

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2017/850

Date: 21 December 2017



918 Greenbank Road, North Maclean

Stormwater Management Plan

Client: Roubaix Properties Pty Ltd

Project No: BE160355

Document No: BE160355-RP-SMP-01

May 2017

Document Control Record

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Version No.	Description	Date	Prepared	Approved
00	Original Issue	05.05.2017	TB	DD
01	Minor Amendments	22.05.2017	TB	DD

Recipients are responsible for eliminating all superseded documents in their possession

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Executive Summary

Roubaix Properties are proposing to develop land described as Lot 2 on SP267252 located at 916 – 944 Greenbank Road, North Maclean, within the Logan City Council (LCC) area. The proposal is for the development of a commercial warehouse facility.

This report was prepared to address the stormwater management requirements of the various State and Local stormwater management policies and guidelines including:

- Construction phase stormwater management;
- External catchment management;
- Peak flow management; and
- Stormwater quality management.

Construction Phase

Construction phase stormwater controls have been designed in accordance with *Best Practice Erosion and Sediment Control* (IECA, 2008). The controls include physical and management measures to ensure erosion on the site is kept to a minimum and any eroded sediment is captured prior to discharge from site.

External Catchment Management

The 2,994 m² external catchment that drains into the subject site from the south will be directed towards Greenbank Road and Mount Lindesay Highway via a drainage channel to be constructed along the site boundary.

Peak Flow Management

The proposed development will result in an increase in runoff volume and peak flow rates from the subject site. It is proposed to mitigate this increase by providing a series of on-site detention basins designed to restrict peak flows from the 2, 5, 10, 20, 50, and 100 year ARI design storm events to within the pre-development peak flow rates for each event.

Stormwater Quality Management

Stormwater runoff quality will be managed through the inclusion of bioretention filters located in the base of the proposed detention basins. The proposed bioretention systems were modelled in MUSIC to ensure the pollutant load reduction targets set out in the State Planning Policy will be achieved for the development.

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1. Introduction

1.1 Background

This Stormwater Management Plan (SMP) has been prepared for Roubaix Properties Pty Ltd, the proponent of this development application, seeking Development Permit approval for a Material Change of Use (MCU) for the establishment of an industrial complex at 916-944 Greenbank Road, North Maclean (the subject site).

The subject site is situated within the Greater Flagstone Priority Development Area (PDA).

1.2 Regulatory Requirements and Technical Guidelines

The strategies proposed in this SMP have been developed to address the requirements of the Logan City Council Planning Scheme and Development Guidelines, and have also been prepared in accordance with the following guidelines:

- Logan City Council, Stormwater Quality and Flow Management Guidelines (LCC, 2013);
- *State Planning Policy July 2014* (DSPIP, 2014);
- Queensland Urban Drainage Manual (QUDM) – Second Edition 2008 (DNRW, 2008);
- Australian Rainfall and Runoff – A Guide to Flood Estimation, Volume 1 (IEAust, 2003);
- Australian Rainfall and Runoff – A Guide to Flood Estimation, Volume 2 (IEAust, 1987);
- MUSIC Modelling Guidelines (Water By Design, 2010);
- Urban Stormwater Quality Planning Guidelines 2010 (DERM, 2010); and
- Best Practice Erosion and Sediment Control (IECA, 2008).

1.3 Objectives

The main objectives of this SMP have been established from the criteria set out in the Logan City Council Stormwater Quality and Flow Management Guidelines (LCC, 2013) and are summarised as follows:

- to protect receiving water quality by limiting the quantity of key pollutants discharged in stormwater from urban development;
- to prevent increased in-stream erosion downstream of urban areas by controlling the magnitude and duration of sediment-transporting flows; and
- to protect in-stream ecosystems from the significant effects of increased runoff frequency by capturing the initial portion of runoff from impervious areas.

1.4 Scope

To achieve the abovementioned objectives, this SMP details the following:

- Site description including:
 - Topography;
 - Soils; and
 - Vegetation.
- Erosion and Sediment;
 - Best Practice Erosion and Sediment Control Measures (IECA 2008) for the construction phase of the development;

- Stormwater Quantity:
 - Control measures to ensure no net increase in peak discharge from the subject site up to the 100 year Average Recurrence Interval (ARI) event;
- Stormwater Quality:
 - Methods to ensure quality objectives of the receiving waters are achieved, and the existing hydrological regime is maintained to an acceptable level.

To minimise the impact of the proposed development on the external environment and to avoid significant and/or sustained deterioration in downstream water quality, the proponent shall implement this SMP. This SMP may be amended as required, in response to the monitoring and maintenance program.

2. Site Details

2.1 Location

The subject site is located at 916-944 Greenbank Road, North Maclean and is comprised of a single lot. The lot is properly described as Lot 2 on SP267252 and covers a combined area of 25,310 m². The site is identified by the Logan City Council Planning Scheme as being within the Greater Flagstone PDA Zone. Figure 2.1 below identifies the location of the subject site.

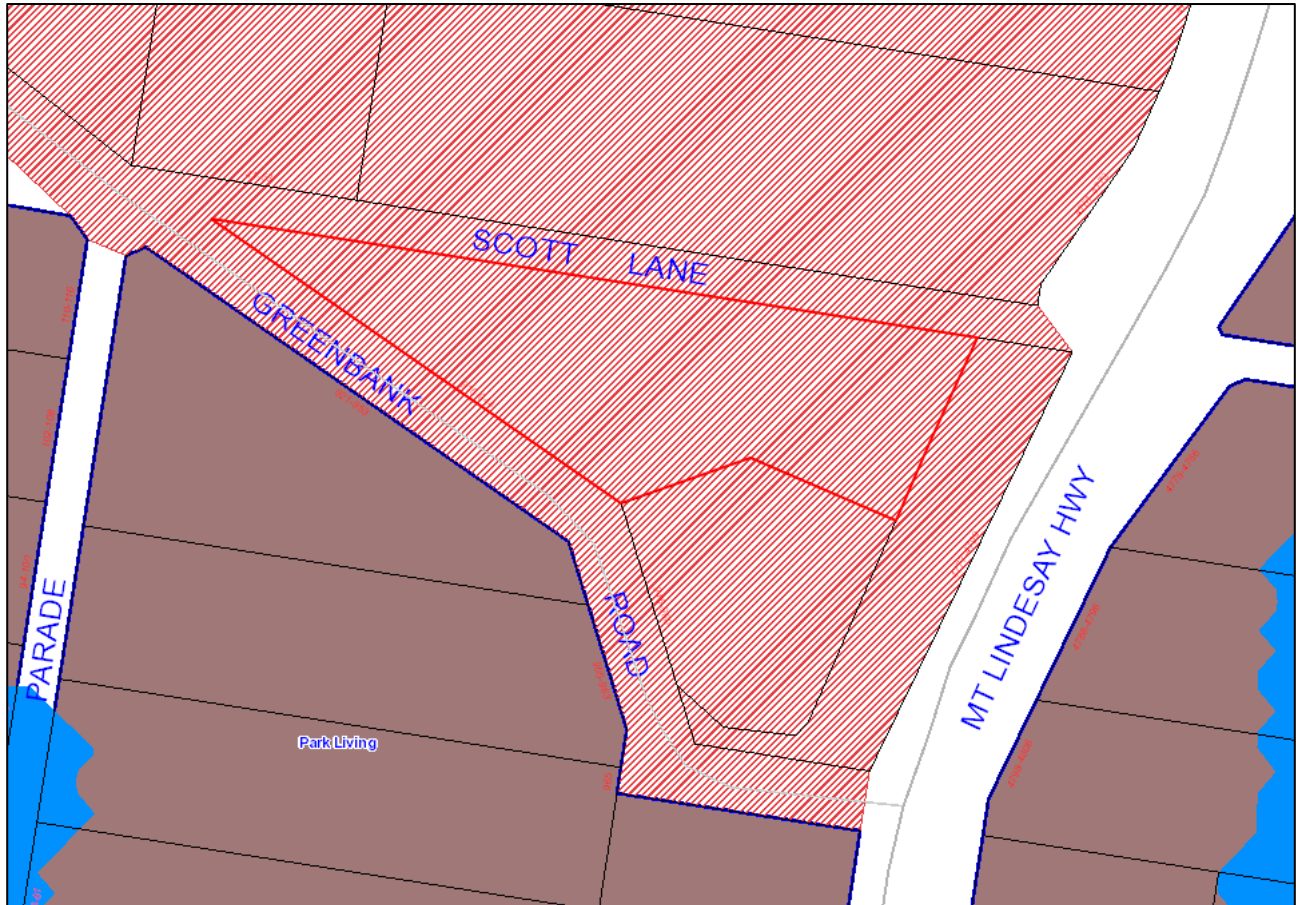


Figure 2.1 Site Locality Plan (LCC, 2016)

2.2 Topography

The existing topography of the proposed site is very flat with an average slope of < 0.5% across the site. Generally, the site slopes towards the northern boundary. There is a minor vegetated depression on the north-west corner of the subject site where parts of the site (approximately 20%) drains into. The remainder of the runoff generated from the site flows to the north-easterly corner where the existing topography is slightly lower and then discharging out of the site to the proposed road (Scott Lane).

For further details relating to the topography of the subject site and the delineation of catchments please refer to Appendix E.

2.3 Downstream Environment

As stated above, the subject site has a very flat overall slope ($< 0.5\%$) and generally flows in a south to north direction where it then discharges as overland sheet flow to the undeveloped Scott Lane and further north to undeveloped heavily vegetated land. The Logan River is in the vicinity of the site approximately 1 km to the south.

2.4 Rainfall

Mean annual rainfall for the site has been estimated at 926 mm from the data set obtained from the nearest Bureau of Meteorology (BOM) station number 40542 at Maclean Bridge (BOM, 2017).

2.5 Description of Development

The proposal seeks to develop the existing lot, creating industrial warehousing and sheds which will deliver the following:

- 3 separate buildings containing 34 individual lots;
- 178 car parks; and
- construction of Scott Lane to the north of the site (excluded from this SMP).

The site will have three (3) access points. One access to Greenbank Road and two other access points onto Scott Lane.

For further details regarding the proposed layout, please refer to the complete site plan attached within Appendix A.

3. Stormwater Quantity Management Plan

3.1 Overview

The following section of this report outlines the measures required to meet the above-mentioned objective in regards to stormwater quantity. In order to meet these objectives, it is necessary to ensure that post development discharge from the site will not create a worse situation for downstream property owners than that which existed prior to the development (i.e. non-worsening) (DEWS; BCC; IPWEA, 2013).

Due to the increase in impervious areas within the proposed development, peak stormwater flow rates will increase. In order to mitigate these flow rates from the developed site it is proposed to implement an On Site Detention (OSD) system. OSD systems temporarily store stormwater runoff and release flows at a controlled rate that is no greater than the pre-developed peak rate.

3.2 Catchment Parameters

Drainage catchments have been delineated using site survey in the pre-development scenario, and development plans in the post developed scenario. Pre and post development catchment parameters are summarised in Table 3.1. Further catchment parameters used within the XP-SWMM model are included in Appendix C.

Table 3.1 Catchment Parameters

Scenario	Catchment ID	Total Area (ha)	Impervious (%)	Catchment Slope (%)
Pre-developed	Pre A	2.231	0	0.35
	Ext A	0.299	0	4
Post-developed	Post A1	0.400	82	1
	Post A2	0.225	86	1
	Post A3	0.492	79	1
	Post A4	0.384	93	1
	Post A5	0.317	85	1
	Post A6	0.413	85	1

3.3 XP-SWMM Analysis

XP-SWMM (version 2017) software was utilised to model the performance of the proposed stormwater quantity control measures. This modelling software is a link-node model capable of performing hydrology and hydraulics of stormwater drainage systems simultaneously.

Laurenson's Hydrology has been adopted as the runoff routing method within XP-SWMM. Sub-catchment routing in this method is carried out using the Muskingum procedure, which is a storage routing method based on the storage equation. Details of the assumptions and input parameters used within the XP-SWMM model inputs are included in Appendix C.

A comparison between the peak runoff values obtained using the Rational Method and the XP-SWMM model for the pre- and post-development scenarios during the 100 year ARI design storm event is contained in Table 3.2.

Table 3.2 Rational Method vs XPSWMM Generated Peak Discharges

Scenario	Catchment ID	Rational (m ³ /s)	XP-SWMM (m ³ /s)	Difference (%)
Pre-developed	Pre A	0.668	0.470	-29.9
Post-developed	Post A1	0.318	0.285	-10.3
	Post A2	0.179	0.168	-6.0
	Post A3	0.381	0.343	-9.9
	Post A4	0.294	0.300	1.9
	Post A5	0.245	0.233	-5.0
	Post A6	0.321	0.301	-6.3

The peak discharges generated by XP-SWMM are considered to be within an acceptable range of the values obtained from Rational Method calculations. Similar variations were observed for all other ARI events, and are therefore considered appropriate for subsequent hydraulic analysis. It should be noted that the Rational Method has not been used for the design of any mitigation measures.

3.4 Conveyance of Flows

In the post developed scenario, it is proposed to provide OSD with five (5) separate combined bioretention/detention basins that discharge to five (5) different locations. These discharge locations are located around the perimeter of the site. All runoff generated within the proposed development site will be conveyed to each of the proposed bioretention/detention basins as surface flow (i.e. no underground drainage is proposed).

The 2,994 m² external catchment that drains into the subject site from the south will be directed towards Greenbank Road and Mount Lindesay Highway via a drainage channel to be constructed along the site boundary.

3.5 Detention Modelling

3.5.1 Performance of OSD

To confirm the performance of the proposed OSD systems, a pre- and post-development model was constructed. These models compare the total runoff hydrographs for the 100, 50, 20, 10, 5, and 2 year ARI events.

A summary of the modelling results for different ARI events is contained in Table 3.3. Results of the modelling indicate the proposed system is capable of maintaining the pre-development peak site runoff flow rate for the all storm events up to the 100 year ARI event.

Table 3.3 Pre-Development vs Post-Development (Mitigated) Peak Discharge

ARI Event	Peak Discharge (m ³ /s)	
	Pre-Development	Post-Development
100 year	0.469	0.457
50 year	0.403	0.383
20 year	0.330	0.308
10 year	0.272	0.255
5 year	0.231	0.214
2 year	0.165	0.164

A plot of the pre-development vs post-development (mitigated) hydrographs for the 100 year ARI event is included as Figure 3.1.

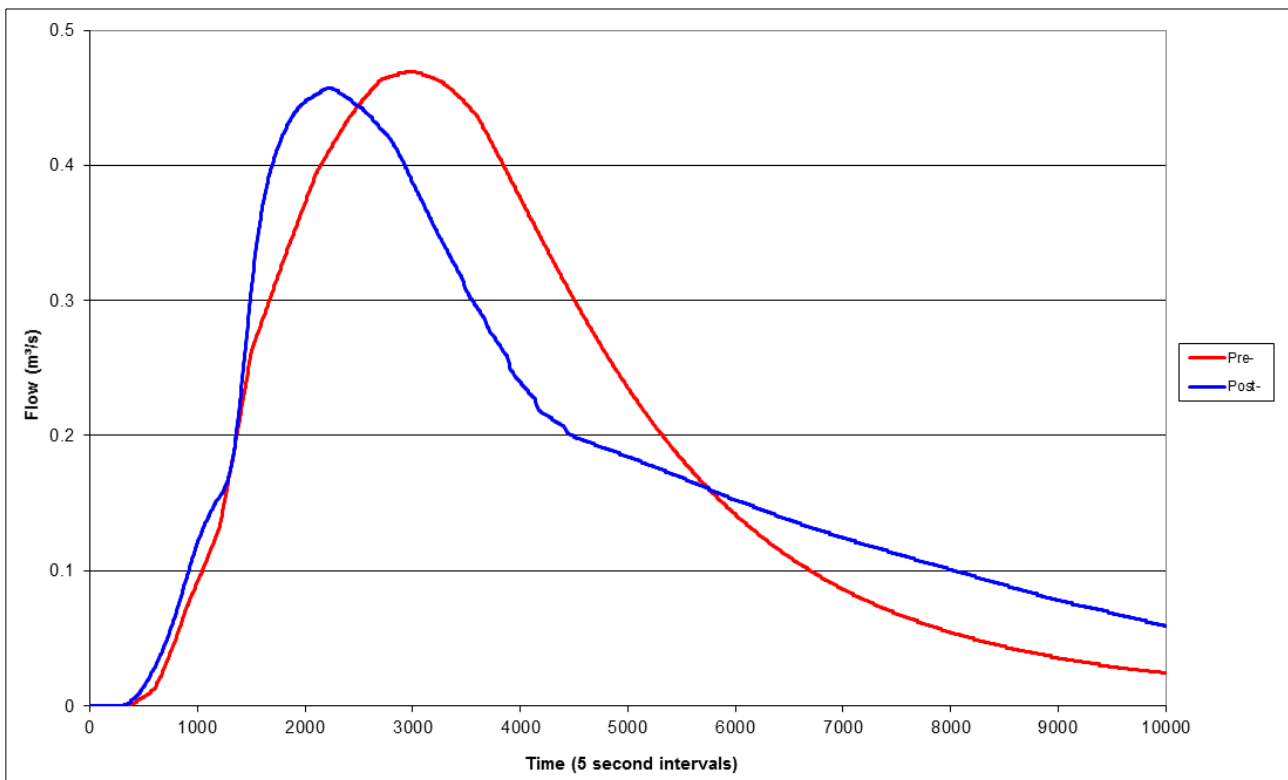


Figure 3.1 Pre- versus Post-Development 100 year ARI total runoff hydrographs

3.6 OSD Details

The proposed OSD systems are to be implemented to ensure a non-worsening of peak discharges at the LPDs. Table 3.4 below contains the details of the proposed OSD systems within the subject site.

Table 3.4 OSD Details

Detention ID	Outlet Structures			100yr Detention Volume (m3)	Total Volume (m3)
	Orifices	Riser	Outlet Pipe (s)		
Bio/Detention Basin 1+2	150x250mm orifice @ RL 27.7	0.6x0.6m Pit Crest @ R.L.28.12	375mm ϕ , 0.5% Grade	321	329
Bio/Detention Basin 3	100x200mm orifice @ RL 27.7	0.6x0.6m Pit Crest@ RL 28.15	300mm ϕ , 0.5% Grade	319	330
Bio/Detention Basin 4	100x200mm orifice @ RL 27.6	0.6x0.6m Pit Crest@ RL 28.25	300mm ϕ , 0.5% Grade	234	243
Bio/Detention Basin 5	100x150mm orifice @ RL 27.6	0.6x0.6m Pit Crest@ RL 28.0	300mm ϕ , 0.5% Grade	119	122
Bio/Detention Basin 6	150x200mm orifice @ RL 27.8	0.6x0.6m Pit Crest@ RL 28.18	375mm ϕ , 0.5% Grade	135	137

4. Stormwater Quality Management Plan

4.1 Overview

The following section of this report outlines the measures required to meet the above-mentioned objective in regards to stormwater quality for both the construction and operational phase of the development.

4.2 Construction Phase Best Management Practices

Stormwater runoff quality during the construction phase of this development shall be managed in accordance with *Best Practice Erosion and Sediment Control* (IECA, 2008), which is the current recognised construction industry best management practice (BMP) for erosion and sediment control.

In order to meet Council requirements Erosion and Sediment Control (ESC) plans are to be implemented during the construction phase to minimise environmental harm to on-site stormwater treatment devices and downstream receiving waters.

Conceptual construction phase erosion and sediment control drawings are included in the stormwater management plan drawings in Appendix E of this report.

4.3 Permanent Water Quality Objective (WQO)

In accordance with the Logan City Council guidelines, the total effect of permanent water quality control measures is to achieve reductions in the mean annual load generated by the development site at a minimum of:

- 80% for Total Suspended solids (TSS);
- 60% for Total Phosphorus (TP); and
- 45% for Total Nitrogen (TN).
- 90% for Gross Pollutants (>5mm).

This will ensure the environmental values of the downstream receiving waters are maintained and have been chosen as the WQO for the development (LCC, 2013).

4.4 Treatment Train Modelling

Water quality modelling was carried out for the proposed treatment train using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) software to demonstrate that the load based reduction targets can be achieved. Details of the MUSIC model input parameters used are included in Appendix D.

4.5 Bioretention Systems

Bio-retention systems operate by filtering stormwater runoff through a soil media prior to discharge into the drainage system. These systems remove pollutants through a number of processes including:

- Sedimentation in the extended detention storage;
- Filtration by the filter media;
- Nutrient uptake by biofilms;

- Nutrient adsorption and pollutant decomposition by soil bacteria; and
- Adsorption of metals and nutrients by filter particles (Somes & Crosby, 2007).

Water captured in the ponding area should be no more than 400 mm deep for a maximum of four (4) days to prevent anaerobic conditions, plant death and insect breeding.

The proposed development includes five (5) separate bioretention systems in the base of the proposed detention basins to treat all runoff from the developed site. Further details of the proposed bioretention systems are included in drawings N400 and N401 included in Appendix E of this report.

4.6 MUSIC Results

Results of the MUSIC modelling for the treatment train effectiveness are summarised in Table 4.1. The results indicate that the 80%, 60%, 45% and 90% reduction target for TSS, TP, TN and gross pollutants respectively are achieved for the rainfall data set simulated. A screen capture of the MUSIC modelling results is included as Figure 4.1.

Table 4.1 Treatment Train Effectiveness

Pollutant	Inflows (kg/yr)	Outflows (kg/yr)	Reduction Achieved (%)	Water Quality Objective (%)
TSS	3,010	538	82.1	80
TP	6.22	1.72	72.3	60
TN	41.0	22.3	45.6	45
GP	311	0	100	90

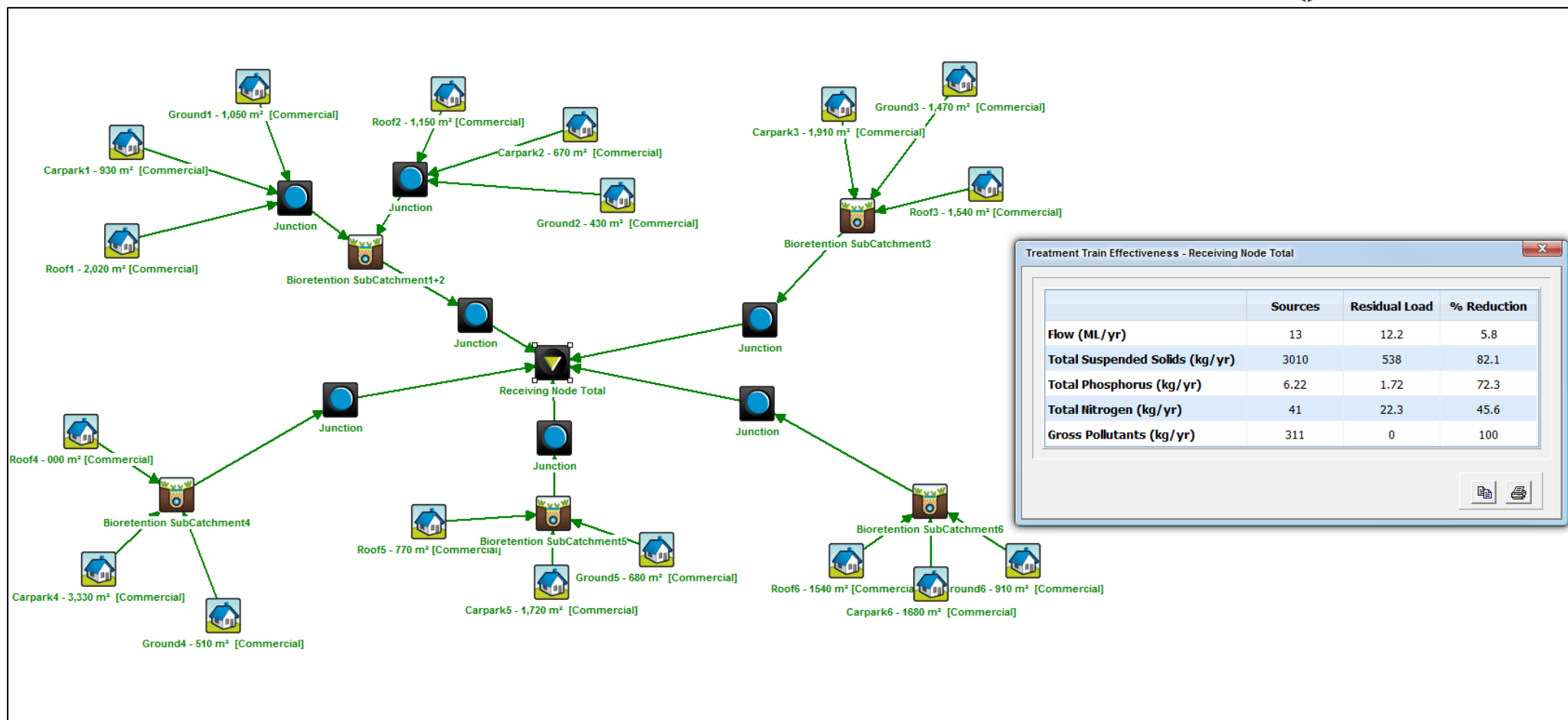


Figure 4.1 Treatment Train Layout and MUSIC Results

5. Conclusions

This study has reviewed the hydrology and hydraulics of the site for pre-development and post-development conditions and investigated the impact of the proposed development on the downstream environment.

Based on this study, the following conclusions have been drawn:

- Development of the subject site will result in an increase in stormwater runoff volume and peak flow rates.
- The increase in peak flow rates will be mitigated to within pre-development peak flow rates for the 2, 5, 10, 20, 50 and 100-year ARI design storm events through the inclusion of On Site Detention (OSD).
- All runoff from the developed areas of the site will be directed as surface flow to the five (5) proposed OSD basins before discharging under controlled conditions to the road side drainage systems in Greenbank Road, Mount Lindesay Highway, and Scott Lane.
- Construction phase stormwater quantity and quality shall be managed in accordance with *Best Practice Erosion and Sediment Control* (IECA, 2008).
- Stormwater quality improvement measures will be incorporated into the development in the form of bioretention filters located in the base of the proposed detention basins.
- The bioretention systems were sized in MUSIC to ensure the pollutant load reduction targets set out in the State Planning Policy are achieved.

Provided the stormwater management strategy described in this report is fully implemented, the proposed development shall not cause any adverse impacts on the downstream environment.

6. References

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Appendix A - Proposed Plans of Development

Appendix B - Time of Concentration and Rational Method Calculations

Pre-Development Hydrology

The natural hydrology of the site has been assessed in accordance with QUDM 2008 Section 4.06.3. The time of concentration for all catchments has been determined using Friend's Equation as per QUDM Table 4.06.3, combined with a channel time flow calculation.

$$\text{Friend's Equation } t_c = (107nL^{0.333})/S^{0.2}$$

Table B.1 presents a summary of the catchment parameters used within Friend's Equation and the calculated time of concentration for the pre-development scenario.

Table B.1 Time of Concentration for Pre-Development Scenario

Catchment ID	Ext A	Pre A
Standard Inlet Time	-	-
Overland Flow		
Estimated Sheet flow Length (Table 4.06.3)	45m	50m
Horton's Roughness Value	0.035	0.035
Slope (%)	4	0.35
tc (minutes)	10.08	17.00
Minor Concentrated Flow		
Length of channel flow (m)	-	170
Velocity (m/s)	-	0.3
tc (minutes)	-	9.44
TOTAL tc (minutes)	10.08	26.44

Post-Development Hydrology – Unmitigated

The total time of concentration calculated for the subject site contains a standard inlet time of 5 minutes. Table B.2 presents a summary of the catchment parameters used for the calculated time of concentration for the post-development scenario.

Table B.2 Time of Concentration for Post-Development Scenario

Catchment ID	Post A1	Post A2	Post A3	Post A4	Post A5	Post A6
Standard Inlet Time	5	5	5	5	5	5
Channel Flow						
Length of channel flow (m)	35	35	60	70	60	55
Velocity (m/s)	1	1	1	1	1	1
tc (minutes)	0.58	0.58	1.00	1.17	1.00	0.92
TOTAL tc (minutes)	5.58	5.58	6.00	6.17	6.00	5.92

Design storm event flows across the site were derived using the Rational Method as per the above-mentioned manuals. This involved:

- Determination of a C10 value (derived in accordance with QUDM Table 4.05.3(b) and Council guidelines). Values of 0.60-0.70 were applied to the pre-development catchments and values varying between 0.85-0.88 were applied to the post-development catchment;
- Adoption of design rainfall using BOM IFD data; and
- Calculation of design flows through the site for Q100, Q50, Q20, Q10, Q5, Q2, Q1 and Q3_{month}, where Q3_{month} is deemed to be 50% of Q1.

Summaries of the hydrologic calculations are contained in Table B.3 and Table B.4 for pre and post-development (un-mitigated) scenarios respectively.

Table B.3 Pre-Development Hydrology

Catch.	Area (ha)	tc (min)	I ₁₀₀ (mm/hr)	C	Q ₁₀₀ (m³/s)	I ₅₀ (mm/hr)	C	Q ₅₀ (m³/s)	I ₂₀ (mm/hr)	C	Q ₂₀ (m³/s)	I ₁₀ (mm/hr)	C	Q ₁₀ (m³/s)	I ₅ (mm/hr)	C	Q ₅ (m³/s)	I ₂ (mm/hr)	C	Q ₂ (m³/s)	I ₁ (mm/hr)	C	Q _{3month} (m³/s)
Ext A	0.299	10.08	228.76	0.84	0.160	205.87	0.81	0.138	176.08	0.74	0.107	153.74	0.70	0.089	137.32	0.67	0.076	109.54	0.60	0.054	85.59	0.56	0.020
Pre A	2.231	26.44	149.68	0.72	0.668	134.49	0.69	0.575	114.80	0.63	0.448	99.97	0.60	0.372	89.09	0.57	0.315	70.73	0.51	0.224	55.20	0.48	0.082

Table B.4 Un-Mitigated Post-Development Hydrology

Catch.	Area (ha)	tc (min)	I ₁₀₀ (mm/hr)	C	Q ₁₀₀ (m³/s)	I ₅₀ (mm/hr)	C	Q ₅₀ (m³/s)	I ₂₀ (mm/hr)	C	Q ₂₀ (m³/s)	I ₁₀ (mm/hr)	C	Q ₁₀ (m³/s)	I ₅ (mm/hr)	C	Q ₅ (m³/s)	I ₂ (mm/hr)	C	Q ₂ (m³/s)	I ₁ (mm/hr)	C	Q _{3month} (m³/s)
Post A1	0.400	5.58	286.08	1.00	0.318	257.66	0.98	0.280	220.66	0.89	0.219	192.87	0.85	0.182	172.57	0.81	0.155	137.99	0.72	0.111	107.92	0.68	0.041
Post A2	0.225	5.58	286.08	1.00	0.179	257.66	0.99	0.159	220.66	0.90	0.125	192.87	0.86	0.104	172.57	0.82	0.088	137.99	0.73	0.063	107.92	0.69	0.023
Post A3	0.492	6.00	278.67	1.00	0.381	250.95	0.98	0.335	214.85	0.89	0.262	187.76	0.85	0.218	167.93	0.81	0.185	134.23	0.72	0.133	104.96	0.68	0.049
Post A4	0.384	6.17	275.88	1.00	0.294	248.43	1.00	0.265	212.67	0.92	0.210	185.84	0.88	0.174	166.20	0.84	0.148	132.82	0.75	0.106	103.85	0.70	0.039
Post A5	0.317	6.00	278.67	1.00	0.245	250.95	0.99	0.219	214.85	0.90	0.171	187.76	0.86	0.142	167.93	0.82	0.121	134.23	0.73	0.086	104.96	0.69	0.032
Post A6	0.413	5.92	280.10	1.00	0.321	252.25	0.99	0.286	215.97	0.90	0.224	188.74	0.86	0.186	168.83	0.82	0.158	134.95	0.73	0.113	105.53	0.69	0.042

Appendix C - XP-SWMM Input Parameters

Rainfall Parameters

Logan City temporal patterns and IFD data has been utilised. The IFD data used in the hydrologic analysis for a range of storm events is presented in Table C.1.

Table C.1 Adopted Intensity Frequency Duration Data (mm/hr)

Storm Duration (minutes)	Average Recurrence Interval - Years						
	1	2	5	10	20	50	100
5	113.00	144.00	180.00	201.00	230.00	268.00	298.00
10	85.90	110.00	138.00	154.00	177.00	207.00	230.00
15	72.37	92.65	116.32	130.32	149.39	174.76	194.27
20	63.40	81.20	102.00	114.00	131.00	154.00	171.00
25	56.81	72.78	91.64	102.81	118.04	138.26	153.86
30	51.70	66.20	83.50	93.70	108.00	126.00	140.00
45	41.07	52.69	66.64	74.93	86.20	101.19	112.78
60	34.40	44.20	56.00	63.00	72.60	85.30	95.10
90	26.31	33.82	42.98	48.45	55.86	65.74	73.40
120	21.50	27.70	35.20	39.70	45.90	54.00	60.40
180	16.00	20.60	26.30	29.70	34.30	40.50	45.30

To input the IFD information into XP-SWMM, rainfall multipliers are generated to represent the depth of rainfall for a given storm event and storm duration. The rainfall multipliers are then applied to the temporal patterns within XP-SWMM to generate hydrographs for use within the hydraulic analysis.

Table C.2 Rainfall Multipliers Applied to Temporal Patterns (mm)

Storm Duration (minutes)	Average Recurrence Interval - Years						
	1	2	5	10	20	50	100
5	9.42	12.00	15.00	16.75	19.17	22.33	24.83
10	14.32	18.33	23.00	25.67	29.50	34.50	38.33
15	18.09	23.16	29.08	32.58	37.35	43.69	48.57
20	21.13	27.07	34.00	38.00	43.67	51.33	57.00
25	23.67	30.33	38.18	42.84	49.18	57.61	64.11
30	25.85	33.10	41.75	46.85	54.00	63.00	70.00
45	30.81	39.52	49.98	56.19	64.65	75.89	84.59
60	34.40	44.20	56.00	63.00	72.60	85.30	95.10
90	39.46	50.73	64.46	72.67	83.78	98.61	110.11
120	43.00	55.40	70.40	79.40	91.80	108.00	120.80
180	48.00	61.80	78.90	89.10	102.90	121.50	135.90

Laurenson Routing Parameters

In this study, the “Laurenson” routing method was applied to XP-SWMM for hydrograph generation. To enable this method to be used, each catchment must be split into pervious (undeveloped) and impervious (developed) portions. Adopted parameters for the Laurenson routing method included:

The fraction impervious has been determined by analysis of aerial photographs and the proposed development layout;

- Manning Roughness coefficient (n):
 - Pervious portion: 0.035; and
 - Impervious portion: 0.015.

Initial Loss (IL) and Continuing Losses (CL) have been applied to the hydrologic model. Details of IL and CL parameters applied in the XP-SWMM model are presented in Table C.3.

Table C.3 Adopted Initial & Continuing Losses

Impervious Area		Pervious Area	
IL (mm)	CL (mm/hr)	IL (mm)	CL (mm/hr)
0.0	0.0	5.0	2.0

Analysis of the catchment has been undertaken to determine the average slope, with the results of this being applied to the model.

Table C.4 Pre-Development Catchment Parameters

Catchment	Impervious Area			Pervious Area		
	Area (ha)	Fraction Impervious (%)	Slope (%)	Area (ha)	Fraction Impervious (%)	Slope (%)
Pre A	0.001	100	0.35	2.231	0	0.35
Ext A	0.001	100	4	0.299	0	4

Table C.5 Post-Development Catchment Parameters

Catchment	Impervious Area			Pervious Area		
	Area (ha)	Fraction Impervious (%)	Slope (%)	Area (ha)	Fraction Impervious (%)	Slope (%)
Post A1	0.327	100	1	0.074	0	1
Post A2	0.194	100	1	0.031	0	1
Post A3	0.389	100	1	0.103	0	1
Post A4	0.357	100	1	0.027	0	1
Post A5	0.269	100	1	0.048	0	1
Post A6	0.349	100	1	0.064	0	1

OSD Depth Area

XP-SWMM requires a depth area relationship to be defined when modelling onsite detention (OSD). A summary of the total depth-area relationship applied to the storage nodes of the XP-SWMM model in the post-development (mitigated) scenario is contained in Table C.6.

Table C.6 Depth - Area Relationship Adopted for OSD

OSD ID	RL (m AHD)	Depth (m)	Surface Area (ha)
Det 1+2	27.7	0	0.025
	27.75	0.05	0.026856
	27.8	0.1	0.040954
	27.85	0.15	0.04592
	27.9	0.2	0.065417
	27.95	0.25	0.071611
	28	0.3	0.077848
	28.05	0.35	0.084129
	28.1	0.4	0.090453
	28.15	0.45	0.09682
	28.2	0.5	0.103249
Det 3	27.7	0	0.02
	27.75	0.05	0.030498
	27.8	0.1	0.044894
	27.85	0.15	0.060606
	27.9	0.2	0.065707
	27.95	0.25	0.070842
	28	0.3	0.076011
	28.05	0.35	0.081214
	28.1	0.4	0.086451
	28.15	0.45	0.091721
	28.2	0.5	0.097017
Det 4	27.6	0	0.034
	27.65	0.05	0.034295
	27.7	0.1	0.034375
	27.75	0.15	0.034455
	27.8	0.2	0.034534
	27.85	0.25	0.034614
	27.9	0.3	0.034694
	27.95	0.35	0.034774
	28	0.4	0.034853
	28.05	0.45	0.034933
	28.1	0.5	0.035013
	28.15	0.55	0.035092
	28.2	0.6	0.035172

	28.25	0.65	0.035252
	28.3	0.7	0.035331
Det 5	27.6	0	0.017
	27.65	0.05	0.01772
	27.7	0.1	0.019186
	27.75	0.15	0.020717
	27.8	0.2	0.022358
	27.85	0.25	0.024156
	27.9	0.3	0.026117
	27.95	0.35	0.028199
	28	0.4	0.030074
	28.05	0.45	0.031543
	28.1	0.5	0.032871
Det 6	27.8	0	0.0215
	27.85	0.05	0.022552
	27.9	0.1	0.023748
	27.95	0.15	0.024961
	28	0.2	0.02619
	28.05	0.25	0.027435
	28.1	0.3	0.028697
	28.15	0.35	0.029975
	28.2	0.4	0.03127
	28.25	0.45	0.032581
	28.3	0.5	0.033908

Appendix D - MUSIC Input Parameters

Rainfall and Evapotranspiration Parameters

MUSIC modelling was based on 6-minute interval data obtained from the Bureau of Meteorology (BOM) for rainfall station 40659 Greenbank Thompson Rd, as summarised in Table D.1.

Table D.1 Meteorological and Rainfall Runoff Data Reporting Table

Input	Data Used in Modelling
Rainfall station	40659 Greenbank Thompson Rd
Time step	6 minute
Modelling period	01/01/1980 to 31/12/1989 (10 years)
Mean annual rainfall (mm)	745
Evapotranspiration	1427
Rainfall runoff parameters	Commercial
Pollutant export parameters	Commercial

Catchment Parameters

Based on the proposed land uses within the development, the subject site has been modelled as commercial/industrial land use as detailed in Table D.2. The site has been divided into 6 sub catchments and each of these catchments divided in roof and ground level source nodes as per the architectural drawings included in Appendix A.

Table D.2 Land Use Parameters

Catchment ID	Area (ha)	Land use	Total Impervious (%)
Roof 1	0.202	Commercial Roof	100
Carpark 1	0.093	Commercial Carpark	80
Ground 1	0.105	Commercial Ground	20
Roof 2	0.115	Commercial Roof	100
Carpark 2	0.067	Commercial Carpark	80
Ground 2	0.043	Commercial Ground	20
Roof 3	0.154	Commercial Roof	100
Carpark 3	0.191	Commercial Carpark	80
Ground 3	0.147	Commercial Ground	20
Roof 4	0.001	Commercial Roof	100
Carpark 4	0.333	Commercial Carpark	80
Ground 4	0.051	Commercial Ground	20
Roof 5	0.077	Commercial Roof	100
Carpark 5	0.172	Commercial Carpark	80
Ground 5	0.068	Commercial Ground	20
Roof 6	0.154	Commercial Roof	100

Carpark 6	0.168	Commercial Carpark	80
Ground 6	0.091	Commercial Ground	20

The MUSIC catchment plan with full breakdown of roof and ground areas is presented in Appendix E. The pollutant loads and runoff parameters for each source node have been based on the data from the Water by Design MUSIC Modelling Guidelines (2010), as summarised in

Table D.3 and Table D.4.

Table D.3 Rainfall Runoff Parameters

Parameter	All Nodes
Landuse	Commercial
Rainfall threshold (mm)	1
Soil storage capacity (mm)	18
Initial storage (% capacity)	10
Field capacity (mm)	80
Infiltration capacity coefficient a	243
Infiltration capacity exponent b	0.6
Initial depth (mm)	50
Daily recharge rate (%)	0
Daily baseflow rate (%)	31
Daily deep seepage rate (%)	0

Table D.4 Pollutant Load Parameters

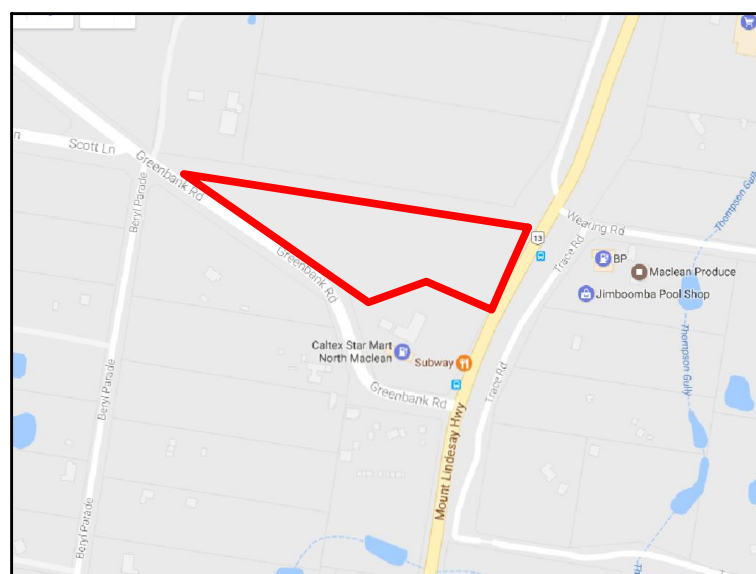
Urban Residential	Total Suspended Solids (log mg/L)		Total Phosphorous (log mg/L)		Total Nitrogen (log mg/L)	
	Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.
Storm Flow Concentration	1.30 ⁽¹⁾ 2.43 ⁽²⁾ 2.16 ⁽³⁾	0.38	-0.89 ⁽¹⁾ -0.30 ⁽²⁾ -0.39 ⁽³⁾	0.34	0.37	0.34
Base Flow Concentration	0.78 ^(2,3)	0.39 ^(2,3)	-0.60 ^(2,3)	0.50 ^(2,3)	0.32 ^(2,3)	0.30 ^(2,3)

NOTE: (1) Values applied to "Roof" areas
 (2) Values applied to "Carpark" areas
 (3) Values applied to "Ground" areas

Appendix E - Stormwater Management Plan Drawings

LOT 2 ON SP267252, 918 GREENBANK ROAD, NORTH MACLEAN, LOGAN CITY

CONCEPTUAL STORMWATER MANAGEMENT DRAWINGS



LOCALITY PLAN

SCHEDULE OF DRAWINGS	
Drawing No.	Drawing Title
N000	LOCALITY AND DRAWING INDEX PLAN
N200	PRE-DEVELOPMENT CATCHMENT PLAN
N201	POST-DEVELOPMENT CATCHMENT PLAN
N202	MUSIC CATCHMENT PLAN
N300	EROSION & SEDIMENT CONTROL PLAN
N301	EROSION & SEDIMENT CONTROL TYPICAL CROSS SECTION
N400	OPERATIONAL CONTROL PLAN
N401	OPERATIONAL CONTROL TYPICAL CROSS SECTION - 1
N402	OPERATIONAL CONTROL TYPICAL CROSS SECTION - 2

PREPARED FOR

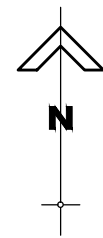
ROUBAIX PROPERTIES PTY LTD

PREPARED BY



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Coote Burchills Engineering Pty Ltd
ABN 76 166 942 365

FILENAME: Y:\AQUATIC WATER ENGINEERING\PROJECTS\2016\BE160355_918_Greenbank_Road_North_Maclean\ACAD\Water\BE-160355-N200.dwg
PLOTTED: 03.05.2017 at: 09:43



LEGEND

- PRE-DEVELOPMENT CATCHMENT
- FLOW DIRECTION
- DISCHARGE LOCATION

LOT 2 ON SP267252,
918 GREENBANK ROAD,
NORTH MACLEAN,
LOGAN CITY

FOR
ROUBAIX PROPERTIES
PTY LTD

ORIGINAL SCALE BEFORE REDUCTION

A3 0 10 20 30 40mm.

VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		03.05.17

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Coote Burchills Engineering Pty Ltd
ABN 76 166 942 365

DRAWING TITLE :

PRE-DEVELOPMENT
CATCHMENT PLAN

DEVEL. APPLIC. No. : DATE : 03.05.17

PROJECT LEADER : JF

DESIGNER : TB/TP

DRAFTSPERSON : TP / HN

CHECKED : TB

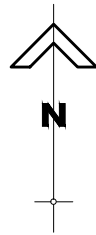
APPROVED FOR AND ON BEHALF OF
BURCHILLS ENGINEERING SOLUTIONS ABN 76 166 942 365

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PROJECT No.: BE160355 DRAWING No. : N200 VERSION: A

SCALE 10 0 10 20 30 40 50 (metres)
1 : 1000 (FULL SIZE)



LOT 2 ON SP267252,
918 GREENBANK ROAD,
NORTH MACLEAN,
LOGAN CITY

FOR
ROUBAIX PROPERTIES
PTY LTD

ORIGINAL SCALE BEFORE REDUCTION
A3 0 10 20 30 40mm.

VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		03.05.17

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DRAWING TITLE :

POST-DEVELOPMENT
CATCHMENT PLAN

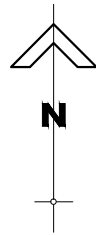
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DESIGNER : TB/TP		
DRAFTSPERSON : TP / HN		
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LEGEND

- POST-DEVELOPMENT CATCHMENT
- FLOW DIRECTION
- DIVERSION CHANNEL
- LEGAL POINT OF DISCHARGE

SCALE 10 0 10 20 30 40 50 (metres)
1 : 1000 (FULL SIZE)



LOT 2 ON SP267252,
918 GREENBANK ROAD,
NORTH MACLEAN,
LOGAN CITY

FOR

ROUBAIX PROPERTIES
PTY LTD

CATCHMENT A1
ROOF: 0.202 ha
ROAD AND CARPARK: 0.093 ha
GROUND: 0.105 ha
TOTAL AREA: 0.400 ha

CATCHMENT A2
ROOF: 0.115 ha
ROAD AND CARPARK: 0.067 ha
GROUND: 0.043 ha
TOTAL AREA: 0.225 ha

CATCHMENT A3
ROOF: 0.154 ha
ROAD AND CARPARK: 0.191 ha
GROUND: 0.147 ha
TOTAL AREA: 0.492 ha

CATCHMENT A4
ROOF: 0.000 ha
ROAD AND CARPARK: 0.333 ha
GROUND: 0.051 ha
TOTAL AREA: 0.384 ha

CATCHMENT A5
ROOF: 0.077 ha
ROAD AND CARPARK: 0.172 ha
GROUND: 0.068 ha
TOTAL AREA: 0.317 ha

CATCHMENT A6
ROOF: 0.154 ha
ROAD AND CARPARK: 0.168 ha
GROUND: 0.091 ha
TOTAL AREA: 0.413 ha

LEGEND

-  MUSIC CATCHMENT
-  GROUND
-  ROOF
-  ROAD AND CARPARK

SCALE 10 0 10 20 30 40 50 (metres)
1 : 1000 (FULL SIZE)

ORIGINAL SCALE BEFORE REDUCTION
A3 0 10 20 30 40mm.

VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		03.05.17

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Coote Burchills Engineering Pty Ltd
ABN 76 166 942 365

DRAWING TITLE :

MUSIC CATCHMENT PLAN

DEVEL. APPLIC. No. :	DATE : 03.05.17
PROJECT LEADER : JF	
DESIGNER : TB/TP	
DRAFTSPERSON : TP / HN	
CHECKED : TB	
APPROVED FOR AND ON BEHALF OF BURCHILLS ENGINEERING SOLUTIONS	ABN 76 166 942 365
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	VERSION: A

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PLOTTED: 03.05.2017 at: 0942



LEGEND

- SUBJECT SITE
- CONSTRUCTION EXIT
- SEDIMENT FENCE
- CW-DC CLEAN WATER DIVERSION CHANNEL

LOT 2 ON SP267252,
918 GREENBANK ROAD,
NORTH MACLEAN,
LOGAN CITY

FOR
ROUBAIX PROPERTIES
PTY LTD

ORIGINAL SCALE BEFORE REDUCTION
A3 0 10 20 30 40mm.

VER.	DESCRIPTION	APPR.	DATE
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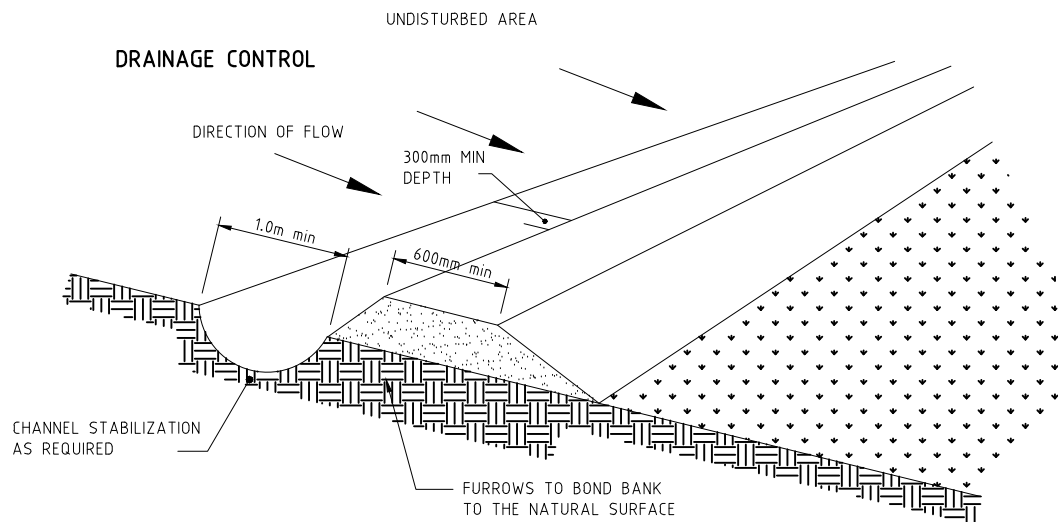
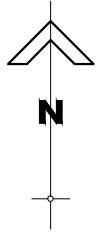
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DRAWING TITLE :

**EROSION & SEDIMENT
CONTROL PLAN**

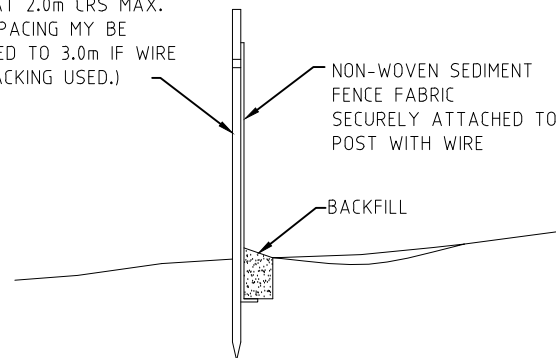
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RPEQ No. :		
SCALE : 1:1000	DATUM :	FULL SIZE : A3
PROJECT No.:	DRAWING No. :	VERSION:
BE160355	N300	A



CLEAN WATER DIVERSION CHANNEL (TYPICAL)

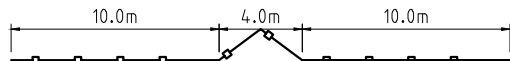
N.T.S.

POSTS AT 2.0m CRS MAX.
(POST SPACING MY BE
INCREASED TO 3.0m IF WIRE
MESH BACKING USED.)



SEDIMENT FENCE DETAIL

N.T.S.



SEDIMENT FENCE SETOUT DETAIL

N.T.S.

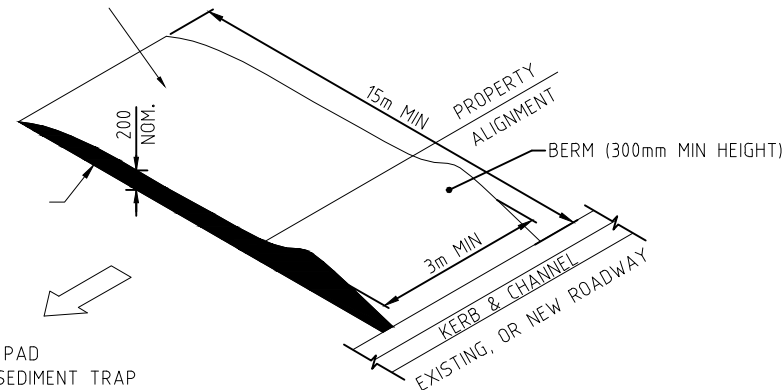
GENERAL NOTES:

1. THESE EROSION AND SEDIMENT CONTROL PLANS TO BE READ IN CONJUNCTION WITH THE APPROVED STORMWATER MANAGEMENT PLAN.
2. PRIOR TO THE COMMENCEMENT OF SITE WORKS, THE LOCATION OF THE SITE ACCESS POINT MUST BE VERIFIED WITH THE LOCAL AUTHORITY.
3. SITE EXIT POINTS MUST BE APPROPRIATELY MANAGED TO MINIMISE THE RISK OF SEDIMENT BEING TRACKED ONTO SEALED, PUBLIC ROADWAYS.
4. STOCKPILES OF ERODIBLE MATERIAL THAT HAS THE POTENTIAL TO CAUSE ENVIRONMENTAL HARM IF DISPLACED MUST BE APPROPRIATELY PROTECTED FROM WIND, RAIN, CONCENTRATED SURFACE FLOW AND EXCESSIVE UP-SLOPE STORMWATER SURFACE FLOWS.
5. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO CONTROL AND MINIMISE EROSION AND DOWNSTREAM SEDIMENTATION DURING ALL STAGES OF CONSTRUCTION INCLUDING THE MAINTENANCE PERIOD.
6. THE CONTRACTOR IN CONJUNCTION WITH THE ENVIRONMENTAL ENGINEER IS TO MAINTAIN A WATER QUALITY LOG IN ACCORDANCE WITH THE APPROVED STORMWATER MANAGEMENT PLAN. THE LOG SHALL NOMINATE DATE, TESTS UNDERTAKEN, RESULTS, NOTES AND CORRECTIVE ACTIONS UNDERTAKEN. THE LOG SHALL ALSO CONTAIN RELEVANT INFORMATION RELATING TO CHEMICAL FLOCCULATION RATES, RESIDENCE TIME ETC, IF USED ON THE SITE.
7. PLANS AND ALL CALCULATIONS HAVE BEEN CONDUCTED IN ACCORDANCE WITH THE INTERNATIONAL EROSION CONTROL ASSOCIATION (IECA) BEST PRACTICE EROSION AND SEDIMENT CONTROL GUIDELINES, NOVEMBER 2008.
8. ALL DRAINAGE CONTROL MEASURES INCLUDING DIVERSION BUNDS AND CATCH DRAIN HAVE BEEN DESIGNED TO INCLUDE 150mm FREEBOARD FOR THE 5 YEAR ARI EVENT.
9. SUITABLE ALL-WEATHER MAINTENANCE ACCESS MUST BE PROVIDED TO ALL SEDIMENT CONTROL DEVICES.
10. ALL SEDIMENT CONTROL DEVICES MUST BE DE-SILTED AND MADE FULLY OPERATIONAL AS SOON AS REASONABLE AND PRACTICABLE AFTER A SEDIMENT PRODUCING EVENT, WHETHER NATURAL OR ARTIFICIAL, IF THE DEVICE'S SEDIMENT RETENTION CAPACITY FALLS BELOW 75% OF ITS DESIGN RETENTION CAPACITY.
11. ALL UNSTABLE OR DISTURBED SOIL SURFACES MUST BE ADEQUATELY STABILISED AGAINST EROSION (MINIMUM 70%) PRIOR TO COMMENCEMENT OF USE, OR SURVEY PLAN ENDORSEMENT.

UNIFORMLY-SIZED
CRUSHED ROCK (AVOID
ROCK <40mm AND 75 TO 100mm)

UNDERLAIN BY GEOTEXTILE
FILTER CLOTH

RUNOFF FROM PAD
DIRECTED TO SEDIMENT TRAP



ROCK CONSTRUCTION EXIT

N.T.S.

LOT 2 ON SP267252,
918 GREENBANK ROAD,
NORTH MACLEAN,
LOGAN CITY

FOR

ROUBAIX PROPERTIES
PTY LTD

ORIGINAL SCALE BEFORE REDUCTION

A3 0 10 20 30 40mm.

VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		03.05.17

REVISIONS

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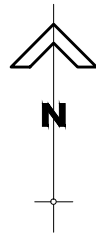


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Fax: +61 7 5509 6411
Email: admin@burchills.com.au
Coote Burchills Engineering Pty Ltd
ABN 76 166 942 365

DRAWING TITLE :

EROSION & SEDIMENT
CONTROL PLAN
TYPICAL CROSS SECTION

DEVEL. APPLIC. No. :	DATE :03.05.17
PROJECT LEADER : JF	
DESIGNER : TB/TP	
DRAFTSPERSON : TP / HN	
CHECKED : TB	
APPROVED FOR AND ON BEHALF OF BURCHILLS ENGINEERING SOLUTIONS ABN 76 166 942 365	
RPEQ No. :	
SCALE : N.T.S	DATUM : FULL SIZE : A3
PROJECT No.: BE160355	DRAWING No. : N301
	VERSION: A



LOT 2 ON SP267252,
918 GREENBANK ROAD,
NORTH MACLEAN,
LOGAN CITY

FOR
ROUBAIX PROPERTIES
PTY LTD

ORIGINAL SCALE BEFORE REDUCTION
A3 0 10 20 30 40mm.

VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		03.05.17

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Email: admin@burchills.com.au
Coote Burchills Engineering Pty Ltd
ABN 76 166 942 365

DRAWING TITLE :

OPERATIONAL CONTROL PLAN

DEVEL. APPLIC. No. :		DATE : 03.05.17
PROJECT LEADER : JF		
DESIGNER : TB/TP		
DRAFTSPERSON : TP / HN		
CHECKED : TB		
APPROVED FOR AND ON BEHALF OF BURCHILLS ENGINEERING SOLUTIONS ABN 76 166 942 365		
RPEQ No. :		
SCALE : 1:1000	DATUM :	FULL SIZE : A3
PROJECT No.: BE160355	DRAWING No. : N400	VERSION: A

Bio-Retention\Detention Basin 1+2:
Filter Area: 135 m²
Detention Volume: 321 m³

Bio-Retention\Detention Basin 3:
Filter Area: 85 m²
Detention Volume: 319 m³

Bio-Retention\Detention Basin 4:
Filter Area: 80 m²
Detention Volume: 234 m³

Bio-Retention\Detention Basin 5:
Filter Area: 40 m²
Detention Volume: 119 m³

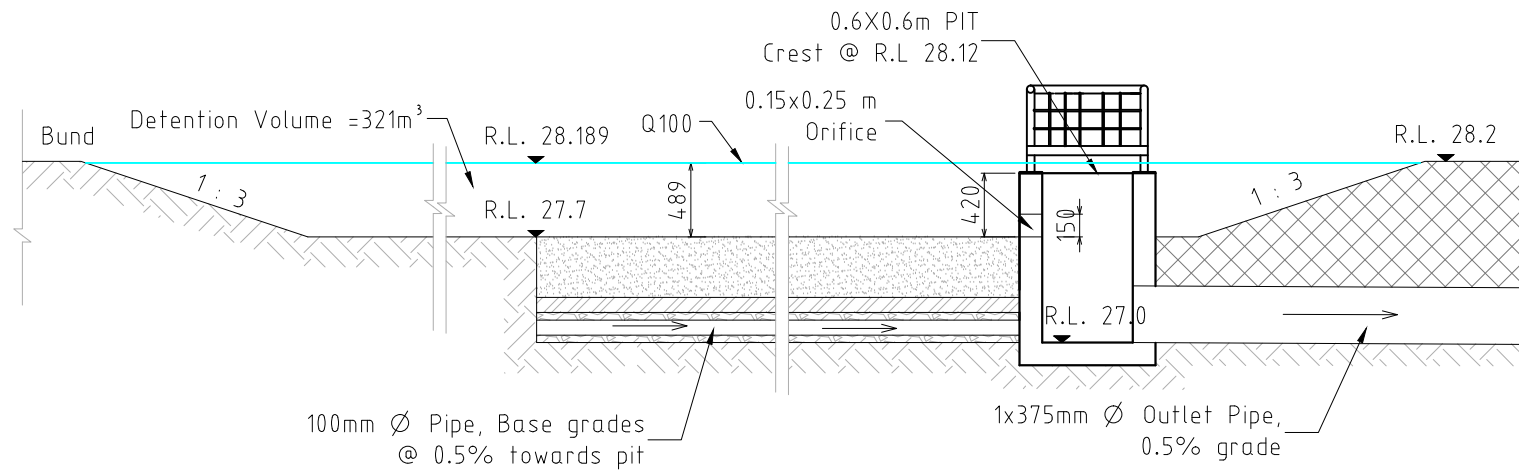
Bio-Retention\Detention Basin 6:
Filter Area: 75 m²
Detention Volume: 135 m³

LEGEND

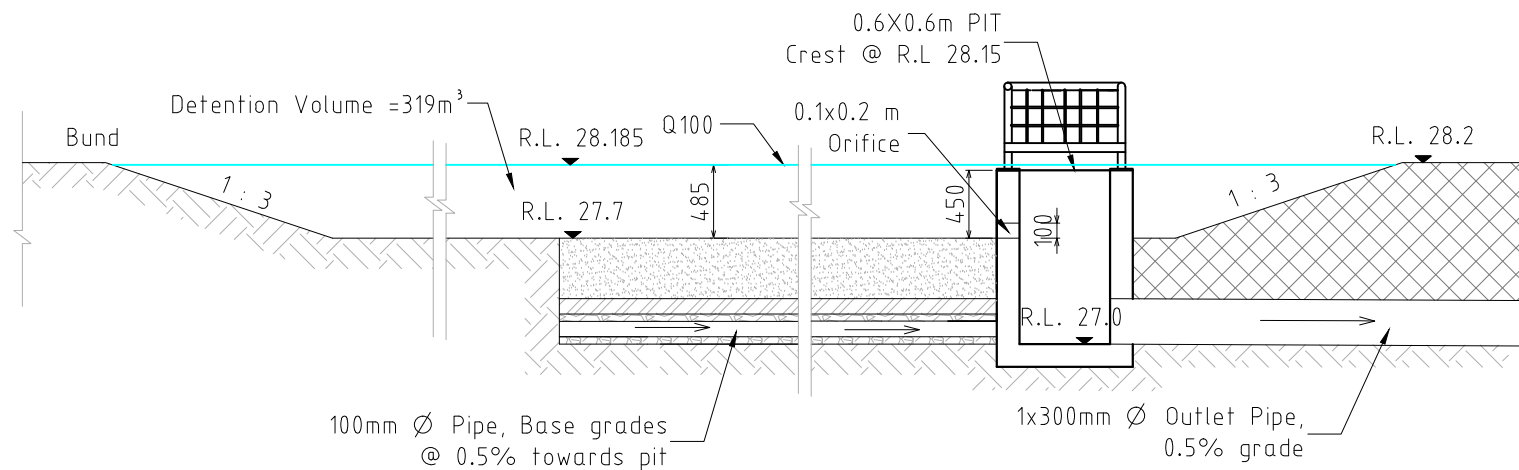
- POST-DEVELOPMENT CATCHMENT
- PIPE DRAINAGE
- DIVERSION CHANNEL
- BIORETENTION SYSTEM
- ON-SITE DETENTION
- PIT

SCALE 10 0 10 20 30 40 50 (metres)
1 : 1000 (FULL SIZE)

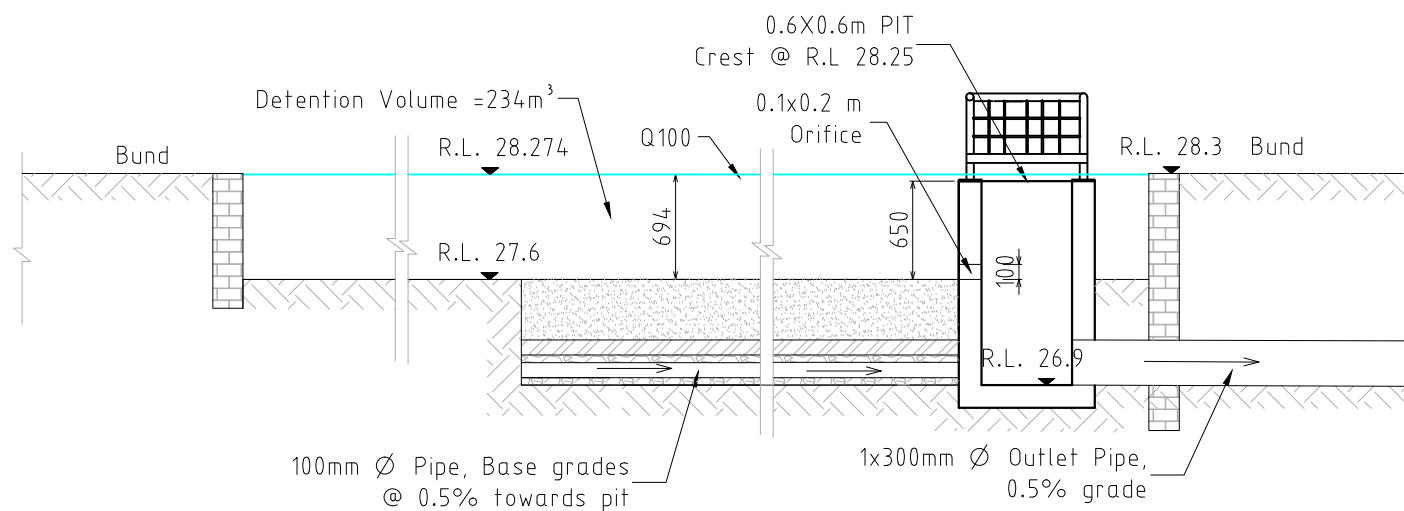
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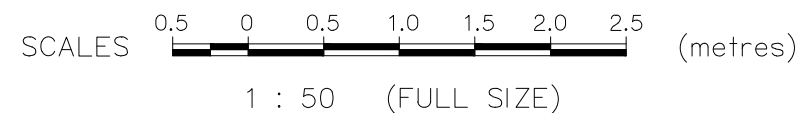
CROSS SECTION BASIN 1+2



CROSS SECTION BASIN 3



CROSS SECTION BASIN 4



LOT 2 ON SP267252,
918 GREENBANK ROAD,
NORTH MACLEAN,
LOGAN CITY

FOR
ROUBAIX PROPERTIES
PTY LTD

ORIGINAL SCALE BEFORE REDUCTION
A3 0 10 20 30 40mm.

VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		03.05.17

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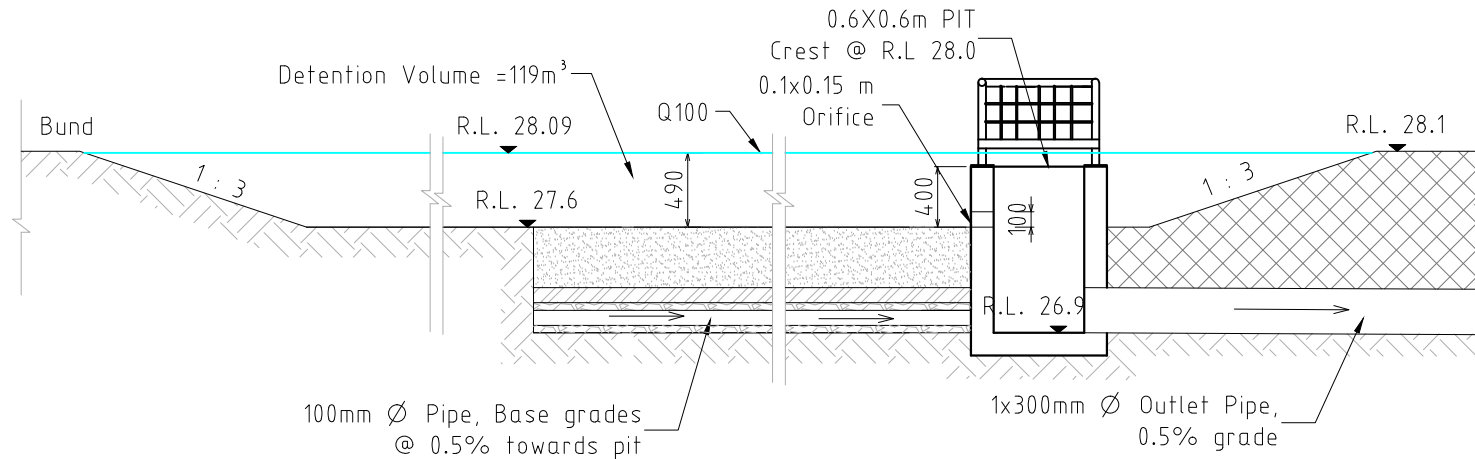
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Email: admin@burchills.com.au
Coote Burchills Engineering Pty Ltd
ABN 76 166 942 365

DRAWING TITLE :

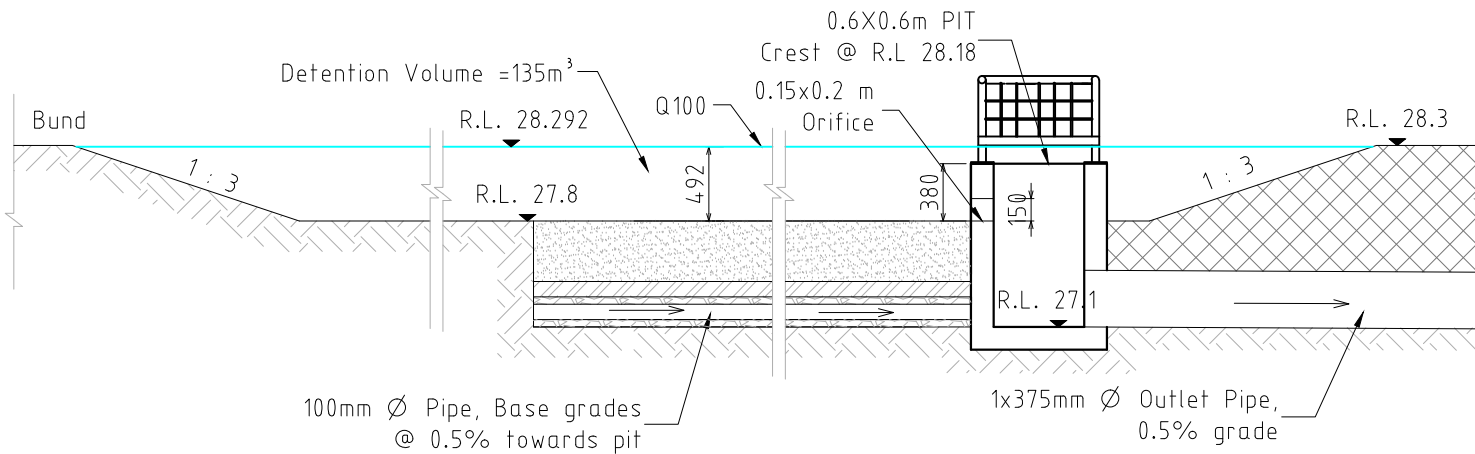
OPERATIONAL CONTROL PLAN
TYPICAL CROSS SECTION - 1

DEVEL. APPLIC. No. :	DATE :03.05.17
PROJECT LEADER : JF	
DESIGNER : TB/TP	
DRAFTSPERSON : TP / HN	
CHECKED : TB	
APPROVED FOR AND ON BEHALF OF BURCHILLS ENGINEERING SOLUTIONS	ABN 76 166 942 365
RPEQ No. :	
SCALE : 1:50	DATUM :
PROJECT No. : BE160355	DRAWING No. : N401
	VERSION: A

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CROSS SECTION BASIN 5

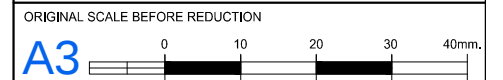


CROSS SECTION BASIN 6



LOT 2 ON SP267252,
918 GREENBANK ROAD,
NORTH MACLEAN,
LOGAN CITY

FOR
ROUBAIX PROPERTIES
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VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		03.05.17

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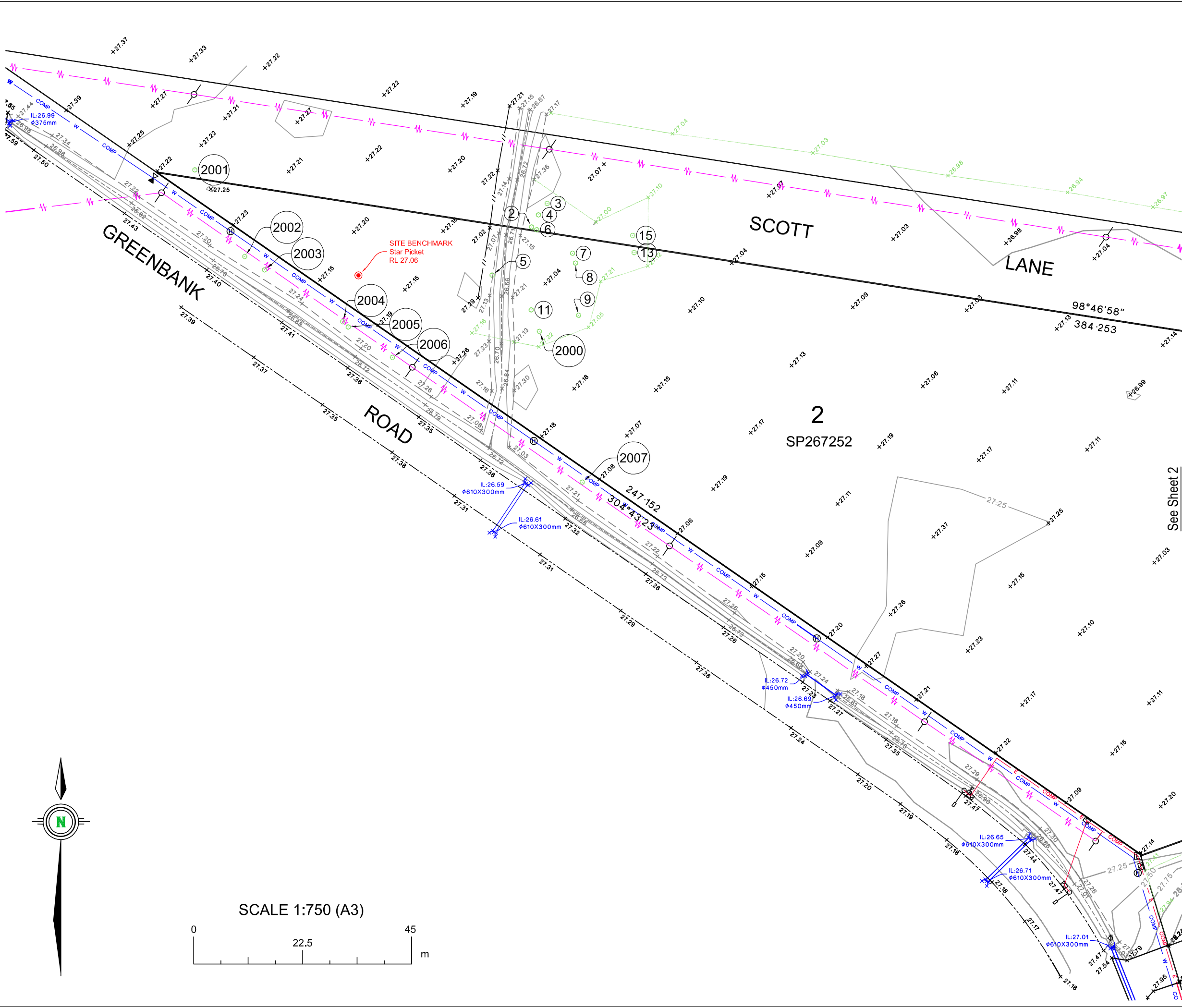
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DRAWING TITLE :

**OPERATIONAL CONTROL PLAN
TYPICAL CROSS SECTION - 2**

DEVEL. APPLIC. No. :	DATE :03.05.17
PROJECT LEADER : JF	
DESIGNER : TB/TP	
DRAFTSPERSON : TP / HN	
CHECKED : TB	
APPROVED FOR AND ON BEHALF OF BURCHILLS ENGINEERING SOLUTIONS	ABN 76 166 942 365
RPEQ No. :	
SCALE : 1:50	DATUM : FULL SIZE : A3
PROJECT No. : BE160355	DRAWING No. : N402
	VERSION: A

Appendix F - Site Survey



Client
Maclean Bridge Pty Ltd

Project
**Detail Survey of
914 Greenbank Road, North Maclean**
Described as
Lot 2 on SP267252

Scale: 1:750 at A3
Datum: AHD vide CORS
RL: x.xxx
Contour Int: 0.25m

Locality: North Maclean
LGA: Logan C. C.
Cadfile: RBX-304.DET.01

C	Detail Extension to Culvert	FEW	21.02.17	MP
B	Trees located by Ecologist.	FEW	02.02.17	MP
A	INITIAL ISSUE	FEW	29.06.16	MP
Issue Description		Drw	Date	Appd

NOTES The title boundaries shown hereon were not marked at the time of survey and have been compiled from previous survey. Services shown hereon have been located where possible by field survey. Prior to any demolition, excavation or construction on the site, the relevant authority should be contacted for possible location of further underground services and detailed locations of all services.

LEGEND	
BB	Bottom of bank
DCL	Drain centreline
EBT	Edge of bitumen
EBX	Electricity Box
ECM	Electricity cable marker
EDT	Edge of trees
ELP	Light Pole
EMH	Electricity Pit
EP	Electricity Pole
FHY	Fire Hydrant
FNC	Fence
TB	Top of Bank
TEP	Telstra Pit
TW	Top of wall
WV	Water Valve

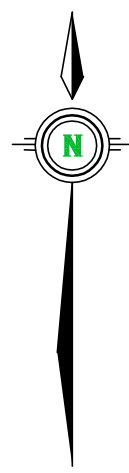
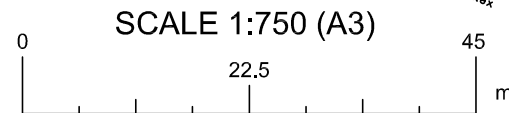
UNDERGROUND SERVICES COMPILED	
Sewer main	S COMP
Stormwater drainage	SW COMP
Water main	W COMP
Telstra supply	T COMP
Gas supply	GAS COMP GAS COMP
Electricity supply	E COMP

FOCUS
ON SURVEYING

www.focussurvey.com.au
info@focussurvey.com.au ph 3338 5095
Suite 6, 214 Waterworks Road . Ashgrove . QLD . 4060



See Sheet 1



Client
Maclean Bridge Pty Ltd

Project
**Detail Survey of
914 Greenbank Road, North Maclean**
 Described as
 Lot 2 on SP267252

Scale: 1:750 at A3
 Datum: AHD vide CORS
 RL: x.xxx
 Contour Int: 0.25m

Locality: North Maclean
 LGA: Logan C. C.
 Cadfile: RBX-304.DET.01

C	Detail Extension to Culvert	FEW	21.02.17	MP
B	Trees located by Ecologist.	FEW	02.02.17	MP
A	INITIAL ISSUE	FEW	29.06.16	MP

Issue Description
Drw Date Appd

NOTES The title boundaries shown hereon were not marked at the time of survey and have been compiled from previous survey. Services shown hereon have been located where possible by field survey. Prior to any demolition, excavation or construction on the site, the relevant authority should be contacted for possible location of further underground services and detailed locations of all services.

LEGEND

BB	Bottom of bank	---
DCL	Drain centreline	— D —
EBT	Edge of bitumen	---
EBX	Electricity Box	⊞
ECM	Electricity cable marker	⊞
EDT	Edge of trees	---
ELP	Light Pole	⊞
EMH	Electricity Pit	⊞
EP	Electricity Pole	⊞
FHY	Fire Hydrant	⊞
FNC	Fence	---
TB	Top of Bank	---
TEP	Telstra Pit	⊞
TW	Top of wall	---
WV	Water Valve	⊞

UNDERGROUND SERVICES COMPILED

Sewer main	S	COMP
Stormwater drainage	SW	COMP
Water main	W	COMP
Telstra supply	T	COMP
Gas supply	GAS	COMP
Electricity supply	E	COMP

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 Suite 6, 214 Waterworks Road . Ashgrove . QLD . 4060

Sheet No.	Surveyed By:	Date Surveyed:
2 of 2	FEW	21.02.17
Dwg. No.	Issue	
RBX-304.DET.01	C	