Summit at Kemps Creek – 706-752 Mamre Road

SSD-30628110

Water and Stormwater Management Plan

ISPT Super Property

17/02/2023

21-855

Commercial in Confidence

Document Registration

Document Title	Summit at Kemps Creek – 706-752 Mamre Road – Water and Stormwater Management Plan
Document File Name	REP001-03-21-855 SSDA Water & Stormwater Management Plan.docx
Section	Civil / Urban Water Management
Document Author	Tim Michel

Issue	Description	Date	Author	Checked	Approved
01	Draft	18/08/22	Tim Michel	☒	☐
02	Issue for SSDA	08/09/22	Tim Michel	☒	☒
03	Issue for SSDA	17/02/23	Tim Michel	☐	☐
				☐	☐
				☐	☐

Contents

Figures

Tables

1. Introduction

This Water and Stormwater Management Plan (WSMP) has been prepared by AT&L on behalf of ISPT in support of a State Significant Development Application (SSD-30628110) for the proposed development of the 'Summit at Kemps Creek' site located at 706-752 Mamre Road, Kemps Creek (the Site).

The extent of the Summit at Kemps Creek site is presented in **Figure 1**.

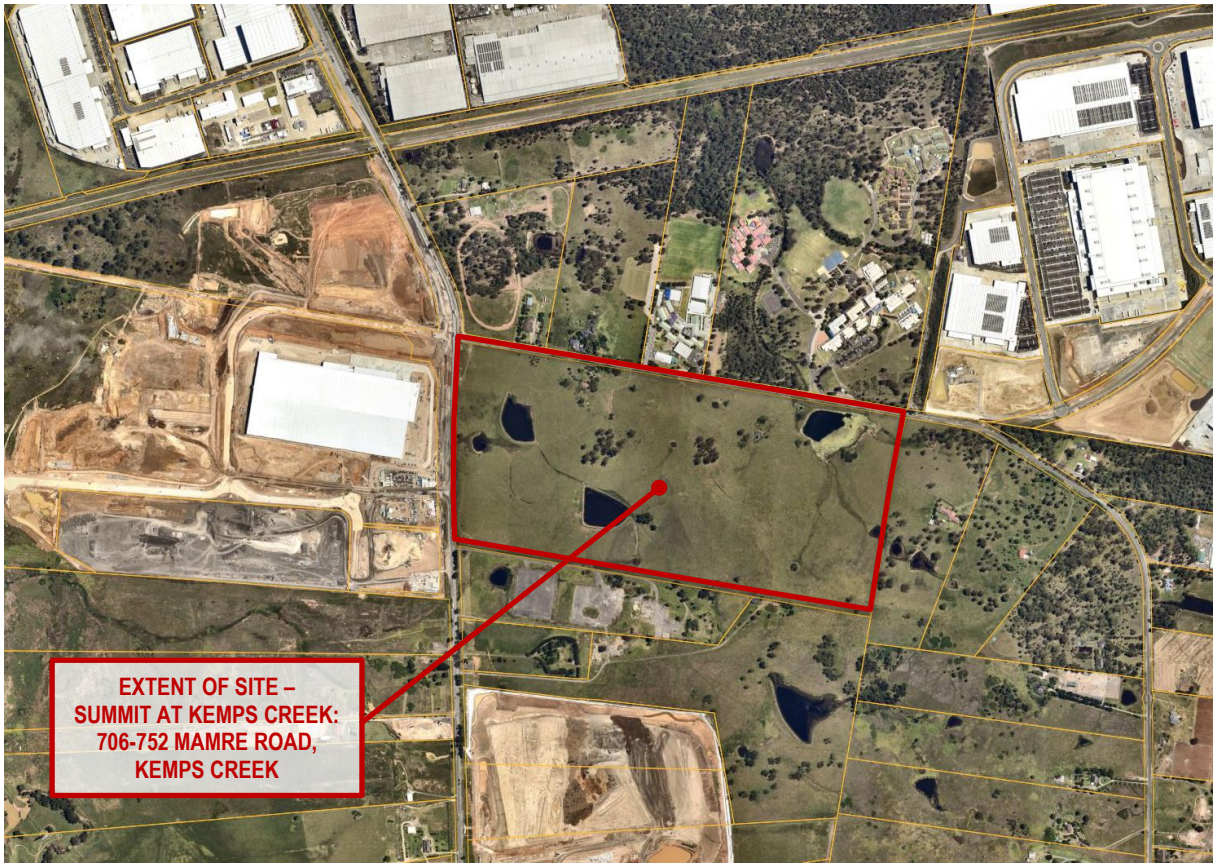

Figure 1: Site Extent (imagery from Nearmap, dated 10 January 2023)

The following documentation is referred to throughout and should be read in conjunction with this report:

1) Civil Infrastructure Report and Civil Drawings (AT&L, February 2023)
2) Landscape design package
3) Geotechnical Investigation Report (PSM, August 2022)

2. Site Description and Pre-Development Site Conditions

2.1. Location

The Site is located in the suburb of Kemps Creek, within the Penrith Local Government Area (LGA) and approximately 13 km south-east of the Penrith CBD and 7 km north-east of the under-construction Western Sydney Airport. The site is made up of a single allotment (Lot 1 DP104958). The total area of the Site is approximately 52 hectares.

The Site is currently characterised as rural land and comprises a single residential dwelling and some farm dams.

In June 2020, the site was rezoned *IN1 – General Industrial* under the *State Environmental Planning Policy (Western Sydney Employment Area) 2009*. The site is also located in the Mamre Road Precinct and is therefore subject to controls outlined in the *Mamre Road Precinct Development Control Plan 2021*.

2.2. Waterways and Vegetation

Based on large-scale topographic mapping (1:25,000 from NSW SIX Maps), there is one mapped hydroline that runs from south-west to north-east across the north-eastern portion of the site, refer to **Figure 2**.

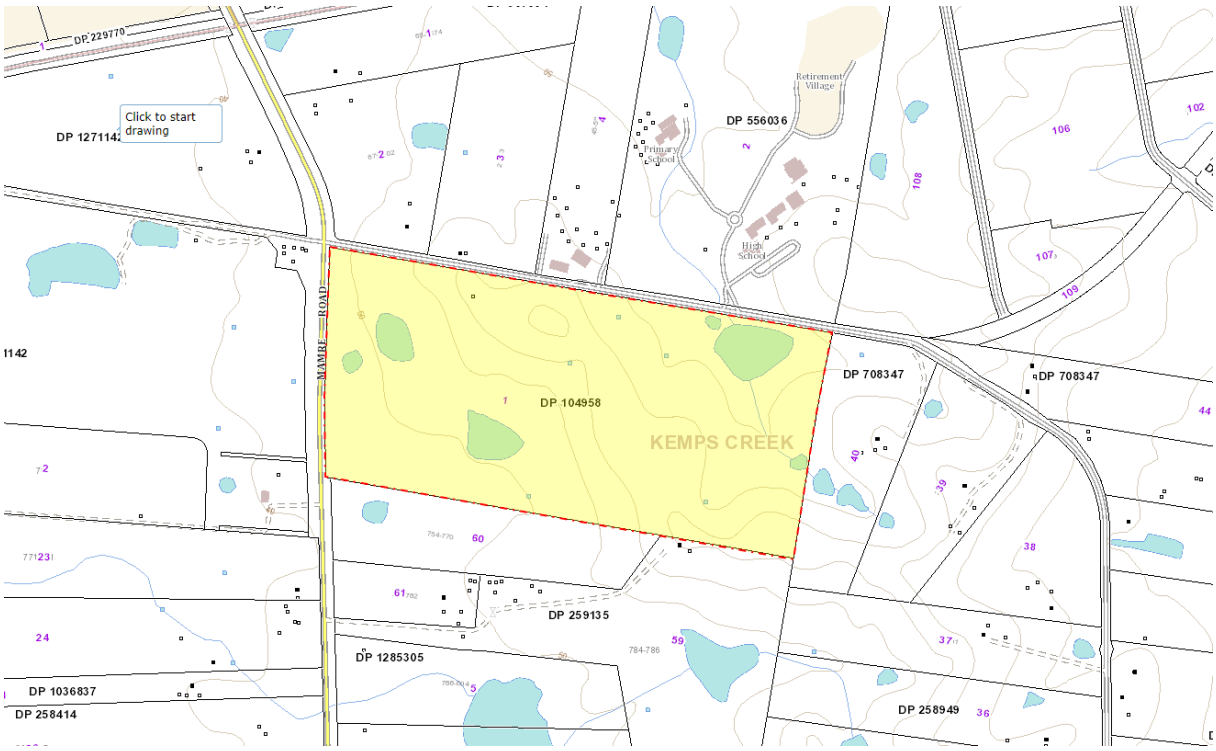

Figure 2: Topographic mapping showing drainage lines in the vicinity of the Site (Source: NSW SIX Maps)

The *Mamre Road Precinct Waterway Assessment* (CTEnvironmental, April 2020), contained in the *Mamre Road Flood, Riparian Corridor, and Integrated Water Cycle Management Strategy* (Sydney Water, October 2020) presents the extents of waterways in the Mamre Road Precinct that have been the subject of a desktop review and field assessment to confirm the presence of mapped and unmapped waterways. An extract of mapping indicating the extents of waterways in the Mamre Road Precinct is presented as **Figure 3**. This shows an unnamed tributary of South Creek within the site.

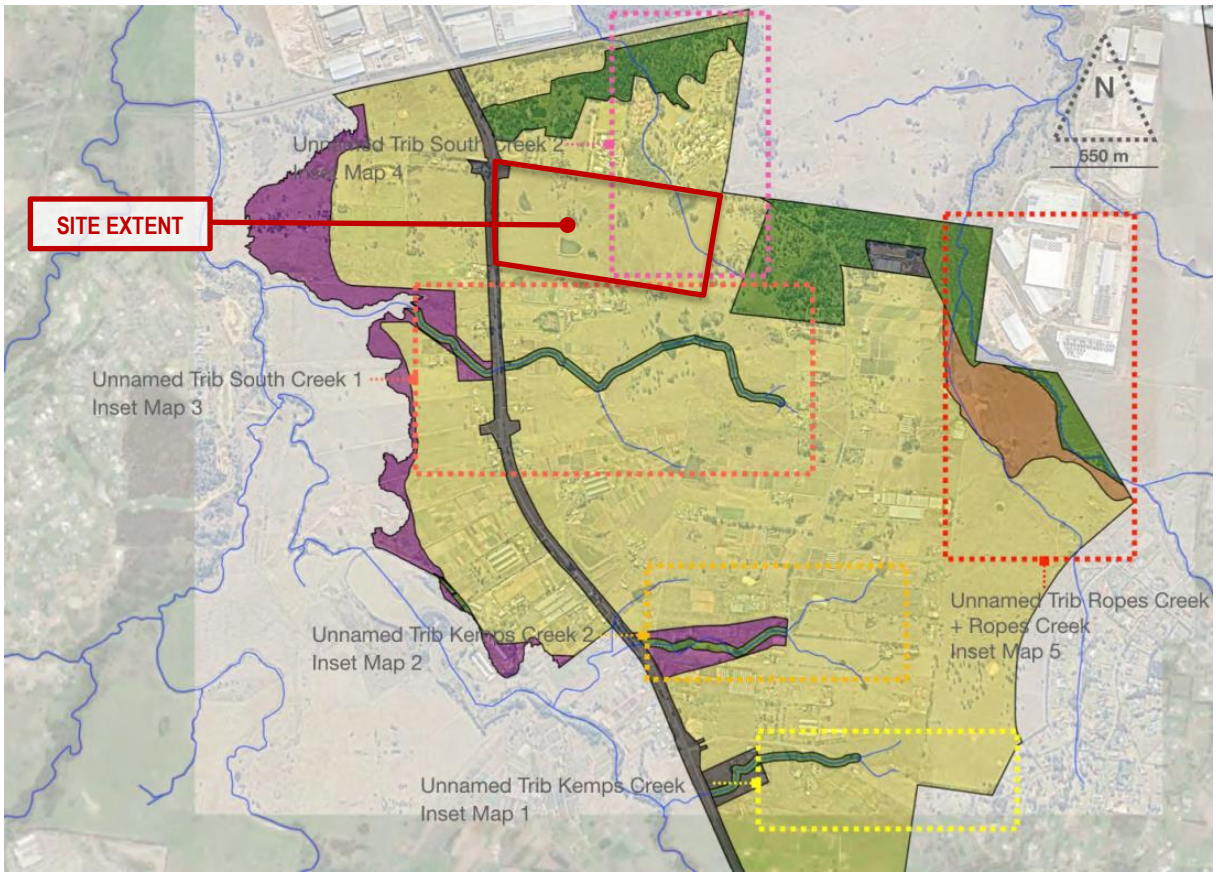

Figure 3: Extract of waterway mapping (CTEnvironmental, April 2020)

Results of the inspection of the unnamed tributary of South Creek are described in the *Mamre Road Precinct Waterway Assessment* (CTEnvironmental, April 2020), and are summarised below:

- Field inspection validated the presence of a 1st order watercourse within the site.
- The section of the watercourse within the Site has been modified to a series of farm dams with overland flow paths providing links across a broad and shallow drainage depression.
- Fringing and emerging wetland vegetation and large native trees were present around all farm dams.

The extent of the field validated top of bank and ground-truthed flow path is reproduced below as **Figure 4**. It is noted that the top of bank and the vegetated riparian buffer zone is limited to the section of watercourse downstream (north) of the Site.

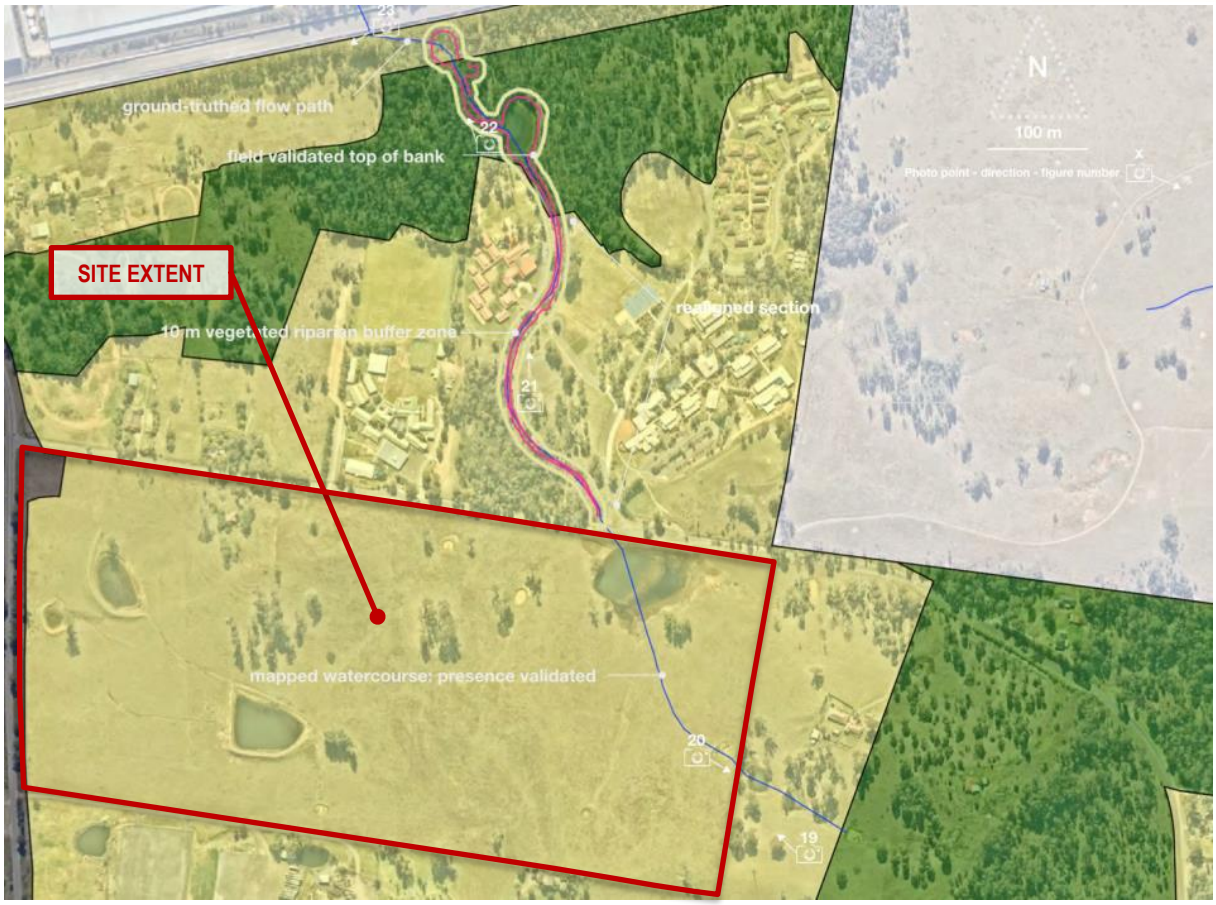

Figure 4: Field validated flow paths and watercourses within and downstream of the site

2.3. Existing Geology

Based on a preliminary geotechnical investigation undertaken by PSM dated 17 June 2022, it is understood that the Site is underlain by Bringelly Shale of the Wianamatta group which consists of shale, carbonaceous claystone, claystone, laminate, fine to medium grained lithic sandstone, rare coal and tuff.

A summary of the inferred subsurface conditions based on boreholes analysis undertaken by PSM is as follows:

- Topsoil (at surface) – sandy clay to clayey sand, low to medium plasticity
- Natural soil (up to 0.2m deep) – clay to sandy clay, low to medium plasticity
- Bedrock A (between 0.6m and 6.6m deep) – shale/sandstone, extremely to moderately weathered, very low to low strength.
- Bedrock B (between 3.1m and 10m deep) – shale/sandstone, moderately weathered, medium to high strength.

2.3.1. Salinity

Based on site investigations undertaken by PSM, consisting of six samples across the Site, soils were found to be either “non-saline” (four out of six samples) or “slightly saline” (two out of six samples).

2.3.2. Sodicity

The Exchangeable Sodium Percentages (ESPs) calculated from tests undertaken by PSM ranged from <0.1% to 18.8%, which indicates that the natural soil on the site is classified as “non-sodic” (<5% ESP) to “highly sodic” (>15% ESP).

2.4. Existing Topography and Catchments

The Site in its existing condition is characterised by undulating topography. A ridgeline runs across the site, generally aligned from south-east to north-west. The ground slope either side of the ridgeline is generally between 6% and 15%. Elsewhere across the site the ground slope is generally 2-3%. A slope analysis of the existing topography is presented in **Figure 5**.

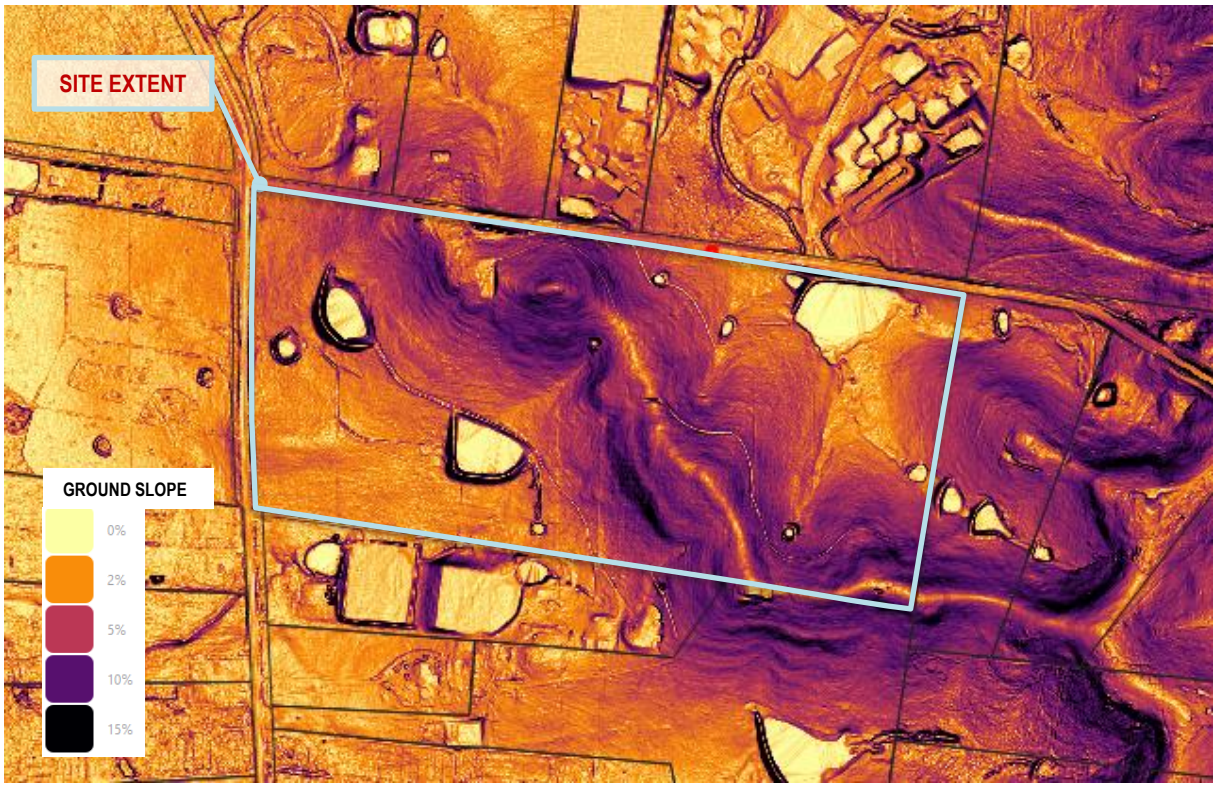

Figure 5: Slope analysis of existing site topography (based on NSW Government LiDAR data, 2019)

The highest ground elevation within the Site is approximately 85 mAHD adjacent to the south-eastern corner. The lowest ground elevation is approximately 42 mAHD at the south-western corner adjacent to Mamre Road. The lowest point adjacent to Bakers Lane is approximately 54 mAHD.

Most of the site in its existing condition is pervious, other than a single residential building and some access driveways.

Delineation of the internal drainage catchment and external catchment that drain through the Site is presented in **Figure 6**.

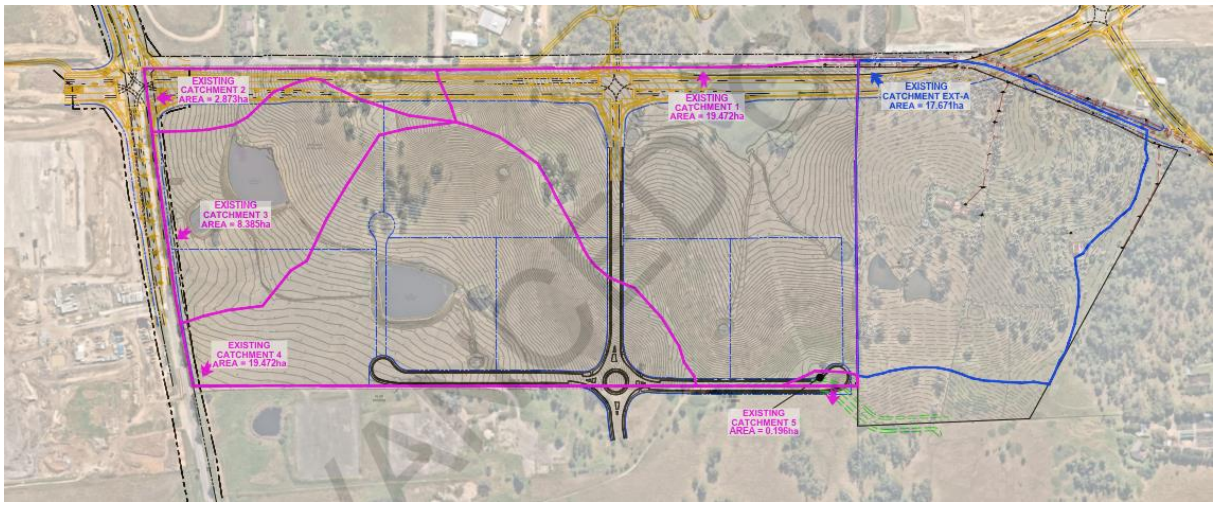

Figure 6: Catchment extents under existing conditions

A summary of the internal catchments under existing conditions is as follows:

- Existing Catchment 1 (19.472 ha) – discharges towards Bakers Lane and through an existing culvert under Bakers Lane.
- Existing Catchment 2 (2.873 ha) – discharges towards a low point adjacent to the western site boundary, approximately 50 metres south of Bakers Lane.
- Existing Catchment 3 (8.385 ha) – discharges towards the western boundary of the site and towards an existing culvert under Mamre Road.
- Existing Catchment 4 (19.472 ha) – discharges towards the south-western corner of the site and towards Mamre Road.
- Existing Catchment 5 (0.196 ha) – discharges towards a local depression near the south-eastern corner of the site.

The sole external catchment that drains to the site is approximately 17.67 hectares and drains towards the north-eastern corner of the site, adjacent to Bakers Lane. The majority of this catchment is contained within the proposed Gibb Group Development at 1-51 Aldington Road (SSD-22595032).

There is currently no formal trunk stormwater infrastructure within the site. Visual inspection on site indicates that there are no formal creeks or waterways, more so localised depressions occurring naturally in the undulating nature of the site.

2.5. Trunk Drainage Paths

The *Mamre Road Precinct DCP* includes indicative locations of trunk drainage infrastructure across the precinct, refer to **Figure 7**. The indicative trunk drainage line within the site is located at the northern boundary of proposed Lot 1 and extends towards the east along the northern boundary of 21 Aldington Road within the Gibb Group Development. The nature and extent of trunk stormwater drainage at the interface between the two development sites will be subject to coordination at the detailed design phase.

The geometry of the channel will be subject to ongoing coordination with Sydney Water, the Gibb Group development and WSP design for the future Southern Link Road.

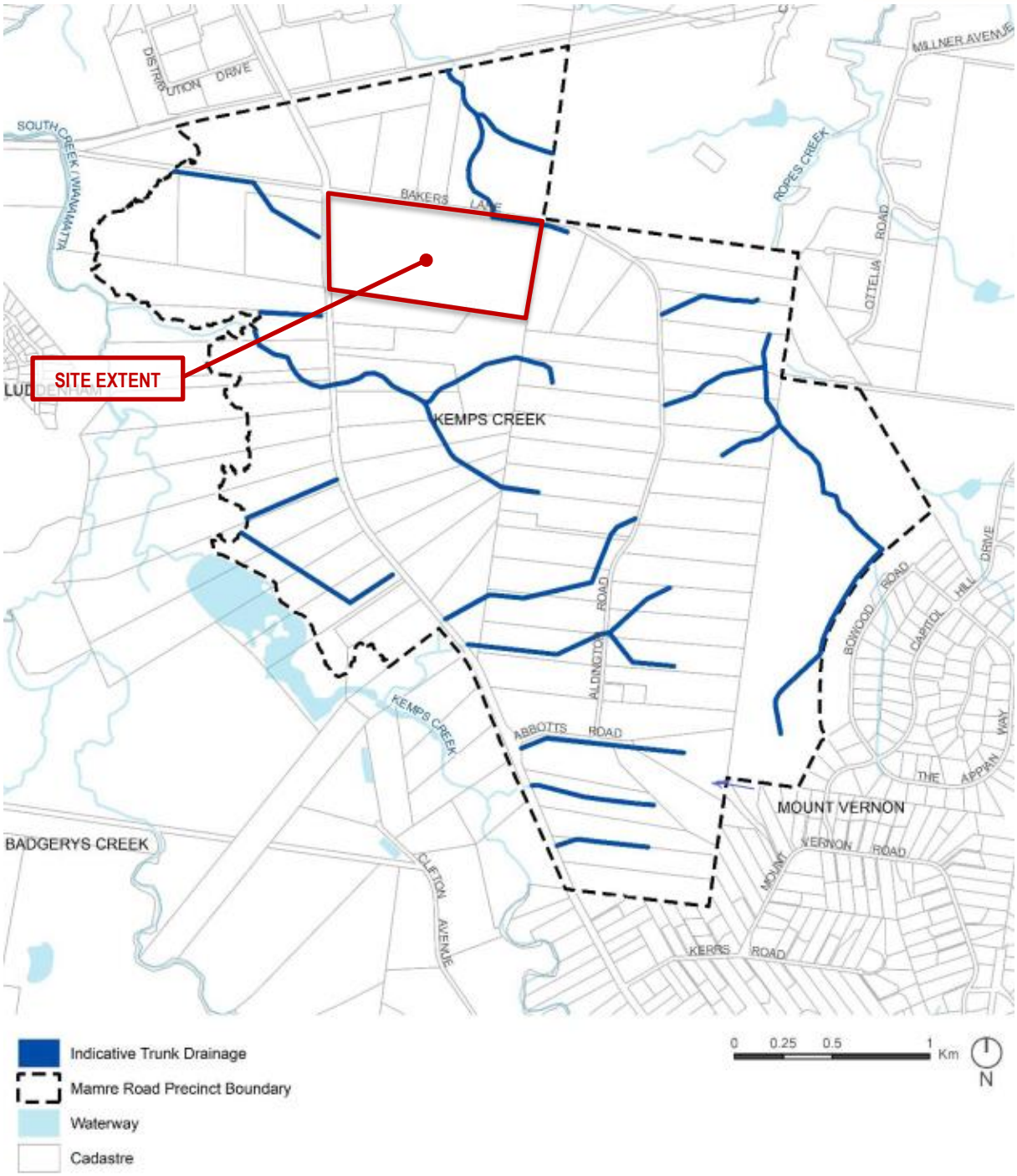

Figure 7: Trunk Drainage Infrastructure identified in the Mamre Road Precinct DCP

Preliminary channel design parameters, peak flows and indicative flow depths from DRAINS model outputs are presented in **Table 1**.

Table 1: Preliminary trunk drainage channel design parameters

	Channel east
Inflow characteristics	Flow from proposed Aldington Road, which will capture and convey the upstream catchment east of the site
Low flow channel	To contain peak flow up to the 50% AEP design event
High flow channel	To contain peak flow up to the 1% AEP design event, with sufficient freeboard (minimum 0.5m) to surrounding development to satisfy development controls
50% AEP peak flow	0.676 m^3/s
1% AEP peak flow	3.16 m^3/s

Further design and coordination with Sydney Water, the project landscape designer and ecologist will be undertaken to develop other design parameters for the proposed trunk drainage channel, including:

- Channel planform (including low flow channel sinuosity and meander)
- Depth variability (in the form of pools and riffles)
- Channel bed grade control structures (e.g., rock chutes or ramps)
- Bank stabilisation
- Ecological values (e.g., habitat structures, vegetation types and variety)
- Social values (e.g., amenity, community connection)

3. Proposed Development

3.1. Scope of SSDA

SSD-30628110 seeks approval for the following scope of development:

- Concept Masterplan comprising eight (8) industrial allotments with a total gross floor area of approximately 263,010 m^2.
- Stage 1 infrastructure works, including:
  - Demolition, vegetation clearing and removal of existing farm dams
  - Bulk earthworks and construction of retaining walls
  - Construction of two internal roads (Road No. 1 in a north-south direction and Road No. 2 in an east-west direction), including a roundabout at the intersection of the two roads.
  - Construction of an interim arrangement of the Southern Link Road, which will provide vehicular access between Mamre Road and the Site.
  - Construction of stormwater infrastructure, utility services and landscaping.
  - Construction of three (3) warehouse buildings, one each on proposed lots 1, 2 and 3 (east of proposed Road No. 1).
  - Implementation of construction-phase erosion and sediment controls, including measures required to satisfy stormwater quantity and flow controls on the remainder of the site west of proposed Road No. 1 (lots 4-8 inclusive).

3.2. Post-Development Catchment Extents

A post-development catchment plan based on the proposed site grading is presented in **Figure 8**.

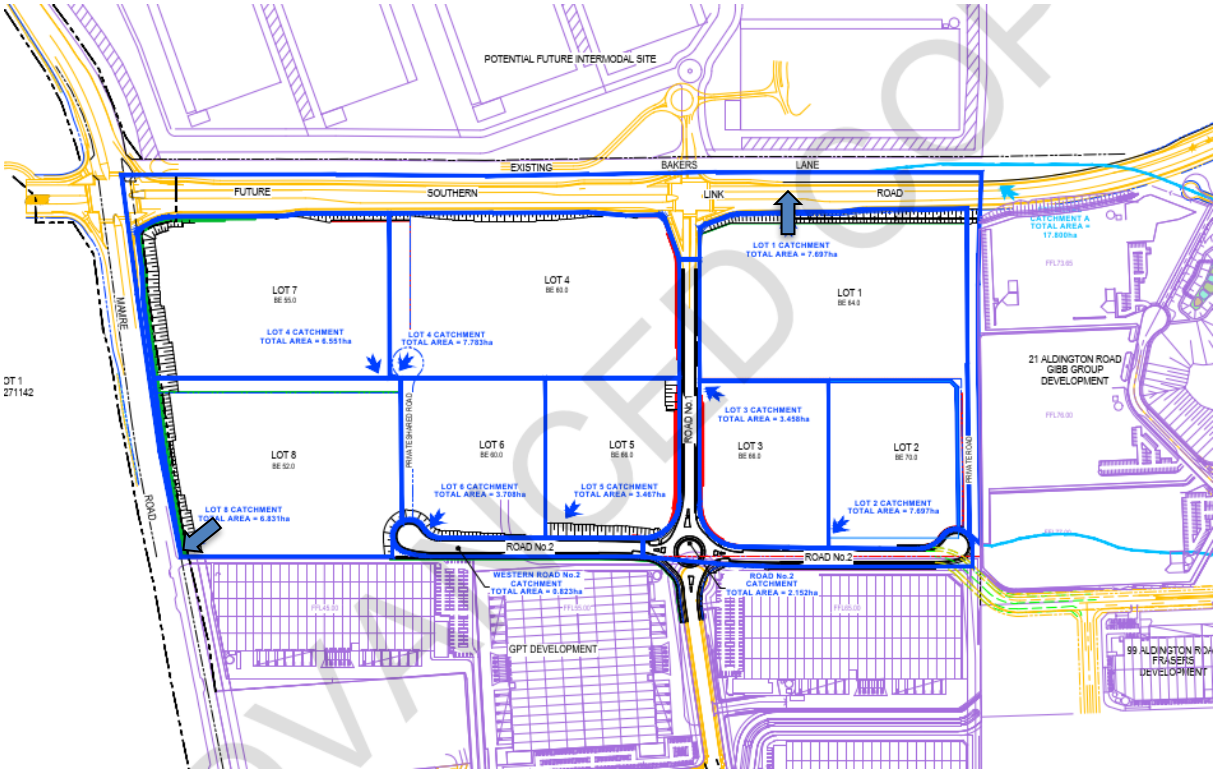

Figure 8: Catchment extents under proposed conditions

As shown in **Figure 8**, the Site under proposed conditions is broadly divided into two catchments:

1) The eastern catchment (proposed Lots 1-3), which drains north towards Bakers Lane and ultimately towards the unnamed tributary of South Creek.
2) The western catchment (proposed Lots 4-8), which drains west towards Mamre Road and ultimately towards Kemps Creek.

Based on the proposed site grading, there will be two (2) main points of surface water discharge from the site:

- Across the northern boundary of the site adjacent to proposed Lot 1 towards the existing culvert at Bakers Lane.
- At the south-western corner of the site towards the verge on the eastern side of Mamre Road.

3.3. Water Sources and Demands

3.3.1. Water Requirements

Water requirements within the Summit at Kemps Creek site will be typical of large format warehouses and distribution centres. Sources of demand for water within the proposed allotments and public domain will include:

- Office amenities (kitchen, bathrooms)
- Landscape irrigation
- Dust suppression (depending on end user requirements)

3.3.2. Water Sources

The primary source of water to Summit at Kemps Creek will be Sydney Water's potable water reticulation network. Details of existing and proposed infrastructure that will be required to service the estate is presented in the Civil Infrastructure Report, prepared by AT&L in support of SSD-30628110.

A "third-pipe" reticulated recycled water network will supply non-potable water throughout the Mamre Road Precinct. Non-potable water will be supplied from two sources:

- Stormwater harvested within precinct-wide wetlands / ponds, to be delivered and operated by Sydney Water as part of a regional stormwater management scheme.
- Recycled water from the planned Upper South Creek Advanced Recycled Water Centre.

3.3.3. Water Use Minimisation

Sydney Water provides a wide range of advice and guidance relating to water use minimisation and water efficiency. Whilst warehouses and distribution centres are relatively low water users in comparison to other industrial users, the following water use minimisation principles will apply to development within Summit at Kemps Creek:

- **Avoid using water** where possible, such as sweeping hard surfaces instead of washing them.
- **Reduce water use** by installing water-efficient appliances and equipment (e.g., toilets, urinals, shower heads).
- **Reuse water** from manufacturing or cooling processes to toilet flushing, landscape irrigation and dust suppression.

4. Stormwater Targets

The Mamre Road Precinct DCP establishes the construction and operational phase stormwater quality and quantity (flow) targets for the Site. This Water and Stormwater Management Plan addresses operational phase targets only. Construction phase targets are addressed in an Erosion and Sediment Control Plan for the Site.

For the operational phase targets there are two options available for stormwater quality and two options available for stormwater flow.

Stormwater quality targets for Option 1 (annual load reduction) and Option 2 (allowable loads) are summarised in **Table 2**.

Table 2: Operational phase stormwater quality targets – Options 1 and 2

Parameter	Option 1 Target (reduction in mean annual load from unmitigated development)	Option 2 Target (allowable mean annual load from development)
Gross pollutants (anthropogenic litter >5mm and coarse sediment >1mm)	90%	< 16 kg/ha/yr
Total suspended solids (TSS)	90%	< 80 kg/ha/yr
Total phosphorus (TP)	80%	< 0.3 kg/ha/yr
Total nitrogen (TN)	65%	< 3.5 kg/ha/yr

Stormwater quantity (flow) targets for Option 1 (mean annual runoff volume) and Option 2 (flow percentiles) are summarised in **Table 3**.

Table 3: Operational phase stormwater quantity (flow) targets – Options 1 and 2

Parameter	Option 1 Target (MARV)	Option 2 Target (flow percentiles)
Mean annual runoff volume (MARV)	≤ 2 ML/ha/yr at the point of discharge to the local waterway	n/a
95%ile flow (L/ha/day at the point of discharge to the local waterway)	n/a	3000 – 15000
90%ile flow (L/ha/day at the point of discharge to the local waterway)	1000 – 5000	1000 – 5000
75%ile flow (L/ha/day at the point of discharge to the local waterway)	n/a	100 – 1000
50%ile flow (L/ha/day at the point of discharge to the local waterway)	5 – 100	5 – 100
10%ile flow (L/ha/day at the point of discharge to the local waterway)	0	n/a
Cease to flow	n/a	Between 10% to 30% of the time

5. Water Sensitive Urban Design Strategy

This Water Sensitive Urban Design (WSUD) Strategy for SSD-30628110 incorporates a series of stormwater management measures to address stormwater quality, quantity (peak flow attenuation) and flow volume. This Strategy should be read in conjunction with the following documents:

- Sydney Water, *Stormwater Management Framework for Aerotropolis and Mamre Road Precincts*, December 2022.
- Sydney Water, Mamre Road Precinct Stormwater Scheme Plan

5.1. Mamre Road Precinct Stormwater Scheme Plan

In December 2022, Sydney Water released the Mamre Road Precinct Stormwater Scheme Plan (SSP), reproduced below as **Figure 9**, along with a document titled *Stormwater Management Framework for Aerotropolis and Mamre Road Precincts*. The SSP presents indicative regional trunk drainage infrastructure proposed by Sydney Water in the Mamre Road Precinct. The SSP was developed in line with NSW Government planning requirements and includes measures that would ensure development in the precinct complies with the waterway health targets outlined in the *Mamre Road Precinct DCP*.

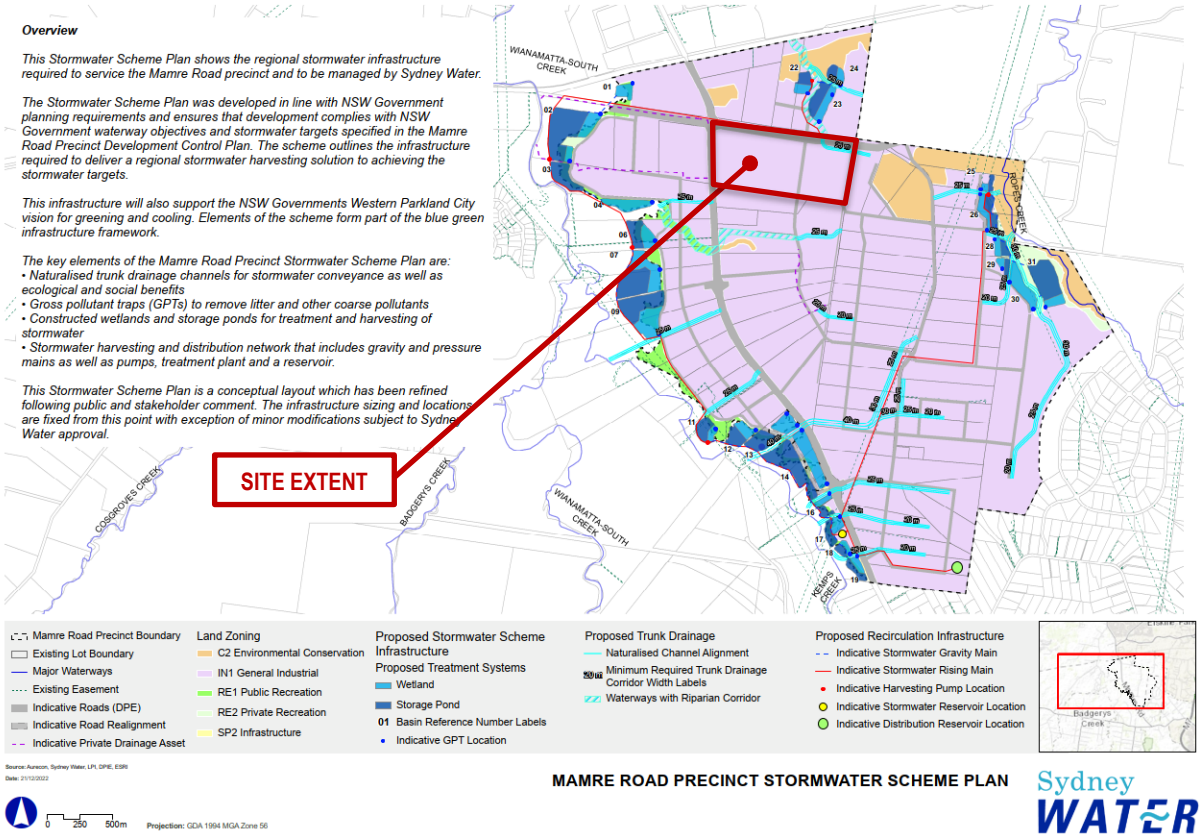

Figure 9: Mamre Road Precinct Stormwater Scheme Plan (Sydney Water, December 2022)

The Mamre Road Precinct SSP incorporates the following components:

- Naturalised channels and rehabilitated streams for stormwater flow conveyance
- Wetlands and storage ponds for harvesting and treatment of stormwater
- Gross pollutant traps (GPTs) to protect the treatment infrastructure from major litter and other pollutant loads
- A recycled water distribution network that will include gravity and pressure mains as well as pumps, a treatment plant and a reservoir for reticulation.

The Mamre Road Precinct SSP shows a 25-metre-wide naturalised channel along a portion of the northern boundary of the Site, nominally within the extent of proposed Lot 1. This channel would drain from east to west towards the low point at Bakers Lane and ultimately through the unnamed tributary of South Creek (refer to **Section 2.2** for further details). As outlined in **Section 2.5**, further design coordination will be required with Sydney Water and the developer of the adjacent Gibb Group Site to establish channel design parameters. In particular, hydrological and hydraulic modelling of channel flow will need to be undertaken to simulate post-development conditions for a range of design storm events, noting the proposed final landform and catchment delineation will be significantly different to the existing landform.

Ultimately, the Site would discharge to planned stormwater management measures presented on the SSP, namely:

- Wetlands / Storage Ponds 22 and 23 to the north of the Site
- Wetland / Storage Pond 04 to the west of the Site

5.2. Strategy Overview

This Water Management Strategy has been developed for two scenarios:

1) An Interim Arrangement (refer to drawing 21-855-C1220), for which approval is being sought under SSD-30628110. This Arrangement has been presented to demonstrate a solution that could be implemented to satisfy stormwater quality, quantity and flow controls in the absence of regional stormwater management measures.
2) An Ultimate Arrangement (refer to drawing 21-855-C1225), which incorporates measures to address stormwater quantity controls within the Site. This Arrangement is presented on the basis that measures adopted in the Mamre Road Precinct Stormwater Scheme Plan (refer to **Figure 9**) are in place (or will be in place) to satisfy stormwater quality and flow controls for the Site. The Ultimate Arrangement is proposed to supersede the Interim Arrangement, without modification to any development approval in place, once formal confirmation has been received by DPE and/or Sydney Water that regional stormwater management measures will be delivered (by others) to service the estate.

Under the scope of SSD-30628110, stormwater management interventions within the western catchment would be limited to interim measures required to satisfy the stormwater quality, quantity and flow controls for the Site. Final stormwater management measures would be required at subsequent stages of development within Summit at Kemps Creek, which will be subject to separate development applications.

A summary of the proposed stormwater management measures that would be required to satisfy stormwater quality, quantity and flow controls under both the Interim and Ultimate Arrangements is presented in **Table 4**.

Table 4: Proposed water management measures under the Interim and Ultimate Arrangements

	Interim Arrangement (prior to implementation of regional stormwater management scheme)		**Ultimate Arrangement** (with regional stormwater scheme to be operated by Sydney Water)	
Rainwater tanks for non-potable reuse (Refer to **Section 5.3.1** for further details)	✓	Assumed to be required for proposed Lots 1, 2 and 3 to comply with the following DCP control: *Where development is not serviced by a recycled water scheme, at least 80% of its non-potable demand is to be supplied through allotment rainwater tanks.*	×	Rainwater tanks would not be required under the Ultimate Arrangement, on the basis that a reticulated recycled water scheme is in place and is deemed to be a more commercially viable solution than rainwater tanks for the supply of non-potable water throughout the estate.

	Interim Arrangement (prior to implementation of regional stormwater management scheme)		Ultimate Arrangement (with regional stormwater scheme to be operated by Sydney Water)	
Gross pollutant traps (GPTs) (Refer to **Section 5.3.2** for further details)	✓	GPTs with capacity for hydrocarbon and sediment removal (SPEL Stormceptor® or equivalent) to be installed upstream of the proposed detention basin / tank as a pre-treatment measure for the regional stormwater management scheme. GPTs to capture and treat road runoff prior to discharge from the Site.	✓	GPTs with capacity for hydrocarbon and sediment removal (SPEL Stormceptor® or equivalent) to be installed upstream of the proposed detention basin as a pre-treatment measure for the regional stormwater management scheme.
Proprietary bio-retention (refer to **Section 5.3.3** for further details)	✓	Required to satisfy stormwater quality controls until the regional stormwater management scheme is in place.	×	Will not be required on the basis that stormwater quality controls will be incorporated into the regional stormwater management scheme.
Detention tanks (Refer to **Section 5.3.4** for further details)	✓	Required to satisfy stormwater quantity controls.	✓	Required to satisfy stormwater quantity controls.
Sediment basins (Refer to **Section 5.3.5** for further details)	✓	Required on proposed lots 4 to 8 inclusive to satisfy stormwater flow controls (as well as construction phase stormwater quality controls).	×	Will not be required on the basis that stormwater flow controls will be incorporated into the regional stormwater management scheme.
Pond for stormwater harvesting and reuse for irrigation (Refer to **Section 5.3.6** for further details)	✓	Required to satisfy stormwater flow controls.	×	Will not be required on the basis that stormwater flow controls will be incorporated into the regional stormwater management scheme.

5.3. Proposed Stormwater Management Measures

A series of stormwater quantity and quality control measures are proposed to be adopted within the site to satisfy the stormwater management strategy objectives listed in **Section** Error! Reference source not found.. A general description of the proposed stormwater treatment train components is presented in the following sections.

5.3.1. Rainwater tanks

Rainwater tanks retain a significant proportion of stormwater that falls on roof areas. Given the large-scale industrial development proposed on the site, rainwater tanks can provide a significant contribution to the objective of minimising the total volume of runoff discharging from the site.

A rainwater tank reuse system on individual lots can be installed in many different configurations, including placing the tank above or below ground and using gravity or pressure systems (pumps) to supply rainwater for non-potable domestic uses. These uses typically include toilet flushing, laundry, hot water installations, car washing and irrigation.

A MUSIC model was developed to estimate the rainwater tank volume required to satisfy the Mamre Road Precinct DCP stormwater quality and flow targets. To determine the tank volume required to meet these targets, the following assumptions have been made:

- Non-potable demand of 0.1 kL/toilet/day has been adopted. The number of toilets within each lot has been estimated based on the floor area of warehouses and offices. Fixed daily demands have been pro-rated based on the warehouses and offices being occupied six days per week (Monday to Saturday).
- Non-potable demand of 600 mm per year across 50% of the on-lot landscape areas has been adopted to estimate the annual irrigation demand on lots 1, 2 and 3. :
- At least 50% of the total warehouse roof area would drain to the rainwater tanks.

A summary of the rainwater tanks for non-potable reuse is presented below in **Table 5**.

Table 5: Summary of rainwater tank parameters

	Lot 1 (Nth)	Lot 1 (Sth)	Lot 2	Lot 3
Total lot area (ha)	3.78	3.78	3.68	3.50
Warehouse roof area to tank (ha)	1.10	1.10	1.10	0.90
Carpark and hardstand area to tank (ha)	0.81	0.81	0.84	1.07
Adopted tank volume (kL)	120	120	100	120
Non-potable demand				
Toilets (kL/day)	1.37	1.37	1.63	1.37
Landscape irrigation (ML/yr)	1.30	1.30	1.10	1.05
Tank Water Balance				
Inflow (ML/yr)	6.78	6.78	6.79	5.58
Overflow (ML/yr)	5.28	5.28	5.40	4.25
% reuse demand met (including roof evaporation)	83.9	83.9	82.3	86.6
% flow reduction	22.1	22.1	20.4	23.8

5.3.2. Gross pollutant traps

The proposed stormwater treatment train under both the Interim and Ultimate Arrangements will consist of gross pollutant traps (GPTs) just upstream of the point of discharges from proposed lots 1, 2 and 3 to the estate road network drainage. GPTs will capture litter, debris and coarse sediment, as well as some oils and greases.

A high-flow bypass for the GPTs would nominally be equivalent to the 4 EY (3-month ARI) peak flow rate discharging to the GPT. Design flows for the GPTs and their final configuration will be confirmed at the detailed design phase.

5.3.3. Proprietary bio-retention

Two proprietary bio-retention systems (Filterra® or equivalent) have been adopted in the Interim Arrangement to satisfy stormwater quality controls:

- A 50 square metre system to capture and treat surface water runoff from Road 1.
- A 25 square metre system to capture and treat surface water runoff from the portion of Road 2 west of Road 1.

5.3.4. On-site stormwater detention

Surface water runoff from the proposed lots 1 to 3 inclusive is proposed to be collected via an on-lot stormwater network, which will connect to on-lot on-site stormwater detention (OSD) tanks. For the post-development

scenario, the design intent is to demonstrate a solution where post-development peak flow rates at the point of discharge at Bakers Lane are no greater than pre-development peak flow rates.

A summary of the key OSD tank parameters is presented in **Table 6**.

Table 6: Key OSD tank parameters

OSD Tank	Contributing Catchment Area (ha)	Peak 1% AEP Inflow (m^3/s) (A)	Peak 1% AEP Outflow (m^3/s) (A)	Peak 1% AEP Storage Volume (m^3)
Lot 1 West (Tank 1A)	3.71	2.26	1.16	1110
Lot 1 East (Tank 1B)	3.71	2.26	1.20	1060
Lot 2 (Tank 2)	3.43	2.09	0.87	1070
Lot 3 East (Tank 3A)	2.91	1.77	0.73	950
Lot 3 West (Tank 3B)	0.57	0.35	0.24	140

(A) Based on results of high-level DRAINS modelling, subject to review and refinement at detailed design once on-lot drainage layout is confirmed.

5.3.5. Sediment basins

Under the Interim Arrangement, oversized sediments basins on proposed lots 4 to 8 inclusive are proposed to provide capacity to capture, store and reuse water for irrigation of the undeveloped lots. Apart from being required to satisfy construction phase water quality targets, the enlarged sediment basins would also satisfy the following water management objectives:

1) Provide attenuation of discharge towards Mamre Road, thereby mitigating potential flood impacts west of the Site.
2) Contributing to the capacity to satisfy the stormwater flow volume targets adopted within the Mamre Road Precinct.

The broad parameters for the proposed oversized sediment basins are as follows:

- 8% of the total area of proposed lots 4 to 8 inclusive would be dedicated to a temporary sediment basin as an interim measure.
- The sediment basins would capture and store surface water runoff from the respective lot only, and stored water would be used to irrigate up to 20% of the lots.
- The average depth of the sediment basins would be 1.5 metres.

5.3.6. Pond for stormwater harvesting and reuse for irrigation

To satisfy the stormwater flow controls under the Interim Arrangement, a pond on undeveloped lot 4 is proposed to capture and store surface water runoff from proposed lots 2 and 3 and approximately half of lot 1. The pond will store water for irrigation across approximately 2.5 hectares of undeveloped lot 4. This harvesting and reuse system will satisfy the stormwater flow controls under the Interim Arrangement. To discharge water to the pond, the following interim stormwater drainage infrastructure will be required:

- A stormwater line (nominal diameter 1050mm) that will drain outflow from lots 2 and 3 through and adjacent to the southern boundary of lot 1. The line will cross Road 1 and discharge into the temporary pond on lot 4.
- A pump (nominal flow rate 25 l/s) and pressure main to transfer stormwater from proposed detention tank 1A into the temporary pond on lot 4.

General parameters for the proposed pond is summarised in **Table 7**.

Table 7: Adopted pond parameters (Interim Arrangement only)

Parameter	Pond 4
Location	Lot 4
Inflow from:	Lots 2 and 3 and part of lot 1 Southern portion of Road 1 Eastern portion of Road 2
Outflow to:	Catch drain on lot 4
Surface area (m^2)	5,800
Permanent pool volume (m^3)	5,800
Irrigation area (ha)	2.50
Annual irrigation demand [1] (kL/yr)	15,000 (assuming application to 2.5 hectares of lot 4 at a rate of 600 mm/year)

[1] applied as Monthly Pattern *defined in the MUSIC Modelling Toolkit – Wianamatta*

The pond and its associated irrigation system is intended to be an interim measure and would be superseded by Sydney Water's planned regional scheme infrastructure.

The irrigation system would need to incorporate a series of measures to demonstrate ongoing compliance with the stormwater flow controls and to mitigate potential risks associated with stormwater harvesting and reuse. The design and operation of these systems will comply with the principles and guidance outlined in the *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2); Stormwater harvesting and reuse* (Australian Government, 2009). As a minimum it is expected that the system will incorporate the following:

- A pump system to transfer water from the pond to the irrigation area, and potentially a small holding tank to store water upstream of irrigation infrastructure
- Stormwater treatment, including filtration and UV disinfection

A multi-channel irrigation controller including inputs for flow meters, moisture sensors and weather stations would be implemented to control, monitor and record irrigation system operation. It is expected that the controller would be a readily available "off-the-shelf" product and would be implemented and operated by the Proponent.

6. Performance Assessment

6.1. Hydrological and Hydraulic Modelling

DRAINS modelling software has been used to calculate the Hydraulic Grade Line (HGL) of the proposed estate-wide stormwater network, including pits, pipes, overland flow paths and detention basins. DRAINS is a software package used for designing and analysing urban stormwater drainage systems and catchments. It is widely accepted by Council's across NSW as the basis for stormwater design and has been confirmed by Penrith City Council as the preferred stormwater software analysis package.

A summary of the key hydrological and hydraulic design parameters adopted in DRAINS to develop a major and minor system drainage design for the proposed development are as follows:

- Rainfall intensities have been adopted using the Bureau of Meteorology Design Rainfall Data System (2016).
- Hydrological input parameters:
  - Paved (impervious) area depression storage: 1 mm
  - Grassed (pervious) area depression storage: 5 mm
  - Soil Type: 3
- Times of concentration for each sub catchment have been determined using the friend's equation.
  - Minimum tc: 5 minutes
  - Maximum tc: 20 minutes
- Pit Loss coefficients have been calculated in accordance with the Missouri-Hare Charts as documented in the Queensland Urban Drainage Manual.
- Onsite detention methodology: Post development flows are to be less than Predevelopment site flows for a range of design storm events between and including the 50% AEP and 1% AEP.

6.2. Stormwater Quality Modelling

6.2.1. MUSIC Model Parameters

The proposed stormwater treatment train has been modelled using the MUSICX software package (Version 1.1.0). The MUSIC model of the proposed stormwater management strategy has been created to simulate post-development mean annual loads and treatment train effectiveness. MUSIC model parameters including rainfall and evaporation, rainfall-runoff and source node pollutant generation are consistent with the parameters adopted in the *MUSIC Modelling Toolkit – Wianamatta* (NSW DPIE, 2021).

6.2.2. Scenario Modelling

A MUSIC model was created to simulate post-development mean annual loads under the Interim Arrangement scenario. The post-development (Interim Arrangement) model has been created based upon the proposed post-development catchment extents presented in **Figure 8**. Source nodes for each of the proposed lots have been adopted based on typical large-scale industrial land uses, including those depicted in the Estate Plan prepared by Watson Young. The layout of the post-development scenario is presented in **Figure 10**.

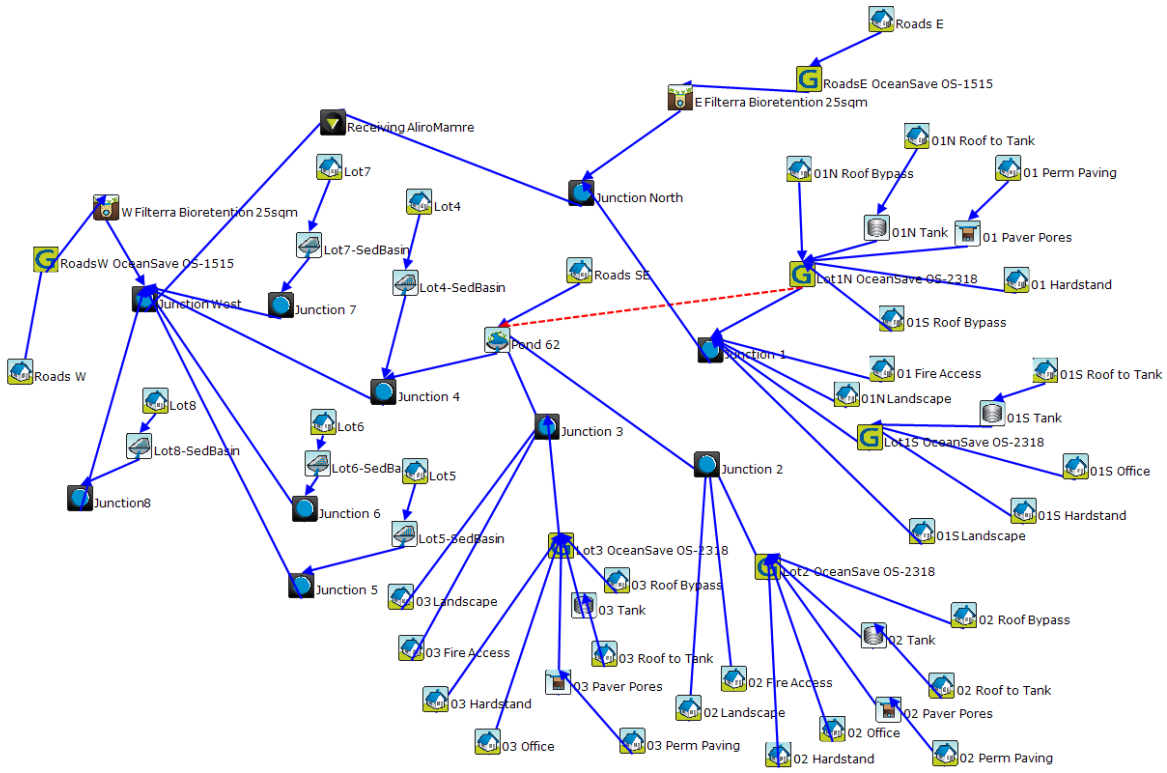

Figure 10: Post-development MUSIC model layout (Interim Arrangement)

6.3. Performance against stormwater targets

6.3.1. Stormwater quality

MUSIC model results presented as mean annual loads are presented in the following tables:

- Eastern catchment (including developed Lots 1-3, Road 1 and eastern part of Road 2) – **Table 8**.
- Western catchment (including undeveloped Lots 4-8 and western part of Road 2) – **Table 9**.
- Total Site (Stage 1 development conditions) – **Table 10**.

Table 8: Summary of MUSIC modelling results against stormwater quality targets – Eastern catchment

Parameter	Sources – Post-Development	Residual Load – Post-Development	Reduction (%)	Target Option 1 – annual load reduction	Residual load per unit area (kg/ha/yr)	Target Option 2 – allowable mean annual load
TSS (kg/yr)	5697	1073.4	81.2	90	37	< 80kg/ha/yr
TP (kg/yr)	9.1	3.5	61.6	80	0.12	< 0.3kg/ha/yr
TN (kg/yr)	93.0	53.8	42.1	65	1.84	< 3.5kg/ha/yr
Gross Pollutants (kg/yr)	1192.6	20.8	98.3	90	0.70	< 16kg/ha/yr

NB: shaded cells indicate compliance against the operational phase water quality targets outlined in the MUSIC Modelling Toolkit – Wianamatta (NSW DPE, April 2022).

Table 9: Summary of MUSIC modelling results against stormwater quality targets – Western catchment

Parameter	Sources – Post-Development	Residual Load – Post-Development	Reduction (%)	Target Option 1 – annual load reduction	Residual load per unit area (kg/ha/yr)	Target Option 2 – allowable mean annual load
TSS (kg/yr)	14642	1007	93.1	90	61.8	< 80kg/ha/yr
TP (kg/yr)	24.0	4.4	81.6	80	0.27	< 0.3kg/ha/yr
TN (kg/yr)	198.9	60.6	69.5	65	3.72	< 3.5kg/ha/yr
Gross Pollutants (kg/yr)	2295.8	0.0	100.0	90	0	< 16kg/ha/yr

Table 10: Summary of MUSIC modelling results against stormwater quality targets – Estate

Parameter	Sources – Post-Development	Residual Load – Post-Development	Reduction (%)	Target Option 1 – annual load reduction	Residual load per unit area (kg/ha/yr)	Target Option 2 – allowable mean annual load
TSS (kg/yr)	17511	2081	88.1	90	45.7	< 80kg/ha/yr
TP (kg/yr)	28.1	7.9	71.8	80	0.17	< 0.3kg/ha/yr
TN (kg/yr)	232.9	114.4	50.9	65	2.51	< 3.5kg/ha/yr
Gross Pollutants (kg/yr)	2727.2	20.8	99.2	90	0.46	< 16kg/ha/yr

NB: shaded cells indicate compliance against the operational phase water quality targets outlined in the MUSIC Modelling Toolkit – Wianamatta (NSW DPE, April 2022).

The MUSIC model results presenting above demonstrate that:

- For the proposed development of the eastern catchment, the proposed on-lot and interim estate-wide stormwater management measures would satisfy the targets for either Option 1 (annual load reduction_ or Option 2 (allowable mean annual load).
- Across the estate, the proposed stormwater management measures would satisfy the Option 2 water quality targets (allowable mean annual load).

6.3.2. Stormwater quantity

Eastern catchment towards Bakers Lane

Table 11 presents the pre-development and post development flow rates, generated by hydrologic and hydraulic modelling in DRAINS, for a range of events between and including the 50% AEP and 1% AEP design storm events at the Bakers Lane discharge point from the site.

Table 11: Pre-development and post-development peak flow rates from the proposed development – Bakers Lane outlet

Design Storm Event	Pre-Development Peak Flow Rate (m^3/s)	Post-Development Peak Flow Rate (m^3/s)
	Bakers Lane outlet	Bakers Lane outlet
50% AEP	1.43	0.78
20% AEP	3.07	1.32
10% AEP	4.17	2.01
5% AEP	5.22	2.88
2% AEP	6.86	3.53
1% AEP	8.02	4.30

The DRAINS model results demonstrate that the post-development peak flow rates would be less than or equal to pre-development peak flow rates for a range of storm events between (and including) the 50% AEP and 1% AEP design events. Therefore, the stormwater drainage system and detention basins as proposed would satisfy the development controls relating to stormwater quantity management.

Western catchment towards Mamre Road

The proposed enlarged sediment basins on lots 4 to 8 inclusive have been included in the DRAINS model to estimate the effect on attenuation of flow towards Mamre Road.

Table 12 presents the pre-development and post development flow rates, generated by hydrologic and hydraulic modelling in DRAINS, for a range of events between and including the 50% AEP and 1% AEP design storm events at the Mamre Road discharge point from the site.

Table 12: Pre-development and post-development peak flow rates from the proposed development – Mamre Road outlet

Design Storm Event	Pre-Development Peak Flow Rate (m^3/s)	Post-Development Peak Flow Rate (m^3/s)
	Mamre Road outlet	Mamre Road outlet
50% AEP	0.83	0.56
20% AEP	1.72	0.90
10% AEP	2.04	1.30
5% AEP	3.19	1.57
2% AEP	4.36	2.34
1% AEP	5.70	3.20

The results presented above demonstrate that, under the Stage 1 development scenario, the proposed stormwater management measures will satisfy the stormwater quantity management objectives for the Site.

Under the ultimate development scenario, additional OSD will be required for future development of the western catchments (Lots 4 to 8 inclusive), the design of which will be subject to assessment under a future development application.

6.3.3. Stormwater flow volume

MUSIC model results demonstrating performance of the proposed stormwater management measures across the Site against the stormwater flow targets are presented below in **Table 13**.

Table 13: Summary of MUSIC model results against stormwater flow targets

Parameter	Result	DCP Target	Complies with DCP target	
			DCP Option 1 (MARV approach)	DCP Option 2 (Flow Duration Curve approach)
Mean annual runoff volume (ML/ha/yr)	1.47	2.0	Yes	n/a
95%ile flow (L/ha/day)	27073	3000 to 15000	n/a	No
90%ile flow (L/ha/day)	7625	1000 to 5000	No	No
75%ile flow (L/ha/day)	44	100 to 1000	n/a	No
50%ile flow (L/ha/day)	5.7	5 to 100	Yes	Yes
10%ile flow (L/ha/day)	0.006	0	No	n/a
Cease to flow	9.7%	10% to 30%	n/a	No

The resultant flow duration curves for the total site, as well as separate curves presenting results at the northern outlet near Bakers Lane and the western outlet at Mamre Road, are presented as **Figure 11**.

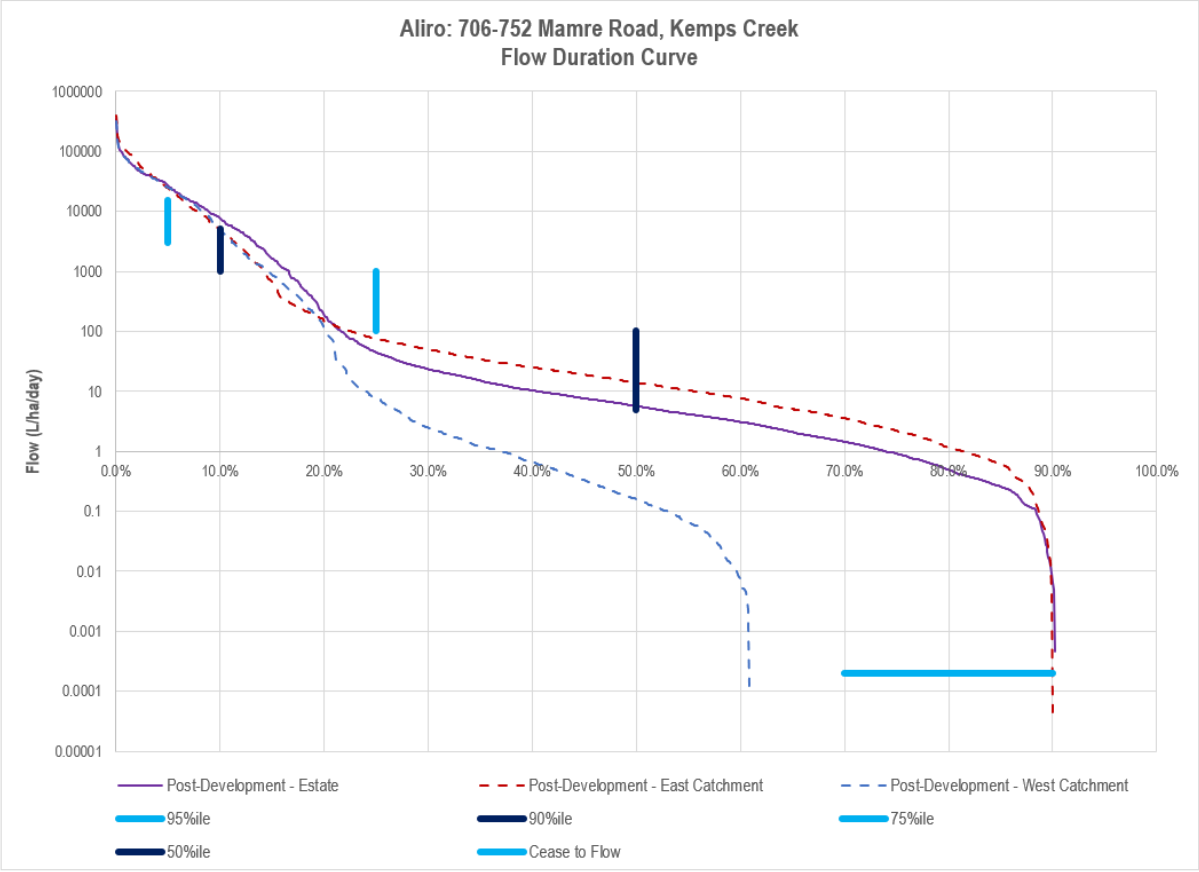

Figure 11: Flow duration curve for the proposed stormwater management measures (Interim Arrangement)

The results presented in **Table 13** demonstrate the proposed stormwater management measures that will be implemented across the Site satisfy the Option 1 DCP stormwater flow targets for the site, with the exception of the 90-percentile and 10-percentile flow. Further discussion of these results is presented below:

- While the 90-percentile flow for the combined site exceeds the flow target, as shown in **Figure 11** the 90-percentile flow is within the target for the eastern catchment (4974 L/ha/day) and the western catchment (4790 L/ha/day).

- The 10-percentile value of 0.006 litres per hectare per day equates to a total runoff from the site (excluding the portion of the Site dedicated to future upgrades of Mamre Road and the Southern Link Road) of approximately 0.27 litres per day (equivalent to 11 millilitres per hour). Whilst it is acknowledged the values that generate the flow duration curve represent a statistical probability of the exceedance of a particular flow value, in reality the calculated 10-percentile flow from the site represents a value too small to practically measure.
- The MUSIC model does not take into account some parameters that may contribute to a further reduction in runoff volumes across the site, such as transmission losses in the section of proposed open drainage channel adjacent to Lot 1.
- The flow duration curve presented in **Figure 11** represents the site under Stage 1 developed conditions, without regional stormwater management measures in place. Based on the proposed Draft Scheme Plan recently exhibited by Sydney Water, future wetlands and harvesting ponds north of Bakers Lane will provide additional capacity for stormwater quality and flow volume management.
- Ultimately, the combination of on-lot, estate-wide and regional measures will satisfy the waterway health objectives and controls adopted in the Mamre Road Precinct DCP.

7. Maintenance and Operations

All proposed water management measures that make up the Interim Arrangement of the water management strategy would be managed and maintained by the proponent. An Inspection and Maintenance Plan will be prepared and lodged with the construction certificate for the subdivision works once final design details and the extent and layout of all proposed water management measures is confirmed.

It is anticipated that the Inspection and Maintenance Plan would be prepared using current best practice guidance such as *Water sensitive urban design inspection and maintenance guidelines* (Blacktown City Council, 2019) and would describe:

- Each of the functional components of each water management measure
- Expertise required to inspect, maintain and (where necessary) repair or replace components
- Minimum required frequency of inspection, repair or replacement activities
- Inspection and maintenance forms that list all necessary activities and contain a record of activities completed.

Estate-based and on-lot measures such as rainwater tanks and GPTs will be managed and maintained by the Proponent, with inspection and maintenance requirements consistent with those described above.

The planned regional stormwater management scheme, which would incorporate measures to manage stormwater quality and volume across the Mamre Road Precinct, would be managed and maintained by Sydney Water.

at&l

NORTH SYDNEY
LEVEL 7
153 WALKER STREET
NORTH SYDNEY NSW 2060
029439 1777
INFO@ATL.NET.AU

PARRAMATTA
LEVEL 4
17-21 MCQUARIE STREET
PARRAMATTA NSW 2150
INFO@ATL.NET.AU

BRISBANE
SUITE A1 LEVEL 20
127 CREEK STREET
BRISBANE QLD 4000
07 3211 9581
INFO-QLD@ATL.NET.AU

MELBOURNE
7 BENNETT DRIVE
ALTONA NORTH VIC 3025
INFO-VIC@ATL.NET.AU

atl.net.au