

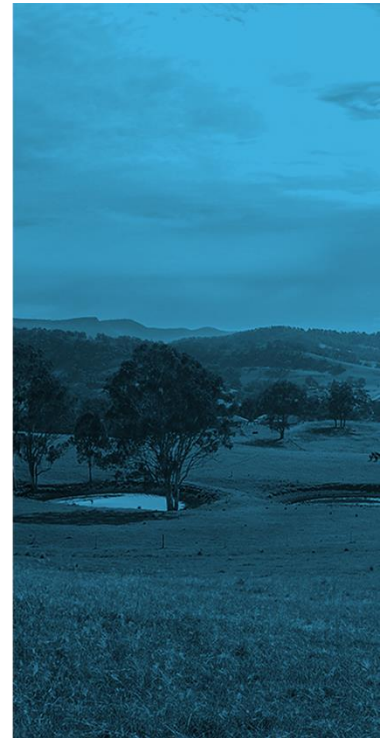
Integrated Water Cycle Management Report

DA03a

Mirvac Residential

Lot 4 in DP 1276275

No. 589 Cobbitty Road, COBBITTY



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Document Control

Revision	Prepared	Reviewed	Approved	Date	Description	Project Reference
A	Nathan Gundlach	Christopher Scholes	Mariano Polisciuk	31/03/2023	Issued for DA	21-0258-13

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Executive Summary

This report has been prepared by Orion Consulting (Orion) for Mirvac Homes (NSW) Pty Limited (Mircvac) to support the development application for the site known as No. 589 Cobbitty Road, Cobbitty, located within the Oran Park release area. This report is to be read in conjunction with the Road and Drainage Civil Engineering Plans as prepared by Orion Consulting (Job Reference 21-0258-13) for the proposed development.

This report demonstrates that the current proposed integrated water cycle management strategy meets the stormwater management and water sensitive urban design requirements as specified by Camden Council and other regulating authorities for this proposed development application.

1 Introduction

1.1 Site Description

The subject site is located within Camden Council LGA, approximately 3km South West of the new Oran Park town centre. The proposed development led by Mirvac comprises approximately 2.67 hectares in area with site extents shown in the figure below.

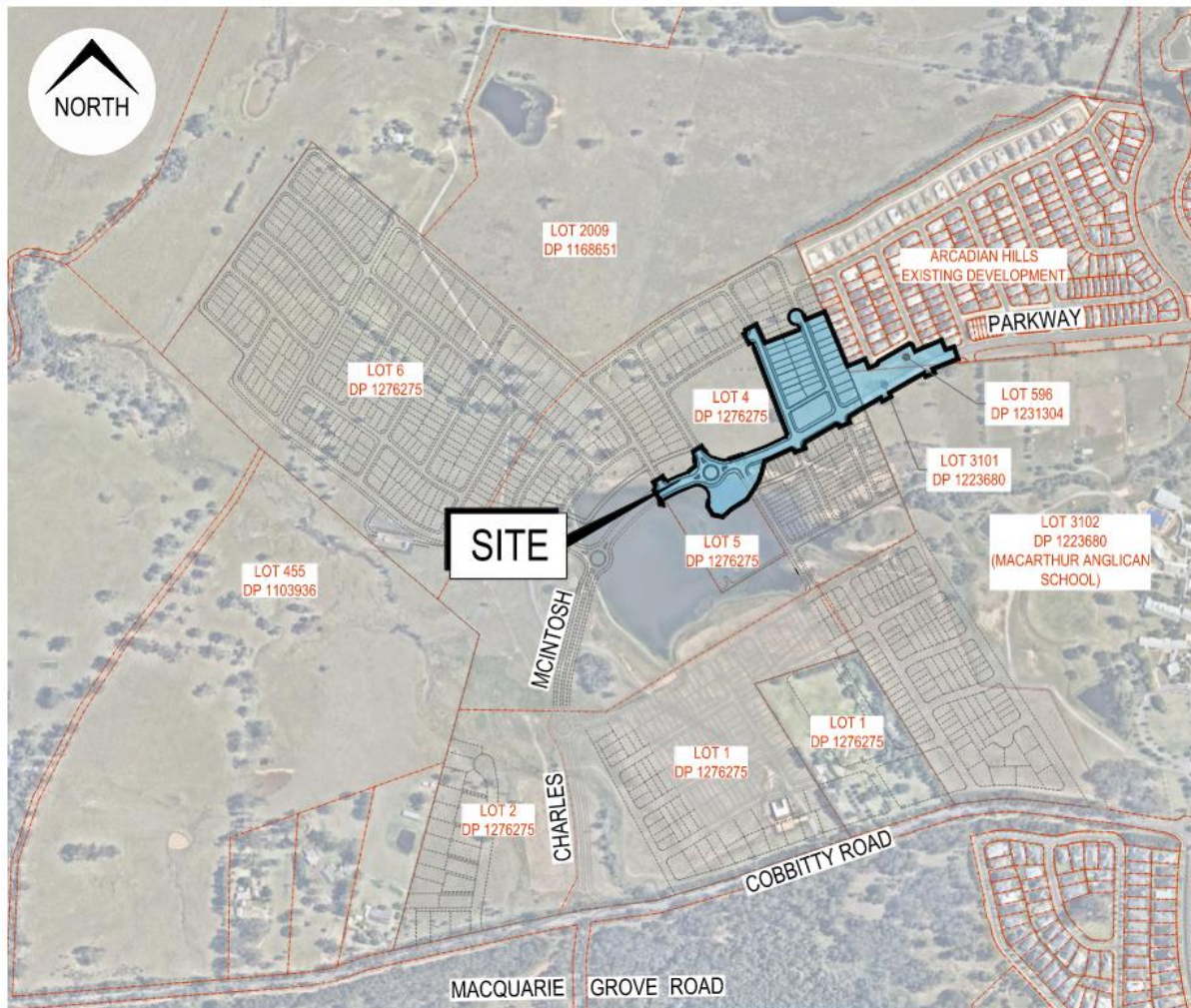


Figure 1 – Site Extents (Imagery courtesy of Nearmap ©)

The site is bordered by the Arcadian Hills development to the east, rural properties and farmland to the West, the Denbigh Heritage listed homestead to the North (531A and 531B Cobbitty Road) and proposed Stage 1 of Tranche 3 of the 531 Cobbitty Road development to the south.

A large farm dam approximately 9 hectares in area is situated centrally within the subject site and sits on-line to a 3rd order stream, entering the site along the eastern boundary from Oran Park. Cobbitty Creek enters the site along the southern boundary at an existing culvert crossing under Cobbitty Road. Both the high-level overflow from the farm dam and Cobbitty Creek combines at a washout zone with undefined creek banks that straddle the common boundary with No. 455 Cobbitty Road. The confluence of these streams results in a 4th order stream classification of Cobbitty creek exiting the site to the West.

The proposed modifications to the existing farm dam approved under the Tranche 3 Stage 1 SWC (SWC.16.2022.176.1) have been utilised for On-Site Stormwater Detention (OSD) as a result of the proposed development and urban catchment areas considered under this Development Application. Refer to the approved IWCM Report under DA2022/176 (Orion Consulting, job ref 21-0258-03, REV C, dated 15th September 2022) for information and discussion on the farm dam alterations.

1.1 The Proposed Development

As a part of the proposed development, Mirvac are proposing to provide the following:

- Maintain existing vegetation and riparian corridors along Cobbitty Creek and minimising impact to the existing riparian zones.
- Maintaining and minimising the interface with the existing farm dam to minimise development impact.
- To provide temporary integrated water cycle management control facilities to ensure performance objectives are met for the proposed development footprint.

1.2 Objectives

The purpose of this report and assessment is to design, establish and present the integrated water cycle management strategy proposed for this development submission, including the following:

- Stormwater management controls that meet the intent of the Oran Park Development Control Plan (DCP).
- Stormwater management controls that do not adversely impact conditions downstream of the subject site. Adoption of 'no-net-negative' design principles to generally ensure that post development flooding impacts are not greater than pre-existing flooding.
- Water Sensitive Urban Design (WSUD) to meet the requirements of the DCP for the post-development percentage reduction targets for total suspended solids, phosphorus, nitrogen and gross pollutants.
- Implementation of a temporary water quality treatment train for water quality control.

1.3 Study Methodology

The study methodology is in two distinct components; water quantity assessment and water quality or WSUD controls.

1.3.1 Water Quantity Methodology

- Development of overall catchment plans encompassing the whole study are with clear structure. The overall catchment mapping is consistent with the Tranche 3 Stage 1 approved IWCW Report under DA2022/176 (Orion Consulting, job ref 21-0258-03, REV C, dated 15th September 2022).
- Adoption of a DRAINS-RAFTS hydrological model, consistent with the Tranche 3 Stage 1 Integrated Water Cycle Management Addendum Report to approved DA2022/176/1 for SWC Approval (Orion Consulting, job ref 21-058-09, REV A, dated 31/01/2023) to determine pre-development and post-development flows and assess the requirements for OSD.

1.3.2 Water Quality Methodology

- Development of a detailed catchment plan encompassing a breakdown of total lots and proposed land use by sub-catchment.
- Development of a MUSIC Model (Model for Urban Stormwater Improvement Conceptualisation) for pre and post development cases to determine the treatment train requirements to achieve the percentage reduction targets.

2 Adopted Information

2.1 Integrated Water Cycle Management Report (Orion Consulting, job ref 21-0258-03, REV C, dated 15/09/2022)

A previous IWCW report has been prepared by Orion Consulting detailing the water cycle requirements for Tranche 3 Stage 1, to the south of this proposed development.

The basis for the catchment mapping, hydrological assessment and water quality assessment have been adopted from this study to assess the current proposal.

A key difference between studies is that the previous report adopted WBNM the hydrological model to assess the water quantity requirements of the proposed development.

2.2 Integrated Water Cycle Management Addendum Report to approved DA2022/176/1 for SWC Approval (Orion Consulting, job ref 21-0258-09, REV A, dated 31/01/2022)

An addendum report has been prepared in addition to the Tranche 3 Stage 1 DA report discussed above. The addendum report adopts a DRAINS-RAFTS hydrological model to determine the water quantity requirements. This study has adopted the DRAINS-RAFTS model utilised in the addendum report.

3 Hydrology – DRAINS-RAFTS

3.1 Catchment Delineation

The following catchments have been delineated for the Pre-Developed DRAINS-RAFTS Hydrological model.

The figure below shows an extract of the pre-developed scenario catchment plan and can be found in full in Appendix A.

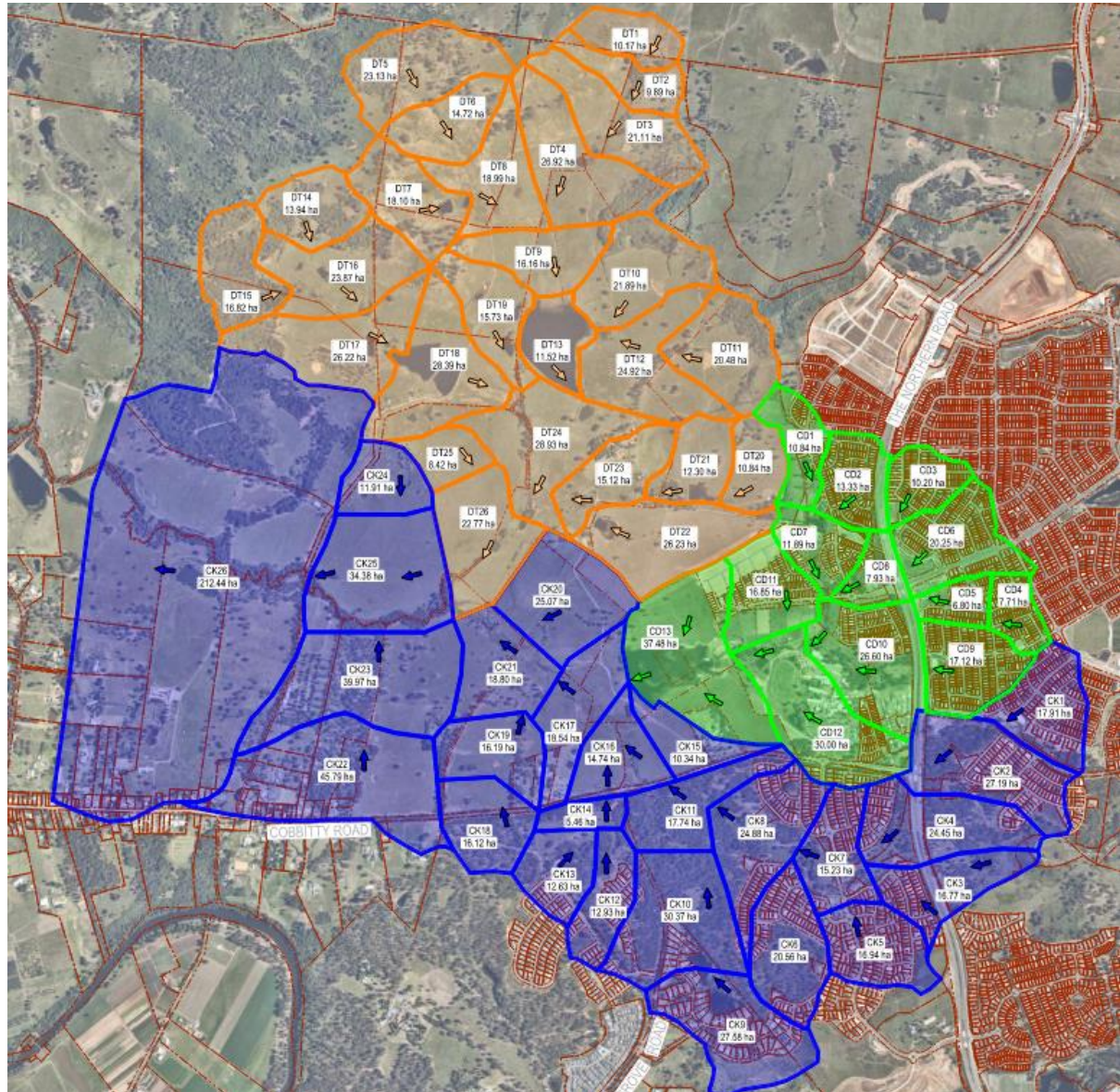
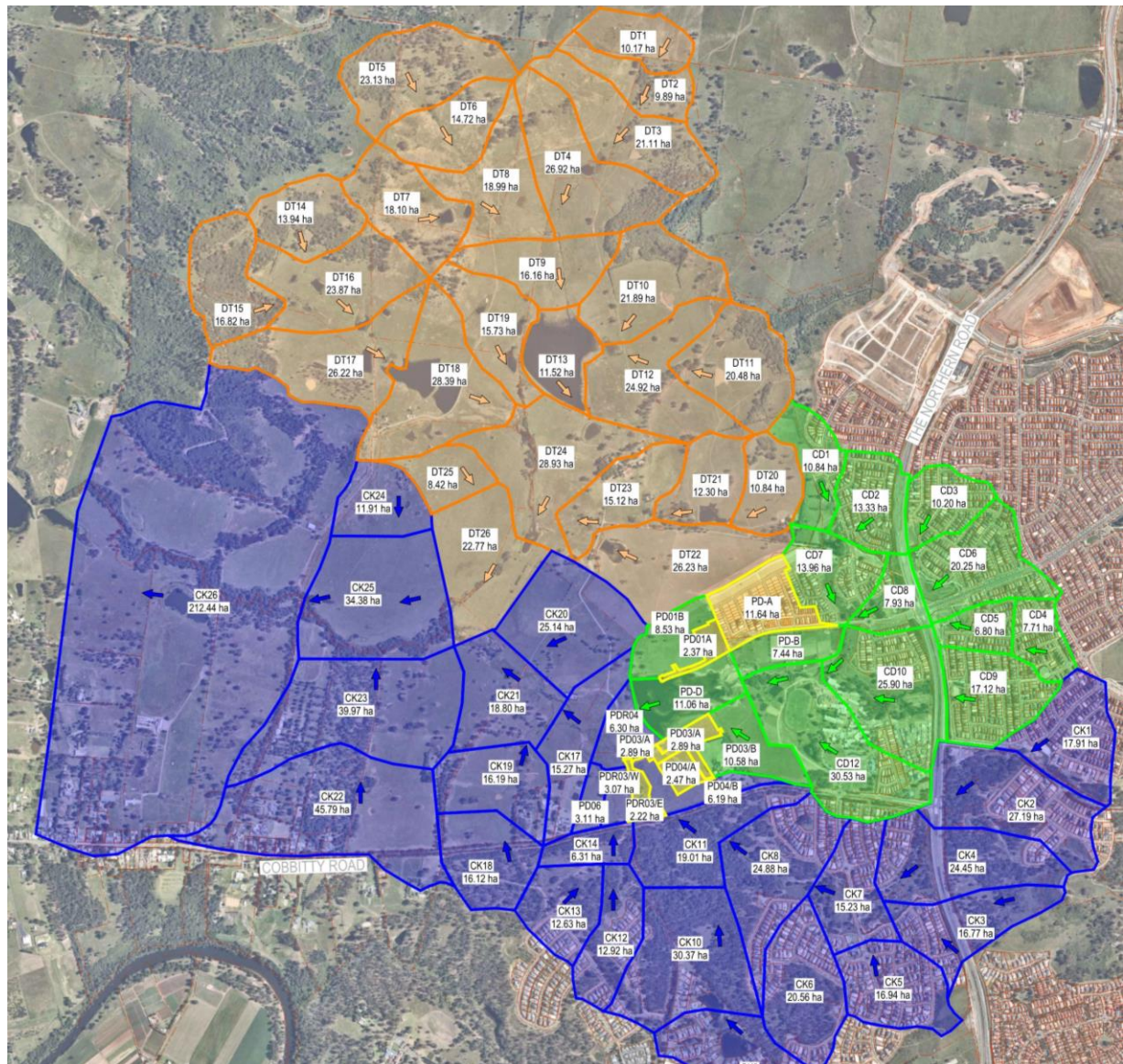


Figure 2 - Pre-Developed Scenario Catchment Plan

The pre-developed scenario catchment delineation is adjusted to suite the proposed civil engineering works. The figure below shows an extract of the post developed scenario catchment plan and can be found in full in Appendix A.



3.2 Modelling Parameters

3.2.1 Rainfall Data

ARR1987 Rainfall data was extracted from the Nepean River Tributaries study (Cardno, 2022) for the DRAINS RAFTS model. The coefficients adopted for rainfall and storm event generation are shown in Table 1 below:

Table 1 - ARR1987 Rainfall Data Coefficients

Coefficient	Value
2 Year ARI, 1 Hour Intensity	29.7 mm/hr
2 Year ARI, 12 Hour Intensity	6.36 mm/hr
2 Year ARI, 72 Hour Intensity	1.86 mm/hr
50 Year ARI, 1 Hour Intensity	59.9 mm/hr
50 Year ARI, 12 Hour Intensity	13.0 mm/hr
50 Year ARI, 72 Hour Intensity	4.06 mm/hr
F2 Factor	4.29
F50 Factor	15.78
Skew	0.02

3.2.2 Soil Loss Model

To account for soil infiltration losses an Initial Loss - Continuing Loss (ILCL) model was with the parameters shown in Table 2 below:

Table 2 - Soil Loss Model Parameters

Parameter	Loss
Initial Loss (pervious)	15 mm
Continuing Loss (pervious)	2.5 mm/hr
Initial Loss (impervious)	1.0 mm
Continuing Loss (impervious)	0 mm/hr

3.2.3 Lag Parameters

For the DRAINS-RAFTS Model the Bx factor was left at **1.0**

3.2.4 Calibration

Discussion of model calibration is contained within the Orion Consulting reports IWCM Report under DA2022/176 (Orion Consulting, job ref 21-0258-03, REV C, dated 15th September 2022) and Integrated Water Cycle Management Addendum Report to approved DA2022/176/1 for SWC Approval (Orion Consulting, job ref 21-058-09, REV A, dated 31/01/2023).

3.3 Post Developed Scenario Management Strategy

On-Site Stormwater Detention Control Measures are proposed as follows. The existing farm dam is consistent with the proposed farm dam within the SWC proposed for DA2022/176/1.

Table 3 – On-Site Stormwater Detention Facilities

Outlet / Catchment	Control Measures
Existing Farm Dam - online to existing stream	Storage above permanent water level. Weir 1: 2.3m wide @ RL 73.5 Weir 2: 5.5m wide @ RL 74.85

The post-development scenario includes demolition of the basin within the adjoining development to the east in order to facilitate the extension of Charles McIntosh Parkway through to the development site. As such, the adjoining development has been included in the post-development model to ensure that any water cycle management structures and assessment appropriately include the adjoining development.

3.3.1 On-Site Stormwater Detention Performance

OSD performance has been measured for the 5, 10, 20, 50 and 100 Year ARI critical duration events at a number of locations within the subject site.

Results have been extracted from two locations within the catchment, at the upstream end of catchment CK17, downstream of the site and at the outlet of the existing farm dam.

Table 4 - Pre vs Post Developed Scenario Flow Summary – Downstream Boundary

Event	Q _{PRE} CK17	Q _{POST} CK17	ΔQ CK17
ARI	cu.m/s	cu.m/s	cu.m/s
5	19.8	19.4	-0.4
10	24	23.5	-0.5
20	29.1	28.7	-0.4
50	35.3	34.8	-0.5
100	41.7	41.4	-0.3

From the above table the proposed OSD design reduces the post developed flows to below the modelled pre-developed flow rates downstream of the subject site. This model takes into account the existing active storage that the farm dam provides for both pre and post development scenarios.

Table 5 - Pre vs Post Developed Scenario Flow Summary - Farm Dam Outlet (Located within Site)

Event	Q _{PRE} CD13	Q _{POST} CD13	ΔQ CD13
ARI (duration)	cu.m/s	cu.m/s	cu.m/s
5	6.13	6.12	-0.01
10	7.72	7.41	-0.31
20	10.1	9.75	-0.35
50	12.7	12.7	0.00
100	15.45	15.7	+0.25

Table 6 - Post Developed Scenario - OSD Storage Facility Water Level Summary

Existing Farm Dam		
	m(AHD)	Volume (m ³)
Initial Water Level	73.50	23,882
5 Year ARI	74.79	85,050
10 Year ARI	74.93	94,634
20 Year ARI	75.10	106,968
50 Year ARI	75.27	118,591
100 Year ARI	75.42	126,075
Top of Bank (Max.) RL	76.0	

4 Water Quality

The water quality or water sensitive urban design strategy for the proposed development has been determined through the adoption and implementation of a MUSIC model. MUSIC is an industry standard modelling tool to design and size water quality controls subject to a number of water quality assessment criteria.

4.1 Assessment Metrics

The Oran Park Development Control Plan Section 6.2 identifies the following assessment criteria for water sensitive urban design:

Percentage reduction targets:

- Total Suspended Solids (TSS) 85%
- Total Phosphorus (TP) 65%
- Total Nitrogen (TN) 45%
- Gross Pollutants (GP) 90%

4.2 Proposed Treatment Train

The table below summarises the proposed treatment train strategy for the proposed development:

Table 7 - Water Quality Control Treatment Train Strategy

Outlet / Catchment	Control Measures	Comments
T4.1	Temporary GPT and Temporary 1650 m ² Conventional Raingarden	Conventional raingarden. 300mm Extended Detention depth with 500mm deep filter media. Temporary only until regional controls established

4.3 Modelling Input Data

Camden Council MUSIC Link version 6.34 was implemented for water quality modelling and assessment.

4.3.1 Catchment Delineation

The post-developed scenario catchment delineation that was adopted for the hydrological modelling has been further refined and is shown in greater detail in Appendix A. The MUSIC model includes the existing development upstream of the site, defined as PD-A in the catchment mapping.

4.3.2 Sub-Catchment Breakdown

To apply both a conservative and accurate modelling approach sub-catchments and adopted impervious areas were defined by the following method:

- i. Breakdown of the total lot areas into both roof area and supplementary (garden, driveway) areas. Supplementary areas (setbacks/gardens/driveways) were modelled as 65% impervious.
- ii. A conservative estimate of minimum 60% of the lot area (or 225sq.m per roof) has been allowed for the roof area with 50% of the roof area to drain to a rainwater tank. All roof areas were modelled as 100% impervious.
- iii. Total area of road corridors was calculated for each sub-catchment and assumed to be 95% impervious.

4.3.3 Catchment Areas Summary

The tables below summarises the primary sub-catchment areas and breakdown of land use:

Table 8 - MUSIC Sub-Catchment Summary

	T4.1 Dev	PD-A (External)	T4.B1 (Bypass
Lot Area (ha)	1.20	8.37	-
Roof Area (ha)	0.81	3.56	-
Lot Sup. Area (ha)	0.39	4.82	-
Roads (ha)	0.77	3.26	0.48
Total Area (ha)	1.96	11.64	

4.3.4 Model Layout

The figure below shows the MUSIC model layout and breakdown and can be reviewed in full in the provided modelling file (.sqz).

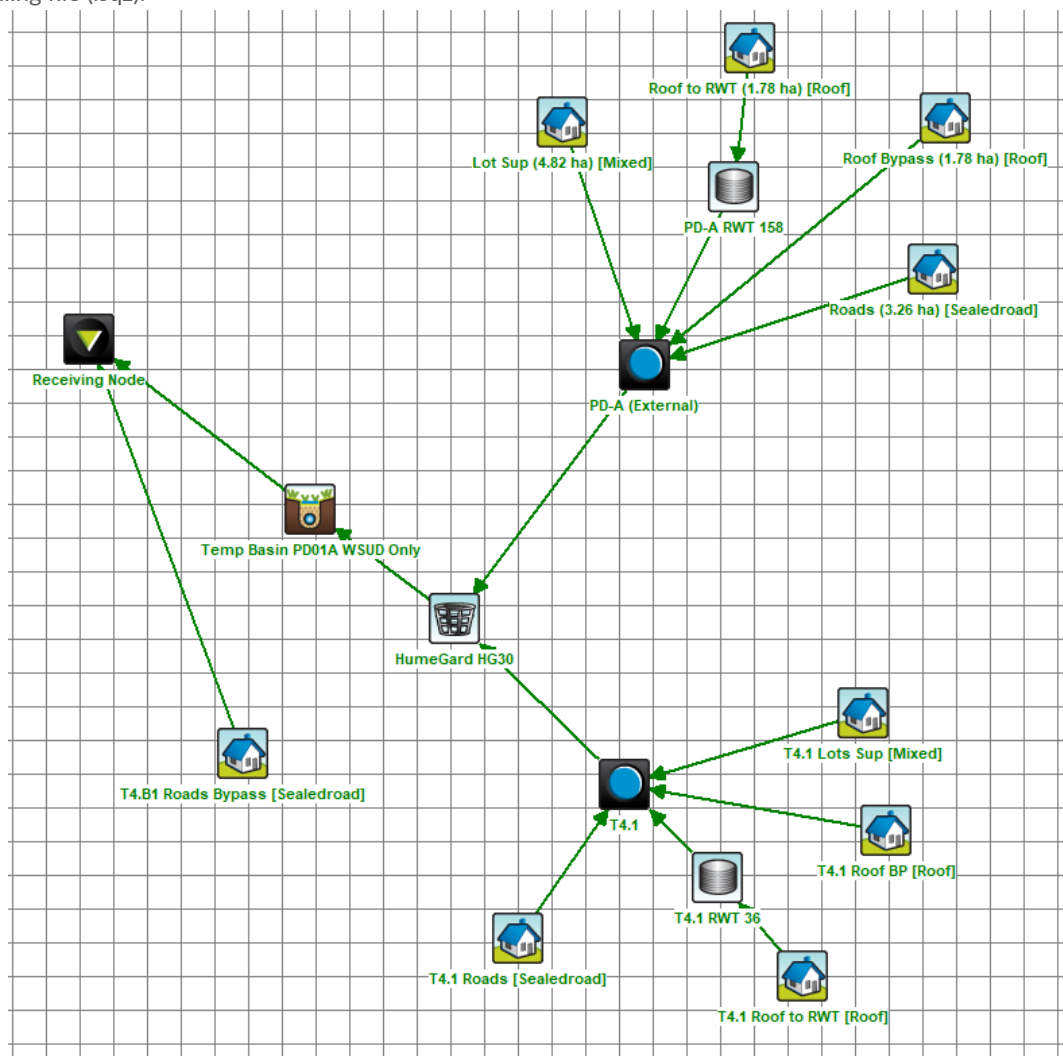


Figure 4 - MUSIC Model Layout

4.4 MUSIC Modelling Results

The table below summarises post-developed scenario source and residual pollutant loads as well as the percentage reduction results.

Table 9 - Treatment Train Effectiveness

	Sources	Residual Load	% Reduction	% Target
TSS (kg/yr)	16,600	2,470	85.1	85
TP (kg/yr)	33.2	8.88	73.2	65
TN (kg/yr)	217	79.2	63.5	45
Gross Pollutants (kg/yr)	2,460	95.7	96.1	90

The above table demonstrates percentage reduction targets are achieved with the proposed treatment train and water quality management strategy.

5 Conclusion and Recommendations

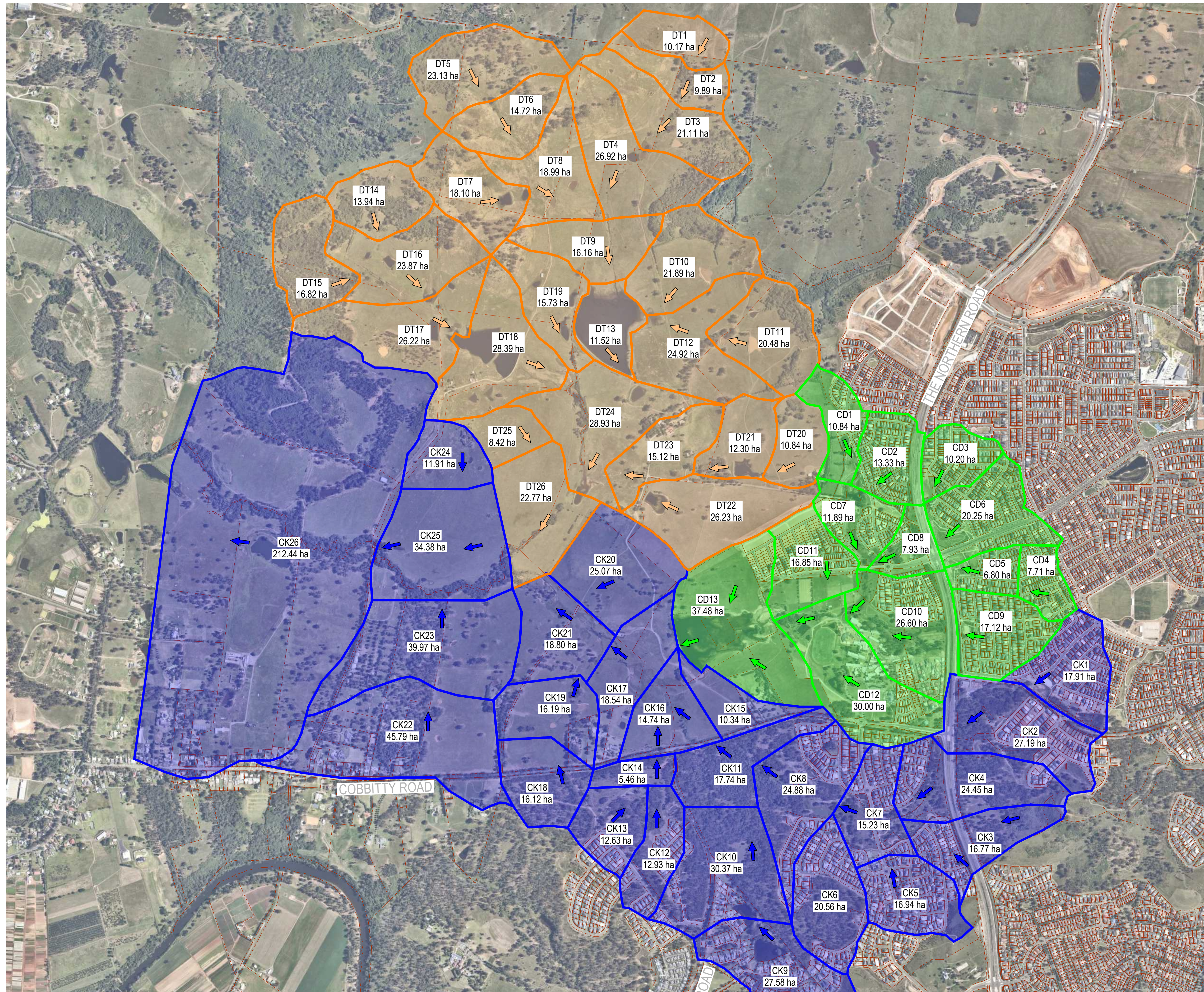
For both water quantity and water quality this report demonstrates that the proposed management strategies reduce downstream peak flows and meet the relevant regulatory requirements for water quality targets. As such, we consider that this integrated water cycle management strategy is suitable to support the development proposal.

A summary of key findings is provided below:

- i. The proposed modification to the water level and outlet structure of the existing farm dam proposed under DA 2022/176/1 is suitable to reduce the peak development flows from this proposed development to at or below pre development flows.
- ii. The proposed water quality treatment train comprising of rainwater tanks, a GPT and a temporary bioretention system meets the post developed percentage reduction targets as outlined in the Oran Park DCP

We note that the modelling and reporting of this strategy is concept in nature and future stages, under separate approvals, will be subject to further review and refinement as more detailed design of the proposed management methodology is undertaken.

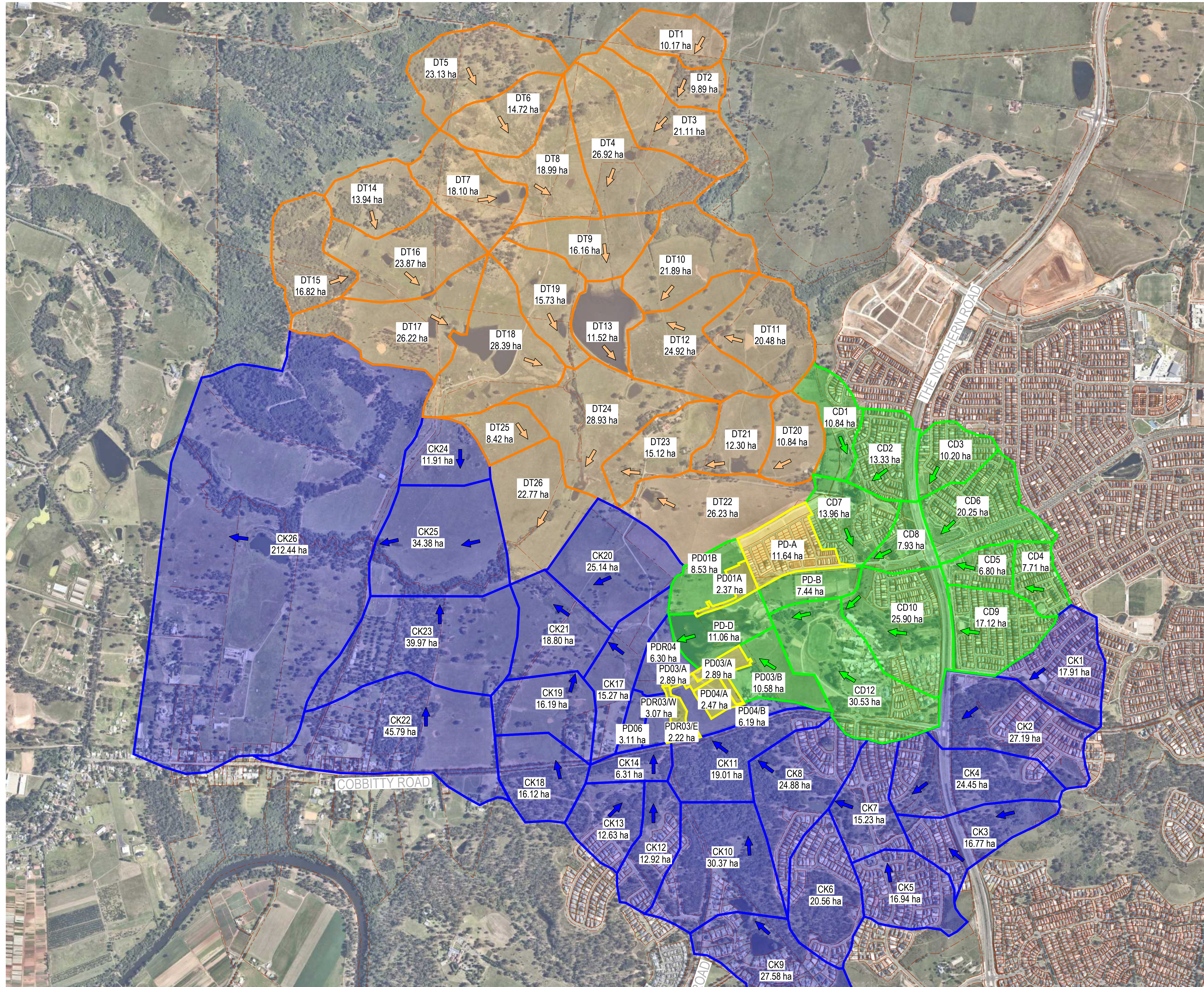
APPENDIX A - Catchment Plans



LEGEND	
CATCHMENT NAME, DIRECTION OF FALL & AREA	DESIGN 0.1760ha 
COBBITTY DAM CATCHMENTS	
COBBITTY CREEK CATCHMENTS	

ISSUED FOR INFORMATION

						Disclaimer and Copyright: ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR PRIOR TO CONSTRUCTION. USE WRITTEN DIMENSIONS ONLY, DO NOT SCALE. THESE DRAWINGS, PLANS, AND SPECIFICATIONS AND THE COPYRIGHT ARE THE PROPERTY OF ORION CONSULTING ENGINEERS PTY LTD AND MUST NOT BE REPRODUCED OR COPIED WHOLLY OR IN PART WITHOUT THE PERMISSION OF ORION CONSULTING ENGINEERS PTY LTD										Scale: 0 100 200 300 400 500 600 700 800 900 1000 SCALE 1:10000 (A1) SCALE 1:20000 (A3) For: <									
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LEGEND	
CATCHMENT NAME, DIRECTION OF FALL & AREA	DESIGN 0.1760ha 
COBBITTY DAM CATCHMENTS	
COBBITTY CREEK CATCHMENTS	
POST DEVELOPED CATCHMENTS	

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02 WP AP AP xx/xx/xxxx						RE-ISSUED FOR INTERNAL REVIEW																																																																																									
01 WP/MS AP AP 17/03/2023						ISSUED FOR INTERNAL REVIEW																																																																																									
Rev	Drawn	Design	Check	Appd.	Date	Revision Description																																																																																									

APPENDIX B - MUSIC Link Report



MUSIC-link Report

Project Details		Company Details	
Project:	Mrvac - Cobbitty T4 DA03a	Company:	The Orion Group
Report Export Date:	20/03/2023	Contact:	Christopher Scholes
Catchment Name:	21-0258 Cobbitty DA03a Music Model Temp DA	Address:	Suite 4.04/12 Century Circuit, Norwest 2153
Catchment Area:	14.1ha	Phone:	0499 010 239
Impervious Area*:	85.69%	Email:	c.scholes@theoriongroup.au
Rainfall Station:	67035 LIVERPOOL(WHITLAM		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1985 - 31/12/1994 11:54:00 PM		
Mean Annual Rainfall:	783mm		
Evapotranspiration:	1261mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.34		
Study Area:	Camden City Council		
Scenario:	Camden City Council		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: Receiving Node	Reduction	Node Type	Number	Node Type	Number
Flow	15%	Rain Water Tank Node	2	Urban Source Node	9
TSS	85.2%	Bio Retention Node	1		
TP	73.2%	GPT Node	1		
TN	63.6%				
GP	96.1%				

Comments

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	Temp Basin PD01AWSUD Only	Hi-flow bypass rate (cum/sec)	None	None	1.2
Bio	Temp Basin PD01AWSUD Only	PET Scaling Factor	2.1	2.1	2.1
GPT	HumeGard HG30	Hi-flow bypass rate (cum/sec)	None	99	1.33
Rain	PD-ARWT 158	% Reuse Demand Met	None	None	33.9643
Rain	T4.1 RWT 36	% Reuse Demand Met	None	None	34.50
Receiving	Receiving Node	% Load Reduction	None	None	15
Receiving	Receiving Node	GP % Load Reduction	90	None	96.1
Receiving	Receiving Node	TN % Load Reduction	45	None	63.6
Receiving	Receiving Node	TP % Load Reduction	65	None	73.2
Receiving	Receiving Node	TSS % Load Reduction	85	None	85.2
Urban	Lot Sup (4.82 ha)	Area Impervious (ha)	None	None	3.154
Urban	Lot Sup (4.82 ha)	Area Pervious (ha)	None	None	1.665
Urban	Lot Sup (4.82 ha)	Total Area (ha)	None	None	4.82
Urban	Roads (3.26 ha)	Area Impervious (ha)	None	None	3.104
Urban	Roads (3.26 ha)	Area Pervious (ha)	None	None	0.155
Urban	Roads (3.26 ha)	Total Area (ha)	None	None	3.26
Urban	Roof Bypass (1.78 ha)	Area Impervious (ha)	None	None	1.78
Urban	Roof Bypass (1.78 ha)	Area Pervious (ha)	None	None	0
Urban	Roof Bypass (1.78 ha)	Total Area (ha)	None	None	1.78
Urban	Roof to RWT (1.78 ha)	Area Impervious (ha)	None	None	1.78
Urban	Roof to RWT (1.78 ha)	Area Pervious (ha)	None	None	0
Urban	Roof to RWT (1.78 ha)	Total Area (ha)	None	None	1.78
Urban	T4.1 Lots Sup	Area Impervious (ha)	None	None	0.253
Urban	T4.1 Lots Sup	Area Pervious (ha)	None	None	0.136
Urban	T4.1 Lots Sup	Total Area (ha)	None	None	0.39
Urban	T4.1 Roads	Area Impervious (ha)	None	None	0.733
Urban	T4.1 Roads	Area Pervious (ha)	None	None	0.036
Urban	T4.1 Roads	Total Area (ha)	None	None	0.77
Urban	T4.1 Roof BP	Area Impervious (ha)	None	None	0.41
Urban	T4.1 Roof BP	Area Pervious (ha)	None	None	0
Urban	T4.1 Roof BP	Total Area (ha)	None	None	0.41
Urban	T4.1 Roof to RWT	Area Impervious (ha)	None	None	0.41
Urban	T4.1 Roof to RWT	Area Pervious (ha)	None	None	0
Urban	T4.1 Roof to RWT	Total Area (ha)	None	None	0.41
Urban	T4.B1 Roads Bypass	Area Impervious (ha)	None	None	0.457
Urban	T4.B1 Roads Bypass	Area Pervious (ha)	None	None	0.022
Urban	T4.B1 Roads Bypass	Total Area (ha)	None	None	0.48

Only certain parameters are reported when they pass validation

