Appendix 5 – Stormwater Strategy

AXIOM
CONSULTING
ENGINEERS

STORMWATER STRATEGY

RESIDENTIAL SUBDIVISION
4719 Midland Highway, Daylesford

Prepared For
Smith Development Partnership Pty Ltd

Document Reference
984-01Rev A

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This investigation and report have been authorised by Mr. Chris Coughlan, the Director of Axiom Consulting Engineers Pty Ltd.

Chris Coughlan BEng (Civil), MIEAust

Contents

Definitions

AEP	Annual Exceedance Probability
OSD	On-site Stormwater Detention
Rational Method	A method of estimating the runoff at a specific point and time by means of the rational formula $Q = C.I.A/360$, where C is a runoff coefficient based on type of surface, I is the rainfall intensity in mm/hour, and A is the area in hectares.
WSUD	Water Sensitive Urban Design
AS3500.3	Australian Standard for Plumbing and Drainage – Stormwater Drainage

1. EXECUTIVE SUMMARY

It is proposed for land at 4719 Midland Highway, Daylesford to be subdivided into 7 low-density residential allotments and a superlot, which will become a medium density development. Drainage infrastructure is to be provided to convey storm flows to a nominated discharge point.

There will be four elements to the proposed stormwater drainage system:

- Conveyance of flows that arise in minor storm events up to the of 20% AEP event; Those minor flows will be conveyed along the underground drainage system that will be constructed as part of the development;
- Detention of minor flows back to the discharge rate that is calculated for pre-development flow;
- Conveyance of major flows that arise in storm events greater than the 20% AEP event up to the 1% AEP event along overland flow paths to appropriately sized drainage infrastructure;
- Reduction of pollutants in stormwater flows to best practice targets

2. SITE AND SURROUNDS AND EXISTING DRAINAGE

The subject site totals approximately 3.8ha in area and exhibits a natural fall to the north and northwest. A plan showing contours of the natural surface is shown in Appendix A.

All lots will have vehicular access to proposed internal roads. The proposed layout for the development can be seen in Appendix B.

Based on the existing slopes, the site can be divided into two separate catchments – Catchments A and B. A plan showing the catchments can be found in Appendix C.

The site is located within the limits of the Hepburn Shire region and is zoned Neighbourhood Residential Zone (NRZ). The surrounding area is made up of Farming Zone (FZ) to the north, NRZ to the east and west and Industrial Zone 1 (IN1Z) to the south.

3. PROPOSED DRAINAGE STRATEGY

a. Conveyance of Minor Flows

The proposed development will incorporate a drainage system that is to be designed and constructed in accordance with the IDM[1] as follows:

i. An underground drainage system consisting of stormwater pits to collect surface flow and underground pipes connected to the pits to convey the flow towards the existing waterway/depression on the western and northern boundaries of the site;
ii. Surfaces designed and constructed so that they are free flowing and facilitate overland flows towards the receiving drainage infrastructure;

b. Detention of Minor Flows

In order to provide stormwater detention for the road reserves and lots, it is proposed to provide a detention basin for each catchment, generally as shown in Appendix D. Each basin is to be controlled by an orifice pit (dual chamber pit with diving baffle wall and orifice located at the invert).

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The orifice diameter will be determined in the detailed design phase and is dependant on the amount of head in the orifice pit (subject to detailed design of the retarding basins). Each orifice will be designed to let out a maximum flow rate equivalent of the 20% AEP pre-development flow for each catchment during a post-development 20% AEP event.

A summary of the OSD computations for the road reserves is shown below.

	CATCHMENT A		CATCHMENT B	
	20% AEP PRE-DEVELOPMENT	20% AEP POST DEVELOPMENT	20% AEP PRE-DEVELOPMENT	20% AEP POST DEVELOPMENT
Catchment Area (Ha)	1.25		1.929	
Coefficient of Runoff	0.14	0.52	0.14	0.54
Time of Concentration (min)	9	6	11	6
Rainfall Intensity (mm/h)	68	99	54	99
Flow (m^3/s)	0.048	0.168	0.062	0.244
Detention Volume Required (m^3)	51		83	

The above computations allow for the superlot to be developed as medium density rediential.

c. Major Flows

The surface of the proposed allotments will be designed such that the development is free flowing towards the stormwater pits and road reserves to ensure no damage to private property occurs. Pits and pipes will be designed to convey flows in a 20% AEP event.

Roads will act as overland flow paths for events greater than the 20% AEP and be designed to meet flood safety criteria (maximum flood depth of 0.3m, maximum velocity of 1.5m/s and maximum d x v of $0.3m^2/s$) for the 1% AEP event.

d. Water Sensitive Urban Design

To address the WSUD requirements for stormwater quality treatment post development, a MUSIC model has been produced based. MUSIC is a software tool used to measure the pollutant loads on stormwater networks based on development and the reduction of pollutants based on various treatment options. Refer to Appendix E for model layout and pollutant reduction results.

The model comprises of rainwater tanks, which would be plumbed to each dwelling for reuse in toilet flushing, laundry and irrigation. The allocated reuse volume for each lot is 2,000 litres and a reuse rate of 150 litres per day is assumed.

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Runoff from the balance of lots and road reserves will be treated using a bioretention system in each catchment, which is located in the base of the retarding basins. Storm flows will infiltrate through the filter media within the bioretention systems and be directed to the piped stormwater network via a series of agi drains.

All runoff from both catchments will discharge into the swale/depression at the western and northern boundaries of the site.

The following table shows the targets that are required to be met in order to satisfy the best practice guidelines[2] against the performance of the proposed treatment cycle (via tanks):

	Target	Projected Performance
Reduction in suspended solids	80%	90.0%
Reduction in total nitrogen	45%	56.4%
Reduction in total phosphorous	45%	53.8%

The MUSIC model demonstrates best practice targets are met. And makes allowance for the superlot to be developed as medium density residential.

4. CONCLUSION

A drainage system is to be included in the development in accordance with the Infrastructure Design Manual that conveys minor flows in subsurface drainage pipes and allows major flows to discharge through the catchments to the existing waterways west and north of the site (or 1% AEP pipe if no overland flow path is available).

Detention is to be provided that will reduce the storm flows to pre-development flow rates in a 20% AEP event.

WSUD best practice guidelines will be achieved by directing storm flows from roofs to water tanks and balance land to bioretention systems.

5. REFERENCES

1 Infrastructure Design Manual (version 5.10), *Local Government Infrastructure Design Association*, 11 January 2018.

2 WSUD ENGINEERING PROCEDURES STORMWATER, CSIRO PUBLISHING, 2005

3 SPEL are a leading provider in Australia of Stormwater Treatment products

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APPENDIX A – Site Contours

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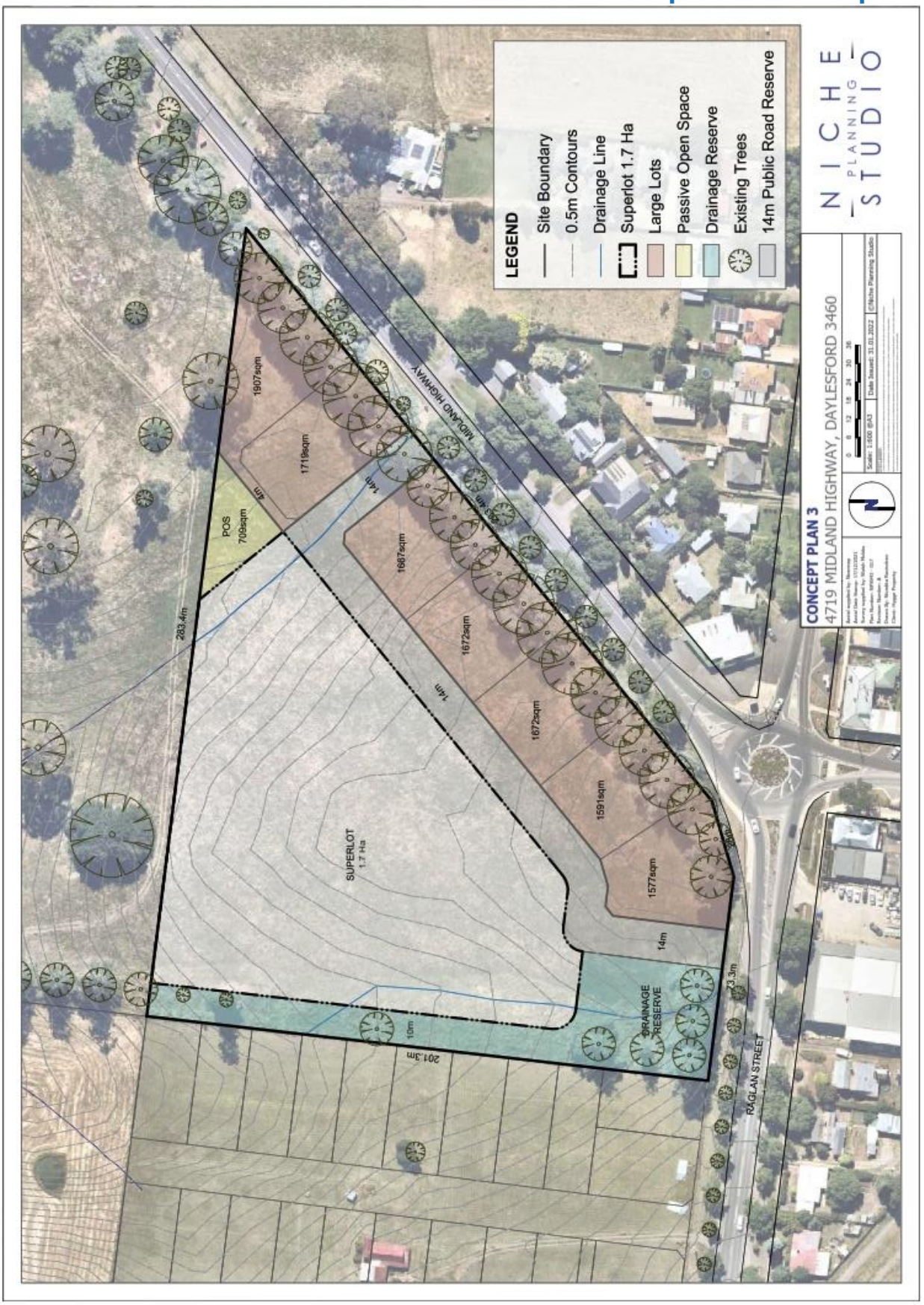
APPENDIX B – Proposed Development



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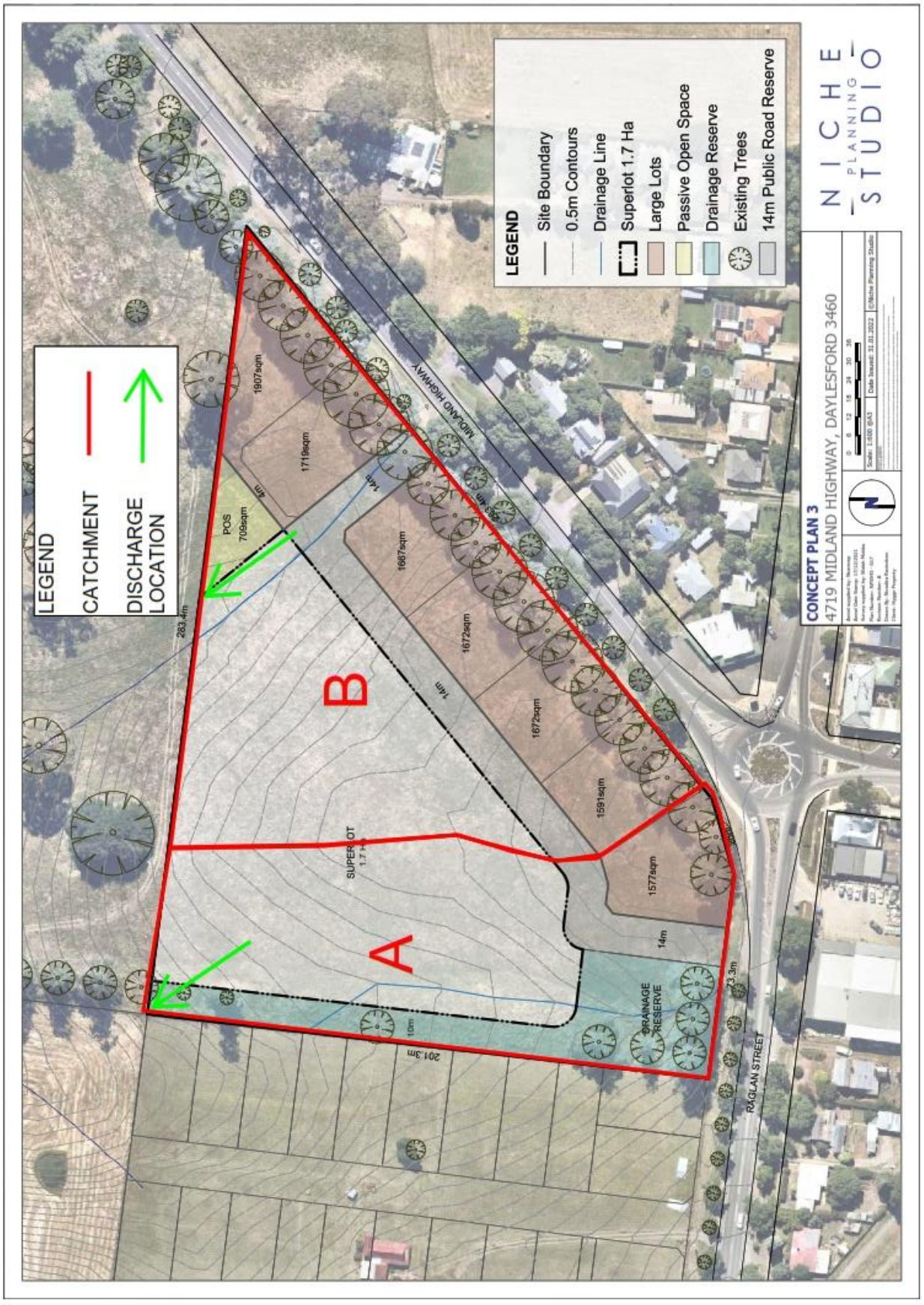
APPENDIX C – Catchment Plan



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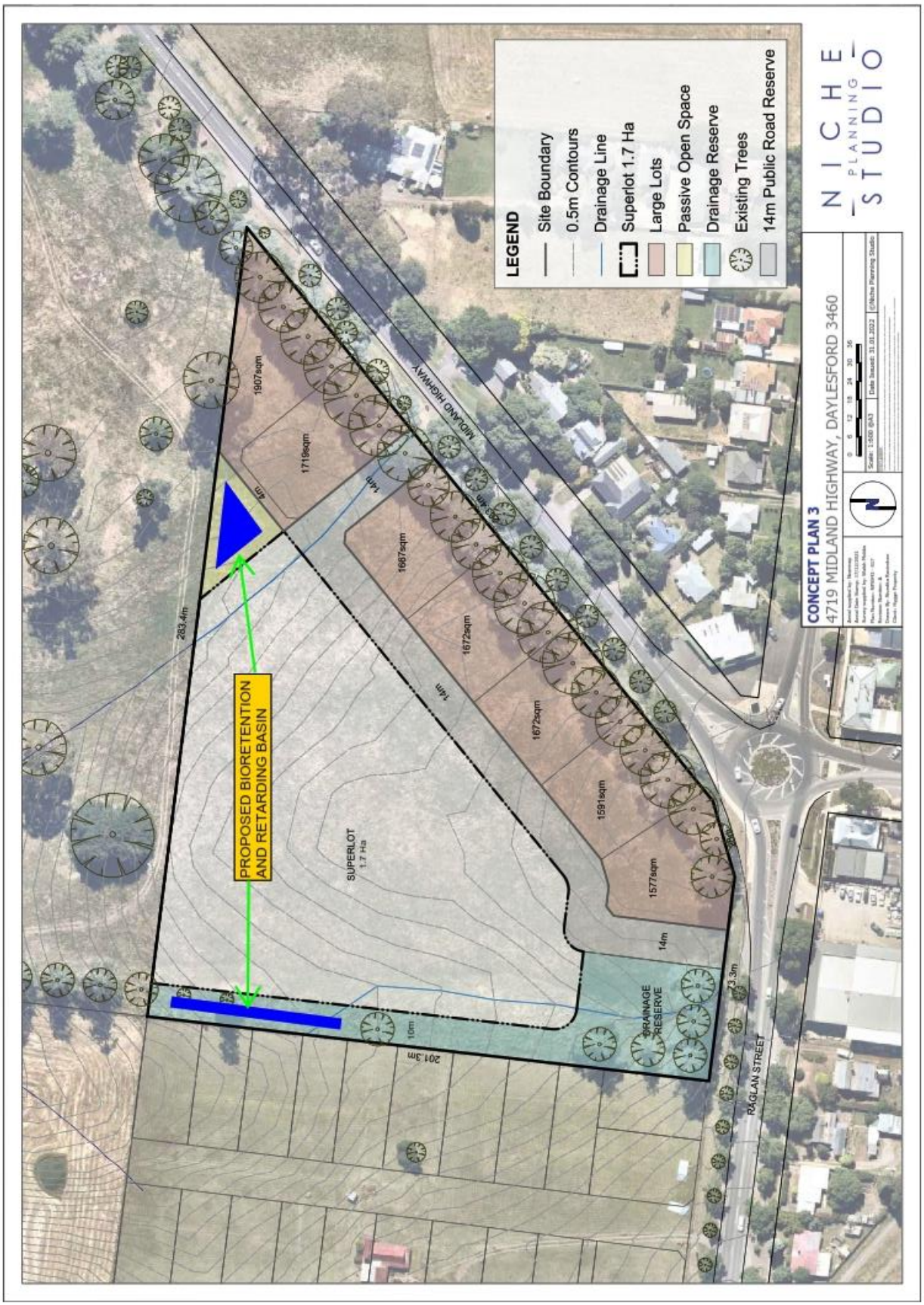
APPENDIX D – Retarding Basin Plan



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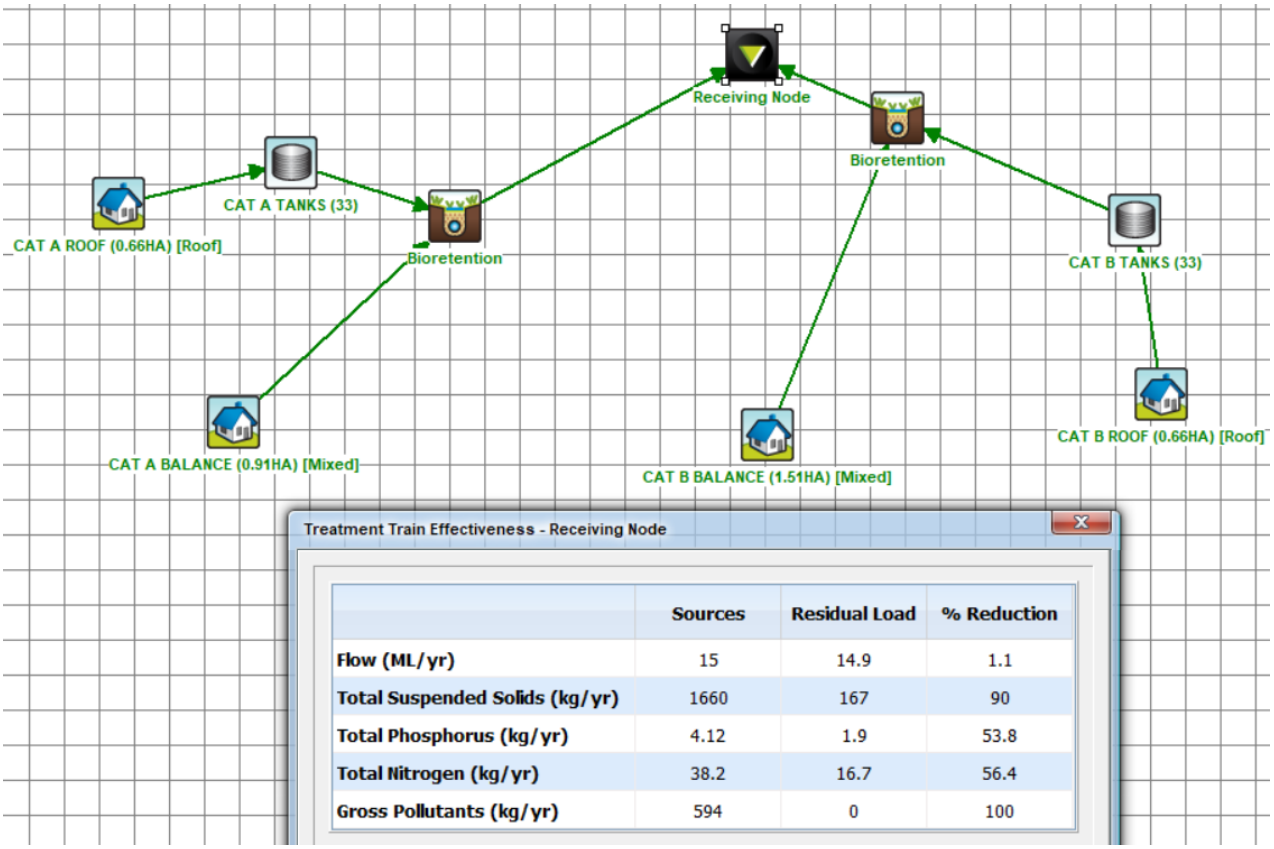
APPENDIX E – MUSIC Model



Treatment Train Effectiveness - Receiving Node

	Sources	Residual Load	% Reduction
Flow (ML/yr)	15	14.9	1.1
Total Suspended Solids (kg/yr)	1660	167	90
Total Phosphorus (kg/yr)	4.12	1.9	53.8
Total Nitrogen (kg/yr)	38.2	16.7	56.4
Gross Pollutants (kg/yr)	594	0	100

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