



Aerotropolis Initial Precincts Integrated Stormwater Scheme Design Report

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Change history

Version	Status	Issue Date	Endorsed by	Approved by	Brief description of change and consultation
1.1	Draft	25/3/2025	Dan Cunningham	Phillip Birtles	Draft for internal review
1.1	Draft	29/3/2025	Dan Cunningham	Phillip Birtles	Draft for Public Exhibition
1.1	Final	10/4/2026	Dan Cunningham	Phillip Birtles	Final for Public Exhibition

1 INTRODUCTION

1.1 BACKGROUND

Wianamatta-South Creek is an impaired, yet significant, natural waterway system which retains important ecological value. The NSW government adopted a land-use planning and urban design strategy to realise the vision of Western Parkland City and implement locally specific waterway health objectives and targets for the catchment. Sydney Water is the Regional Stormwater Authority for the Mamre Road and Aerotropolis Initial Precincts and is implementing a regional integrated stormwater service as an effective way to achieve the Parkland City Vision.

The Aerotropolis Initial Precincts Integrated Stormwater Scheme (“Scheme”) is the second tranche of integrated stormwater servicing to be designed by Sydney Water. The learnings from the initial Mamre Road Precinct Scheme, including feedback from IPART, have been applied to optimise scheme planning for the Aerotropolis Initial Precincts.

1.2 REPORT PURPOSE

This report is the design report for stormwater elements of the Scheme. It is a technical report that documents the approach, assumptions and key criteria that were followed in design of the regional stormwater infrastructure.

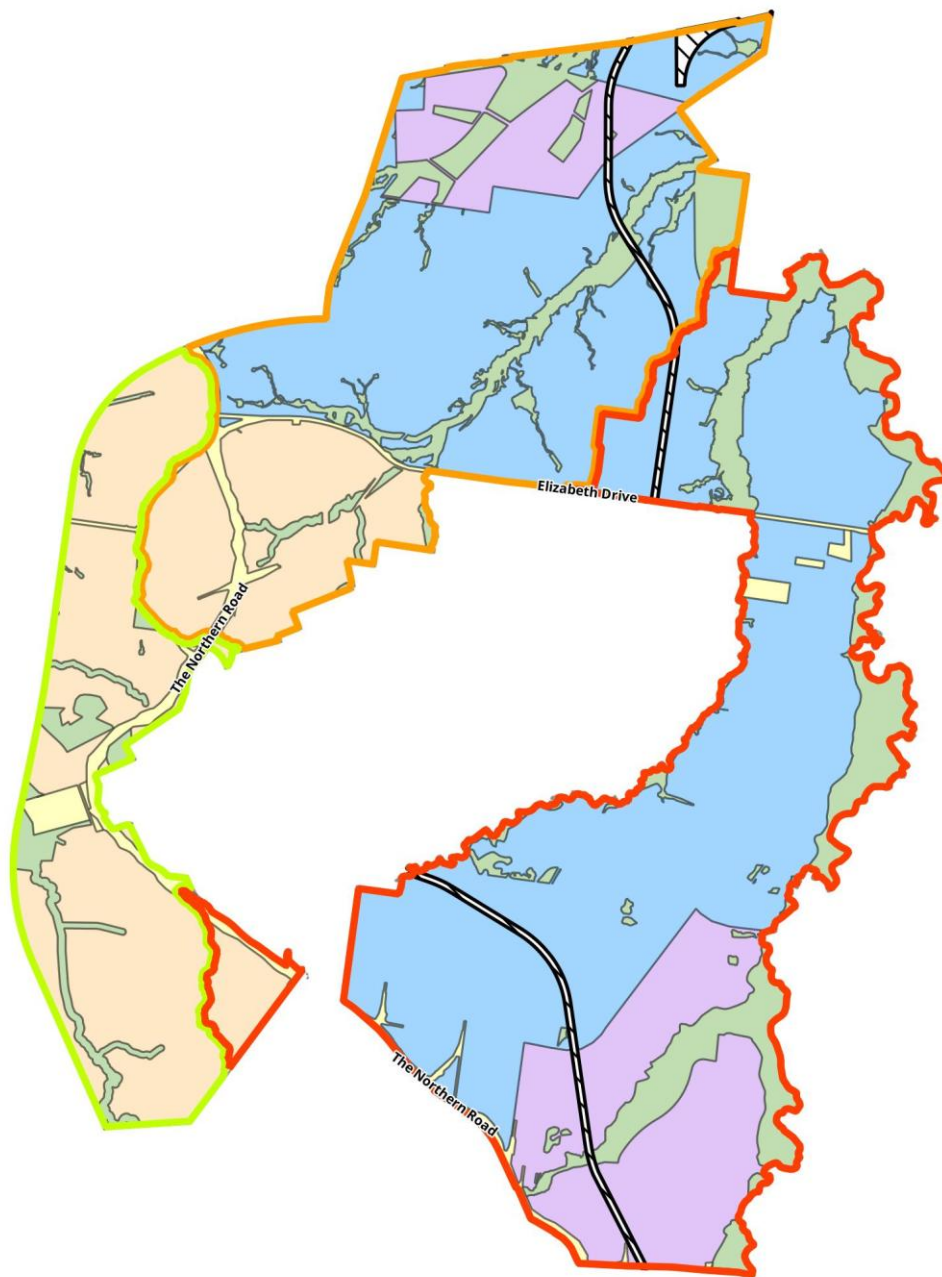
This report aims to help stakeholders understand the design process, complexities and constraints that drive the sizing and placement of infrastructure. The report should be read in conjunction with the *Aerotropolis Integrated Water Management (IWCM) Outcomes Report* (Sydney Water, 2026), the *Stormwater Scheme Infrastructure Design Guideline Draft* (Sydney Water, 2024) and the Stormwater Scheme Plan maps (March 2026). It is noted that the Guidelines and Scheme Plan maps may be periodically updated as developments in Aerotropolis Initial Precincts progress.

1.2.1 General approach

The Scheme has been divided into three Catchments (henceforth ‘Catchments’) that are defined by major creek catchments. The three Catchments are:

1. Wianamatta Badgerys
2. Cosgroves
3. Duncans-Mulgoa

The Scheme define areas of development that will be serviced and charged by Sydney Water for managing stormwater runoff to statutory requirements detailed in Section 1.3. Their boundaries are shown in Figure 1-1.



Catchments	Land Zoning
 Wianamatta-Badgerys Catchment	 Agribusiness (AGB)
 Cosgroves Catchment	 Enterprise (ENT)
 Duncan-Mulgoa Catchment	 Environment and Recreation (ENZ)
	 Mixed Use (MU)
	 Major Infrastructure Corridor (MIC)

Figure 1-1 Catchments* and State Environmental Planning Policy Western Sydney Aerotropolis (SEPP) zoning.

*Note the Nancy Bird Airport site is not currently included in the Scheme area, however the Airport will be serviced with recycled water from the Scheme.

A regional scale, iterative water and pollution balance modelling exercise has informed the sizing of the infrastructure while consideration of landform, cultural and ecological values, land-use and costs have guided the infrastructure placement and arrangement.

The infrastructure planning and design has responded to the following key drivers:

- The Wianamatta South Creek stormwater management targets
- Land use and how this drives the volume of runoff generated from development
- The recycled water demands in each Catchment
- Design constraints in locating the regional stormwater infrastructure

Sydney Water has modelled the Scheme based on available government planning data, detailed in Section 2.1. It is acknowledged that this data was the best available at the time of planning and is subject to change through the master planning and development assessment processes. The Scheme Plans and models will need to be refined in step with development approvals and in alignment with the scheme design principles documented in Section 4 of this report.

The results of the work documented in this report are shown in the following Scheme Plans.

1. [Wianamatta Badgerys Catchment Stormwater Scheme Plan](#) (March 2026)
2. [Cosgroves Catchment Stormwater Scheme Plan](#) (March 2026)
3. [Duncans-Mulgoa Catchment Stormwater Scheme Plan](#) (March 2026)

1.3 STATUTORY STORMWATER TARGETS

The regional stormwater infrastructure has been designed to ensure compliance with stormwater flow and quality targets and objectives set by the NSW Government (DCCEEW formerly DPE) on behalf of the developments, to protect the stream health of Wianamatta-South Creek and its major tributaries. The infrastructure's ability to be compliant with the targets and objectives is demonstrated through modelling using MUSIC 6 with inputs per the calculations in the following sections and parameters set by Government in the *Technical guidance for achieving Wianamatta - South Creek stormwater management targets* (DPE, 2022).

1.3.1 Flow Targets

The operational phase stormwater flow targets presented in the Western Sydney Aerotropolis Development Control Plan (henceforth, 'the DCP') are provided below in Table 1-1 and Table 1-2. Compliance was met by achieving either of the options.

Table 1-1 DCP flow target – Option 1

Parameter	Target
Mean Annual Runoff Volume (MARV)	≤ 2 ML/ha/year at the point of discharge to the local waterway
90%ile flow	1000 to 5000 L/ha/day at the point of discharge to the local waterway
50%ile flow	5 to 100 L/ha/day at the point of discharge to the local waterway
10%ile flow	0 L/ha/day at the point of discharge to the local waterway

Table 1-2 DCP flow target – Option 2

Parameter	Target
95%ile flow	3000 to 15000 L/ha/day at the point of discharge to the local waterway
90%ile flow	1000 to 5000 L/ha/day at the point of discharge to the local waterway
75%ile flow	100 to 1000 L/ha/day at the point of discharge to the local waterway
50%ile flow	5 to 100 L/ha/day at the point of discharge to the local waterway
Cease to flow	Cease to flow to be between 10% to 30% of the time

1.3.2 Quality Targets

The DCP also requires that operational phase stormwater quality targets are met. Compliance was met by achieving either of the options as presented in Table 1-3 and Table 1-4.

Table 1-3: DCP stormwater quality targets – Option 1

Parameter	Target
Gross Pollutants	90% reduction in mean annual load
Total Suspended Solids (TSS)	90% reduction in mean annual load
Total Phosphorus (TP)	80% reduction in mean annual load
Total Nitrogen (TN)	65% reduction in mean annual load

Table 1-4: DCP stormwater quality targets – Option 2

Parameter	Target
Gross Pollutants	< 16 kg/ha/yr
Total Suspended Solids (TSS)	<80 kg/ha/yr
Total Phosphorus (TP)	<0.3 kg/ha/yr
Total Nitrogen (TN)	<3.5 kg/ha/yr

2 WATER BALANCE METHOD AND ASSUMPTIONS

The water balance estimate across the Scheme is a fundamental input for the regional stormwater scheme infrastructure ('scheme infrastructure') design and captures the assumed stormwater supply and recycled water demands across the Catchments. The water balance for greenfield development areas is inherently based on a range of assumptions.

The water balance assumptions are one of the most sensitive inputs driving the sizing and therefore cost of the scheme infrastructure. Sydney Water, its stakeholders and independent reviewers have undergone rigorous studies and analyses to agree on catchment, runoff and water demand assumptions that are grounded in quality data and that balance the needs for the infrastructure to be robust in meeting its statutory water quality and flow targets now and in the future as well as driving efficiency of the Scheme.

The following sections outline the information, assumptions and methods adopted to estimate the water balance across the three Catchments.

2.1 CATCHMENT PROPERTIES & STORMWATER RUNOFF

2.1.1 Land use

Land use assumptions are fundamental to estimating the water balance. Land use determines:

- The assumed imperviousness; a key metric to understand stormwater runoff generated
- The assumed pervious area; a key metric to understand irrigation demand potential
- The type of built form e.g. residential, commercial, light industrial and population density assumptions; which are key to understanding internal recycled water demand potential.

A combination of the published DCCEEW (formerly DPE) and DCP land zoning and road GIS layers have been combined to build a land use map with adequate resolution and detail from which was used to reasonably estimate land pervious and imperviousness as well as on-lot and other non-potable water demands for the purpose of modelling and infrastructure planning.

The government published GIS layers used in these workings are shown in Table 2-1, and the resulting basis layer for modelling is shown in Figure 2-1.

Table 2-1 : Selected information from SEPP and DCP GIS layers that have informed the land use map for infrastructure planning.

Land use category	GIS layers	Details
Lots (SEPP dataset)	• 'EPI_Land_Zoning'	Lots categorised into: • 'Employment' = AGB and ENT land zoning* • 'Mixed Use' = MU land zoning*
TfNSW corridors (SEPP dataset, select features)	• 'EPI_Transport_Arterial_Rd_Infra'	Select features used: • East-West Rail Link • M12 motorway • Outer Sydney Orbital (OSO)

Land use category	GIS layers	Details
		Above ground sections of MIC land zoning (estimated; all MIC in the Aerotropolis Core precinct has been denoted underground)
SP2 Corridors (SEPP dataset)	'EPI_Land_Zoning'	SP2 land zoning
Roads (DCP dataset)	'RoadNetwork_220506'	Buffer widths applied to centerlines as per Table 2-3.
Public Open Space (POS) (SEPP and DCP datasets)	'EPI_Land_Zoning' (SEPP) 'StormwaterInfrastructure' (DCP) 'OpenSpaceNetwork_Local' (DCP)	POS includes: - ENZ land zoning - Listed DCP datasets
<i>Note that for the purpose of modelling, land zones for lots have been simplified into two categories. It is not considered that this simplification has a material impact on the water demand figures adopted.</i> <i>The data from this table was used as the 'base' layer for planning and was updated as more data became available for specific developments.</i>		

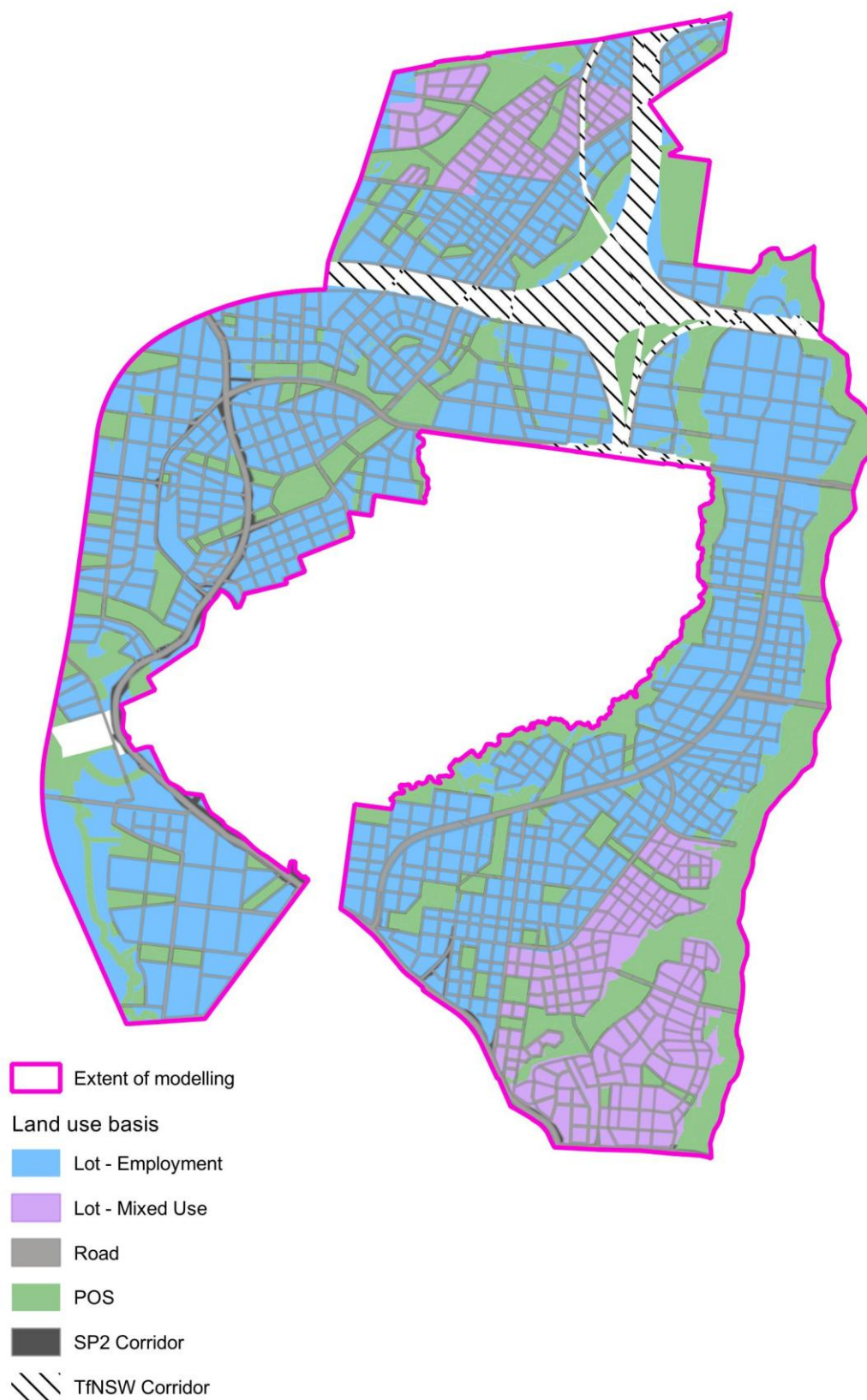


Figure 2-1 Land use basis for modelling

2.1.2 Pervious and Impervious Fraction

The impervious fraction for the land use types shown in Figure 2-1 above have been determined through different means to ensure that they are aligned with relevant development plans and guidelines and reflect the development occurring in Western Sydney.

Developable land

For practical purposes, the Scheme modelling has amalgamated different developable land zones in the SEPP into two developable land typologies; Employment (AGB + ENT) and Mixed Use (MU) (see Figure 2-1). It was assumed that the majority of Employment land is 'large format industrial and light industry' and Mixed Use land is 'mixed use centres over 2:1 Floor Surface Ratio (FSR)'. Suitable values from the 'Minimum perviousness targets' table specified in the DCP (PO8) have been adopted for Employment and Mixed Use land typologies (see Table 2-2). Note that these perviousness targets are for development lots and road reserves combined and provided an overarching limit for imperviousness. Further resolution was required to estimate recycled water demands and pollutant loads generated from the Catchments. An effective impervious factor of 1 was assumed for development lots and roads.

Table 2-2 Adopted impervious and pervious fractions for the modelled developable land typologies.

Land uses	Employment	Mixed Use
<i>Pervious %</i>	15%	30%
<i>Impervious %</i>	85%	70%

The total area of road reserve and its impervious fraction were estimated by using the lengths of DCP mapped roads (as per Table 2-1) and applying the road widths and pervious/impervious percentages shown in Table 2-3 below which were derived from the DCP road typologies cross sections.

Table 2-3 Road width and impervious assumptions for road reserves derived from typical road cross sections shown in the DCP.

Street Type	Width (m)	Impervious %	Pervious %
Primary Arterial	60	38.3%	61.7%
Primary Arterial – Bus	45	62.2%	37.8%
Sub Arterial	40	55.0%	45.0%
ParkEdge	19.5	74.4%	25.6%
Laneway (Service)	8	100%	0.0%
Collector – Employment	25.6	80.5%	19.5%
Collector - Mixed Use	20	79%	21.0%
Local - Employment	24	84%	15.8%

Street Type	Width (m)	Impervious %	Pervious %
Local - Mixed Use - excl Resi	25	78%	22.4%
Local - Mixed Use - Resi	16	67%	33.1%

The residual area was assumed to be lots. Lot impervious areas for each Catchment were estimated using the assumptions and method as follows:

- **Lot roof area** for both developable land typologies was adopted from that adopted in the Mamre Rd Precinct for IN1 (Industrial) land. This value was agreed upon by Sydney Water and Government third party reviewers as 60% of the total lot area. These areas were used in estimating internal recycled water demands (see section 2.2.1 and 2.2.2).
- **Lot pervious** was calculated as:
 - minimum pervious target (per Table 2-2) – pervious area of the roads in that Catchment = lot pervious
- **Lot hardstand** area was calculated as:
 - total lot area – lot roof area – lot pervious area = lot hardstand

The pervious area calculation has not been increased to factor in areas such as easements or trunk drainage channels that may cross the lots, as it was assumed that easements and trunk drainage channels can be used to meet the minimum pervious targets as per Table 2-2 and will not increase the overall perviousness of a catchment.

The catchment areas (henceforth 'basin catchments') and impervious assumption for each of the Regional Stormwater Basins (henceforth 'regional basins') as they were inputted into MUSIC models are provided in Appendix A. Table 2-4 provides the average pervious/impervious breakdown for Wianamatta-Badgerys Catchment, which is indicative of the other two Catchments. While the roof area percentage is constant, the hardstand and pervious percentages vary relative to the extent of road in a given basin catchment.

Table 2-4 Catchment typology average pervious and impervious breakdown for Lots only.

Lot type	Hardstand (%)	Roof (%)	Pervious (%)
Mixed Use	9	60	31
Employment Lands	29	60	11

SP2 Corridors

The impervious area on SP2 Corridors was calculated using the length of road and the typical road cross sections shown in the DCP (see Table 2-3). The SP2 land impervious area has been calculated for each Catchment. Residual SP2 zoned land outside of the DCP prescribed road width was assumed to be 100% pervious as it will likely form the road batter slopes.

TfNSW and Metro Corridors

All roads and transport (rail and metro) corridors within the Aerotropolis have been included in the scheme modelling and are assumed to be serviced by the Scheme. However, there is a level of uncertainty around the percentage of impervious land that will result within the large M12, Outer Sydney Orbital (OSO) land reserve. Because these areas are significant, changes in these assumptions could be significant on the stormwater assets required and scheme cost. Sydney Water will continue to work with TfNSW and government to refine these assumptions and confirm how these areas will be serviced and paid for and to ensure stormwater from these areas doesn't impact waterways.

In the modelling, the impervious area in TfNSW corridors has been calculated on a catchment-by-catchment basis using design strings where they have been supplied (i.e. East-West rail link) or by tracing out where infrastructure is already shown in available aerial imagery (i.e. the M12 roads using Nearmaps imagery). Where transport infrastructure has not begun construction and where there are no design strings available, particularly for the portion of OSO corridor running North-South in the Cosgroves Catchment, the impervious % has been 'mirrored' from the areas where there is data as it is assumed these areas will have similar coverage. An effective impervious factor of 1 was applied.

Note that while scheme planning has been undertaken for the OSO corridor (North-South) and northern rail alignment at the far northern edge of Cosgroves Catchment, the regional basins that service these catchments are not shown in the published Scheme maps nor have they been included in the scheme costings as the project timeline for this TfNSW infrastructure is beyond the period of the Development Servicing Plan(DSP) for the Scheme.

Public Open Space

Public Open Space (POS) in the catchment modelling has included areas of:

- pocket parks and vegetated bushland (upstream of proposed regional basins); assumed to be 95% pervious to allow for the effective imperviousness of small areas of hardstand such as paths or buildings.
- floodplain areas and parks (downstream of proposed regional basins); assumed to have 100% effective perviousness.

Site based assessments of larger scale structures or facilities will be required during design stage.

2.1.3 Rainfall and Climate

For the purposes of water balance modelling, DPE developed the MUSIC MODELLING TOOLKIT which includes a MUSIC model climate record and hydrologic modelling parameters. This was used as the basis for demonstrating compliance against water quality and flow targets.

The adopted climate data uses 6-minute pluviograph rainfall data from 01/01/1999 to 31/12/2008 and monthly potential evapotranspiration (PET) values. The average annual rainfall and PET for the period is 691mm and 1,336mm respectively which includes a relatively dry climate period but also includes wet years. This rainfall dataset has been used for the scheme modelling to estimate stormwater runoff from the Catchments and evapotranspiration losses.

2.1.4 Stormwater Runoff

The catchment areas and total average annual runoff generated for each Catchment are documented in Table 2-5. These values were generated using MUSIC 6 and the catchment pervious/impervious characteristics as documented in the sections above.

Table 2-5: Summary of modelled areas and runoff generated.

Catchment	Area (ha)	Impervious Area (ha)	Average Annual Stormwater Runoff Generated (GL/y)	Notional Target Discharge to Creek (GL/yr)
<i>Wianamatta Badgerys</i>	2297	1528	9.7	4.5
<i>Cosgroves</i>	1990	1113	7.1	4.0
<i>Duncans Mulgoa</i>	904	565	3.7	1.7
<i>Total</i>	5191	3206	20.5	10.2

2.2 WATER DEMANDS

A water budget approach has been adopted to determine the potential recycled water demand across the three Catchments. The water demand forms the basis for calculating the potential stormwater harvesting rate across the Scheme. Harvesting rates have been distributed across the three Catchments to optimise infrastructure efficiency as described in section 2.2.4.

2.2.1 Industrial, commercial and business (non-residential) internal recycled water demands

A number of studies have been undertaken by Sydney Water and third-party reviewers to determine the most reasonable estimate of industrial demand for recycled water.

Sydney Water most recently commissioned a review of demands for the Mamre Industrial Precinct stormwater scheme (Aurecon Arup, 2022) which recommended a value of total water demand of 7.5 kL/Net hectares (Nha)/day as the upper rate feasible industrial demands. Up to 50% of this demand is considered suitable to be supplied with recycled water.

To ensure a level of conservatism and endorsement through peer review, a rate of 2.8 kL/Nha/day was adopted as the recycled water demand for industrial development in the Mamre Road Precinct Stormwater Scheme (*Source – Mamre Road Precinct Revised Industrial Recycled Water Demands Memo (Sydney Water, 2022)*).

For consistency with this previous work, the same daily demand for recycled water of 2.8 kL/Nha/day has been adopted for all enterprise lands, light industrial and business land use and including commercial development associated with mixed use zones in the Scheme.

Irrigation demands have been calculated separately in Section 2.2.3 to account for the on-lot irrigation demands.

2.2.2 Mixed-use internal recycled water demands

The initial precincts include 645 Ha of mixed-use land zoning uses which comprise local centres, high rise commercial areas and medium and high-density residential land use:

- Mixed Use Residential in Aerotropolis Core (Bradfield)
- Specialised Centre Mixed Use in the Northern Gateway

As with any planning that occurs over long periods of time there is uncertainty over exactly what future development will occur including both scale of development and the type of development. Hence, water demands are 'a best estimate' given the available knowledge at the time. A conservative approach is also warranted to ensure that demands were not over-estimated resulting in issues with staging and increasing stormwater infrastructure footprints at a later time.

Local centres and high-rise commercial areas are identified in the Precinct Plan however the SEPP land zoning only identifies mixed use and does not differentiate between different land uses or identify local centres. The Precinct Plan identifies height of buildings and floor space ratio which indicates a potential for high density development in a number of areas, particularly in the south of the Aerotropolis.

For commercial and business land uses at ground level, a daily recycled water demand of **2.8 kL/Nha/day** has been adopted to be consistent with other non-residential land use (see Section 2.2.1).

For residential development assumed to occupy the upper floors of buildings in mixed use areas, a recycled water demand of **10.2 kL/Nha/day** has been adopted. This demand has been informed by values published for typical residential recycled water demand rates in recent Sydney Water planning studies including *Aerotropolis Initial Precincts Integrated Water Cycle Management – Recycled Water Viability Study* (Sydney Water, 2021) and *Orchard Hills Precinct Growth Servicing - Basis of Planning* (Sydney Water, 2023). For comparison, the Bradfield City Centre masterplan (November 2022) reports 15,200 residents within a footprint of 78 Ha (excluding open space). This is equivalent to 75 dwellings per net hectare of development and yields a non-potable water demand of approximately 10.8 kL/day/Nha, based on an occupancy of 2.6 people per dwelling and a non-potable water demand of 55 L/person/day approximately.

The mixed-use demand for recycled water was adopted as the total of both commercial/business and residential demand values, equating to **13.0kL/Nha/day**. This figure is comparable to water demands predicted for a residential demand at a dwelling density of approximately 90 dwellings per hectare without any associated commercial use. Various early planning proposals in the south of the Aerotropolis have indicated dwelling densities between 100 and 480 dwellings per hectare.

2.2.2.1 High Demand Industrial Water Users

There are high-demand recycled water-users who are already confirmed in the Scheme or are projected to be present in the Scheme for the foreseeable future. These few, specific high water-users can significantly skew water demands and their projected demands have been separately accounted for. Demand assumptions adopted for these water users are documented in Sections 2.2.2.2 and 2.2.2.3 below.

2.2.2.2 Western Sydney Airport (WSA) demands

Current average daily water demand estimations for the Western Sydney Airport (WSA) begin at 1ML/day in 2029 and increases up to almost 2ML/day in 2040. The increase in daily water demands is projected to reach 3ML/day by 2055. A total of 3ML/day has been allocated across the three Catchments to account for WSA future demands.

2.2.2.3 Data Centres

During the scheme development, Sydney Water has been included in various discussions with developers and government about the likelihood of data centres being built within the Aerotropolis initial precincts. Whilst at this time no data centres have been approved, it seems highly likely that one or more will be built in the Aerotropolis within the planning period. Therefore based on its

developer intelligence, Sydney Water has estimated that an additional 3ML/day will be needed to meet future demands for data centres within the Scheme.

Sydney Water is in continuing conversations with data center developers and Government and will modify demand estimates for data centers as further intelligence is gathered and confirmed to ensure that the Scheme is able to service these users and capitalise on the efficiencies that higher demands will bring to the Scheme.

2.2.3 External recycled water demands/ Irrigation

Irrigation has been allowed for on the following pervious land:

- Landscaped areas in the private domain
- POS (excluding the areas of POS listed below)

Irrigation has not been assumed over the following areas:

- Road verges
- Existing native vegetation
- CPCP lands
- Channels and Vegetated Riparian Zones (VRZ)
- Open water zones of regional basins

The areas for these spaces have been calculated using several data sources which are summarised in Table 2-6 below.

Table 2-6: Summary of information sources for calculating irrigation areas.

Pervious Spaces	GIS layers/Information Source	Details
<i>Landscaped areas in private domain</i>	• Developable land areas (See Figure 2-1 and Table 2-1) • Minimum pervious targets (See Table 2-2) • Road pervious (See Table 2-3)	• Employment land area x minimum pervious targets = total pervious. • Total pervious – road pervious = private domain pervious.
<i>Public Open Space</i>	• See Table 2-1 • Environmental overlays (see Table 4-2). • VRZ layer delineated from top-of-bank mapping collected by Sydney Water	• Existing native vegetation areas, CPCP lands and VRZ layer areas + non-irrigatable areas of the regional stormwater harvesting basins were subtracted from the POS areas

The irrigation calculations considered the ultimate development state.

Infiltration modelling was performed for Sydney Water as part of early planning investigations for the Aerotropolis. This modelling was informed by infiltration testing and ground investigations. Modelling showed that irrigating at 600 mm/yr would start to increase groundwater recharge rates by 10%, which is significant enough to begin influencing salt budgets. Salt budgets are understood to be influenced by salt in the soils of the upper slopes rather than within the alluvial soils of the floodplain, and irrigation rates could be as high as 600 mm/yr in the floodplain without influencing salt budgets or increasing groundwater recharge.

Based on the above study, an irrigation rate of 600mm/ha/year has been adopted, applied across 50% of irrigatable area (equates to a rate 300mm/ha/year). The seasonal variability in irrigation demands is shown in Table 2-7. The adopted irrigation rate and seasonal variability align with the *Technical guidance for achieving Wianamatta-south creek stormwater management targets* (DPE, 2022). The resulting total irrigation demands are shown in Table 2-8.

Table 2-7 Public open space irrigation seasonal factor

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%	13%	6%	6%	4%	2%	0%	4%	7%	12%	14%	13%	19%

Table 2-8 Total irrigation demands on-lot and in POS

Pervious Areas	Area (ha)	Irrigation allocation rate (mm/ha/year)	Irrigation demand total (ML/year)
<i>Landscaped areas in private domain</i>	398	300	1193
<i>Public Open Space</i>	256*	300	767

**This figure is discounted by 20% to account for any additional constraints that were not already identified in Table 2-6 that may prevent irrigating the POS*

2.2.4 Allocation of demands

The impervious land (*lots + roads*) within each Catchment was used to determine how the water demand rates should be allocated between the Catchments. Catchments with a greater fraction of impervious area are allocated a greater portion of the total demands.

The estimated impervious area for each Catchment was divided by the total impervious area across the Scheme to calculate the demand allocation factors shown in Table 2-9. This allocation factor was applied to the total of the demands discussed in sections 2.2.1 to 2.2.3 to arrive at the demand allocation per Catchment. This is documented in Table 2-10.

Table 2-9 Demand allocation factors per Catchment

Catchment	Demand Allocation Factor
<i>Wianamatta Badgerys</i>	48%
<i>Cosgroves</i>	34%
<i>Duncans-Mulgoa</i>	18%

Table 2-10 Summary of demands per Catchment

Catchment	Internal Demands			External Demands		Demand Totals	
	<i>Airport (ML/d)</i>	<i>Data Centres (ML/d)</i>	<i>Internal on-lot (ML/d)</i>	<i>Irrigation of POS (ML/yr)</i>	<i>Irrigation on-lot (ML/yr)</i>	<i>Internal Demands (ML/day)</i>	<i>Annual Irrigation Demand (ML/yr)</i>
<i>Wianamatta Badgerys</i>	1.4	1.4	8.2	367.3	571.7	11.03	939
<i>Cosgroves</i>	1.0	1.0	5.8	260.6	405.5	7.82	666
<i>Duncans Mulgoa</i>	0.6	0.6	3.1	138.9	216.2	4.17	355
<i>Totals</i>	3.0	3.0	17.1	766.7	1193.4	23.03	1,960

2.3 SUPPLY AND DEMAND SUMMARY

A stormwater balance has been calculated for the three Catchments based on preliminary water balance model results. The water balance is presented in Figure 2-2 and shows the notional volumes of rainfall, stormwater runoff, harvested stormwater, recycled wastewater and local creek discharge under the proposed Scheme over the modelled climate period (1999 to 2008), as recommended for scheme design (Department of Planning and Environment, 2021).

The average annual water balance accounts for:

Rainfall – volume of rainfall falling over the Scheme

Losses – rainfall that is infiltrated into pervious areas and street trees

Runoff – excess rainfall that becomes runoff and enters regional basins

Evaporation at basins – stormwater runoff captured and lost to the atmosphere through evaporation and transpiration losses within regional basins

Harvested – water pumped into the stormwater harvesting network

Irrigation – estimated irrigation demands for non-potable grade water on private and public lands

Internal reuse - estimated residential, commercial and industrial demands for non-potable grade water

Recycled water top up – the volume of water required to supply irrigation and internal demands when water is not available from the stormwater harvesting network.

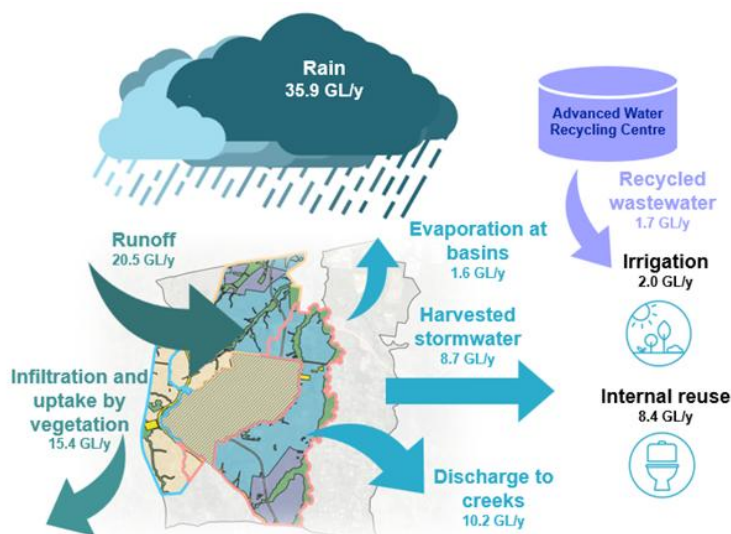


Figure 2-2: Summary water balance for the Scheme (GL/yr).

3 SCHEME INFRASTRUCTURE AND MODELLING

3.1 SCHEME OVERVIEW

The major elements of the Scheme are shown in the flow diagram in Figure 3-1.

Note that this diagram excludes privately owned and Sydney Water owned GPTs and Council owned Wianamatta passively irrigated street trees, which none-the-less play a role in stormwater management in the Schemes and have been included in the scheme modelling.

The following section outlines the scheme infrastructure elements, their key design details and (where relevant) the modelling parameters of each of the elements in the treatment train.

The focus of this design report is to document the design approach adopted for the stormwater conveyance infrastructure and regional basins (including treatment and harvesting components) in the development of the Scheme Plans. Developments that seek to deviate from the Scheme Plan design must consider the adopted design approach and principles for their proposed design.

For the design of any downstream infrastructure (further polishing and recycled water infrastructure), *Aerotropolis Recycled Water Planning for Initial Precincts Options Assessment Report (Sydney Water 2026)* must be referred.

3.2 MUSIC MODELLING OVERVIEW

MUSIC modelling of the catchment areas and stormwater treatment and harvesting elements was required to design and size the regional basins. Modelling of these basins was undertaken in MUSIC 6 and in accordance with DPE's MUSIC MODELLING TOOLKIT – WIANAMATTA

Each Catchment has been subdivided into basin catchments and/or clusters of basin catchments (henceforth 'sub-catchments') to model treatment trains in parallel. It was intended that each sub-catchment represents the point of compliance to meet the statutory stormwater quantity (flow) targets and stormwater quality targets. For clarity, the definition of MUSIC catchment terminology adopted for this report is shown in Table 3-1. In some cases, several sub-catchments have had to be paired in order to achieve compliance due to design constraints (further discussed in section 4) but this has been avoided where possible. A map of the sub-catchments and compliance points is shown in Appendix B.

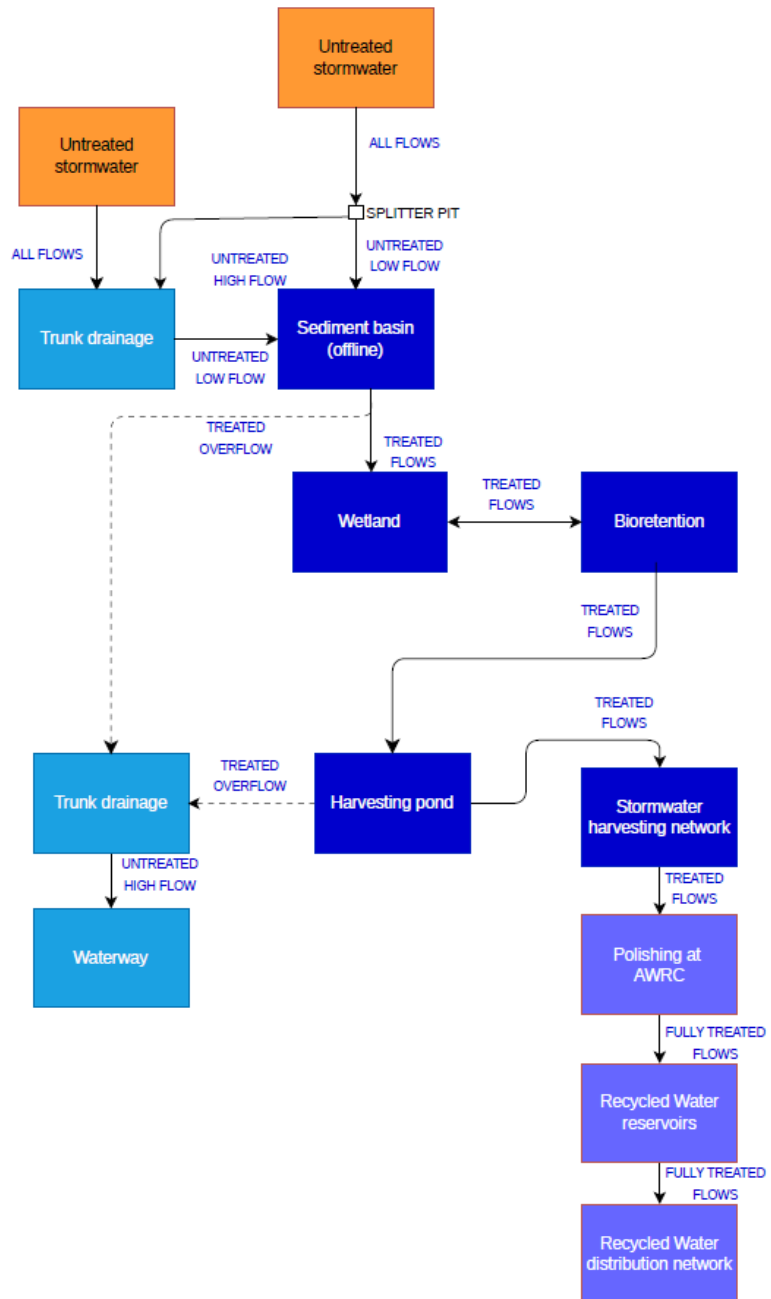


Figure 3-1: Flow diagram of Scheme infrastructure

Note - If a splitter pit is proposed upstream of the trunk drainage channel, trunk drainage channel receives high flows while the low flows discharge to the offline sediment basin. In the absence of a splitter pit, the flows are diverted from the trunk drainage channel.

Table 3-1 Catchment Terminology definition

Catchment terminology adopted	Definition
Catchments	The three major creek catchments as per 1.2.1
Sub-catchments	Cluster of basin catchments that are linked to a compliance point
Basin catchment	Catchment area draining to a regional basin

Elements of the Scheme that were modelled in MUSIC include:

- Basin catchment areas (source nodes)
- Gross pollutant traps (GPTs) on allotments (privately owned) and at end of pipe (in specific areas, see section 3.4)
- Wianamatta passively irrigated street trees (Council owned),
- Regional basins made up of:
 - wetlands (sediment basin and macrophyte zone) for stormwater pre-treatment and algal management
 - bioretention basins
 - harvesting ponds (henceforth 'Ponds') with regional non-potable water demands drawn from them.
- An example of the MUSIC model setup with primary and secondary links is shown in Figure 3-2.

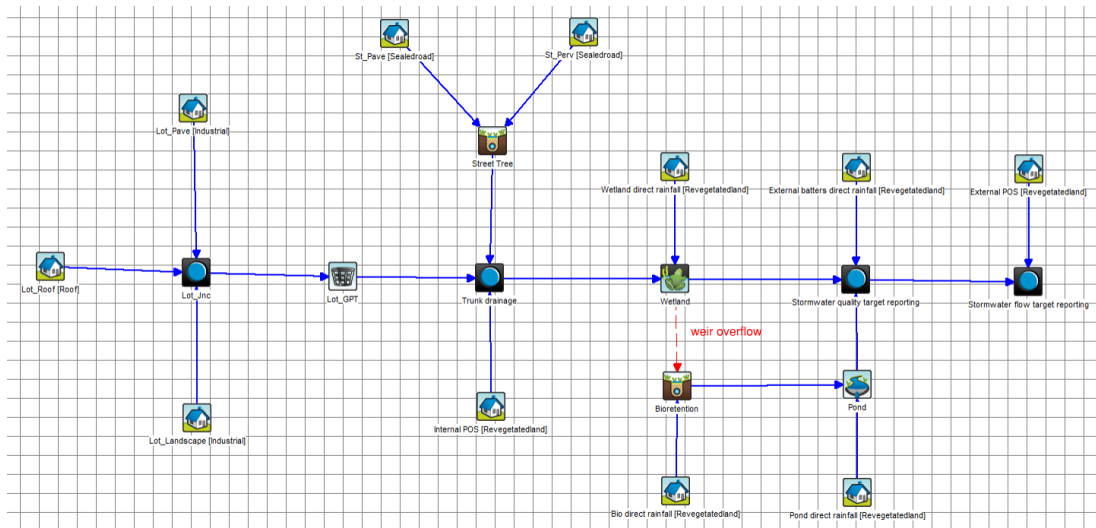


Figure 3-2 Notional MUSIC model setup

3.3 STORMWATER CATCHMENTS

3.3.1 Basin Catchment Delineation

The delineation of basin catchments used the following principles:

- Use of natural catchments based on Penrith 2019 1m LiDAR.
- Catchments were modified to represent developed-state catchments as much as possible, using Precinct Plan road layouts and existing cadastre lot boundaries.
- Limiting change to natural catchment areas to +/- 10% on a sub-catchment basis.

Each basin catchment was broken into the following source nodes:

- *Lot roof*
- *Lot imperviousness*: paths, driveways, car parks and estate road pavements
- *Lot perviousness*: gardens, lawns and vegetated setbacks
- *Street imperviousness*: road and footpath pavements
- *Street perviousness*: roadside verges and street trees
- *Public open space (POS) upstream of proposed regional basins*: pocket parks and vegetated bushland
- *External public open space (POS) downstream of proposed regional basins*: floodplain areas and parks that will not connect to wetlands and drain directly to creeks
- Area of proposed regional basins (wetlands, bioretention and ponds) that receive *direct rainfall*

This level of detailed breakdown allowed:

- a more nuanced representation of pollutant loads generated from the catchment
- detailed connection of different areas of catchment to specific treatment nodes (e.g. street and footpath runoff to street trees, lot runoff to GPTs)
- Inclusion of floodplain areas downstream of proposed regional basins but still within the Catchments into the total model output (which results in smaller basin footprints).
- Section 2.1 documents the pervious and impervious fractions adopted for different land uses represented in the source nodes. The ultimate breakdown of pervious and impervious areas used per basin catchment in modelling is documented in Appendix A.

3.3.2 Trunk Drainage Channels

Basin catchments were delineated as described in section 3.3.1. Based on modelling undertaken by Sydney Water, trunk drainage is required where urbanized catchments exceed 15ha. Naturalised trunk drainage channels are the preferred method to safely convey all flows as opposed to culverts. These naturalised trunk drainage paths are required to be provided as per the DCP, when the contributing catchment exceeds 15 hectares. For practicality, the channels have typically been made to align with the nearest road culvert or lot boundary.

For further details on the trunk drainage modelling, refer to section 3.5. For trunk drainage design principles, refer to section 4.1.4.

3.4 GROSS POLLUTANT TRAPS

3.4.1 On-Lot Gross Pollutant Traps

The on-lot gross pollutant traps (GPTs) are a DCP requirement for developers. These have been modelled to achieve an efficient level of sediment reduction on lot prior to discharge into the downstream treatment train elements.

These are intended to ensure private mixed use and enterprise lands manage litter and sediment loads from development sites prior to discharge.

The high flow bypass has been assumed to be 0.017m³/s/ha of upstream catchment. This achieves a %TSS reduction on-lot of 23% which is modest but contributes to the total reductions across the Scheme.

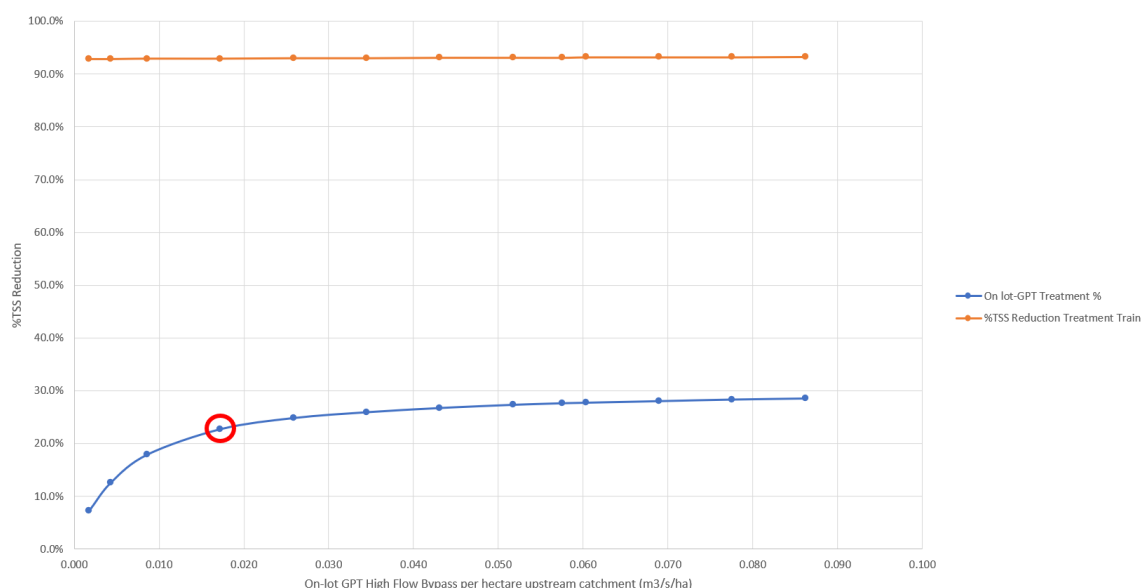




Figure 3-3 On-lot GPT sizing curve showing ideal treated flow rate

3.4.2 End of Pipe Gross Pollutant Traps

End of pipe gross pollutant traps are to be adopted for town centers, transit-oriented development and mixed-use land use with a high pedestrian activity and potential for litter.

The treatable flow rate sent from the GPT into wetlands and ponds for harvesting is critical to scheme performance.

Design criteria recommends the 4EY flow rate is adopted as a starting point. This flow rate was manually adjusted in MUSIC to achieve performance targets.

During detailed design, the GPT treatable flow rate may need to be further optimised.

3.5 PASSIVELY IRRIGATED STREET TREES

Wianamatta passively irrigated street trees are a requirement of the DCP. They are required to be planted at 8m centres to deliver government tree canopy targets and reduce stormwater volumes. A fraction of these trees are likely to be constrained and not suitable for passive irrigation, however all trees may require improved soil conditions beyond business-as-usual and will also be irrigated to provide greening and cooling.

3.5.1 Allocation

GIS road mapping has provided the centerlines for the road network, and total land take was calculated using the nominal road type widths denoted in the DCP. This mapping shows that DCP streets account for 960ha. It is understood that TfNSW would not include street trees on major transport corridors. It has also been assumed that 'service streets' in the DCP road layer will not include street trees.

DCP and Council roads provide 388,130km of road corridor (excluding 'service streets'). Assuming that 80% of the road corridors are suitable for inclusion of passively irrigated trees along both sides of the road, this provides 77,626 passively irrigated street trees across 960 ha of roads at an average of 81 trees per hectare of road. This rate has been applied across the Scheme areas to allocate street trees on a pro-rata basis, without applying trees to the SP2 transport corridors and major TfNSW transport corridors.

3.5.2 Design Template

The street tree design adopted for the Scheme Plans was based on early advice from Penrith Council and reflects a street tree design adopted by Brisbane City Council. Street trees were modelled to reflect a design template recommended by Penrith

Council which are detailed in the *Stormwater Scheme Infrastructure Design Guideline Draft* (Sydney Water, 2024) and the following assumptions.

Street tree inlets were assumed to comprise a small network of pipes to deliver water to the tree root zone and encourage uptake of stormwater within a shallow zone below the street verge. The scheme design adopts a filtration area equivalent to 2.8m²/tree and the small network of delivery pipes assumed to provide an extended detention storage volume that is the equivalent to 0.02m of ponding across this area.

Street trees were modelled as biofiltration pits in the road verges to achieve a stormwater volume reduction that passive irrigation contributes to Scheme compliance and provides a secondary benefit of filtration and stormwater quality. Filtration was achieved through a 500mm layer of improved soil with a saturated hydraulic conductivity of 25mm/hour.

Downward migration of stormwater into saline soils was assumed to be mitigated by lining and area underneath the root zone and inlet pipes. Subsurface slotted pipes near the base of the tree pit were assumed to convey excess water to the stormwater drainage.

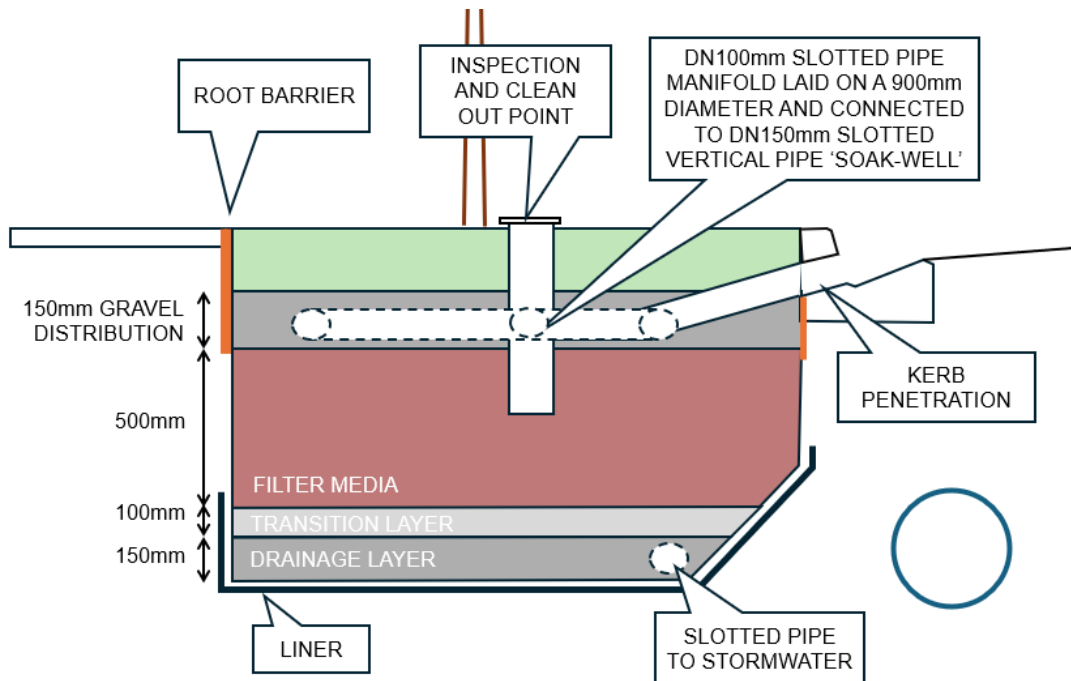


Figure 3-4 Passively Irrigated Street Tree Configuration

3.6 TRUNK DRAINAGE CHANNELS

Trunk drainage channels have been proposed to convey major stormwater flows from their respective catchments to the regional waterways. These channels also convey minor flows to diversion pipes that discharge to wetlands and ponds. Trunk drainage channels form part of an interconnected system with natural creek lines (see section 5.2).

Trunk drainage swales and natural creek systems have not been modelled as pollution removal elements. The trunk drainage channels have been modelled as part of the perviousness on lots.

Trunk drainage channels have been sized to contain the 1% AEP flood extent. For areas within the floodplain, trunk drainage can be sized to contain the 10% AEP, with 1% AEP contained across the regional basins and public open space.

There are two channel typical drawings in *Appendix A Stormwater Scheme Infrastructure Design Guideline Draft* (Sydney Water, 2024), these are shown in Figure 3-5 and Figure 3-6.

The flow rate that can be contained within each notional channel size for trunk drainage channel typical 1 and typical 2 have been provided in Table 3-2 and Table 3-3 respectively. Trunk drainage channels have been sized to convey the peak developed state 1% AEP storm event within developable areas. A notional channel size has been applied to the sub-catchments based on the post-development flow rates corresponding to post-development discharge rates, and assuming trunk drainage channel typical 1. These notional channel sizes assume a Manning's roughness coefficient of 0.08 and a 0.8% design channel grade. To avoid staging issues, trunk drainage channel cross-sections have been kept within one land ownership (i.e. have avoided being split across two cadastral parcels with centreline on the lot boundary) where possible. Due to natural topography and/or the presence of existing road culverts, this has not always been possible.

Note these flowrates are a general guide and do not replace appropriate hydraulic modelling. Hydraulic modelling requirements are documented in the *Sydney Water Stormwater Scheme Infrastructure Design Guideline*.

As part of the treatment train, for a number of basins, it is proposed that a portion of flows conveyed in the channels (the treatable flow rate) are directed from the trunk drainage channels into the regional basins via diversion pipe offtakes. The minimum level in the trunk drainage channels at the offtake locations have been set by grading the diversion pipes back from the wetland EDD, with an additional 500mm to allow for a sump. In instances where levels have been too constrained, a shallower sump or weir offtake have been considered.

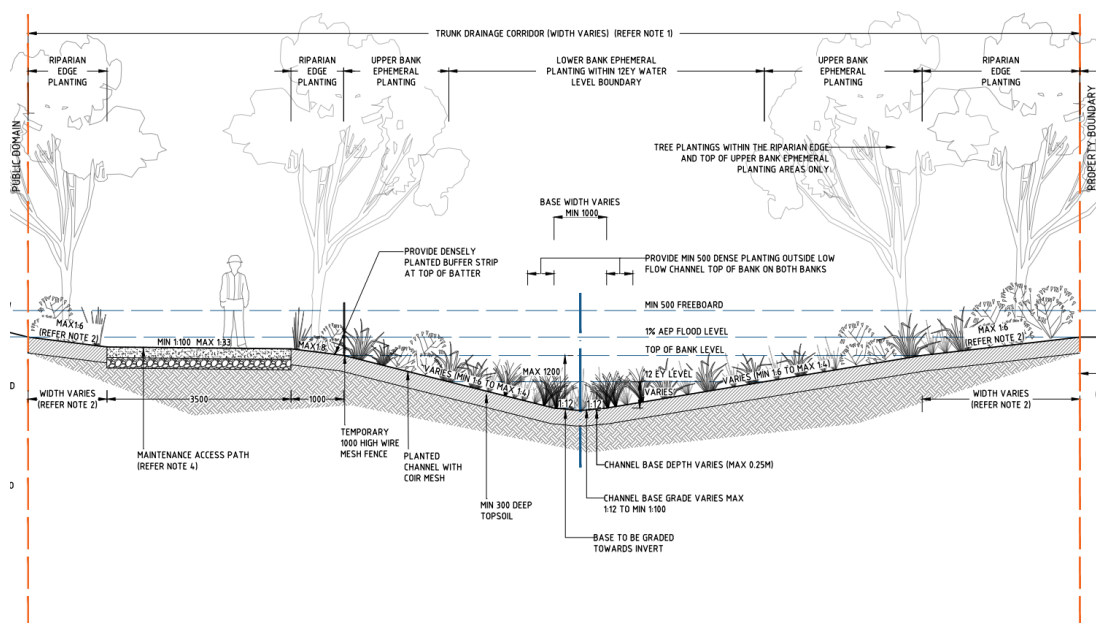
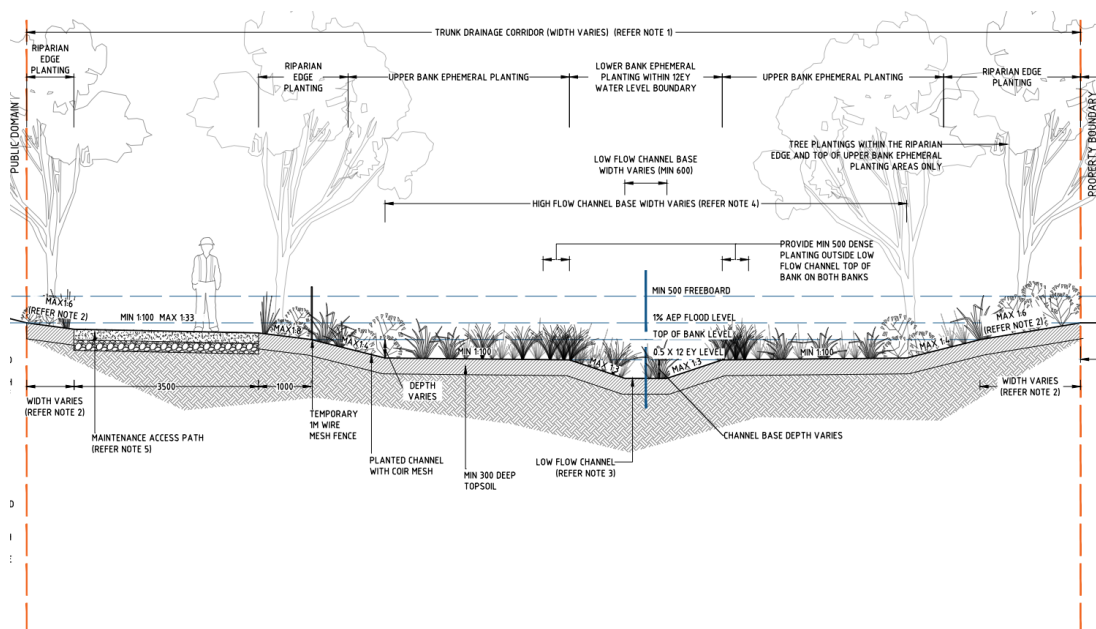


Table 3-2 Notional channel widths and flow ranges for Trunk Drainage Channel Typical 1

Channel Width (m)	Channel (m)	Depth	Maximum Flow (m3/s)	Flow Range (m3/s)
20	1.2		7.2	0 to 7.2
25	1.7		18.5	7.2 to 18.5
30	1.7		25.9	18.5 to 25.9
40	1.7		40.5	25.9 to 40.5

Table 3-3 Notional channel widths and flow ranges for Trunk Drainage Channel Typical 2

Channel (m)	Width	Channel Depth (m)	Maximum Flow (m3/s)	Flow Range (m3/s)
20		1.5	10.4	0 to 10.4
25		1.9	21.3	10.4 to 21.3
30		1.9	31.2	21.3 to 31.2
40		2.4	66.3	31.2 to 66.3

3.7 CHARGED PIPE SYSTEM

Charged stormwater pipes have been proposed to divert stormwater into regional basins in areas where the natural topography is flat and multiple small land holdings create a staging issue for regional infrastructure.

Charged stormwater pipes also balance competing needs to keep regional stormwater basins elevated above tailwater levels in creeks while accommodating existing culvert and drainage inverts where stormwater will be diverted from. Charged stormwater pipe systems consolidate the number of regional basins while avoiding the need for extensive filling of adjacent lots to create positive drainage, particularly where multiple small land holdings would require staging and coordinated construction. This enables flexible delivery, minimises the number of regional basin assets and de-risks staging for both developers and Sydney Water.

Charged stormwater pipes do not freely drain under gravity to regional basins and rely on hydraulic grades to surcharge water into regional basins. The pipe and pit network holds water that is then pumped out at a low flow rate to dewater the pipeline for the next rain event.

Sediment management is a key element in design. The upstream drainage network will be required to achieve a suitable cleansing velocity for frequent storm events when in the dewatered state. This is to prevent sediment deposition in the drainage network and limit risk of long-term blockage. The sediment storage sump volume is intended to accommodate a reasonable maintenance interval for sediment clean out via eductor truck or similar mechanism. The dewatering pump may be specified as slurry type pump, capable of pumping highly sediment laden fluid pending detailed design outcomes.

The dewatering pump elevation and pit structure will also be required to ensure the frequency of start/stop cycles is minimised and can be determined through the detailed design process.

A schematic design of the charged pipeline is provided in Figure 3-7.

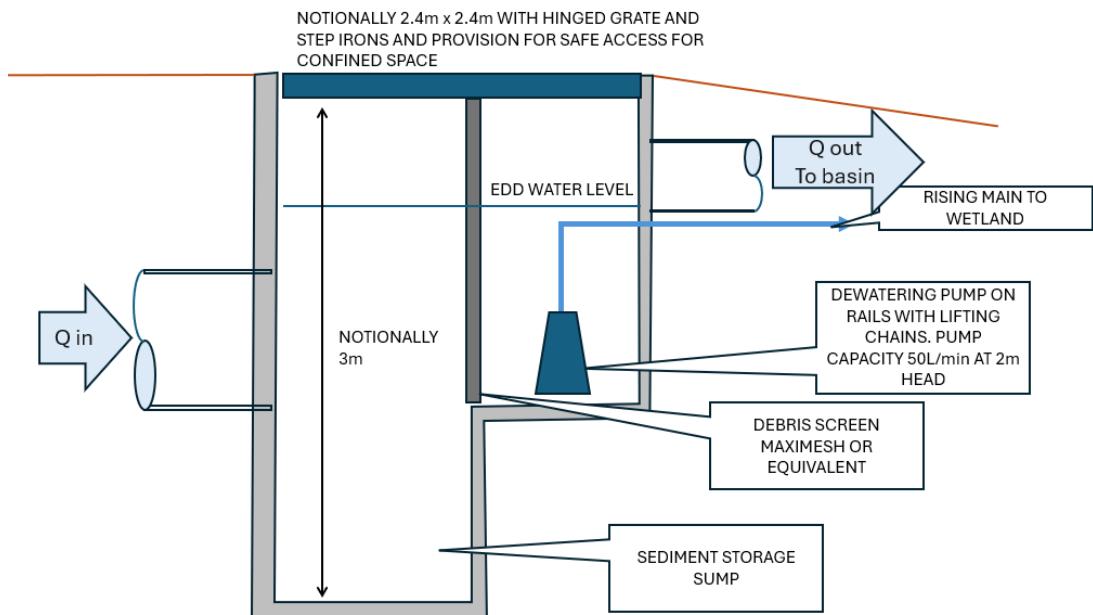


Figure 3-7 Charged Pipe System End Pit and Pump

There are two charged pipe networks proposed at regional basins AC_SC01 and AC_SC05 within Bradfield along the western edge of the Wianamatta-South Creek floodplain.

3.8 REGIONAL BASINS

The function of the regional basins is to capture and treat a portion of the stormwater runoff from developed catchments for every storm event, and to store it for harvesting and re-use. The regional basins are made up of the elements listed in Table 3-4, which shows their default sizing per net hectare of development in the upstream

catchment and the impervious fractions adopted for direct rainfall on the regional basins. The default sizing was based on generic catchment modelling and was used as the starting point for basin modelling and placement in the landscape.

Table 3-4 excludes batter slopes and access tracks as this greatly varies per basin and was ultimately modelled in MUSIC based on the latest 3D outputs. The extent of batter slopes depends on vertical alignment of surrounding topography and has been modelled based on existing topography.

Parcels of land were reserved for the regional basins in the Western Sydney Aerotropolis Initial Precincts Plan (DPHI, 2024). The default functional areas shown in Table 3-4 did not always align with the catchments and reserved areas available, with some reserved areas being oversized, some undersized and in some instances, no adequate land was reserved for a given catchment.

Table 3-4: Ideal functional basin element areas for catchments.

Basin Element	% Per NHa	% Impervious
Sediment Basin	0.20%	90%
Macrophyte Zones (Wetland)	0.80%	0%
Bioretention	0.50%	90%
Pond	2.50%	0%

In the majority of cases, there was sufficient land available to enable the default configuration including all elements. Alternative treatment trains were used under specific circumstances following these principles:

- Where insufficient land was reserved for a given basin catchment, appropriate and cost-effective land in neighboring basin catchments within the same sub-catchment was considered for basin placement before extending basins into developable land.
- Where environmental constraints on the reserved land precluded cost effective design and delivery of the full treatment train (e.g. levels, presence of shallow groundwater, critical flood storage etc.) removal of bioretention from the treatment train was sometimes an effective resolution to still allow harvesting, or removal of ponds was considered where we were otherwise still meeting the stormwater targets within the sub-catchment.

- Where only one treatment element was able to be accommodated, either a wetland or a bioretention system was included to help achieve the water quality targets. In these cases:
 - The flows were hydraulically connected to a nearby pond for harvesting where possible. (See Appendix A)
 - Where a connection was not able to be made to a nearby pond, other basins within the modelled cluster potentially needed to overcompensate and harvest more stormwater to help meet the stormwater targets.
- Selection between wetland and bioretention was determined using MUSIC modelling, as each treatment type has a different retention time and therefore effects the stormwater flow targets differently. In a small number of areas where there were small catchments and limited development (for example around the future orbital, north of the M12) the regional basins included sediment basins and bioretention basins, without wetlands or ponds. To assist in achieving the stormwater quantity targets in these areas, the bioretention basins were modelled with leaky bases as well as a standard subsoil drain collection. A low infiltration rate was adopted for the leaky bioretention systems - 0.36mm/hr exfiltration was adopted which represents the heavy clay soils of Western Sydney.

Accounting for where the above alternative treatment trains were required, the sizing of the basin elements was further refined through model optimization, which often resulted in variations from the default sizing. Changes were driven by the specific land use breakdown within each basin catchment, the amount of pervious floodplain modelled downstream of the proposed regional basins and the land available for the regional basin footprint. For example, basin catchments with high POS areas were able to achieve basin footprints that were smaller than the default sizing shown in Table 3-4 due to the effect of increased pervious area reducing the MARV, and vice versa. Optimisation of the models included balancing the land use specifics of each model with the demands applied to the ponds, to the benefit of the overall Scheme (i.e. cost reduction or land impact considerations) as further described in section 0.

All elements within the regional basins require specific design and edge treatment to manage wildlife habitat and wildlife strike risk at the airport. All elements have been modelled in accordance with parameters and typical design sketches included in the *Stormwater Scheme Infrastructure Design Guideline Draft (Sydney Water, 2024)*.

3.8.1 Options considered

During the preliminary planning, both the online and offline sediment basins were considered. However, during the scheme plan development online sediment basins

have been deemed to be unpreferable and therefore not incorporated for the following key reasons.

- Online sediment basins are recommended for open drainage channels with sufficient space and access, as they reduce land take. But there are only limited trunk drainage channels proposed within the Scheme.
- Based on lessons learnt from Mamre Road including risk to sediment resuspension and incompatibility with the surface levels.
- Ongoing management complexities with the asset on private landholdings.

3.8.2 Basin Elements

Sediment Basins

Sediment basins are proposed as inlet pond to offline wetlands with a set treatable flow rate, unless in the circumstances described in Figure 3-8.

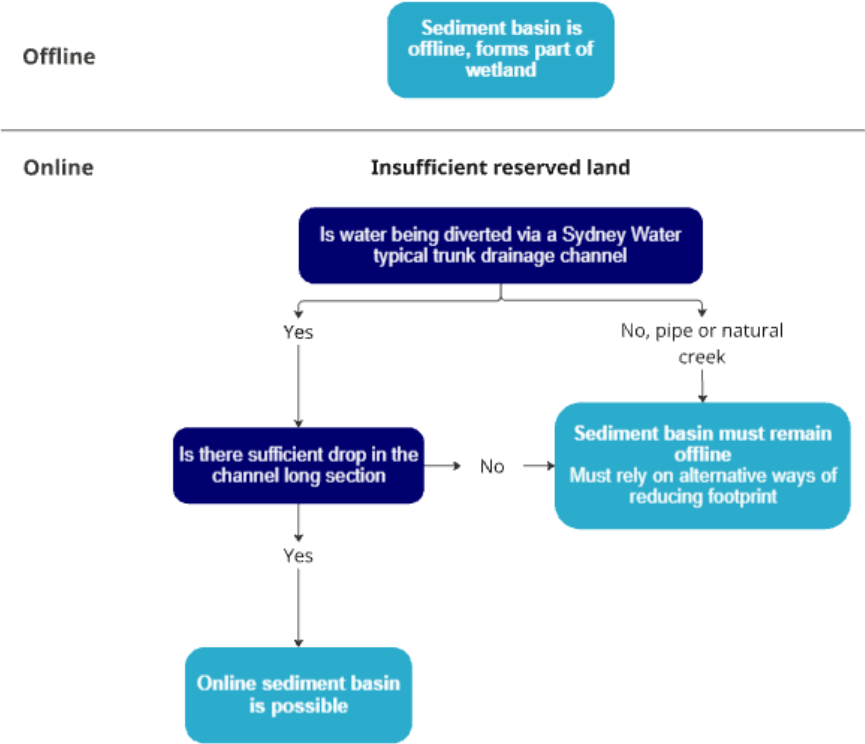


Figure 3-8 Sediment basin decision tree



Wetlands

Wetlands have been prescribed to manage the quality of stormwater entering the stormwater harvesting system. They are proposed to function during both rainfall events and to manage poor water quality in the adjacent harvesting ponds through recirculating water through the wetland (e.g. during algal blooms). Wetlands are also more suitable where continuous / frequent low flows are discharged into the basins, particularly relevant in larger catchments, as continuous low flows can lead to algal build up in bioretention filter media. When coupled with bioretention, these low flows are treated and released from the wetland prior to the bioretention being engaged.

Bioretention

Bioretention is proposed to filter water prior to collection and storage. Bioretention basins filter stormwater through vegetation and soil media to remove sediments and nutrients.

Bioretention is efficient (more so than wetlands in terms of performance vs surface area) at filtering water and has been coupled with wetlands to provide an efficient and reliable way of treating stormwater, thereby reducing the overall footprint of regional basins.

Ponds

Ponds have been included to store treated stormwater for non-potable re-use, contribute to meeting stormwater quantity (flow) targets and contribute to the retention of stormwater in the landscape for greening and cooling.

Default pond footprints are approximately 2.5% of the basin catchment. Pond depths are notionally up to 3m with safety batters in accordance with the *Stormwater Scheme Infrastructure Design Guideline Draft (Sydney Water, 2024)*. In some cases, pond depths have been set shallower than 3m where local context dictates (see section 4.4) and other design criteria are still met.

Recycled water demands have been modelled as daily or annual extractions (with seasonal variation) from the ponds as quantified in Section 2.2. Daily and annual extraction rates were assigned to each basin catchment using the same process that was used to allocate the global demands to each of the three Catchments as discussed in section 2.2.4. However, in many cases in Wianamatta Badgerys and Duncans Mulgoa Catchments, the extraction rates were then re-allocated between regional basins to improve modelling outcomes depending on several factors:

- Basin catchments that only had a wetland and/or bioretention and were without a pond could then have that extraction rate given to another pond in the Catchment.

- Sub-catchments that had a large portion of POS downstream of the stormwater basins were able to more readily comply with the stormwater flow targets with less reliance on stormwater harvesting, as there was more pervious land in these models and therefore less runoff per modelled hectare. This meant that the extraction rates could be lessened on these ponds without having to significantly increase the pond footprint to achieve flow target compliance. This freed up some available demand (extraction rate) to be applied to other more constrained ponds.
- Regional basins that were forced to be on developable land zoning (due to other constraints) had their footprints minimised by applying a higher extraction rate. The additional extraction rate came from basins on ENZ land as these basins could be designed with lower extraction rates than their initial allocation and remain cost-effective.

3.9 STORMWATER HARVESTING NETWORK

The purpose of the stormwater harvesting network is to supply stormwater from the ponds to the Advanced Water Recycling Centre (AWRC) in a controlled manner. The stormwater will then be treated at the AWRC before it is distributed via reticulation to recycled water users.

3.9.1 Options Considered

During the preliminary planning, a daisy chain arrangement was considered for the stormwater harvesting network based on the Mamre Road Precinct design. The daisy chain system consists of:

- Harvesting pumps within each storage pond, pump to the gravity main.
- The gravity pipeline drains away to a lift pumping station.
- The lift station, similar to a submersible wet well SPS, raises the water to the invert of the next gravity pipe.
- The last pumping station in the chain pumps via pressure main to the AWRC.

Alternatives to the daisy chain arrangement were investigated during planning, as the proposed depth of the gravity network was likely to be challenging to construct and as a result, expensive. Therefore, a high-level comparative Multi Criteria Analysis (MCA) using a representative network was carried out between the daisy chain arrangement and a low-pressure harvesting system. In this arrangement, individual harvesting pumps pump directly to the AWRC via a shared pressure main.

The alternative arrangement considered:

- Harvesting pumps within each storage pond, pump to the shared pressure main.

- A booster pumping station at the last pond before the AWRC.

The comparative analysis proved the low-pressure harvesting system to be sustainable and cost efficient. Therefore, low-pressure harvesting has been adopted for the Scheme Plan design. Further, Sydney Water will be commencing a concept design for the harvesting network for the Catchments to finalise the alignments and design methodology.

Design Criteria

The design criteria adopted for the development of Scheme Plans is as follows.

General:

- Stormwater assumed to be pumped from a range of ponds across the scheme to the AWRC.
- Each pond assumed to have its own pump station to deliver the required flow rate to the AWRC.
- The pipes and pump stations have been sized based on the peak monthly demands adopted in MUSIC for the ponds.
- The peak monthly demand includes the constant daily demand applied in MUSIC ponds and the peak seasonal demand (month of December) which was converted to the equivalent daily demand.
- The peak monthly demand in MUSIC was converted to L/s and then scaled by a factor of 1.8 to account for a peak daily demand.
- The 1.8 scaling factor is an initial estimate of the peak daily demand scaling factor including both variation across days (weekday/weekend) and diurnal peak demands
- It is noted that the regional basins are generally located higher than the AWRC, resulting in the system pumping downhill. Hence further design should consider the requirements for pressure sustaining valves to maintain a minimum set pressure, preventing cavitation and protecting the pumps and upstream pipeline.

Pump station:

- The pumped fluid is stormwater.
- Wet well-type pump stations were preferred, with a typical depth of approximately 3–4 meters.
- The pumping station arrangement needs to be further considered during future design phases.

Pipeline:

- The stormwater network requires several pressure mains to transfer stormwater to the AWRC. Each pump station was assumed to be connected to the closest mains via a branch pipeline or directly to the main line.
- HDPE pipe material roughness value of $k = 0.009 \text{ mm}$ (AS 2200) has been used.
- Slopes were obtained based on Google Earth elevation data in the absence of survey information.
- Water properties at 20°C temperature were used for the calculations, with a kinematic viscosity of $1.01 \times 10^{-6} \text{ m}^2/\text{s}$. (AS2200)
- Minimum pipe cover in accordance with WSA 03 requirements ($750 \text{ mm} + \text{DN} + \text{Lo} + \text{Lb}$)
- Ponds AG_BC01 and AG_BC02A have been reassigned to the Duncans-Mulgoa catchment alignment, as they are located closer to the main pipe in the Duncans-Mulgoa catchment than in the Wianamatta-Badgerys catchment.

3.9.2 Assumptions

The assessment was based on the following key assumptions:

Pipeline:

- Available HDPE sizes from the Clover Pipe range were assumed for pipe selection.

3.9.3 Pipe sizing principles and criteria

Pipe sizing was undertaken using a methodology based on a series of design assumptions and calculation checks.

All pipelines were assumed to be HDPE, with an internal roughness value of $k = 0.009 \text{ mm}$ adopted in accordance with AS 2200. Pipe slopes were derived from the maximum available Google Earth elevation data, as no detailed survey was carried out at that time.

A design velocity range of $0.8\text{--}1.4 \text{ m/s}$ was applied to keep flows within WSA 03 guidance, with a maximum allowable velocity of 1.5 m/s adopted for determining the minimum diameter. The initial DN was calculated based on this velocity limit and then rounded up to the nearest available HDPE size from the Clover Pipe product range, ranging between DN90 and DN710 (excluding connection pipes).

Actual velocities were recalculated using $V = Q/A$, followed by determination of the Reynolds number, friction factor, and hydraulic gradient.



Final verification of hydraulic performance was completed using the Colebrook–White equation, applying a water temperature of 20°C and kinematic viscosity of $1.01 \times 10^{-6} \text{ m}^2/\text{s}$.

This process ensures that all selected pipe sizes provide adequate conveyance capacity and operate within the adopted hydraulic limits and recognised design standards.

3.9.4 Main alignment, horizontal and vertical profiles

A high-level indicative alignment of the stormwater harvesting main has been developed for initial planning and costing purposes. This alignment is considered an indicative only and should be further refined during future design phases.

The alignments have taken into account future lot boundaries and road layouts and aligned to road reserves and/or riparian corridors and avoids boundary impacts as much as possible.

The alignment of the mains generally follows the following criteria:

- collection pipeline alignments aim to minimize overall pipe length.
- avoid crossing developable land.
- avoid vegetation and proposed infrastructure.
- collection pipelines follow riparian corridors or proposed future utility easements to the AWRC where appropriate.



4 DESIGN PRINCIPLES AND CONSTRAINTS

4.1 DESIGN PRINCIPLES

The following principles were used to guide the design and placement of the scheme infrastructure.

4.1.1 Regional Basin Sizing and Location

- The primary principle for location and size of regional basins was to minimise land take by finding efficiencies in the basin designs.
- Regional basins have been contained within areas mapped in the Precinct Plans (2022) overlay for Stormwater Infrastructure (henceforth 'reserved area') wherever possible unless more cost effective and technically viable land was identified, in which case this land was given preference.
- Where additional basins were required outside of reserved areas:
 - SEPP and DCP land zoning and the cost of land have been considered, whereby un-developable land (i.e. ENZ or Floodplain land) was prioritized for basins, followed by areas mapped for Open Space land use, and lastly areas mapped for development (ENT, MU and AGB).
 - Regional basins have been consolidated wherever possible for greater efficiency.
 - Basin footprints have been shaped to maximise useable developable space on developable land.
- Regional basins have only been sized to treat flow coming from the catchment area within the Initial Precincts boundaries and are not sized to treat/harvest external catchment flow.
- Regional basins have been located to respond to the vegetated riparian zone principles in Section 4.2.
- Regional basins have been located to respond to the environmental constraints summarised in Section 4.3.
- Access to back of lots has been retained wherever possible. A 4 m access track has been provided to all residual back of lot land where that land is floodplain (regardless of zoning) unless that land is planned to be acquired. A 20 m allowance for a road has been provided where the residual back of lot is developable land.
- Treatable flow diversion pipe lengths have been minimised by:

- 
- Positioning regional basins directly adjacent trunk drainage channels where feasible.
 - Positioning regional basins to best accommodate the contributing catchments and/or with respect to existing culvert locations.
 - Adequate space for high-flow bypass flow paths around wetlands has been allowed for.
 - Batter slopes have been calculated to existing terrain.

4.1.2 Regional Basin Levels

- Wetlands and pond levels have been set to allow drainage to the existing receiving waterways at the peak 50% AEP water level in the downstream creek.
- The diversion levels set within the Scheme are critical to allow function of the wetlands and ponds.
- Diversion pipes have been set to an optimum grade of 1.2%, with a minimum grade of 0.5% with appropriate pit drops.
- Basins levels were at times set such that the basin elements may experience inundation from the regional 1% AEP flood (i.e. the maintenance track levels were below the 1% AEP flood level and/or regional basin is within the 1% AEP extent) but the basins were located outside the 1% AEP floodway extent, where possible, and aimed to result in no flood impacts outside of the precinct or within development land.
- Bioretention and wetland elements have been placed outside the 5%AEP flood extent as a minimum where possible.

4.1.3 Peak Flow Attenuation

- The regional basins do not serve any peak flow attenuation function for development.
- The Aerotropolis DCP requires development sites to have Water Management Strategies with details of on-site stormwater detention (Section 2.3.2 PO3) to support development.
- Trunk drainage channels have been designed and sized (refer to Section 3.6) assuming upstream flow attenuation on sites (i.e. On-site stormwater detention as per above).



4.1.4 Trunk Drainage Channels

- As discussed in section 3.3.2, where catchments exceed 15ha in size, trunk drainage channels were provided to convey the full range of low and high flows, without underground pipes (as per the DCP). Trunk drainage was sized for the full upstream catchment (not only the portion of the catchment that falls within the Initial Precinct or Scheme boundaries).
- Where possible, Sydney Water has located the trunk drainage channels to share their function with the DCP Riparian Streets. The purpose and alignment of the Riparian Streets in the DCP is not restricted to their hydraulic function but also considered the active transport corridors and the urban form intended as part of the Aerotropolis Precinct Plan. As such, the locations of the Riparian Streets were not ideally located within the catchments, and in these cases Sydney Water has had to locate Trunk Drainage Channels along different alignments.
- Where Trunk Drainage Channels have been able to follow the DCP Riparian Street alignments, the length may also differ from what was mapped in the DCP as Sydney Water only require this infrastructure once the catchment exceeds 15ha. This does not preclude a riparian street from being extended further upstream from the Sydney Water Trunk Drainage Channel, but any length greater than what has been mapped in the Stormwater Scheme Plans is not necessitated or intended to be owned by Sydney Water.
- Trunk Drainage Channels have been located in alignment with the vegetated riparian zone principles in Section 4.2.
- Trunk Drainage Channels have been located in alignment with the environmental constraints summarised in Section 4.3.
- Some mapped natural waterway alignments have been adjusted to align with real alignment as evidenced from recent aerial imagery (NearMaps). These are in the process of being confirmed and endorsed by relevant NSW Government Departments. Vegetated riparian zones have been mapped for these adjusted alignments where relevant.

4.2 WATERWAYS AND VEGETATED RIPARIAN ZONES

The waterways in the Scheme are of highly varying quality, from ill-defined depressions with little ecological value, to well-defined channels with high value riparian vegetation. Conserving and enhancing the ecological value of the Catchment's waterways is a fundamental objective of the Scheme and Aerotropolis in general. Most waterways have been ground truthed as part of the Western Sydney Aerotropolis precinct planning. Top of bank mapping carried out during this process has been the foundation of the Scheme design around waterways.



Vegetated riparian zones (VRZ) refer to lands adjacent to waterways, characterised by native vegetation that plays a crucial role in maintaining water quality, providing habitat for wildlife, and supporting biodiversity. Effective management of VRZs is essential for stabilising riverbanks, minimising erosion, and protecting aquatic ecosystems from pollution and urban development.

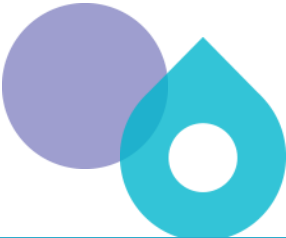
Scheme infrastructure adjacent to or within the VRZ has been designed in accordance with the *Controlled activities – Guidelines for riparian corridors on waterfront land* (DCCEEW (formerly DPE), 2022) (henceforth “Controlled activity guideline”).

A summary of principles that have been followed in the Scheme design in regards to waterways and VRZs are presented in Table 4-1. Where a principle has not been able to be followed due to constraints, Sydney Water will seek approval from the appropriate approval-body during the next design phases.

It is noted that the cultural value of waterways will also need to be considered during further design development once cultural studies are undertaken. This may identify minor waterways which have low ecological value to be of importance for cultural conservation. The cultural value of minor watercourses has not been assessed or considered at this stage.

Table 4-1 Waterways and VRZ principles

Stream order		Total corridor (VRZ+channel) width	Stream re-alignment	Regional Basins in channel/riparian zone
Naturalised	Trunk Drainage Channel	No VRZ.	Trunk drainage is typically aligned to minimise impact on developable land (ie. Aligned with lot boundaries or roads) within the bounds of other planning and design constraints.	Sydney Water allow basins between the 5% and 1% AEP flow extents where no flood impacts are demonstrated where significant cost/space saving can be realised.
1 st order	(catchment area < 15ha)	20m plus channel width at top of bank. If the existing waterway does not meet the 'waterway' definition, in the controlled activity Guideline, that waterway can be piped.	Waterway may be re-aligned if the VRZ has been assessed to contain low biodiversity value (i.e. no/little native vegetation).*	Basins permitted in the outer 50% of the VRZ** and outside the 5% AEP flow extent where no flood impact is demonstrated, significant cost/space saving can be realised and VRZ offset accommodated.
1 st order	(catchment area > 15ha)	20m plus channel width at top of bank. If the existing waterway does not meet the 'waterway' definition, in the controlled activity Guideline, apply naturalised trunk drainage corridor sizing and design guides.	Realignment must consider additional standard planning constraints and drivers.	
2 nd order		40m plus channel width at top of bank.		
3 rd order		60m plus channel width at top of bank.	May be permissible where there is no natural stream channel/channel is artificial/farm dams. Must be discussed with Water and Licensing (DCCEEW) for endorsement.	Basins may be permitted in the outer 50% of the VRZ** and outside of the 5% AEP flow extent where no flood impacts are demonstrated to be acceptable, significant cost/space

Stream order	Total corridor (VRZ+channel) width	Stream re-alignment	Regional Basins in channel/riparian zone
4 th order and above	80m plus channel width at top of bank.	May be permissible where there is no natural stream channel or the channel is artificial. Must be discussed with Water and Licensing (DCCEEW) for endorsement.	saving can be realised and VRZ offsetting rules can be accommodated.

Note:

*Realignments require endorsement from Water and Licensing (DCCEEW)

**Rehabilitation of the VRZ required in line with Controlled Activity guidelines.

***Assumptions based on discussion with water and licensing (DCCEEW)

4.3 ENVIRONMENTAL OVERLAY PRINCIPLES

There are several mapping overlays provided from various government agencies that are important to consider in the placement of naturalised trunk drainage and regional basin infrastructure, as per Table 4-2. Where regional basin placement relies on ground-truthing of vegetation, Sydney Water will seek approval for each case from the appropriate approval-body during the next design phases.

Table 4-2 Environmental constraints

GIS Layer	Adopted Approach
CPCP_LAND_CATEGORY_SEED	Attribute: Avoided land Vegetation cannot be cleared on Avoided land. Vegetation within this layer requires ground-truthing. If no vegetation is present on aerial photos, Sydney Water can proceed in putting infrastructure there. If necessary to clear vegetation, an application to the DPHI is required with justification and offsets. Removal of exotic species (e.g. sedges) are not considered to be an issue. Attribute: Excluded land Justification and offset for removing vegetation
StrategicConservationArea	Hard constraint No infrastructure can be built on this land
EPI_Terrestrial_Biodiversity	Attribute: High Biodiversity Value Area (Existing Native Vegetation) Vegetation within this layer requires ground-truthing. If no vegetation is present on aerial, it has been considered appropriate to place infrastructure there. If necessary to clear vegetation, an application to DPHI with justification and offsets would be required. Removal of exotic species (e.g. sedges) are not considered to be an issue.
Existing_Native_Vegetation & Certified Land	Hard constraint on Existing Non-Certified land Not a constraint on Existing Certified land
GC_LandCertification_withCondition	Hard constraint Not present in Initial Precincts. Relevant for work in future precincts.



GIS Layer	Adopted Approach
Native Vegetation Protection	Vegetation within this layer requires ground-truthing. If no vegetation is present on aerial, it has been considered appropriate to place infrastructure there. If necessary to clear vegetation, an application to DPHI with justification and offsets would be required. Removal of exotic species (e.g. sedges) are not considered to be an issue. Not present in Initial Precincts. Relevant for work in future precincts.

4.4 GROUNDWATER

Groundwater is considered a potential risk to the regional basin design from two key standpoints:

1. Unlined basins are at risk of saline groundwater ingress which has the potential to affect infrastructure and water quality.
2. Regional basins within groundwater zones may be subject to hydrostatic pressure. Deeper basins may require more expensive lining materials i.e. reinforced concrete.
3. Scheme performance will be impacted if groundwater interactions prevent stormwater being harvested as intended.

Where groundwater risks haven't been confirmed through site investigations, ponds were made shallower to balance the risk of groundwater interaction.

As such, potential local groundwater levels have been considered as a constraint to regional basin depth (particularly the pond depth) to avoid unfavourable ground conditions, costs associated with dewatering and disposal, licensing and additional approvals if groundwater interference is likely and scheme performance impacts if harvesting from ponds is ceased.

In the absence of detailed groundwater information across the Catchments, the following 'Groundwater Check' method has been adopted to inform regional basin depths:

1. Depths of regional basins were designed to be above creek invert to ensure groundwater flow paths to creeks. An example of a regional basin section with respect to the adjacent creek invert is presented in Figure 4-1.
2. Review of aerial imagery where there is imagery, existing farm dams or where information is available which show groundwater at surface.

3. Where groundwater information has been sought as part of a DA, this information was quickly reviewed to understand if it contains any useful information on groundwater levels or ground conditions.

Following the groundwater check approach, groundwater level assumptions have been documented to allow for future review and confirmation against any further information and to inform the scope of future groundwater investigations.

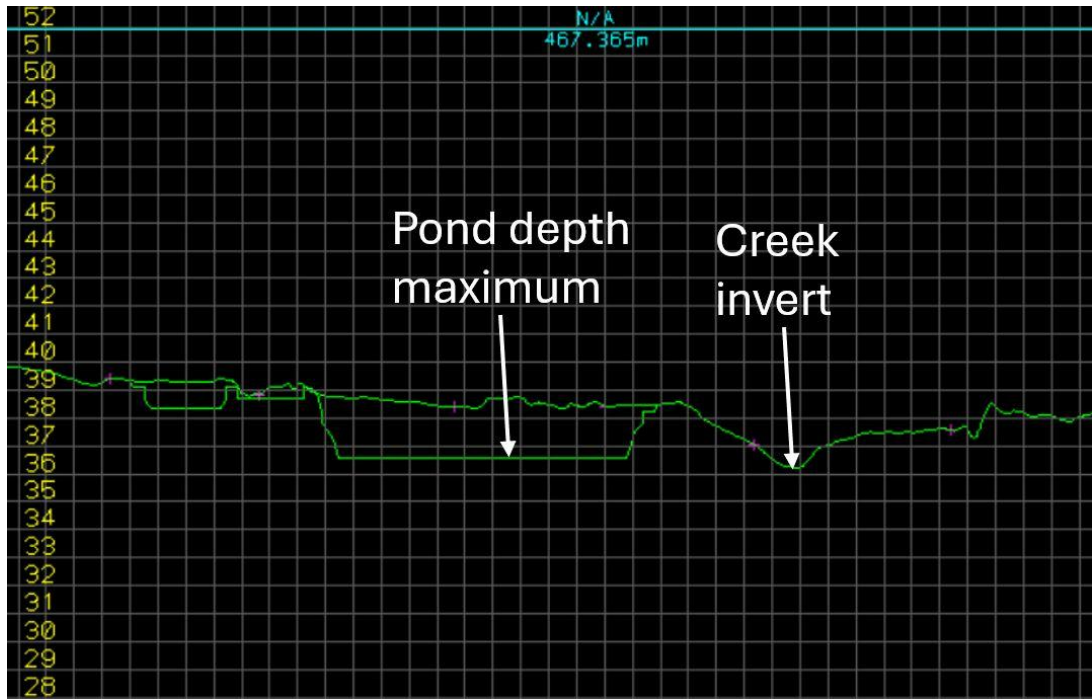


Figure 4-1 Example regional basin section where pond base is above adjacent creek invert.

5 REFERENCES

Title
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Sydney Water (2024) <i>Stormwater Infrastructure Design Guideline Draft</i> . Online: [Stormwater scheme infrastructure design guideline: Western Sydney (draft)].
Sydney Water (2026) <i>Aerotropolis Integrated Water Management (IWCM) Outcomes Report</i>

APPENDIX A – REGIONAL BASIN SUMMARIES

Table A- 1: Wianamatta Badgerys - Basin catchment modelling parameters

Catchment ID	Impervious catchment (ha)	Pervious catchment (ha)	Catchment imperviousness excl direct rainfall%	Daily demand applied to pond (kL/day)	Annual demand applied to pond (kL/year)	Max Pump Rate (L/s)
AC_SC01	37.74	21.69	63%	244	21008	7.8
AC_SC02	2.85	1.22	70%	0	0	0.0
AC_SC03	18.72	12.48	60%	95	7909	3.0
AC_SC04	7.17	3.10	70%	0	0	0.0
AC_SC05	40.20	17.23	70%	349	29745	11.1
AC_TC02	7.31	3.13	70%	33	2848	1.1
AC_TC03A	14.15	6.06	70%	69	5855	2.2
AC_TC03B	6.78	2.90	70%	69	5855	2.2
AC_TC12	56.42	30.07	65%	199	16974	6.3
AC_TC04	12.33	6.38	66%	90	8000	2.9
AC_TC05	19.02	10.62	64%	110	9000	3.4
AC_TC07	12.80	9.94	56%	86	7380	2.7
AC_TC08	2.14	1.86	53%	0	0	0.0
AC_TC10	27.48	9.65	74%	283	24051	9.0
AC_TC11	2.46	1.05	70%	0	0	0.0
AC_SC06	50.63	20.97	71%	357	30391	11.3
AC_SC07	12.93	6.56	66%	80	6823	2.5
AC_SC08	7.77	3.33	70%	35	2945	1.1
AC_SC09	12.07	3.72	76%	0	0	0.0
AC_SC10	19.35	3.62	84%	51	4325	1.6
AC_SC12	8.06	2.27	78%	21	1814	0.7
AC_SC13	30.40	5.37	85%	136	11567	4.3
AC_BC09	7.57	3.80	67%	52	4468	1.7
AC_BC10	16.67	6.26	73%	122	10364	3.9
AC_BC11	6.23	1.12	85%	60	5100	1.9
AC_BC13	22.46	9.13	71%	262	22300	8.3
AC_BC15	16.73	2.99	85%	140	11900	4.4



Catchment ID	Impervious catchment (ha)	Pervious catchment (ha)	Catchment imperviousness excl direct rainfall%	Daily demand applied to pond (kL/day)	Annual demand applied to pond (kL/year)	Max Pump Rate (L/s)
AC_BC16	26.85	5.08	84%	172	14666	5.5
AC_BC17	12.38	2.20	85%	134	11429	4.3
AC_BC18A	10.44	1.88	85%	148	12568	4.7
AC_BC18B	9.12	2.47	79%	121	10300	3.8
AC_BC19	35.64	7.06	83%	154	13151	4.9
AC_BC22	32.35	15.77	67%	268	22846	8.5
AC_BC22C	5.34	1.76	75%	0	0	0.0
AC_BC01	25.96	5.71	82%	237	20150	7.5
AC_BC02	25.53	4.78	84%	196	16718	6.2
AC_BC03	29.22	5.16	85%	216	18374	6.8
AC_BC04	20.08	3.54	85%	133	11349	4.2
AC_BC05	9.12	1.62	85%	69	5879	2.2
AC_BC06	6.71	1.19	85%	53	4522	1.7
AC_BC08	18.77	3.32	85%	136	11610	4.3
AC_BC20	2.11	0.37	85%	0	0	0.0
BC_SC01	36.83	6.50	85%	295	25124	9.4
BC_SC02	21.71	4.13	84%	165	14078	5.2
BC_SC03	19.21	3.39	85%	195	16561	6.2
BC_SC04	40.88	7.67	84%	355	30184	11.2
BC_SC05	3.94	0.70	85%	0	0	0.0
BC_SC07	10.44	1.84	85%	0	0	0.0
BC_BC01	39.27	7.48	84%	307	26173	9.7
BC_BC02	28.67	5.07	85%	225	19191	7.1
BC_BC03	9.03	1.59	85%	65	5562	2.1
BC_BC05	8.35	1.47	85%	60	5141	1.9
BC_BC06	15.85	2.80	85%	115	9748	3.6
BC_SC08	10.50	1.85	85%	0	0	0.0
BC_SC09	31.30	5.52	85%	181	15420	5.7
BC_SC10	29.16	5.18	85%	243	20671	7.7
BC_SC11	3.74	0.66	85%	0	0	0.0

Catchment ID	Impervious catchment (ha)	Pervious catchment (ha)	Catchment imperviousness excl direct rainfall%	Daily demand applied to pond (kL/day)	Annual demand applied to pond (kL/year)	Max Pump Rate (L/s)
BC_SC12	11.14	1.97	85%	82	6941	2.6
BC_SC13	3.08	0.55	85%	0	0	0.0
BC_SC14	8.20	1.45	85%	83	7084	2.6
BC_BC08A	30.20	5.33	85%	400	32000	12.4
BC_BC08B	16.68	2.95	85%	0	0	0.0
BC_BC09	30.86	5.45	85%	310	26352	9.8
BC_BC10	62.23	10.98	85%	501	42642	15.9
BC_BC11	1.19	0.21	85%	0	0	0.0
BC_SC15	5.05	0.89	85%	34	2857	1.1
NG_BC03	34.59	8.47	80%	307	26234	9.7
NG_BC04	4.52	1.22	79%	0	0	0.0
NG_BC05	13.97	8.91	61%	182	15461	5.8
NG_BC06	10.19	7.41	58%	165	14064	5.2
NG_BC07	4.56	10.40	30%	84	7135	2.7
NG_BC08	10.08	1.78	85%	0	0	0.0
NG_BC09	10.88	1.92	85%	0	0	0.0

Table A- 2: Wianamatta-Badgerys regional basins with piped connections to other basins

Catchment ID	Connection
AC_BC19	Treatment (AC_BC19A) and pond (AC_BC19B) physically separated, connected by pipe
AC_BC22	Basin split into AC_BC22A and AC_BC22B, physically separated by a road. The pond is split across both basins at same level (hydraulically connected).
BC_SC13	BC_SC14 pond
BC_BC08B	BC_BC08A pond
NG_BC03	Treatment (NG_BC03A) and pond (NG_BC03B) physically separated, connected by pipe
NG_BC04	NG_BC05 pond
NG_BC05	Treatment and pond physically separated, connected by pipe

Table A- 3: Cosgroves - Basin catchment modelling parameters

Catchment ID	Impervious Catchment (ha)	Pervious Catchment (ha)	Catchment imperviousness excluding rainfall (%) split	Daily demand applied to pond (kL/day)	Annual demand applied to pond (kL/year)	Max Pump Rate (L/s)
Ag_CC02	32.64	8.30	80%	257	21838	8.1
Ag_CC03A	9.40	2.62	78%	74	6287	3.73*
Ag_CC03B	5.51	2.30	71%	43	3690	
Ag_CC04	14.98	6.84	69%	118	10023	2.99
Ag_CC05A	21.62	3.97	84%	170	14467	11.07*
Ag_CC05B	14.49	2.57	85%	114	9694	
Ag_CC06	15.46	3.12	83%	122	10345	3.78
Ag_CC08	14.71	2.68	85%	115	9755	3.62
Ag_CC09	12.27	2.25	84%	96	8209	2.95
Ag_CC10	16.46	4.23	80%	129	11012	4.21
Ag_CC11A	7.66	2.60	75%	60	5123	4.82*
Ag_CC11B	11.91	2.18	85%	94	7968	
Ag_CC12A	6.83	4.09	63%	54	4571	4.14*
Ag_CC12B	10.02	2.24	82%	79	6701	
Ag_CC13A	8.14	2.90	74%	64	5455	3.47*
Ag_CC13B	5.78	2.11	73%	46	3871	
Ag_CC14	22.85	4.95	82%	175	14888	7.15
Ag_CC15	14.32	2.53	85%	113	9582	3.58
Ag_CC16	13.23	2.50	84%	104	8848	3.46
Ag_CC17	21.63	6.37	77%	170	14480	5.4
Ag_CC18	10.12	2.70	79%	80	6771	2.52
Ag_CC19	16.62	7.81	68%	131	11125	3.96
Ag_CC20	19.56	5.05	79%	154	13087	4.63
Ag_CC21	13.41	2.37	85%	105	8971	3.35
NG_CC01	9.44	3.64	72%	74	6317	2.36
NG_CC03	13.59	2.84	83%	107	9107	3.19
NG_CC06	34.59	12.96	73%	272	23139	8.53
NG_CC07	15.07	6.72	69%	118	10080	3.64
NG_CC08	8.17	3.36	71%	64	5468	2.02
NG_CC09	6.81	2.00	77%	54	4555	1.67
NG_CC10	9.15	5.01	65%	72	6124	2.27
NG_CC11	18.30	3.23	85%	144	12240	4.43
NG_CC12	34.20	8.15	81%	269	22883	8.46
NG_CC13	15.13	2.73	85%	119	10124	3.78
NG_CC14	21.98	5.28	81%	173	14707	5.44



Catchment ID	Impervious Catchment (ha)	Pervious Catchment (ha)	Catchment imperviousness excluding rainfall (%) split	Daily demand applied to pond (kL/day)	Annual demand applied to pond (kL/year)	Max Pump Rate (L/s)
NG_CC15	11.90	5.66	68%	94	7958	3.4
NG_CC16	34.93	12.36	74%	275	23370	8.73
NG_CC17	14.50	3.45	81%	114	9707	3.64
NG_CC18A	18.73	5.28	78%	112	9529	4.68*
NG_CC18B	18.73	5.28	78%	35	3004	
NG_CC19	13.42	3.58	79%	106	8981	3.35
NG_CC20	6.49	1.81	78%	51	4347	1.62
NG_CC21	7.23	3.44	68%	57	4838	1.82
NG_CC22	11.97	4.20	74%	94	8010	2.99
NG_CC24	21.45	4.52	83%	169	14410	4.86
NG_CC25	21.19	4.32	83%	167	14187	5.31
NG_CC26	5.43	1.39	80%	43	3636	1.3
NG_X01	5.64	1.22	82%	45	3848	1.15
NG_X02	13.73	2.43	85%	108	9212	3.38
NG_X03	8.79	1.55	85%	69	5887	2.2
NG_X04	7.75	1.44	84%	61	5208	1.93
NG_X05A	20.81	5.43	79%	118	10034	5.24*
NG_X05B	20.81	5.43	79%	48	4085	
NG_X06	13.73	3.50	80%	108	2370	2.88
NG_X07	29.74	16.74	64%	234	19894	7.43
NG_X08	61.76	22.35	73%	486	41319	15.37
NG_X10	23.46	8.95	72%	184	15694	5.78
NG_X11A	30.30	14.65	67%	143	12148	7.58*
NG_X11B	30.30	14.65	67%	96	8133	
NG_X12A	24.30	10.83	69%	144	12252	5.99*
NG_X12B	24.30	10.83	69%	47	4022	
NG_X13	23.18	4.12	85%	187	15940	5.96
NG_X98	23.29	5.32	81%	185	15778	2.39

* The pump rates correspond to the total catchment areas and shared between A and B basins

Table A- 4: Duncans Mulgoa - Basin catchment modelling parameters

Catchment ID	Impervious catchment (ha)	Pervious catchment (ha)	Catchment imperviousness excl direct rainfall %	Daily demand applied to pond (kL/day)	Annual demand applied to pond (kL/year)	Max Pump Rate (L/s)
AG_MC01	50.71	9.76	84%	468	39849	14.8
AG_MC02	17.42	4.98	78%	151	12897	4.8
AG_MC04	61.58	13.47	82%	535	45567	17.0
AG_DC01	5.47	0.96	85%	0	0	0.0
AG_DC02	25.01	4.52	85%	242	20629	7.7
AG_DC03	13.99	2.55	85%	130	11026	4.1
AG_DC04	13.97	2.64	84%	112	9534	3.6
AG_DC05	11.86	2.13	85%	96	8200	3.1
AG_DC06	16.74	8.06	68%	0	0	0.0
AG_DC07	4.17	4.43	49%	35	2962	1.1
AG_DC08	8.55	5.09	63%	62	5260	2.0
AG_DC09	14.97	5.02	75%	107	9132	3.4
AG_DC10	1.92	0.38	84%	0	0	0.0
AG_DC12	10.96	2.10	84%	40	3432	1.3
AG_DC13	7.04	11.85	37%	32	2763	1.0
AG_DC14	5.75	1.01	85%	0	0	0.0
AG_DC15	6.03	1.09	85%	114	9680	3.6
AG_DC16	6.78	1.22	85%	0	0	0.0
AG_DC17	2.77	0.52	84%	0	0	0.0
AG_DC18A	7.75	3.60	68%	99	8442	3.1
AG_DC18B	3.33	2.36	59%	0	0	0.0
AG_DC19	2.33	0.42	85%	22	1911	0.7

Table A- 5: Duncans-Mulgoa basins with piped connections to other basins

Catchment ID	Connection
AG_DC16	AG_DC15 pond

APPENDIX B – MAP OF SUB-CATCHMENTS

