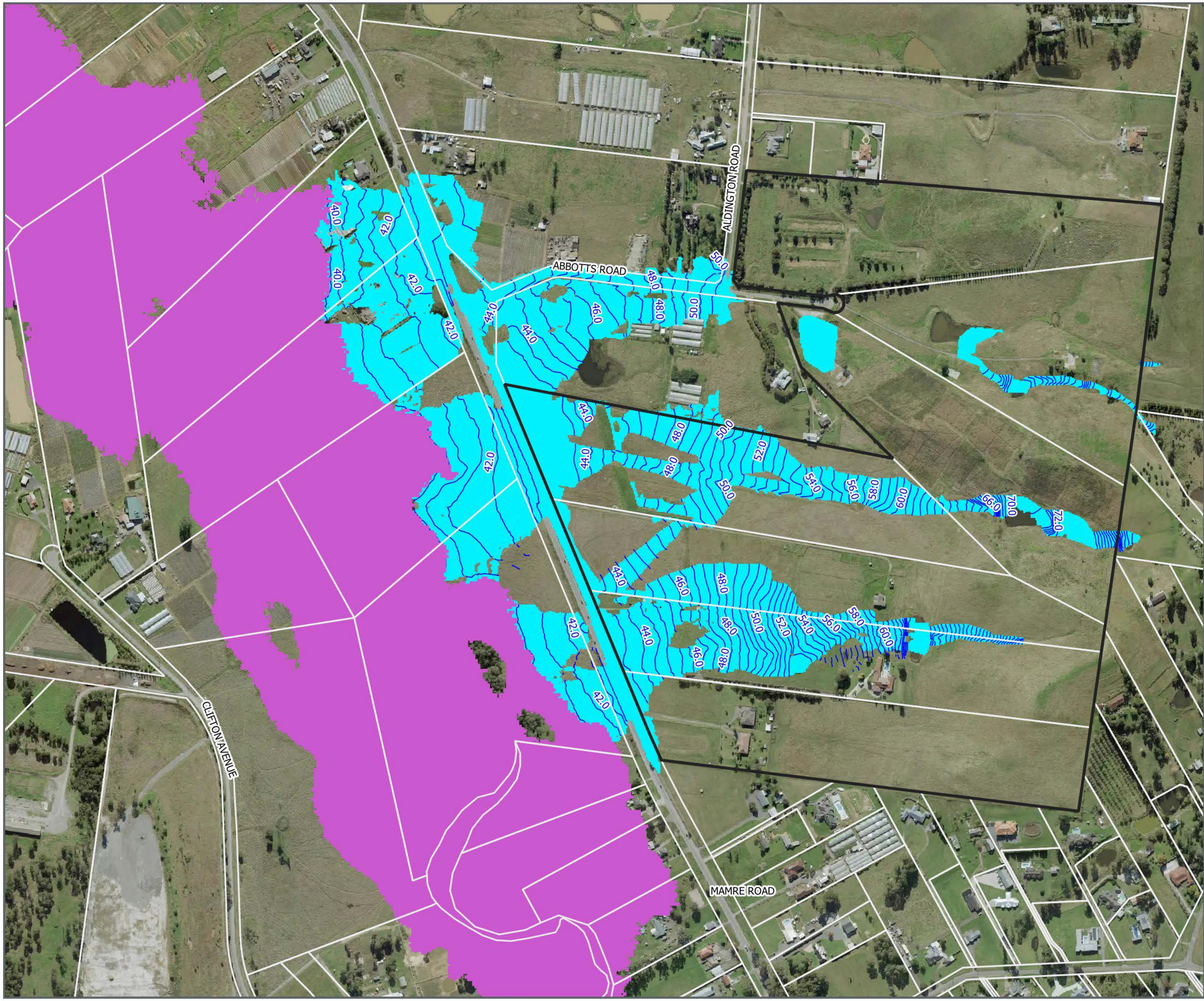
Map: 304600730_Figures.qgz



Flood Risk Assessment Westlink Industrial Estate

Stage 1 Proposed Less Existing
100 Year ARI
Flood Extents & Flood Levels

Legend

- Site Boundary
- Cadastre
- South Creek Flood Study (2015) 100yr ARI Flood Extent
- 0.5m Water Level Contour (mAHD)
- Flood Extent

FIGURE F7

1:6,000 Scale at A3

0 80 160 240 320 m

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
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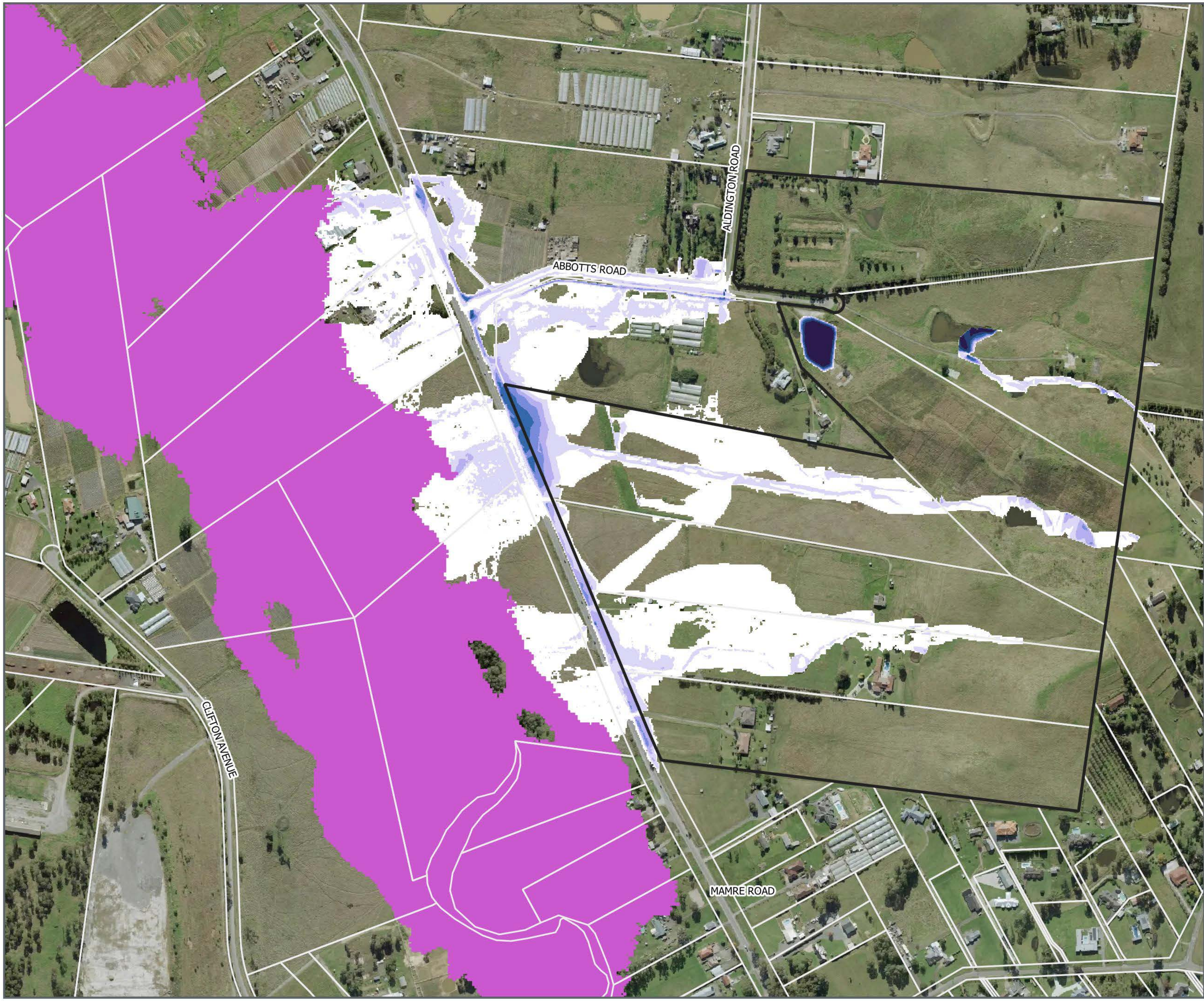
Map: 304600730_Figures.qgz



Flood Risk Assessment Westlink Industrial Estate

Stage 1 Proposed Less Existing
100 Year ARI
Flood Depths

Legend

- Site Boundary
- Cadastre
- South Creek Flood Study (2015) 100yr ARI Flood Extent

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 F8

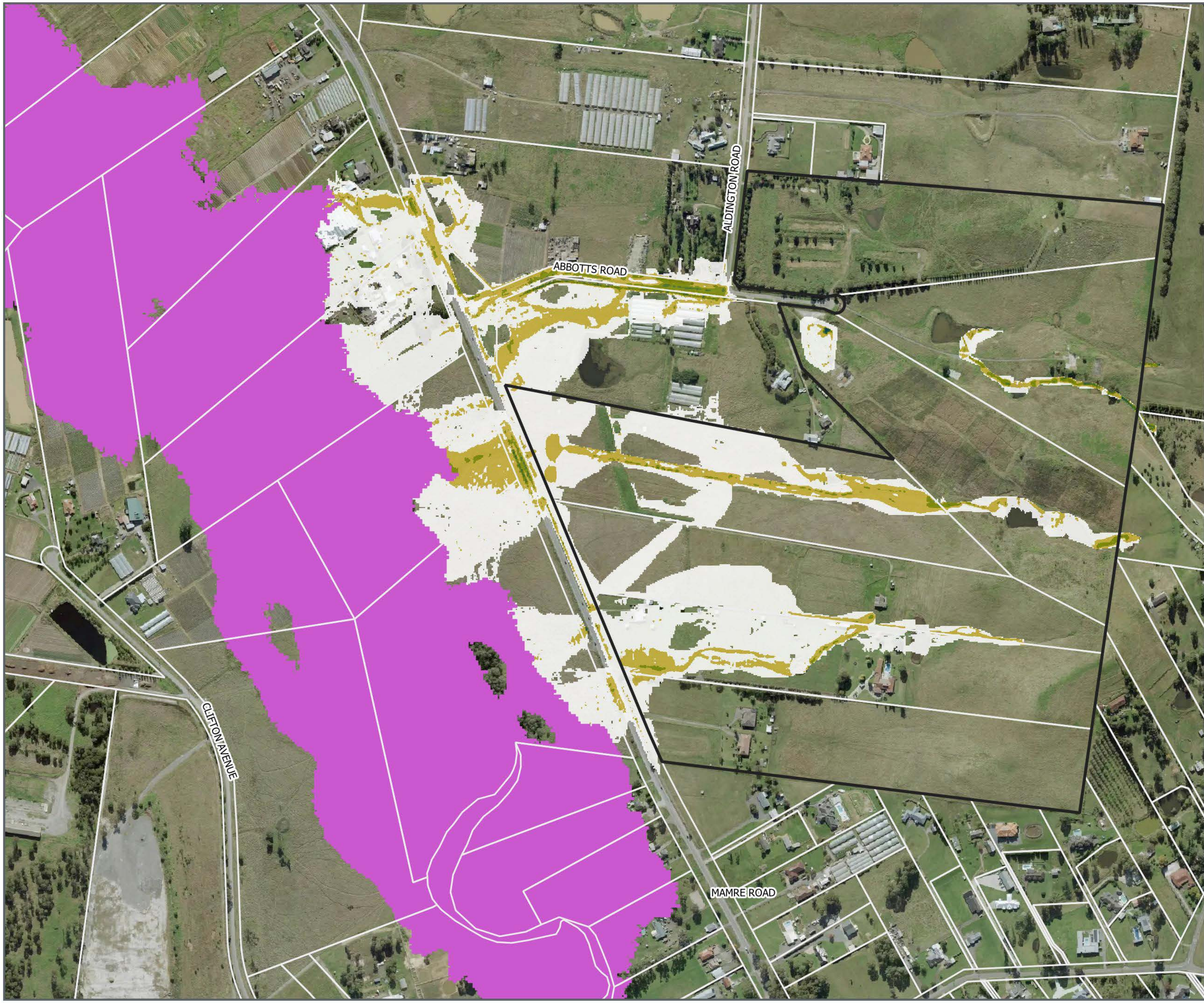
1:6,000 Scale at A3

0 80 160 240 320 m

N

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz



Flood Risk Assessment Westlink Industrial Estate

Stage 1 Proposed Less Existing
100 Year ARI
Flood Velocities

Legend

- Site Boundary
- Cadastre
- South Creek Flood Study (2015) 100yr ARI Flood Extent

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 F9

1:6,000 Scale at A3

0 80 160 240 320 m

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
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Map: 304600730_Figures.qgz

Flood Risk Assessment Westlink Industrial Estate

Stage 1 Proposed Less Existing
100 Year ARI
Flood Hazard

Legend

- Site Boundary
- Cadastre
- South Creek Flood Study (2015) 100yr ARI Flood Extent

Flood Hazard

- Low
- Transitional
- High

FIGURE F10

1:6,000 Scale at A3

0 80 160 240 320 m

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz

Flood Risk Assessment Westlink Industrial Estate

Stage 1 Proposed Less Existing
100 Year ARI
Water Level Difference

Legend

Site Boundary

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

1:6,000 Scale at A3

0 80 160 240 320 m

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Map: 304600730_Figures.qgz

Flood Risk Assessment
Westlink Industrial Estate

Stage 1 Proposed Less Existing
100 Year ARI
Velocity Difference

Legend

Site Boundary

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

1:6,000 Scale at A3

0 80 160 240 320 m

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
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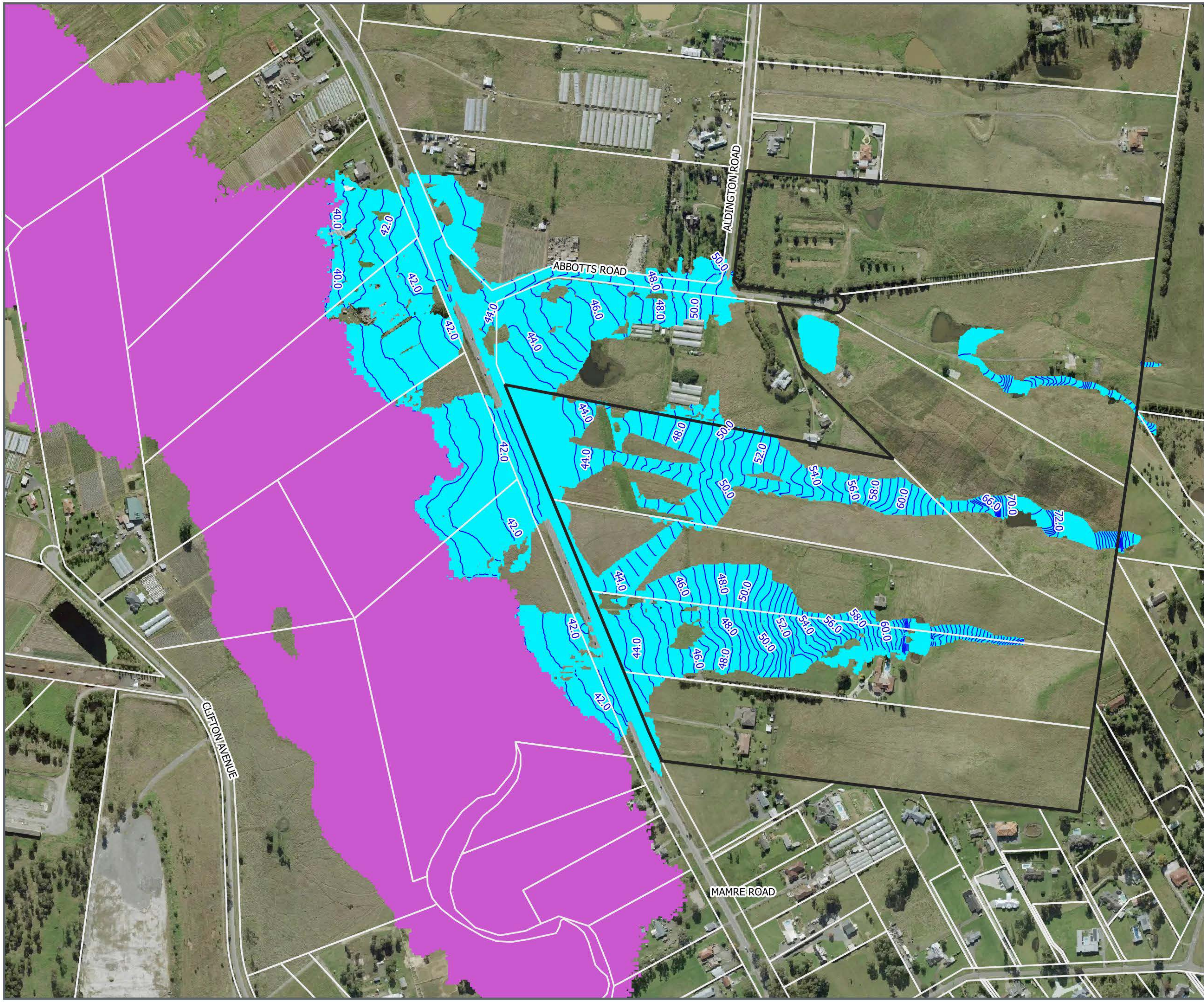
Map: 304600730_Figures.qgz



Flood Risk Assessment Westlink Industrial Estate

Stage 1 Proposed Less Existing
200 Year ARI
Flood Extents & Flood Levels

Legend

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

FIGURE F13

1:6,000 Scale at A3

0 80 160 240 320 m

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
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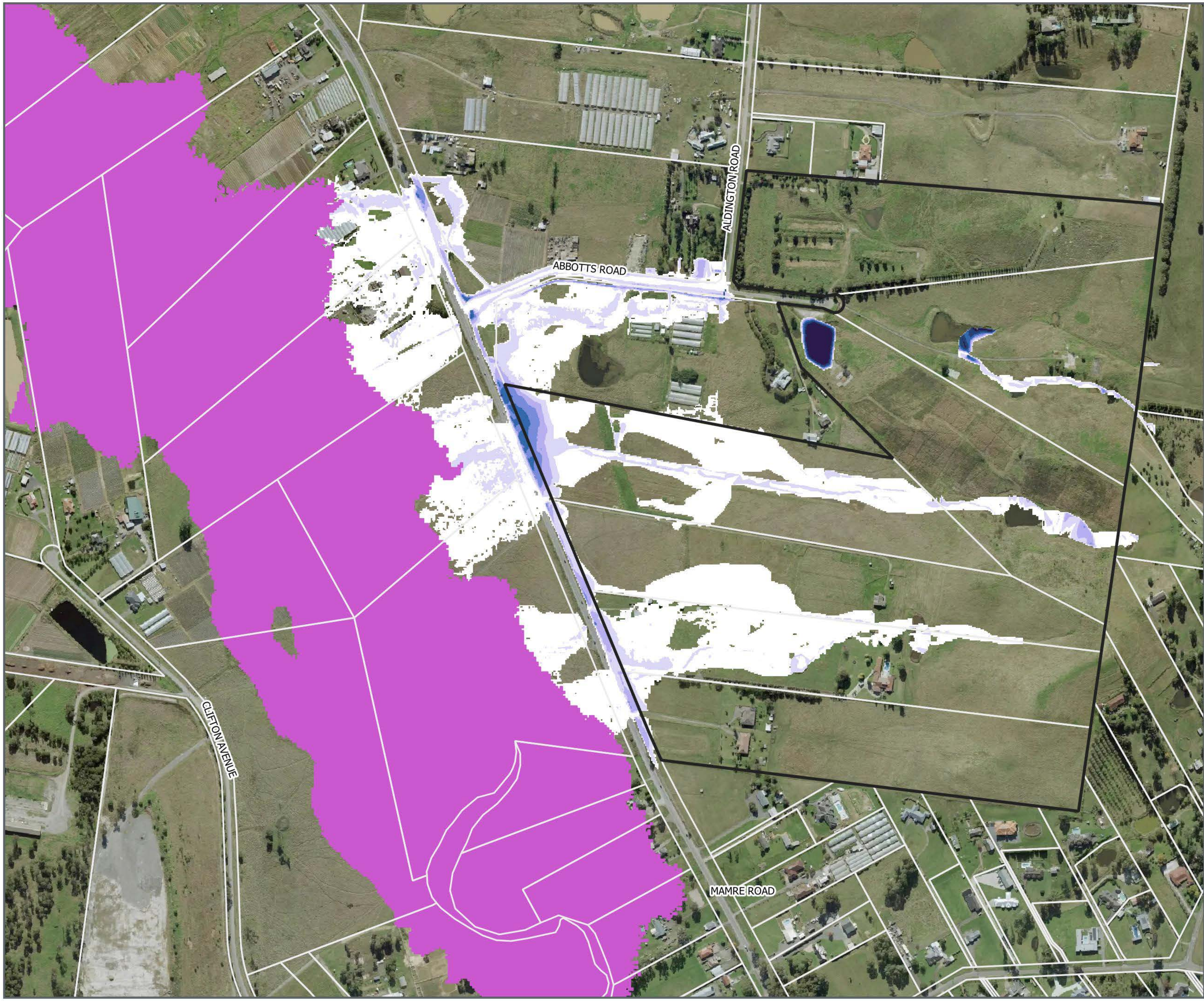
Map: 304600730_Figures.qgz



Flood Risk Assessment Westlink Industrial Estate

Stage 1 Proposed Less Existing
200 Year ARI
Flood Depths

Legend

- Site Boundary
- Cadastre
- South Creek Flood Study (2015) 200yr ARI Flood Extent

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

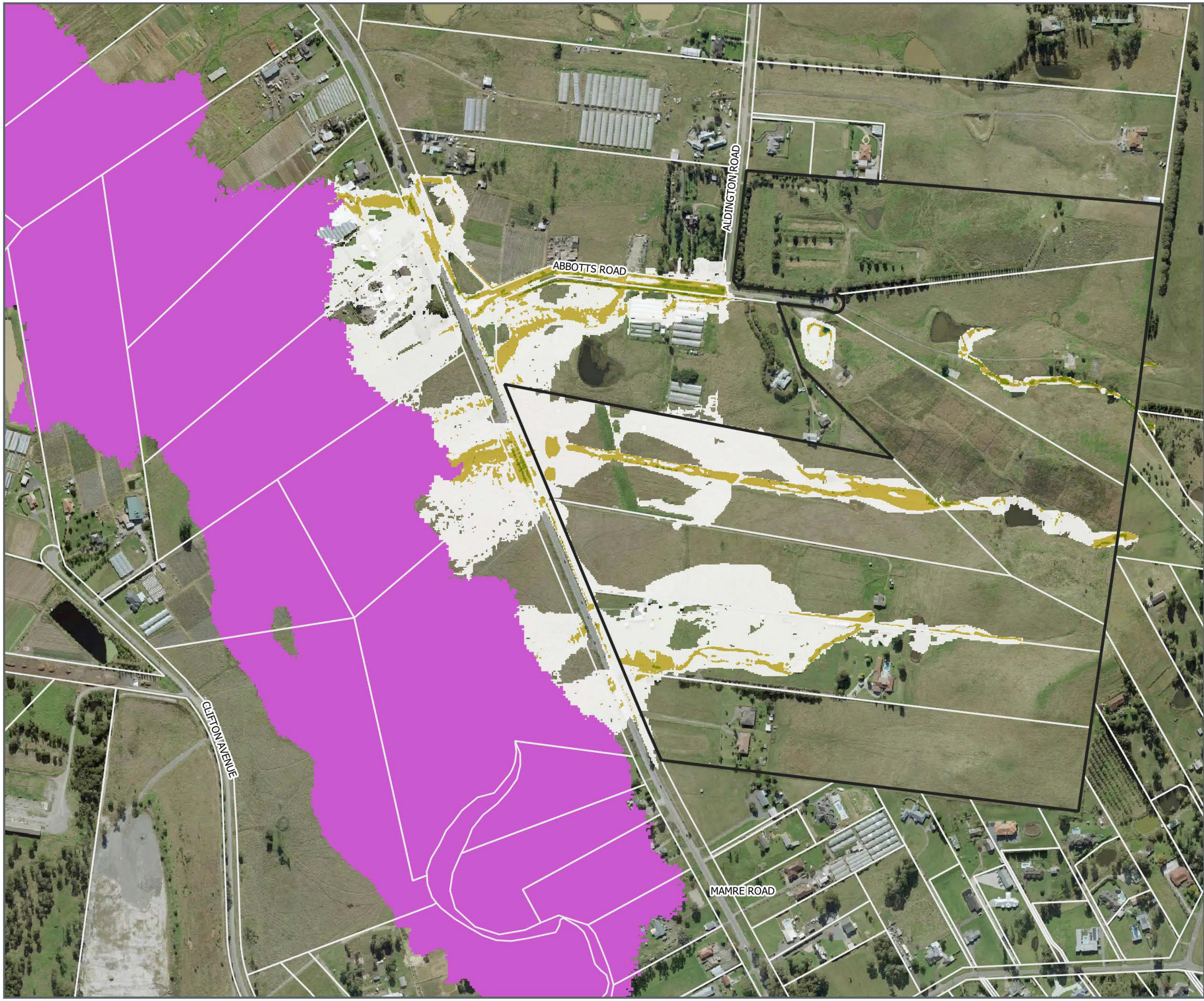
FIGURE F14

1:6,000 Scale at A3

0 80 160 240 320 m

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz



Flood Risk Assessment Westlink Industrial Estate

Stage 1 Proposed Less Existing
200 Year ARI
Flood Velocities

Legend

- Site Boundary
- Cadastre
- South Creek Flood Study (2015) 200yr ARI Flood Extent

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

1:6,000 Scale at A3

0 80 160 240 320 m

N

Cardno now Stantec

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Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz

Flood Risk Assessment Westlink Industrial Estate

Stage 1 Proposed Less Existing
200 Year ARI
Flood Hazard

Legend

- Site Boundary
- Cadastre
- South Creek Flood Study (2015) 200yr ARI Flood Extent

Flood Hazard

- Low
- Transitional
- High

FIGURE F16

1:6,000 Scale at A3

0 80 160 240 320 m

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz

Flood Risk Assessment
Westlink Industrial Estate

Stage 1 Proposed Less Existing
200 Year ARI
Water Level Difference

Legend

- Site Boundary

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 F17

1:6,000 Scale at A3

0 80 160 240 320 m

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz

Flood Risk Assessment
Westlink Industrial Estate

Stage 1 Proposed Less Existing
200 Year ARI
Velocity Difference

Legend

Site Boundary

Velocity Difference (m/s)

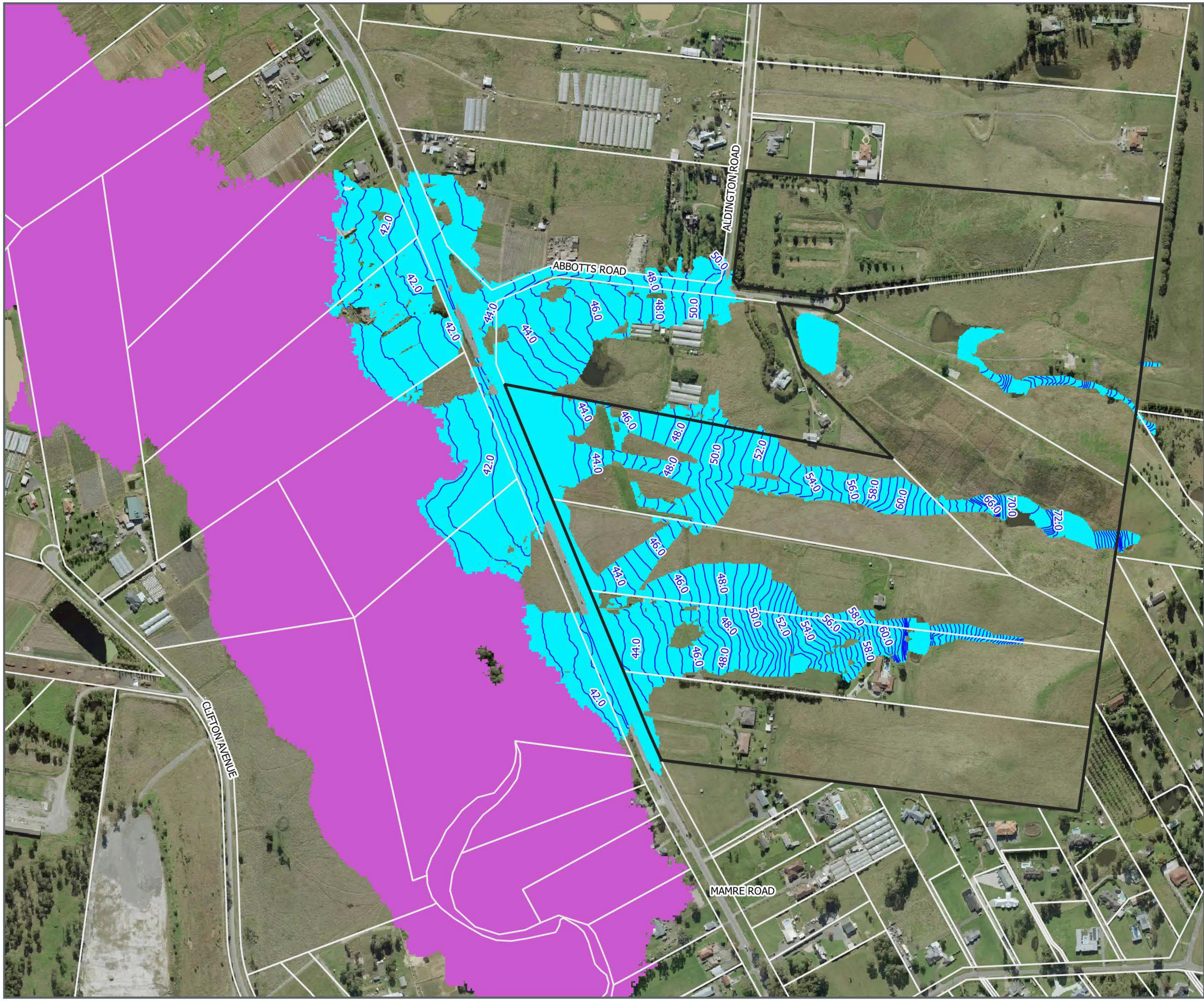
- < -0.50
- -0.50 to -0.20
- -0.20 to -0.10
- -0.10 to -0.05
- -0.05 to -0.01
- -0.01 to 0.01
- 0.01 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.50
- > 0.50

FIGURE F18

1:6,000 Scale at A3

0 80 160 240 320 m

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz



Flood Risk Assessment Westlink Industrial Estate

Stage 1 Proposed Less Existing
500 Year ARI
Flood Extents & Flood Levels

Legend

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

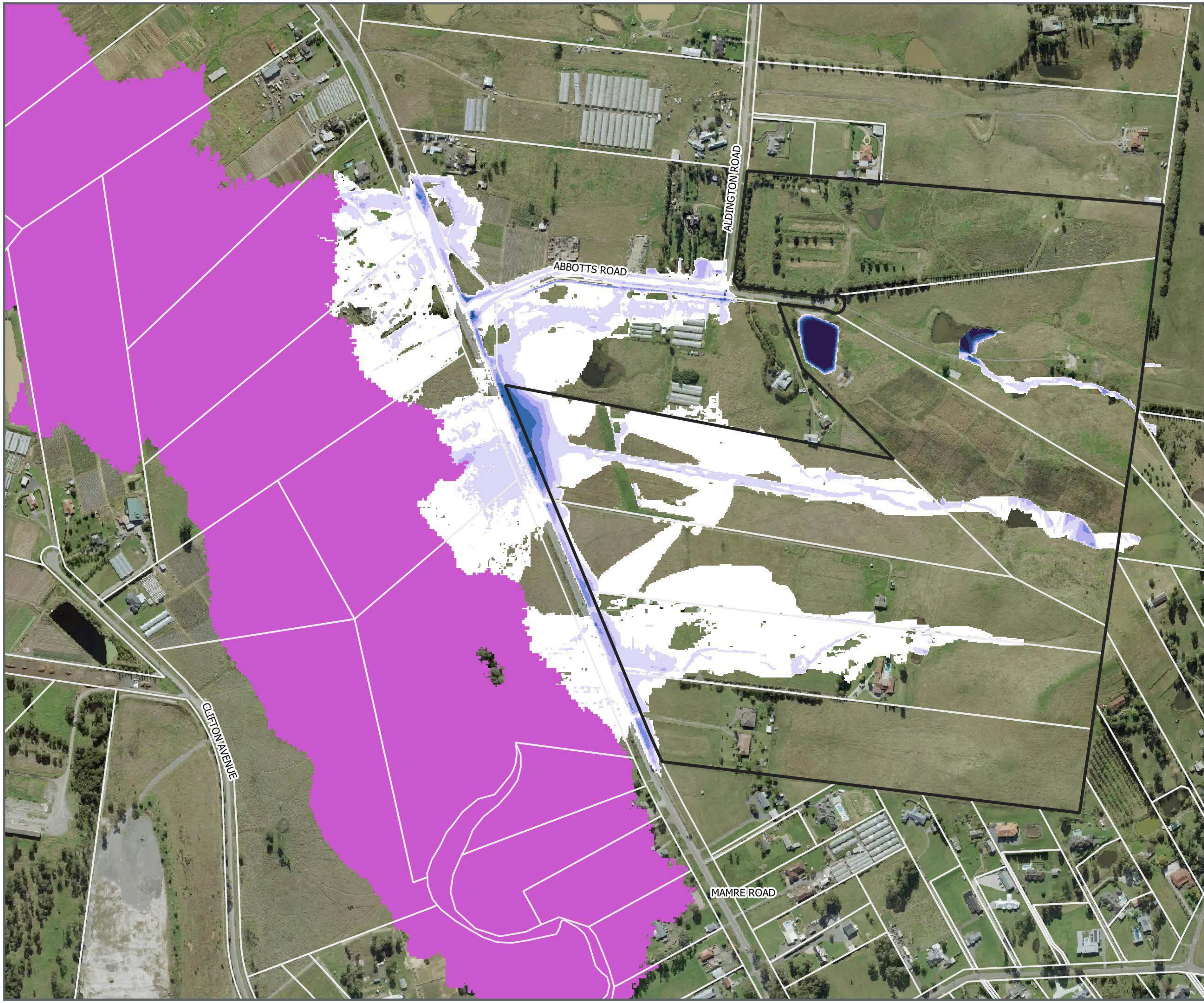
FIGURE F19

1:6,000 Scale at A3

0 80 160 240 320 m

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz



Flood Risk Assessment
Westlink Industrial Estate

Stage 1 Proposed Less Existing
500 Year ARI
Flood Depths

Legend

- Site Boundary
- Cadastre
- South Creek Flood Study (2015) 500yr ARI Flood Extent

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

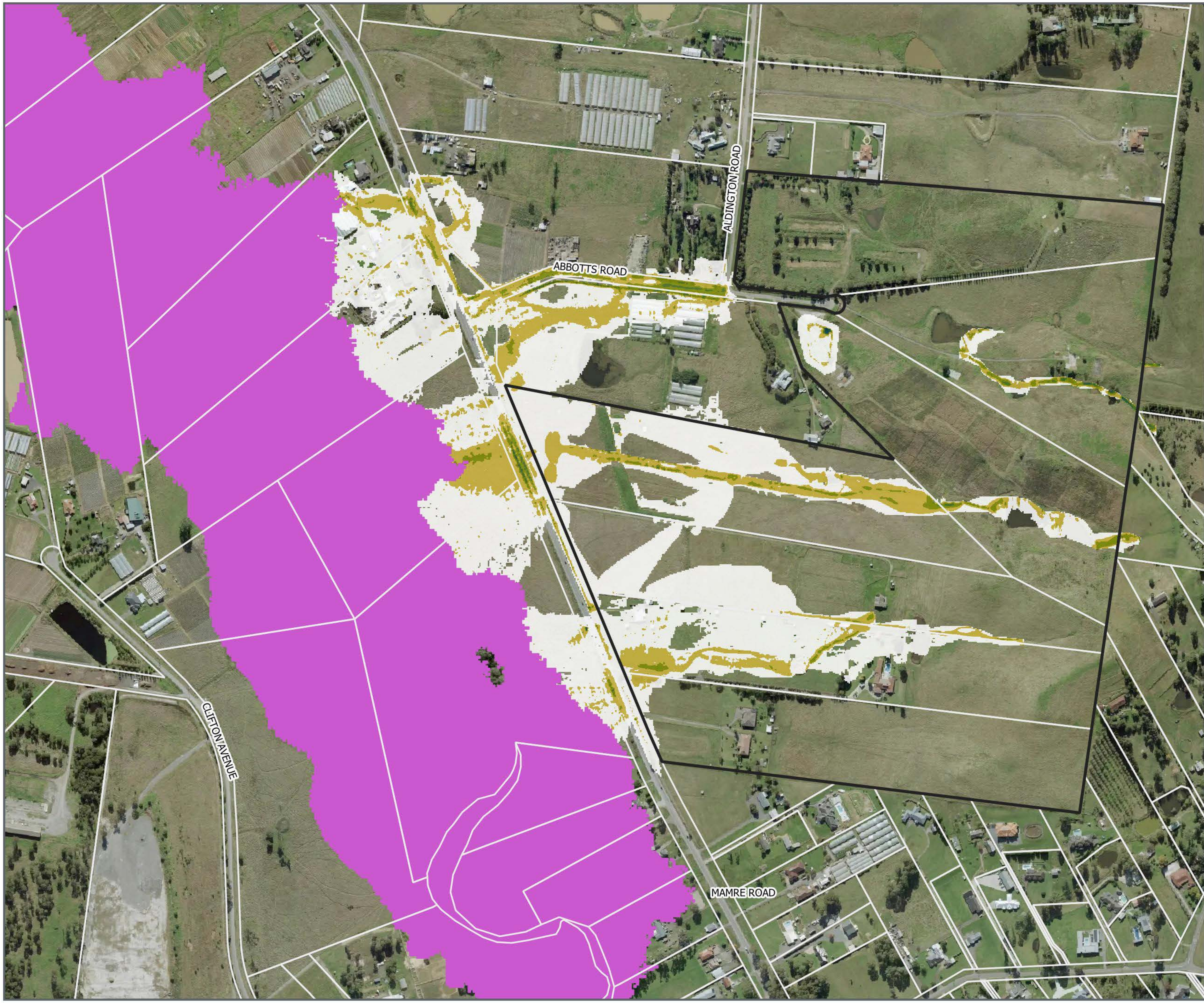
FIGURE F20

1:6,000 Scale at A3

0 80 160 240 320 m

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz



Flood Risk Assessment
Westlink Industrial Estate

Stage 1 Proposed Less Existing
500 Year ARI
Flood Velocities

Legend

- Site Boundary
- Cadastre
- South Creek Flood Study (2015) 500yr ARI Flood Extent

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

1:6,000 Scale at A3

0 80 160 240 320 m

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz

Flood Risk Assessment Westlink Industrial Estate

Stage 1 Proposed Less Existing
500 Year ARI
Flood Hazard

Legend

- Site Boundary
- Cadastre
- South Creek Flood Study (2015) 500yr ARI Flood Extent

Flood Hazard

- Low
- Transitional
- High

FIGURE F22

1:6,000 Scale at A3

0 80 160 240 320 m

N

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz

Flood Risk Assessment
Westlink Industrial Estate

Stage 1 Proposed Less Existing
500 Year ARI
Water Level Difference

Legend

- Site Boundary

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

1:6,000 Scale at A3

0 80 160 240 320 m

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz

Flood Risk Assessment Westlink Industrial Estate

Stage 1 Proposed Less Existing
500 Year ARI
Velocity Difference

Legend

Site Boundary

Velocity Difference (m/s)

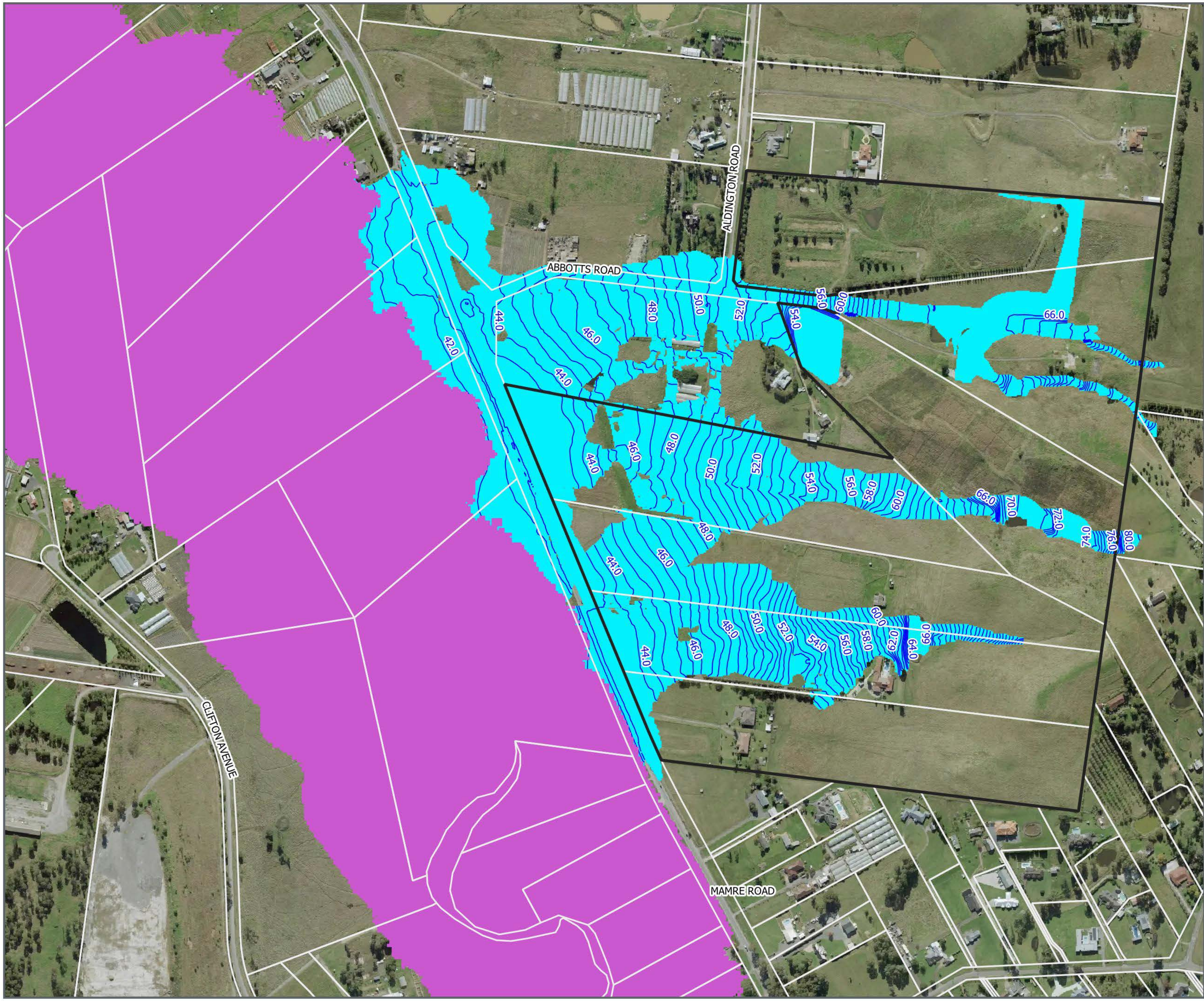
- < -0.50
- -0.50 to -0.20
- -0.20 to -0.10
- -0.10 to -0.05
- -0.05 to -0.01
- -0.01 to 0.01
- 0.01 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.50
- > 0.50

FIGURE F24

1:6,000 Scale at A3

0 80 160 240 320 m

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz



Flood Risk Assessment
Westlink Industrial Estate

Stage 1 Proposed Less Existing
PMF
Flood Extents & Flood Levels

Legend

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

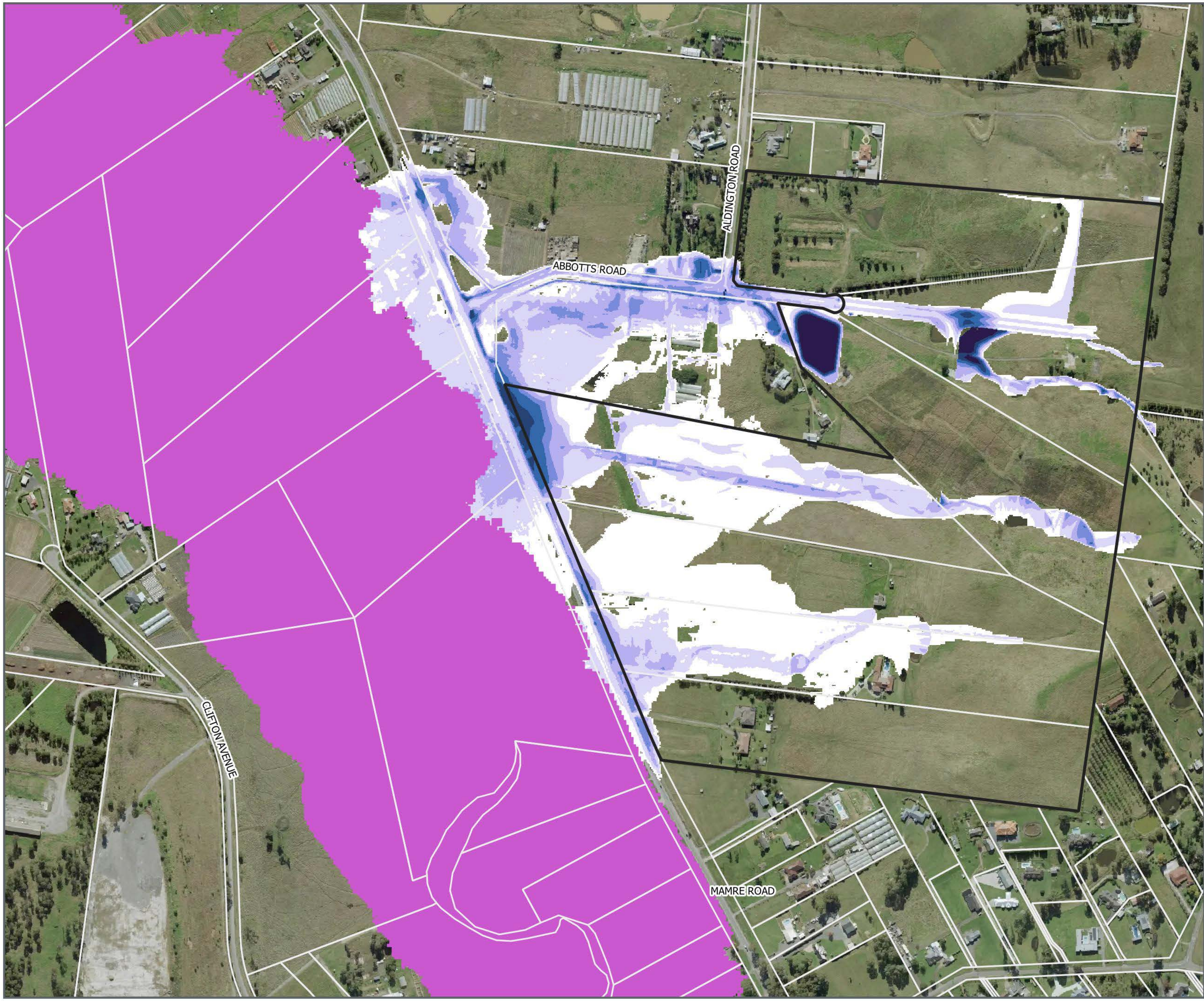
FIGURE F25

1:6,000 Scale at A3

0 80 160 240 320 m

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz



Flood Risk Assessment
Westlink Industrial Estate

Stage 1 Proposed Less Existing
PMF
Flood Depths

Legend

- Site Boundary
- Cadastre
- South Creek Flood Study (2015) PMF Flood Extent

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

1:6,000 Scale at A3

0 80 160 240 320 m

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz

Flood Risk Assessment Westlink Industrial Estate

Stage 1 Proposed Less Existing
PMF
Flood Velocities

Legend

- Site Boundary
- Cadastre
- South Creek Flood Study (2015) PMF Flood Extent

Flood Velocity (m/s)

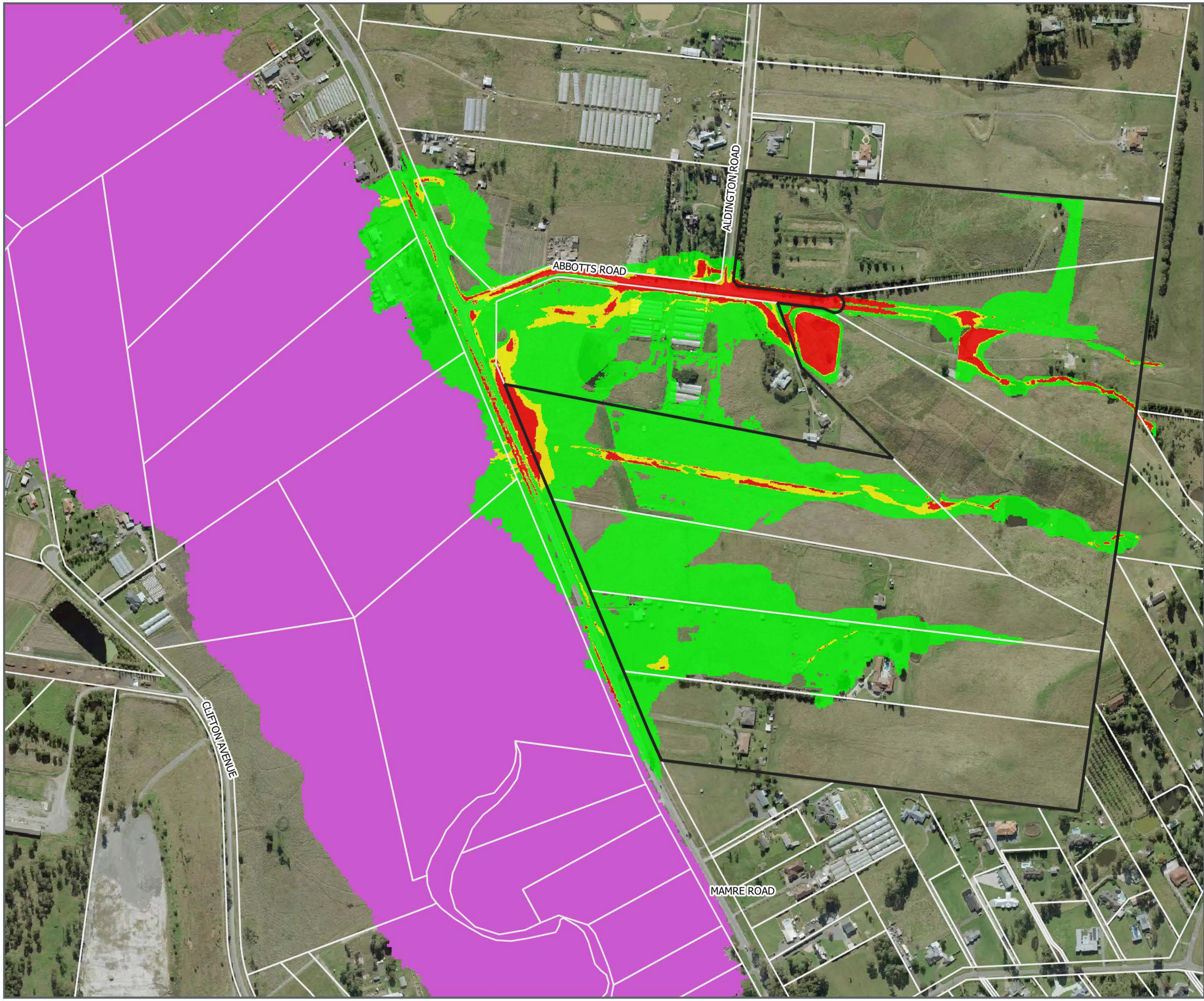
- 0.00 to 0.50
- 0.50 to 1.00
- 1.00 to 1.50
- 1.50 to 2.00
- 2.00 to 3.00
- > 3.00

FIGURE F27

1:6,000 Scale at A3

0 80 160 240 320 m

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz



Flood Risk Assessment
Westlink Industrial Estate

Stage 1 Proposed Less Existing
PMF
Flood Hazard

Legend

Site Boundary
Cadastre
South Creek Flood Study (2015) PMF Flood Extent

Flood Hazard

Low
Transitional
High

FIGURE F28

1:6,000 Scale at A3

0 80 160 240 320 m

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz

Flood Risk Assessment Westlink Industrial Estate

Stage 1 Proposed Less Existing
PMF
Water Level Difference

Legend

- Site Boundary

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

1:6,000 Scale at A3

0 80 160 240 320 m

Cardno now Stantec

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz

Flood Risk Assessment Westlink Industrial Estate

Stage 1 Proposed Less Existing
PMF
Velocity Difference

Legend

Site Boundary

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

1:6,000 Scale at A3

0 80 160 240 320 m

Map Produced by Cardno Now Stantec (Nat W&E)
Date: 2022-9-9| Project: 304600730
Coordinate System: MGA Zone 56
Map: 304600730_Figures.qgz

APPENDIX A
STAGE 1 OF THE MASTERPLAN

Cardno

now

Stantec

GFA DEFINITION:
According to Standard Instrument – Principal Local Environmental Plan
Gross Floor Area means
the sum of the floor area of each floor of a building measured from the internal face of external walls, or from the internal face of walls separating the building from any other building, measured at a height of 1.4 metres above the floor, and includes—
(a) the area of a mezzanine, and
(b) habitable rooms in a basement or an attic, and
(c) any shop, auditorium, cinema, and the like, in a basement or attic,
but excludes—
(d) any area for common vertical circulation, such as lifts and stairs, and
(e) any basement—
(i) storage, and
(ii) vehicular access, loading areas, garbage and services, and
(f) plant rooms, lift towers and other areas used exclusively for mechanical services or ducting, and
(g) car parking to meet any requirements of the consent authority (including access to that car parking), and
(h) any space used for the loading or unloading of goods (including access to it), and
(i) terraces and balconies with outer walls less than 1.4 metres high, and
(j) voids above a floor at the level of a storey or storey above.

DEVELOPMENT SUMMARY

GROSS LAND AREA	320,258m²
ROAD AREA (24M WIDE)(TBC)	20,379m²
ALDINGTON ROAD WIDENING	1270m²
NETT DEVELOPABLE AREA	298,609m²
STORMWATER DETENTION BASIN (WITHIN LOT 4)	9,721m²

SITE AREA (LOT 1) 109,952m²

WAREHOUSE (GFA) INCL. WAREHOUSE AMENITIES EXCL. LOADING ZONE (3842 m²)		61,158m²
BATTERY CHARGING CHAMBER		650m²
OFFICE (2 STOREY)		1,576m²
TRANSPORT OFFICE		160m²
TOTAL BUILDING AREA (GFA)		63,544m²
LANDSCAPE	11,040m²+110m²PP	10.1%
TOTAL CARS REQUIRED (RMS) WAREHOUSE 1/300m² (GFA) OFFICE 1/40sqm (GFA)		251
TOTAL CARS PROVIDED PERMEABLE CARPARKING 44		300

SITE AREA (LOT 4)(INCL. OSD) 43,417m²

WAREHOUSE (GFA) EXCL. LOADING ZONE (1695 m²)		16,785m²
OFFICE (2 STOREY x2)		900m²
DOCK OFFICE		100m²
TOTAL BUILDING AREA (GFA)		17,785m²
LANDSCAPE	3,016m²+518m²PP	10.4%
TOTAL CARS REQUIRED (RMS) WAREHOUSE 1/300m² (GFA) OFFICE 1/40sqm (GFA)		81
TOTAL CARS PROVIDED PERMEABLE CARPARKING 51		81

SITE AREA (RESIDUAL LOT) 145,240m²

LAND SUBJECT TO FUTURE DA	145,240m²

NOTE:
PP: Pervious Paving Carparking

KEY LEGEND

RL	PROPOSED LEVEL
P	PUMP ROOM
S/T	SPRINKLER TANK
FSA	FIRE STANDING AREA
COL	COLUMN
	CARPARKING - PERVIOUS PAVING
	CARPARKING - CONCRETE / BITUMEN

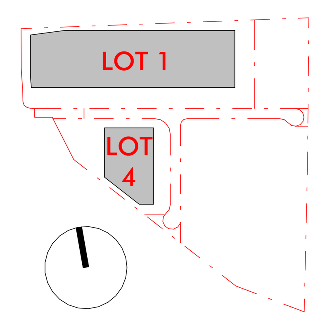
Client
ESR

Issue	Description	Date
P4	ISSUE FOR INFORMATION	23.08.2022
P3	ISSUE FOR INFORMATION	12.08.2022
P2	ISSUE FOR INFORMATION	03.08.2022
P1	ISSUE FOR INFORMATION	01.08.2022

Builder and/or subcontractors shall verify all project dimensions before commencing on-site work or off-site fabrication. Figured dimensions shall take precedence over scaled dimensions. This drawing is copyright and cannot be reproduced in whole or in part or by any medium without the written permission of Nettleton Tribe Partnership Pty Ltd.

PRELIMINARY

Key Plan



Project Name
Westlink
Project Address
Mamre Road, Kemps Creek

Bar Scales
0 30000 75000

Drawing Title:
Estate Plan - Stage 1

Author:	Checker:	Sheet Size:	Scale:
BC/HS	MA	A1	1:1500@A1 1:3000@A3

Drawing Number: **12587_DA102**
Issue: **P4**

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APPENDIX B

XP-RAFTS RESULTS

Cardno

now

Stantec

304600730 290_Aldington ARR1987 Hydrology

Benchmark Conditions

20 yr ARI **ARR Edition** **1987**

Pervious Area Losses
Initial Burst Loss (mm) 15
Continuing (mm/h) 1.5

Source: 2012 Upper South Creek Flood Study (WMAwater)
BX 1.3
Roughness 0.025

ARI (yrs)	20	20	20	20	20	20	20	20	20	20	20	20	Peak Flow (m3/s)	Critical Duration (hrs)
Subcatchment ID Duration (min)	30	45	60	90	120	180	270	360	540	720	1440	2160		
A1	0.22	0.22	0.30	0.35	0.35	0.25	0.22	0.17	0.14	0.14	0.09	0.07	0.35	1.5
A2	1.09	1.09	1.43	1.60	1.66	1.21	1.08	0.82	0.71	0.71	0.47	0.36	1.66	2.0
A15	2.36	2.72	3.23	3.41	3.63	2.72	3.02	2.62	2.31	2.37	1.67	1.30	3.63	2.0
A6	0.37	0.39	0.49	0.55	0.58	0.43	0.39	0.30	0.26	0.26	0.17	0.13	0.58	2.0
A4	1.47	1.52	1.95	2.13	2.27	1.67	1.52	1.19	1.04	1.03	0.68	0.53	2.27	2.0
A7	0.55	0.58	0.74	0.85	0.87	0.64	0.57	0.44	0.38	0.38	0.25	0.19	0.87	2.0
A5	1.17	1.25	1.55	1.68	1.72	1.29	1.23	0.98	0.86	0.86	0.56	0.44	1.72	2.0
A3	3.71	3.94	4.89	5.10	5.52	4.10	3.95	3.17	2.76	2.76	1.82	1.42	5.52	2.0
A14	4.48	4.99	6.08	6.31	6.76	5.08	5.22	4.28	3.75	3.69	2.57	2.01	6.76	2.0
A8	0.53	0.49	0.68	0.75	0.71	0.48	0.42	0.30	0.26	0.26	0.17	0.13	0.75	1.5
A9	1.52	1.53	2.01	2.14	2.25	1.63	1.47	1.13	0.98	0.98	0.64	0.50	2.25	2.0
A13	3.40	3.95	4.75	4.88	5.09	3.86	4.22	3.52	3.06	3.12	2.15	1.68	5.09	2.0
A10	0.55	0.53	0.73	0.85	0.83	0.59	0.51	0.38	0.33	0.33	0.22	0.17	0.85	1.5
A11	0.19	0.15	0.20	0.22	0.20	0.12	0.11	0.08	0.07	0.07	0.04	0.03	0.22	1.5
A12	2.58	2.79	3.45	3.58	3.75	2.74	2.84	2.38	2.06	2.08	1.38	1.07	3.75	2.0
290_Out	12.06	14.10	16.64	17.35	17.97	13.76	15.13	12.64	11.05	11.23	7.77	6.06	17.97	2.0

100 yr ARI **ARR Edition** **1987**

Pervious Area Losses
Initial Burst Loss (mm) 15
Continuing (mm/h) 1.5

Source: 2012 Upper South Creek Flood Study (WMAwater)
BX 1.3
Roughness 0.025

ARI (yrs)	100	100	100	100	100	100	100	100	100	100	100	100	Peak Flow (m3/s)	Critical Duration (hrs)
Subcatchment ID Duration (min)	30	45	60	90	120	180	270	360	540	720	1440	2160		
A1	0.35	0.34	0.43	0.46	0.45	0.32	0.27	0.20	0.18	0.18	0.12	0.09	0.46	1.5
A2	1.65	1.62	1.98	2.15	2.19	1.55	1.34	1.00	0.88	0.87	0.58	0.45	2.19	2.0
A15	3.81	4.12	4.81	4.95	5.21	3.88	3.95	3.35	2.89	2.96	2.08	1.64	5.21	2.0
A6	0.56	0.57	0.70	0.78	0.78	0.56	0.49	0.37	0.32	0.32	0.21	0.17	0.78	2.0
A4	2.24	2.21	2.72	2.93	3.04	2.19	1.90	1.46	1.27	1.27	0.84	0.66	3.04	2.0
A7	0.85	0.85	1.06	1.17	1.16	0.83	0.71	0.54	0.47	0.47	0.31	0.24	1.17	1.5
A5	1.80	1.83	2.21	2.23	2.36	1.75	1.53	1.21	1.05	1.05	0.70	0.55	2.36	2.0
A3	5.67	5.77	6.84	7.09	7.44	5.46	4.93	3.91	3.40	3.40	2.26	1.78	7.44	2.0
A14	7.01	7.43	8.65	8.89	9.26	6.90	6.63	5.32	4.65	4.59	3.20	2.52	9.26	2.0
A8	0.85	0.75	0.92	0.95	0.89	0.58	0.51	0.37	0.32	0.32	0.21	0.17	0.95	1.5
A9	2.37	2.29	2.79	2.76	2.99	2.12	1.83	1.39	1.21	1.21	0.80	0.63	2.99	2.0
A13	5.60	6.02	6.84	6.75	7.01	5.28	5.38	4.43	3.82	3.87	2.67	2.10	7.01	2.0
A10	0.87	0.84	1.04	1.10	1.06	0.73	0.64	0.46	0.40	0.40	0.27	0.21	1.10	1.5
A11	0.26	0.21	0.26	0.27	0.25	0.15	0.13	0.09	0.08	0.08	0.05	0.04	0.27	1.5
A12	4.12	4.25	4.94	4.86	5.14	3.87	3.58	2.94	2.55	2.56	1.72	1.35	5.14	2.0
290_Out	19.53	21.11	24.03	24.19	24.81	19.10	19.27	15.94	13.76	13.96	9.66	7.60	24.81	2.0

200 yr ARI **ARR Edition** **1987**

Pervious Area Losses
Initial Burst Loss (mm) 15
Continuing (mm/h) 1.5

Source: 2012 Upper South Creek Flood Study (WMAwater)
BX 1.3
Roughness 0.025

ARI (yrs)	200	200	200	200	200	200	200	200	200	200	200	200	Peak Flow (m3/s)	Critical Duration (hrs)
Subcatchment ID Duration (min)	30	45	60	90	120	180	270	360	540	720	1440	2160		
A1	0.42	0.41	0.49	0.52	0.51	0.35	0.30	0.22	0.20	0.20	0.13	0.10	0.52	1.5
A2	1.94	1.90	2.26	2.42	2.45	1.72	1.49	1.11	0.97	0.97	0.64	0.51	2.45	2.0
A15	4.50	4.76	5.57	5.74	6.00	4.47	4.45	3.74	3.22	3.29	2.31	1.83	6.00	2.0
A6	0.67	0.66	0.81	0.88	0.88	0.63	0.54	0.41	0.36	0.36	0.24	0.19	0.88	1.5
A4	2.62	2.57	3.09	3.33	3.42	2.45	2.11	1.62	1.41	1.41	0.94	0.74	3.42	2.0
A7	1.02	1.00	1.22	1.32	1.30	0.92	0.79	0.59	0.52	0.52	0.34	0.27	1.32	1.5
A5	2.12	2.11	2.51	2.48	2.68	1.98	1.70	1.34	1.17	1.16	0.78	0.61	2.68	2.0
A3	6.57	6.60	7.74	8.05	8.39	6.12	5.48	4.33	3.77	3.77	2.52	1.98	8.39	2.0
A14	8.17	8.53	9.84	10.13	10.47	7.79	7.39	5.90	5.16	5.10	3.56	2.81	10.47	2.0
A8	1.00	0.88	1.02	1.06	0.99	0.65	0.57	0.41	0.36	0.36	0.24	0.19	1.06	1.5
A9	2.78	2.66	3.15	3.09	3.35	2.36	2.03	1.53	1.34	1.33	0.89	0.70	3.35	2.0
A13	6.62	6.96	7.80	7.68	7.91	6.01	6.00	4.93	4.26	4.31	2.97	2.35	7.91	2.0
A10	1.05	0.99	1.19	1.23	1.18	0.81	0.70	0.51	0.45	0.45	0.30	0.23	1.23	1.5
A11	0.30	0.24	0.28	0.30	0.28	0.16	0.14	0.10	0.09	0.09	0.06	0.05	0.30	1.5
A12	4.82	4.93	5.65	5.47	5.83	4.47	3.99	3.26	2.84	2.84	1.91	1.50	5.83	2.0
290_Out	22.93	24.37	27.64	27.48	28.33	21.84	21.48	17.74	15.32	15.52	10.76	8.48	28.33	2.0

500 yr ARI **ARR Edition** **1987**

Pervious Area Losses
Initial Burst Loss (mm) 15
Continuing (mm/h) 1.5

Source: 2012 Upper South Creek Flood Study (WMAwater)
BX 1.3
Roughness 0.025

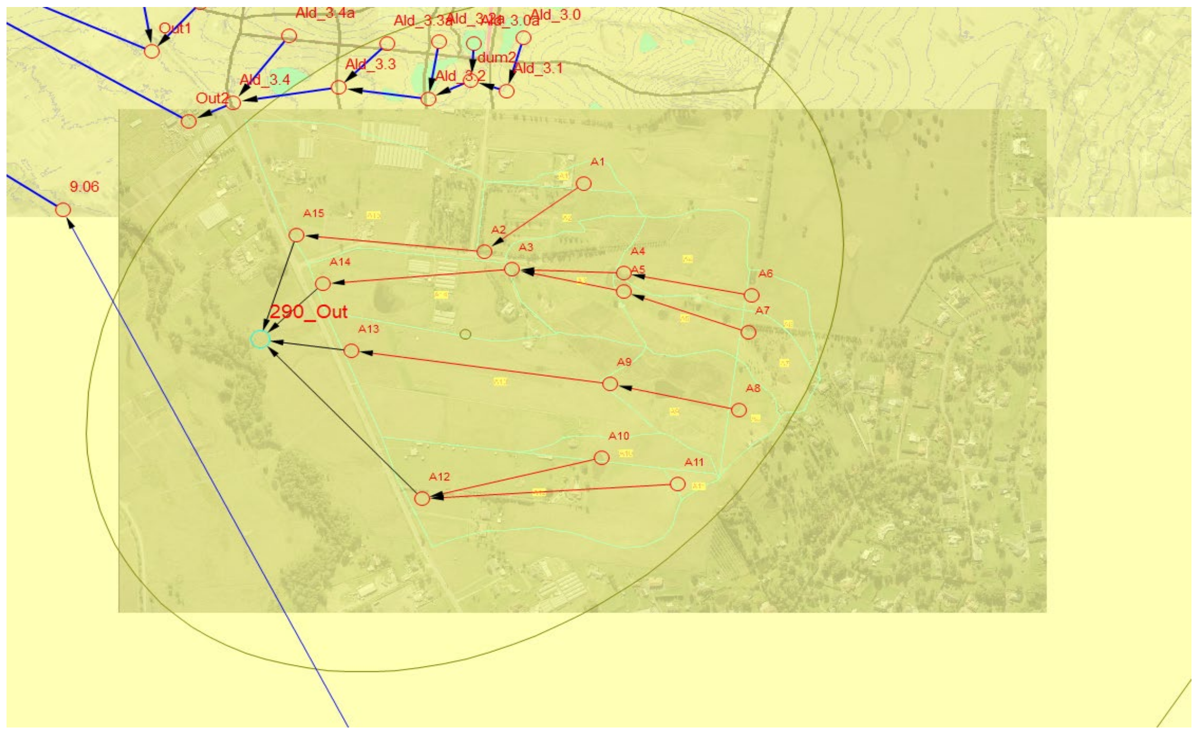
ARI (yrs)	500	500	500	500	500	500	500	500	500	500	500	500	Peak Flow (m3/s)	Critical Duration (hrs)
Subcatchment ID Duration (min)	30	45	60	90	120	180	270	360	540	720	1440	2160		
A1	0.52	0.49	0.58	0.59	0.57	0.40	0.35	0.25	0.22	0.22	0.15	0.12	0.59	1.5
A2	2.37	2.30	2.65	2.78	2.79	1.95	1.68	1.26	1.10	1.09	0.73	0.58	2.79	2.0
A15	5.46	5.67	6.62	6.81	7.06	5.25	5.12	4.27	3.67	3.75	2.63	2.08	7.06	2.0
A6	0.82	0.80	0.96	1.02	1.01	0.72	0.61	0.46	0.40	0.40	0.27	0.21	1.02	1.5
A4	3.16	3.08	3.61	3.85	3.92	2.80	2.39	1.83	1.59	1.59	1.06	0.84	3.92	2.0
A7	1.25	1.22	1.45	1.52	1.49	1.04	0.90	0.67	0.59	0.58	0.39	0.31	1.52	1.5
A5	2.54	2.48	2.91	2.83	3.08	2.27	1.93	1.51	1.32	1.32	0.88	0.70	3.08	2.0
A3	7.78	7.76	8.98	9.31	9.61	7.02	6.21	4.90	4.27	4.27	2.86	2.27	9.61	2.0
A14	9.77	10.06	11.49	11.75	12.04	9.01	8.40	6.69	5.85	5.80	4.05	3.21	12.04	2.0
A8	1.19	1.02	1.16	1.21	1.13	0.73	0.64	0.46	0.40	0.40	0.27	0.21	1.21	1.5
A9	3.34	3.15	3.61	3.54	3.82	2.68	2.31	1.73	1.51	1.51	1.01	0.80	3.82	2.0
A13	7.94	8.27	9.10	8.88	9.08	6.99	6.82	5.60	4.85	4.90	3.38	2.68	9.10	1.0
A10	1.30	1.18	1.37	1.41	1.34	0.91	0.80	0.58	0.51	0.51	0.34	0.27	1.41	1.5
A11	0.34	0.28	0.32	0.34	0.32	0.18	0.16	0.12	0.10	0.10	0.07	0.05	0.34	0.5
A12	5.78	5.82	6.56	6.27	6.74	5.22	4.53	3.70	3.22	3.22	2.17	1.72	6.74	2.0
290_Out	27.61	28.89	32.45	31.86	32.99	25.40	24.44	20.17	17.43	17.65	12.24	9.69	32.99	2.0

PMF **ARR Edition** **1987**

Pervious Area Losses
Initial Burst Loss (mm) 0
Continuing (mm/h) 0

Source: 2012 Upper South Creek Flood Study (WMAwater)
BX 1.3
Roughness 0.025

ARI (yrs)	PMF	PMF	PMF	PMF	PMF	PMF	PMF	PMF	PMF	PMF	-	-	Peak Flow (m3/s)	Critical Duration (hrs)
Subcatchment ID Duration (min)	30	45	60	90	120	150	180	240	300	360	-	-		
A1	2.37	2.02	1.78	1.50	1.34	1.19	1.09	0.93	0.82	0.72	-	-	2.37	0.5
A2	11.21	9.90	8.69	7.26	6.44	5.78	5.32	4.56	4.04	3.56	-	-	11.21	0.5
A15	35.24	32.32	29.81	25.21	21.99	19.45	17.84	15.43	13.80	12.28	-	-	35.24	0.5
A6	4.19	3.67	3.22	2.69	2.39	2.14	1.97	1.69	1.49	1.32	-	-	4.19	0.5
A4	15.91	14.17	12.60	10.44	9.24	8.28	7.64	6.58	5.85	5.17	-	-	15.91	0.5
A7	6.14	5.33	4.68	3.92	3.49	3.12	2.86	2.45	2.17	1.91	-	-	6.14	0.5
A5	13.00	11.66	10.48	8.68	7.66	6.80	6.22	5.37	4.81	4.28	-	-	13.00	0.5
A3	40.93	37.46	33.39	27.99	24.58	21.88	20.15	17.36	15.47	13.73	-	-	40.93	0.5
A14	53.80	51.06	46.12	39.21	34.50	30.59	28.10	24.15	21.50	19.13	-	-	53.80	0.5
A8	4.42	3.76	3.35	2.84	2.52	2.23	2.03	1.71	1.50	1.32	-	-	4.42	0.5
A9	15.85	13.82	12.16	10.19	8.97	7.97	7.31	6.29	5.58	4.92	-	-	15.85	0.5
A13	45.75	42.51	39.07	33.05	28.88	25.52	23.33	19.94	17.75	15.82	-	-	45.75	0.5
A10	5.46	4.65	4.10	3.47	3.09	2.75	2.52	2.13	1.88	1.65	-	-	5.46	0.5
A11	1.14	0.98	0.88	0.74	0.65	0.57	0.51	0.43	0.38	0.33	-	-	1.14	0.5
A12	31.71	28.61	25.70	21.33	18.73	16.60	15.17	13.03	11.72	10.44	-	-	31.71	0.5
290_Out	159.51	149.39	138.61	118.12	103.36	91.52	83.71	71.71	64.12	57.09	-	-	159.51	0.5



304600730 290_Aldington ARR1987 Hydrology

Stage 1

20yr — ARR Edition 1987

Pervious Area Losses: Initial Burst Loss (mm) 15; Continuing (mm/h) 1.5

Source: 2012 Upper South Creek Flood Study (WMAwater); BX 1.3; Roughness 0.025

ARI (yrs)	20	20	20	20	20	20	20	20	20	20	20	20		
Subcatchment ID / Duration (min)	30	45	60	90	120	180	270	360	540	720	1440	2160	Peak Flow (m3/s)	Critical Duration (hrs)
A6	0.37	0.39	0.49	0.55	0.58	0.43	0.39	0.30	0.26	0.26	0.17	0.13	0.58	2.0
CatA2	0.47	0.52	0.62	0.74	0.75	0.57	0.52	0.41	0.35	0.35	0.23	0.18	0.75	2.0
A7	0.55	0.58	0.74	0.85	0.87	0.64	0.57	0.44	0.38	0.38	0.25	0.19	0.87	2.0
A5	1.79	1.60	1.78	2.05	1.82	1.39	1.31	1.08	0.94	0.94	0.62	0.49	2.05	1.5
Lot4	1.22	1.09	1.18	1.25	1.19	0.66	0.58	0.44	0.38	0.38	0.25	0.20	1.25	1.5
CatA3	0.13	0.12	0.13	0.14	0.13	0.07	0.06	0.05	0.04	0.04	0.03	0.02	0.14	1.5
CatA	0.13	0.12	0.13	0.14	0.13	0.07	0.07	0.05	0.04	0.04	0.03	0.02	0.14	1.5
CatA1	0.78	0.69	0.75	0.80	0.75	0.42	0.38	0.28	0.24	0.24	0.16	0.13	0.80	1.5
Lot1	4.52	3.91	4.16	4.42	4.04	2.51	2.23	1.68	1.47	1.48	0.99	0.78	4.52	0.5
Rd	8.15	7.07	7.35	7.87	7.19	5.09	4.76	3.88	3.39	3.40	2.27	1.79	8.15	0.5
Bas	9.59	7.81	9.53	10.36	9.35	6.71	6.17	4.90	4.28	4.29	2.86	2.24	10.36	1.5
Rd1	9.64	7.86	9.58	10.41	9.41	6.75	6.20	4.93	4.30	4.31	2.87	2.25	10.41	1.5
Rd2	9.66	7.89	9.60	10.42	9.44	6.77	6.22	4.94	4.32	4.32	2.88	2.26	10.42	1.5
A1	0.22	0.22	0.30	0.35	0.35	0.25	0.22	0.17	0.14	0.14	0.09	0.07	0.35	1.5
A1_dum	0.22	0.22	0.30	0.35	0.35	0.25	0.22	0.17	0.14	0.14	0.09	0.07	0.35	1.5
A15	10.72	9.02	11.24	12.36	11.41	8.47	8.28	6.89	6.05	6.05	4.17	3.27	12.36	1.5
A14	0.80	1.06	1.20	1.21	1.24	1.03	1.28	1.11	0.99	1.03	0.75	0.59	1.28	4.5
A8	0.53	0.49	0.68	0.75	0.71	0.48	0.42	0.30	0.26	0.26	0.17	0.13	0.75	1.5
A9	1.52	1.53	2.01	2.14	2.25	1.63	1.47	1.13	0.98	0.98	0.64	0.50	2.25	2.0
A13	3.40	3.95	4.75	4.88	5.09	3.86	4.22	3.52	3.06	3.12	2.15	1.68	5.09	2.0
A10	0.55	0.53	0.73	0.85	0.83	0.59	0.51	0.38	0.33	0.33	0.22	0.17	0.85	1.5
A11	0.19	0.15	0.20	0.22	0.20	0.12	0.11	0.08	0.07	0.07	0.04	0.03	0.22	1.5
A12	2.58	2.79	3.45	3.58	3.75	2.74	2.84	2.38	2.06	2.08	1.38	1.07	3.75	2.0
290_Out	15.57	15.20	18.55	20.95	20.67	15.67	16.29	13.78	12.05	12.27	8.46	6.61	20.95	1.5

100yr — ARR Edition 1987

Pervious Area Losses: Initial Burst Loss (mm) 15; Continuing (mm/h) 1.5

Source: 2012 Upper South Creek Flood Study (WMAwater); BX 1.3; Roughness 0.025

ARI (yrs)	100	100	100	100	100	100	100	100	100	100	100	100		
Subcatchment ID / Duration (min)	30	45	60	90	120	180	270	360	540	720	1440	2160	Peak Flow (m3/s)	Critical Duration (hrs)
A6	0.56	0.57	0.70	0.78	0.78	0.56	0.49	0.37	0.32	0.32	0.21	0.17	0.78	2.0
CatA2	0.71	0.74	0.90	1.04	1.02	0.75	0.65	0.50	0.43	0.43	0.29	0.23	1.04	1.5
A7	0.85	0.85	1.06	1.17	1.16	0.83	0.71	0.54	0.47	0.47	0.31	0.24	1.17	1.5
A5	2.15	1.98	2.36	2.73	2.39	1.89	1.65	1.32	1.15	1.15	0.77	0.61	2.73	1.5
Lot4	1.45	1.34	1.45	1.54	1.46	0.81	0.72	0.53	0.47	0.47	0.31	0.25	1.54	1.5
CatA3	0.16	0.15	0.16	0.17	0.16	0.09	0.08	0.06	0.05	0.05	0.03	0.03	0.17	1.5
CatA	0.16	0.15	0.16	0.17	0.16	0.09	0.08	0.06	0.05	0.05	0.03	0.03	0.17	1.5
CatA1	0.93	0.85	0.92	0.98	0.93	0.53	0.46	0.34	0.30	0.30	0.20	0.16	0.98	1.5
Lot1	5.43	4.85	5.14	5.41	4.97	3.10	2.76	2.06	1.80	1.80	1.22	0.97	5.43	0.5
Rd	9.87	8.81	9.28	10.02	9.14	6.65	5.97	4.76	4.15	4.16	2.80	2.22	10.02	1.5
Bas	12.35	10.51	12.30	13.15	12.02	8.64	7.71	6.02	5.25	5.25	3.53	2.79	13.15	1.5
Rd1	12.41	10.58	12.37	13.21	12.09	8.68	7.75	6.05	5.28	5.28	3.54	2.80	13.21	1.5
Rd2	12.45	10.61	12.40	13.23	12.14	8.71	7.78	6.07	5.29	5.29	3.56	2.81	13.23	1.5
A1	0.35	0.34	0.43	0.46	0.45	0.32	0.27	0.20	0.18	0.18	0.12	0.09	0.46	1.5
A1_dum	0.35	0.34	0.43	0.46	0.45	0.32	0.27	0.20	0.18	0.18	0.12	0.09	0.46	1.5
A15	14.34	12.67	15.17	16.31	15.26	11.33	10.61	8.55	7.47	7.47	5.17	4.08	16.31	1.5
A14	1.40	1.67	1.82	1.80	1.85	1.44	1.71	1.46	1.25	1.30	0.94	0.74	1.85	2.0
A8	0.85	0.75	0.92	0.95	0.89	0.58	0.51	0.37	0.32	0.32	0.21	0.17	0.95	1.5
A9	2.37	2.29	2.79	2.76	2.99	2.12	1.83	1.39	1.21	1.21	0.80	0.63	2.99	2.0
A13	5.60	6.02	6.84	6.75	7.01	5.28	5.38	4.43	3.82	3.87	2.67	2.10	7.01	2.0
A10	0.87	0.84	1.04	1.10	1.06	0.73	0.64	0.46	0.40	0.40	0.27	0.21	1.10	1.5
A11	0.26	0.21	0.26	0.27	0.25	0.15	0.13	0.09	0.08	0.08	0.05	0.04	0.27	1.5
A12	4.12	4.25	4.94	4.86	5.14	3.87	3.58	2.94	2.55	2.56	1.72	1.35	5.14	2.0
290_Out	22.91	22.28	27.02	29.03	28.57	21.50	21.03	17.33	14.98	15.19	10.49	8.27	29.03	1.5

200yr — ARR Edition 1987

Pervious Area Losses: Initial Burst Loss (mm) 15; Continuing (mm/h) 1.5

Source: 2012 Upper South Creek Flood Study (WMAwater); BX 1.3; Roughness 0.025

ARI (yrs)	200	200	200	200	200	200	200	200	200	200	200	200		
Subcatchment ID / Duration (min)	30	45	60	90	120	180	270	360	540	720	1440	2160	Peak Flow (m3/s)	Critical Duration (hrs)
A6	0.67	0.66	0.81	0.88	0.88	0.63	0.54	0.41	0.36	0.36	0.24	0.19	0.88	1.5
CatA2	0.83	0.83	1.06	1.19	1.15	0.84	0.72	0.55	0.48	0.48	0.32	0.25	1.19	1.5
A7	1.02	1.00	1.22	1.32	1.30	0.92	0.79	0.59	0.52	0.52	0.34	0.27	1.32	1.5
A5	2.41	2.19	2.68	3.10	2.72	2.14	1.83	1.46	1.28	1.27	0.86	0.68	3.10	1.5
Lot4	1.61	1.48	1.60	1.70	1.61	0.90	0.80	0.59	0.52	0.51	0.35	0.28	1.70	1.5
CatA3	0.18	0.16	0.18	0.19	0.18	0.10	0.09	0.06	0.06	0.06	0.04	0.03	0.19	1.5
CatA	0.18	0.16	0.18	0.19	0.18	0.10	0.09	0.06	0.06	0.06	0.04	0.03	0.19	1.5
CatA1	1.03	0.94	1.02	1.09	1.03	0.58	0.51	0.38	0.33	0.33	0.22	0.18	1.09	1.5
Lot1	6.00	5.36	5.69	5.99	5.51	3.44	3.06	2.28	1.99	1.99	1.35	1.07	6.00	0.5
Rd	10.92	9.74	10.36	11.22	10.25	7.50	6.62	5.26	4.59	4.60	3.11	2.47	11.22	1.5
Bas	13.96	11.81	13.76	14.71	13.48	9.70	8.55	6.66	5.81	5.81	3.91	3.10	14.71	1.5
Rd1	14.05	11.88	13.83	14.78	13.56	9.75	8.59	6.69	5.84	5.84	3.93	3.12	14.78	1.5
Rd2	14.10	11.92	13.86	14.80	13.61	9.77	8.62	6.71	5.86	5.85	3.95	3.13	14.80	1.5
A1	0.42	0.41	0.49	0.52	0.51	0.35	0.30	0.22	0.20	0.20	0.13	0.10	0.52	1.5
A1_dum	0.42	0.41	0.49	0.52	0.51	0.35	0.30	0.22	0.20	0.20	0.13	0.10	0.52	1.5
A15	16.35	14.45	17.21	18.44	17.24	12.85	11.85	9.48	8.28	8.28	5.74	4.55	18.44	1.5
A14	1.68	1.93	2.12	2.09	2.17	1.69	1.92	1.63	1.40	1.45	1.04	0.83	2.17	2.0
A8	1.00	0.88	1.02	1.06	0.99	0.65	0.57	0.41	0.36	0.36	0.24	0.19	1.06	1.5
A9	2.78	2.66	3.15	3.09	3.35	2.36	2.03	1.53	1.34	1.33	0.89	0.70	3.35	2.0
A13	6.62	6.96	7.80	7.68	7.91	6.01	6.00	4.93	4.26	4.31	2.97	2.35	7.91	2.0
A10	1.05	0.99	1.19	1.23	1.18	0.81	0.70	0.51	0.45	0.45	0.30	0.23	1.23	1.5
A11	0.30	0.24	0.28	0.30	0.28	0.16	0.14	0.10	0.09	0.09	0.06	0.05	0.30	1.5
A12	4.82	4.93	5.65	5.47	5.83	4.47	3.99	3.26	2.84	2.84	1.91	1.50	5.83	2.0
290_Out	26.85	25.85	31.24	33.08	32.43	24.41	23.49	19.26	16.66	16.88	11.67	9.23	33.08	1.5

500yr — ARR Edition 1987

Pervious Area Losses: Initial Burst Loss (mm) 15; Continuing (mm/h) 1.5

Source: 2012 Upper South Creek Flood Study (WMAwater); BX 1.3; Roughness 0.025

ARI (yrs)	500	500	500	500	500	500	500	500	500	500	500	500		
Subcatchment ID / Duration (min)	30	45	60	90	120	150	180	240	300	360	1440	2160	Peak Flow (m3/s)	Critical Duration (hrs)
A6	0.82	0.80	0.96	1.02	1.01	0.72	0.61	0.46	0.40	0.40	0.2702	0.2137	1.02	1.5
CatA2	1.04	1.02	1.26	1.38	1.32	0.96	0.82	0.62	0.54	0.54	0.3633	0.2879	1.38	1.5
A7	1.25	1.22	1.45	1.52	1.49	1.04	0.90	0.67	0.59	0.58	0.3912	0.3094	1.52	1.5
A5	2.78	2.53	3.14	3.59	3.17	2.45	2.08	1.65	1.44	1.44	0.9716	0.7721	3.59	1.5
Lot4	1.82	1.67	1.81	1.92	1.82	1.02	0.90	0.66	0.58	0.58	0.3932	0.3135	1.92	1.5
CatA3	0.20	0.18	0.20	0.21	0.20	0.11	0.10	0.07	0.06	0.06	0.0425	0.0339	0.21	1.5
CatA	0.20	0.18	0.20	0.22	0.21	0.11	0.10	0.07	0.06	0.06	0.0428	0.0341	0.22	1.5
CatA1	1.17	1.06	1.16	1.23	1.16	0.66	0.58	0.42	0.37	0.37	0.2506	0.1998	1.23	1.5
Lot1	6.77	6.04	6.44	6.78	6.24	3.90	3.46	2.57	2.25	2.25	1.528	1.219	6.78	1.5
Rd	12.34	11.00	11.85	12.87	11.77	8.63	7.50	5.94	5.19	5.19	3.522	2.804	12.87	1.5
Bas	16.13	13.50	15.73	16.85	15.47	11.10	9.67	7.52	6.56	6.56	4.439	3.53	16.85	1.5
Rd1	16.24	13.58	15.81	16.92	15.56	11.16	9.73	7.55	6.60	6.60	4.461	3.547	16.92	1.5
Rd2	16.29	13.62	15.85	16.94	15.61	11.19	9.76	7.58	6.62	6.61	4.477	3.56	16.94	1.5
A1	0.52	0.49	0.58	0.59	0.57	0.40	0.35	0.25	0.22	0.22	0.148	0.1171	0.59	1.5
A1_dum	0.52	0.49	0.58	0.59	0.57	0.40	0.35	0.25	0.22	0.22	0.148	0.1171	0.59	1.5
A15	19.12	16.84	20.00	21.35	20.06	14.85	13.50	10.74	9.38	9.39	6.522	5.182	21.35	1.5
A14	2.06	2.30	2.53	2.50	2.61	2.03	2.19	1.87	1.60	1.65	1.188	0.943	2.61	2.0
A8	1.19	1.02	1.16	1.21	1.13	0.73	0.64	0.46	0.40	0.40	0.2702	0.2137	1.21	1.5
A9	3.34	3.15	3.61	3.54	3.82	2.68	2.31	1.73	1.51	1.51	1.01	0.799	3.82	2.0
A13	7.94	8.27	9.10	8.88	9.08	6.99	6.82	5.60	4.85	4.90	3.384	2.677	9.10	1.0
A10	1.30	1.18	1.37	1.41	1.34	0.91	0.80	0.58	0.51	0.51	0.3383	0.2676	1.41	1.5
A11	0.34	0.28	0.32	0.34	0.32	0.18	0.16	0.12	0.10	0.10	0.0681	0.0539	0.34	0.5
A12	5.78	5.82	6.56	6.27	6.74	5.22	4.53	3.70	3.22	3.22	2.172	1.718	6.74	2.0
290_Out	32.21	30.90	36.94	38.49	37.83	28.25	26.78	21.87	18.94	19.16	13.266	10.52	38.49	1.5

PMF — ARR Edition 1987

Pervious Area Losses: Initial Burst Loss (mm) 0; Continuing (mm/h) 0

Source: 2012 Upper South Creek Flood Study (WMAwater); BX 1.3; Roughness 0.025

ARI (yrs)	PMF	PMF	PMF	PMF	PMF	PMF	PMF	PMF	PMF	PMF	-	-		
Subcatchment ID / Duration (min)	30	45	60	90	120	150	180	240	300	360	-	-	Peak Flow (m3/s)	Critical Duration (hrs)
A6	4.20	3.67	3.22	2.70	2.39	2.14	1.97	1.69	1.49	1.32	0.21	0.17	4.20	0.5
CatA2	5.57	4.89	4.29	3.57	3.15	2.82	2.61	2.24	1.99	1.75	0.29	0.23	5.57	0.5
A7	6.14	5.33	4.68	3.93	3.49	3.12	2.87	2.45	2.17	1.91	0.31	0.24	6.14	0.5
A5	13.54	12.83	11.29	9.33	8.17	7.22	6.58	5.77	5.19	4.62	0.77	0.61	13.54	0.5
Lot4	6.24	5.40	4.87	4.01	3.53	3.11	2.83	2.39	2.11	1.85	0.31	0.25	6.24	0.5
CatA3	0.71	0.61	0.55	0.45	0.39	0.34	0.31	0.26	0.23	0.20	0.03	0.03	0.71	0.5
CatA	0.72	0.61	0.55	0.45	0.39	0.34	0.31	0.26	0.23	0.20	0.03	0.03	0.72	0.5
CatA1	3.86	3.38	3.06	2.57	2.27	1.99	1.81	1.53	1.34	1.18	0.20	0.16	3.86	0.5
Lot1	22.35	19.45	17.46	14.61	12.89	11.66	10.85	9.23	8.15	7.18	1.22	0.97	22.35	0.5
Rd	46.28	44.35	39.65	33.29	28.96	25.48	23.77	20.63	18.50	16.49	2.80	2.22	46.28	0.5
Bas	58.38	55.93	50.44	42.14	36.61	32.70	30.57	26.42	23.59	20.96	3.53	2.79	58.38	0.5
Rd1	58.64	56.19	50.70	42.35	36.79	32.86	30.72	26.55	23.71	21.06	3.54	2.80	58.64	0.5
Rd2	58.81	56.34	50.86	42.50	36.91	32.97	30.82	26.64	23.79	21.13	3.56	2.81	58.81	0.5
A1	2.37	2.02	1.78	1.50	1.34	1.19	1.09	0.93	0.82	0.72	0.12	0.09	2.37	0.5
A1_dum	2.37	2.02	1.78	1.50	1.34	1.19	1.09	0.93	0.82	0.72	0.12	0.09	2.37	0.5
A15	84.59	80.07	73.46	61.83	54.07	47.56	44.35	38.39	34.33	30.51	5.17	4.08	84.59	0.5
A14	14.88	14.08	13.16	11.31	9.95	8.74	7.96	6.81	6.10	5.46	0.94	0.74	14.88	0.5
A8	4.42	3.76	3.35	2.84	2.52	2.23	2.03	1.71	1.50	1.32	0.21	0.17	4.42	0.5
A9	15.85	13.82	12.16	10.19	8.97	7.97	7.32	6.29	5.59	4.92	0.80	0.63	15.85	0.5
A13	45.77	42.52	39.08	33.05	28.88	25.53	23.33	19.95	17.76	15.82	2.67	2.10	45.77	0.5
A10	5.46	4.65	4.10	3.47	3.09	2.75	2.52	2.13	1.88	1.65	0.27	0.21	5.46	0.5
A11	1.14	0.98	0.88	0.74	0.65	0.57	0.51	0.43	0.38	0.33	0.05	0.04	1.14	0.5
A12	31.72	28.62	25.71	21.34	18.74	16.60	15.17	13.04	11.72	10.44	1.72	1.35	31.72	0.5
290_Out	174.02	161.76	149.69	126.84	110.71	97.72	90.13	77.82	69.50	61.77	10.49	8.27	174.02	0.5