Flood Impact Assessment

Westlink Industrial Estate – Stage 2
290-308 Aldington Road, Kemps Creek

304600730

Prepared for
ESR Investment Management 1 Pty Ltd

30 October 2023

Stantec

Contact Information

Stantec Australia Pty Ltd
ABN 17 007 820 322

Level 16, 207 Kent St Sydney NSW 2065

Telephone: +61 2 9493 9700

Document Information

Prepared for	ESR Investment Management 1 Pty Ltd
Project Name	Westlink Industrial Estate
File Reference	304600730 Stage 2 FIA Rpt v3B 17Oct23.docx
Job Reference	304600730
Date	30 October 2023

Document Control

Version	Date	Description of Revision	Prepared By	Prepared (Signature)	Reviewed By	Reviewed (Signature)
1	13/10/2022	Draft Final	SY, YL, BCP	Brett C. Phillips	A. Tweedie	
2	17/10/2022	Final	SY, YL, BCP	Brett C. Phillips	A. Tweedie	
3a	17/10/2022	Final – Stage 2 Modification	SY, EL	Eric Lin	A. Tweedie	

Version	Reason for Issue	Approved for Release By	Approved (Signature)	Approved Release Date
1	Draft Final Report	BCP	Brett C. Phillips	13/10/2022
2	Final Report	BCP	Brett C. Phillips	17/10/2022
3a	Final Report – Updated Stage 2 Modification	BCP	Brett C. Phillips	30/10/2023

Document Reference:
U:\304600730\4_ISSUED_DOCS\2_Report\2023 10 18 FIA Stage 2 v3\304600730 Stage 2 FIA Rpt v3d 30Oct23.docx

Executive Summary

This report aims to evaluate the collective flood impact of Stage 1 and Stage 2 of the Masterplan for the proposed development of 290-308 Aldington Road, 59-62 Abbotts Road, and 63 Abbotts Road, Kemps Creek. It is noted that the stage 1 design has been approved under SSDA9138102, and therefore this report will mainly focus on the flood impact of Stage 2 design modification, while maintaining the stage 1 approved earthwork and pipe arrangement.

The approved Stage 1 SSDA and revised concept details of Stage 2 of the Masterplan for Westlink Industrial Estate, Kemps Creek are shown in **Figure 2.**

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 and Stage 2 Conditions. The adopted imperviousness for the proposed development was 90%.

Stage 1 and Stage 2 Conditions

The approach proposed by AT&L to mitigate the impact of the Stage 1 and Stage 2 development is to construct one basin in Stage 1 as set out in **Figure 2** and in Stage 2 to install On-Site Detention systems to limit peak flows to no greater than peak flows under Benchmark Conditions**.**

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 Stage 2 and gave an estimate of the required basin storages 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 and Stage 2 Conditions without basins are summarised in **Appendix B**.

Hydraulics

Stage 1 and Stage 2 Conditions

The DEM as updated based on the proposed platform levels, proposed roadworks, drainage network, basin and swales under Stage 2 Modification as provided by AT&L

The basins were included in the TUFLOW model as was all pipe drainage lines. Benchmark conditions were adopted external to the Stage 1 and Stage 2 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 and Stage 2 Conditions are plotted for each of these events.

Flood Impact Assessment

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 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 Figures also disclose negligible adverse localise impacts south of the Stage 2 development in the 20yr ARI, 100 yr ARI and 200 yr ARI events. In the PMF these local impacts south of Stage 2 increase and limited extents of adverse impacts are also observed north of Stage 2.

The flood levels, velocities and hazards assessed under Stage 1 and Stage 2 Conditions for 20 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood levels and PMF are mapped in this Report.

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 Figures also disclose negligible adverse impacts south of the Stage 2 development in the 20yr ARI, 100 yr ARI and 200 yr ARI events. In the 500 yr ARI event local impacts are also observed south of the southwest corner of Stage 2. In the PMF these local impacts south of Stage 2 increase.

There are limited local impacts in downstream of Stage 2 Channel outlet from 100 yr ARI to PMF. The proposed Stage 2 channel works will be discharging to the existing culverts under the Mamre Road. Transport for NSW (TfNSW) is responsible for the design and construction of the Mamre Road & culverts upgrade and is currently undertaking detailed modelling and analysis to mitigate these impacts as part of their road design upgrade works. The final flood assessment report for Stage 2 will incorporate the outcomes of TfNSW's design and demonstrate compliance with the relevant flood criteria.

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 and Stage 2 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 Stage 1 and Stage 2 of the Masterplan addresses all of the considerations set out under Section 2.5 of the Mamre Road DCP.

How the Stage 1 and Stage 2 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.

Table of Contents

Appendices

List of Tables

List of Figures

Stage 2 Conditions

List of Figures Continued

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 and Environment (DPE) formally 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. Stage 1 development been approved under SSDA9138102

Stage 2 construction works will involve the construction of the internal road, warehouse 4 on the northern part of the proposed Lot 2 and warehouse 2 on the southern part of Lot 2 including its associated site landscaping and vehicular parking, a detention basin sized for ultimate conditions. The stage 2 of the project also involved the two segments of earthen bund along the southern border. The main objective of these bunds was to mitigate the flood risk to the south by reducing the overflow in that direction. For more information, please consult the civil design package prepared by AT&L.

The remainder of the proposed development will be constructed in a third final stage 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 and Stage 2 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**).

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

1.2 Location

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

1.3 Stage 1 and Stage 2 of the Masterplan

The approved Stage 1 SSDA and revised concept details of Stage 2 of the Masterplan for Westlink Industrial Estate, Kemps Creek are shown in **Figure 2**.

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.

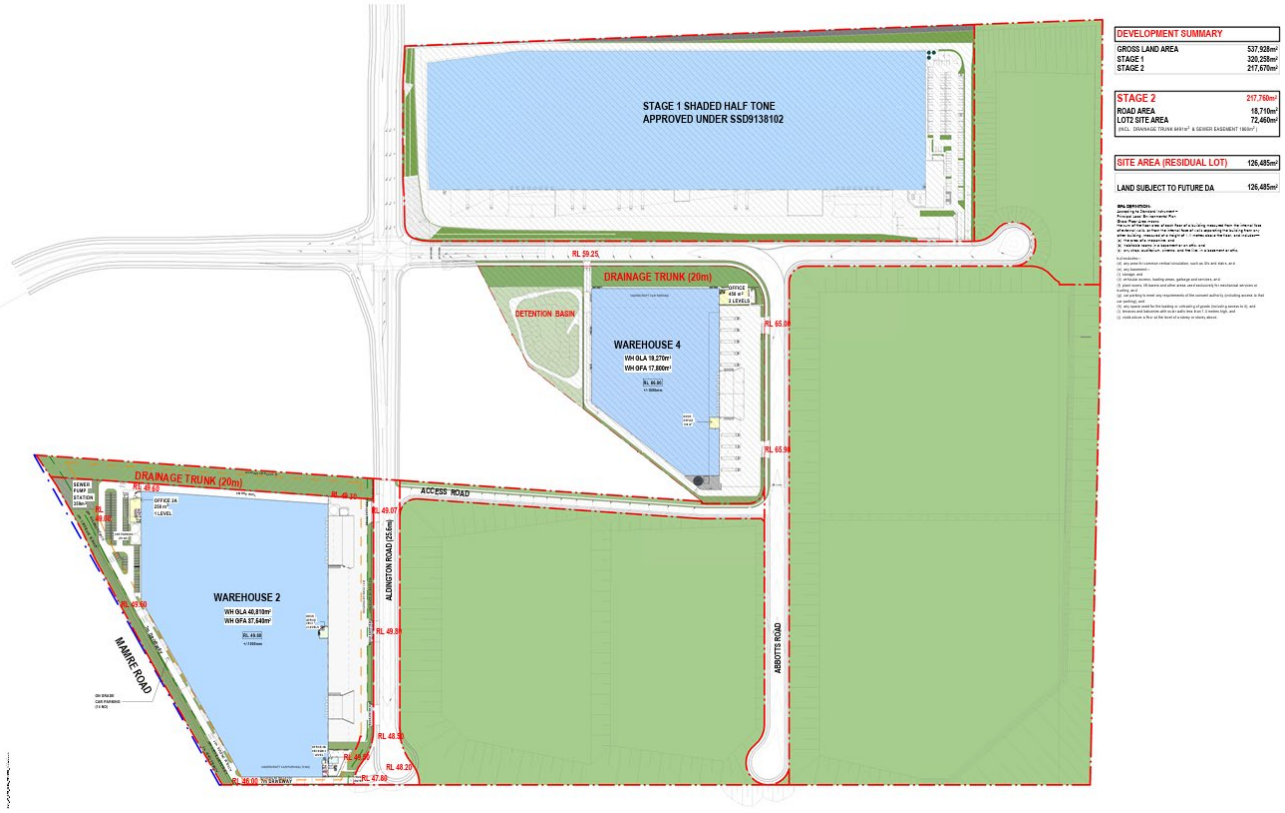


Figure 2 Stages 1 and 2 of the Masterplan for Westlink Industrial Estate

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.

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
Extreme	0.0005	0.05	2000	2000
	0.0002	0.02	5000	5000
			↓	
			PMP/ PMPDF	

Figure 1.2.1. Australian Rainfall and Runoff Preferred Terminology

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.

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 and Stage 2 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 and Stage 2 development is to construct one basin in Stage 1 as set out in **Figure 2** and in Stage 2 to install On-Site Detention systems to limit peak flows to no greater than peak flows under Benchmark Conditions**.**

2.2 Concept Sizing of Basins

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 catchments draining to the basins located in Stage 1 and Stage 2 and gave an estimate of the required basin storages 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	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
	ESR Industrial Estate Stage 1 Area (ha)	32.69							
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
	ESR Industrial Estate Stage 2 Area (ha)	21.76							
1987	2 yr ARI (12 hr) & 100 yr ARI (2 hr)	4,379	9,148	201	420	0.93	2.56	42.8	117.7

2.3 Earth Bunds

The **STAGE 2** of the project also involved the two segments of earthen bund along the southern border. The main objective of these bunds was to mitigate the flood risk to the south by reducing the overflow in that direction. For more information, please consult the civil design package prepared by AT&L

2.4 Hydrological Modelling

A local hydrological model was created to assess runoff under Stage 1 and Stage 2 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 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

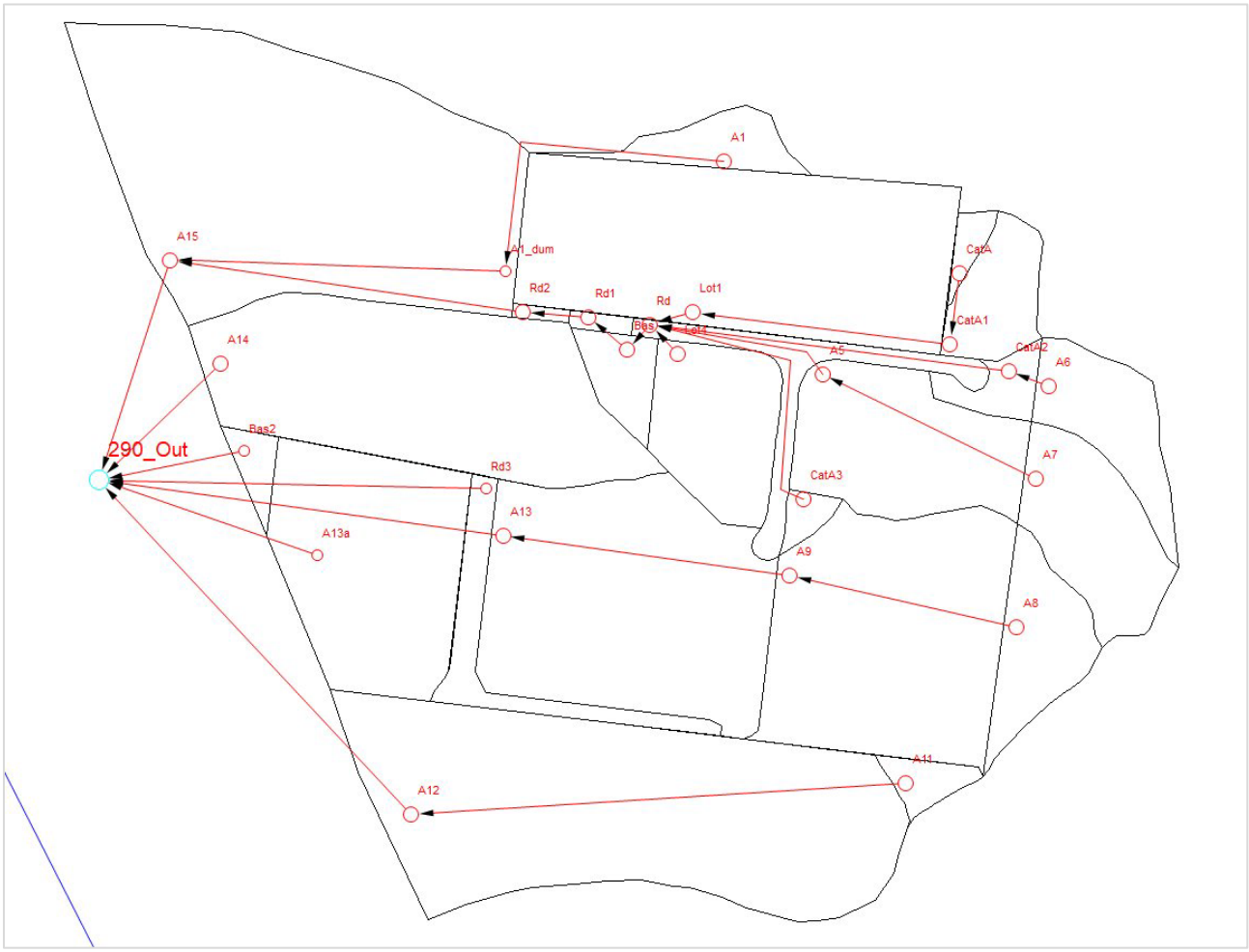


Figure 3 XP-RAFTS Subcatchment Layout for Stage 1 and Stage 2 of the Westlink Industrial Estate

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.**

3 Flooding Assessment

The assessment of flooding under Stage 1 and Stage 2 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 1and Stage 2 Conditions as provided by AT&L.

The Stage 1 basin was included in the TUFLOW model as was all pipe drainage lines. Stage 2 relies on On-Site Detention to limit peak flows to no greater than peak flows under Benchmark Conditions. Benchmark conditions were adopted external to the Stage 1 and Stage 2 development.

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

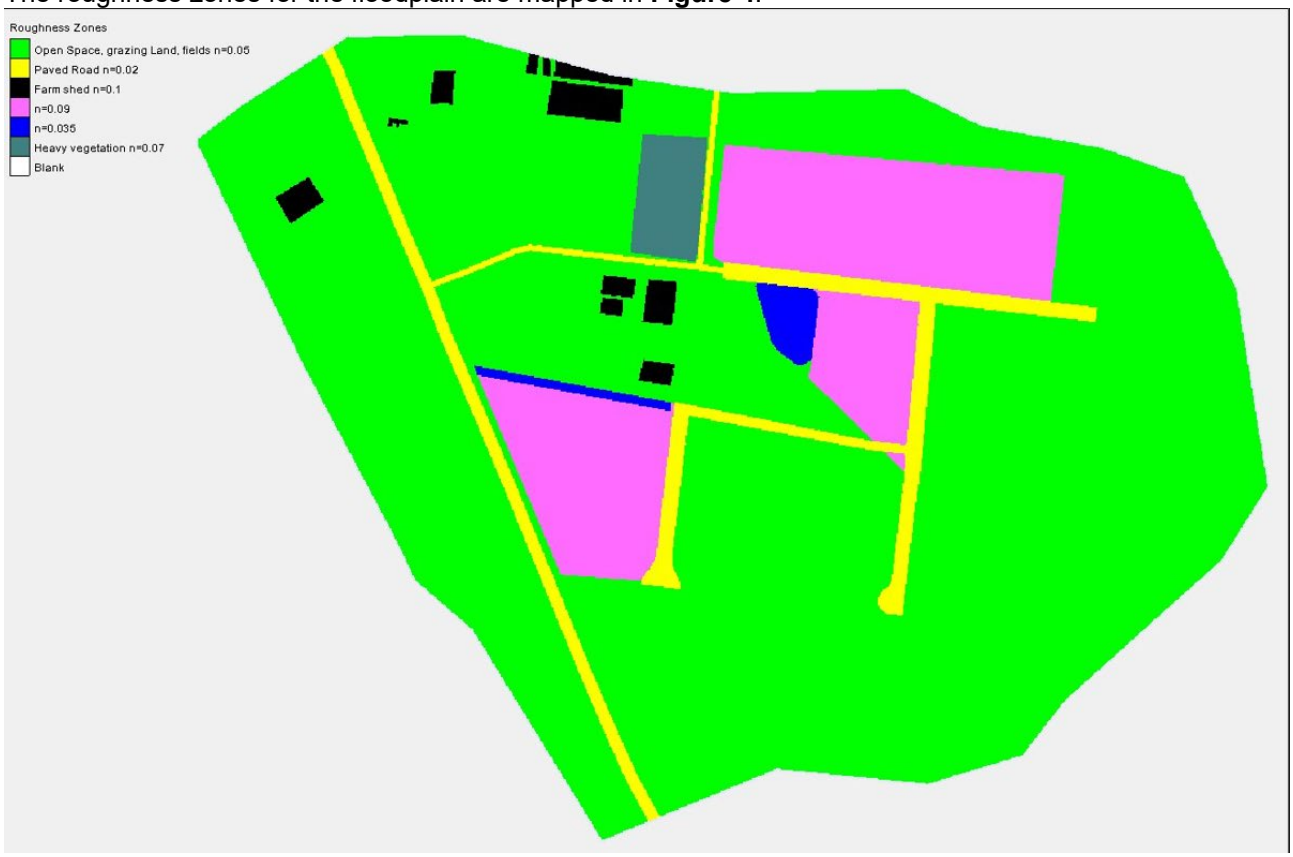


Figure 4 Adopted Roughness Zones under Stage 1 and Stage 2 Conditions

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.

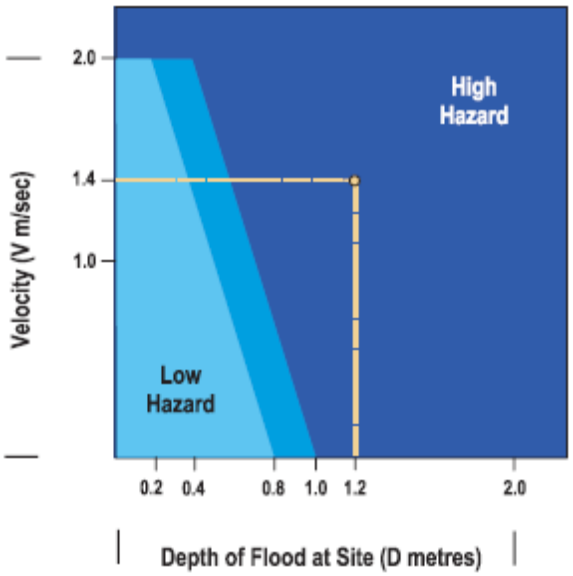
3.1 Stage 1 and Stage 2 Conditions

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 and Stage 2 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 Stage 1 and Stage 2 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 Stage 1 and Stage 2 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 Stage 1 and Stage 2 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 Stage 1 and Stage 2 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 Stage 1 and Stage 2 Conditions are plotted respectively in **Figures F25, F26, F27** and **F28**.

4 Flood Impact Assessment

The impacts of Stage 1 and Stage 2 of the Westlink Industrial Estate, Kemps Creek are summarised as follows.

4.1 Flood Level Impacts

The estimated impact of Stage 1 and Stage 2 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 Figures also negligible adverse impacts south of the Stage 2 development in the 20yr ARI, 100 yr ARI and 200 yr ARI events. In the 500 yr ARI event local impacts are observed south of Stage 2. In the PMF these local impacts south of Stage 2 increase and limited extents of adverse impacts are also observed at stormwater channel outlet to Stage 2.

There are minor local impacts in downstream of Stage 2 channel outlet in floods from 100 yr ARI to the PMF. The proposed Stage 2 channel works discharge to the existing culverts under the Mamre Road. Transport for NSW (TfNSW) is responsible for the design and construction of the Mamre Road and crossing upgrade and is currently undertaking detailed modelling and analysis to mitigate these impacts as part of their road design upgrade works.

The impacts occur on agricultural lands only.

4.2 Flood Velocity Impacts

The estimated impact of the Stage 1 and Stage 2 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.

These Figures also 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 Figures also show negligible adverse impacts south of the Stage 2 development in the 20yr ARI, 100 yr ARI and 200 yr ARI events. In the 500 yr ARI event local impacts are also observed south of the southwest corner of Stage 2 and in the PMF these local impacts south of Stage 2 increase.

There are limited local impacts at the Stage 2 drainage outlet in the northwest corner of Stage 2 in all events. TfNSW are currently designing a culvert crossing to connect to the Stage 2 channel outlet. It is expected that the minor local flood impacts will be resolved as part of these works.

The impacts occur on agricultural lands only.

4.3 Discussion

It is noted that the Stage 1 design has been approved under SSDA9138102, and therefore this report concentrates on the flood impact of Stage 2 design modification, while maintaining the Stage 1 approved earthwork and pipe arrangement.

The flood impact assessment has been undertaken on the basis of currently available information downstream of the development in Abbotts Road and Aldington Road. It is expected that the future upgrade to Abbotts Road and Aldington Road will include an upgrade of the cross drainage to accommodate outflows from the Westlink Stage 1 and Stage 2 development.

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 and Stage 2 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 and Stage 2of 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 FRA.

- *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 Stage 1 and Stage 2 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 Figures herein 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 Figures also show negligible adverse impacts south of the Stage 2 development in the 20yr ARI, 100 yr ARI and 200 yr ARI events. In the 500 yr ARI event local impacts are observed south of Stage 2. In the PMF these local impacts south of Stage 2 increase and limited extents of adverse impacts are also observed at stormwater channel outlet to Stage 2. There are minor local impacts in downstream of Stage 2 channel outlet in floods from 100 yr ARI to the PMF. The proposed Stage 2 channel works discharge to the existing culverts under the Mamre Road. Transport for NSW (TfNSW) is responsible for the design and construction of the Mamre Road and crossing upgrade and is currently undertaking detailed modelling and analysis to mitigate these impacts as part of their road design upgrade works.

The flood levels, velocities and hazards assessed under Stage 1 and Stage 2 Conditions for 20 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood levels and PMF are mapped in this Report.

The Figures herein also 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 Figures also show negligible adverse impacts south of the Stage 2 development in the 20yr ARI, 100 yr ARI and 200 yr ARI events. In the 500 yr ARI event local impacts are also observed south of the southwest corner of Stage 2 and in the PMF these local impacts south of Stage 2 increase.

There are limited local impacts at the Stage 2 drainage outlet in the northwest corner of Stage 2 in all events. TfNSW are currently designing a culvert crossing to connect to the Stage 2 channel outlet. It is expected that the minor local flood impacts will be resolved as part of these works.

The impacts occur on agricultural lands only.

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

Under Stage 1 and Stage 2 Conditions all flows up to the 500 yr ARI are conveyed through the Stage 1 and Stage 2 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 and Stage 2 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 and Stage 2 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 Figures herein 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 Figures also show negligible adverse impacts south of the Stage 2 development in the 20yr ARI, 100 yr ARI and 200 yr ARI events. In the 500 yr ARI event local impacts are observed south of Stage 2. In the PMF these local impacts south of Stage 2 increase and limited extents of adverse impacts are also observed at stormwater channel outlet to Stage 2. There are minor local impacts in downstream of Stage 2 channel outlet in floods from 100 yr ARI to the PMF. The proposed Stage 2 channel works discharge to the existing culverts under the Mamre Road. Transport for NSW (TfNSW) is responsible for the design and construction of the Mamre Road and crossing upgrade and is currently undertaking detailed modelling and analysis to mitigate these impacts as part of their road design upgrade works.

The flood levels, velocities and hazards assessed under Stage 1 and Stage 2 Conditions for 20 yr ARI, 100 yr ARI, 200 yr ARI, 500 yr ARI flood levels and PMF are mapped in this Report.

The Figures herein also 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 Figures also show negligible adverse impacts south of the Stage 2 development in the 20yr ARI, 100 yr ARI and 200 yr ARI events. In the 500 yr ARI event local impacts are also observed south of the southwest corner of Stage 2 and in the PMF these local impacts south of Stage 2 increase.

There are limited local impacts at the Stage 2 drainage outlet in the northwest corner of Stage 2 in all events. TfNSW are currently designing a culvert crossing to connect to the Stage 2 channel outlet. It is expected that the minor local flood impacts will be resolved as part of these works.

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.

The approach proposed by AT&L to mitigate the impact of the Stage 1 and Stage 2 development is to construct one basin in Stage 1 and in Stage 2 to install On-Site Detention systems to limit 1% AEP peak flows to no greater than peak flows under Benchmark Conditions**.**

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 Stage 1 development while OSD systms are proposed for Stage 2 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 and Stage 2 of the Masterplan addresses all of the considerations set out under Section 2.5 of the Mamre Road DCP.

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 (NSW/ACT) (2020) "Flood Impact Assessment, Aspect Industrial Estate (AIE)", *Final Report*, prepared for Mirvac, October, 17 pp + Apps

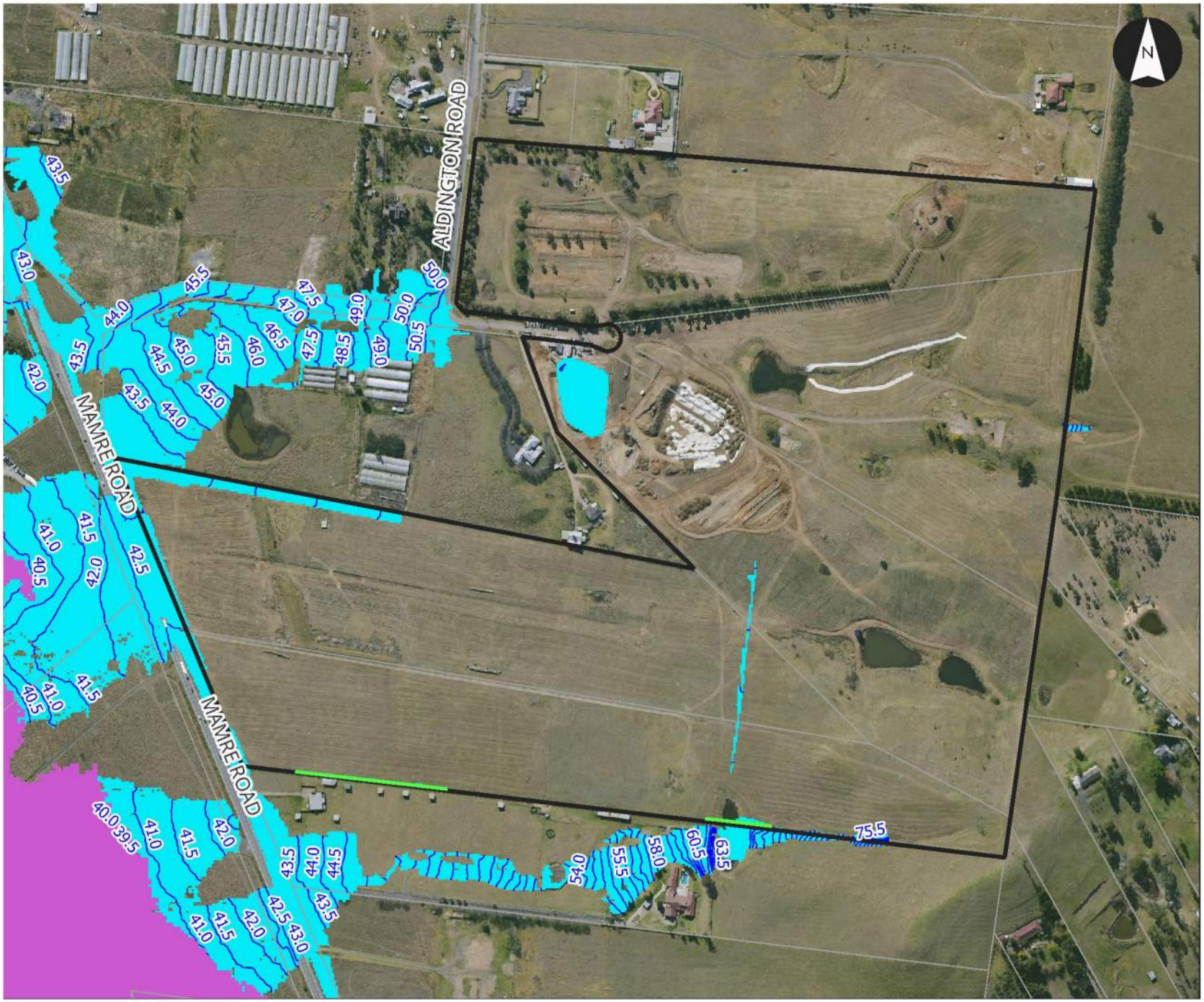
Cardno now Stantec (2022) "Flood Risk Assessment, Westlink Industrial Estate, Kemps Creek", Draft Final Report, prepared for ESR Investment Management 1 Pty Ltd, September, 26 pp + Apps

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

WMAwater (2012) "Upper South Creek Flood Study", *Final Report 2011 Revision 1*, prepared for Camden Council, May, 39 pp + Apps.

WorleyParsons (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.



Stage 1A + Stage 2A Modification 20 Year ARI
Flood Extents & Flood Levels

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F1

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (20yr) Flood Extent
- 0.5m Water Level Contour (mAHD)
- Flood Extent

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification 20 Year ARI Flood Depths

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F2

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (20yr) 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

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification 20 Year ARI Flood Velocities

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F3

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (20yr) 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

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification 20 Year ARI Flood Hazard

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F4

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (20yr) Flood Extent

Flood Hazard

- Low
- Transitional
- High

DRAFT - Not For Construction

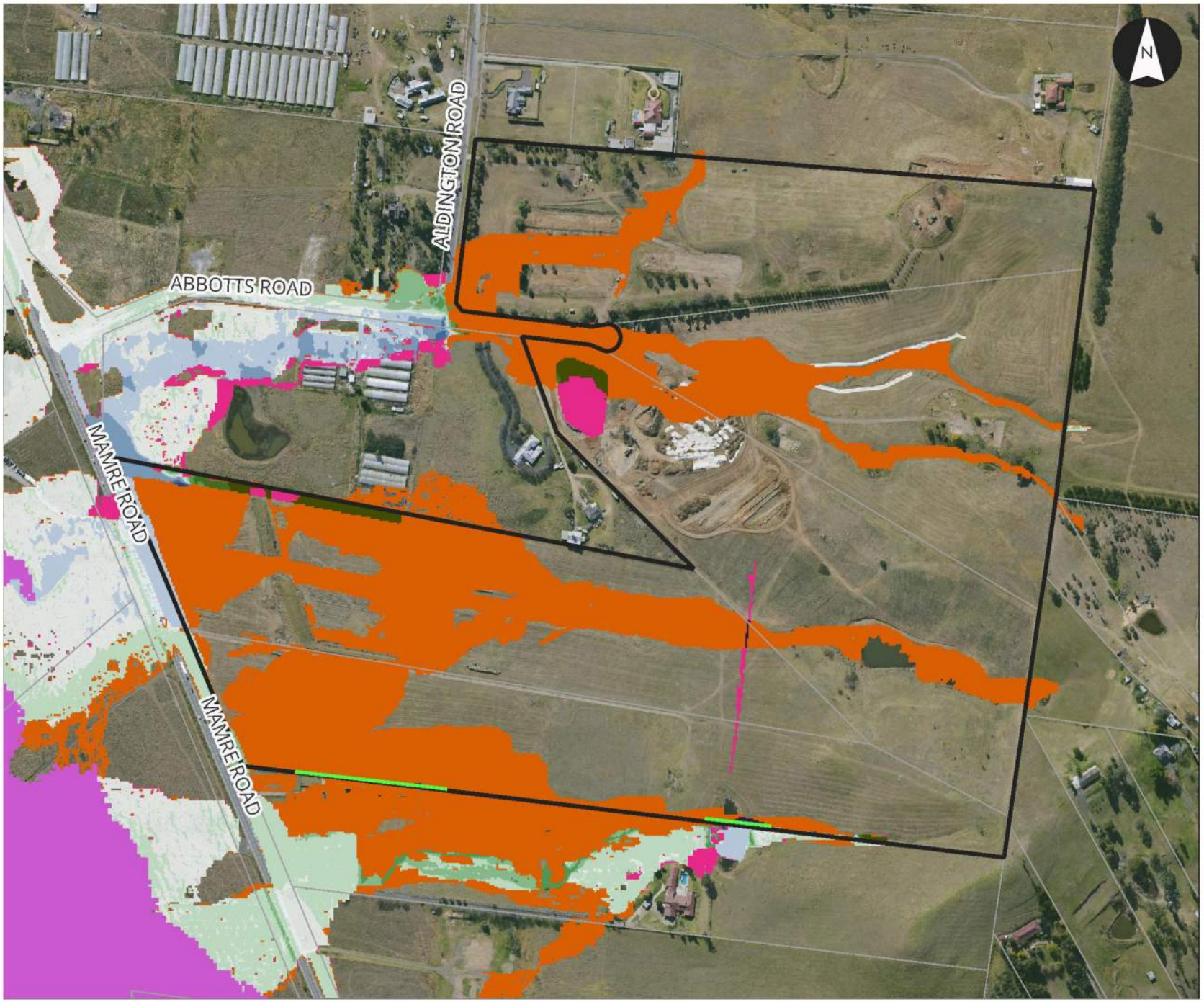
Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000



Stage 1A + Stage 2A Modification 20 Year ARI
Water Level Difference
Design Minus Existing

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F5

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (20yr) Flood Extent

Change in Flood Extents (Wet/Dry)

- 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

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification 20 Year ARI
Velocity Difference
Design Minus Existing

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F6

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (20yr) Flood Extent

Velocity Difference (m/s)

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

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
100 Year ARI
Flood Extents & Flood Levels

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F7

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (100yr) Flood Extent
- 0.5m Water Level Contour (mAHD)
- Flood Extent

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
100 Year ARI
Flood Depths

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F8

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (100yr) 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

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
100 Year ARI
Flood Velocities

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F9

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (100yr) 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

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
100 Year ARI
Flood Hazard

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F10

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (100yr) Flood Extent

Flood Hazard
- Low
- Transitional
- High

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
100 Year ARI
Water Level Difference
Design Minus Existing

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F11

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (100yr) Flood Extent

Change in Flood Extents (Wet/Dry)

- 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

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
100 Year ARI
Velocity Difference
Design Minus Existing

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F12

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (100yr) Flood Extent

Velocity Difference (m/s)

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

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
200 Year ARI
Flood Extents & Flood Levels

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F13

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (200yr) Flood Extent
- 0.5m Water Level Contour (mAHD)
- Flood Extent

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
200 Year ARI
Flood Depths

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F14

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (200yr) 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

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
200 Year ARI
Flood Velocities

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F15

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (200yr) 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

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
200 Year ARI
Flood Hazard

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F16

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (200yr) Flood Extent

Flood Hazard
- Low
- Transitional
- High

DRAFT - Not For Construction

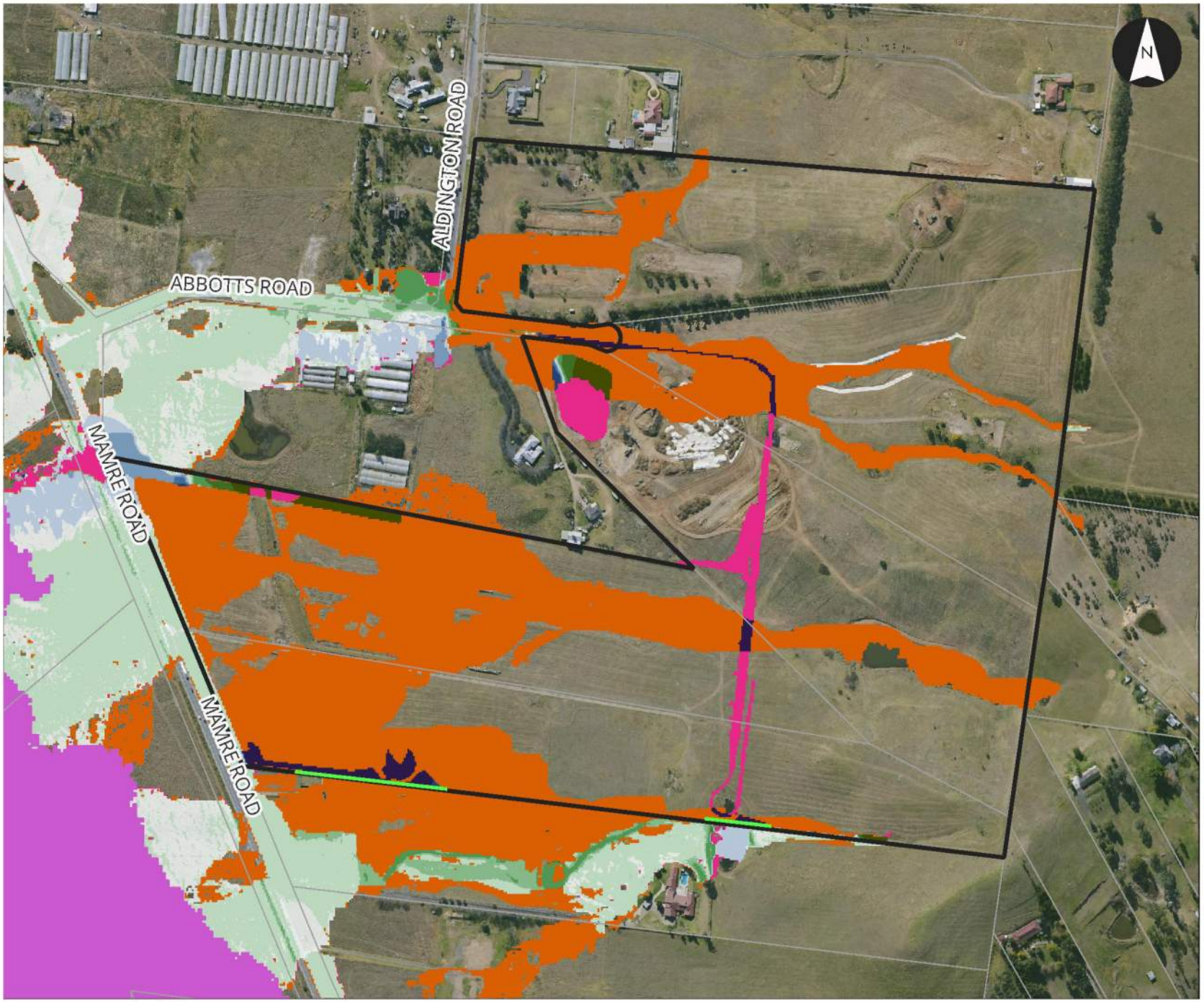
Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000



Stage 1A + Stage 2A Modification
200 Year ARI
Water Level Difference
Design Minus Existing

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F17

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (200yr) Flood Extent

Change in Flood Extents (Wet/Dry)

- 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

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
200 Year ARI
Velocity Difference
Design Minus Existing

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F18

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (200yr) Flood Extent

Velocity Difference (m/s)

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

DRAFT - Not For Construction

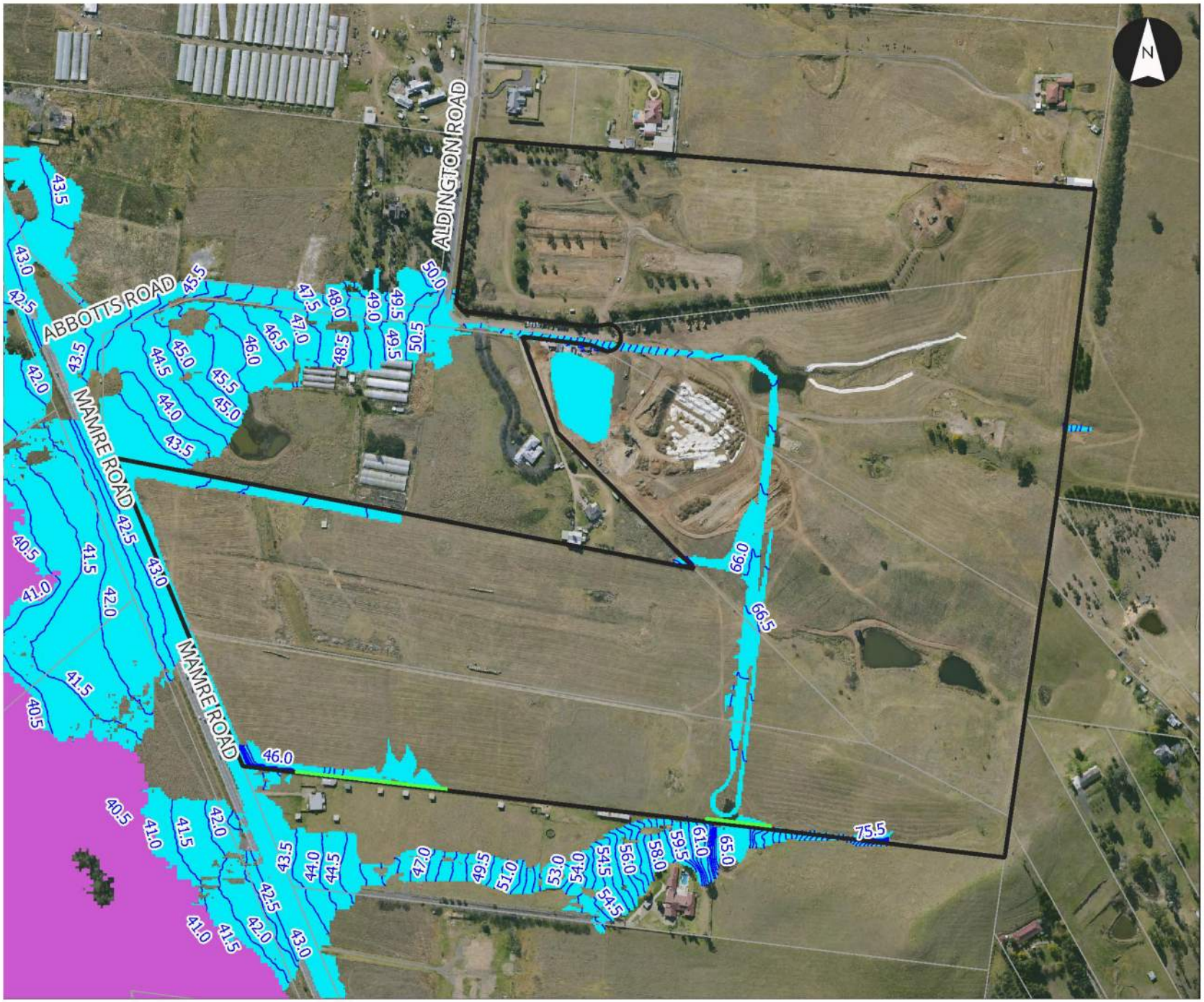
Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000



Stage 1A + Stage 2A Modification
500 Year ARI
Flood Extents & Flood Levels

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F19

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (500yr) Flood Extent
- 0.5m Water Level Contour (mAHD)
- Flood Extent

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
500 Year ARI
Flood Depths

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F20

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (500yr) 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

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
500 Year ARI
Flood Velocities

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F21

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (500yr) 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

DRAFT - Not For Construction

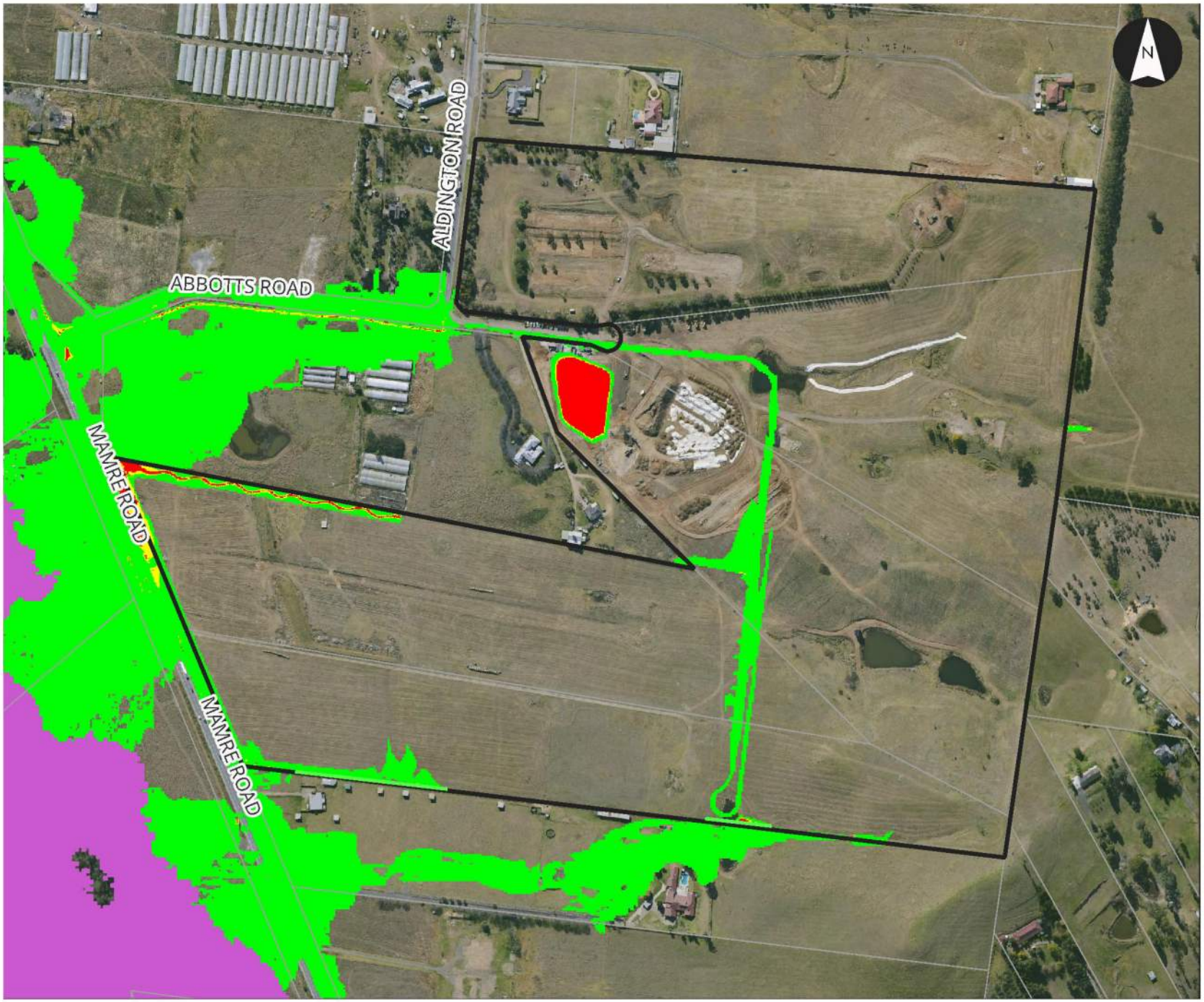
Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000



Stage 1A + Stage 2A Modification
500 Year ARI
Flood Hazard

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F22

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (500yr) Flood Extent

Flood Hazard
- Low
- Transitional
- High

DRAFT - Not For Construction

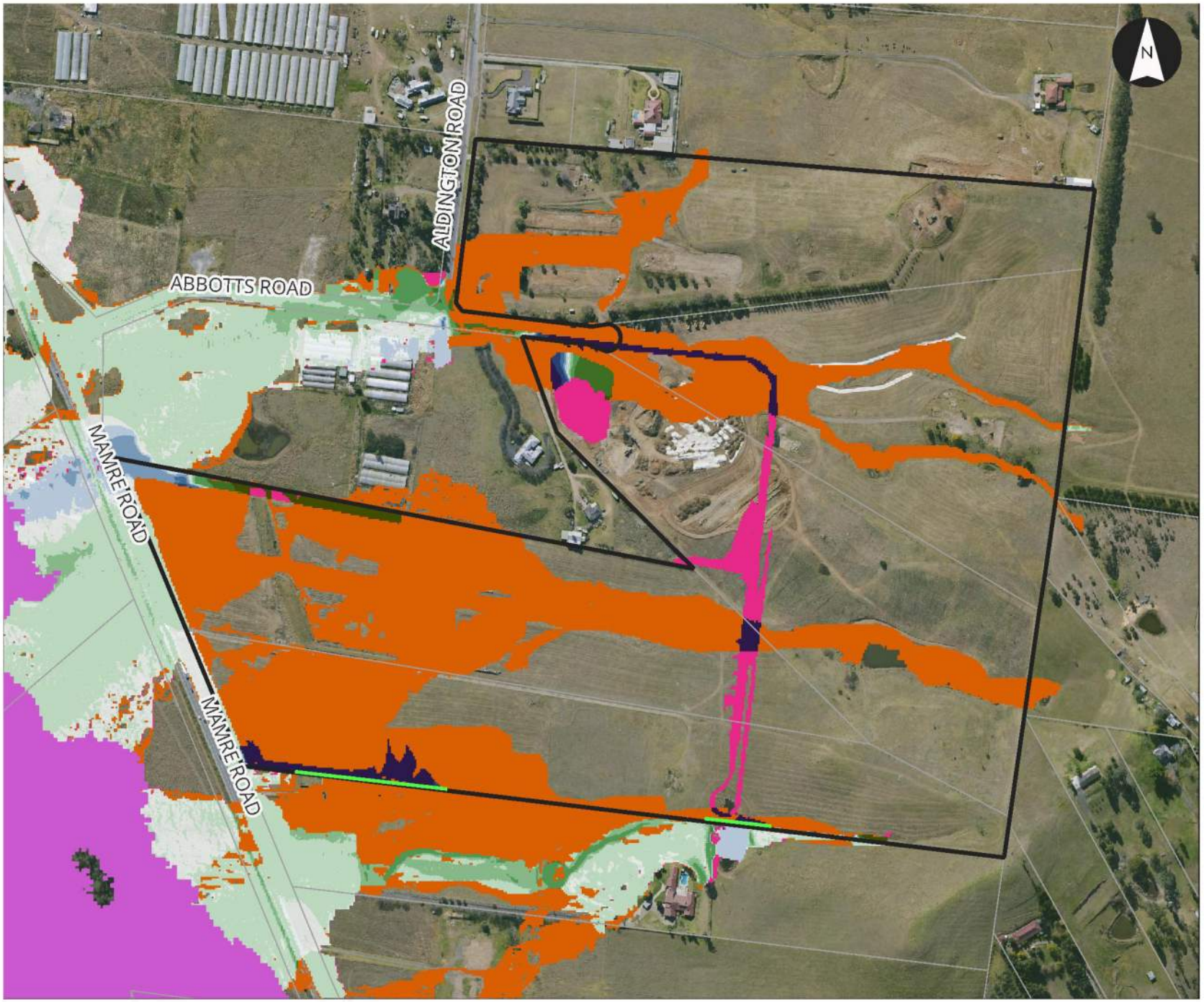
Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000



Stage 1A + Stage 2A Modification
500 Year ARI
Water Level Difference
Design Minus Existing

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F23

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (500yr) Flood Extent

Change in Flood Extents (Wet/Dry)

- 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

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
500 Year ARI
Velocity Difference
Design Minus Existing

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F24

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (500yr) Flood Extent

Velocity Difference (m/s)

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

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
PMF
Flood Extents & Flood Levels

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F25

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (PMF) Flood Extent
- 0.5m Water Level Contour (mAHD)
- Flood Extent

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
PMF
Flood Depths

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730

Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F26

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (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

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
PMF
Flood Velocities

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F27

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (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

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
PMF
Flood Hazard

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F28

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (PMF) Flood Extent

Flood Hazard
- Low
- Transitional
- High

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

Stage 1A + Stage 2A Modification
PMF
Water Level Difference
Design Minus Existing

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F29

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (PMF) Flood Extent

Change in Flood Extents (Wet/Dry)

- 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

DRAFT - Not For Construction

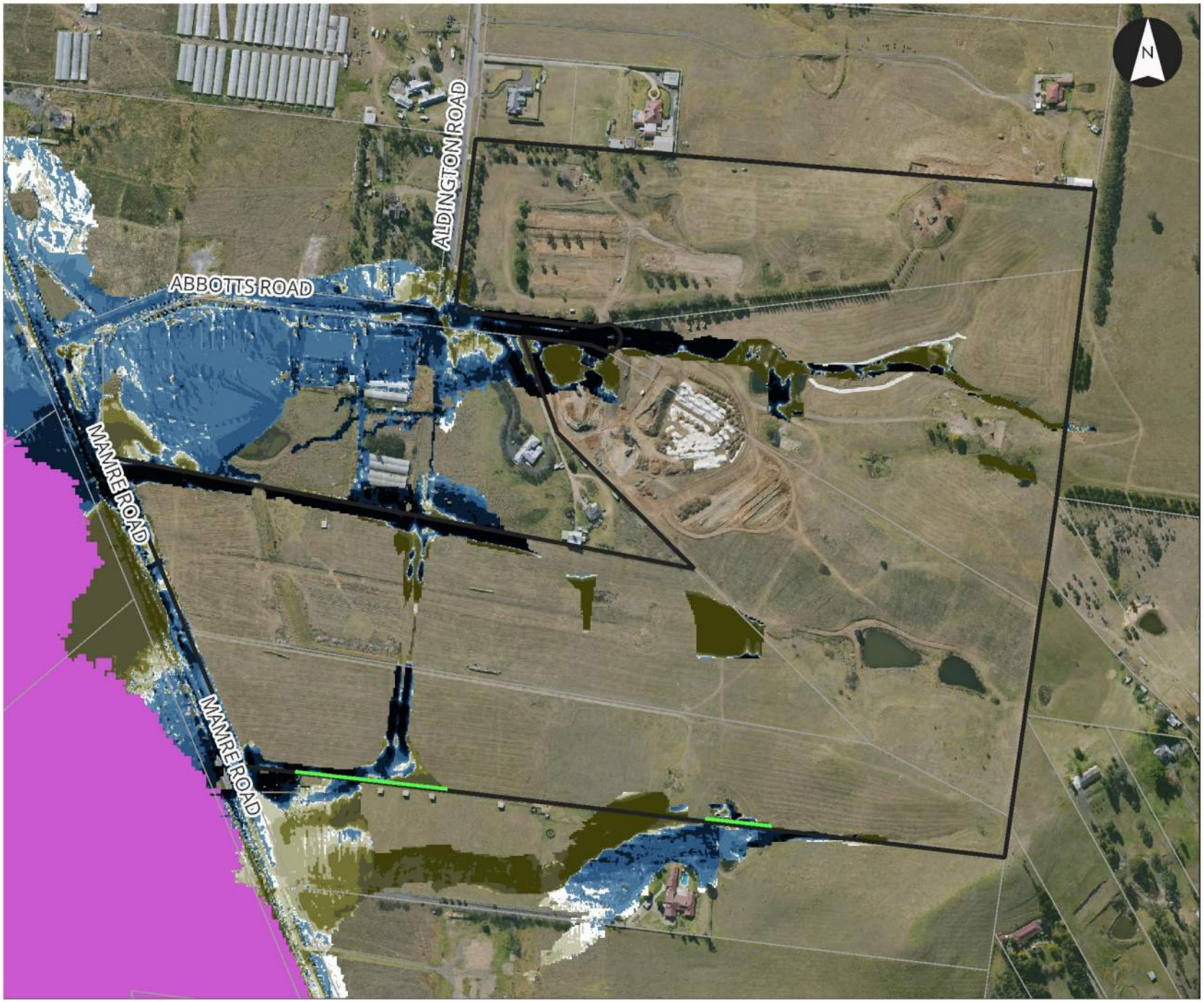
Notes:
1. Map displayed in EPSG:28356

References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000



Stage 1A + Stage 2A Modification
PMF
Velocity Difference
Design Minus Existing

Project: Westlink ESR Industrial Estate
Client: ESR Australia
Project Code: 304700730
Drawn By: AC, Checked By: SY
Date: (2023-10-13)
Figure No: F30

Legend

- 1m High Bunds
- Site Boundary
- Cadastre
- South Creek Flood Study (PMF) Flood Extent

Velocity Difference (m/s)

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

DRAFT - Not For Construction

Notes:
1. Map displayed in EPSG:28356

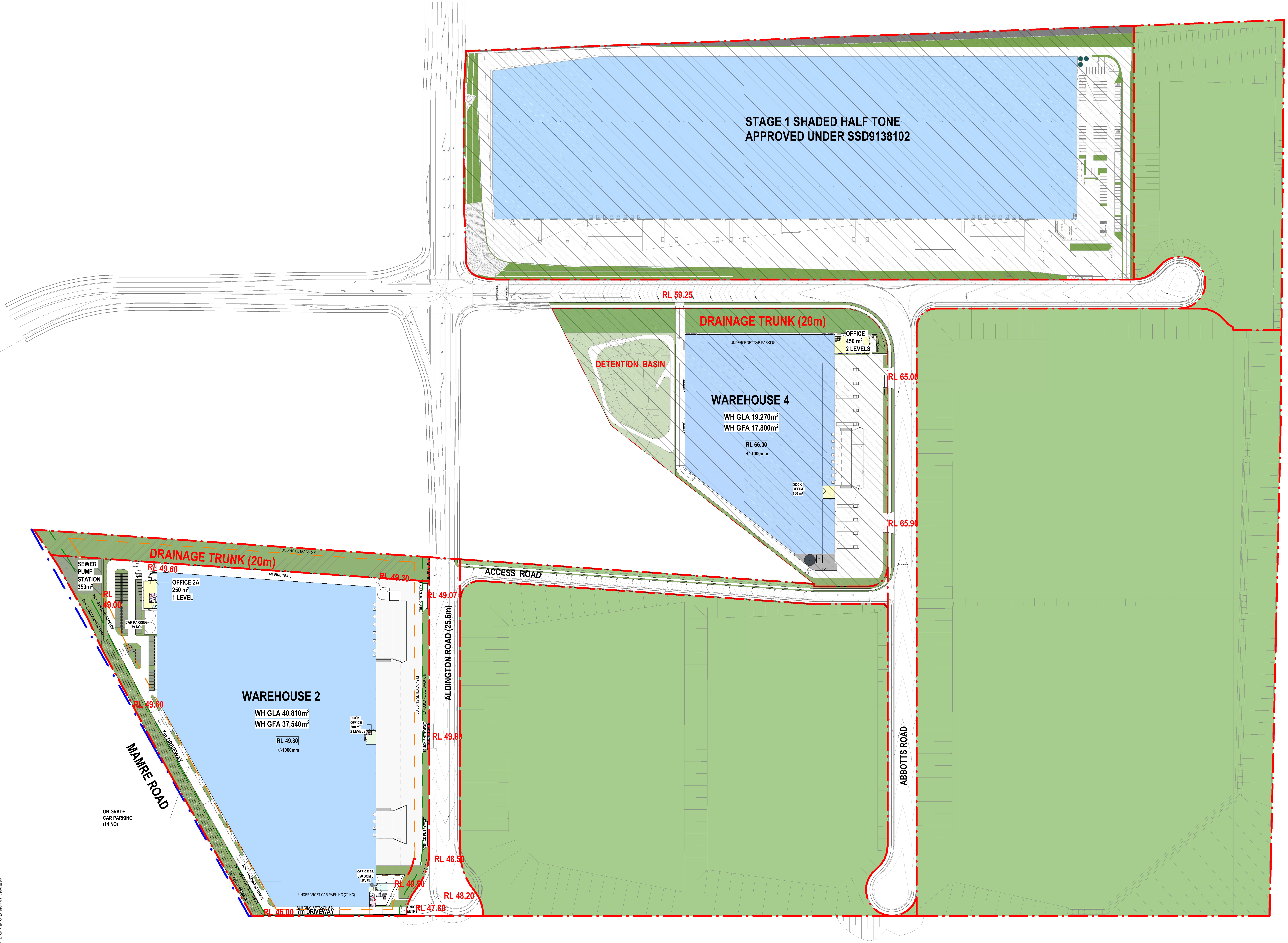
References:
1. Base map - Metromap

Stantec

48 0 48 96 144 192 m

Scale at A3: 1:6000

APPENDIX A
STAGE 1 AND STAGE 2 OF THE MASTERPLAN



DEVELOPMENT SUMMARY	
GROSS LAND AREA	537,928m²
STAGE 1	320,258m²
STAGE 2	217,670m²

STAGE 2	217,760m²
ROAD AREA	18,710m²
LOT2 SITE AREA	72,460m²
(INCL. DRAINAGE TRUNK 6491m² & SEWER EASEMENT 1860m²)	

SITE AREA (RESIDUAL LOT)	126,485m²
LAND SUBJECT TO FUTURE DA	126,485m²

GFA DEFINITION:
Accroding 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.

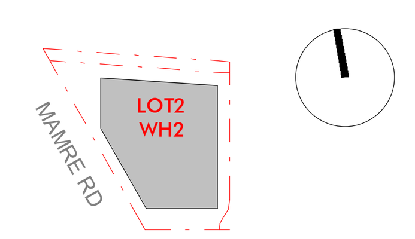
Client

ESR

Issue	Description	Date
P8	ISSUE FOR SSDA	28.09.2023
P7	ISSUE FOR SSDA	27.09.2023
P6	ISSUE FOR SSDA	12.09.2023
P5	PRELIMINARY	05.09.2023
P4	PRELIMINARY	01.09.2023
P3	PRELIMINARY	02.08.2023
P2	PRELIMINARY	28.07.2023
P1	PRELIMINARY	19.07.2023

SSDA

Key Plan



Project Name
Westlink

Project Address
Mamre Road, Kemps Creek

Bar Scales
0 20000 50000

Drawing Title:
ESTATE PLAN - STAGE 1&2

Author:	Checker:	Sheet Size:	Scale:
VF	ES	A1	1 : 1500

Drawing Number: **12963_DA002**
Issue: **P8**

nettletontribe
nettleton tribe partnership pty ltd ABN 58 161 683 122
117 Willoughby Road, Crows Nest, NSW 2065
t +61 2 9431 6431
e: sydney@nettletontribe.com.au w: nettletontribe.com.au

APPENDIX B
XP-RAFTS RESULTS

304600730 290_Aldington ARR1987 Hydrology

Stage 1 + Stage 2

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	Peak Flow (m3/s)	Critical Duration (hrs)
Subcatchment ID / Duration (min)	30	45	60	90	120	180	270	360	540	720	1440	2160		
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	4.73	4.11	4.37	4.63	4.25	2.62	2.33	1.76	1.54	1.54	1.03	0.82	4.73	0.5
Rd	8.36	7.26	7.55	8.09	7.40	5.21	4.86	3.95	3.45	3.47	2.32	1.82	8.36	0.5
Bas	9.81	7.96	9.74	10.58	9.56	6.82	6.27	4.98	4.35	4.36	2.90	2.28	10.58	1.5
Rd1	9.86	8.00	9.79	10.63	9.62	6.86	6.30	5.00	4.37	4.38	2.92	2.29	10.63	1.5
Rd2	9.87	8.03	9.81	10.64	9.65	6.88	6.32	5.02	4.38	4.39	2.93	2.30	10.64	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	10.94	9.16	11.45	12.58	11.55	8.59	8.38	6.96	6.12	6.12	4.22	3.31	12.58	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	1.81	1.87	2.41	2.59	2.71	2.00	1.82	1.43	1.24	1.24	0.81	0.63	2.71	2.0
A13	2.83	3.18	3.89	4.01	4.22	3.19	3.28	2.66	2.30	2.32	1.58	1.23	4.22	2.0
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	2.04	2.26	2.73	2.72	2.96	2.20	2.33	2.00	1.73	1.75	1.17	0.91	2.96	2.0
Bas2	0.18	0.16	0.18	0.19	0.18	0.10	0.09	0.07	0.06	0.06	0.04	0.03	0.19	1.5
A13a	2.53	2.26	2.44	2.60	2.47	1.35	1.20	0.90	0.79	0.79	0.53	0.42	2.60	1.5
Rd3	0.62	0.56	0.61	0.65	0.61	0.34	0.30	0.22	0.20	0.20	0.13	0.10	0.65	1.5
290_Out	15.99	15.05	18.64	20.43	19.84	15.20	16.18	13.75	12.00	12.26	8.41	6.58	20.43	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	Peak Flow (m3/s)	Critical Duration (hrs)
Subcatchment ID / Duration (min)	30	45	60	90	120	180	270	360	540	720	1440	2160		
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	5.69	5.09	5.39	5.68	5.22	3.24	2.88	2.16	1.88	1.89	1.27	1.01	5.69	0.5
Rd	10.13	9.05	9.53	10.28	9.40	6.79	6.09	4.85	4.23	4.24	2.86	2.26	10.28	1.5
Bas	12.60	10.70	12.56	13.42	12.28	8.77	7.83	6.11	5.33	5.33	3.58	2.83	13.42	1.5
Rd1	12.67	10.76	12.62	13.48	12.35	8.82	7.87	6.14	5.36	5.36	3.60	2.85	13.48	1.5
Rd2	12.71	10.79	12.65	13.50	12.39	8.85	7.90	6.16	5.38	5.37	3.61	2.86	13.50	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	14.59	12.85	15.42	16.58	15.44	11.47	10.74	8.64	7.55	7.55	5.22	4.13	16.58	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	2.83	2.78	3.40	3.41	3.68	2.64	2.28	1.76	1.53	1.53	1.01	0.79	3.68	2.0
A13	4.53	4.77	5.49	5.45	5.68	4.23	4.11	3.31	2.86	2.88	1.96	1.54	5.68	2.0
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	3.26	3.44	3.92	3.87	4.14	3.22	2.96	2.48	2.15	2.16	1.45	1.14	4.14	2.0
Bas2	0.22	0.20	0.22	0.24	0.23	0.12	0.11	0.08	0.07	0.07	0.05	0.04	0.24	1.5
A13a	3.02	2.80	3.00	3.18	3.02	1.67	1.49	1.11	0.97	0.97	0.65	0.52	3.18	1.5
Rd3	0.75	0.69	0.75	0.80	0.76	0.42	0.37	0.27	0.24	0.24	0.16	0.13	0.80	1.5
290_Out	23.12	22.45	26.71	28.12	27.29	20.75	20.75	17.26	14.91	15.15	10.43	8.23	28.12	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	Peak Flow (m3/s)	Critical Duration (hrs)
Subcatchment ID / Duration (min)	30	45	60	90	120	180	270	360	540	720	1440	2160		
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	6.28	5.62	5.97	6.28	5.79	3.59	3.19	2.38	2.08	2.08	1.41	1.12	6.28	0.5
Rd	11.20	10.00	10.64	11.51	10.53	7.66	6.76	5.37	4.68	4.69	3.17	2.52	11.51	1.5
Bas	14.24	12.01	14.04	15.00	13.76	9.85	8.68	6.76	5.90	5.90	3.98	3.15	15.00	1.5
Rd1	14.33	12.08	14.11	15.07	13.84	9.90	8.73	6.79	5.93	5.93	4.00	3.17	15.07	1.5
Rd2	14.38	12.12	14.14	15.09	13.89	9.93	8.76	6.81	5.95	5.94	4.01	3.18	15.09	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	16.64	14.65	17.49	18.74	17.51	13.00	11.99	9.58	8.37	8.37	5.80	4.60	18.74	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	3.34	3.23	3.86	3.83	4.14	2.96	2.54	1.94	1.69	1.69	1.13	0.89	4.14	2.0
A13	5.34	5.51	6.21	6.17	6.37	4.75	4.56	3.67	3.18	3.20	2.18	1.72	6.37	2.0
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	3.80	3.96	4.46	4.50	4.76	3.73	3.31	2.75	2.39	2.40	1.61	1.27	4.76	2.0
Bas2	0.25	0.22	0.25	0.26	0.25	0.14	0.12	0.09	0.08	0.08	0.05	0.04	0.26	1.5
A13a	3.34	3.09	3.32	3.52	3.35	1.86	1.65	1.22	1.07	1.07	0.72	0.58	3.52	1.5
Rd3	0.83	0.77	0.83	0.88	0.84	0.47	0.41	0.30	0.26	0.26	0.18	0.14	0.88	1.5
290_Out	26.87	26.01	30.72	31.96	31.21	23.50	23.14	19.18	16.58	16.82	11.59	9.17	31.96	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	Peak Flow (m3/s)	Critical Duration (hrs)
Subcatchment ID / Duration (min)	30	45	60	90	120	150	180	240	300	360	1440	2160		
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	7.09	6.33	6.75	7.11	6.56	4.07	3.61	2.69	2.35	2.35	1.598	1.275	7.11	1.5
Rd	12.66	11.30	12.17	13.21	12.09	8.80	7.66	6.06	5.29	5.29	3.592	2.86	13.21	1.5
Bas	16.44	13.73	16.05	17.18	15.79	11.28	9.83	7.63	6.67	6.66	4.509	3.585	17.18	1.5
Rd1	16.55	13.81	16.13	17.25	15.88	11.34	9.88	7.67	6.70	6.70	4.531	3.603	17.25	1.5
Rd2	16.60	13.85	16.16	17.28	15.93	11.37	9.91	7.69	6.72	6.71	4.547	3.616	17.28	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	19.43	17.07	20.31	21.68	20.38	15.02	13.66	10.85	9.48	9.49	6.592	5.238	21.68	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	4.02	3.84	4.45	4.42	4.74	3.37	2.89	2.20	1.92	1.91	1.28	1.013	4.74	2.0
A13	6.38	6.52	7.19	7.09	7.27	5.44	5.18	4.16	3.61	3.63	2.475	1.958	7.27	2.0
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	4.52	4.66	5.20	5.39	5.64	4.37	3.78	3.12	2.71	2.72	1.834	1.45	5.64	2.0
Bas2	0.28	0.25	0.28	0.30	0.28	0.16	0.14	0.10	0.09	0.09	0.0589	0.047	0.30	1.5
A13a	3.77	3.49	3.75	3.98	3.78	2.10	1.86	1.38	1.21	1.21	0.8194	0.6534	3.98	1.5
Rd3	0.94	0.87	0.94	1.00	0.95	0.53	0.46	0.34	0.30	0.30	0.20	0.16	1.00	1.5
290_Out	31.94	30.85	36.15	37.09	36.45	27.12	26.34	21.77	18.84	19.08	13.17	10.45	37.09	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	-	-	Peak Flow (m3/s)	Critical Duration (hrs)
Subcatchment ID / Duration (min)	30	45	60	90	120	150	180	240	300	360	-	-		
A6	4.20	3.67	3.22	2.70	2.39	2.14	1.97	1.69	1.49	1.32	-	-	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	-	-	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	-	-	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	-	-	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	-	-	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	-	-	0.71	0.5
CatA	0.72	0.61	0.55	0.45	0.39	0.34	0.31	0.26	0.23	0.20	-	-	0.72	0.5
CatA1	3.86	3.38	3.06	2.57	2.27	1.99	1.81	1.53	1.34	1.18	-	-	3.86	0.5
Lot1	23.35	20.30	18.25	15.31	13.49	12.19	11.34	9.65	8.52	7.51	-	-	23.35	0.5
Rd	47.13	45.20	40.43	33.93	29.52	25.97	24.25	21.05	18.87	16.81	-	-	47.13	0.5
Bas	59.23	56.79	51.21	42.79	37.16	33.23	31.06	26.83	23.96	21.28	-	-	59.23	0.5
Rd1	59.49	57.05	51.47	42.99	37.34	33.39	31.21	26.97	24.08	21.39	-	-	59.49	0.5
Rd2	59.66	57.20	51.63	43.14	37.47	33.50	31.31	27.06	24.16	21.46	-	-	59.66	0.5
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
A1_dum	2.37	2.02	1.78	1.50	1.34	1.19	1.09	0.93	0.82	0.72	-	-	2.37	0.5
A15	85.54	80.93	74.23	62.47	54.62	48.08	44.84	38.81	34.70	30.84	-	-	85.54	0.5
A14	14.88	14.08	13.16	11.31	9.95	8.74	7.96	6.81	6.10	5.46	-	-	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	-	-	4.42	0.5
A9	19.97	17.41	15.32	12.83	11.32	10.06	9.23	7.95	7.06	6.23	-	-	19.97	0.5
A13	34.17	31.60	28.85	24.37	21.31	18.86	17.25	14.76	13.10	11.63	-	-	34.17	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	26.38	23.97	21.60	17.89	15.64	13.87	12.72	11.00	9.90	8.81	-	-	26.38	0.5
Bas2	0.98	0.83	0.75	0.62	0.54	0.47	0.43	0.36	0.32	0.28	-	-	0.98	0.5
A13a	12.78	11.13	10.03	8.26	7.26	6.42	5.86	4.96	4.38	3.85	-	-	12.78	0.5
Rd3	3.26	2.79	2.52	2.08	1.83	1.60	1.46	1.23	1.08	0.95	-	-	3.26	0.5
290_Out	169.42	159.23	148.26	125.43	109.58	96.64	88.89	76.65	68.43	60.76	-	-	169.42	0.5