Water and Stormwater Management Plan

High Density Residential Development

40 The Retreat

Bradfield NSW 2556

CLIENT/ SCG Developments

DATE/ 07/06/2024

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Commercial in Confidence

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Contents

Figures

Tables

1. Introduction

This Water and Stormwater Management Plan has been prepared by AT&L on behalf of SCG Developments to support the State Significant Development Application (SSDA) of the proposed development at 40 The Retreat, Bradfield NSW 2556.

The site is located within the development area of the Western Sydney Aerotropolis Precinct. It is approximately 2.1 hectares in area and is currently occupied by a single house and presumed farmland. The main access point is via a vehicular driveway on The Retreat, on the southwest corner of the site. Refer to Figure 1 for location of the proposed development.

Figure 1: Site Location (Source: Nearmap image dated 30/03/2024)

1.1. Development Description

This State Significant Development Application seeks consent for the detailed design and delivery (including construction and use) of a new mixed use residential development, to be developed in two (2) stages. Specifically, development consent is sought for:

Stage 1

- Overall site clearing and preparation works, including demolition of all existing development on the Site;
- The redevelopment of the northern portion of the Site, comprising:
  - Temporary Site access to the northern portion of the Site from The Retreat;
  - Temporary bin enclosure adjacent the temporary access;
  - Excavation works and construction of a shared two (2) storey basement to a maximum depth of RL 60.60, with capacity for 311 vehicle car spaces;
  - Construction of three (3) individual mixed use buildings, comprising:
  - Maximum building heights between 30.4m and 39.8m;
  - A total Gross Floor Area (**GFA**) of 26, 204sqm, comprising 25,744 sqm of residential GFA, 248 sqm of non-residential GFA and 212 sqm of retail GFA, distributed across the three buildings;
  - 254 residential units, distributed across the three buildings.
  - Associated landscaping, communal open space and embellishment works; and
  - Delivery and augmentation of services.

Stage 2

- The redevelopment of the southern portion of the Site, comprising:
  - Removal of the Stage 1 temporary access from The Retreat;
  - Connection and access of the Stage 1 basement to the western boundary (to become a future Collector Road);
  - Excavation works and construction of a shared three (3) storey basement to a depth of RL 56.35, with capacity for 336 vehicle car spaces;
  - Site and basement access from the western boundary (to become a future Collector Road);
  - Construction of three (3) individual mixed use buildings, comprising:
  - Maximum building heights between 23.8m and 39.9m;
  - A total Gross Floor Area (**GFA**) of 29,126 sqm, comprising 28,540 sqm of residential GFA, 212 sqm of retail GFA and 374 sqm of non-residential GFA, distributed across the three buildings;
  - 279 residential units, distributed across the three buildings.
  - Associated landscaping, communal open space and embellishment works; and
  - Delivery and augmentation of services.

A detailed description of the proposed development is detailed in Section 3.0 of the Environmental Impact Statement prepared by Ethos Urban.

Refer to Figure 2 for a conceptual ground level layout of site. The proposed development incorporates various landscaping measures including swales and a raingarden, in-line with Western Sydney Aerotropolis's vision for new high-density developments in the precinct.

Figure 2: Proposed Development (Source: DKO DA Drawings)

1.2. Supporting Documentation

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

- Civil and Utilities Infrastructure Report (AT&L)
- Civil Drawings (AT&L)
- Erosion and Sediment Control Plan (AT&L)
- Preliminary Geotechnical Investigation Report (Intrax, dated 22/02/2024)

2. Compliance with SEARS

This report responds to the NSW Planning Secretary's Environmental Assessment Requirements (SEARs) issued by the NSW Department of Planning, Industry and Environment (DPIE) on 21 September 2022. **Table 1** below summarises key issues relating to soil and water management that are listed in the SEARs, and where they are addressed in this report.

Table 1: Planning Secretary's Environmental Assessment Requirements addressed in this report

Key issues listed in the SEARs	**Response**
Water Management	
Provide an Integrated Water Management Plan for the development that:	
– *is prepared in consultation with the local council and any other relevant drainage or water authority*	**Section 3**
– *outlines the water-related servicing infrastructure required by the development (informed by the anticipated annual and ultimate increase in servicing demand) and evaluates opportunities to reduce water demand (such as recycled water provision).*	**Section 6**
– *details the proposed drainage design (stormwater and wastewater) for the site including any on-site detention facilities, water quality management measures and nominated discharge points, on-site sewage management, and measures to treat, reuse or dispose of water.*	**Section 6**
– *demonstrates compliance with the local council or other drainage or water authority requirements and avoids adverse downstream impacts*	**Sections 5 and 6**
– *Where water and drainage infrastructure works are required that would be handed over to the local council, or other drainage or water authority, provide full hydraulic details and detailed plans and specification of proposed works that have been prepared in consultation with, and comply with the relevant standards of, the local council or other drainage or water authority.*	**Sections 5 and 6**

3. Development Control Requirements

3.1. Precinct Plan

The *Western Sydney Aerotropolis Precinct Plan* (NSW DPE, March 2022) was prepared and is in force under the provisions of Chapter 4 of the Aerotropolis SEPP. The Precinct Plan provides place-based objectives and requirements to guide development in the Aerotropolis. The Precinct Plan applies to five precincts within the Western Sydney Aerotropolis, including the Aerotropolis Core Precinct in which the Site is located (refer to Figure 3).

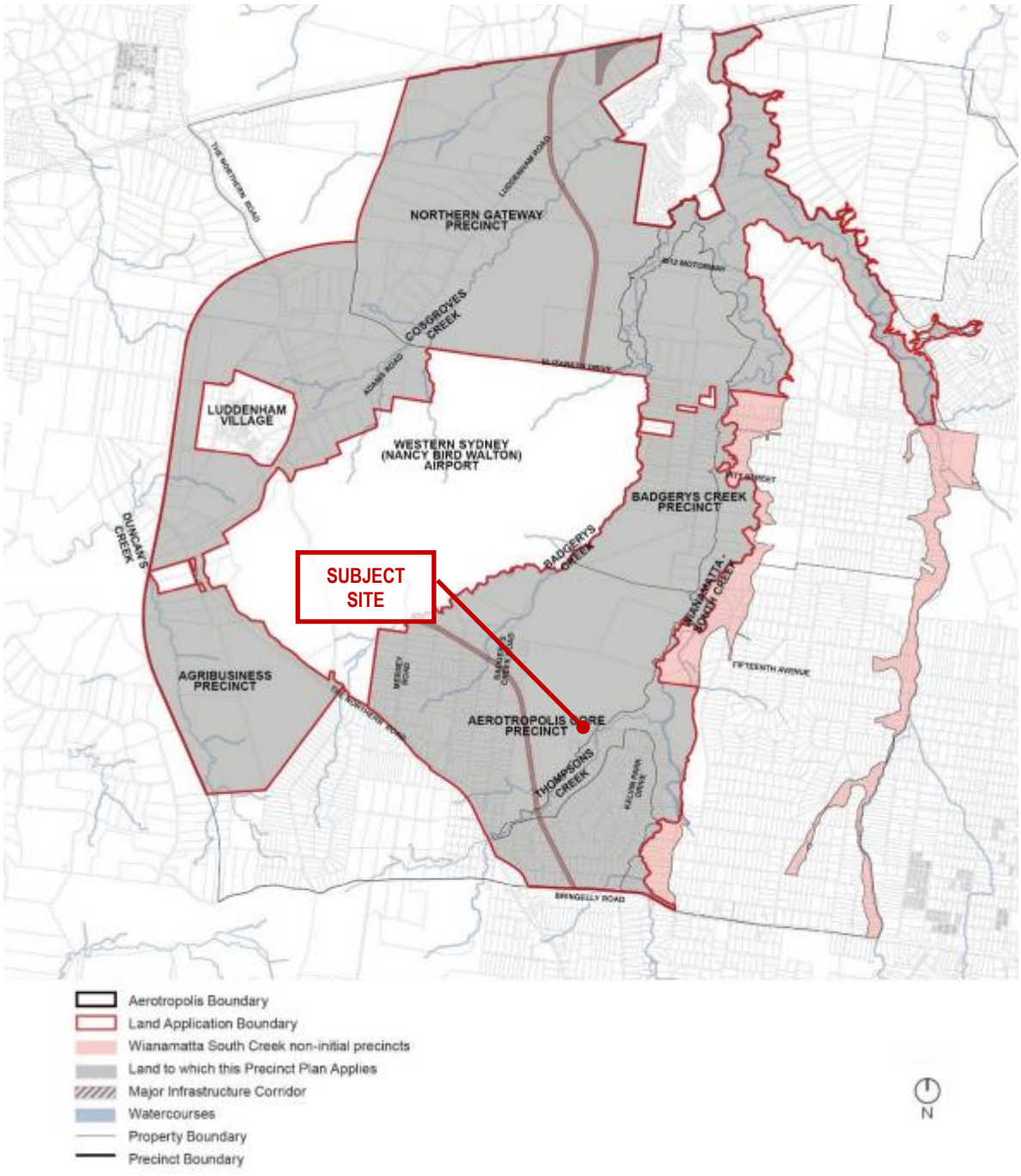

Figure 3:Location of Site within the Western Sydney Aerotropolis

3.2. Development Control Plan

The Western Sydney Aerotropolis Development Control Plan Phase 2 (WSA DCP) was finalised on 10 November 2022. It supports the ongoing implementation of the Aerotropolis Precinct Plan by providing controls to guide development across the initial precincts, including the Aerotropolis Core Precinct in which the Site is located.

4. Site Characteristics

4.1. Site Geology

Based on the geotechnical investigation undertaken by Intrax Consulting Engineers (report dated 22/02/2024), the site is underlain by Bringelly Shale from the Wianamatta Group formation, typically comprising shale claystone, laminate, carbonaceous claystone and fine to medium-grained sandstone.

Based on Intrax's investigation, a summary of the inferred subsurface conditions across the site is summarised below:

- Topsoil/Fill (to depths of 0.1m) – generally Silty Sand; brown, fine to medium grained, medium dense and moist. Generally grey-brown to dark grey-brown, clayey silt and silty clay topsoil.
- Residual Soil (between 0.8m and 4.5m deep): Clay; high plasticity with variable minor sand content and lesser gravel.
- Extremely Weathered Bringelly Shale (EW BS – base ranging from 1.3m to 5.8mbgl) – extremely weathered siltstone or sandstone. Recorded as clay with high plasticity.
- Bringelly Shale (BS) – Siltstone or Sandstone bedrock, from moderately weathered to slightly weathered rock between 4.95 and 9.26 mbgl).

Further details can be found within Intrax's geotechnical investigation report.

4.2. Existing Topography and Catchments

The site in its existing condition is characterised by a ridge along the northern boundary of site; however, there is approximately 4032m^2 of external, pervious, catchment flowing towards site from the east of Site (refer to Figure 4).

Typically, the site falls from the north-east to south-west corner of site and the ground slope across most of the stie is between 3% and 5%. Most of the site in its existing condition is pervious, except for a dwelling and an internal access road.

Based on survey undertaken by LTS (reference 51975 001DT, dated 21/03/2023), there is no formal stormwater infrastructure within the site.

Figure 4: Catchment Plan (AT&L Drawing C0040)

5. Stormwater Drainage

5.1. Stormwater Drainage Design Criteria

Design criteria and requirements for the proposed site stormwater management and stormwater drainage are outlined in the following documents:

- AS 3500.3 – Plumbing and drainage – Stormwater drainage
- Commonwealth of Australia (Geoscience Australia), Australian Rainfall and Runoff: A guide to flood estimation, 2019.
- NSW Department of Planning, Industry and Environment (DPIE), Western Sydney Aerotropolis Phase 2 Development Control Plan 2022.
- NSW Department of Planning, Industry and Environment (DPIE), MUSIC Modelling Toolkit – Wianamatta, September 2022.

Table 2: General stormwater drainage design criteria

Component	Design Criteria
Hydrology	▪ Time of concentration values 5 minutes (minimum) and 20 minutes (maximum). ▪ Design Storm events: 50% AEP, 20% AEP, 10% AEP, 5% AEP, 2% AEP and 1% AEP.
Minor and Major System	▪ Minor system: 5% AEP conveyed by way of pit and pipe drainage. ▪ Major system: 1% AEP conveyed by way of pit and pipe drainage and overland flow.
Pipes	▪ Minimum pipe diameter size on roads: 375mm ▪ Minimum pipe grade: 1% (desirable), 0.5% (absolute minimum) ▪ Minimum pipe cover: 450mm (grassed area), 600mm (under carriageway) ▪ Where minimum cover cannot be achieved due to physical constraints the pipe class shall be suitably increased. ▪ All pipes in trafficable areas will be Reinforced Concrete Pipes (RCP) or Fibre Reinforced Cement (FRC) equivalent. ▪ Pipes discharging to an overland flow path shall adopt a minimum tailwater level equivalent to respective overland flow level. ▪ A hydraulic grade line HGL design method shall be adopted for all road pipe drainage design.
Pits	▪ Minimum pit freeboard: 150mm from HGL to surface level in the minor event. ▪ Where trapped low points are unavoidable and potential for flooding private property is a concern, an overland flow path capable of carrying the total 1% AEP storm event has been provided. Alternatively, the pipe and inlet system has been upgraded to accommodate the 1% AEP storm event. ▪ Maximum pit spacing: 75 metre intervals. ▪ Blockage factors of 20% and 50% shall be adopted for on-grade and sag pits respectively.
Gutter flow widths	▪ Maximum flow width: 2.5m ▪ Bypass from any pit on grade shall not exceed 15% of the total flow at the pit.
Overland flow paths	▪ Velocity x depth product shall not exceed 0.4 m^2/s for all storms up to and including the 1% AEP event.

5.2. Proposed Site Stormwater Drainage

As discussed in Section 1.1 , the site is proposed to be developed in two stages. The proposed drainage network within the site has been designed to safely convey major and minor flows in both stages.

5.2.1. Stage 1 (Interim Stage)

During Stage 1, an interim access road is proposed in the southern portion of site, with the point of entry being a vehicular crossing on The Retreat. The interim southern portion of site will drain to a temporary pond located on the south-west corner of site. The outlet and overflow weir of the pond is directed to the south-west, in-line with the overland flow path of the existing site. Figure 5 below presents the interim civil and stormwater layout prior to precinct roads and Sydney Water regional stormwater infrastructure being built.

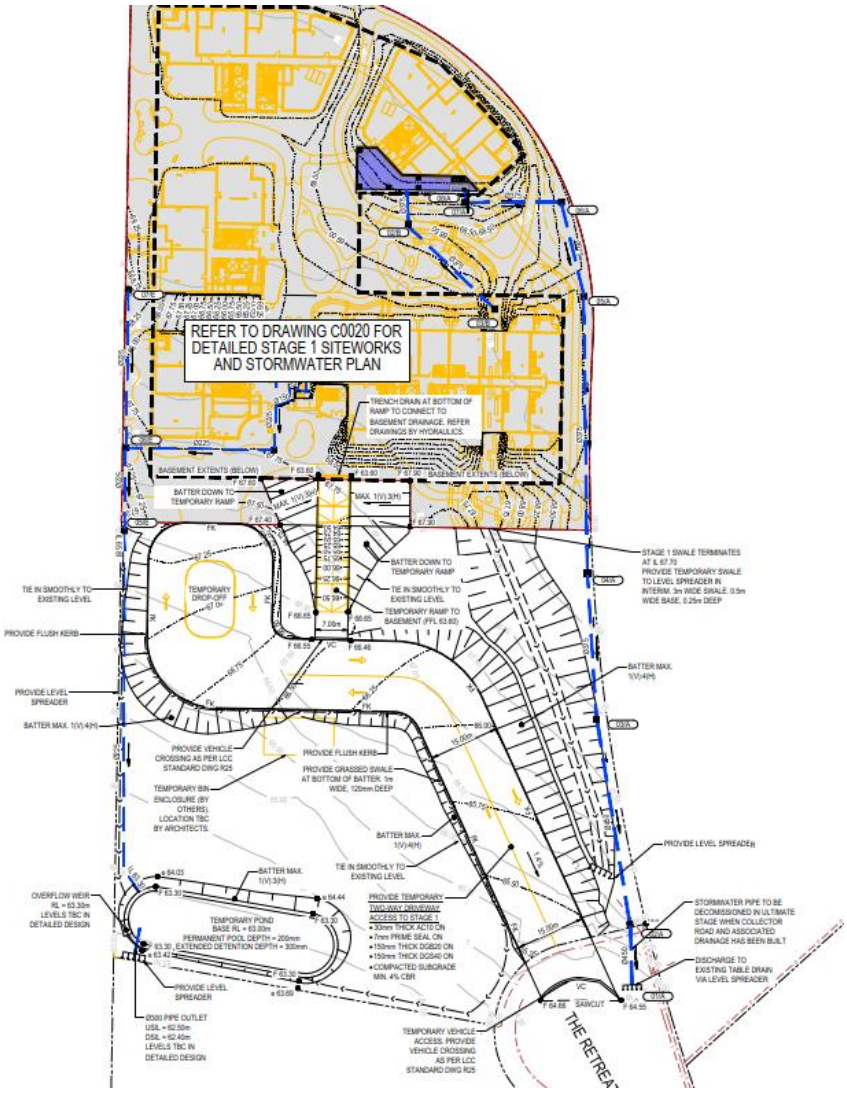

Figure 5: Interim Plan (AT&L Drawing C0015)

The majority of the Stage 1 (northern portion of site) will drain to a proposed On-Site Detention ('OSD North') tank located in the basement. The OSD will discharge flows, in a controlled manner, temporarily to an existing table drain on the Retreat.

Refer to AT&L drawing CC015 for the interim siteworks and stormwater plan. Table 3 below contains details of OSD North.

Table 3: OSD North Summary

OSD North	Catchment to Tank (ha)	OSD Volume (m^3)	Primary Outlet	Emergency Outlet
Tank	0.802 ha	212	Orifice plate with 130mm orifice diameter	Overflow pipe located above 1% AEP Top Water Level of tank

5.2.2. Ultimate Stage

In the ultimate stage, both Stage 1 and Stage 2 will be fully developed and access to site will be via an adjacent future road (developed by others) to the west of site.

The majority of Stage 2 will drain to another OSD tank ('OSD South') in the basement. The OSD will discharge flows to stormwater infrastructure within the future roads and eventually to Sydney Water's regional stormwater infrastructure. Additionally, OSD North's temporary point of discharge will be decommissioned at this stage and will also be connected into the future road's stormwater infrastructure.

Refer to AT&L drawings C0020 and C0021 for details. Table 4 below contains details of OSD South.

Table 4: OSD South Summary

OSD South	Catchment to Tank (ha)	OSD Volume (m^3)	Primary Outlet	Emergency Outlet
Tank	0.570 ha	221	Orifice plate with 130mm orifice diameter	Overflow from grated lid overflow to surface/landscape

The WSA DCP requires that the pre-development flow rates are not exceeded due to the development for the 50% to 1% AEP events. Section 6.8 contains the results of the analysis showing this requirement is met.

5.2.3. Sydney Water Regional Stormwater Scheme

At the time of this report, details and timelines of delivery of Sydney Water's regional stormwater scheme are unavailable. Figure 6 and Figure 7 below present images from the Bradfield masterplan Integrated Water Cycle Management Report showing the regional basin and the State Environmental Planning Policy (SEPP) acquisition land. The SEPP acquisition zone (Figure 7) as nominated by the masterplan does not impact the subject site. It is noted that there seems to be a discrepancy in the plans with regards to the location of the regional basin and SEPP acquisition land (as per the figures below), however, the proposed development intends to connect to the regional stormwater scheme once available.

Figure 11 – Bradfield Precinct Breakdown

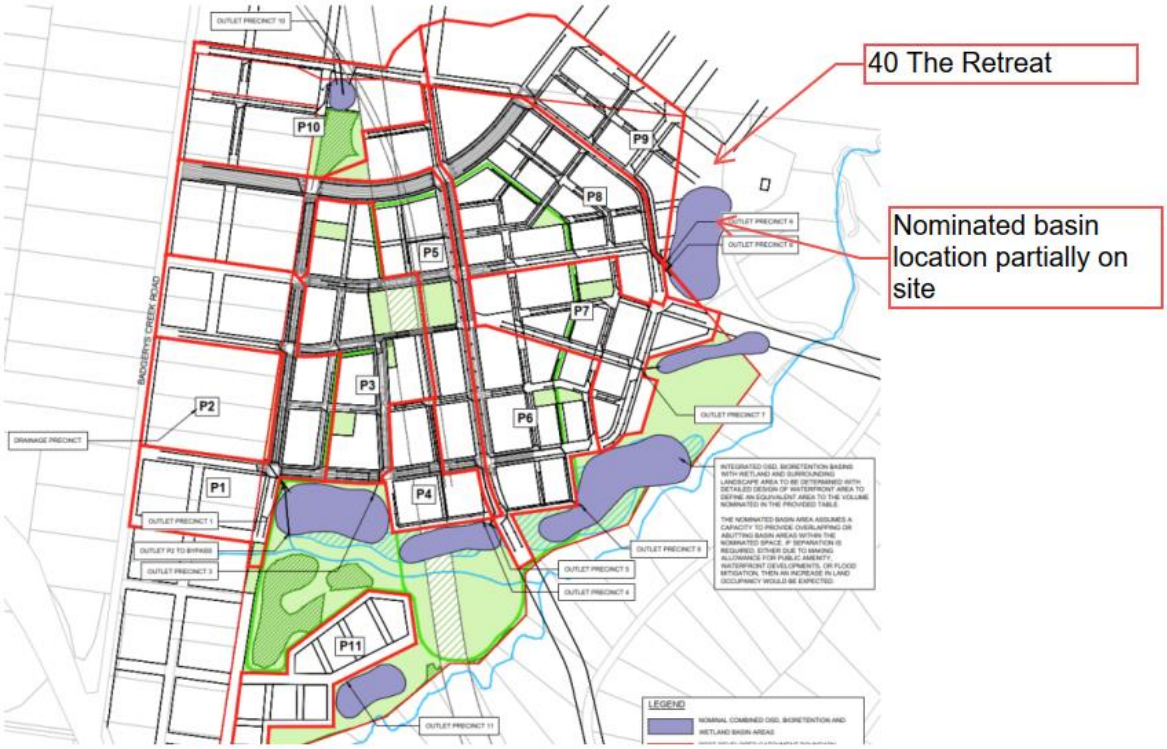

Figure 6: Regional Basin (Source: Bradfield Masterplan Appendix I – Integrated Water Cycle Management Report)

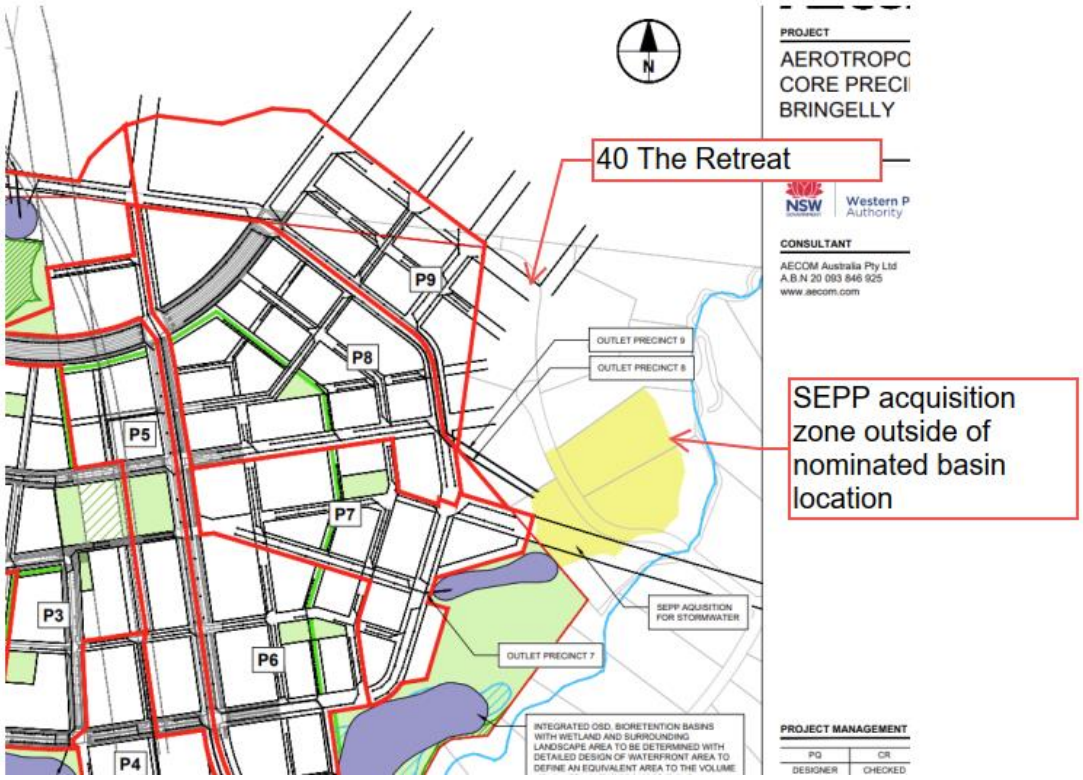

Figure 7: SEPP Acquisition land for stormwater (Source: Bradfield Masterplan Appendix I – Integrated Water Cycle Management Report)

6. Water Management Strategy

This section summarises the proposed stormwater quality, quantity and flow management measures that will satisfy the Performance Outcomes described in the *Western Sydney Aerotropolis Phase 2 Development Control Plan 2022*.

6.1. Water Management Strategy Objectives and Controls

The main objectives pertaining to the management of stormwater within the proposed development Site are outlined in Section 2.3.2 of the *Western Sydney Aerotropolis Phase 2 Development Control Plan 2022*. The overall objectives relating to stormwater management and water sensitive urban design (WSUD) outlined in the Phase 2 DCP are as follows:

O1. Manage indirect and ongoing impacts of development on waterways to ensure that Wianamatta-South Creek Catchment water quality and flow objectives in the Aerotropolis Precinct Plan are achieved and maintained.

O2. Ensure development is integrated with water cycle management to meet the Wianamatta-South Creek Catchment stormwater management targets.

O3. Utilise stormwater for passive irrigation of street trees to promote healthy trees, optimise canopy cover and contribute to streetscape, urban cooling and amenity.

O4. Ensure overland flows are conveyed in a safe manner to the trunk drainage system.

O5. Protect, maintain and restore the ecological condition, hydrology and hydrogeology of aquatic ecosystems (including but not limited to wetlands and riparian lands).

Performance Outcomes (POs) and benchmark solutions relating to stormwater management and WSUD, as well as the proposed response to these, is summarised below in Table 5.

Table 5: Response to Phase 2 DCP performance outcomes relating to stormwater and WSUD

DCP Controls	Response
Stormwater management and Water Sensitive Urban Design	
PO1) *Development applications must demonstrate compliance with the stormwater quality targets at all times through interim stormwater management measures incorporated within the development, or by connection to the regional stormwater system once operational.*	Performance of the proposed water management strategy against the stormwater quality targets is presented in Table 10 Performance of the proposed water management strategy against the operational stormwater flow targets is presented in Table 12. Performance against the construction phase stormwater flow targets is contained within Section 4 of the *Erosion and Sediment Control Plan* prepared by AT&L.
PO2) *Development applications must demonstrate compliance with the stormwater flow targets at all times through interim stormwater management measures incorporated within the development, or by connection to the regional stormwater system once operational.*	Refer to Section 6.9 for details of compliance of the proposed stormwater management measures with the stormwater flow targets adopted in the Phase 2 DCP
PO3) *Development applications must include a Water Management Strategy (WMS)*	Refer to Section 6 outlining the proposed approach to WSUD, how the approach will be implemented and how it is consistent with the *Technical guidance for achieving Wianamatta-*

DCP Controls	Response
	South Creek stormwater management targets (DPE, 2022).
PO4) *The regional stormwater system includes requirements for on lot as well as streetscape measures to ensure the Targets in PO1 and PO2 are met.*	Not applicable to this Development Application.
PO5) *[NOT USED IN PHASE 2 DCP]*	
PO6) *Development must not increase existing urban salinity or result in increased salt loads in waterways, wetlands, drainage lines or soils*	Refer to Preliminary Geotechnical Investigation Report prepared by Intrax Consulting Engineers (reference 51975 001DT, dated 21/03/2023.
PO7) *Drainage is designed to safely convey overland flows*	Refer to Section 5.1 for a summary of drainage design criteria and trunk drainage design parameters.
PO8) *Lots achieve minimum perviousness to meet stormwater drainage manager requirements and green and cooling objectives.*	Refer to Architectural design package by DKO.
Management and access to Regional Stormwater Infrastructure and Waterways	
PO1) *Regional infrastructure Stormwater assets (including land and infrastructure) are management and maintained by the stormwater drainage manger.*	Interim stormwater management measures are proposed within the site to allow initial development of the site. Ultimate development of the site will require regional stormwater infrastructure, which will be managed and maintained by Sydney Water as the Waterway Manager for the Wianamatta-South Creek catchment. Refer to AT&L drawings 23-1110-C0015, C0020 and C0021 for interim and ultimate stormwater management layouts.
PO2) *Development provides management access to the stormwater drainage manager.*	Interim access will be via The Retreat as per AT&L drawing 23-1110-C0015 and ultimate access will be via future roads adjacent to site.

6.2. Water Management Strategy Overview

Since the release of the *Draft Aerotropolis Precinct Plan* (Western Sydney Planning Partnership, November 2020), AT&L has been working with several landowners in the Aerotropolis, Government, industry bodies and experts in water management to resolve practical solutions that will address the stormwater quality and flow targets that have been adopted in the Phase 2 DCP.

The *Western Sydney Aerotropolis (Initial Precincts) Stormwater and Water Cycle Management Study* (December 2021) (SWCMS) addresses links between waterway health, hydrology and water quality targets. The stormwater management objectives outlined in the SWCMS Report were developed by applying the *Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions* (NSW OEH, 2017). The effects-based assessment outlined in the SWCMS Report addressed three primary metrics relating to stormwater management for waterway health:

1. Flow volume – mean annual runoff volume (MARV), measured in ML/ha/year. The target adopted in the SWCMS is 2 ML/ha/year.
2. Seasonal pulses – as shown by flow duration curves.
3. Water quality – as indicated by stormwater pollution reduction.

The Water Management Strategy for the site has been developed for two scenarios:

a) An Interim Arrangement (refer to drawing 23-1110-C0015), for which approval is being sought under this SSDA. This Arrangement is intended to be implemented to satisfy stormwater quality, quantity and flow controls in the absence of regional stormwater management interventions.

b) An Ultimate Arrangement (refer to drawings 23-1110-C0020 and C0021), has been developed on the basis that a regional stormwater management scheme is in place to satisfy the stormwater quantity, quality and flow controls for the Aerotropolis Precinct. This Arrangement is proposed to supersede the Interim Arrangement, without modification to any development approval in place, once regional stormwater management measures that will service the site have been delivered.

6.3. 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 6.1. A general description of the proposed stormwater treatment train components is presented in the following sections.

All interim stormwater management measures described below are purely to achieve interim measures until such time as Sydney Water's regional stormwater scheme is operational. At this time it is intended that all interim stormwater management measures would be decommissioned and removed unless agreed prior with Sydney Water that the infrastructure is contributing to the regional stormwater scheme.

6.3.1. Rainwater Tanks

Rainwater tanks retain a significant proportion of stormwater that falls on roof areas. Given the high-density residential 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.

The MUSICX model was developed to incorporate the following rainwater reuse parameters:

- Residential non-potable water demand was calculated based on population rates of the development (based on residential unit numbers on the architectural drawings) as per Table 10 and 11 of the *MUSIC Modelling Toolkit – Wianamatta.*
- Non-potable demand of 600 mm/year (equivalent to 6 ML/ha/yr) has been adopted for irrigation of 100% of the total landscape on site. Irrigation demand has been applied using a monthly distribution as per the *MUSIC Modelling Toolkit – Wianamatta* to account for the likely variability in irrigation demand throughout the year (i.e., high demand in summer, low demand in winter). It is noted that the toolkit suggests irrigation of 50% of the landscape area, however a higher percentage of irrigation reuse is deemed feasible for this site.
- All roof areas are to drain to the rainwater tanks.
- A 100kL rainwater tank is proposed in the basement of each Stage 1 and Stage 2 of the development.

6.3.2. Gross Pollutant Traps

The proposed stormwater treatment train would consist of gross pollutant traps (GPTs) as a means of primary stormwater treatment. GPTs are designed to capture litter, debris, coarse sediment, as well as some oils and greases.

Proprietary GPTs such as the Ocean Protect OceanGuard are proposed within pits on Site to capture and treat frequent flows, nominally up to the 4EY (3-month ARI) peak flow.

6.3.3. Temporary Storage Pond

As an interim measure to satisfy the stormwater flow volume targets, a pond is proposed on site to provide an effective means of reducing runoff volume from the site. Ponds can capture and store large quantities of water while also being relatively easy to maintain.

Key parameters adopted for the ponds are summarised below in Table 6. This pond will only be required as an interim measure, until the ultimate Sydney Water management strategy is established.

Table 6: Pond Parameters

Parameter	Units	Interim Pond
Surface area	m^2	500
Permanent pool volume	m^3	100
Exfiltration rate	mm/hr	0.00
Evaporation loss (% of PET)	%	100
Extended detention depth	m	0.30
Outlet (equivalent pipe diameter)	mm	300

6.4. Hydrological and Hydraulic Modelling

DRAINS modelling software has been used to calculate the Hydraulic Grade Line (HGL) of the proposed 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 which is widely accepted by Council's across NSW as the basis for stormwater design.

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 t_c: 5 minutes
  - Maximum t_c: 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 (refer Section 5.2).

6.5. Stormwater Quality Modelling

The proposed stormwater treatment train has been modelled using the MUSIC X software package (Version 1.30.0). Modelling has been undertaken in accordance with the *MUSIC Modelling Toolkit – Wianamatta* (NSW DPE, September 2022).

The 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.*

Rainfall-runoff parameters

The rainfall-runoff parameters adopted in the MUSIC model are consistent with the parameters adopted in *MUSIC Modelling Toolkit – Wianamatta*, refer to Table 7.

Table 7: Rainfall-runoff parameters adopted in MUSIC X

Parameter	Unit	Value
Impervious area parameters		
Rainfall Threshold	mm/day	1.0
Pervious area parameter		
Soil Storage Capacity	mm	150
Initial Storage	% of Capacity	30
Field Capacity	mm	130
Infiltration Capacity Coefficient α	-	175
Infiltration Capacity Coefficient β	-	2.5
Groundwater properties		
Initial Depth (groundwater)	mm	10
Daily Recharge Rate	%	25
Daily Baseflow Rate	%	1.4
Daily Seepage Rate	%	0.0

Source nodes and pollutant generation

Consistent with the requirements of the *MUSIC Modelling Toolkit – Wianamatta*, pollutant events mean concentrations (EMCs) for base flow and storm flow scenarios have been adopted from Table 6 of Blacktown City Council's WSUD developer handbook. The EMC values are applied to source nodes in the MUSIC model to estimate annual pollutant loads exported from the site under the proposed ultimate development scenario. The adopted pollutant EMCs for various catchment types are summarised in Table 8.

Table 8: Stormwater quality parameters for MUSIC source nodes

Land use category		log10 TSS (mg/l)		log10 TP (mg/l)		log10 TN (mg/l)	
		Base flow	Storm flow	Base flow	Storm flow	Base flow	Storm flow
Roof areas	Mean	1.20	1.30	-0.85	-0.89	0.11	0.30
	Std dev	0.17	0.32	0.19	0.25	0.12	0.19
Road areas	Mean	1.20	2.43	-0.85	-0.30	0.11	0.34
	Std dev	0.17	0.32	0.19	0.25	0.12	0.19
Pervious areas	Mean	1.20	2.15	-0.85	-0.60	0.11	0.30
	Std dev	0.17	0.32	0.19	0.25	0.12	0.19

6.6. Scenario Modelling

A MUSIC X 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 AT&L drawing C0045 within Appendix A. Source nodes for each of the proposed lots have been adopted based on urban mixed land uses. The layout of the post-development scenario is presented in Figure 8, which is to be read in conjunction with drawing C0045. A land use breakdown for the interim post-development scenario has also been provided in Table 9.

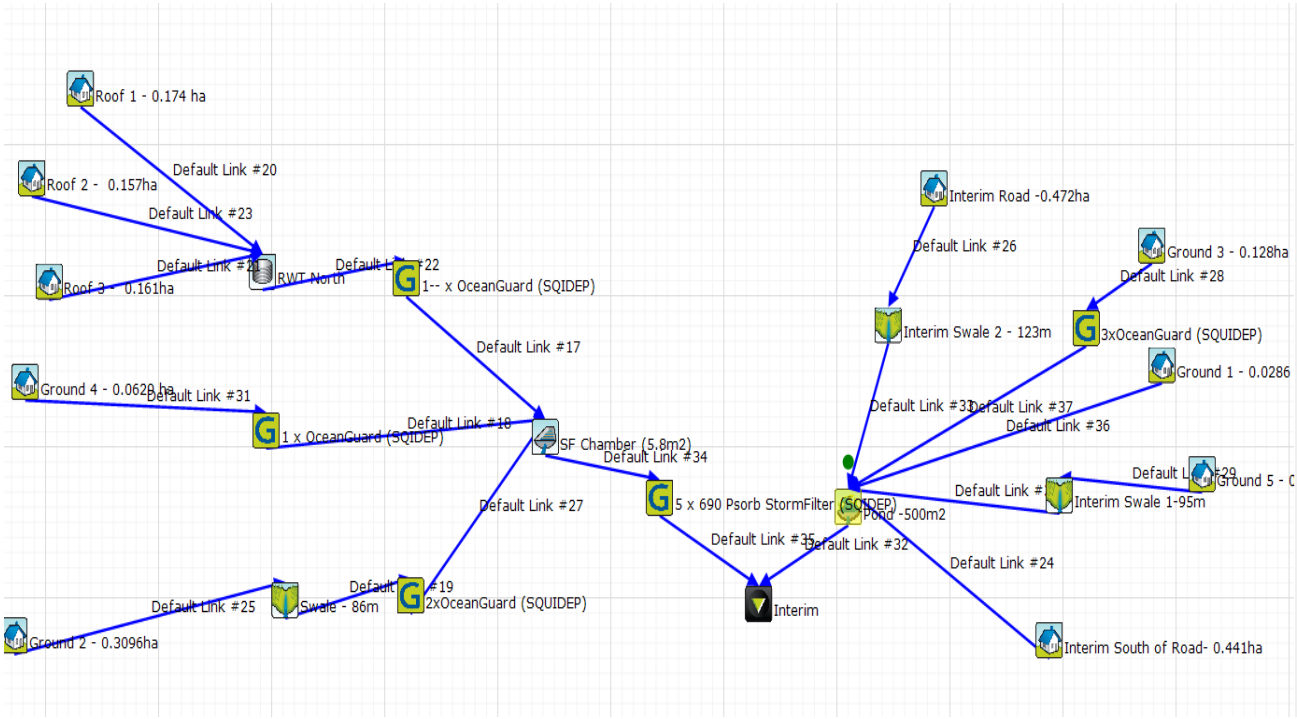

Figure 8: Post-development MUSIC X model layout (Interim Arrangement)

Table 9: Post-development land use breakdown (Interim Arrangement)

Land Use (Read in conjunction with drawing C0045)	Area (ha)	% Imperviousness
Roof		
Roof 1 (Building A)	0.1741	100
Roof 2 (Building B)	0.1567	100
Roof 3 (Building C)	0.1613	100
Ground		
Ground 1	0.0286	50
Ground 2	0.3096	10
Ground 3	0.1283	30
Ground 4	0.0629	30
Ground 5	0.1537	0
Interim Ground	0.4408	0
Interim Road/Batters	0.4721	50
	TOTAL SITE AREA = 2.09	

As discussed in Section 6.3, The Interim Arrangement incorporates a combination of rainwater tanks, GPTs, evaporation/storage pond and grassed swales. The attributes for each of the proposed stormwater management measures have been determined such that they will satisfy the stormwater quality, quantity and flow targets outlined in Section 6.1.

6.7. Performance Against Stormwater Quality Targets

MUSIC X modelling results presented as mean annual allowable loads at the receiving node indicate that the adopted stormwater quality target reductions are achieved, as shown in Table 10.

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

Parameter	Sources	Residual Load	% Reduction Achieved	Target Reduction per Option 1	Complies with Option 1 (Y/N)
Gross Pollutants (kg/yr)	166	0	100%	90%	**Yes**
TSS (kg/yr)	1034	92.5	91.05%	90%	**Yes**
TP (kg/yr)	2.145	0.2973	86.14%	80%	**Yes**
TN (kg/yr)	15.41	4.148	73.08%	65%	**Yes**

The MUSICX model results presenting treatment train effectiveness (load reduction as a comparison to allowable pollutant loads) demonstrate the proposed stormwater management measures under the Interim Arrangement will satisfy the stormwater quality controls.

Under the Ultimate Arrangement, stormwater quality management measures would be incorporated into the regional stormwater management scheme to be designed and delivered by the Waterway Manager.

6.8. Performance Against Stormwater Quantity Targets

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 discharge points from the site in the ultimate scenario.

Table 11: Pre-development and post-development peak flow rates from the proposed development

Design Storm Event	Pre-Development Peak Flow Rate (m^3/s)	Post-Development Peak Flow Rate (m^3/s)
50% AEP	0.156	0.122
20% AEP	0.338	0.319
10% AEP	0.457s	0.420
5% AEP	0.576	0.468
1% AEP	0.844	0.526

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.

6.9. Performance Against Stormwater Flow Targets

MUSIC X model results demonstrating performance of the proposed stormwater management measures in the Interim Arrangement against the stormwater flow targets are presented below in Table 12. The resultant flow duration curve is presented as Figure 9.

Table 12: Summary of MUSIC model results against stormwater flow targets under the Interim Arrangement

Parameter	Result	DCP Target	Complies with DCP target	
			Option 1	Option 2
Mean annual runoff volume (ML/ha/yr)	1.43	2.0	Yes	-
95%ile flow (L/ha/day)	13,728	3000 to 15000	-	Yes
90%ile flow (L/ha/day)	4,778	1000 to 5000	Yes	Yes
75%ile flow (L/ha/day)	423	100 to 1000	-	Yes
50%ile flow (L/ha/day)	14	5 to 100	Yes	Yes
10%ile flow (L/ha/day)	0	0	Yes	-
Cease to flow	29%	10% to 30%	-	Yes

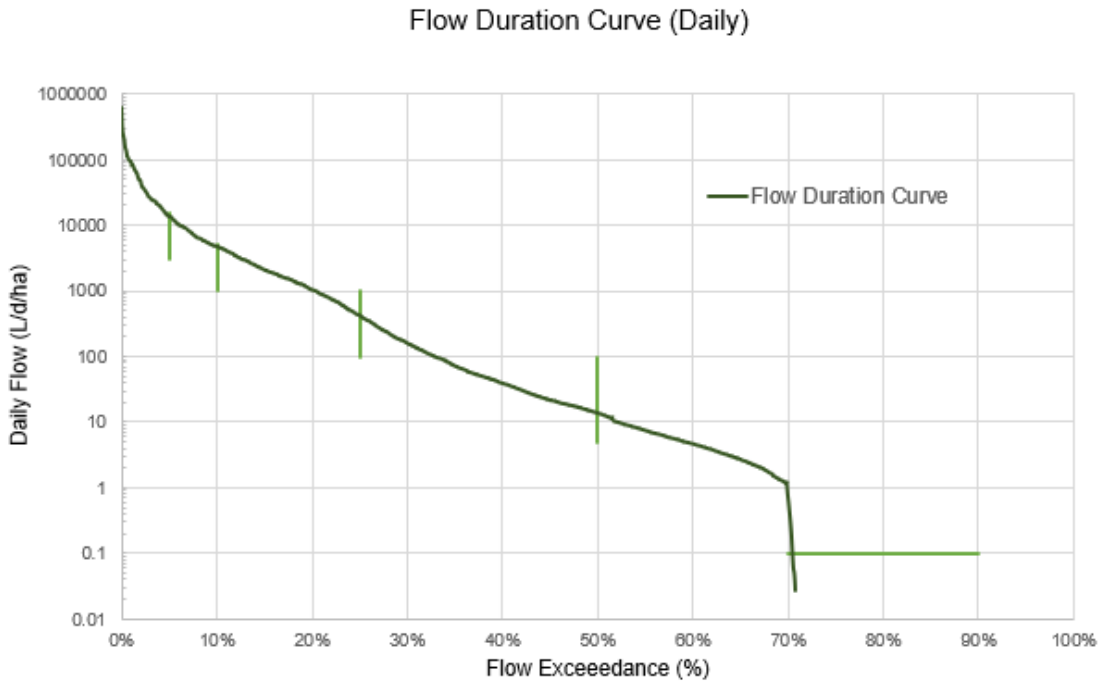

Figure 9: Flow duration curve for the proposed stormwater management measures

The results presented in Table 12 demonstrate the proposed stormwater management measures that will be implemented under the Interim Arrangement to satisfy both Option 1 and Option 2 of the DCP stormwater flow targets.

The MUSIC X model results represent performance against the stormwater flow targets under the Interim Arrangement only. As described in Section 6.2, the Interim Arrangement is intended to only remain in place until such time as the regional stormwater management scheme is delivered.

6.10. Ongoing Management and Maintenance

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.

As described in Section 6.2, the Ultimate Arrangement will be provided by the regional stormwater management scheme, which would incorporate measures to manage stormwater quality and volume across the Aerotropolis and would be managed and maintained by the Waterway Manager.

7. Summary of Mitigation Measures

A summary of mitigation measures relevant to Water and Stormwater Management are summarized in the table below.

Table 13: Summary of mitigation measures

ID	Mitigation Measure
Civil and Stormwater Management	
Impacts to downstream properties due to stormwater generation from developed site.	▪ On-Site Detention tanks are proposed within the site during the interim stage to ensure the flows generated from site is not worsened compared to the existing flows from site (refer Section 6.8). As a result, stormwater impacts downstream of the development is mitigated. ▪ In the ultimate scenario, once Stage 2 is built, the stormwater discharge from site will be addressed by the Sydney Water regional stormwater scheme.
Impacts to water quality to properties downstream of site and to downstream water bodies.	▪ Water quality, quantity and flow targets have been met in accordance with the *Western Sydney Aerotropolis Development Control Plan 2022* to mitigate adverse effects to downstream properties. This has been done via the use of SQUIDEP approved water quality devices, landscaped channels and raingardens.

8. Conclusion

This WSMP presents a WSUD Strategy that will satisfy the stormwater quality, quantity (peak flow attenuation) and flow volumes targets outlined in the Western Sydney Aerotropolis DCP.

The interim waterway health measures outlined in this WSMP are provided as temporary measures up until Sydney Water Regional Facilities are provided. Should the Regional Facility be brought online prior to the finalisation of any works on site then stormwater management will be transferred to the waterway manager.

Appendix A – Civil SSDA Drawings

NORTH SYDNEY
LEVEL 7
153 WALKER STREET
NORTH SYDNEY NSW 2060
02 9439 1777
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PARRAMATTA
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BRISBANE QLD 4000
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MELBOURNE
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