infrastructure & development consulting

Fyve Austral – 575-595 Fifteenth Avenue, Austral

Stormwater Management & Infrastructure Report

April 2024

Table of Contents

Table of Figures

Table of Tables

Project Number	21-034	Date	05 April 2024
Project Name	Fyve Austral	Status	Response to RFI
Client	Fyve Developments	Revision	D
Author	Dean Reilly / Andrew Hilly	Checked	Chris Avis

1 Executive Summary

This report has been updated to reflect the following changes as discussed with Council in the meeting dated 17/03/2024:

- The addition of a temporary level spreader located in the north-western corner of the subject site to discharge stormwater as sheet flows overland to the existing downstream flowpath as per the current flow regime (refer to Section 8.2 DRAINS Modelling - Interim Scenario and Section 9 Flooding Assessment for details). As discussed during the meeting, the level spreader has been proposed to replace the previously documented temporary tail-out line through the adjoining downstream properties as appropriate consent was unable to be obtained from the relevant land owners to undertake these works. We note that the level spreader has been proposed to suit the interim arrangement prior to the future delivery of Basin 18 and associated connecting drainage (by others) and has been designed to minimise impacts on adjoining properties and mirror the current flow regime for the catchment; and
- Introduction of a permanent on-site water quality treatment system to satisfy Council's performance targets prior to discharge to the downstream trunk drainage system (Refer to Section 8.3 MUSIC Modelling Ultimate Scenario for details)

2 Introduction

Infrastructure & Development Consulting (IDC) have been commissioned by Fyve Developments to prepare a Stormwater Management Report for a proposed commercial / industrial development located at 575-595 Fifteenth Avenue, Austral. This report will be lodged with Liverpool City Council to support the Development Application (DA) and details the modelling procedures and results achieved in preparing the proposed stormwater management strategy for the site.

The results as outlined in this report and documented on the IDC drawings address the following items:

- Review the existing stormwater flow conditions for the site and establish requirements for post-development flows from Council guidelines;
- Design a suitably sized stormwater pipe network to convey flows throughout the site to appropriate discharge points;
- Assess the safety of overland flows throughout the development; and
- Identify appropriate measures to meet Council's water quality requirements and determine the location and land area required to implement the measures

The following studies have taken into consideration the economical, engineering, environmental and social aspects of the works through the implementation of appropriate stormwater controls and best management practices.

3 Site Description & Proposed Works

The subject site is located approximately 40km south-west of the Sydney CBD at 575-595 Fifteenth Avenue, Austral (identified as Lots 384-385 DP2475 and Lot 8 DP235953) and falls within the Liverpool City Council local government area. The development site, which is zoned IN2 Light Industrial, covers an area of approximately 5.6ha and forms part of the Austral & Leppington North Precinct within the South West Growth Area.

The existing site comprises rural residential land which naturally falls to the west towards Kemps Creek. The site is bound by Fifteenth Ave to the south and existing rural lots to all other sides.

Figure 1 - Existing Site

Stormwater runoff from the existing development area generally drains east-west across the site via informal overland flowpaths before eventually discharging to Kemps Creek approximately 550m further downstream. We note that this flow regime is to generally be maintained in the post-developed scenario, with Kemps Creek to remain as the proposed discharge point for stormwater flows generated by the proposed development in the interim until the future Regional Basin 18 has been completed by Council.

Figure 2 – Proposed Land Zoning

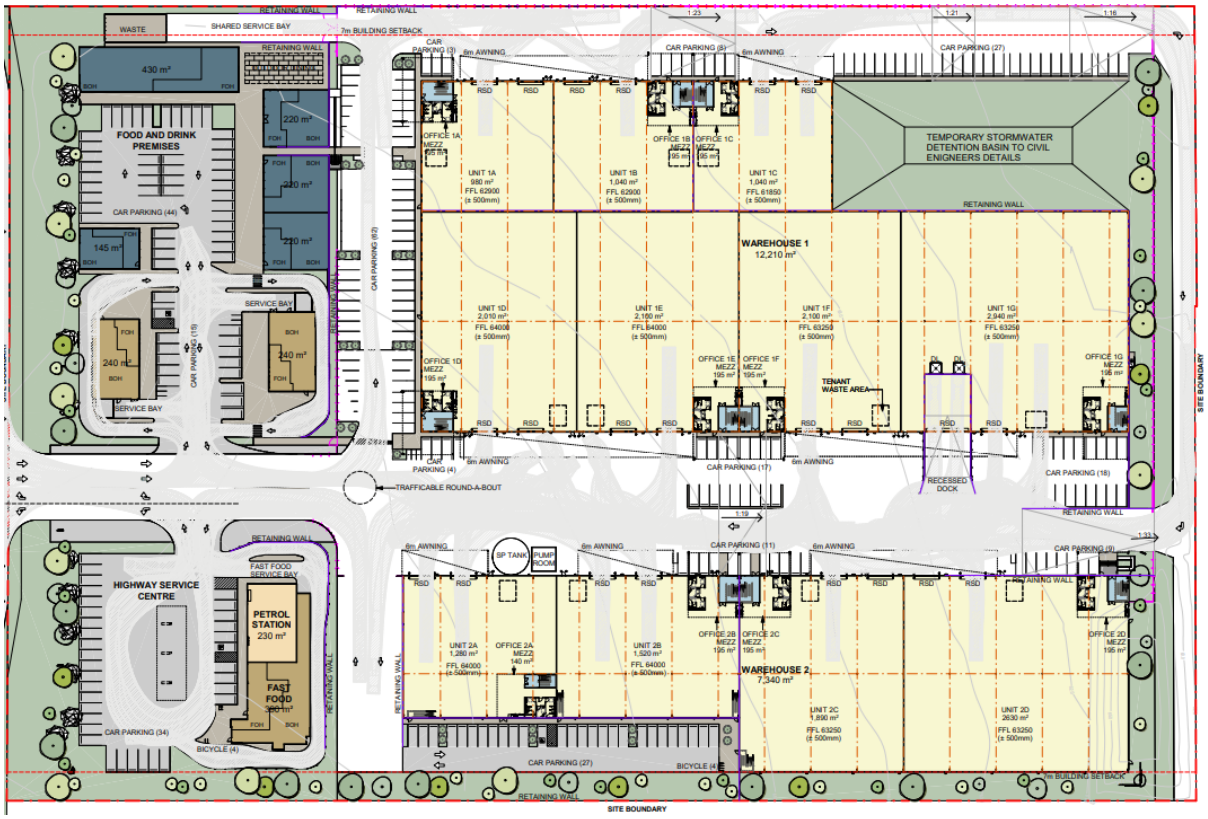
Source: Liverpool City Council

3.1 Proposed Works

The proposed works consists of the creation of a new retail centre and service station fronting Fifteenth Avenue as well as two (2) separate large warehouses making up 11 tenancies on the northern portion of the lot.

The proposal will also include half-road construction of a new 20m wide industrial road along the northern boundary as well as approximately 1,940m^2 of SP2 land dedication on the southern portion of the site for the future Fifteenth Avenue SIC road upgrade and 630m^2 of land dedication along the eastern boundary for the future 20m wide ILP Collector Road.

Figure 3 – Proposed Development



Source: Reid Campbell Architects

4 Methodology

To fully appreciate the water cycle characteristics of the local catchment, a number of analyses have been undertaken in support of the Development Application proposal.

The following is a breakdown of the key technical studies split into the various aspects of the water cycle which have been used to inform the concept civil design for the proposed subdivision:

4.1 DRAINS

- Sizing of the proposed below ground pit and pipe network to adequately convey stormwater flows during the design storm event;
- Assessment of the safety of surface flows in the road reserve during major storm events to suit the ultimate development scenario; and
- Iterations to determine a suitably sized temporary stormwater basin to ensure the development has a negligible impact on downstream properties in accordance with Council requirements.

4.2 MUSIC

- Pollutant loadings to determine a suitably sized temporary water quality facility to satisfy water quality improvement objects for the interim development scenario as set out in Council's DCP. In addition, a permanent stormwater quality solution in the form of a below ground tank with cartridge system to meet Council's stormwater quality requirements.

4.3 Tuflow

- Undertake a 2-dimensional assessment of local overland flows from the existing upstream catchments and identify whether the proposal is likely to have a positive, negative or negligible impact on adjoining properties.

We note that modelling parameters and design development for the different analyses described above is discussed in more detail throughout the following sections of this Report.

5 Data

5.1 Topography

Topographic information for the site was obtained from a combination of detailed site survey prepared by Onesight Surveys and aerial Lidar data.

5.2 Rainfall Data

5.2.1 Intensity-Frequency-Duration

IFD data obtained from Council's *Handbook for Drainage Design Criteria* for "Liverpool – Western South Creek" was utilised for the subject site, with the IFD data for durations longer than the 60 minute interval interpolated based on the IFD polynomial coefficients supplied by Council (see table below for details).

Table 1 - Rainfall Intensities for "Liverpool - Western South Creek"

Duration	5 Year	20 Year	100 Year
5min	125.88	166.8	220.7
10min	96.36	127.7	169.1
15min	80.40	106.4	140.8
20min	69.94	92.52	122.4
25min	62.43	82.58	109.2
30min	56.71	75.02	99.27
45min	45.41	60.11	79.58
1hr	38.57	51.09	67.65
1.5hrs	30.50	40.40	53.52
2hrs	25.76	34.12	45.20
3hrs	20.28	26.85	35.55

Source: Liverpool Council's *Handbook for Drainage Design Criteria*

5.2.2 Pluviograph Data

Pluviography data from 67035 Liverpool (Whitlam Centre – 6 minute interval) was utilised within the proposed MUSIC model as per Council's *WSUD Technical Guidelines*.

6 Design Controls & Guidelines

The stormwater network for the site has been designed to comply with the following guidelines:

- Liverpool City Council Development Control Plans
  - Liverpool City Council Development Control Plan (2008) – Part 1, General Controls
  - Liverpool Growth Centre Precincts Development Control Plan (2014) – Schedule 1, Austral and Leppington North Precincts
- Liverpool City Council – Development Design Specification D5: Stormwater Drainage Design Guidelines (2003)
- Liverpool City Council – Handbook for Drainage Design Criteria;
- Liverpool City Council – WSUD Technical Guidelines;
- Australian Rainfall and Runoff; and
- Managing Urban Stormwater: Soils and Construction

7 Stormwater Management Strategy

7.1 Sediment & Erosion Control

Prior to any works commencing on site, erosion and sediment control measures will be put in place generally in accordance with Managing Urban Stormwater: Soils and Construction 4th Edition, March 2004. These measures include:

- Installation of a 1.8m high chain wire fence covered with geotextile fabric to the perimeter of the work site area
- A sediment basin situated towards the low point of the site for the collection of stormwater runoff during construction
- The use of appropriate sediment diverting methods to minimise sediment in Council's stormwater drainage network
- Locations for temporary stockpiling
- Provision of a temporary truck wash down facility for vehicles exiting the site during construction

7.2 Water Quantity Management

7.2.1 Major/Minor System Drainage

As per Liverpool City Council requirements, the minor (pit and pipe network) has been designed for a minimum 10-year ARI storm, while the major has been assessed against the 100-year ARI design storm event.

For the purposes of this study, DRAINS software has been used to size the below ground pipe network to adequately convey the 10-year ARI storm with provision for safe overland flows during the 100-year ARI storm event.

7.2.2 Temporary Detention Basins

In accordance with Council's regional stormwater strategy for the *Austral and Leppington North Growth Area*, we note that the subject site is to ultimately be serviced by future Basin 18 to be constructed downstream of the site near Kemps Creek. As such, in accordance with Council requirements, a temporary basin has been included as part of the stormwater management strategy of the site to manage the flood risk in the interim until the future regional facilities have been constructed. We note that this basin has been sized to ensure that the peak post-development flow does not exceed peak pre-development levels for all storms ranging from the 5 year to 100 year ARI in accordance with Council requirements.

7.2.1 Temporary Outlet Control

Prior to the delivery of future Basin 18 and the associated connecting drainage infrastructure by Council, a temporary level spreader has been proposed at the north-west corner of the development site to suit the interim arrangement. Here, the level spreader will mirror the existing flow regime for the catchment by discharging stormwater runoff as sheetflows overland to the existing downstream flowpath, with runoff from the site to be controlled via the temporary upstream on-lot basin discussed in Section 7.2.2 above.

Following completion of the future downstream regional drainage infrastructure by Council, the temporary level spreader is to be decommissioned and the upstream drainage infrastructure connected to the trunk downstream culvert network to convey flows to Basin 18 in accordance with the Masterplan Stormwater strategy for the catchment.

7.3 Water Quality Management

We note that two (2) separate phases have been considered for the site with respect to water quality management as follows:

Interim Arrangement – this scenario considers the interim arrangement prior to the delivery of the future downstream regional drainage facilities (including Basin 18) by Council. Here, temporary on-lot WSUD treatment has been proposed to manage the risk of pollution and sediment runoff being conveyed from the site onto the existing downstream rural properties and waterways, with the treatment facilities to be integrated as part of the temporary on-lot stormwater basin as discussed in Section 7.2.2 above.

Permanent Solution – Following completion of the future downstream regional infrastructure by Council, the temporary on-site stormwater management facilities are to be decommissioned (including temporary basin, level spreader, and water quality treatment system) and permanent on-site WSUD treatment facilities installed. The permanent water quality treatment system is to be sized to satisfy Council's statutory performance targets with respect to pollutant reduction prior to discharge to the downstream trunk drainage system within the roadway.

In addition to the above, as per Council's regional stormwater strategy for *Austal and Leppington North*, Bioretention "Raingardens" are to be provided at select intersections throughout the precinct to provide at source pollutant control within the roadway. From Council's Masterplan

Strategy, we understand that the only future intersection raingarden treatment within the vicinity of the development area is at the intersection of the future 20m wide Collector Road at the north-eastern boundary. As such, provision has been made within the proposed design to accommodate these future raingarden facilities. Here, as part of the proposed subdivision works, the raingardens are to be constructed as temporary silt traps to manage runoff in the interim. The temporary silt traps are then to be converted to Raingardens in the future once 80% of the lots have been developed, with the proposed raingarden works to be undertaken separately by Council.

8 Stormwater Modelling

8.1 Existing System

Upstream Flows

The development area is currently impacted by an existing overland flow path which conveys upstream runoff through the site from the existing rural residential properties to the east. Here, flows drain east-west along the northern boundary of the property before continuing overland through the existing rural lots to the west before eventually discharging to Kemps Creek further downstream.

Local Site Flows

Based on a review of detailed site survey and visual site inspections we note that local stormwater runoff generated within the subject site boundary is currently conveyed overland via informal flow paths to Fifteenth Ave and the existing overland flow route situated along the northern boundary. From here, flows continue to the west before eventually joining Kemps Creek further downstream.

8.2 DRAINS Modelling

We note that flows associated with the upstream overland flow route through the site have been assessed separately as part of the Flooding and Overland Flow Impact Assessment (refer to Section 0 of this Report for details).

As such, the DRAINS model of the proposed site was created to assess the performance of the new lot pit and pipe network to adequately convey runoff to the downstream drainage network. Here, two (2) separate DRAINS models were prepared for the site as follows:

i) *Ultimate Scenario* – which allows for the developed catchments upstream and downstream of the site once the temporary detention facilities have been removed; and

ii) *Interim Scenario* – this scenario incorporates the undeveloped catchments upstream and downstream of the site in order to mirror the current scenario as well as

provision of a temporary stormwater basin to ensure the developments impact on downstream properties is negligible.

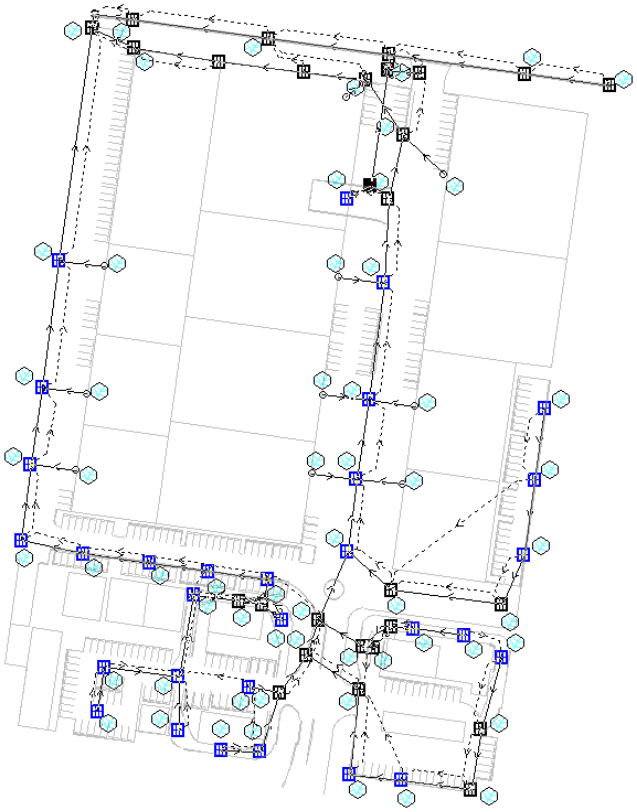
Ultimate Scenario

The DRAINS model of the ultimate scenario was developed based on the following methodology:

- An indicative pit and pipe network was developed for the proposed siteworks (refer to IDC DA Drawings for details). Here, piped flows from the development are to ultimately drain to the new 20m wide industrial road that is to be constructed along the northern boundary of the site;
- Tailwater conditions at the outflow to the downstream pit and pipe network in the new industrial road have been set as follows:
    - Minor 10-year ARI = 150mm below the grate level of the receiving stormwater pit; and
    - Major 100-year ARI = Grate level (i.e. point of surcharge) of the receiving stormwater pit in accordance with general engineering practice.

  These levels have been specified to simulate a charged system downstream to verify the capacity of the proposed piped network for stormwater flows generated during the design storm event and are considered appropriate as they assume the worst-case scenario for the site.
- In accordance with Council's Handbook for Drainage Design Criteria, a minimum impervious fraction of 90% was adopted for the new IN2 Light Industrial lots;
- Contributing flows from the future developments to the east of the site have also been considered in the modelling process to verify the capacity of the proposed stormwater network and to minimise the number of future connections to the system; and
- 10 year and 100 year ARI events were considered for all standard durations.

Figure 4 – Proposed DRAINS Model – Ultimate Scenario



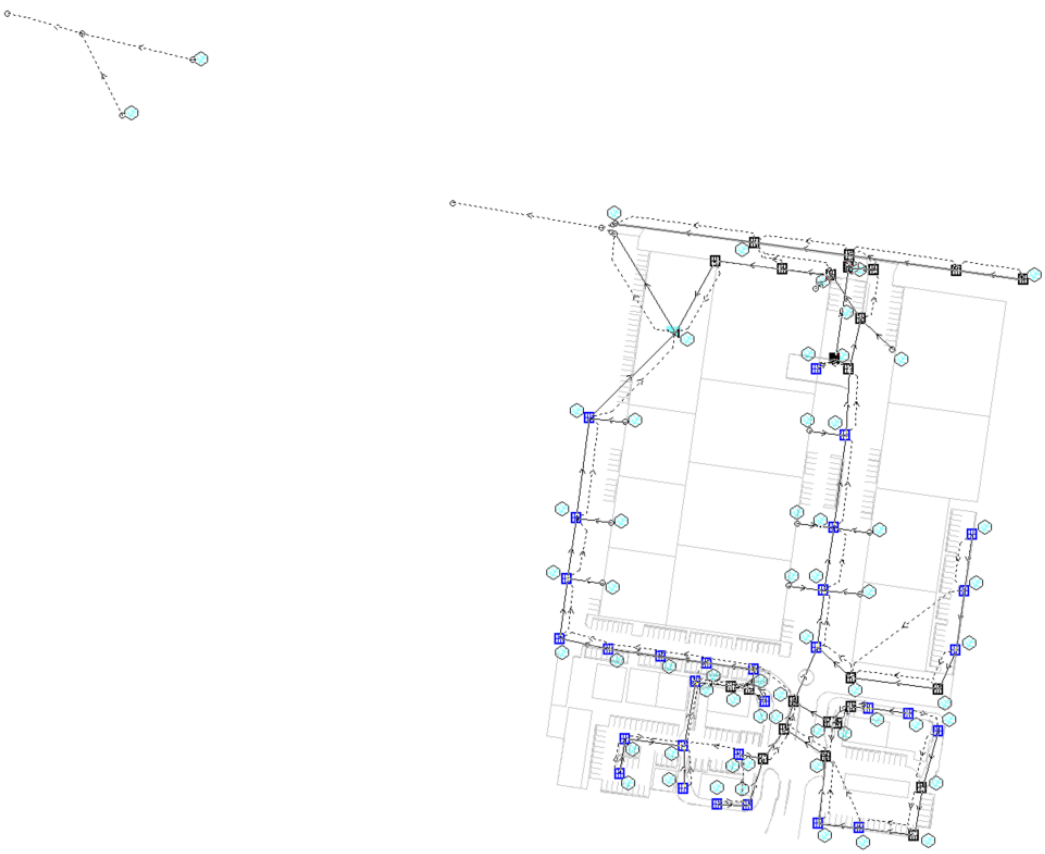
Interim Scenario

A separate DRAINS model was then created to assess the performance of the proposed temporary stormwater basin and level spreader outlet.

The DRAINS model for the interim scenario was developed based on the same methodology as the ultimate scenario with the following modifications:

- An above ground detention basin was also incorporated into the model to control flows from the site to the discharge point in accordance with Council requirements. The location of the basin has been proposed at the north-west corner of the lot in order to maximize basin efficiency and allow easy access for maintenance.
- Flows from the stormwater basin are to discharge to a temporary 20m wide level spreader situated at the north-west corner of the development area. From here, flows are to discharge overland as sheetflow to the downstream flowpath as per the current flow regime;
- Tailwater levels at the connection to the level spreader have been set as follows:
    - 5 year, 10 year, 20year, 50 year and 100 year = overflow level of level spreader.
- 5 year, 10 year, 20year, 50 year and 100 year ARI events were considered for all standard durations.

Figure 5 – Proposed DRAINS Model – Interim Scenario



8.2.1 DRAINS Results

Ultimate Scenario

The proposed piped drainage system has been designed to cater for a minimum of the 1 in 10 year ARI event leading to the outlet to the downstream watercourse. A provision for overland flows greater than the 1 in 10 year ARI event were also considered.

Results of the DRAINS assessment indicate that major / minor system requirements are satisfied at all proposed pits in the development area and that the piped system sufficiently conveys minor storm flows with safe provision for major system flows.

Interim Scenario

Iterations were performed in the DRAINS model to determine the size of the temporary stormwater basin to satisfy Council's pre-post requirements.

The proposed basin has the following parameters:

- The temporary basin is situated at the north-west corner of the development and has been sized to capture and convey runoff from the new roof, hardstand and parking areas within the site;
- Storage volume provided is approximately 1,600m^3 and is contained within the above ground system;
- Discharge is controlled via a Ø300mm choke pipe installed as the outlet from the discharge control pit, with flows to discharge to the temporary level spreader prior to leaving the site. Here the basin has been oversized to minimise the volume of runoff discharging to the level spreader to avoid concentrating flows at the outlet while also satisfying pre-post requirements;
- A 15m wide overflow weir at RL61.50 has also been provided as a secondary stage outlet in larger storm events; and
- Due to depth of ponding, safety fencing has been provided around the perimeter of the basin in accordance with Liverpool Council requirements.

Results of the DRAINS analysis are summarized in the following table:

Table 2 – DRAINS Pre-Post Comparison

ARI	Pre-Developed Peak Discharge to Downstream Lot (m^3/s)	Post-Developed Peak Discharge to Downstream Lot (m^3/s)
1 year	0.26	0.26
5 year	1.34	1.09
10 year	1.69	1.21
20 year	2.22	1.50
50 year	2.82	1.77
100 year	3.21	2.19

Results of the DRAINS analysis indicate that the temporary basin provides sufficient flow retardation and attenuation to ensure that the downstream peak post-developed discharges do not exceed those of the pre-developed scenario for the worst-case storm duration.

8.3 MUSIC Modelling

Modelling of the proposed development was undertaken using Model for Urban Stormwater Improvement Conceptualisation (MUSIC) software.

A pre-post comparison of stormwater runoff was undertaken for the site for both the interim and ultimate stormwater quality management scenarios.

Interim Scenario

The aim of the model being that the development presents a negligible impact on downstream water quality in the interim.

As such, the existing (un-developed) site has been compared directly against the proposed (developed) site. Here, two (2) separate cases were considered in the MUSIC model, one representing the existing scenario and the other the post-developed site as per the below methodology:

- The post-developed site was consolidated into two (2) main sub-catchment areas based on the proposed lot and drainage layout as follows, with the site defined as either "Commercial" or "Industrial" in accordance with the different land use categories specified in Council's *WSUD Technical Guidelines*.

Table 3 - MUSIC Sub-Catchment Summary

MUSIC Sub-Catchment	Land Use	Area (Ha)
M1	Commercial	1.50
M2	Industrial	3.90
Total		**5.4**

- The pollutant concentration parameters used within the model were based on the recommended model defaults for different land use categories as specified in Council's *WSUD Technical Guidelines*.
- The soil properties for the pervious areas of the catchment were defined based on the recommended default parameters for "Clay Type" soils listed in Council's *WSUD Technical Guidelines* and are summarised below:

Table 4 - MUSIC Soil Parameters

Soil Properties	
Impervious Threshold (mm)	1
Soil Storage Capacity (mm)	187
Initial Storage (% of capacity)	30
Field Capacity (mm)	127

Infiltration coefficient 'a'	135
Infiltration coefficient 'b'	4
Initial groundwater depth (mm)	10
Daily recharge rate (%)	10
Daily base flow rate (%)	10
Daily deep seepage rate (%)	0

- Nodes were also included in the model to represent the existing (un-developed) site, with the pollutant concentration parameters based on the recommended model defaults for "rural-residential" land use categories for 575-595 Fifteenth Avenue.

8.3.1 Water Quality Treatment Train

The following treatment train has been proposed for the site:

- A Rainwater Tank has been assumed to be provided to collect roof water for re-use on-site via toilet flushing and for irrigation of landscape areas, with overflows to be directed to the new below ground pit and pipe network. It should be noted that for the purposes of this study that the rainwater tank has been excluded as a treatment device from the proposed MUSIC model – this is considered appropriate as it assumes the worst-case scenario for the site. Moving forward, the exact type, size and the location of the rainwater tank is to be confirmed via detailed modelling by the project hydraulic engineer during the subsequent detailed design phase. This will also allow for different options to be explored to achieve higher standards (including BASIX requirements) where feasible;
- Runoff from the new parking and hardstand areas of the site are to be collected within the below-ground pit and pipe network before being conveyed to the temporary stormwater basin; and
- Bioretention is proposed within the temporary basin as an end of line treatment prior to discharge.

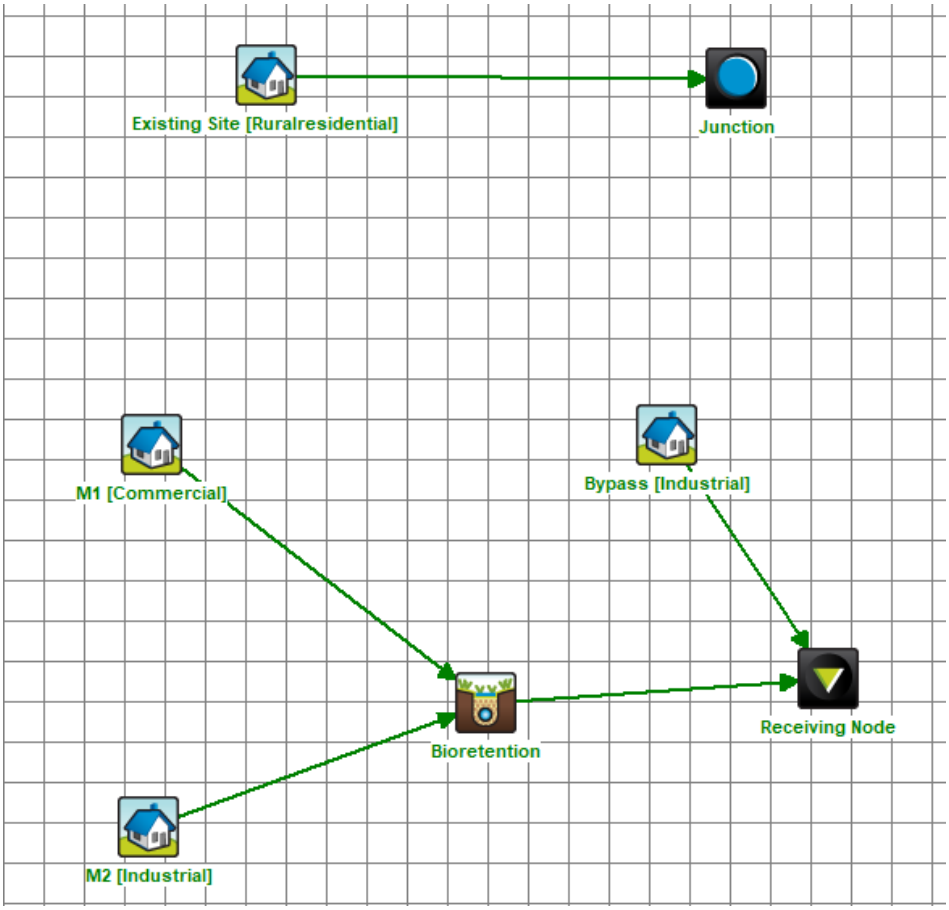
Bioretention

In developing the MUSIC model for the post-developed site, the following assumptions have been made regarding the bioretention system:

- Filter Area = 370m^2;
- Extended Detention Depth = 0.3m;
- Filter Depth = 0.4m;
- Saturated Hydraulic Conductivity = 180mm/hr

We note that the remaining bioretention parameters are as per the recommended model defaults listed in Council's WSUD Technical Guidelines.

Figure 6 - Proposed MUSIC Model (Interim Scenerio)



8.3.2 MUSIC Results Interim Scenario

The results of the MUSIC analysis are summarised in the table below:

Table 5 - MUSIC Results

Pollutant	Pre-Developed Output (kg/yr)	Post-Developed Generation (kg/yr)	Post-Developed Output (kg/yr)	Reduction
Total Suspended Solids	1,230	6,260	1,310	79.1%
Total Phosphorus	2.85	10.1	3.16	68.6%
Total Nitrogen	25.8	74.7	39.8	47%
Gross Pollutants	344	916	43.5	95.2%

From the results of the MUSIC analysis it can be seen that, by including the nominated treatment train as described in this Report, the post-developed pollutant loads for phosphorus, nitrogen and gross pollutants have been reduced to a level greater than Council's statutory target removal rate.

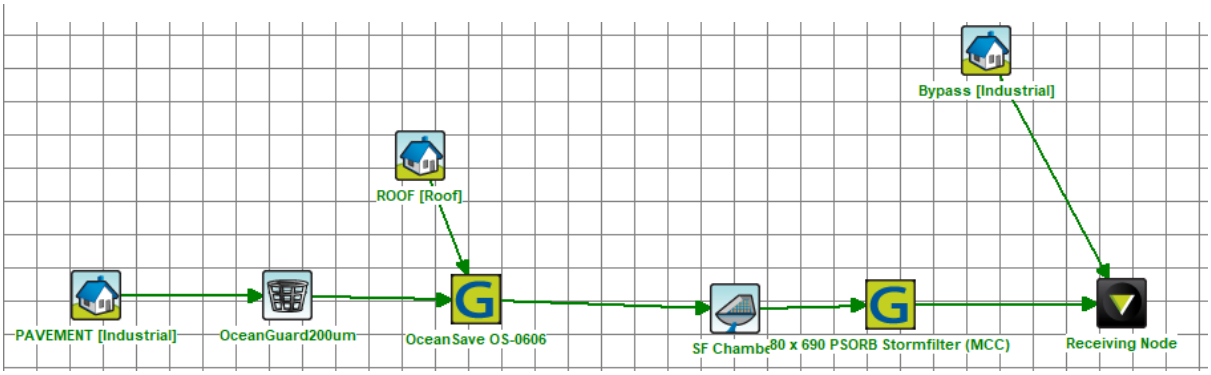
While we note that the post-developed removal rate for suspended solids is slightly less than Council's target rate, it has been reduced to a level comparable with the pre-development load (less than 7.5% increase). As such, it is understood that the proposal also satisfies the water quality outcomes for suspended solids based on a pre-post comparison as the development will present a negligible impact on water quality in the downstream watercourses in the interim until the surrounding sites have been developed and the future permanent stormwater quality treatment in the form of a below ground tank with cartridge system has been implemented.

Ultimate Scenario

The MUSIC model for the ultimate scenario was developed based on the same methodology as the interim scenario with the following modifications:

- A below ground tank with stormwater cartridge system (StormFilter system or similar) to replace the temporary stormwater basin / bioretention to provide permanent on-site stormwater quality treatment prior to discharge downstream trunk drainage network.
- Gross pollutant traps (GPT) or similar to be installed immediately upstream of the below-ground cartridge system to pre-screen gross pollutants and larger sediments in accordance with manufacturers requirements; and
- Pit baskets are to be installed in all surface inlet pits within the subject site to capture gross pollutants.

Figure 7 – Proposed MUSIC Model (Ultimate Scenario)



8.3.3 MUSIC Results Ultimate Scenario

The results of the MUSIC analysis are summarised in the table below:

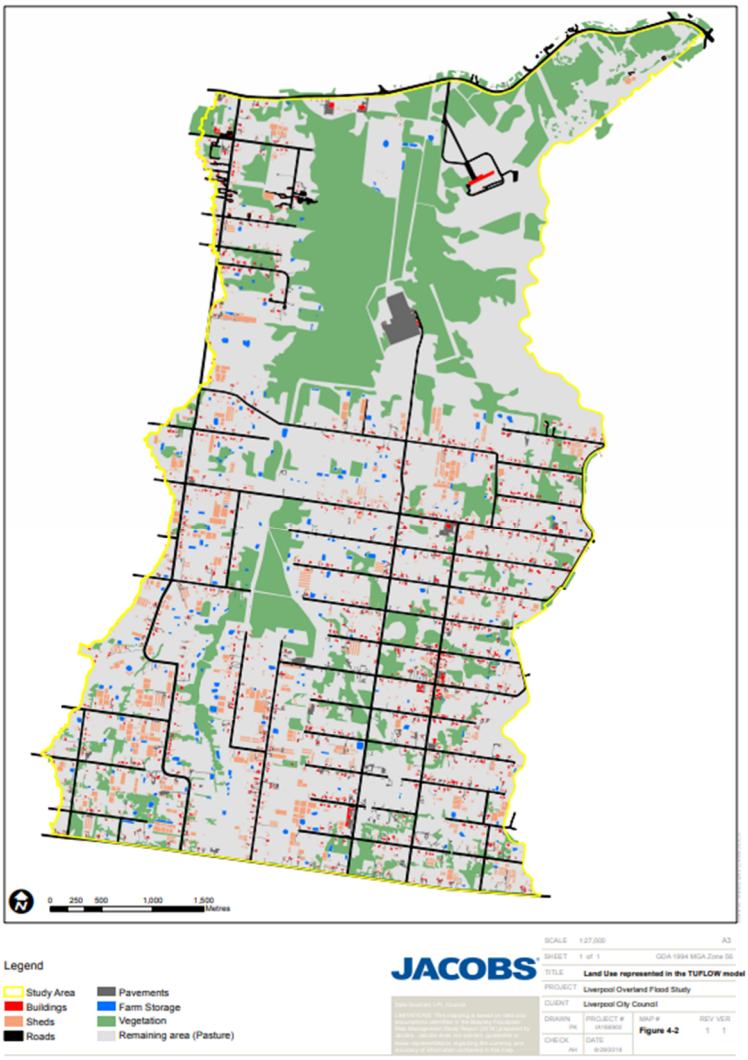
Pollutant	Pre-Developed Output (kg/yr)	Post-Developed Generation (kg/yr)	Post-Developed Output (kg/yr)	Reduction
Total Suspended Solids	1,230	3,530	528	85.1%
Total Phosphorus	2.85	8.11	2.18	73.1%
Total Nitrogen	25.8	83.3	43.8	47.4%
Gross Pollutants	344	1040	51.8	95.0%

The results of the MUSIC analysis indicate that the proposed permanent on-site water quality system will satisfy Council's statutory pollutant removal rates.

9 Flooding Assessment

The regional Austral and Kemps Creek TUFLOW model (undertaken by Jacobs, 2019) was provided by Liverpool Council and served as the foundation for the flood assessment of the proposed design for the development site. This Council model was originally developed to generate a detailed overland flow study over rural areas within the Liverpool Local Government Area (LGA).

Figure 8 - Jacobs (2019) Model Extent



9.1 Design Approach

For this investigation, updates were made to the existing Council-provided overland flow study model specifically in the vicinity of the project land. The updates aimed to achieve two main objectives:

- to reduce the spatial scale of the model and decrease model run times; and
- to truncate the model around the area of hydraulic influence to the project boundary, ensuring sufficient space for 1% Annual Exceedance Probability (AEP) overland flows to naturally enter and exit the site boundary.

It is important to note that this assessment does not cover flooding impacts for land use updates upstream of the proposed development site. This falls outside the scope of this investigation.

9.2 Model Parameters

For consistency, the parameters adopted in the Council's overland study were maintained where possible. The updated hydraulic modelling parameters used for our assessment are listed in Table 6, including the TUFLOW version, LiDAR Data resolution, model domain size, hydraulic structures, and materials file.

Table 6 - Model Configuration

Parmeter	Austral & Kemps Creek Model	Model Updates
TUFLOW Version	TUFLOW 2017-09-AC-iDP-w64 (HPC)	TUFLOW 2023-03-AA-iSP-w64
LIDAR Data	Digital Elevation model (DEM) of 1m spatial resolution based on 2014 survey	No change
Model Domain	30.3km^2	1.9km^2
Hydraulic Structures	Existing hydraulic structures within catchment	No change
Rainfall Input	Rainfall on Grid using sub catchment delineation	No change
Materials File	Rural land use, pasture: n = 0.035 Creek channel, some reedy vegetation: n = 0.05 Vegetated, bushland: n = 0.1 Roads: n = 0.025 Other paved areas: n = 0.02	Industrial land use: n = 0.1 adopted over subject site. External areas: No change.

9.3 Inputs & Assumptions

The Austral and Kemps Creek TUFLOW model (Jacobs, 2019) provided by Council was used as the basis of the site specific flood model. The received model has been developed for the purpose of generating detailed overland flow studies for rural areas of the entire Liverpool Local Government Area (LGA). The Austral and Kemps Creek area is 30.3km^2, bounded by Elizabeth Drive to the north, Bringelly Road to the south, Sydney Water's Upper Canal to the east and the catchment boundary of Kemps Creek to the west. The proposed subdivision is located within this study area, shown below in Figure 9.

Figure 9 - Liverpool Overland Flood Study - Site Context

For the purpose of this investigation, truncating the model was prioritised within the vicinity of the subject site to reduce model computation time and determine flow behaviour at a higher level of detail specifically for the proposed development. The Austral and Kemps Creek overland flow study only considered flooding for present day land use and was adapted for this study. The revised model limit is shown in Figure 9 above shaded green.

A peak flood event duration of the 1% AEP 60-minute duration was selected to determine the worst-case flooding conditions in the vicinity of the development. Based on the identification of the 60-minute storm duration contributing to the worst-case flooding conditions locally to the subject site, results assessed further in this study are based on this storm durations maximum flood envelope.

Temporal pattern selection has been modelled in accordance with the original Jacobs (2019) overland flow assessment for the catchment, whereby the median result from the suite of 10 temporal patterns for the area of interest were adopted. In the context of this study, the area of interest looks at flooding conditions in the vicinity of the development.

The flood mapping and results presented in this report (Section 9.4 below) represents the flooding in the 1% AEP event under the above-mentioned conditions. Depths less than 50mm have been shown transparent for the purpose of determining areas of ponding and overland flows, as the rainfall-on-grid modelling approach results in all active grid cells of the model being shown 'wet'. The 50mm depth tolerance removes shallow sheet flows over the digital terrain

model. This is the same methodology adopted in the Jacobs (2019) report provided by Liverpool Council.

9.4 Modelling Results

The model was simulated for the 1% AEP 60-minute storm duration to determine the worst-case flooding condition at the site, adopting a compiled median result from the running of temporal patterns from a sample of 10 representative storms in accordance with the current Australian Rainfall and Runoff guidelines.

9.4.1 Existing Conditions

Under the existing conditions, flooding in the area is directed through informal overland flows into local depressions and drainage channels. Formal drainage channels are aligned with natural gullies, road reserves, intercepting lower lying portions of the catchment. The flood depth and velocity for the 1% AEP event under existing conditions are depicted in Figure 10 and Figure 11, respectively.

Figure 10 - Existing Scenario - 1% AEP Flood Depth

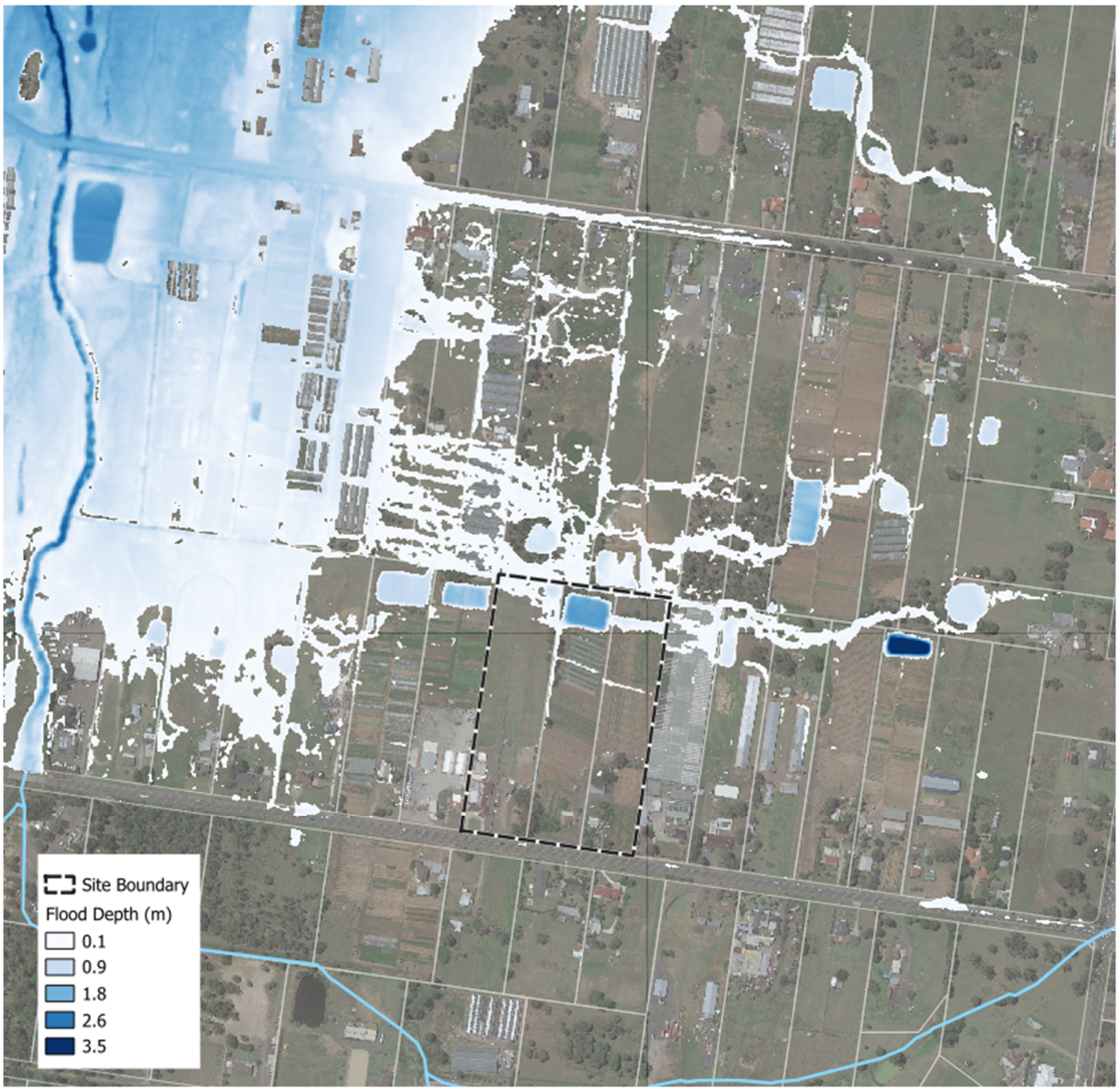
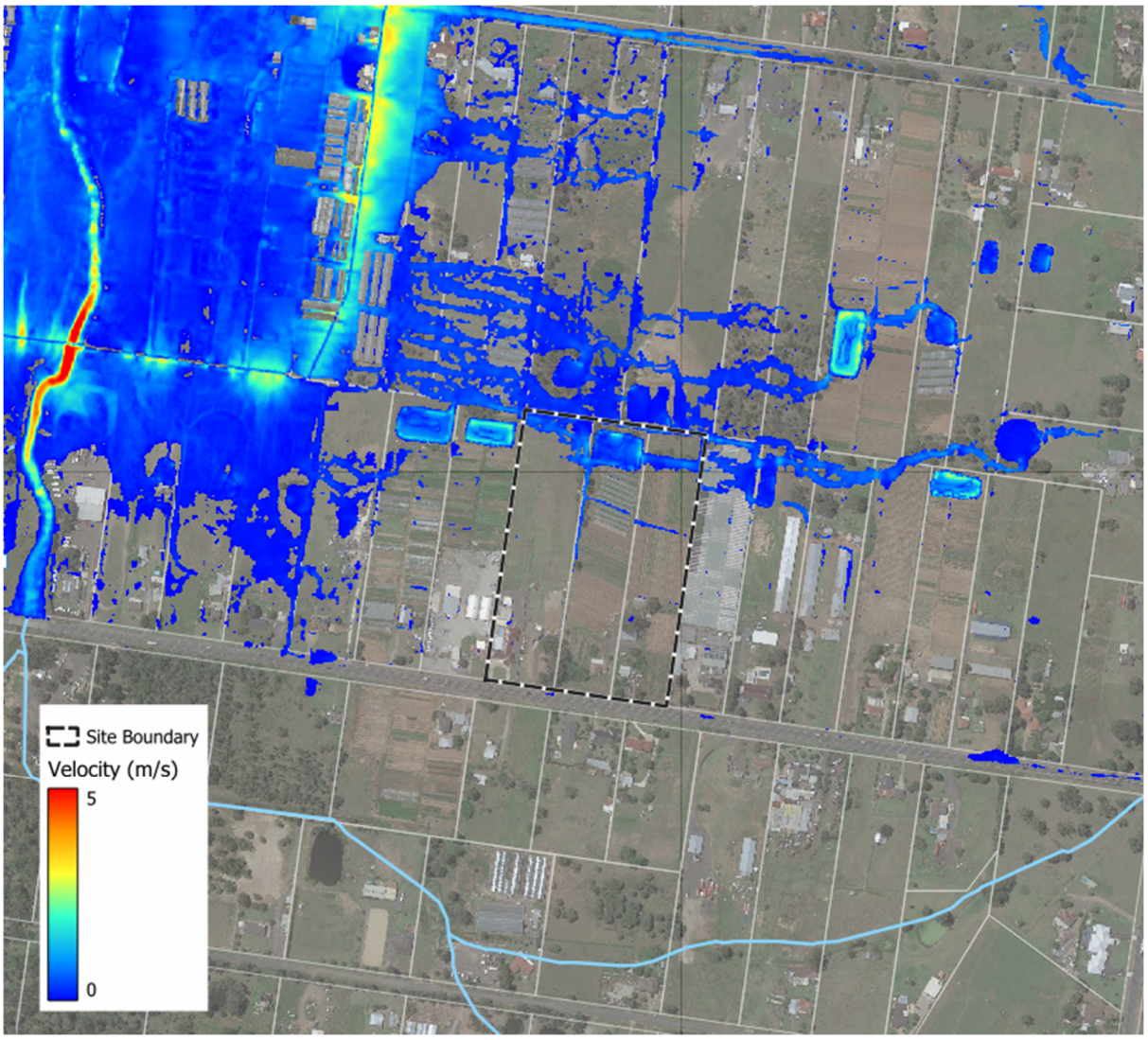


Figure 11 - Existing Scenario - 1% AEP Flood Velocity

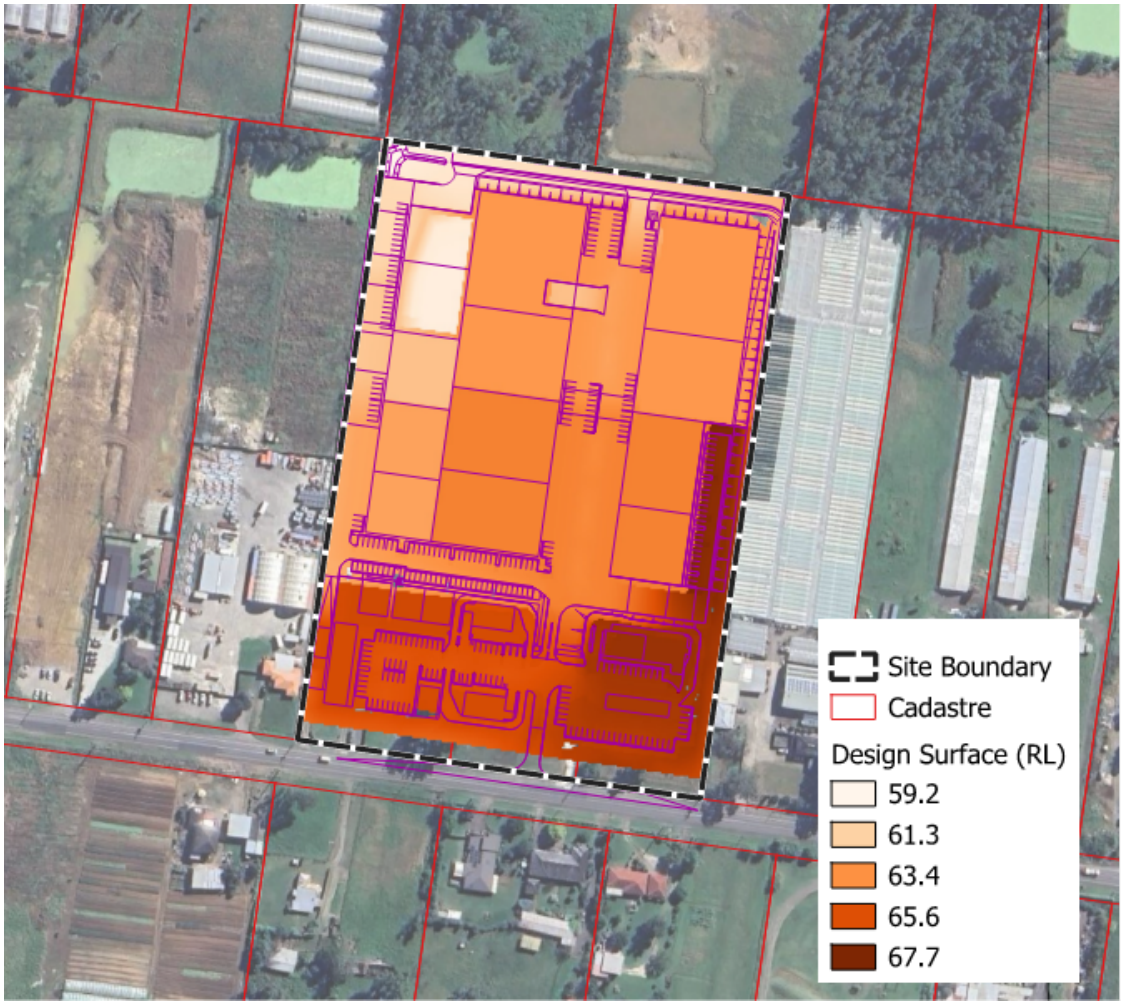


The existing results indicate shallow depths (0.1-0.2m) and low velocities (0.1-0.15 m/s) adjacent to the site with flows passing across the northern section of the site from east to west, following natural low points and depressions formed by agricultural activities (i.e., farm dams and channels, etc.).

9.4.2 Developed Scenario

The proposed development raises the development lots to create a series of stepped building pads for future industrial and commercial development. Roads are also proposed for access with carparking areas spread throughout. Notably the development will also include a half-road construction of a new 20m wide industrial road along the northern boundary. It is proposed that the road corridor will function as a temporary route for overland flows until such time the full road reserve is developed. A 20m wide level spreader is proposed downstream of the temporary stormwater basin at the north-west corner of the development area. This level spreader has been provided to re-distribute stormwater runoff overland as sheet flow to the downstream floodway as per the current flow regime for the catchment.

Figure 12 - Design Surface



For the developed scenario conditions (post-construction), the flood depth and velocity maps are shown in Figure 13 and Figure 14, respectively.

Figure 13 - Developed Scenario - 1% AEP Flood Depth

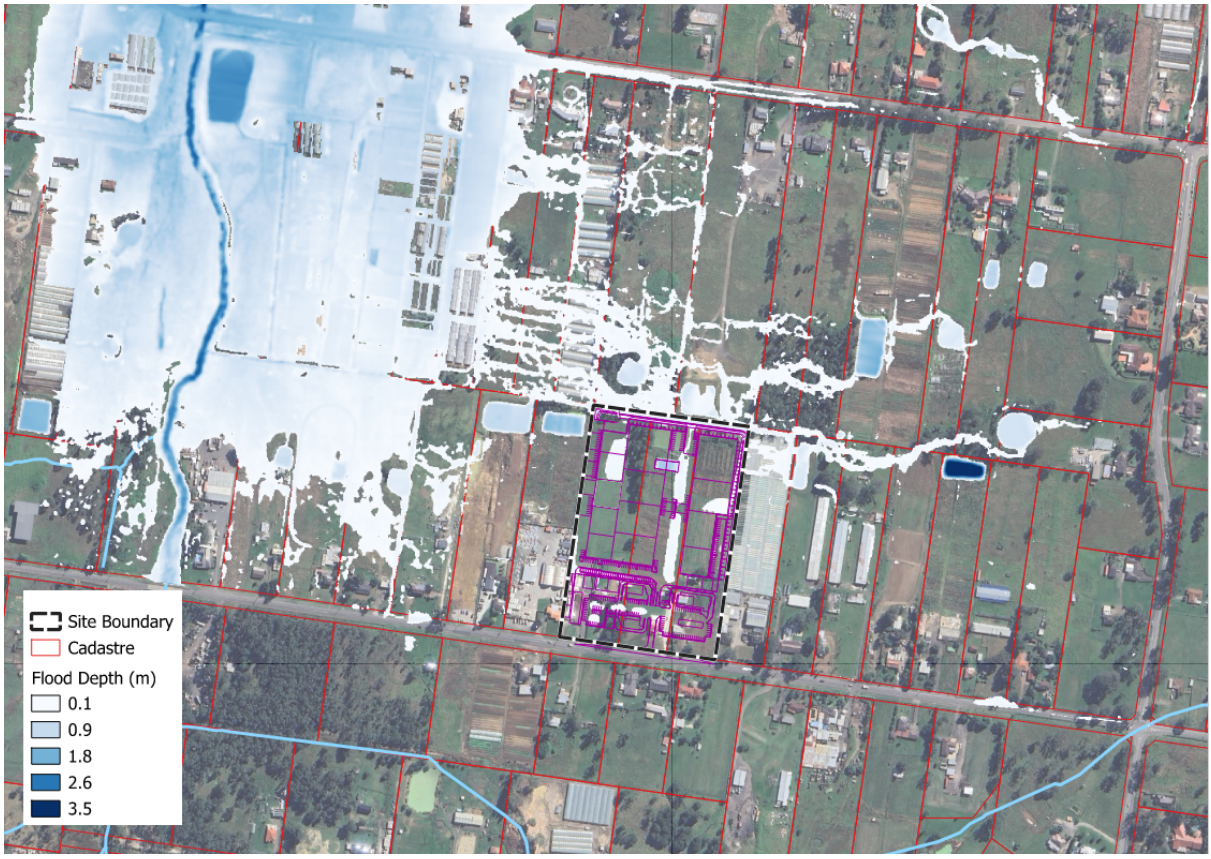
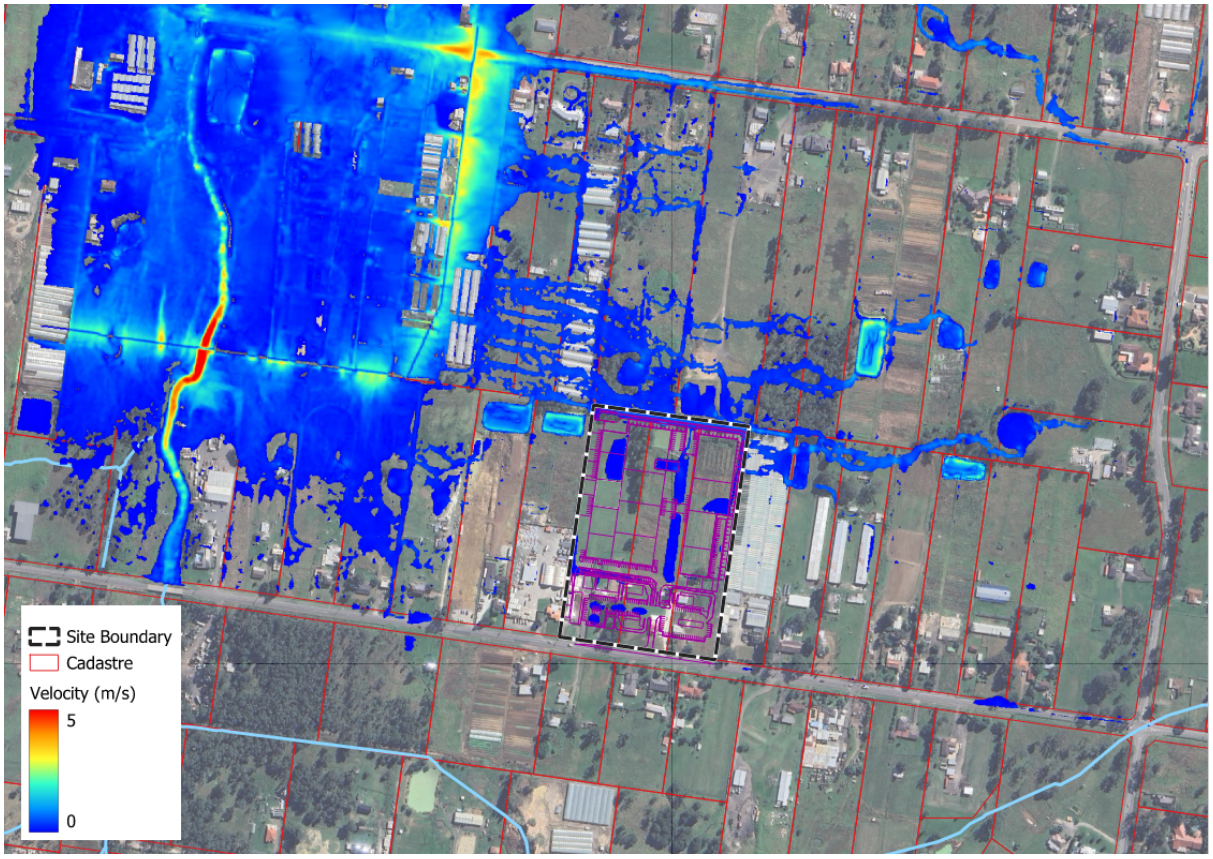
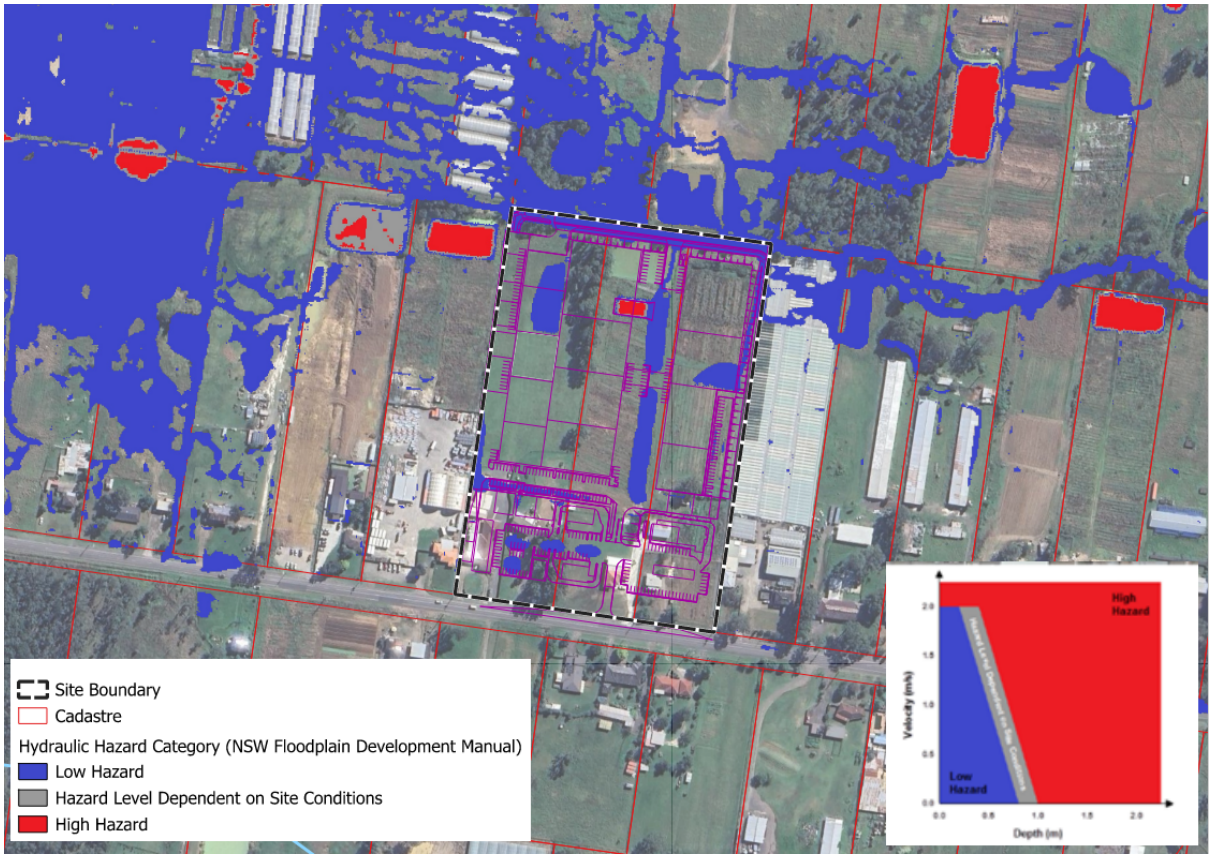


Figure 14 - Developed Scenario - 1%AEP Flood Velocity



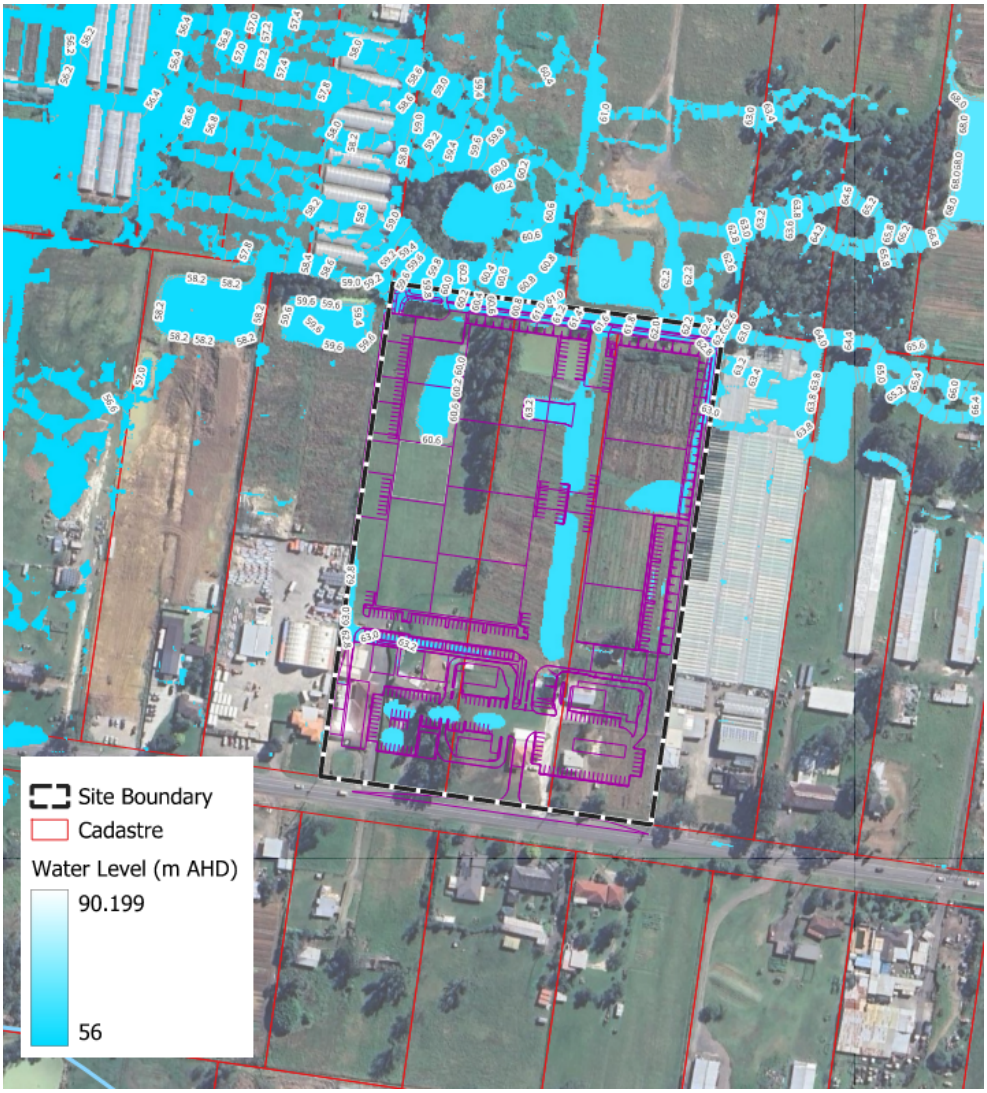
The results show shallow sheet flow depths of less than 100-200mm across the properties adjacent to the development site at the northern end of the site. Lot areas are generally free from ponding and are unaffected by overland flow paths as they are elevated from the surrounding topography, ensuring a sufficient freeboard between flood levels and future lot developments. The modelling indicates Unit 2C has some affectation, however a refined swale design along the eastern boundary (to be determined during detailed design) will sufficiently protect the development lots from the minor sheet flow (approximately 15mm depth) approaching the site from the east.

Figure 15 –Developed Scenario - 1% AEP Flood Hazard Category



Flow paths adjacent to the site remain categorised as 'Low Hazard' and present very low immediate danger or threat to people or structures.

Figure 16 - Developed Scenario - 1% AEP Flood Level Contours

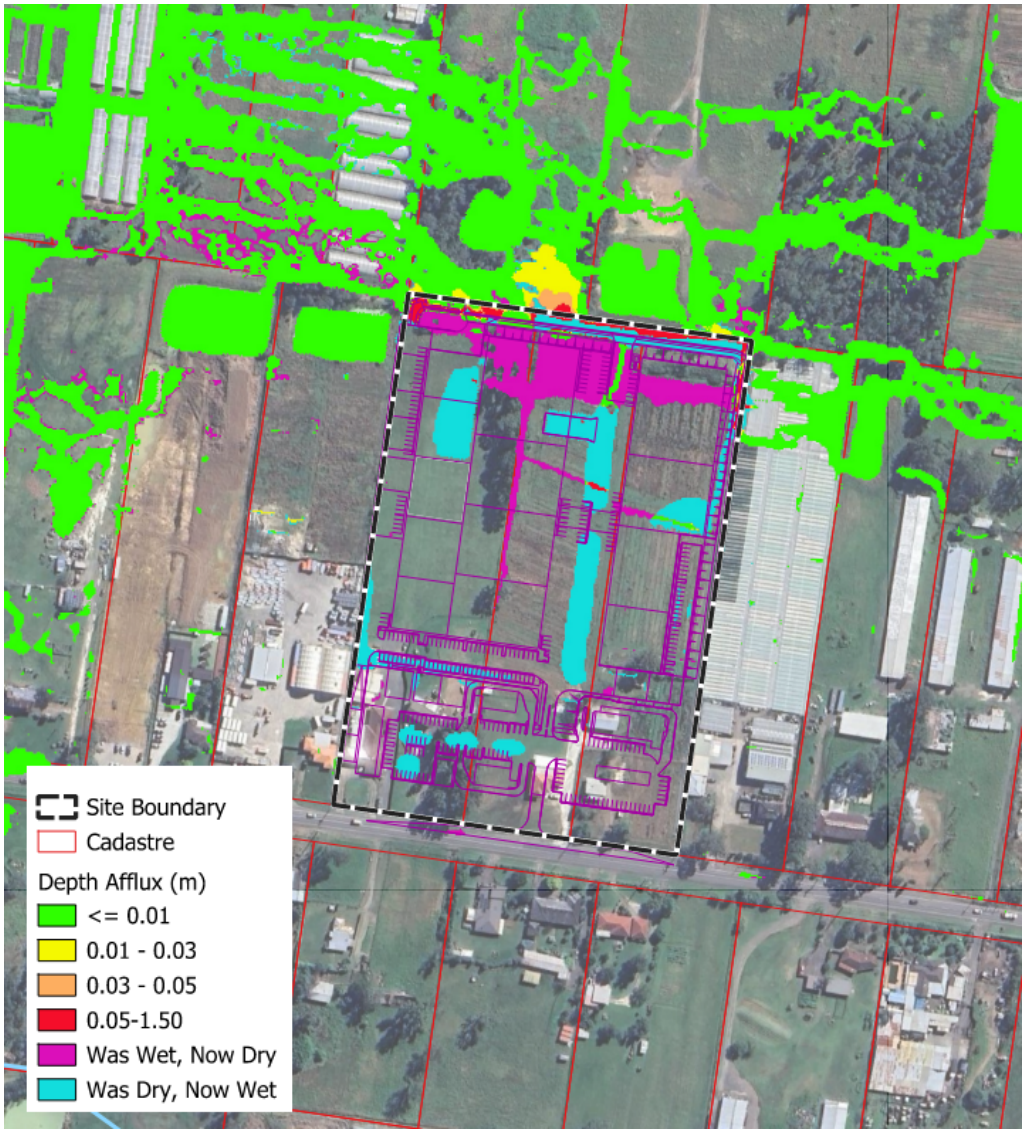


9.4.3 Afflux

A direct comparison of the existing and post developed 1% AEP scenario flood depths and velocities was undertaken to assess flood affectation adjacent to the site.

Increases in the water surface level were separated from decreases and are identified in Figure 17 and Figure 18 below.

Figure 17 – Developed Scenario – 1% AEP Afflux Depth Map



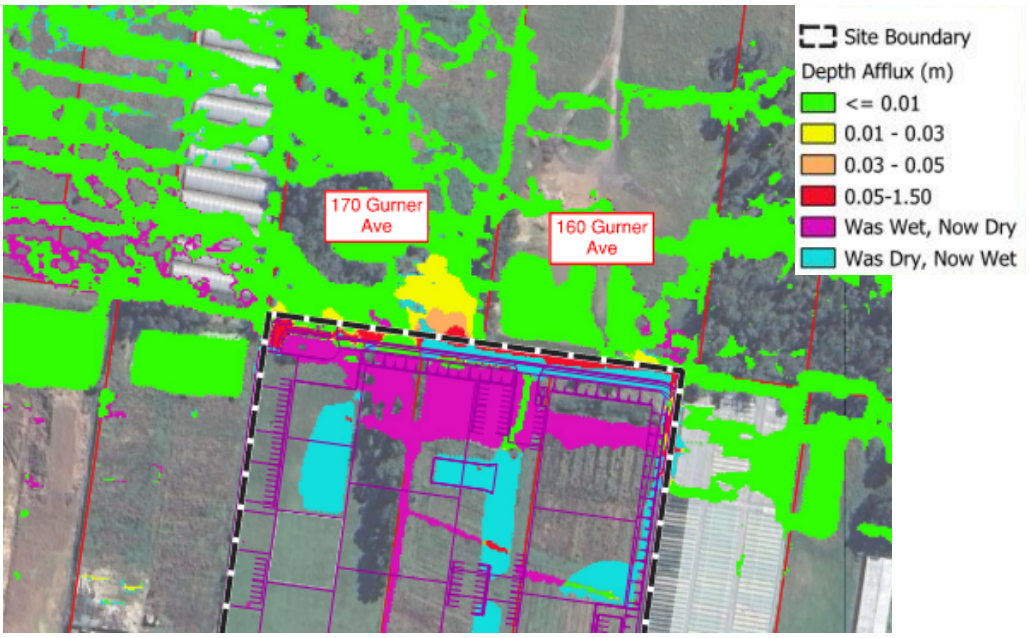
While a pocket of afflux is shown adjacent the northern boundary, the overall flooding conditions at the adjoining property remain generally unchanged, with shallow depth flooding in the overland flow path through the future road reserve along the northern boundary of the site.

The afflux is primarily caused by the surface level adjustment caused by the removal of the existing site's farm dam embankment which alters the flow conditions through this northern area of the site. It is noted that this result will only be present in the proposed scenario conditions until the completion of the 20m wide industrial road, when more formal drainage infrastructure will be provided to cater for the overland flows currently presented in the modelling. There are no building structures within the vicinity of the observed afflux, and thus will have no material impact on local infrastructure and the wider flood regime.

Expanding further, please see screen shots below highlighting the post-developed 1% AEP peak flood levels and afflux on the adjoining properties to the north at 160 and 170 Gurner Avenue.

160-170 Gurner Ave – 1% AEP Peak Flood Levels

160-170 Gurner Ave – 1% AEP Flood Afflux

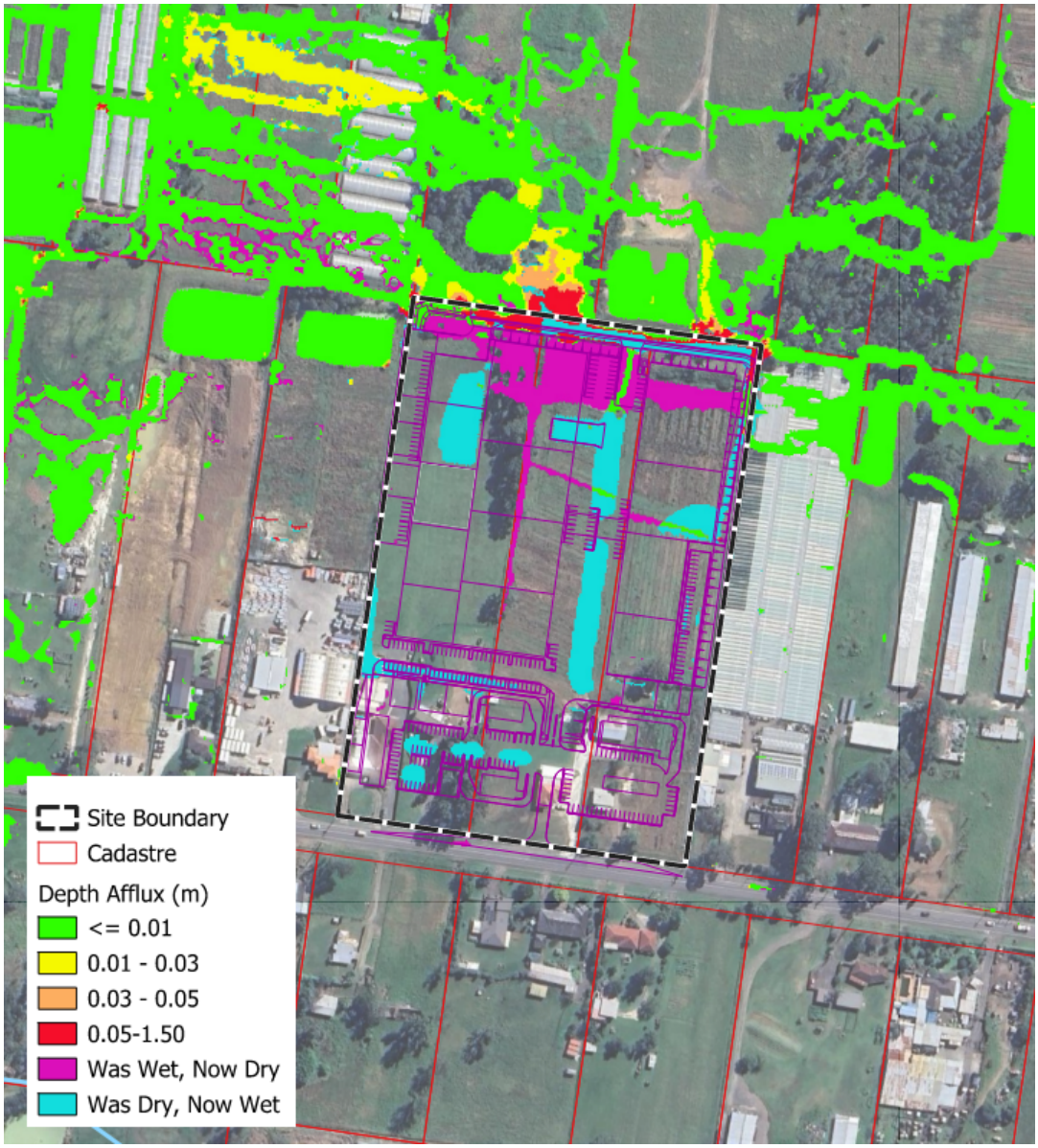


As can be seen from the screen shots above, while small localised areas of afflux have been identified, the peak (worst-case) 1% AEP flood level impacting the adjoining properties remains unchanged in the post-developed scenario at TWL 61.20 for 170 Gurner Ave and TWL 62.80 at 160 Gurner Ave (i.e. no change to Flood Planning Level for the properties).

Further, while afflux is predicted this is contained within the existing floodplain and levels balance out as flows continue downstream along the flowpath. Similarly, the overall flooding conditions remain unchanged, with no increase in risks to either property or life.

Based on the above, we note that the proposal will present a negligible impact on flooding to the adjoining properties and is considered acceptable for fragmented land development of this nature as no significant impacts to the properties were observed due to the proposed development, with the outcomes consistent with other Council approved subdivisions within the local area.

Figure 18 - Developed Scenario – 1% AEP Afflux Velocity Map



Overall, the changes in flood behaviour as a result of the development are considered very minor and are within expected tolerances for the residual land use of adjacent properties. The velocity changes due to the project are minimal and anticipated, with formalized flow paths in the future road reserve along the northern boundary. No increases in scour potential are noted in areas impacted by changes in velocity from existing conditions.

9.5 Conclusions

In conclusion, the study indicates that flooding under existing conditions occurs mainly via established overland flowpaths and lower-lying portions of the rural catchment. The proposed developments design is sufficiently protected from flooding during the 1% AEP event due to its elevated building pads, and through the proposed construction of the development, there are minimal changes to the wider regional flow regimes. The proposal will have negligible impacts on

flooding to the adjoining property and poses no additional flood risk to human safety or existing structures. Based on this assessment, the proposed development is not expected to cause significant impacts to the local or regional flood regime.

10 Services

10.1 Sydney Water

10.1.1 Existing

The subject site currently does not have a formal sewer connection, with the existing rural properties serviced by on-site absorption systems (i.e., septic tanks and infiltration).

The site also currently has frontage to an existing 100mm uPVC potable water main which runs under the northern verge of Fifteenth Avenue.

10.1.2 Proposed

With respect to sewer, we note that the subject site is ultimately to be serviced by the Kemps Creek Carrier which is currently under construction by Sydney Water, with an anticipated completion date of December 2023. As such, a new sewer main extension will need to be constructed from the Kemps Creek Carrier to the subject site.

Similarly, based on past experience on similar sites within the local area, it is anticipated that the existing Ø100mm uPVC rural water supply network in Fifteenth Avenue will be insufficient to support the development. As such, it is anticipated that a watermain upgrade will be required from the existing Ø250mm main in Edmondson Ave.

Once the Development Application has been lodged and a DA Number provided, a Section 73 Compliance Certificate will be lodged with Sydney Water to obtain a formal Anticipated Notice of Requirements.

10.2 Electricity

10.2.1 Existing

The existing electrical supply in the vicinity of the site consists of overhead reticulation which generally follows the alignment of the surrounding street network.

10.2.2 Proposed

It is understood that the existing electrical supply infrastructure in the vicinity of the site does not have sufficient capacity to support the proposal. As such, network upgrades will likely be required, including the provision of new PM substation within the development. Similarly,

provision of a new street lighting network will be required within the new 20m Industrial Road to be constructed along the northern boundary of the site.

Once the Development Application has been lodged an Application for Connection of Load will be submitted and a Level 3 ASP engaged to provide an electrical design to Endeavour Energy in the form of a proposed Method of Supply.

10.3 Telecommunications

DBYD service plans indicate that telecommunication conduits (including NBN) are available along the site frontage in Fifteenth Avenue to service the site. There do not appear to be any telecommunication mains located within the site boundary other than the existing domestic telecom connections.