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Water Quality Management Plan

Proposed Outlook Stage 10 Subdivision

Property:

Lot 10 DP 270583
Minmi Road, Fletcher

Applicant:

Northwest Residential Pty Ltd

Date:

August 2018

Project Management • Town Planning • Engineering • Surveying
Visualisation • Economic Analysis • Social Impact • Urban Planning

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Document Control Sheet

Issue No.	Amendment	Date	Prepared By	Checked By
A	Initial Issue	August 2018	JB	ND
B	Council comments	August 2018	BM	ND

Limitations Statement

This report has been prepared in accordance with and for the purposes outlined in the scope of services agreed between ADW Johnson Pty Ltd and the Client. It has been prepared based on the information supplied by the Client, as well as investigation undertaken by ADW Johnson and the sub-consultants engaged by the Client for the project.

Unless otherwise specified in this report, information and advice received from external parties during the course of this project was not independently verified. However, any such information was, in our opinion, deemed to be current and relevant prior to its use. Whilst all reasonable skill, diligence and care have been taken to provide accurate information and appropriate recommendations, it is not warranted or guaranteed and no responsibility or liability for any information, opinion or commentary contained herein or for any consequences of its use will be accepted by ADW Johnson or by any person involved in the preparation of this assessment and report.

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The Client should be aware that this report does not guarantee the approval of any application by any Council, Government agency or any other regulatory authority.

Executive Summary

ADW Johnson was commissioned by Northwest Residential to prepare a Water Quality Management Plan (WQMP) for stage 10 Outlook Estate, a proposed 116 lot staged subdivision located within Lot 10 DP 270583, Minmi Road, Fletcher.

Stage 10 is the final stage of a larger subdivision approved under Part 3A of the Planning Act. The original approval required the submission of a revised layout for Stage 10 and supporting documentation to be submitted for approval under S75W of the Act.

An existing Stormwater Management Report, prepared by Urban Water Cycle Solutions in 2006, has previously been approved for the development with all stormwater works constructed to date in accordance with that report.

Due to topographical constraints within stage 10 and the proposed amendments to the layout the proposed stormwater management for the stage will differ from the original approved stormwater management report.

This report has been prepared in response to Newcastle City Council's concerns that the stormwater strategy from stage 10 differs from the original approved report. The report outlines the proposed stormwater strategies to comply with the original approved objectives and outcomes in line with Newcastle City Council requirements.

A treatment train process of rainwater tanks, litter baskets, GPT's, bio retention swales and filtration basins was designed to ensure the proposed development met the key objectives contained in Council's DCP.

It has been shown that, by slightly modifying the existing approved stormwater strategy to complement the layout and topography of the site, Council's key objectives can still be met.

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1.0 Introduction

ADW Johnson was commissioned by Northwest Residential to prepare a Water Quality Management Plan (WQMP) for stage 10 Outlook Estate, a proposed 116 lot staged subdivision located within Lot 10 DP 270583, Minmi Road, Fletcher.

Stage 10 is the final stage of a larger subdivision approved under Part 3A of the Planning Act. The original approval required the submission of a revised layout for Stage 10 and supporting documentation to be submitted for approval under S75W of the Act.

An existing Stormwater Management Report, prepared by Urban Water Cycle Solutions in 2006, has previously been approved for the development with all stormwater works constructed to date in accordance with that report.

Due to topographical constraints within stage 10 and the proposed amendments to the layout, the proposed stormwater management for the stage will differ from the original approved stormwater management report.

This report has been prepared in response to Newcastle City Council's concerns that the stormwater strategy from stage 10 differs from the original approved report. The report outlines the proposed stormwater strategies to comply with the original approved objectives and outcomes in line with Newcastle City Council requirements.

2.0 Site Description

2.1 EXISTING SITE

The subject site, as depicted in **Figure 1**, is stage 10 of the Outlook Estate, located within Lot 10 DP 270583, Minmi Road, Fletcher. The site has an area of approximately 14.86ha.

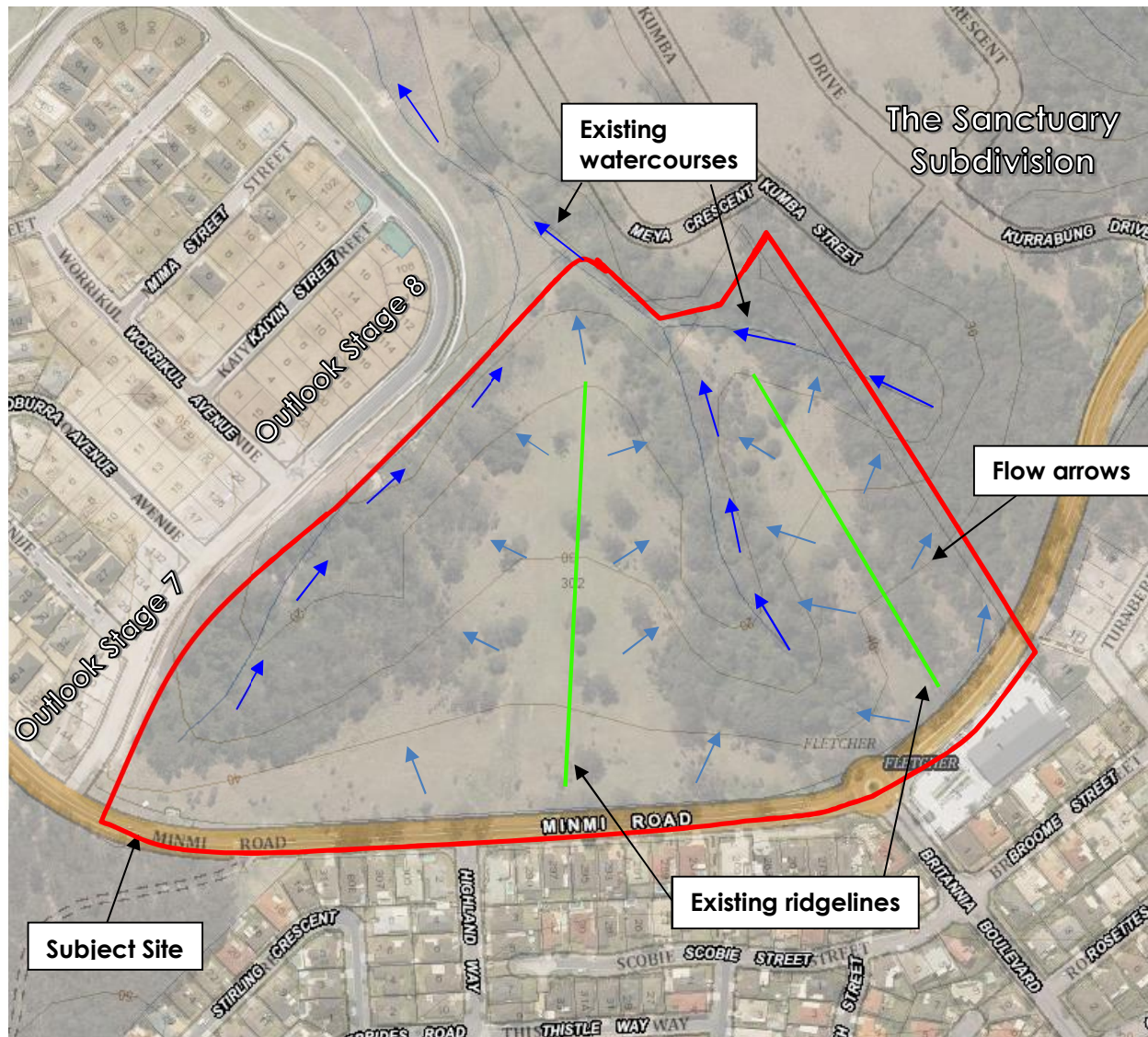


Figure 1: Site Locality (Six Maps Image)

The existing site, as shown in Figure 1, is bound to the south by Minmi Road, to the north and east by the Sanctuary subdivision and to the west by stages 7 and 8 of the Outlook Estate.

The site generally slopes to the north at grades of approximately 3-10%. The site contains two (2) existing ridgelines which are primarily cleared with only a few trees and scattered vegetation present. The existing topography discharges water into three (3) primary watercourses within existing gullies that are densely vegetated. These three (3) gullies combine to form a secondary watercourse, just outside of the site boundary, that discharges into Hexham Swamp to the north of the site.

In addition to the runoff generated within the site itself, flows currently enter the site from the east via an existing gully on the adjoining property and from the previous stages of Outlook Estate to the west.

To the south, Minmi Road acts as the ridgeline with minor flows, primarily through sheet flow, also entering the site from the northern half of Minmi Road.

The existing site can be seen in **Exhibit 1**.

2.2 PROPOSED DEVELOPMENT

The proposed development is a 116-lot staged subdivision providing a combination of small lot housing and medium density residential lots and the associated infrastructure. Similar to the existing site, the proposed development will drain via a number of different stormwater devices to the existing gullies and ultimately discharge into Hexham Swamp to the north of the site. The proposed development can be seen in Figure 2 below.



Figure 2: Proposed development layout

3.0 Objectives

The objectives of this report are to outline the different stormwater devices proposed for the stage to complement the layout and topography of the site and demonstrate that the proposed modifications to the approved stormwater management strategy are consistent with the objectives and outcomes of the approved strategy.

It is still proposed to utilise GPT's, bio-retention swales, vegetated buffer strips and contour banks to convey and treat stormwater before discharging from the site, however in a configuration that suits the layout and topography of the site.

3.1 STORMWATER QUALITY

The stormwater drainage system must effectively remove nutrients and gross pollutants from the site prior to the runoff entering the downstream receiving waters. The guidelines for stormwater quality treatment objectives are expressed as mean annual reductions of pollutant loads. The target objectives for the development are contained within Table 4 of the DCP and are reproduced in **Table 1** below.

Table 1: Stormwater Treatment Objectives

Pollutant	Retention Criteria
Suspended Solids	85% reduction in the average annual load of Total Suspended Solids
Total Phosphorus	65% reduction in the average annual pollutant load of Total Phosphorus
Total Nitrogen	45% reduction in the average annual pollutant load of Total Nitrogen
Gross Pollutants	90% reduction in the average annual pollutant load of Gross Pollutants

4.0 Stormwater Quality Management Strategy

The stormwater system contains a combination of conventional pit and pipe networks and WSUD elements to effectively convey stormwater runoff to the downstream waterways. A number of different treatment devices are proposed within the development to ensure the water quality objectives are met prior to runoff discharging into the downstream receiving waters.

4.1 STORMWATER TREATMENT TRAIN

The stormwater design for the proposed subdivision proposes to use a combination of at source, conveyance and end of line controls to treat the stormwater runoff prior to it leaving the site. The treatment train will be modelled for demonstration of compliance with Council's key performance objectives.

At Source

The roof runoff for each of the future dwellings will be captured by rainwater tanks where the stormwater will receive at source treatment via a first flush system.

Rainwater tanks will also be used to store stormwater for reuse within each dwelling. Whilst the high density lots will have rainwater tanks, as the final built form layout of these lots is currently unknown, these lots have been conservatively modelled with no reuse.

Conveyance

Runoff from the lots, roads and open space areas will be conveyed through a series of GPTs or litter baskets, and bio retention swales.

Litter baskets will be provided in a number of kerb inlet pits to capture gross pollutants and coarse sediments prior to discharge into the bio retention swales. Where the drainage network consists of a long reach of pit and pipes prior to discharge into the swales, a full size GPT will be provided upstream of the swales in lieu of litter baskets.

Bio retention swales are proposed to be provided along the outside perimeter of Road No.1 to provide further treatment prior to discharge from the development. The proposed bio retention swales are to be grassed or rock lined swales underlain by a column of filter media in accordance with NCC standards.

It is noted that the at source and conveyance controls, of litter baskets, GPT's and bio retention swales comply with the strategy outlined in the existing report.

Due to the topography and constraints of the site it is not feasible to include bioretention swales on all of the perimeter roads. This was further noted by council in their response to the original submission. To account for this, additional end of line controls are required to ensure that Council's requirements are met.

End of Line

Due to the topography of the site, it is not viable to drain the entire development to the bio retention swales. As such it is proposed to provide two filtration basins/ trenches within the central gully corridor to provide treatment to those areas that cannot drain to the swales. The filtration basins will act similarly to the gravel diffuser trenches in the original strategy.

The proposed stormwater strategy can be seen in **Exhibit 2**, whilst a summary of the treatment devices adopted for the development can be seen in **section 4.4**.

4.2 MODELLING

In order to demonstrate the effectiveness of the modifications to the strategy, stormwater quality modelling was undertaken using the water quality modelling software MUSIC. MUSIC is considered to be industry best practice for analysis of the effectiveness of treatment mechanisms on the quality of stormwater runoff.

4.2.1 MUSIC LINK

MUSIC Link provides standard modelling nodes for individual LGA's to ensure the most accurate modelling is undertaken within each catchment. MUSIC link provides preset rainfall and evapotranspiration data along with pollutant load and soil type data for given surface types.

It is noted that the NCC MUSIC link provides standard data for four (4) different catchment areas. In accordance with Appendix 8 of the STM, the nodes and data associated with "Catchment 1" were adopted for this development.

4.2.2 Catchment Data

In order to accurately model the pollutant runoff for a given development, the proposed catchments are required to be split into road, roof and remaining lot areas.

The post-developed sub catchment boundaries were determined from the proposed development layout, concept grading and concept stormwater design. The post developed catchments can be seen in **Exhibit 3**, whilst a summary of the areas can be seen in **Table 2** below.

Table 2 – MUSIC Sub catchment Areas

Catchment	Sub Catchment	Total Area (ha)	% Impervious	Impervious Area (ha)	Pervious Area (ha)
Outlet 1	Litter basket 1 Road	0.13	60	0.08	0.05
Outlet 2	Swale 1 High Density Lot (West)	0.97	60	0.58	0.39
	Swale 1 High Density Roof (West)	0.2	100	0.2	0.0
	Swale 1 High Density Lot (East)	0.16	80	0.13	0.03
	Swale 1 High Density Roof (East)	0.15	100	0.15	0.0
	Swale 1 Lots (West)	0.15	80	0.12	0.03
	Swale 1 Roof (West)	0.28	100	0.28	0.0
	Swale 1 Road (West)	0.33	60	0.2	0.13
	Swale 1 Lots (East)	0.48	80	0.38	0.1
	Swale 1 Roof (East)	0.66	100	0.66	0.0
	Swale 2 Road	0.13	60	0.38	0.25
	Swale 2 Lots	0.31	80	0.25	0.06
	Swale 2 Roof	0.34	100	0.34	0.0
	GPT 4 Road	0.43	60	0.34	0.22
Outlet 3	Filtration 1 Lots	0.15	80	0.12	0.03
	Filtration 1 Roof	0.08	100	0.08	0.0
	GPT 2 Lots	0.35	80	0.28	0.07
	GPT 2 Roof	0.50	100	0.50	0.0
	GPT 2 Road	0.46	60	0.28	0.18
Outlet 4	Filtration 2 Lots	0.1	80	0.08	0.02
	Filtration 2 Roof	0.04	100	0.04	0.0
	GPT 3 Lots	0.24	80	0.19	0.05
	GPT 3 Roof	0.34	100	0.34	0.0
	GPT 3 Road	0.36	60	0.22	0.14
Open Space	Open Space 1	3.0	10	0.3	2.7
	Open Space 2	2.33	10	0.23	2.1
	Open Space 3	1.5	10	0.15	1.35
Pump Station	WWPS	0.07	100	0.07	0.0

For the purposes of the modelling it was assumed that each lot would consist of a 100% impervious, 200 m² roof. The remaining area of each lot was modelled as being 80% impervious (accounting for other hardstand areas such as driveways).

The impervious percentage of 60% adopted for the roads was calculated based upon the proposed road layout, accounting for the road carriageway, footpaths and landscaped verges.

The existing drainage gullies were modelled as open space nodes with a 10% impervious area percentage. The proposed Fletcher 5 WWPS at the northern tip of the development was modelled as 100% impervious.

As the open space areas within the existing drainage gullies are proposed to remain untouched for the proposed development, no treatment devices have been provided for these areas. It is however noted that the proposed road crossings over these gullies will effectively form a detention basin and as such detention basin nodes have been modelled in the MUSIC model.

4.3 RESULTS

In accordance with NCC requirements, modelling has been undertaken to demonstrate compliance with the water quality objectives for stormwater runoff from the proposed development. Whilst the catchments were split into multiple outlets for the ease of modelling, the treatment objectives are only considered at the outlet to the overall site. The results of the modelling is shown in **Table 3**.

Table 3: MUSIC Modelling Results

Catchment	Pollutant	Source (kg/yr)	Residual Load (kg/yr)	Reduction (%)	Target (%)
Site Outlet	TSS	11200	1340	88.1	85
	TP	22.1	7.72	65.1	65
	TN	165	81.4	50.6	45
	GP	1930	45.6	97.6	90

It can be seen from **Table 3** that the proposed treatment train of rainwater tanks, litter baskets, gross pollutant traps, bio retention swales and filtration basins adequately treat the runoff generated by the development and meet the key performance criteria set out by Council.

A screenshot of the MUSIC model and a copy of the MUSIC link report can be seen in Appendix A.

4.4 TREATMENT DEVICES

As indicated in the sections above, a number of treatment devices are required in order to meet the treatment target specified by Council. A summary of the required treatment devices can be seen below.

4.4.1 Rainwater Tanks

Rainwater tanks are to be provided for all dwellings within the proposed development. Rainwater tanks were modelled as 10kL tanks with a 90mm overflow pipe located at the top of the tank. The top half of the tank is to be used as detention space with a 5mm weep hole located at the midpoint of the tank connected to the overflow pipe in accordance with NCC DCP requirements for Wetland Catchments.

It was assumed that each rainwater tank would store water for reuse within the proposed dwellings. Reuse numbers for the proposed development have been adopted from Table 4.1 in the NCC STM. It has been conservatively assumed that all small lot housing lots will be either 1 or 2 bedrooms and the rainwater tanks will be used for toilet and laundry reuse only (91 kL/yr/dwelling).

Whilst the high density lots have been modelled with rainwater tanks, as the final layout of the built form within these lots is unknown it has been conservatively assumed that no reuse will be supplied for the purpose of this modelling.

4.4.2 Litter Baskets / Gross Pollutant Traps

Litter baskets and gross pollutant traps have been designed assuming Ecosol units will be specified. It is noted that other manufacturer's products are able to meet the required targets and could be specified if required.

Ecosol units have been selected despite Council stating their preference for a Rocla CDSTM unit as the remainder of the development has already been installed with a number of Ecosol units for consistency within the development. Council already maintains these Ecosol units so it makes sense to keep the same type of unit consistent within the development so they can maintain them all together.

The modelling does not rely on the type of GPT and any equivalent GPT can be used in the place of the nominated unit.

4.4.3 Bio retention Swales

Bio retention swales have been specified along parts the perimeter of Road No.1 to provide conveyance treatment to runoff generated by the development.

The bio retention swales have been designed as grassed or rock lined swales underlain by a column of filter media and a drainage layer. It is noted that the NCC STM specifies that bio retentions swales should be densely planted with native species, however in accordance with the previously approved report the swales have been designed to be turfed lined or rock lined only. This will allow for consistency with the already completed development to the west and reduce the required maintenance of the swales.

In accordance with the STM, the filter media column is to consist of a 0.6m deep filter media, 0.1m deep transition layer and 0.2m deep drainage layer. A typical bio retention swale detail can be seen in **Exhibit 4**.

All parameters adopted within the MUSIC model for the bio retention swales are in accordance with the NCC STM.

4.4.5 Filtration Basins

To enable the treatment of areas that are unable to drain to the bio retention swales, two Filtration basins have been proposed within the central drainage corridor.

Both of these basins are to have a filter area of approximately 60m² and a maximum extended detention depth of 0.3m. The basins have been modelled with a filtration media depth of 0.6m.

The basins have been located adjacent to the perimeter road to allow easy maintenance access.

All parameters adopted within the MUSIC model for the filtration basins are in accordance with the NCC STM.

10.0 Conclusion

ADW Johnson was commissioned by Northwest Residential to prepare a Water Quality Management Plan (WQMP) for stage 10 Outlook, a proposed 116-lot staged subdivision located within Lot 10 DP 270583, Minmi Road, Fletcher.

An existing Stormwater Management Report, prepared by Urban Water Cycle Solutions in 2006, has previously been approved for the development with all stormwater works constructed to date in accordance with that report.

Due to topographical constraints within stage 10 and the proposed amendments to the layout the proposed stormwater management for the stage will differ from the original approved stormwater management report.

This report was prepared to supplement the existing report, outlining the required changes to the water quality treatment strategy in order to comply with the Newcastle City Council Standards.

A treatment train process of rainwater tanks, litter baskets, GPT's, bio retention swales and filtration basins was designed to ensure the proposed development was consistent with the objectives and outcomes of the previously approved report.

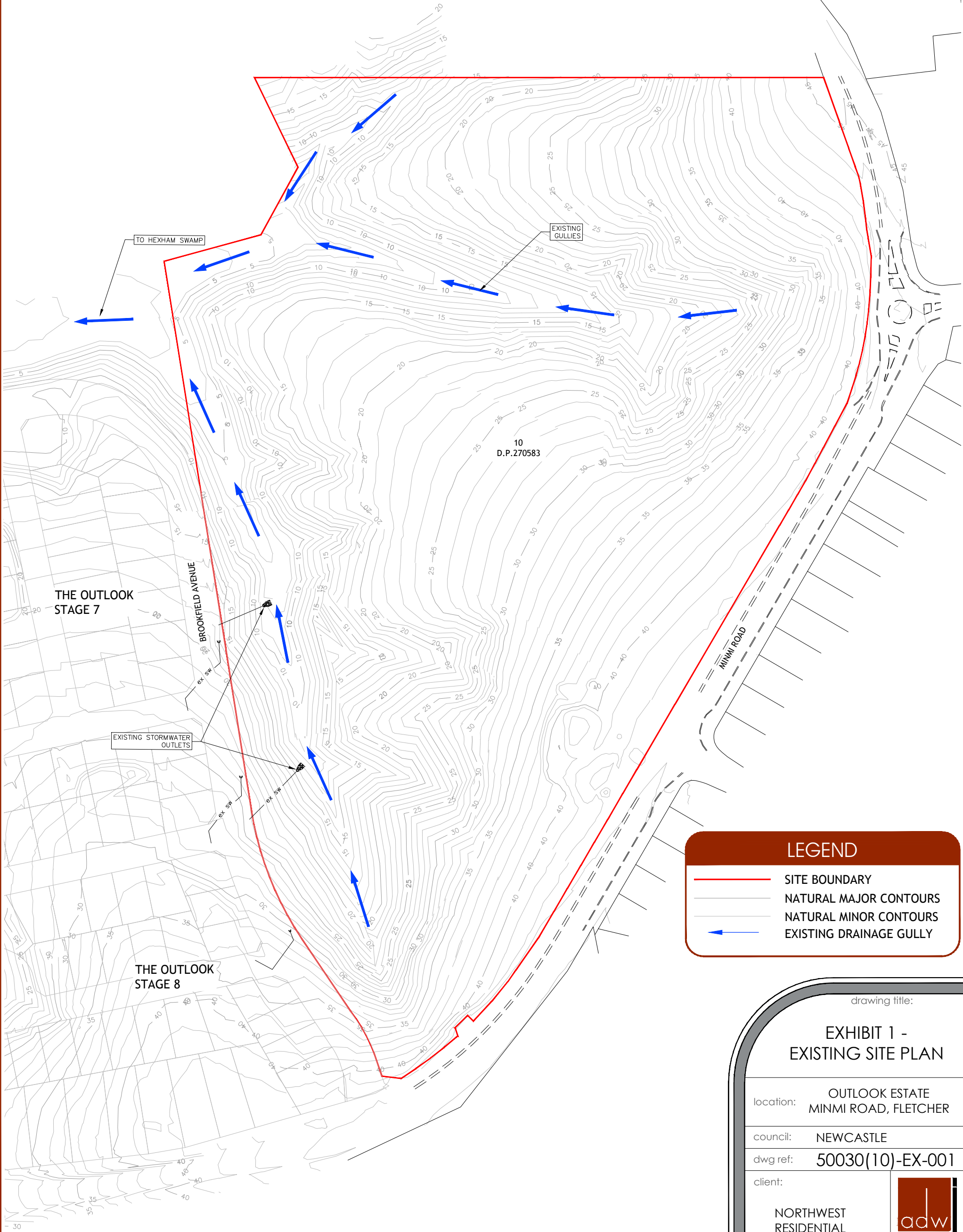
It has been shown that, by slightly modifying the existing approved stormwater strategy, Council's key objectives can still be met.

Exhibits

Exhibit 001	Existing Site Plan
Exhibit 002	Proposed Development Plan
Exhibit 003	Catchment Plan
Exhibit 004	Typical Details



THE SANCTUARY



LEGEND

- SITE BOUNDARY
- NATURAL MAJOR CONTOURS
- NATURAL MINOR CONTOURS
- EXISTING DRAINAGE GULLY

drawing title:

EXHIBIT 1 -
EXISTING SITE PLAN

location: OUTLOOK ESTATE
MINMI ROAD, FLETCHER

council: NEWCASTLE

dwg ref: 50030(10)-EX-001

client:

NORTHWEST
RESIDENTIAL

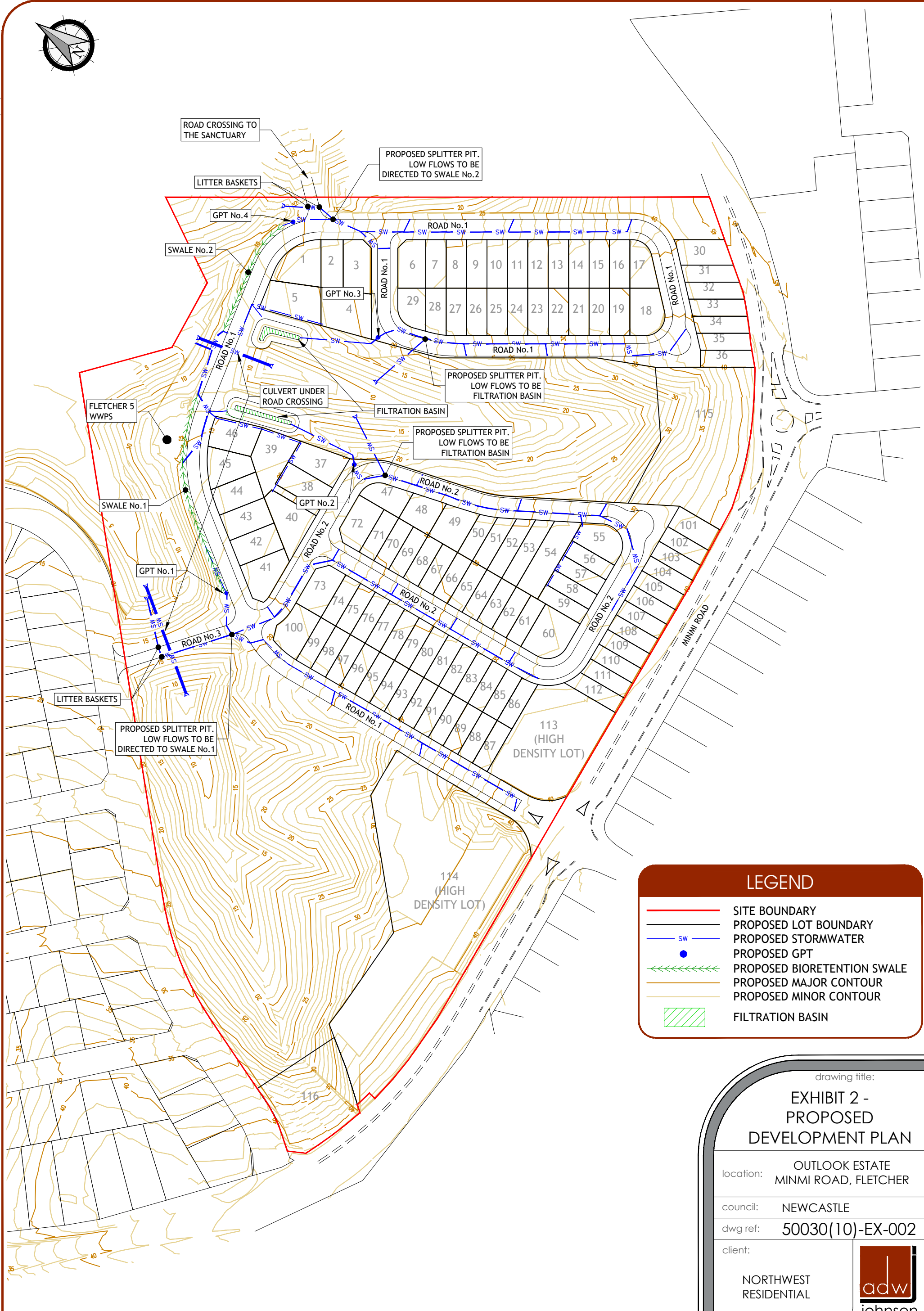


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ver.	date	comment	drawn	pm	level information	scale (A3 original size)
B	16.08.18	STRATEGY AMENDED	PB	BM	DATUM: AHD CONTOUR INTERVAL: 1.0m	0 50 100m SCALE: 1:2000 (FULL)

working beyond expectations



LEGEND

- SITE BOUNDARY
- PROPOSED LOT BOUNDARY
- PROPOSED STORMWATER
- PROPOSED GPT
- PROPOSED BIORETENTION SWALE
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- FILTRATION BASIN

drawing title:

EXHIBIT 2 -
PROPOSED
DEVELOPMENT PLAN

location: OUTLOOK ESTATE
MINMI ROAD, FLETCHER

council: NEWCASTLE

dwg ref: 50030(10)-EX-002

client:

NORTHWEST
RESIDENTIAL

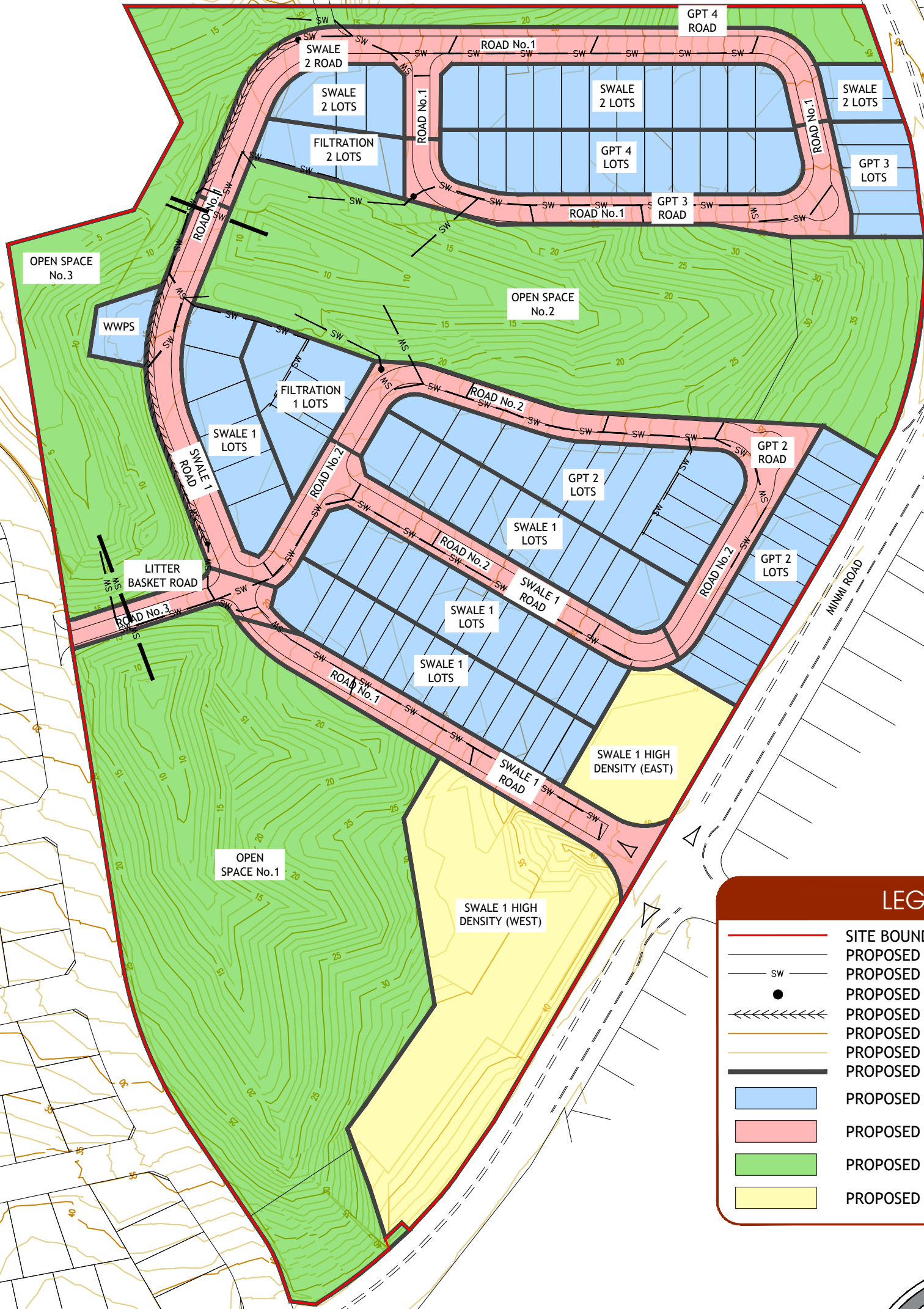


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working beyond expectations



LEGEND

- SITE BOUNDARY
- PROPOSED LOT BOUNDARY
- PROPOSED STORMWATER
- PROPOSED GPT
- PROPOSED SWALE
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED CATCHMENT BDY
- PROPOSED CATCHMENT LOTS
- PROPOSED CATCHMENT ROAD
- PROPOSED CATCHMENT OPEN SPACE
- PROPOSED CATCHMENT HIGH DENSITY

drawing title:

EXHIBIT 3 -
CATCHMENT PLAN

location: OUTLOOK ESTATE
MINMI ROAD, FLETCHER

council: NEWCASTLE

dwg ref: 50030(10)-EX-003

client:

NORTHWEST
RESIDENTIAL

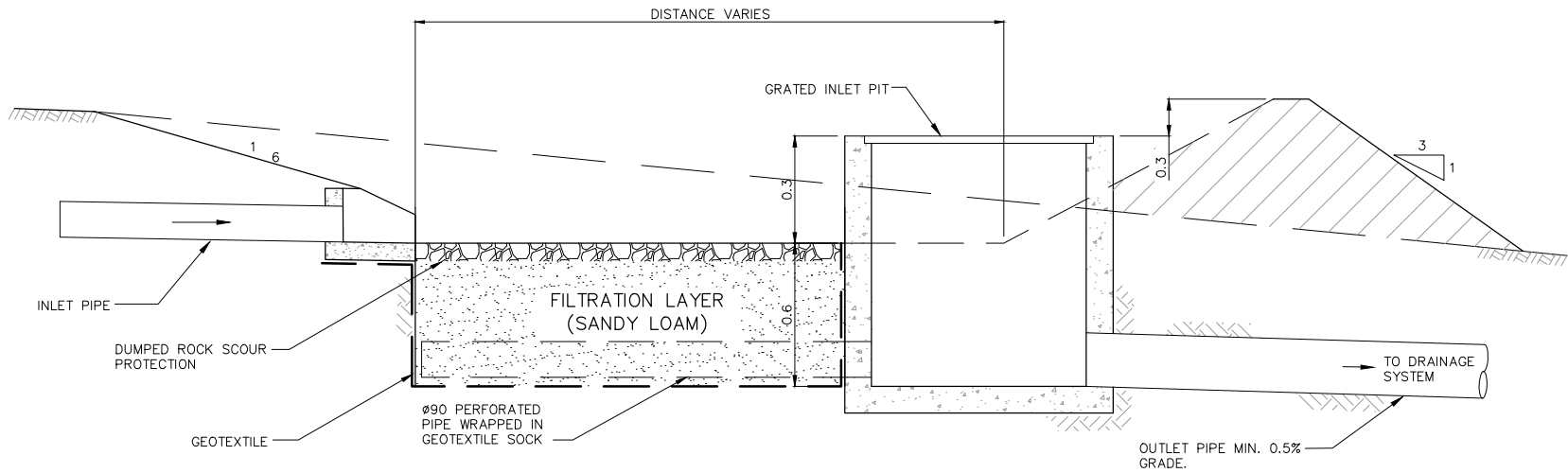
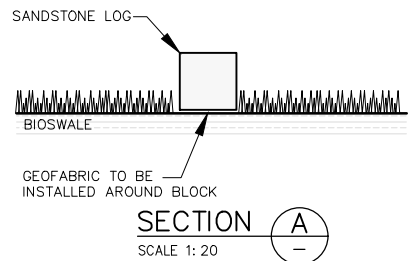
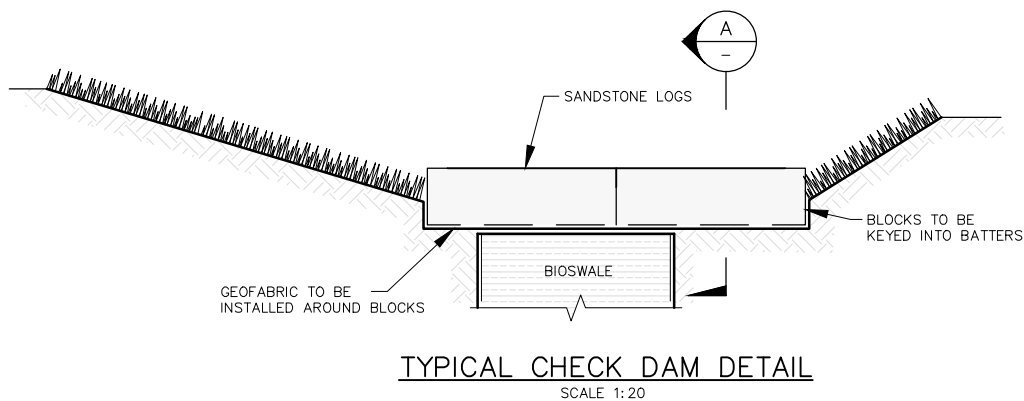
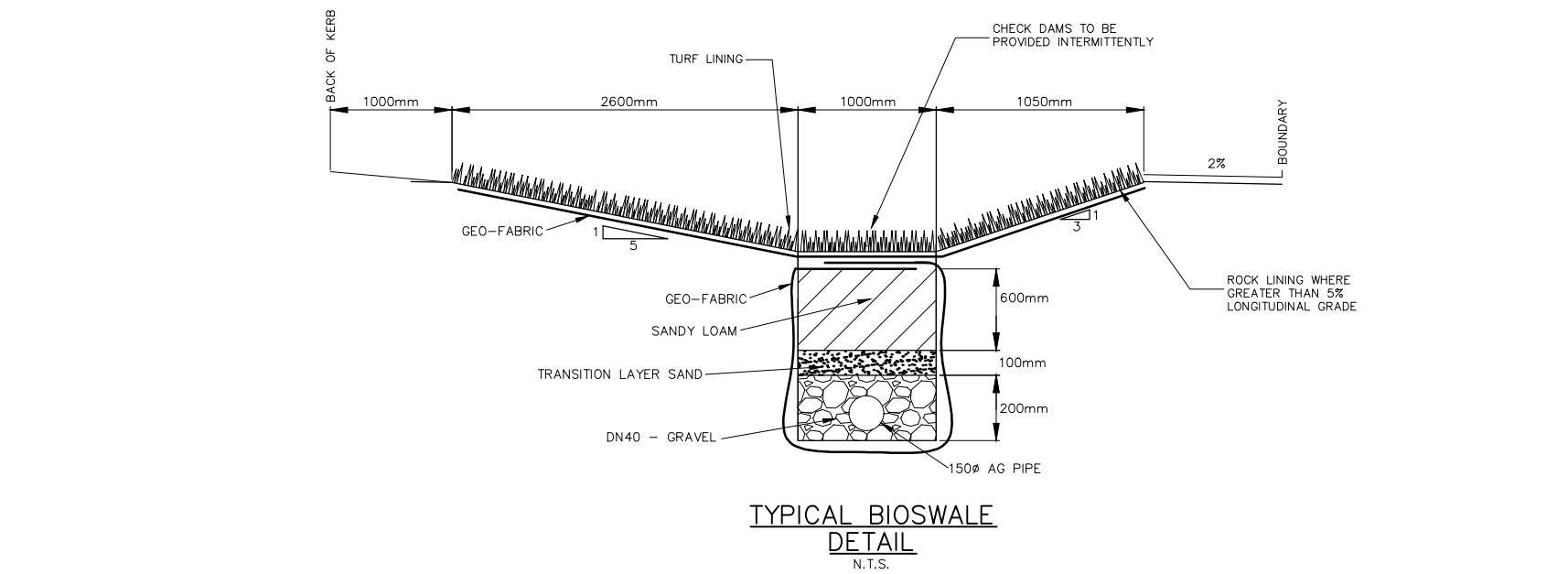


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TYPICAL FILTRATION BASIN
N.T.S.

drawing title:

EXHIBIT 4 - TYPICAL DETAILS

location: OUTLOOK ESTATE
MINMI ROAD, FLETCHER

council: NEWCASTLE

dwg ref: 50030(10)-EX-004

client:
NORTHWEST
RESIDENTIAL



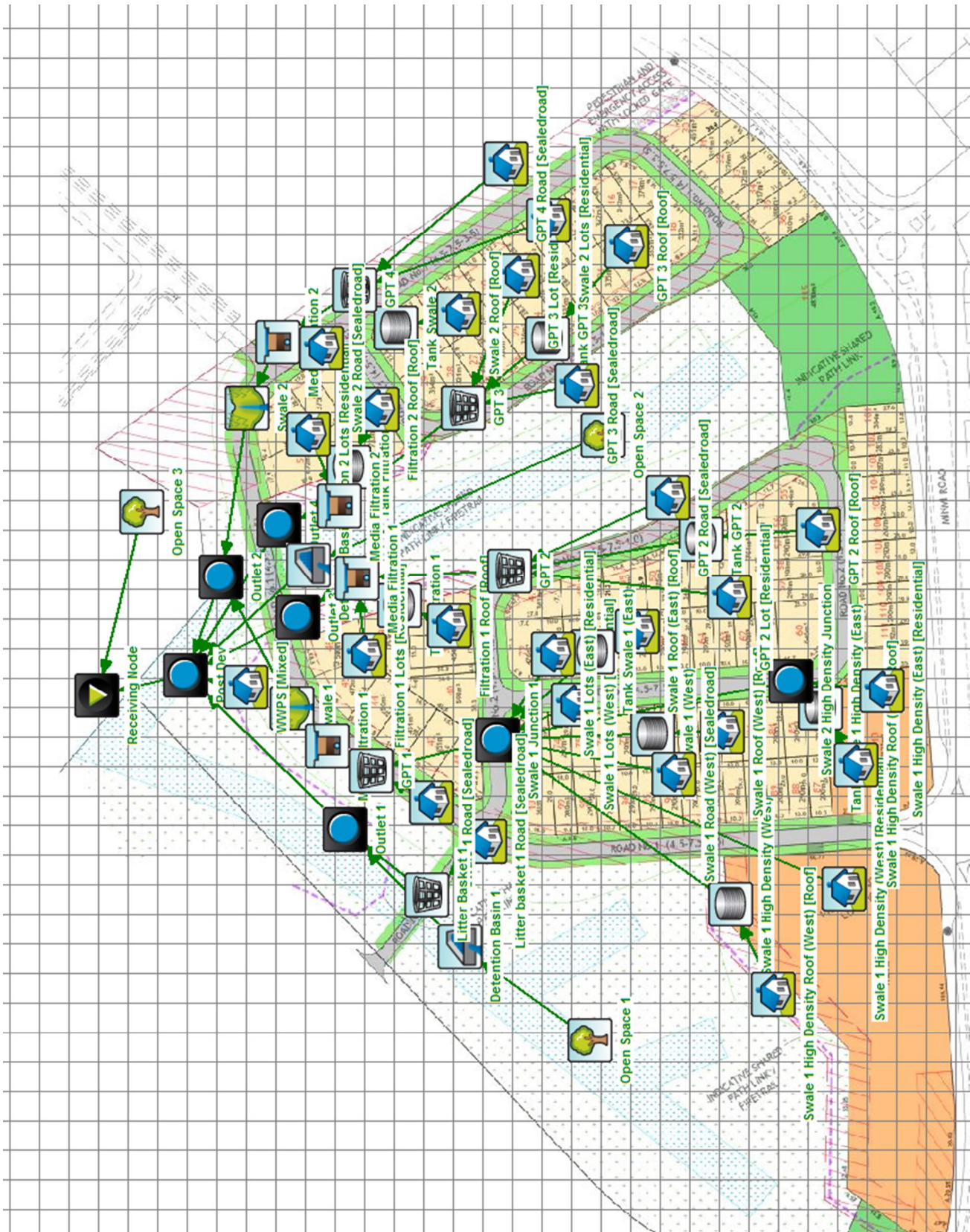
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ver.	date	comment	drawn	pm	level information	scale (A3 original size)
B	16.08.18	STRATEGY AMENDED	PB	BM	DATUM: N/A CONTOUR INTERVAL: N/A	

working beyond expectations

MUSIC DETAILS



MUSIC-*link* Report

Project Details		Company Details	
Project:	Outlook Stage 10	Company:	ADW Johnson
Report Export Date:	16/08/2018	Contact:	Ben Myles
Catchment Name:	Stage 10	Address:	
Catchment Area:	13.37ha	Phone:	(02) 4305 4300
Impervious Area*:	47.00%	Email:	
Rainfall Station:	61078 WILLIAMTOWN		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1995 - 31/12/2008 11:54:00 PM		
Mean Annual Rainfall:	1125mm		
Evapotranspiration:	1735mm		
MUSIC Version:	6.2.1		
MUSIC-link data Version:	6.22		
Study Area:	Newcastle		
Scenario:	Newcastle		

* 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	10.3%	Rain Water Tank Node	9	Forest Source Node	3
TSS	88.1%	Swale Node	2	Urban Source Node	26
TP	65.1%	Detention Basin Node	2		
TN	50.6%	Media Filtration Node	4		
GP	97.6%	GPT Node	5		

Comments

High density tank reuse conservatively modelled as zero. Refer to main report for detail

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Detention	Detention Basin 1	% Reuse Demand Met	None	None	0
Detention	Detention Basin 1	Hi-flow bypass rate (cum/sec)	None	99	99
Detention	Detention Basin 2	% Reuse Demand Met	None	None	0
Detention	Detention Basin 2	Hi-flow bypass rate (cum/sec)	None	99	99
Forest	Open Space 1	Area Impervious (ha)	None	None	0
Forest	Open Space 1	Area Pervious (ha)	None	None	3
Forest	Open Space 1	Total Area (ha)	None	None	3
Forest	Open Space 2	Area Impervious (ha)	None	None	0
Forest	Open Space 2	Area Pervious (ha)	None	None	2.33
Forest	Open Space 2	Total Area (ha)	None	None	2.33
Forest	Open Space 3	Area Impervious (ha)	None	None	0
Forest	Open Space 3	Area Pervious (ha)	None	None	1.5
Forest	Open Space 3	Total Area (ha)	None	None	1.5
GPT	GPT 1	Hi-flow bypass rate (cum/sec)	None	None	0.6
GPT	GPT 2	Hi-flow bypass rate (cum/sec)	None	None	0.6
GPT	GPT 3	Hi-flow bypass rate (cum/sec)	None	None	0.6
GPT	GPT 4	Hi-flow bypass rate (cum/sec)	None	None	0.6
GPT	Litter Basket 1	Hi-flow bypass rate (cum/sec)	None	None	0.2
Rain	Tank Filtration 1	% Reuse Demand Met	70	None	83.035
Rain	Tank Filtration 2	% Reuse Demand Met	70	None	83.0348
Rain	Tank GPT 2	% Reuse Demand Met	70	None	83.0801
Rain	Tank GPT 3	% Reuse Demand Met	70	None	83.34
Rain	Tank Swale 1 (East)	% Reuse Demand Met	70	None	83.10
Rain	Tank Swale 1 (West)	% Reuse Demand Met	70	None	83.02
Rain	Tank Swale 2	% Reuse Demand Met	70	None	83.34
Receiving	Receiving Node	% Load Reduction	None	None	10.3
Receiving	Receiving Node	GP % Load Reduction	90	None	97.6
Receiving	Receiving Node	TN % Load Reduction	45	None	50.6
Receiving	Receiving Node	TP % Load Reduction	65	None	65.1
Receiving	Receiving Node	TSS % Load Reduction	85	None	88.1
Swale	Swale 1	Bed slope	0.01	0.04	0.04
Swale	Swale 2	Bed slope	0.01	0.04	0.04
Urban	Filtration 1 Lots	Area Impervious (ha)	None	None	0.120
Urban	Filtration 1 Lots	Area Pervious (ha)	None	None	0.029
Urban	Filtration 1 Lots	Total Area (ha)	None	None	0.15
Urban	Filtration 1 Roof	Area Impervious (ha)	None	None	0.08
Urban	Filtration 1 Roof	Area Pervious (ha)	None	None	0
Urban	Filtration 1 Roof	Total Area (ha)	None	None	0.08
Urban	Filtration 2 Lots	Area Impervious (ha)	None	None	0.080
Urban	Filtration 2 Lots	Area Pervious (ha)	None	None	0.019

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Node Type	Node Name	Parameter	Min	Max	Actual
Urban	Filtration 2 Lots	Total Area (ha)	None	None	0.1
Urban	Filtration 2 Roof	Area Impervious (ha)	None	None	0.04
Urban	Filtration 2 Roof	Area Pervious (ha)	None	None	0
Urban	Filtration 2 Roof	Total Area (ha)	None	None	0.04
Urban	GPT 2 Lot	Area Impervious (ha)	None	None	0.281
Urban	GPT 2 Lot	Area Pervious (ha)	None	None	0.068
Urban	GPT 2 Lot	Total Area (ha)	None	None	0.35
Urban	GPT 2 Road	Area Impervious (ha)	None	None	0.277
Urban	GPT 2 Road	Area Pervious (ha)	None	None	0.182
Urban	GPT 2 Road	Total Area (ha)	None	None	0.46
Urban	GPT 2 Roof	Area Impervious (ha)	None	None	0.5
Urban	GPT 2 Roof	Area Pervious (ha)	None	None	0
Urban	GPT 2 Roof	Total Area (ha)	None	None	0.5
Urban	GPT 3 Lot	Area Impervious (ha)	None	None	0.192
Urban	GPT 3 Lot	Area Pervious (ha)	None	None	0.047
Urban	GPT 3 Lot	Total Area (ha)	None	None	0.24
Urban	GPT 3 Road	Area Impervious (ha)	None	None	0.216
Urban	GPT 3 Road	Area Pervious (ha)	None	None	0.143
Urban	GPT 3 Road	Total Area (ha)	None	None	0.36
Urban	GPT 3 Roof	Area Impervious (ha)	None	None	0.34
Urban	GPT 3 Roof	Area Pervious (ha)	None	None	0
Urban	GPT 3 Roof	Total Area (ha)	None	None	0.34
Urban	GPT 4 Road	Area Impervious (ha)	None	None	0.258
Urban	GPT 4 Road	Area Pervious (ha)	None	None	0.171
Urban	GPT 4 Road	Total Area (ha)	None	None	0.43
Urban	Litter basket 1 Road	Area Impervious (ha)	None	None	0.078
Urban	Litter basket 1 Road	Area Pervious (ha)	None	None	0.051
Urban	Litter basket 1 Road	Total Area (ha)	None	None	0.13
Urban	Swale 1 High Density (East)	Area Impervious (ha)	None	None	0.127
Urban	Swale 1 High Density (East)	Area Pervious (ha)	None	None	0.032
Urban	Swale 1 High Density (East)	Total Area (ha)	None	None	0.16
Urban	Swale 1 High Density (West)	Area Impervious (ha)	None	None	0.583
Urban	Swale 1 High Density (West)	Area Pervious (ha)	None	None	0.386
Urban	Swale 1 High Density (West)	Total Area (ha)	None	None	0.97
Urban	Swale 1 High Density Roof (East)	Area Impervious (ha)	None	None	0.15
Urban	Swale 1 High Density Roof (East)	Area Pervious (ha)	None	None	0
Urban	Swale 1 High Density Roof (East)	Total Area (ha)	None	None	0.15
Urban	Swale 1 High Density Roof (West)	Area Impervious (ha)	None	None	0.2
Urban	Swale 1 High Density Roof (West)	Area Pervious (ha)	None	None	0
Urban	Swale 1 High Density Roof (West)	Total Area (ha)	None	None	0.2

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Node Type	Node Name	Parameter	Min	Max	Actual
Urban	Swale 1 Lots (East)	Area Impervious (ha)	None	None	0.384
Urban	Swale 1 Lots (East)	Area Pervious (ha)	None	None	0.095
Urban	Swale 1 Lots (East)	Total Area (ha)	None	None	0.48
Urban	Swale 1 Lots (West)	Area Impervious (ha)	None	None	0.120
Urban	Swale 1 Lots (West)	Area Pervious (ha)	None	None	0.029
Urban	Swale 1 Lots (West)	Total Area (ha)	None	None	0.15
Urban	Swale 1 Road	Area Impervious (ha)	None	None	0.378
Urban	Swale 1 Road	Area Pervious (ha)	None	None	0.251
Urban	Swale 1 Road	Total Area (ha)	None	None	0.63
Urban	Swale 1 Road (West)	Area Impervious (ha)	None	None	0.199
Urban	Swale 1 Road (West)	Area Pervious (ha)	None	None	0.130
Urban	Swale 1 Road (West)	Total Area (ha)	None	None	0.33
Urban	Swale 1 Roof (East)	Area Impervious (ha)	None	None	0.66
Urban	Swale 1 Roof (East)	Area Pervious (ha)	None	None	0
Urban	Swale 1 Roof (East)	Total Area (ha)	None	None	0.66
Urban	Swale 1 Roof (West)	Area Impervious (ha)	None	None	0.28
Urban	Swale 1 Roof (West)	Area Pervious (ha)	None	None	0
Urban	Swale 1 Roof (West)	Total Area (ha)	None	None	0.28
Urban	Swale 2 Lots	Area Impervious (ha)	None	None	0.248
Urban	Swale 2 Lots	Area Pervious (ha)	None	None	0.061
Urban	Swale 2 Lots	Total Area (ha)	None	None	0.31
Urban	Swale 2 Road	Area Impervious (ha)	None	None	0.078
Urban	Swale 2 Road	Area Pervious (ha)	None	None	0.051
Urban	Swale 2 Road	Total Area (ha)	None	None	0.13
Urban	Swale 2 Roof	Area Impervious (ha)	None	None	0.34
Urban	Swale 2 Roof	Area Pervious (ha)	None	None	0
Urban	Swale 2 Roof	Total Area (ha)	None	None	0.34
Urban	WWPS	Area Impervious (ha)	None	None	0.07
Urban	WWPS	Area Pervious (ha)	None	None	0
Urban	WWPS	Total Area (ha)	None	None	0.07

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Failing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Rain	Tank Swale 1 High Density (East)	% Reuse Demand Met	70	None	0
Rain	Tank Swale 1 High Density (West)	% Reuse Demand Met	70	None	0

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