

Civil Engineering Design Report Development Application

The Bower, Medowie NSW

Prepared for: McCloy Development Management Pty Ltd

Address: PO Box 2214 DANGAR, NSW 2309

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1 INTRODUCTION

1.1 General

ACOR Consultants have been engaged by McCloy Development Management Pty Ltd to prepare an Engineering Report to support their proposed Development Application for a Seniors Living Development in Medowie. The site is located within the current Bower Residential development off Western Rd, Medowie, New South Wales.

This report covers the concept civil design, stormwater quantity management and stormwater quality management for the site.

Civil design items addressed in this report include:

- Concept site grading, road design and typical roadway profiles;
- Bulk earthworks
- Vehicle access and turn paths;

Stormwater quantity items addressed in this report include:

- Stormwater conveyance/network;
- Stormwater detention

Stormwater quality items to be addressed in this report include:

- Operational water quality management incorporating Water Sensitive Urban Design principles (WSUD);
- Construction water quality management incorporating soil and water management.

2 SITE

2.1 Location

The site is located off Western Road within The Bower development at Medowie. The site is bound to the north, south and east by either existing or future residential lots. To the west a single row of residential properties (future) will separate the development from Western Rd and the existing bushland. Figure 1 shows the location of the site within the existing development layout.

2.2 Topography

The existing site grades from the south west to the north east at approximately 3 to 4%. The levels on the site currently range from approximate RL29.1m AHD at the south western boundary to RL 21.2 m AHD at the north eastern corner. Figure 2 shows the existing topography of the site.

2.3 Existing/previous Land Use

The site is currently cleared in preparation for future development. Some preliminary bulk earthworks have already been undertaken on the site as part of the current approved development application for the residential development.

2.4 Existing Site Drainage

With no current formalised drainage, the existing site sheet flows from the south west to the north east at approximately 3 to 4% grade.

2.5 External Catchments

There are no external catchments impacting the proposed Seniors Living development. A significant external catchment impacts the surrounding residential development at the Bower which is covered in the current approved Stormwater Drainage Strategy prepared by GCA. No adjustment to the treatment of these external catchments is proposed for the Seniors Living Development.

2.6 Proposed Development

The proposed development will consist of 110 independent living units within lots ranging from approximately 250 to 350 m², as well as associated road, stormwater drainage infrastructure. The development will also consist of a community precinct containing a community building, pool/gym, bowling green and a men's shed. It is proposed for the detention and water quality basin/treatment requirements to be incorporated into the wider developments basin and treatment devices.

Access to the site is along a proposed roadway connecting to Western Drive. A secondary access for services vehicle only will be provided at the rear of the site via Topaz Avenue.

The total area of proposed development is approximately 5.76 hectares. Figure 3 shows the proposed layout for the Seniors Living Development.

3 Concept Civil Design

3.1 Site Layout and Grading

The concept grading for the proposed development was undertaken with the aim of flat roadway and lot grades with major level differences treated with retaining walls between units and along boundaries. Roadways reach maximum longitudinal grades of 2% which assists in providing flat lots and access points. Figure 3 shows the concept grading for the development. Figures 4 to 7 show concept road longitudinal sections and typical roadway profiles.

3.2 Bulk Earthworks

The bulk earthworks for the development are detailed in Figures 8 to 10. The figures provide details on the cut and fill depths associated with the concept site grading along with typical sections cut across the development site.

3.3 Vehicle Access

Vehicular turn paths have been run throughout the proposed development. A standard 12.5m single unit truck (Austroads) has been traversed through the developments residential areas as a check vehicle. A 12-seater bus has been run as a check vehicle for access to the community centre. Figures 17 and 18 detail the turn path checks for the development.

4 STORMWATER QUANTITY MANAGEMENT

4.1 Objectives

The objectives of the stormwater quantity management for the development are:

- Provide a stormwater conveyance system in accordance with Australian Rainfall and Runoff's minor/major system philosophy, ARR2016, and the requirements of Port Stephens Council. The minor stormwater conveyance system will be designed to convey peak flows from the 20% AEP storm event and the major stormwater conveyance system will be designed to convey the peak flows from the 1% AEP storm event.
- Provide stormwater detention to reduce the peak flows from the site to or below the current peak runoff from the site.

4.2 Stormwater Conveyance

4.2.1 Minor Storm Event Conveyance

Minor system stormwater conveyance for the development will be a via a pit and pipe system. Roadways within the development will drain to central invert with grated drainage pits being located within the roadway. The minor stormwater system will have the capacity to convey the peak flows from the 20% AEP storm event. The network will connect into the future downstream development drainage.

Peak flows from the upstream catchment will bypass the development site via a pipe network along Carolina Road in accordance with the approved Stormwater Drainage Strategy for The Bower Development prepared by GCA.

The development layout, Figure 11, shows the concept stormwater system for the development.

4.2.2 Major Storm Event Conveyance

Major system stormwater conveyance for the proposed development will be via overland flow. This will be via traditional trunk drainage via road carriage way and footpath. The major stormwater system will have the capacity to convey the peak flows from a 1% AEP storm event, containing flows within the road carriageway.

4.3 Stormwater Detention

4.3.1 General

The overall development site was divided into three major catchments, each containing a detention basin to reduce post development flow to or below current peak runoff from the site. The Basin 1 catchment has been excluded from this pre and post analysis as much of the catchment has been developed or is currently approved for construction under the previous drainage strategy by GCA. The remaining development layout which is contained within the catchments for proposed Basins 2 and 3, has been amended to incorporate the proposed Seniors Living development. A revised drainage model was created for the remaining development area to review the potential impact of the proposed Seniors Living Development. Figures 12 and 13 detail the overall pre and post development catchments included in the drainage model.

4.3.2 DRAINS Modelling

DRAINS modelling was undertaken to determine the predeveloped and developed peak flows for a range of AEP's from 20% to 1%, for storm durations ranging from 5 minutes to 48 hours for the proposed development. Available volumes from rainwater tanks were not accounted for in the modelling.

The model is based on the approved drainage strategy and modelling for The Bower development with no proposed changes to the outlet configuration for basins 2 and 3 as modelled by GCA. The outlet configurations for each basin consists of staged discharge pits and emergency spillways. Minor adjustments to the basin volume for basin 2 were made to suite the adjusted development layout. The below tables detail the basin volumes for basins 2 and 3.

Table 1: Basin 2 Volumes

Height	Volume
(m)	(m ³)
17.2	0
17.6	2590
18	5480

18.4	8700
18.8	12250
19.2	16170

Table 2: Basin 3 Volumes

Height	Volume
(m)	(m ³)
17.2	0
17.6	1410
18	3080
18.4	5020
18.8	7270
19.2	9840

Current approved timing and fraction impervious percentages for the catchments were retained in the modelling except for the proposed Seniors Living Development. For the Seniors Living Development a fraction impervious of 80% was applied to the entire catchment. Figure 14 details the internal site catchments. The catchment naming conventions align with the drains model has been provided with this report for review.

4.3.3 DRAINS Results

The predeveloped and post developed (with detention) peak flows from the combined basin 2 and 3 catchment area are shown in Table 3.

Table 3: Predeveloped vs Developed (with Detention) Peak Flows

AEP Storm Event	Pre-Developed Peak Flow	Developed Peak Flow (with detention)	Difference	Reduction
	(m ³ /s)	(m ³ /s)	(m ³ /s)	(%)
20%	13.6	13.1	0.50	4%
10%	20.2	19.2	1.00	5%
5%	27.3	25.8	1.50	5%
2%	37.2	36.3	0.90	2%
1%	45.6	44.9	0.70	2%

DRAINS inputs and results for the detention modelling are shown in Appendix A. The DRAINS model has also been provided.

As can be seen from the above results, the basins with the volumes and outlet configuration discussed, the peak flows from the development including the seniors living area, are reduced to below the predeveloped peak flows for all the 20% to 1% AEP storm events.

5 STORMWATER QUALITY MANAGEMENT

5.1 General

The Bower Development currently has an approved water quality management and treatment plan. The introduction of the Seniors Living Development has resulted in adjustments to the treatment requirements of the development. As such the current model has been amended to cater for the increase in generated pollutants from the site.

5.2 Objectives

The objectives of the Stormwater Quality for the site are:

- Meet the water quality objectives of Port Stephens Council for the operational phase of the site by using best practice stormwater treatment measures.
- % Reductions from the developed site of:
 - 90% reduction in Total Suspended Solids (TSS);
 - 60% reduction in Total Phosphorus (TP);
 - 45% reduction in Total Nitrogen (TN);
 - 90% reduction in litter/gross pollutants.

5.3 Operational Phase Water Quality Management

5.3.1 General

To meet the water quality requirements of Port Stephens Council, a range of water quality improvement devices will be required. The proposed water quality improvement devices for the site will include:

- rainwater tanks
- gross pollutant traps
- bioretention basins.

The above water quality improvement devices act as a treatment train, progressively reducing pollutants as they pass through each one.

5.3.2 Stormwater Quality Modelling

5.3.2.1 Introduction

The MUSIC model version 6.3 was used to assess the pollutant generation from the development and the performance of the stormwater quality treatment train. MUSIC modelling was undertaken previously as part of the original Bower Development Application. The new MUSIC model is a revised version of the original and accounts for the catchment and layout adjustments along with the increased yield proposed across the wider development, specifically in the Seniors Living Development. The Basin 1 catchment has been excluded from this pre and post analysis as much of the catchment has been developed or is currently approved for construction under the previous water quality strategy by GCA. The new model has been undertaken in accordance with the Port Stephens Council MUSIC Link, the NSW MUSIC Modelling Guidelines (WBM, 2015). Refer to Figure 15 for catchment details and breakdown.

5.3.2.2 Rainfall Data and Evaporation Data

The rainfall data and evapotranspiration data for the project was adopted from the Port Stephens Council MUSIC link.

5.3.2.3 MUSIC Model Source Inputs

The source data for the MUSIC model for the developed model were adopted from the Port Stephens Council MUSIC link for urban residential. The model source node inputs were;

- The area for each roof adopted was;
 - 300m² was adopted for the modelling for the residential development (as per current approved strategy)
 - 150m² was adopted for the Seniors Living development.
- An overall lot fraction impervious (including the roof area) of;
 - 60% was adopted for lots standard residential lots (as per current approved strategy)
 - 30% was adopted for the 4000m² residential lots (as per current approved strategy)
 - 80% was adopted for the Seniors Living development.
- A fraction impervious for the road catchments of.
 - 50% for the residential development (as per current approved strategy)
 - 70% for the Seniors Living development

5.3.2.4 Catchments Pollutant Mean Concentrations

The pollutant Event Mean Concentration (EMC) values for the development were adopted from Port Stephens Council's MUSIC link for both base flows and storm flows. The developed catchments were divided into residential lots (roofs and yards) and road areas.

5.3.2.5 MUSIC Model Treatment Train

The stormwater quality treatment train consists of three parts; rainwater tanks, gross pollutant traps and bioretention basins. This overall treatment train is a modification of the current approved strategy for the development with the inclusion of rainwater tanks into the model and the minor increase to the proposed bioretention area in basin 2 to cater for the additional pollution generated by the Seniors Living development. A schematic of the MUSIC model is shown in Appendix B.

A brief description on each treatment measure is listed below.

- Rainwater Tanks. Rainwater tanks receive water from the roof area of each lot. A 5-kL rainwater tank was assumed for each standard residential lot and 2-kL rainwater tank for each of the seniors living units. Water captured in the rainwater tanks is expected to be reused for toilet flushing, clothes washing, hot water and garden irrigation. An average of 3 persons was assumed for each residential house and an average of 2 persons for each senior living unit. The reuse per house was adopted from the NSW MUSIC Modelling Guidelines, Table 6-1. The reuse adopted for each lot is shown in Table 4.

Table 4: Rainwater Tank Reuse (per lot)

Rainwater Reuse	Residential	Seniors Living
Internal (L/day/dwelling)	318	212
External (L/day/dwelling)	151	151
Total	469	363

- **Gross Pollutant Traps.** Gross pollutant traps are included in the treatment train in accordance with approved strategy for the development. Based on the revised model no increase in gross pollutant capture was required and as such the current Hume Guard GPTs nodes were left unchanged.
- **Bioretention Basins.** Bioretention basins form the final part of the treatment train for the site. Bioretention systems remove sediments (TSS) as well as nutrients (TN and TP) for the stormwater. The bioretention basin consists of a shallow dry basin with deep rooted vegetation and grass on the surface, over an infiltration/filtration area and an underdrain area. These are located within the developments detention basins in accordance with the current approved strategy. The size of the bioretention areas for catchment 3 has remained as per the approved strategy. The bioretention area for catchment 2 has been increased to cater for the additional pollution generated by the proposed Seniors Living development.

Vegetation in the bioretention basins will be in accordance with Port Stephens Council requirements. Table 5 shows the bioretention basin inputs.

Table 5: Bioretention Basin MUSIC Model Inputs

Catchment/Basin	2	3
Extended Detention Depth (m)	0.3	0.3
Surface Area (m ²)	2400	1200
Filter Area (m ²)	120	90
Unlined Filter Material (m)	44	38
Saturated Hydraulic Conductivity (mm/hr)	100	100
Filter Depth (m)	0.4	0.4
TN Content of Filter Media (mg/kg)	800	800
Orthophosphate of Filter Media (mg/kg)	50	50
Exfiltration Rate (mm/hr)	0	0
Base Lined	No	No
Nutrient Removing Plants	Yes	Yes
Under Drain Present	Yes	Yes

5.3.3 Stormwater Quality Modelling Results

The results of the MUSIC model for the total catchment showing the mean annual pollutant loads for the existing and the developed catchment are shown in Table 6.

Table 6: MUSIC Model Existing vs Developed Results

	Source Load	Residual Load	Reduction	PSC % Required Reduction	% Developed Reduction
TSS (kg/yr.)	27400	3560	23840	90	87
TP (kg/yr.)	66.66	22.4	44.2	60	66.3
TN (kg/yr.)	413	203	210	45	50.8
Gross Pollutants (kg/yr.)	5410	5410	5410	90	100

The results of the modelling show that the reductions in the pollutants meet or exceed the requirement of Port Stephens Council except for the TSS. The reduction achieved is significant and only marginally short of the 90% target. With the heavily vegetated downstream catchment it is expected that remaining reductions will occur naturally and not negatively impact the downstream environment. The MUSIC model report detailing the inputs and results of the modelling are shown in Appendix B.

5.4 Construction Phase Water Quality Management

5.4.1 General

During the construction phase of the development, an Erosion and Sediment Control Plan will be implemented to minimise the water quality impacts. The erosion and sediment controls will be in accordance with Landcom's Managing Urban Stormwater: Soils and Construction Volume 1, 4th Edition (Landcom, 2004) and the requirements of Port Stephens Council. Erosion and sediment controls will be required preconstruction, during construction and post construction until the site is stabilized. The expected erosion and sediment control measures will include stabilized site access, sediment fence, gully pit sediment barriers, rock outlet scour protection and a temporary sediment basin.

Figure 16 shows concept erosion and sediment control plans. Detailed erosion and sediment control plans will be provided for the development at the Construction Certificate stage including location and sizing of required sediment basins.

5.4.2 Pre-Construction Erosion and Sediment Control

Due to the topography of the site, the preconstruction erosion and sediment controls will be limited to stabilized site access, sediment fence and a temporary sediment basin until the initial bulk earthworks is undertaken. The proposed detention/water quality basin will be used as a sediment basin while construction is being undertaken as per the construction methods of the currently constructed residential stages of the development.

5.4.3 During Construction Erosion and Sediment Control

During the construction phase of the development, the erosion and sediment controls will consist of installed sediment fence, a constructed sediment basin, gully pit sediment barriers and permanent rock outlet scour protection.

Regular inspection and maintenance of the erosion and sediment controls is required during the construction process.

As the soils on site are Clayey silt and clayey sand, sediment basins will be calculated using the Blue Book for type F soils. The geotechnical reports of the site by Qualtest stated that the soil was not dispersive.

5.4.4 Post Construction Erosion and Sediment Control

The contractor/developer will be responsible for the maintenance of the erosion and sediment control devices from the practical completion of the works for a minimum of 6 months or until stabilization has occurred to the satisfaction of Port Stephens Council.

It is proposed to delay the construction of the bioretention filtration media in the basin until a significant proportion of the contributing lots are built on and established.

5.5 Water Quality Maintenance Plan

5.5.1 General

Port Stephens Council has established a maintenance plan for its existing water quality infrastructure. The proposed infrastructure will be like the existing.

General maintenance will involve implementation of a regular inspection and maintenance schedule. As a minimum, the inspection and maintenance program is to follow the manufacturer's recommended time frame plus after any significant rain event. The inspection regime may be increased when housing construction commences to determine if a more frequent maintenance period is required.

Installation of the bioretention filtration media in the detention basins will be delayed until a significant proportion of the contributing lots are built on and established.

5.5.2 Gross Pollutant Traps

The HumeGard GPT's (or equivalent) will be used at all discharge points into the detention basins for the project. Maintenance will be in accordance with the HumeGard GPT Inspection and maintenance guide attached (refer to Appendix C).

5.5.3 Bioretention Basin

Regular maintenance of the bioretention basins will require removal of sediment build up, maintenance of vegetation and flushing of the underdrain to maintain performance. Eventually the biofiltration material may need replacement when it has reached the end of its lifecycle. This will be determined by testing of the soil properties after 5-10 years of use.

6 CONCLUSION

This civil engineering design report addresses the civil design, stormwater quantity and quality of the proposed Seniors Living development at The Bower, Medowie, along with its impacts on the current approved development application for the wider Bower development.

Concept civil design, site grading and site access details have been provided in the report. Stormwater quantity and stormwater quality (both operational and construction phases) have also been addressed.

Stormwater conveyance for the Seniors Living development will be in accordance with the minor/major system philosophy and the requirements of Port Stephens Council. The minor system consisting of surface inlet pits and pipes has been designed for the 20% AEP storm event. The major stormwater system will consist of the road reserve and will be designed for the 1% AEP storm event. This will align the proposed Seniors Living development with the surrounding residential development.

Detention modelling for the site based on the previous approved strategy has determined that the peak flows, including those generated from the Seniors Living development for AEPs from 20 to 1% have been reduced to or below the predeveloped peak flows.

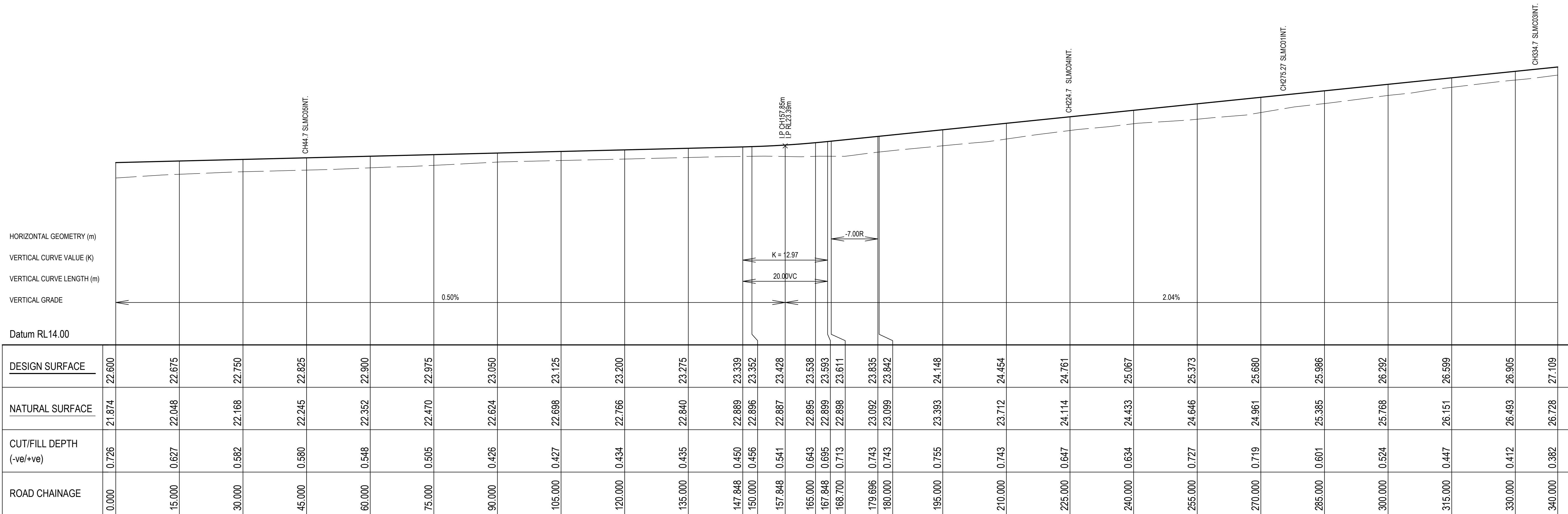
Water quality management for the development will consist of a treatment train utilizing rainwater tanks, gross pollutant traps and a bioretention basin to reduce the pollutant runoff from the site in accordance with the requirements of Port Stephens Council and Hunter Water.

Construction phase erosion and sediment control will be undertaken in accordance with Landcom's Managing Urban Stormwater and Port Stephens Council.

7 REFERENCES

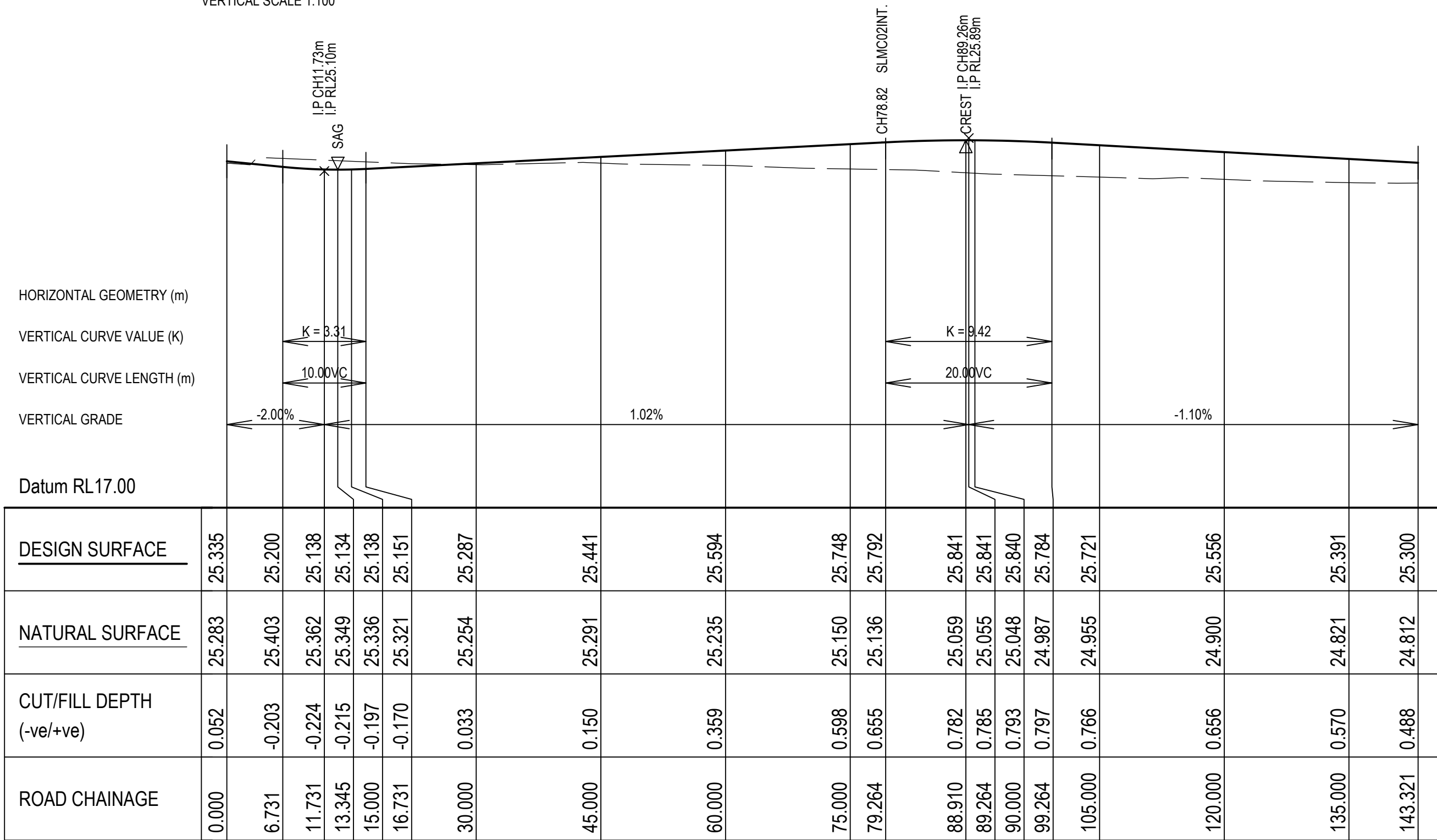
- Port Stephens Council DCP
- NSW MUSIC Modelling Guidelines (WBM 2015)
- Port Stephens Council MUSIC Link function in the MUSIC program
- Landcom Managing Urban Stormwater: Soils and Construction Volume 1, 4th Edition 2004
- GCA - Stormwater Drainage Strategy, Proposed Subdivision Boundary Rd Medowie, 2015

FIGURES



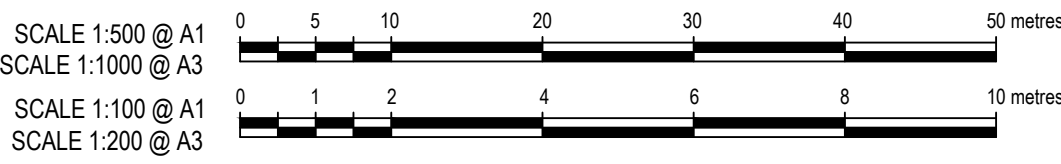
ROAD 2 (SLMC02) - LONGITUDINAL SECTION

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VERTICAL SCALE 1:100

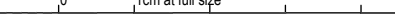


ROAD 1 (SLMC01) - LONGITUDINAL SECTION

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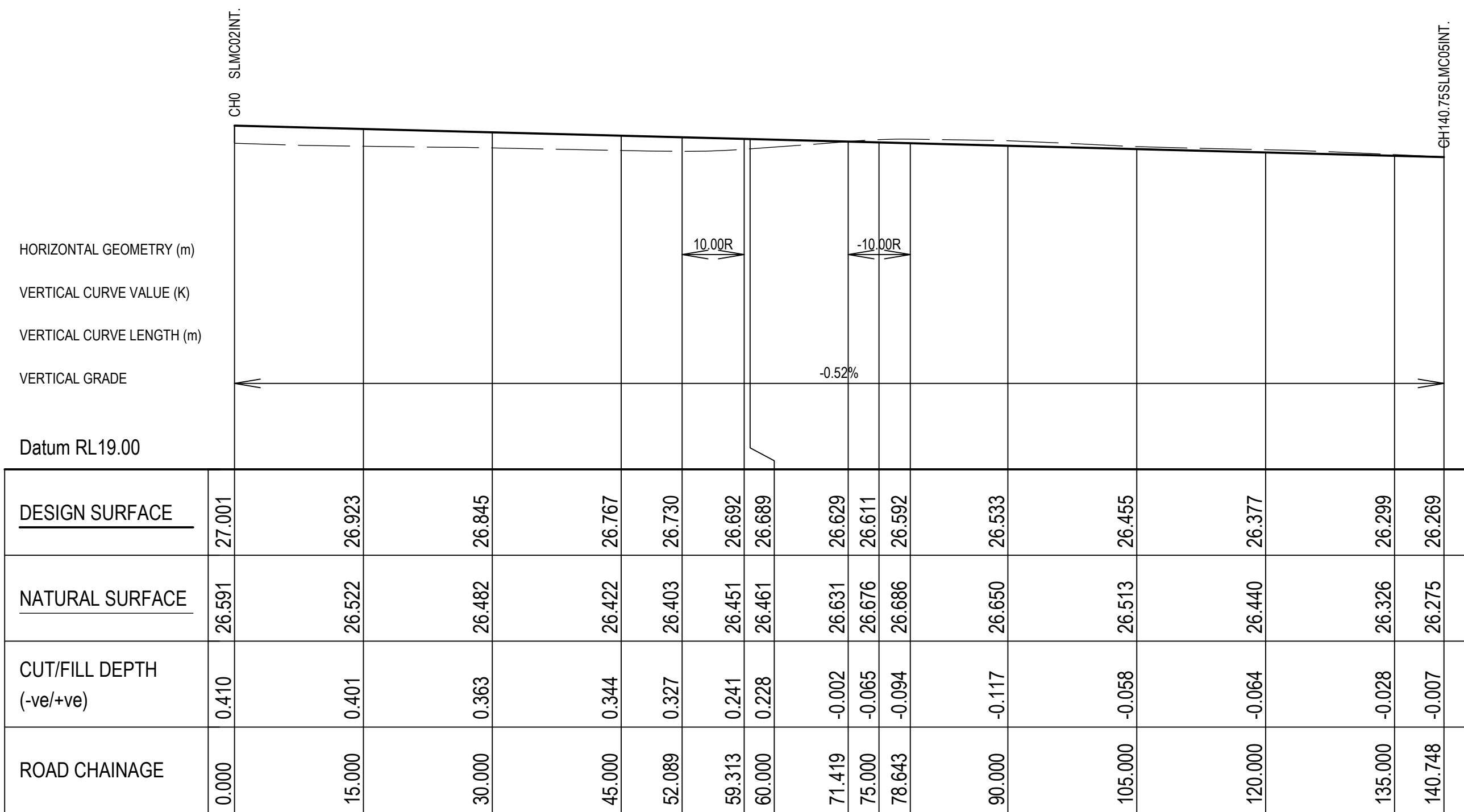
LOT 93, 94, 95 & 96, DP753194
BOUNDARY ROAD, MEDOWIE

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ROAD LONGITUDINAL SECTION SHEET 1

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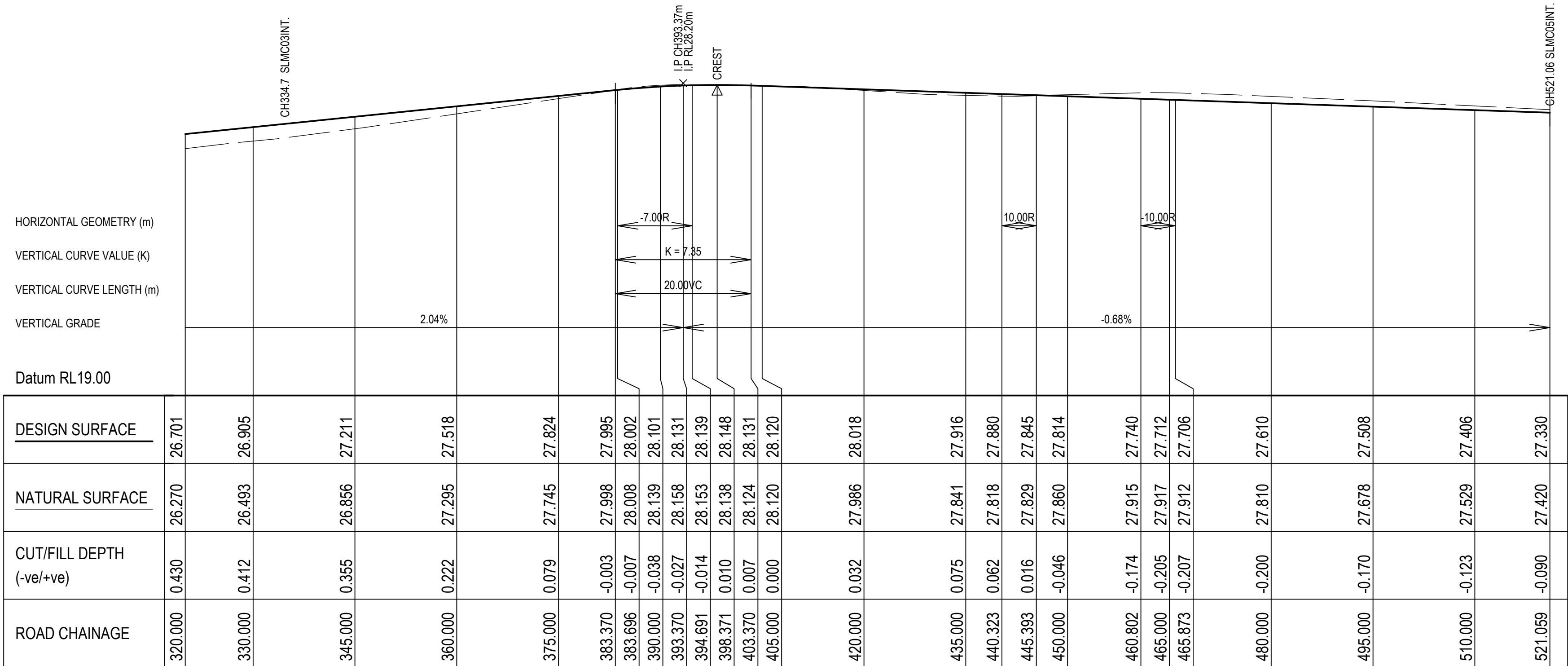


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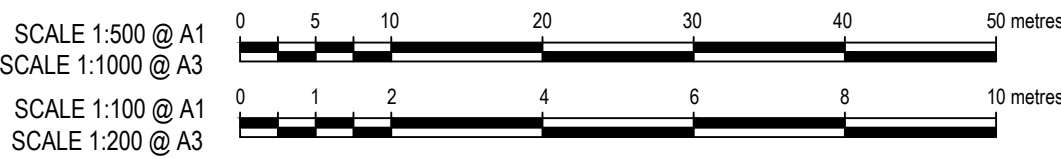
ROAD 3 (SLMC03) - LONGITUDINAL SECTION

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ROAD 2 (SLMC02) - LONGITUDINAL SECTION

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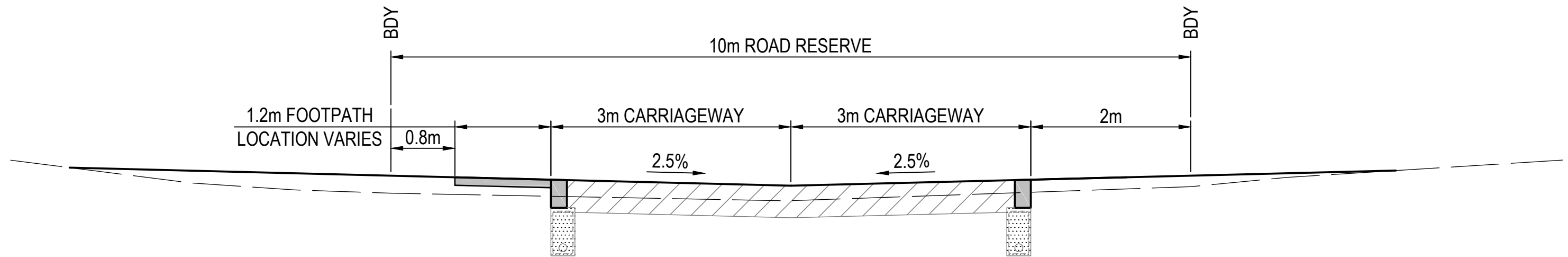
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**ROAD LONGITUDINAL SECTION
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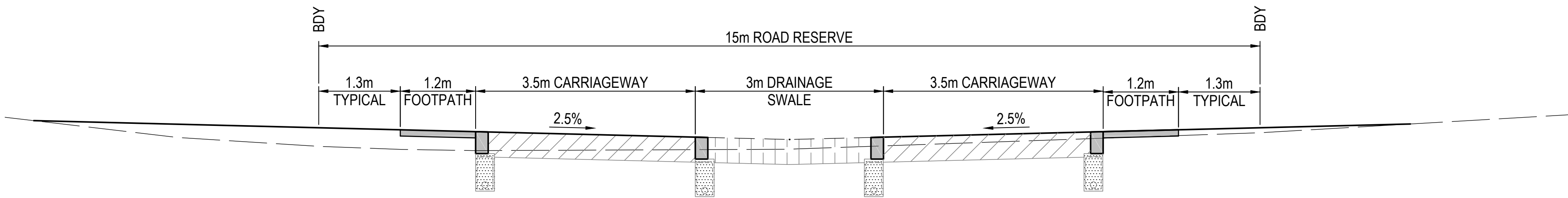


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SENOIRS LIVING TYPICAL CROSS SECTION - ROAD 2, 3, 4 AND 5
SCALE 1:50



SENOIRS LIVING TYPICAL CROSS SECTION - ROAD 1
SCALE 1:50

SCALE 1:50 @ A1
SCALE 1:100 @ A3



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Issue	Description	Date	Drawn	Approved	
1					

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Project
**THE BOWER SUBDIVISION, MEDOWIE
SENIORS LIVING**

LOT 93, 94, 95 & 96, DP753194
BOUNDARY ROAD, MEDOWIE

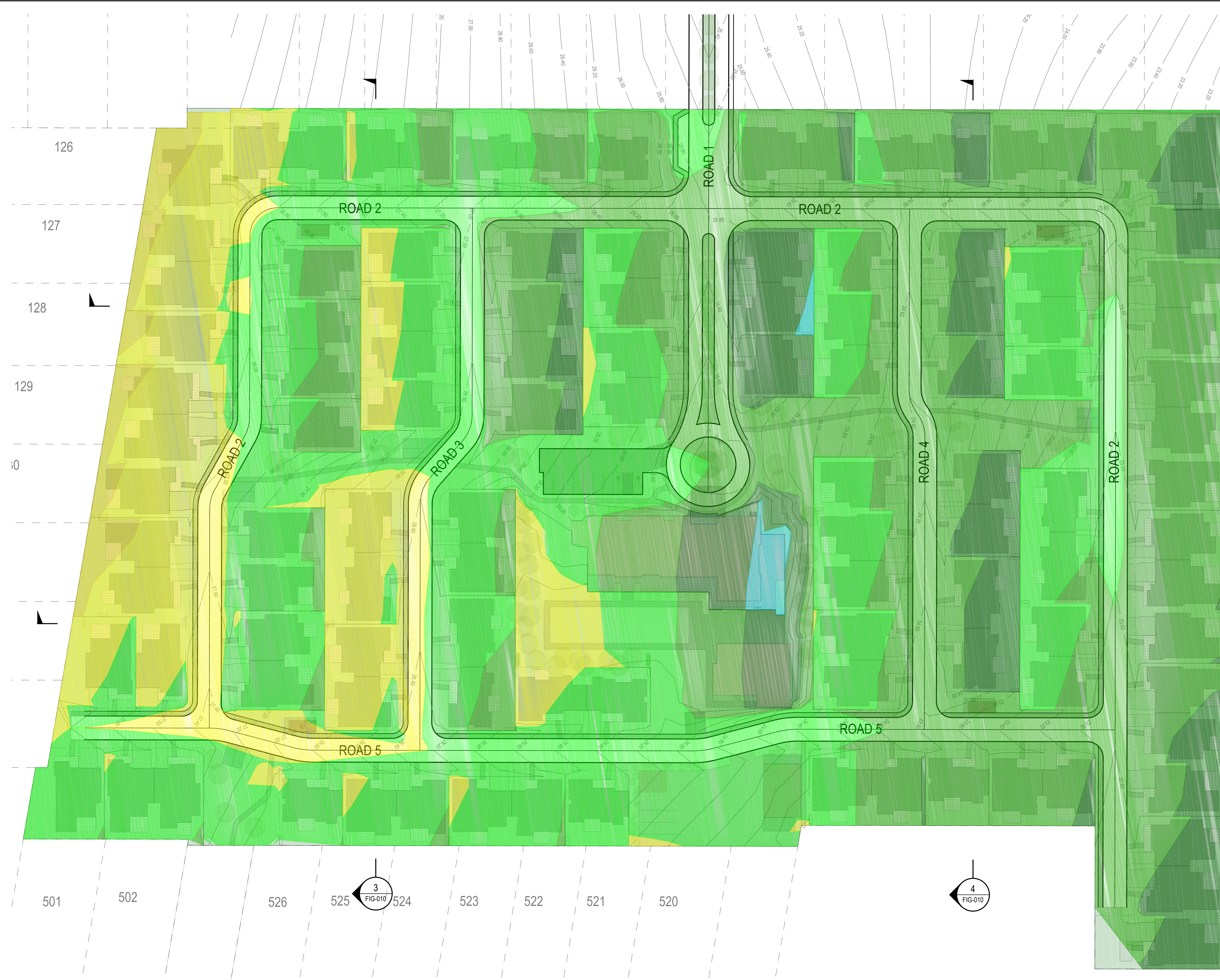
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ROAD TYPICAL CROSS SECTION

Drawn JER	Date JULY 2018	Scale 1:50	A1	Q.A. Check	Date
Designed GPC	Project No. NE180116	Dwg. No. FIG-007	Issue B		



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ACOR CONSULTANTS (NNSW) PTY LTD
23/08/2018 11:00:00



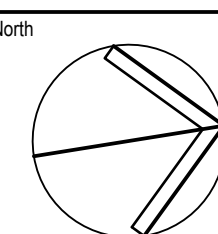
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SCALE 1:500 @ A1
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1	10m at full slope			



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td	Project	THE BOWER SUBDIVISION, MEDOWIE
et		SENIORS LIVING

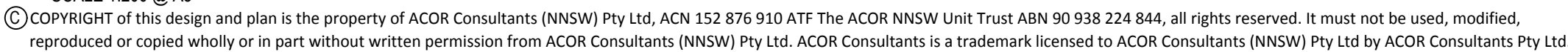
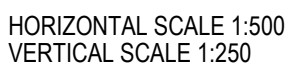
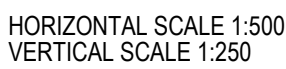
LOT 93, 94, 95 & 96, DP753194
BOUNDARY ROAD, MEDOWIE

Drawing Title	BULK EARTHWORKS PLAN
---------------	----------------------

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Designed GPC	Project No. NE180116			Dwg. No. FIG-008	Issue B	



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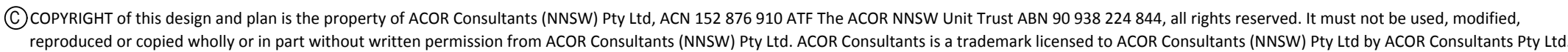
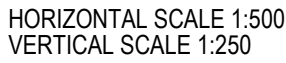
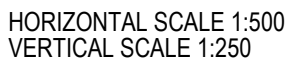
Project THE BOWER SUBDIVISION, MEDOWIE SENIORS LIVING

LOT 93, 94, 95 & 96, DP753194
BOUNDARY ROAD, MEDOWIE

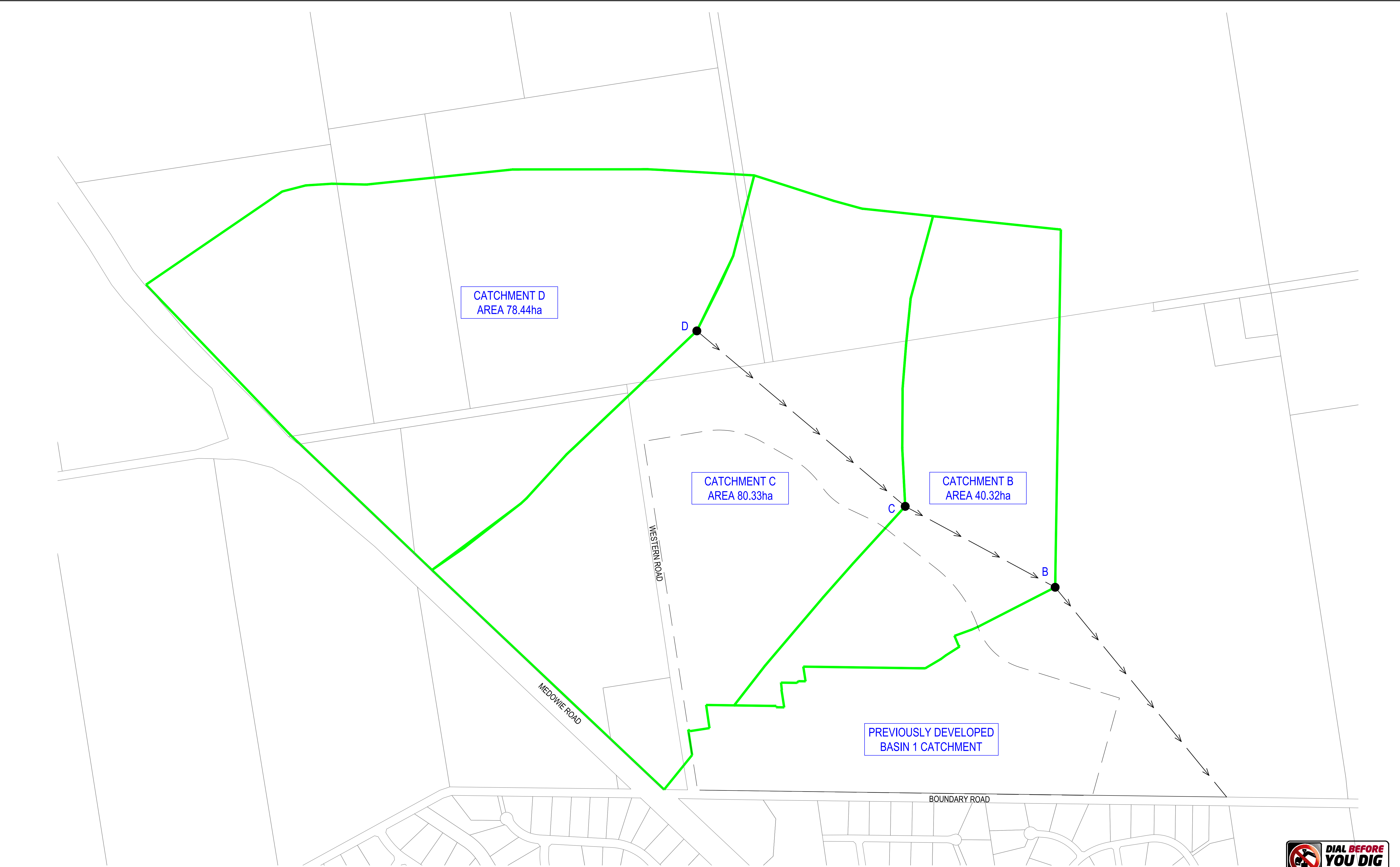
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BULK EARTHWORKS SITE SECTIONS				
SHEET 1				
Drawn	Date	Scale	A1	O.A. Check
JER	JULY 2018	AS SHOWN		
Designed	Project No.		Dwg. No.	Issue
GPC	NE180116		FIG-009	B



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Aug 29, 2018 - 2:39pm P:\NE180116\Drawings\CINDrawings\Figures\NE180116_FIG-010_B.dwg

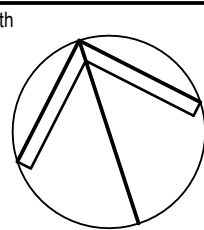


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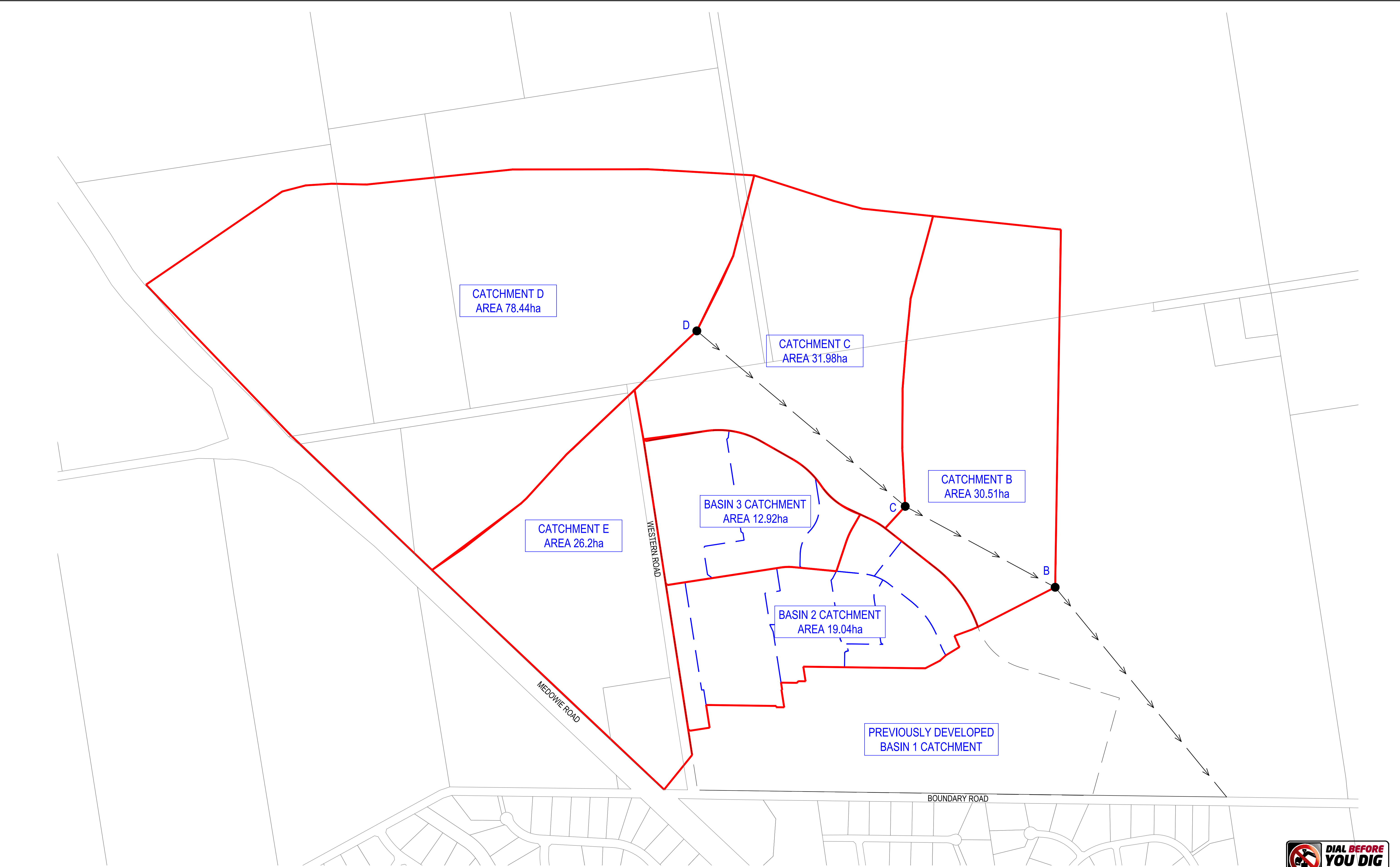
LOT 93, 94, 95 & 96, DP753194
BOUNDARY ROAD, MEDOWIE

Drawing Title STORMWATER CATCHMENT PLAN PRE-DEVELOPMENT					
Drawn	Date	Scale	A1	Q.A. Check	Date
JER	JULY 2018	1:4000			
Designed	Project No.	Dwg. No.		Issue	
GPC	NE180116	FIG-012		B	



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FILE: BOWER SUBDIVISION STORMWATER CATCHMENT PLAN PRE-DEVELOPMENT.dwg

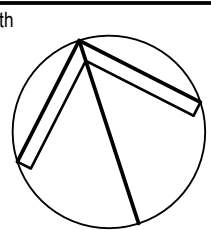


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Drawing Title					
STORMWATER CATCHMENT PLAN POST-DEVELOPMENT					
Drawn	Date	Scale	A1	Q.A. Check	Date
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Designed	Project No.	Dwg. No.		Issue	
GPC	NE180116	FIG-013		B	



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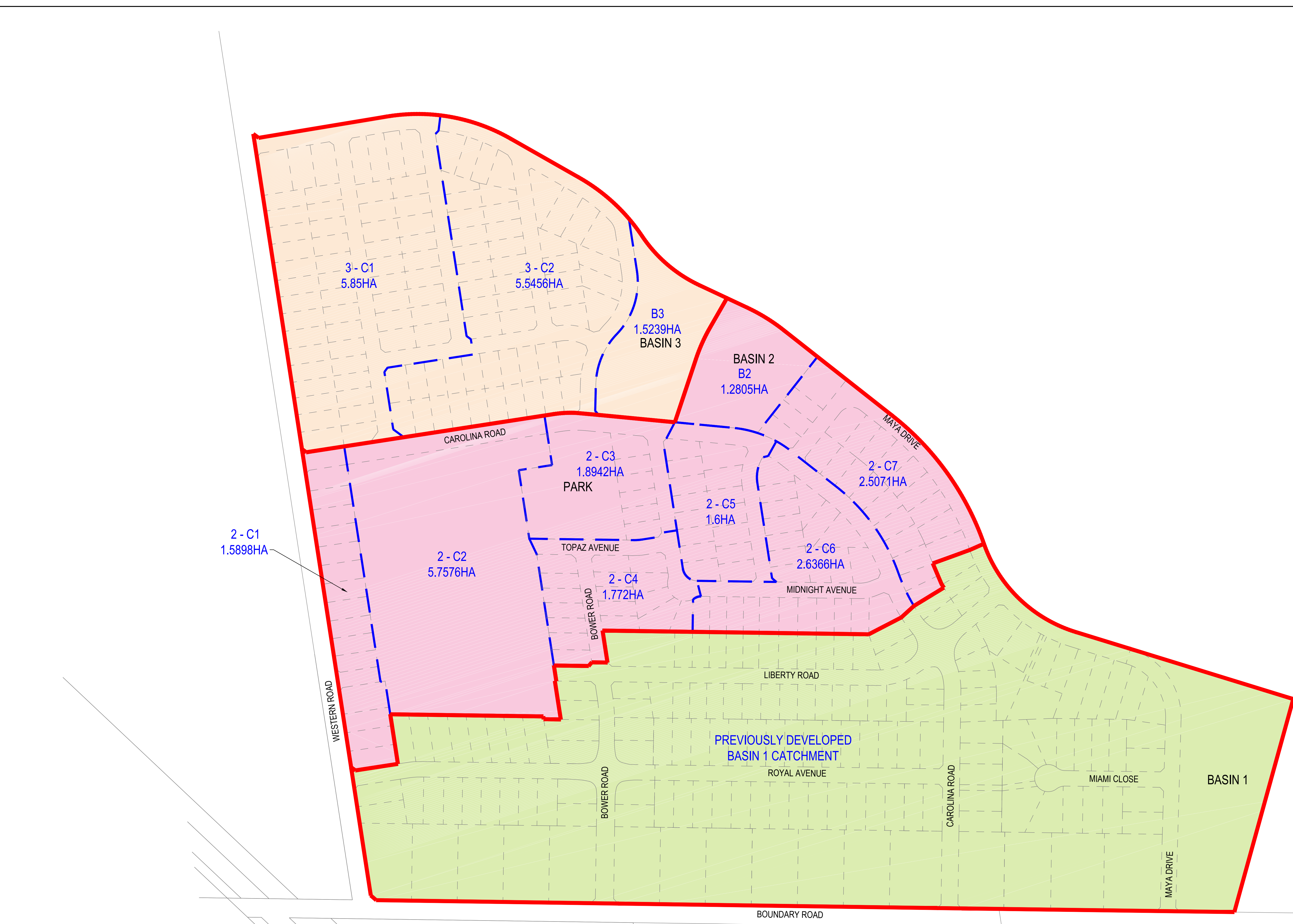
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LEGEND

- CATCHMENT 1

- CATCHMENT 2

- CATCHMENT 3

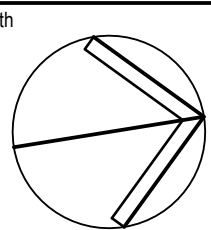


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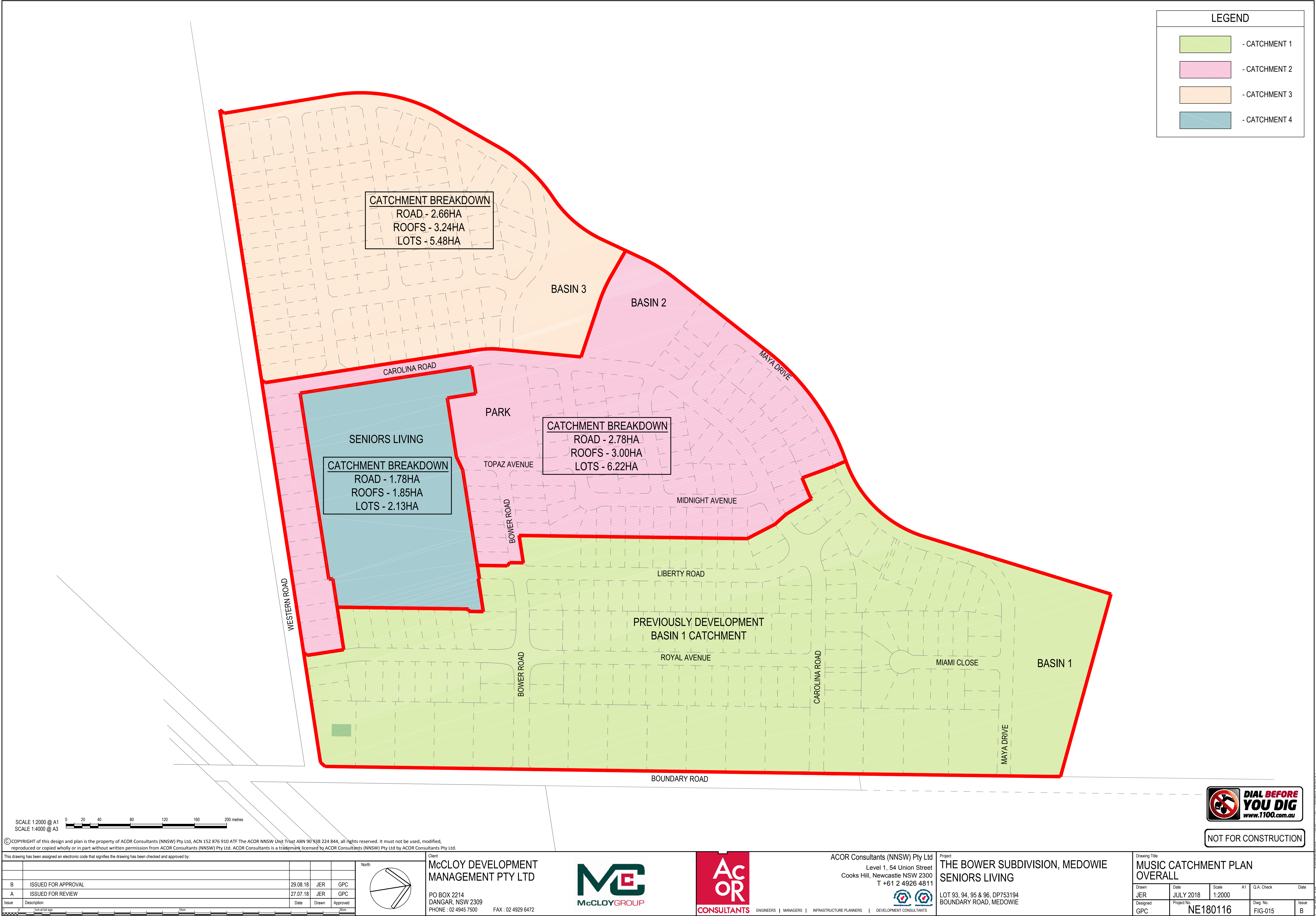
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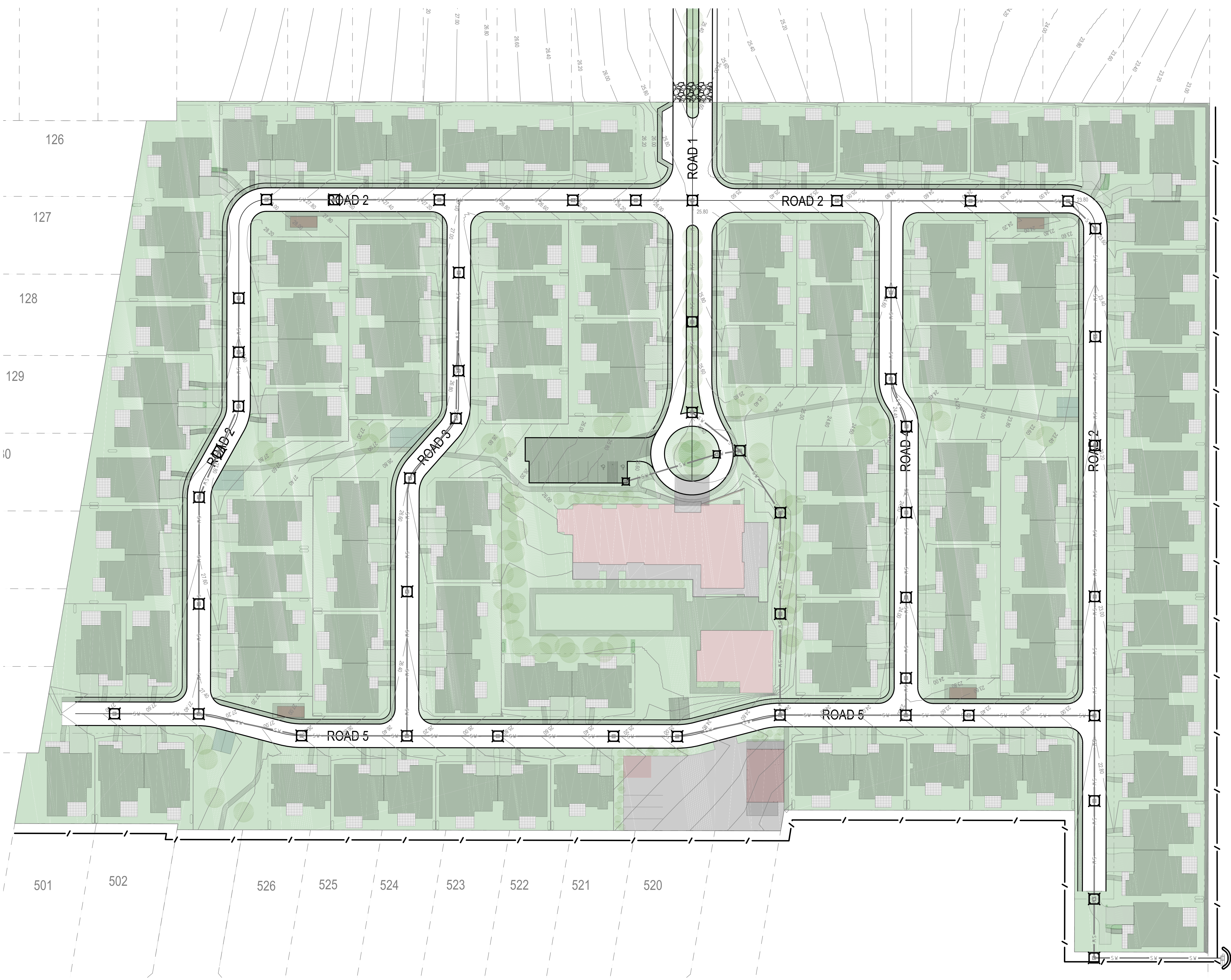
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Drawn JER	Date JULY 2018	Scale 1:2000	A1	Q.A. Check	Date
Designed GPC	Project No. NE180116	Dwg. No. FIG-014		Issue B	



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FILED BY: 8501782 Drawing: C:\Drawing\Projects\B0117\FIG-014.dwg

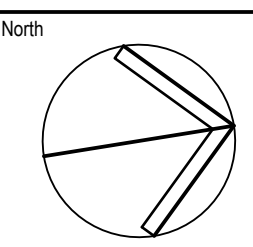




SCALE 1:500 @ A1
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Project
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LOT 93, 94, 95 & 96, DP753194
BOUNDARY ROAD, MEDOWIE

Drawing Title EROSION AND SEDIMENT CONTROL PLAN			
Drawn JER	Date JULY 2018	Scale 1:500	A1
Designed GPC	Project No. NE180116	Q.A. Check FIG-016	Date B

EROSION AND SEDIMENT CONTROL NOTES

1. PROVIDE EROSION AND SEDIMENT CONTROL MEASURES DURING CONSTRUCTION TO COUNCIL STANDARDS AND CONFORMING TO LANDCOM SOILS & CONSTRUCTION Vol 1, 4th EDITION, MARCH 2004.
2. PREPARE EROSION AND SEDIMENT CONTROL PLAN AND OBTAIN COUNCIL APPROVAL PRIOR TO WORKS.
3. ALL PERIMETER CONTROL DEVICES ARE TO BE INSTALLED PRIOR TO WORK COMMENCING AND BE MAINTAINED DURING CONSTRUCTION. LOCATE SEDIMENT FENCE WITHIN WORKS BOUNDARY.
4. CONTRACTOR TO DEFINE ACCESS, STOCKPILE AND OTHER AREAS PRIOR TO WORK COMMENCING.
5. PROVIDE A SINGLE POINT OF ACCESS TO THE SITE.
6. MINIMISE SITE DISTURBANCE AND REDUCE STOCKPILING TO A LEVEL NECESSARY TO CONSTRUCT THE WORKS. STOCKPILE AREAS, CONSTRUCTION ACCESSES AND NO GO AREAS TO BE DEFINED AND CONFIRMED PRIOR TO COMMENCEMENT OF WORK. FENCE NO GO AREAS.
7. PROVIDE MEASURES AT STOCKPILES TO DIVERT CLEAN WATER AND COLLECT SEDIMENT DOWNSTREAM, LOCATE STOCKPILES AWAY FROM STORMWATER FLOWS.
8. PROVIDE AND MAINTAIN PERMANENT GRASSING AS SOON AS POSSIBLE AFTER CONSTRUCTION. STAGE WORKS AS NECESSARY. GRASS SPECIES SHALL BE TO COUNCIL REQUIREMENTS. GRASS TURF TABLEDRAINS AND SWALES. MULCH (IF AVAILABLE FROM SITE CLEARING) AND SEED ALL OTHER DISTURBED AREAS INCLUDING TRENCHES, WHICH HAVE NOT BEEN TURFED. ON COMPLETION OF WORKS PROVIDE STRIP TURFING. SEE GENERAL NOTES.
9. CONTROL DUST BY WINDBREAKS, WATERING ETC.
10. EROSION AND SILT PROTECTION MEASURES ARE TO BE MAINTAINED AT ALL TIMES. ADJUST TO SUIT STAGING AND PROGRESS.
11. HIGH EROSION AREAS, INCLUDING BATTERS TO BE STABILISED WITHIN 7 DAYS OF COMPLETING OF WORKS AND EARLIER IF DIRECTED BY SUPERINTENDENT.
12. ALL STABILISED WORKS ARE TO BE MAINTAINED UNTIL COMPLETION OF WORKS.
13. REMOVE TEMPORARY MEASURES AFTER COMPLETION OF CONSTRUCTION AND STABILISATION OF WORKS.

LEGEND

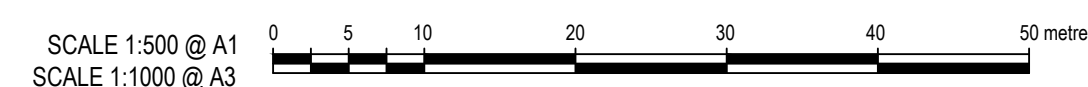
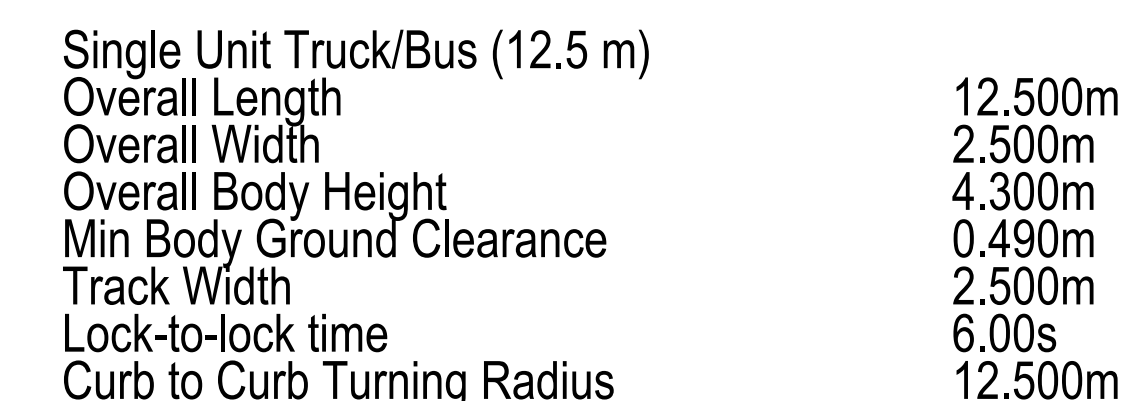
REFER TO LANDCOM: SOILS AND CONSTRUCTION Vol 1, 4th EDITION, MARCH 2004

- SEDIMENT FENCE TO SD 6-8
- MESH AND GRAVEL INLET FILTER TO SD 6-11
- GEOTEXTILE INLET FILTER TO SD 6-12
- STABILISED SITE ACCESS TO SD 6-14



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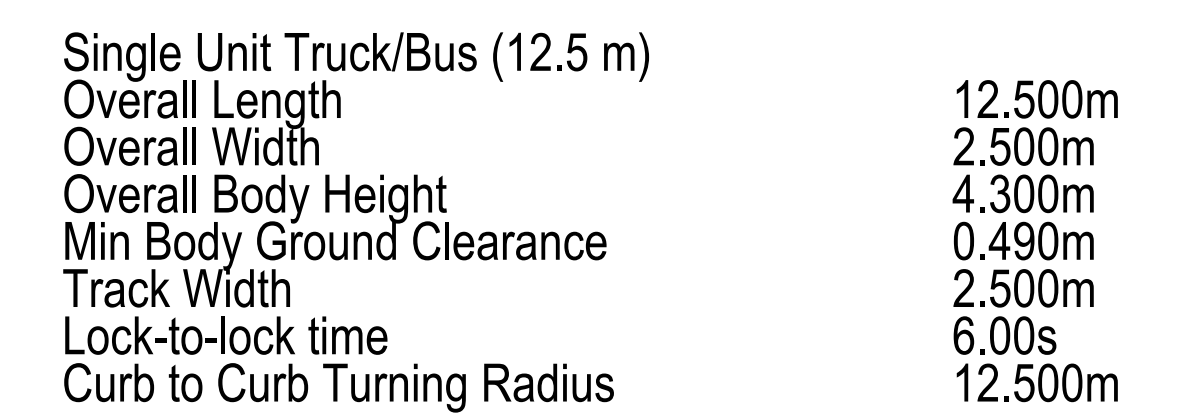
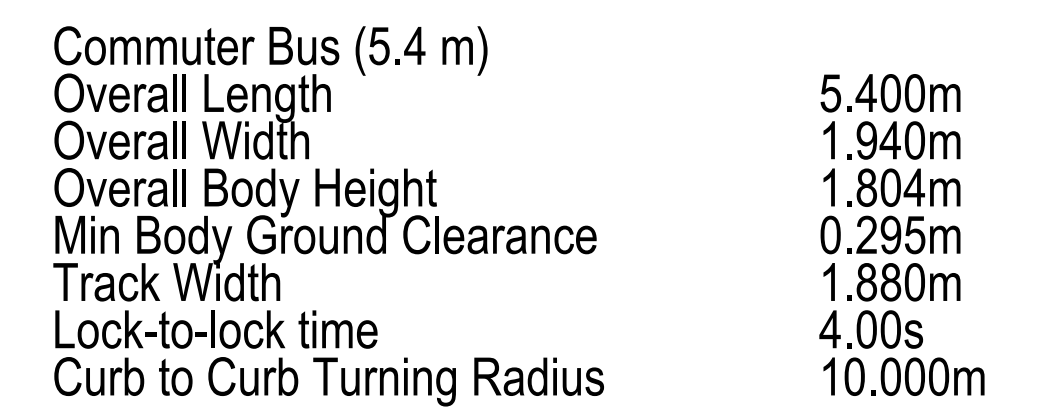
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et		SENIORS LIVING

LOT 93, 94, 95 & 96, DP753194
BOUNDARY ROAD, MEDOWIE

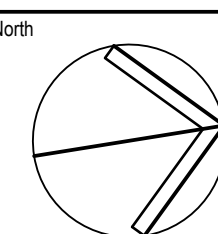
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Drawn JER	Date JULY 2018	Scale 1:500	A1	Q.A. Check
Designed GPC	Project No. NE180116		Dwg. No. FIG-017	Issued By



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LOT 93, 94, 95 & 96, DP753194
BOUNDARY ROAD, MEDOWIE

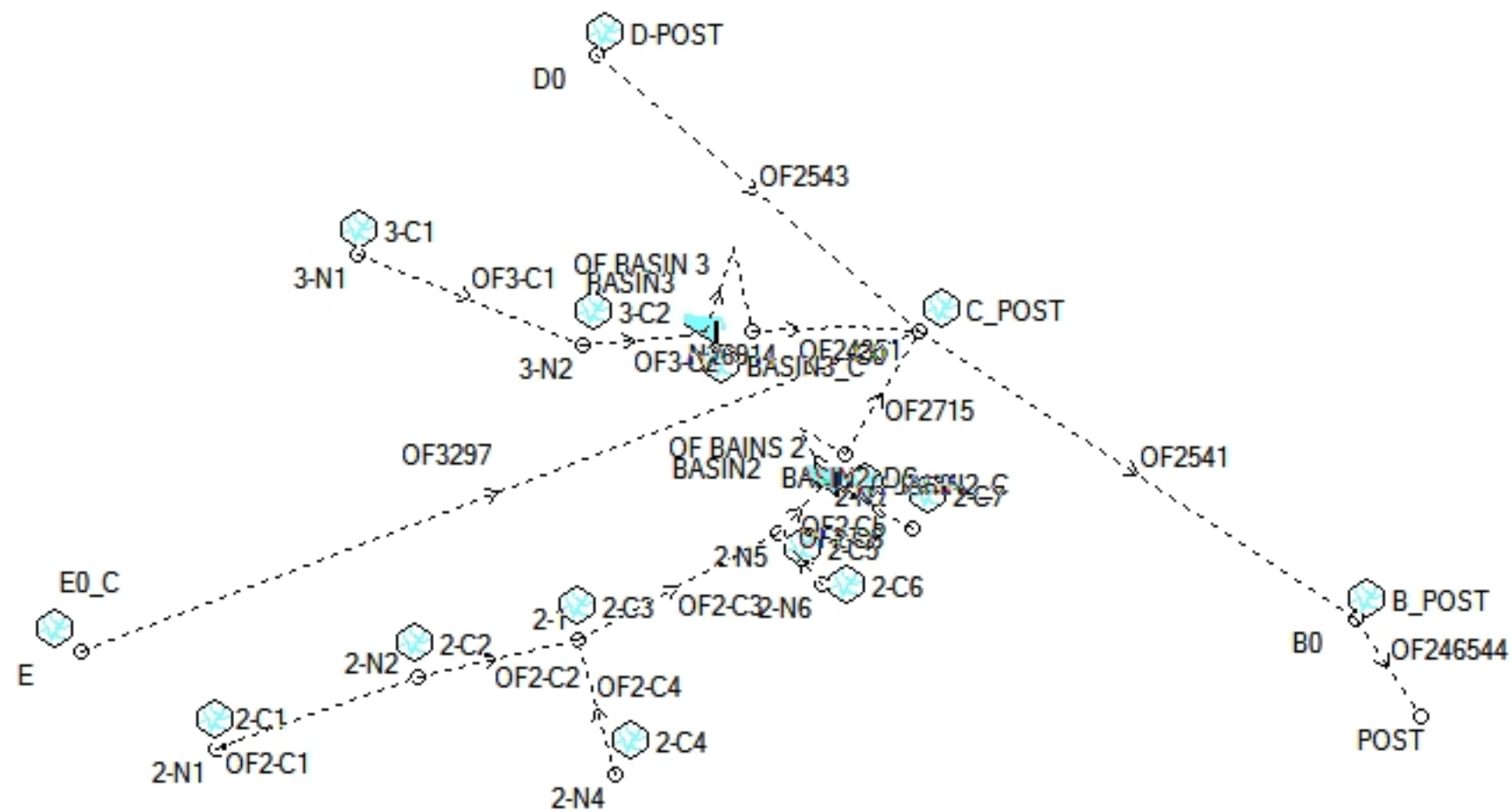
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Drawn	Date	Scale	A1	Q.A. Check Date
JER	JULY 2018	1:500		
Designed GPC	Project No. NE180116		Dwg. No. F/G-018	Issue A



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Appendix A

DRIANS Inputs and Results



PIT / NODE DETAILS

Name	Type	Family	Version 13 Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss	Inflow Hydrograph	Pit is
D	Node					20			0		78.393	-122.717	11981451		No	
C	Node					17			0		77.385	-121.325	11981452		No	
B	Node					16			0		76.749	-120.503	11981453		No	
D0	Node					20			0		70.005	-121.513	11984491		No	
2-N7	Node					19.3			0		68.802	-119.723	11984869		No	
E	Node					26			0		71.959	-119.26	11984871		No	
2-N6	Node					18			0		69.151	-119.511	11984873		No	
2-N4	Node					22.2			0		69.934	-118.793	11984874		No	
2-N1	Node					22.8			0		71.449	-118.89	11984877		No	
3-N1	Node					20.7			0		70.912	-120.765	11984885		No	
PRE	Node					15			0		76.518	-120.131	12710791		No	
POST	Node					15			0		66.882	-119.013	12710798		No	
2-N2	Node					21			0		70.683	-119.163	11984876		No	
2-Jan	Node					20			0		70.076	-119.304	11984875		No	
2-N5	Node					19.4			0		69.319	-119.705	12239017		No	
BASIN2_DS	Node					16.1			0		69.057	-120	12048814		No	
3-N2	Node					19			0		70.05	-120.421	11984870		No	
N26914	Node					16.1			0		69.414	-120.471	12048862		No	
C0	Node					17			0		68.782	-120.473	11984485		No	
B0	Node					16			0		67.122	-119.378	11984477		No	

DETENTION BASIN DETAILS

Name	Elev	Surf. Area	Not Used	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Length(m)	id
BASIN2	17.2	6100		None						69.129	-119.898	No			12061034
	19.2	10245													
BASIN3	17.2	3221		None						69.584	-120.472	No			12061036
	19.2	6841													

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area (ha)	Paved Area %	Grass Area %	Supp Area %	Paved Time (min)	Grass Time (min)	Supp Time (min)	Paved Length (m)	Grass Length (m)	Supp Length (m)	Paved Slope(%)	Grass Slope %	Supp Slope %	Paved Rough	Grass Rough	Supp Rough	Lag Time or Factor	Gutter Length (m)	Gutter Slope %	Gutter FlowFactor	Rainfall Multiplier
D-PRE	D	78.44		0	100	0	0	22.5	0	-1	100	-1	-1	1.5	-1	-1	0.1	-1	0			1
C_PRE	C	80.33		0	100	0	0	25.5	0	-1	100	-1	-1	1.2	-1	-1	0.1	-1	0			1
B_PRE	B	40.32		0	100	0	0	27	0	-1	100	-1	-1	1.1	-1	-1	0.1	-1	0			1
D-POST	D0	78.44		0	100	0	0	22.5	0	-1	100	-1	-1	1.5	-1	-1	0.1	-1	0			1
2-C7	2-N7	2.5071		60	40	0	6	6	0										0			1
E0_C	E	26.2		0	100	0	0	15	0	-1	100	-1	-1	1.5	-1	-1	0.1	-1	0			1
2-C6	2-N6	2.6366		60	40	0	6	6	0				-1	1.5	-1	-1	0.1	-1	0			1
2-C4	2-N4	1.772		60	40	0	6	6	0										0			1
2-C1	2-N1	1.5898		60	40	0	6	6	0										0			1
3-C1	3-N1	5.85		60	40	0	6	6	0										0			1
2-C2	2-N2	5.7576		80	20	0	6	12	0										0			1
2-C3	2-Jan	1.8942		60	40	0	6	6	0										0			1
2-C5	2-N5	1.6		60	40	0	6	6	0										0			1
BASIN2_C	BASIN2	1.2805		0	100	0	0	0	0	0	1	0	0	0.1	0	0	0.03	0	0			1
3-C2	3-N2	5.5456		60	40	0	6	6	0										0			1
BASIN3_C	BASIN3	1.5239		0	100	0	0	0	0	0	1	0	0	0.1	0	0	0.03	0	0			1
C_POST	C0	31.98		0	100	0	0	27	0	-1	100	-1	-1	1	-1	-1	0.1	-1	0			1
B_POST	B0	30.51		0	100	0	0	27	0	-1	100	-1	-1	1.1	-1	-1	0.1	-1	0			1

OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Storms (m)	SafeDepth Minor Storms (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %	id
OF1615	D	C		11.7			Creek Shallow	0.3	0.3	0.6	1	0	11981475
OF1616	C	B		7.2			Creek Shallow	0.3	0.3	0.6	1	0	11981476
OF246541	B	PRE		0.2			Creek Shallow	0.3	0.3	0.6	1	0	12710792
OF246544	B0	POST		0.2			Creek Shallow	0.3	0.3	0.6	1	0	12710796

Name	From	To	Length (m)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Storms (m)	SafeDepth Minor Storms (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %	id
OF2543	D0	C0		650			Creek Shallow	0.3	0.3	0.6	1	0	11984489
OF2-C7	2-N7	BASIN2		10			V drain	0.3	0.3	0.4	1	0	12048829
OF3297	E	C0		660			overflow	0.3	0.3	0.4	1	0	11986868
OF2-C6	2-N6	2-N5		55			Standard Kerb- 7m road	0.3	0.15	0.4	1	0	11984884
OF2-C4	2-N4	2-Jan		120			Standard Kerb- 7m road	0.3	0.15	0.4	1.9	0	11984882
OF2-C1	2-N1	2-N2		220			Standard Kerb- 7m road	0.3	0.15	0.4	0.8	0	11984879
OF3-C1	3-N1	3-N2		210			Standard Kerb- 7m road	0.3	0.15	0.4	0.8	0	11984886
OF2-C2	2-N2	2-Jan		135			Standard Kerb- 7m road	0.3	0.15	0.4	0.8	0	11984881
OF2-C3	2-Jan	2-N5		75			Standard Kerb- 7m road	0.3	0.15	0.4	1	0	11984883
OF2-C5	2-N5	BASIN2		10			overflow	0.3	0.3	0.4	1	0	12239024
OF BAINS 2	BASIN2	BASIN2_DS		10	17.2		overflow	0.3	0.3	0.4	1	0	12048873
OF2715	BASIN2_DS	C0		125			overflow	0.3	0.3	0.4	1	0	11984956
OF3-C2	3-N2	BASIN3		10			overflow	0.3	0.3	0.4	1	0	11984957
OF BASIN 3	BASIN3	N26914		10	17.2		overflow	0.3	0.3	0.4	1	0	12048865
OF24351	N26914	C0		115			overflow	0.3	0.3	0.4	1	0	12048869
OF2541	C0	B0		400			overflow	0.3	0.3	0.4	1	0	11984483

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
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SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
D-PRE	6.19	0	6.19	0	43.84		0 20% AEP, 1 hour burst, Storm 4
C_PRE	5.9	0	5.9	0	50.85		0 20% AEP, 1.5 hour burst, Storm 8
B_PRE	2.854	0	2.854	0	53.02		0 20% AEP, 1.5 hour burst, Storm 2
D-POST	6.19	0	6.19	0	43.84		0 20% AEP, 1 hour burst, Storm 4
2-C7	0.746	0.494	0.252	6	6		0 20% AEP, 10 min burst, Storm 8
E0_C	2.51	0	2.51	0	34.85		0 20% AEP, 45 min burst, Storm 3
2-C6	0.784	0.52	0.265	6	6		0 20% AEP, 10 min burst, Storm 8
2-C4	0.527	0.349	0.178	6	6		0 20% AEP, 10 min burst, Storm 8
2-C1	0.473	0.313	0.159	6	6		0 20% AEP, 10 min burst, Storm 8
3-C1	1.74	1.153	0.587	6	6		0 20% AEP, 10 min burst, Storm 8
2-C2	1.714	1.612	0.155	6	12		0 20% AEP, 10 min burst, Storm 3
2-C3	0.563	0.373	0.19	6	6		0 20% AEP, 10 min burst, Storm 8
2-C5	0.476	0.315	0.161	6	6		0 20% AEP, 10 min burst, Storm 8
BASIN2_C	0.423	0	0.423	0	0.91		0 20% AEP, 5 min burst, Storm 1
3-C2	1.65	1.093	0.556	6	6		0 20% AEP, 10 min burst, Storm 8
BASIN3_C	0.503	0	0.503	0	0.91		0 20% AEP, 5 min burst, Storm 1
C_POST	2.263	0	2.263	0	53.78		0 20% AEP, 1.5 hour burst, Storm 2
B_POST	2.159	0	2.159	0	53.02		0 20% AEP, 1.5 hour burst, Storm 2

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
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CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm
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OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF1615	6.19	6.19	0.346	0.881	1.74	6.67		1.97 20% AEP, 1 hour burst, Storm 4
OF1616	11.393	11.393	0.346	1.119	2.61	8.08		2.33 20% AEP, 1 hour burst, Storm 6
OF246541	13.596	13.596	0.346	1.201	2.93	8.56		2.44 20% AEP, 1 hour burst, Storm 6
OF2543	6.109	5.892	0.346	0.877	1.72	6.64		1.96 20% AEP, 45 min burst, Storm 8
OF2-C7	0.746	0.745	0.394	0.314	0.59	2.51		1.9 20% AEP, 10 min burst, Storm 8
OF3297	2.507	2.408	4.801	0.126	0.21	12.03		1.65 20% AEP, 45 min burst, Storm 8
OF2-C6	0.784	0.774	0.293	0.213	0.32	4.87		1.52 20% AEP, 10 min burst, Storm 8
OF2-C4	0.527	0.506	0.404	0.167	0.28	3.87		1.67 20% AEP, 10 min burst, Storm 8
OF2-C1	0.46	0.405	0.262	0.184	0.22	4.25		1.19 20% AEP, 20 min burst, Storm 1
OF3-C1	1.694	1.604	0.262	0.29	0.51	6.57		1.76 20% AEP, 20 min burst, Storm 1
OF2-C2	2.008	1.938	0.262	0.309	0.57	6.98		1.85 20% AEP, 10 min burst, Storm 8
OF2-C3	2.904	2.91	0.293	0.31	0.82	7		2.66 20% AEP, 20 min burst, Storm 2
OF2-C5	4.006	4.008	4.801	0.167	0.33	12.03		1.99 20% AEP, 20 min burst, Storm 1
OF BAINS 2	0.617	0.617	4.801	0.054	0.05	12.01		0.95 20% AEP, 2 hour burst, Storm 5
OF2715	0.617	0.617	4.801	0.054	0.05	12.01		0.95 20% AEP, 2 hour burst, Storm 5
OF3-C2	3.128	3.118	4.801	0.144	0.26	12.03		1.81 20% AEP, 10 min burst, Storm 8
OF BASIN 3	0.342	0.342	4.801	0.038	0.03	12.01		0.76 20% AEP, 2 hour burst, Storm 3
OF24351	0.342	0.341	4.801	0.038	0.03	12.01		0.76 20% AEP, 2 hour burst, Storm 3
OF2541	11.219	11.188	4.801	0.313	0.93	12.06		2.98 20% AEP, 45 min burst, Storm 8
OF246544	13.147	13.147	0.346	1.185	2.86	8.47		2.42 20% AEP, 45 min burst, Storm 8

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
BASIN2	18.05	5896.9	0.617	0	0.617
BASIN3	18.21	4055.2	0.342	0	0.342

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
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SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
D-PRE	9.191	0	9.191	0	40.79		0 10% AEP, 45 min burst, Storm 2
C_PRE	9.004	0	9.004	0	46.52		0 10% AEP, 1 hour burst, Storm 10
B_PRE	4.335	0	4.335	0	48.58		0 10% AEP, 1 hour burst, Storm 10
D-POST	9.191	0	9.191	0	40.79		0 10% AEP, 45 min burst, Storm 2
2-C7	0.959	0.694	0.305	6	6		0 10% AEP, 15 min burst, Storm 3
E0_C	3.611	0	3.611	0	33.29		0 10% AEP, 45 min burst, Storm 2
2-C6	1.008	0.73	0.321	6	6		0 10% AEP, 15 min burst, Storm 3
2-C4	0.678	0.491	0.215	6	6		0 10% AEP, 15 min burst, Storm 3
2-C1	0.608	0.44	0.193	6	6		0 10% AEP, 15 min burst, Storm 3
3-C1	2.237	1.62	0.711	6	6		0 10% AEP, 15 min burst, Storm 3
2-C2	2.195	1.993	0.292	6	12		0 10% AEP, 15 min burst, Storm 4
2-C3	0.724	0.525	0.23	6	6		0 10% AEP, 15 min burst, Storm 3
2-C5	0.612	0.443	0.195	6	6		0 10% AEP, 15 min burst, Storm 3
BASIN2_C	0.543	0	0.543	0	0.84		0 10% AEP, 5 min burst, Storm 1
3-C2	2.121	1.536	0.674	6	6		0 10% AEP, 15 min burst, Storm 3
BASIN3_C	0.646	0	0.646	0	0.84		0 10% AEP, 5 min burst, Storm 1
C_POST	3.369	0	3.369	0	49.21		0 10% AEP, 1 hour burst, Storm 7
B_POST	3.28	0	3.28	0	48.58		0 10% AEP, 1 hour burst, Storm 7

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
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CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm
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OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF1615	9.191	9.191	0.346	1.028	2.26	7.54		2.2 10% AEP, 45 min burst, Storm 2
OF1616	17.046	17.046	0.346	1.314	3.4	9.23		2.59 10% AEP, 1 hour burst, Storm 10
OF246541	20.244	20.244	0.346	1.408	3.81	9.79		2.71 10% AEP, 1 hour burst, Storm 10
OF2543	9.22	8.933	0.346	1.029	2.26	7.54		2.2 10% AEP, 45 min burst, Storm 8
OF2-C7	0.959	0.963	0.394	0.345	0.7	2.76		2.03 10% AEP, 15 min burst, Storm 3
OF3297	3.508	3.381	4.801	0.155	0.29	12.03		1.89 10% AEP, 45 min burst, Storm 4
OF2-C6	1.008	1.006	0.293	0.232	0.38	5.3		1.64 10% AEP, 15 min burst, Storm 3
OF2-C4	0.678	0.661	0.404	0.181	0.33	4.18		1.81 10% AEP, 15 min burst, Storm 3
OF2-C1	0.601	0.538	0.262	0.202	0.26	4.63		1.29 10% AEP, 15 min burst, Storm 6
OF3-C1	2.213	2.096	0.262	0.31	0.63	7		2.02 10% AEP, 15 min burst, Storm 6
OF2-C2	2.554	2.49	0.262	0.31	0.72	7		2.33 10% AEP, 25 min burst, Storm 3
OF2-C3	3.798	3.752	0.293	0.31	1.08	7		3.47 10% AEP, 15 min burst, Storm 3
OF2-C5	5.169	5.169	4.801	0.196	0.43	12.04		2.2 10% AEP, 15 min burst, Storm 3
OF BAINS 2	0.724	0.724	4.801	0.06	0.06	12.01		1 10% AEP, 3 hour burst, Storm 6
OF2715	0.724	0.724	4.801	0.06	0.06	12.01		1 10% AEP, 3 hour burst, Storm 6
OF3-C2	4.041	4.032	4.801	0.168	0.34	12.03		2 10% AEP, 10 min burst, Storm 7
OF BASIN 3	0.605	0.604	4.801	0.053	0.05	12.01		0.95 10% AEP, 3 hour burst, Storm 6
OF24351	0.604	0.601	4.801	0.053	0.05	12.01		0.95 10% AEP, 3 hour burst, Storm 6
OF2541	16.215	16.177	4.801	0.392	1.35	12.08		3.44 10% AEP, 45 min burst, Storm 3
OF246544	19.232	19.232	0.346	1.379	3.69	9.62		2.67 10% AEP, 1 hour burst, Storm 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
BASIN2	18.31	7904.4	0.724	0	0.724
BASIN3	18.48	5424	0.605	0	0.605

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
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SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
D-PRE	12.493	0	12.493	0	39.55		0 5% AEP, 45 min burst, Storm 3
C_PRE	11.771	0	11.771	0	45.11		0 5% AEP, 1 hour burst, Storm 1
B_PRE	5.746	0	5.746	0	47.13		0 5% AEP, 1 hour burst, Storm 1
D-POST	12.493	0	12.493	0	39.55		0 5% AEP, 45 min burst, Storm 3
2-C7	1.194	0.836	0.392	6	6		0 5% AEP, 15 min burst, Storm 3
E0_C	4.757	0	4.757	0	32.05		0 5% AEP, 45 min burst, Storm 2
2-C6	1.256	0.879	0.412	6	6		0 5% AEP, 15 min burst, Storm 3
2-C4	0.844	0.591	0.277	6	6		0 5% AEP, 15 min burst, Storm 3
2-C1	0.757	0.53	0.248	6	6		0 5% AEP, 15 min burst, Storm 3
3-C1	2.787	1.95	0.914	6	6		0 5% AEP, 15 min burst, Storm 3
2-C2	2.648	2.376	0.385	6	12		0 5% AEP, 15 min burst, Storm 4
2-C3	0.902	0.631	0.296	6	6		0 5% AEP, 15 min burst, Storm 3
2-C5	0.762	0.533	0.25	6	6		0 5% AEP, 15 min burst, Storm 3
BASIN2_C	0.666	0	0.666	0	0.78		0 5% AEP, 5 min burst, Storm 1
3-C2	2.642	1.848	0.866	6	6		0 5% AEP, 15 min burst, Storm 3
BASIN3_C	0.793	0	0.793	0	0.78		0 5% AEP, 5 min burst, Storm 1
C_POST	4.557	0	4.557	0	47.71		0 5% AEP, 1 hour burst, Storm 1
B_POST	4.348	0	4.348	0	47.13		0 5% AEP, 1 hour burst, Storm 1

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
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CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm
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OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF1615	12.493	12.493	0.346	1.161	2.77	8.33		2.38 5% AEP, 45 min burst, Storm 3
OF1616	22.628	22.628	0.346	1.472	4.11	10.17		2.79 5% AEP, 45 min burst, Storm 2
OF246541	27.308	27.308	0.346	1.587	4.65	10.85		2.93 5% AEP, 45 min burst, Storm 1
OF2543	12.493	12.082	0.346	1.161	2.77	8.33		2.38 5% AEP, 45 min burst, Storm 3
OF2-C7	1.196	1.19	0.394	0.374	0.8	2.99		2.13 5% AEP, 15 min burst, Storm 9
OF3297	4.718	4.548	4.801	0.185	0.39	12.04		2.12 5% AEP, 45 min burst, Storm 4
OF2-C6	1.258	1.226	1.089	0.251	0.44	5.71		1.75 5% AEP, 15 min burst, Storm 9
OF2-C4	0.846	0.803	0.914	0.196	0.38	4.5		1.93 5% AEP, 15 min burst, Storm 9
OF2-C1	0.726	0.663	1.161	0.215	0.3	4.93		1.37 5% AEP, 15 min burst, Storm 6
OF3-C1	2.787	2.592	1.161	0.31	0.79	7		2.55 5% AEP, 15 min burst, Storm 3
OF2-C2	3.09	3.044	1.161	0.31	0.88	7		2.82 5% AEP, 25 min burst, Storm 6
OF2-C3	4.675	4.615	1.089	0.31	1.32	7		4.27 5% AEP, 15 min burst, Storm 3
OF2-C5	6.364	6.363	4.801	0.222	0.53	12.04		2.38 5% AEP, 15 min burst, Storm 9
OF BAINS 2	0.823	0.823	4.801	0.064	0.07	12.01		1.07 5% AEP, 3 hour burst, Storm 6
OF2715	0.823	0.822	4.801	0.064	0.07	12.01		1.07 5% AEP, 3 hour burst, Storm 6
OF3-C2	4.957	4.945	4.801	0.191	0.41	12.04		2.16 5% AEP, 10 min burst, Storm 7
OF BASIN 3	0.847	0.847	4.801	0.066	0.07	12.01		1.07 5% AEP, 3 hour burst, Storm 6
OF24351	0.847	0.847	4.801	0.066	0.07	12.01		1.07 5% AEP, 3 hour burst, Storm 6
OF2541	21.708	21.641	4.801	0.469	1.8	12.09		3.84 5% AEP, 45 min burst, Storm 1
OF246544	25.759	25.759	0.346	1.551	4.47	10.63		2.88 5% AEP, 45 min burst, Storm 1

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
BASIN2	18.55	10013.8	0.823	0	0.823
BASIN3	18.63	6282.4	0.847	0	0.847

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
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SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
D-PRE	17.306	0	17.306	0	38.2		0 2% AEP, 45 min burst, Storm 10
C_PRE	16.074	0	16.074	0	42.29		0 2% AEP, 45 min burst, Storm 2
B_PRE	7.808	0	7.808	0	45.54		0 2% AEP, 1 hour burst, Storm 5
D-POST	17.306	0	17.306	0	38.2		0 2% AEP, 45 min burst, Storm 10
2-C7	1.464	0.971	0.514	6	6		0 2% AEP, 10 min burst, Storm 1
E0_C	6.568	0	6.568	0	30.7		0 2% AEP, 45 min burst, Storm 3
2-C6	1.539	1.021	0.54	6	6		0 2% AEP, 10 min burst, Storm 1
2-C4	1.034	0.686	0.363	6	6		0 2% AEP, 10 min burst, Storm 1
2-C1	0.928	0.616	0.326	6	6		0 2% AEP, 10 min burst, Storm 1
3-C1	3.415	2.265	1.198	6	6		0 2% AEP, 10 min burst, Storm 1
2-C2	3.23	2.972	0.407	6	12		0 2% AEP, 10 min burst, Storm 1
2-C3	1.106	0.733	0.388	6	6		0 2% AEP, 10 min burst, Storm 1
2-C5	0.934	0.619	0.328	6	6		0 2% AEP, 10 min burst, Storm 1
BASIN2_C	0.841	0	0.841	0	0.72		0 2% AEP, 5 min burst, Storm 1
3-C2	3.237	2.147	1.136	6	6		0 2% AEP, 10 min burst, Storm 1
BASIN3_C	1.001	0	1.001	0	0.72		0 2% AEP, 5 min burst, Storm 1
C_POST	6.139	0	6.139	0	46.08		0 2% AEP, 1 hour burst, Storm 5
B_POST	5.909	0	5.909	0	45.54		0 2% AEP, 1 hour burst, Storm 5

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
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CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm
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OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF1615	17.306	17.306	0.346	1.322	3.44	9.28		2.6 2% AEP, 45 min burst, Storm 10
OF1616	31.218	31.218	0.346	1.674	5.08	11.37		3.03 2% AEP, 45 min burst, Storm 3
OF246541	37.216	37.216	0.346	1.797	5.7	12.09		3.17 2% AEP, 45 min burst, Storm 1
OF2543	17.28	16.748	0.346	1.321	3.43	9.27		2.6 2% AEP, 45 min burst, Storm 3
OF2-C7	1.464	1.47	0.394	0.435	0.77	5.98		1.77 2% AEP, 10 min burst, Storm 1
OF3297	6.568	6.356	4.801	0.226	0.55	12.05		2.42 2% AEP, 45 min burst, Storm 3
OF2-C6	1.539	1.533	1.089	0.27	0.5	6.12		1.85 2% AEP, 10 min burst, Storm 1
OF2-C4	1.034	1.01	0.914	0.21	0.43	4.81		2.06 2% AEP, 10 min burst, Storm 1
OF2-C1	0.895	0.837	1.161	0.232	0.34	5.28		1.46 2% AEP, 10 min burst, Storm 7
OF3-C1	3.415	3.233	1.161	0.31	0.97	7		3.12 2% AEP, 10 min burst, Storm 1
OF2-C2	3.933	3.828	1.161	0.31	1.11	7		3.59 2% AEP, 10 min burst, Storm 7
OF2-C3	5.737	5.738	1.089	0.31	1.63	7		5.24 2% AEP, 10 min burst, Storm 1
OF2-C5	7.898	7.905	4.801	0.253	0.66	12.05		2.59 2% AEP, 10 min burst, Storm 1
OF BAINS 2	1.331	1.331	4.801	0.086	0.11	12.02		1.28 2% AEP, 2 hour burst, Storm 2
OF2715	1.331	1.325	4.801	0.086	0.11	12.02		1.28 2% AEP, 2 hour burst, Storm 2
OF3-C2	6.261	6.255	4.801	0.219	0.52	12.04		2.38 2% AEP, 10 min burst, Storm 7
OF BASIN 3	1.342	1.343	4.801	0.086	0.11	12.02		1.29 2% AEP, 1.5 hour burst, Storm 8
OF24351	1.343	1.336	4.801	0.086	0.11	12.02		1.29 2% AEP, 1.5 hour burst, Storm 8
OF2541	30.653	30.576	4.801	0.581	2.54	12.12		4.38 2% AEP, 45 min burst, Storm 10
OF246544	36.3	36.3	0.346	1.779	5.61	11.99		3.15 2% AEP, 45 min burst, Storm 10

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
BASIN2	18.84	12583.9	1.331	0	1.331
BASIN3	18.84	7496.4	1.342	0	1.342

PIT / NODE DETAILS

Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Version 8 Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
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SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
D-PRE	21.077	0	21.077	0	37.34		0 1% AEP, 45 min burst, Storm 10
C_PRE	19.931	0	19.931	0	41.36		0 1% AEP, 45 min burst, Storm 10
B_PRE	9.549	0	9.549	0	43.28		0 1% AEP, 45 min burst, Storm 9
D-POST	21.077	0	21.077	0	37.34		0 1% AEP, 45 min burst, Storm 10
2-C7	1.723	1.125	0.628	6	6		0 1% AEP, 10 min burst, Storm 1
E0_C	8.121	0	8.121	0	28.44		0 1% AEP, 30 min burst, Storm 8
2-C6	1.812	1.183	0.661	6	6		0 1% AEP, 10 min burst, Storm 1
2-C4	1.218	0.795	0.444	6	6		0 1% AEP, 10 min burst, Storm 1
2-C1	1.093	0.713	0.398	6	6		0 1% AEP, 10 min burst, Storm 1
3-C1	4.021	2.625	1.466	6	6		0 1% AEP, 10 min burst, Storm 1
2-C2	3.762	3.445	0.494	6	12		0 1% AEP, 10 min burst, Storm 1
2-C3	1.302	0.85	0.475	6	6		0 1% AEP, 10 min burst, Storm 1
2-C5	1.1	0.718	0.401	6	6		0 1% AEP, 10 min burst, Storm 1
BASIN2_C	0.986	0	0.986	0	0.68		0 1% AEP, 5 min burst, Storm 1
3-C2	3.812	2.489	1.39	6	6		0 1% AEP, 10 min burst, Storm 1
BASIN3_C	1.174	0	1.174	0	0.68		0 1% AEP, 5 min burst, Storm 1
C_POST	7.574	0	7.574	0	43.76		0 1% AEP, 45 min burst, Storm 7
B_POST	7.226	0	7.226	0	43.28		0 1% AEP, 45 min burst, Storm 9

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
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CHANNEL DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm
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OVERFLOW ROUTE DETAILS

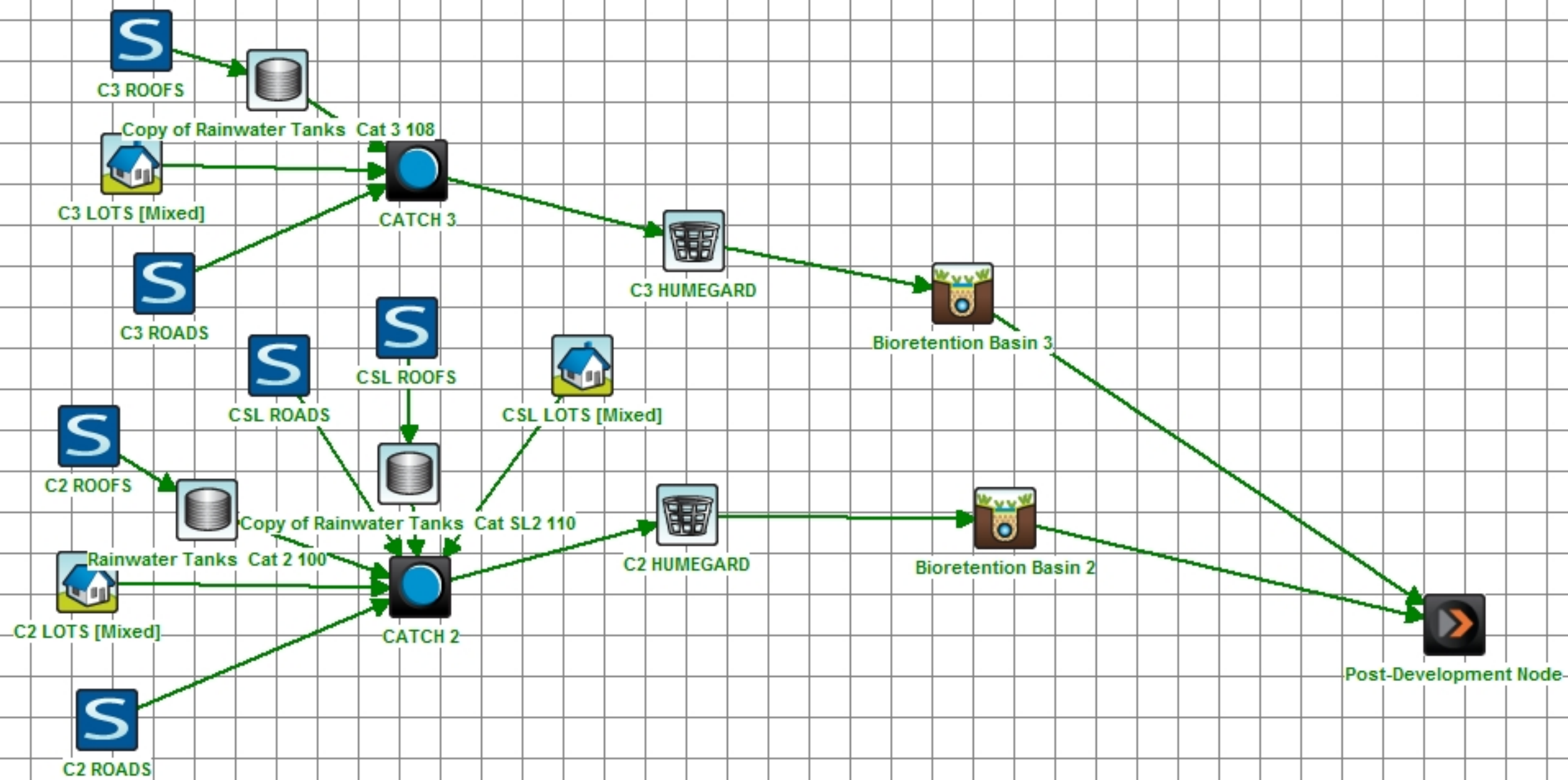
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF1615	21.077	21.077	0.346	1.43	3.92	9.92		2.74 1% AEP, 45 min burst, Storm 10
OF1616	38.142	38.142	0.346	1.815	5.79	12.2		3.19 1% AEP, 45 min burst, Storm 1
OF246541	45.596	45.596	0.346	1.949	6.52	12.99		3.34 1% AEP, 45 min burst, Storm 8
OF2543	21.054	20.498	0.346	1.43	3.92	9.92		2.74 1% AEP, 45 min burst, Storm 3
OF2-C7	1.723	1.709	0.394	0.457	0.81	7.12		1.76 1% AEP, 10 min burst, Storm 1
OF3297	7.984	7.79	4.801	0.254	0.66	12.05		2.61 1% AEP, 45 min burst, Storm 3
OF2-C6	1.812	1.808	1.089	0.286	0.56	6.47		1.94 1% AEP, 10 min burst, Storm 1
OF2-C4	1.218	1.19	0.914	0.222	0.48	5.07		2.17 1% AEP, 10 min burst, Storm 1
OF2-C1	1.039	0.985	1.161	0.244	0.37	5.56		1.52 1% AEP, 10 min burst, Storm 7
OF3-C1	4.021	3.815	1.161	0.31	1.14	7		3.68 1% AEP, 10 min burst, Storm 1
OF2-C2	4.584	4.475	1.161	0.31	1.3	7		4.19 1% AEP, 10 min burst, Storm 7
OF2-C3	6.712	6.723	1.089	0.31	1.9	7		6.14 1% AEP, 10 min burst, Storm 1
OF2-C5	9.24	9.24	4.801	0.278	0.77	12.06		2.77 1% AEP, 10 min burst, Storm 1
OF BAINS 2	2.275	2.274	4.801	0.119	0.19	12.02		1.6 1% AEP, 3 hour burst, Storm 7
OF2715	2.274	2.264	4.801	0.119	0.19	12.02		1.6 1% AEP, 3 hour burst, Storm 7
OF3-C2	7.305	7.298	4.801	0.241	0.61	12.05		2.52 1% AEP, 10 min burst, Storm 7
OF BASIN 3	2.055	2.055	4.801	0.112	0.17	12.02		1.53 1% AEP, 2 hour burst, Storm 6
OF24351	2.055	2.047	4.801	0.112	0.17	12.02		1.53 1% AEP, 2 hour burst, Storm 6
OF2541	37.892	37.806	4.801	0.663	3.14	12.13		4.74 1% AEP, 45 min burst, Storm 10
OF246544	44.897	44.897	0.346	1.937	6.45	12.92		3.33 1% AEP, 45 min burst, Storm 10

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
BASIN2	18.99	14085	2.275	0	2.275
BASIN3	18.96	8260.9	2.055	0	2.055

Appendix B

MUSIC inputs and Results



MUSIC-link Report

Project Details		Company Details	
Project:	NE180116 - The Bower Seniors Living	Company:	ACOR Consultants
Report Export Date:	29/08/2018	Contact:	G Couch
Catchment Name:	NE180116 BOWER_R2	Address:	Level 1, 54 Union St Cooks Hill, NSW 2300
Catchment Area:	29.143ha	Phone:	02 4926 4811
Impervious Area*:	59.74%	Email:	gcouch@acor.com.au
Rainfall Station:	WILLIAMTOWN RAAF - Station 061078 - Zone A		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1998 - 31/12/2007 11:54:00 PM		
Mean Annual Rainfall:	1013mm		
Evapotranspiration:	1394mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.31		
Study Area:	Anna Bay and Nelson Bay		
Scenario:	Default Catchment - Clay soils		

* 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: Post-Development Node	Reduction	Node Type	Number	Node Type	Number
Flow	15.8%	Bio Retention Node	2	Urban Source Node	3
TSS	87%	Rain Water Tank Node	3	User Defined Source Node	6
TP	66.3%	GPT Node	2		
TN	50.8%				
GP	100%				

Comments

TSS reduction falls fractionally short of the 90% target with a result of 87%. This is in line with the current approved water quality strategy.

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	Bioretention Basin 2	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention Basin 2	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention Basin 3	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bioretention Basin 3	PET Scaling Factor	2.1	2.1	2.1
GPT	C2 HUMEGARD	Hi-flow bypass rate (cum/sec)	None	99	1.1
GPT	C3 HUMEGARD	Hi-flow bypass rate (cum/sec)	None	99	0.6
Post	Post-Development Node	% Load Reduction	None	None	15.8
Post	Post-Development Node	GP % Load Reduction	90	None	100
Post	Post-Development Node	TN % Load Reduction	45	None	50.8
Post	Post-Development Node	TP % Load Reduction	60	None	66.3
Rain	Copy of Rainwater Tanks Cat 3 108	% Reuse Demand Met	None	None	62.9826
Rain	Copy of Rainwater Tanks Cat SL2 110	% Reuse Demand Met	None	None	48.09
Rain	Rainwater Tanks Cat 2 100	% Reuse Demand Met	None	None	62.6323
Urban	C2 LOTS	Area Impervious (ha)	None	None	1.843
Urban	C2 LOTS	Area Pervious (ha)	None	None	4.373
Urban	C2 LOTS	Total Area (ha)	None	None	6.217
Urban	C3 LOTS	Area Impervious (ha)	None	None	1.976
Urban	C3 LOTS	Area Pervious (ha)	None	None	3.504
Urban	C3 LOTS	Total Area (ha)	None	None	5.481
Urban	CSL LOTS	Area Impervious (ha)	None	None	1.009
Urban	CSL LOTS	Area Pervious (ha)	None	None	1.122
Urban	CSL LOTS	Total Area (ha)	None	None	2.132

Only certain parameters are reported when they pass validation

Failing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Post	Post-Development Node	TSS % Load Reduction	90	None	87

Only certain parameters are reported when they pass validation

Appendix C

Ecosol Litter Basket Maintenance Manual

HumeGard® GPT Inspection and maintenance guide

Issue 1



Purpose of this guide

This guide outlines the maintenance procedures and requirements for HumeGard® GPT units.

Where the contents of this guide differ from project specifications and drawings, supervisory personnel should consult with a Humes engineer. In the event of any conflict between the information in this guide and local legislative requirements, the legislative requirements will take precedence.

It is the responsibility of the site owner and its contractors to determine the site's suitable access and location for maintenance plant and equipment.

Nothing in this guide is to be construed as a representation, endorsement, promise, guarantee or warranty whether expressed or implied.

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Safety advice

The HumeGard® GPT must be maintained in accordance with all relevant health and safety requirements, including the use of PPE and fall protection where required.

Confined space entry

Maintenance of the HumeGard® should not require entry, however, if entry into the unit is required, then the device is deemed a confined space. As such, if entering the unit, all equipment and training must comply to SHE regulations. It is the responsibility of the contractor or person/s entering the unit to proceed safely at all times.

Personal safety equipment

The contractor is responsible for the provision of appropriate personal protection equipment including, but not limited to safety boots, hard hat, reflective vest, protective eyewear, gloves and fall protection equipment. Make sure all equipment is used by trained and certified personnel, and is checked for proper operation and safety features prior to use.

Handling

The customer, or their contractor, is responsible for the removal of access lids from the HumeGard® unit. The customer or contractor should familiarise themselves with the device and site constraints, and particular attention should be given to safety hazards such as overhead power lines and other services in the vicinity when considering the position of plant and equipment.



Maintenance overview

To ensure ongoing long-term environmental protection HumeGard® needs to be maintained (generally annually). The actual on-going maintenance frequency requirements will be determined through quarterly inspections undertaken during the first year. However, only an annual maintenance period is anticipated for most HumeGard® units installed within drainage infrastructure.

Inspection can be performed by anyone, and procedures for inspection are provided in this document.

Generally, comprehensive maintenance is performed from the surface via vacuum truck. Companies capable of performing this maintenance can be found in the Yellow Pages or online by searching sewer cleaning or liquid waste removal.

Additionally large litter items may also be removed utilizing the optional stainless steel basket arrangement within the HumeGard®. Alternatively the litter can be removed during education/vacuum clean out, which will be required in order to remove the sediment component of the stormwater pollution.

HumeGard® operation

The HumeGard® GPT utilises the processes of physical screening and floatation/sedimentation to separate the litter and coarse sediment from stormwater runoff. It incorporates an upper bypass chamber with a floating boom (or broad-crested weir for small units) that diverts treatable flows into a lower treatment chamber for settling and capturing coarse pollutants from the flow. There are two types of HumeGard® - the super-critical version, which incorporates a broad-crested weir approach for treatment flow diversion, and a larger, standard version, which incorporates a floating boom arrangement to divert treatable flows.

Super-critical HumeGard® (HG12 & HG15)

The super critical HumeGard® consists of an internal broad crested weir and holding chamber.

A specially designed patented broad crested weir diverts material entrained in the flow into the adjacent holding chamber. This consists of the holding sump and another baffle/weir/channel arrangement designed to retain floating material while guiding flow through to the outlet.

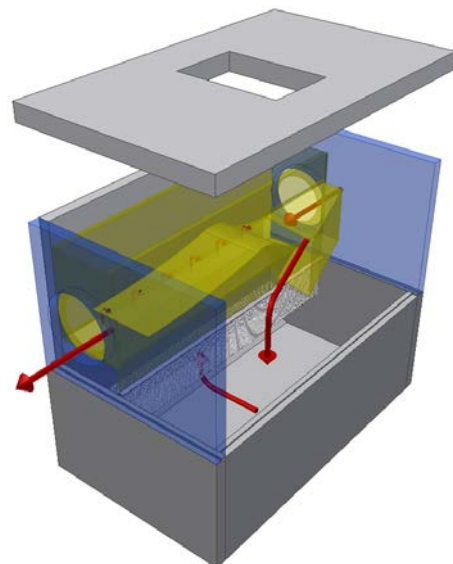
- **Low/Treatment flow operation**

During low to moderate flows, the weir diverts all flows into the sump area where pollutants are captured and retained. The velocity in this sump is controlled and never exceeds a maximum average velocity of 0.2m/s.

- **High/Bypass flow operation**

During high flows, the weir diverts up to the treatable flowrate into the sump and any excess flow is able to flow over the hump and through to the outlet. This ensures that the previously caught pollutants are not disturbed, resuspended and diverted out of the outlet pipe.

Figure 1 – Super-critical HumeGard® GPT



Standard HumeGard® (HG18 – HG45)

The standard HumeGard® consists of an internal separation channel and holding chamber.

A specially shaped boom, which is supported by hangers hinged to the upstream wall, diverts material entrained in the flow from the separator to the adjacent, off line, holding chamber. This consists of the holding sump and another baffle/weir/channel arrangement designed to retain floating material while guiding flow through to the outlet.

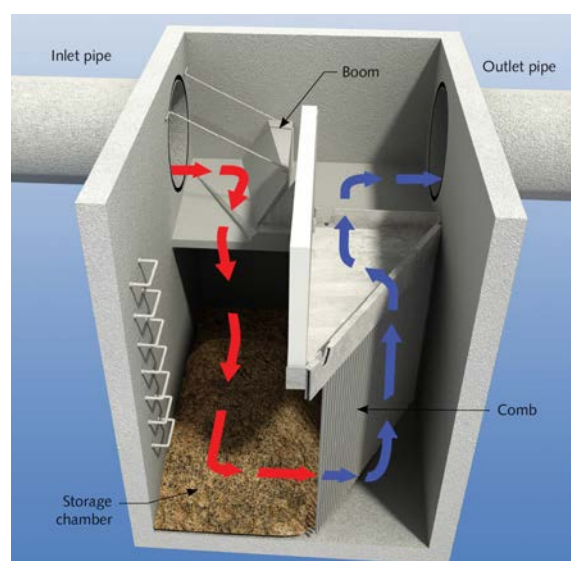
• Low/Treatment flow operation

During low to moderate flows, the boom remains on the floor of the separation channel and imparts an upward and sideways motion to the incoming flow. This action causes deflection into the holding chamber, where heavy and saturated materials settle to the bottom of the sump, while buoyant material is trapped behind the baffle wall arrangement.

• High/Bypass flow operation

During infrequent high flows, the boom lifts, which permits the flow to pass beneath it while continuing to deflect buoyant material to the holding chamber. Once the pipeline flows full, the boom lifts clear, allowing unobstructed flow through the unit, whilst at the same time retaining the floating materials on the upstream side of the device.

Figure 2 – Standard HumeGard® - low flow conditions



Maintenance frequency

It is recommended and good practice for an inspection of the HumeGard® to be carried out on a quarterly basis. The quarterly inspection is to check the operation of the boom, volume of pollutants in the holding sump, etc. But generally, only an annual maintenance period for cleaning is anticipated.

It is important during the quarterly inspections to check that the operation of the boom is satisfactory. The boom should not be impeded by large pieces of litter i.e. logs, etc. or have objects lodged underneath the boom or between it and the baffle plate that may prevent it from rising, or sitting flat on the false floor.

Cleaning maintenance frequency requirements will vary with the amount of stormwater pollution generated in your catchment (amount of litter, sediment, etc.). So it is recommended that as the 3-monthly inspections are performed, the frequency of maintenance be increased or reduced based on local conditions and pollutant capture rates.

The need for maintenance can be determined easily by inspecting the unit from the surface by:

- Checking if litter can be readily seen in the holding chamber once the cover has been removed.
- Using a dipstick or sludge judge (sediment sampling tube) to assess how much sediment or organic material has been captured in the bottom of the holding chamber. A sediment depth over 400mm would indicate cleaning is recommended to minimise the potential for scour.

Sediment sampling tubes are available for purchase from Humes (contact your local sales rep for more details).

Occasionally it may be beneficial to only remove captured litter and not siphon the entire contents of the holding chamber.

Maintenance procedure

Maintenance of HumeGard® units is generally performed using vacuum/eduction trucks.

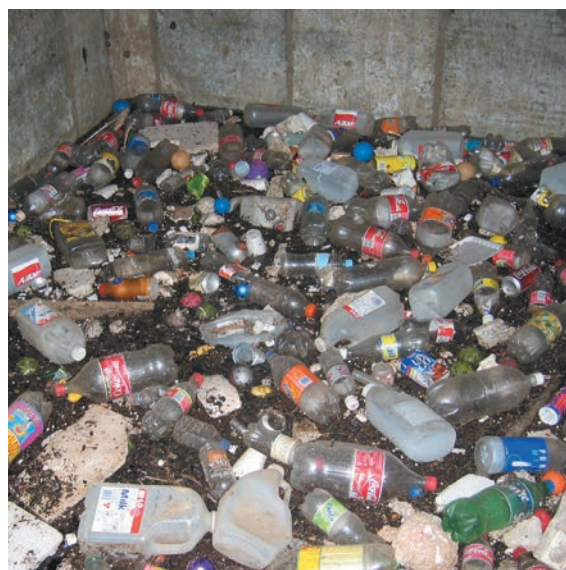
No entry into the unit is required for maintenance. The vacuum service industry is a well-established sector, that services underground tanks, sewers and catch basins.

HumeGard® units are cleaned by adhering to the following steps:

1. Complete a Job Hazard Analysis (JHA) and a Work Method Statement (WMS) before undertaking the maintenance procedure.
2. Prepare the site around the HumeGard for cleaning. This involves establishing the job site (traffic control if required), assembling cleaning equipment, positioning the vacuum truck and ensuring correct equipment is available to use (including PPE).
3. Remove the rectangular lid above the holding chamber and conduct a visual inspection to assess the condition of the HumeGard® and note if there are any blockages or lodged debris.
4. Lower the suction hose to the surface of the water in the holding tank and skim across the top to capture floating litter.
5. Lower the suction hose to the base of the holding chamber to remove sediment, organic matter and litter which has sunk.
6. Dislodge materials trapped in the screen using a water jet or brush/broom.
7. Remove the second rectangular access cover over the diversion boom and ensure there is no debris trapped underneath the boom.
8. Clean the interior of the pit using water jet.
9. Replace lids, ensuring they are firmly and securely in place.

It may be convenient on larger units to de-water some of the water in the holding chamber. This will minimise maintenance costs as disposal of essentially clean stormwater can be avoided. Often this can be done onto adjacent ground or into the council sewer system. However, this should only be done with the appropriate authorities' consent.

If a HumeGard® has been fitted with an optional removable basket, the basket can be used to periodically remove litter in between scheduled eduction/vacuum maintenance visits. The baskets must also be removed prior to vacuuming/eductioning the HumeGard® for the sediment load.



Maintenance cost

The costs to clean out a HumeGard® will vary based on the size of the unit, pollutant volume/type and transportation distances.

A typical cost (equipment and personnel) is estimated to be approximately \$1500-\$3500 (based on best information at time of installation) - exclusive of disposal costs.

This estimated cost is based on the clean out of a single unit. Economies of scale will be achieved where there are multiple units for a given location. The time to clean a single unit is approximately 3-4 hours (including transportation and cleaning).

Disposal costs are estimated to be in the order of \$350-\$600 dependent upon volume and type of pollutants removed from the holding sump.



Removal of hazardous material

A wide range of hazardous materials may be intercepted by the HumeGard® gross pollutant trap, although instances of this have been minimal. Hazardous materials may include high levels of heavy metals accumulated within the collected sediments, certain inorganic chemicals, used syringes, glass, and other matter.

As noted, the potential presence of hazardous material is primarily the reason why education is the preferred cleaning method, since this minimises the potential for maintenance personnel and nearby communities to come into contact with such material. Where baskets are required, the majority of the collected material will fall from the basket into the maintenance truck upon opening of the trap door. Any and all contact with the basket should be undertaken with suitable protective clothing, including heavy duty hand protection. If material is caught within the basket, it should be removed using suitable equipment.

Removal of this material by hand is not recommended. It is noted that it is not necessary to have the sumps/ baskets completely clean. The removal of 95% of the material is satisfactory, and the prospect of completely removing every piece of material increases the occupational health and safety risks.

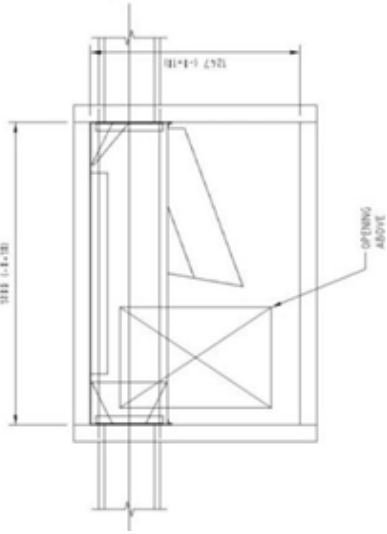
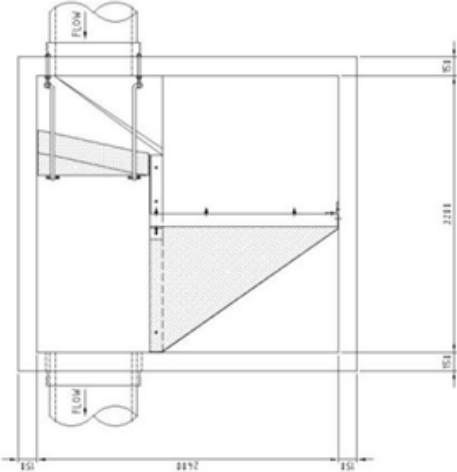
The presence of certain toxicants may need to be considered for the disposal of material and appropriate locations. If elevated levels of toxicants are suspected, then analytical screening of material should be completed to determine an appropriate disposal response according to local and state government regulations.

Example Job Safety Analysis (JSA)/Work Method Statement (WMS)

The following JSA/WMS is a guide only. It is the responsibility of the cleaning contractor or asset owner to develop their own JSA/WMS in line with their own WHS requirements and constraints. It also assumes that there will be no entry into the unit during maintenance.

Project/ Address:				Date:	
Job: Clean out of HumeGard unit				Operator:	
Risk Level:	1 - Extreme	2 - High	3 - Medium	4 – Low	5 - Negligible
Consequence:	Likely to cause very serious harm	Clear potential for serious harm	Similar to risk of driving a car	Little likelihood of any harm	Virtually Harmless
Response:	STOP THE JOB	STOP and Reassess to find better way	Control & ensure controls work	Monitor to ensure risk remains low	Continue work
PROCEDURE	POSSIBLE HAZARDS	INITIAL RISK	CONTROLS	PERSON RESPONSIBLE	END RISK
1. Preliminaries: - Confirm GPT locations and types - Familiarise with GPT technical manual	Nil	-	Refer to relevant manuals	Operator	-
2. Plan the Job: - Room to access & work on the GPT without impacting other property or vehicles - Consider water flows & if excessive note & move onto next job - Condition & status of GPT - Identify water fill point - Identify waste dump point	- Climbing in/out/around of truck - All GPT have a high risk of containing syringes	3 4	- Refer to safety plan on moving around vehicles - Wear PPE and never reach into or lift accumulated matter with hands. If a needle stick injury occurs, wash the affected area with soap & water & report the incident to the branch and seek medical attention ASAP.	Operator	4 5
3. Establish Job Site: - Over 60 km/hr will require traffic management - Within 6.4m of overhead power lines will require spotter	- Traffic - Pedestrians - Overhead power lines	3	- Devise a relevant Traffic Management WMS - Ensure barriers and signs redirect pedestrians - Ensure spotter is present	Operator	5
4. Assemble Cleaning Equipment Position vacuum hose to remove debris from GPT	- Infection - Sharp edges - Manual handling - Falling equipment - High pressure water	3	- Personal hygiene (wash hands prior to smoking/eating) - Wear gloves & remove sharp edges/burrs on equipment - Follow a manual handling WMS - Store equipment securely on vehicle - Inspect vacuum hose fittings firmly secured - Inspect hose daily 7 ensure it has been tested (6 monthly) - Never cap jetting hose - Inspect jetting hose for damage - Never adjust pump pressures or regulators - Maximum reducer on 1" hose is ¾" - No reducers on ½" hose - Fittings to be firmly secured using a spanner	Operator	5
5. Open the GPT Cover - Remove lid using the manhole lifting procedure - If lid is mass concrete & exceeds safe lifting limits, use mechanical lifting device	- Manual Handling - Open Manholes	3	- Refer to a SWP for manual handling - Refer to a SWP for manhole lifting	Operator	5
6. Start Cleaning - Position bottom end of vacuum hose to remove debris from GPT - Run vacuum prior to remove debris - If there is any requirement to enter the pit for any reason, confined Space Entry Procedure is to be followed - Vacuum all material out of the sump until empty clear 7 clean - Dislodge materials trapped in the screen using water jet or brush/broom - Remove access cover over diversion boom/weir, ensure there are no debris trapped underneath boom/around weir - Clean the interior of the pit using water jet &/or brush/broom - Vacuum all materials out of the pit	- Manual handling - Eye injury from flying debris - Noise - People inside exclusion zone - Confined Space Entry (If required)	3	- Follow a SMP for manual handling - Wear eye protection - Wear hearing protection - Stop operation until area clear. Only essential personnel within exclusion zone - Ensuring minim slack in hose to prevent whipping - Refer to confined space manuals and SWPs	Operator	5
7. Finish Cleaning - Replace lid ensuring it is firmly & securely in place - Ensure all waste is vacuumed and site is clean prior to packing up - Complete the CWS recording all details and any problems	Manual handling	3	Follow a SMP for manual handling	Operator	5

HumeGard® unit maintenance record

Customer details			
Company		Phone	
Contact name		Email	
Address		Date	
State		Operator name	
HumeGard® unit details			
Model		Type (circle one)	Small (weir) Standard (boom)
Cleaning method (circle one)	Vacuum Eduction	Lid type	
Plan view (circle one)			
Small HumeGard® (weir)		Standard HumeGard® (boom)	
			
Pollutant removal results			
Estimated volume of water removed (L)		Litter (%)	
Estimated volume of pollutants (m³)		Vegetation (%)	
Percentage of pollutant content (%)		Sediments (%)	
Percentage of pollutant capacity (%)		Total volume (%)	
Any evidence of hydrocarbons (grease/oil) contamination?			YES NO
Any evidence of sewage contamination?			YES NO
Any evidence of any other unexpected contamination?			YES NO
Describe unexpected contamination (if any):			
Any problems cleaning the HumeGard® unit (describe briefly):			
If problems were experienced were they then resolved satisfactorily (describe briefly):			

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