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Civil, Traffic and Structural
Project Management

STORMWATER MANAGEMENT PLAN

782 Greenbank Road, North Maclean

Submission Logan City Council

September 2025

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Rev 1	First Issue	Sept 2025

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1. Introduction

Bana Consulting Engineers (BCE) has been commissioned to develop a Site Based Stormwater Management Plan (SMP) for the proposed Residential development at 782 Greenbank Road, North Maclean.

The aim of this report is to ensure the generated stormwater from the site causes minimal nuisance, danger and damage to people, property and the environment. This report identifies the stormwater quantity management measures required for the operational phase of the proposed development.

The proposed SMP employs the principles of Water Sensitive Urban Design (WSUD), which focuses on reducing stormwater flows and pollutant export from the site with consideration of visual aesthetics of the urban landscape, the site utilisation, and existing constraints. This report includes the study details in regard to:

- Stormwater quality assessment using MUSIC software to achieve pollutant reduction objectives
- Pre and post developed hydrology and hydraulics assessment using DRAINS model and mitigation of the site post development flows in compliance with the stormwater code.

It is shown that by implementing the proposed stormwater management provisions, the stormwater pollutant loads will be reduced in accordance with the western Queensland stormwater treatment objectives and flow attenuation requirements will be achieved in compliance with the Council stormwater code.

2. Site Condition

The subject site is situated in a rural residential area at Lot 1 on RP136420, commonly known as 782-804 Greenbank Road, North Maclean. It is bounded by Greenbank Road to the south, with rural development surrounding it to the north, west, and east. The majority of the site remains undeveloped, encompassing a total area of 3.9 hectares. Existing features include a driveway, a building located in the southern portion of the site, and several shipping containers positioned along the eastern boundary. Figure 1 shows the street view of existing site from Greenbank Road.

The site has a general slope of approximately 5.5% towards the northwest, directing surface runoff to the adjoining property to the north. There are no stormwater pits or pipes present on the site, and the adjacent road lacks a kerb and channel drainage system. A farm dam is located in the north-western corner of the site, and aerial imagery indicates the presence of a spillway on the northern side of the dam..

Figure 1 : Existing Site – Facing North (source: Google)

It is proposed to develop the site to use the site for storage of cars, shipping containers, houses and trucks. The use is defined as a warehouse for outdoor storage service station including carpark, driveway and fuel dispensing area. The site locality is shown in Figure 2.

Figure 2 : Site Locality

The existing catchment area and surface types are summarized in Table 1. The site currently undeveloped and covered with grass. The proposed development will increase to fraction impervious of entire site to approximately 50%.

Table 1: Existing and Proposed Site Catchments.

Catchment	Existing	
	Area (ha)	%Impervious
Building roof	0.09	100
Road	0.01	100
Open Space	3.8	0
Total	3.9	2.5

3. Stormwater Management Strategy

The DRAINS program performs design and analysis calculations for stormwater drainage systems and models the flood behaviour of rural and urban catchments. DRAINS displays the components of a drainage system as “objects”, and presents information about these and the results of calculations pictorially.

The Time of Concentration for each sub-catchment was calculated using Friend’s equation for overland sheet flow in accordance with the Queensland Urban Drainage Manual (QUDM).

The Intensity, Frequency and Duration chart was generated for the region using the most recent Australian Bureau of Meteorology website tools.

The considerations in the proposed SMP and implemented measures to offset the development impacts are summarised below:

- The proposed fill earthwork will not change the direction of the site grades. The site surface grade will be kept toward the northwest with at least 5.5% grades.

- The site runoff will be directed to a detention basin located in the northern side of development via open drains and culvert crossing.

- It is required to regrade the developed area to accommodate open drains and detention basin and treatment devices.

- The low flow and high flow from the proposed detention basin will discharge towards north side of development.

4. Flow Analysis and Mitigation

QUDM specifies that any proposed development must demonstrate that the development shall have a lawful point of stormwater discharge and the proposed development must not cause ‘actionable nuisance’, or, as per QUDM, ‘non-worsening’ must be achieved.

The increase in impervious area in the post development phase causes an increase in peak discharges which requires attenuation.

The runoff generated from the developed pad, road, shed and buildings will discharge to a detention basin via multiple open drains. The open drains will be installed to handle overland flow generated from site for storm event of 1% AEP. Due to steep gradient of site the velocity in the channels are highly erodible. The summary of channel size and parameters are given in

Table 2: Summary of Channel Details

Channel	Catchment	Shape	Base width	batter	Depth	Velocity	Lining	Manning's Roughness
Unit	ha	-	m	m:m	m	(m/s)	-	-
1	1.5	Trapezoidal	0.5	1:2	0.5	1.8	Rock	0.038
2	1.9	Trapezoidal	0.5	1:2	0.5	1.8	Rock	0.038

The proposed drainage plan and details are given in Appendix 3.

The time of concentration for the developed component of the catchment has been calculated using the methodologies in QUDM and the proposed site plan. The proposed attenuation devices were inserted into DRAINS program for peak flow calculation and numerous model iterations have been undertaken to estimate the detention basin size.

It is proposed that all runoff generated from the developed site be collected and conveyed to a 700 m³ detention basin via a dedicated drainage system. The basin will be connected to a 300 mm drainage pipe, which will discharge low flows to the north side of the site. A drainage pit with grated inlet within the basin will manage high flow events. Additionally, an emergency spillway in the form of a broad crest weir with a 5-meter base width will be installed to operate in the event the grated pit becomes blocked. The storage - elevation graph for the basin is given in Figure 3.

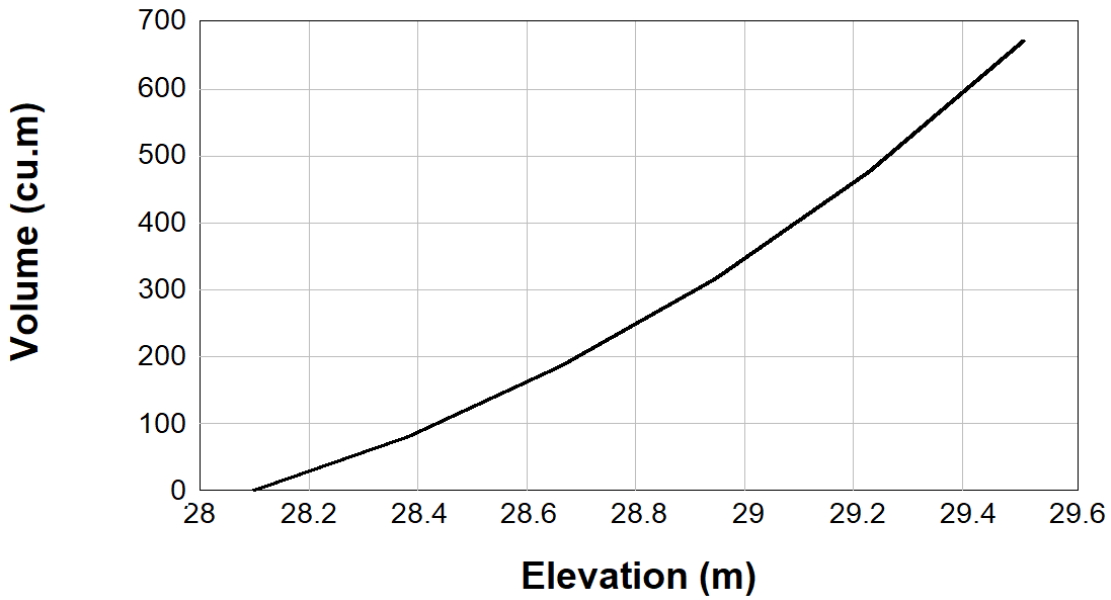


Figure 3 – Stage Elevation Graph of Detention Basin

The runoff generated in the pre-development stage was calculated for the proposed legal point of discharge using DRAINS.
Attenuation of stormwater to pre-developed conditions is required due to the expected increase in the peak flows of stormwater run-off caused by increasing the paved area. To achieve this 'non-worsening', the development was modelled with DRAINS for the pre-development and post-development conditions for Annual Exceedance Probability of 63, 50, 20, 10, 5, 2 and 1%. The pre and post development catchments were modelled with the details shown in Table 3.

Table 3 : Comparison of Peak Discharges for Existing and Developed Phases

Design AEP (%)	Existing-DRAINS (m^3/s)	Developed (m^3/s)	Developed-Mitigated (m^3/s)
63	0.54	0.65	0.192
50	0.69	0.84	0.424
20	0.89	1.09	0.729
10	1.05	1.20	0.896
5	1.20	1.38	1.07
2	1.40	1.66	1.3
1	1.55	1.84	1.47

5. Water Quality Modelling

The State Planning Policy requires development with more than 2500 m^2 to provide stormwater quality treatment. This requires that stormwater quality improvement works be provided to achieve targets as outlined in the council guideline. This policy requires that we protect receiving water environmental values from adverse development impacts by managing development and construction activities in accordance with various stormwater design objectives.

5.1. Methodology

The load-based pollutant reduction objectives outlined in Clause 2.2.3 of Council Stormwater Management Standards for Development are as follows.

- 80% reduction in total suspended solids (TSS).
- 60% reduction in total phosphorus (TP).
- 45% reduction in total nitrogen (TN).
- 90% reduction in litter / gross pollutants (GP).

The above objectives will be achieved by placing a series of stormwater quality treatment measures as part of the site development. To demonstrate sufficiency of this treatment measures,

the site was modelled using MUSIC computer software. MUSIC is widely accepted as the industry standard for water quality modelling and is a reliable tool for assessment of the treatment train effectiveness.

The catchment node parameters used in the MUSIC are summarized in Table 7.

Table 4: MUSIC model input parameters

Parameter	Value
Landscape area - 60% impervious	2.34
Paved area – 50% impervious	1.56
Rainfall threshold (mm/day)	1
Soil storage capacity (mm)	500
Initial storage (%)	10
Field capacity (mm)	200
Infiltration capacity coefficient - a	211
Infiltration capacity exponent – b	5
Daily recharge (%)	28
Initial depth (mm)	50
Daily baseflow rate (%)	27

5.2. Proposed Treatment Devices

A number of different stormwater treatment trains were investigated in order to achieve the water quality objectives of the site. Treatment devices were selected for the site based on current legislation, site constraints and degree of treatment required.

It is proposed to install a bio-retention basin at the outlet of drainage system north of developed site. This bio-basin will be combined with detention basin.

5.2.1. Bioretention systems

Bioretention systems promote filtration through a prescribed filter media. The bioretention has the capability to remove coarse to medium sediments as well as particles and associated contaminants. Treatment occurs by filtration though surface vegetation and percolation through the filter media. Additional treatment occurs through fine filtration, extended detention and some biological uptake.

Vegetation plays a key role in enhancing the bio-retention systems function by preventing surface erosion of the filter media. Plants provide biofilms on their roots, facilitate oxygen transport and improve soil microbial communities which all enhance the absorption and biological transfer of pollutant. The summary of bioretention basin parameters are summarized in Table 5.

Table 5: Bioretention Basin

Parameter	Value
Filter Area (m^2)	100
Filter depth (m)	0.5
Vegetation height (m)	0.25
Extended detention (m)	0.3
Saturated hydraulic conductivity	200
TN content of filter media	800
Orthophosphate content of filter	50

The MUSIC schematic and results for pre and post development conditions is given in Figure 4.

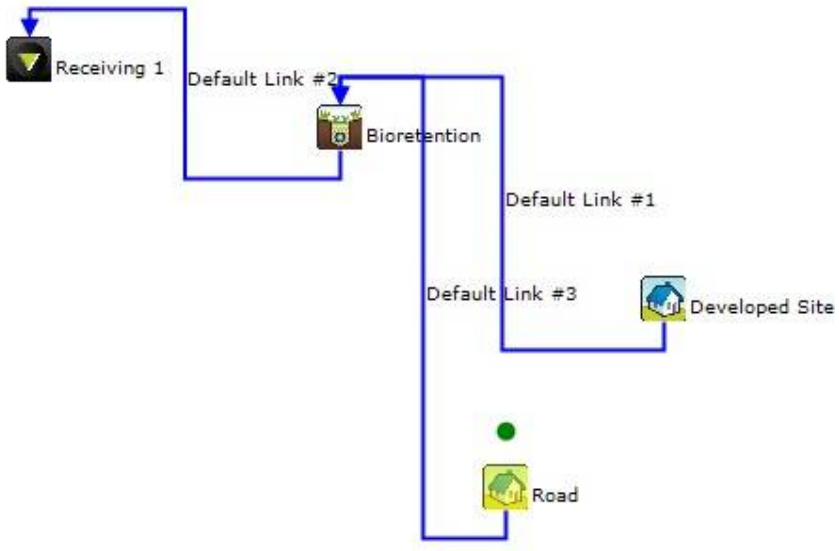


Figure 4 – MUSIC Schematic

A summary of the results from the MUSIC modelling is provided for proposed legal point of discharge in Table 6.

Table 6: MUSIC Modelling Results

	Source	Residual Load	% Reduction	Target %
Total Suspended Solids (kg/yr)	29.49	0.6552	97	80
Total Phosphorus (kg/yr)	0.068	0.0169	75	60
Total Nitrogen (kg/yr)	0.410	0.2144	47	45
Gross Pollutants (kg/yr)	7.165	0	100	90

The MUSIC results show that the proposed stormwater treatment devices will improve the discharging stormwater quality for the proposed development's runoff. The results meet with nominated load reduction targets recommended in State Planning Policy.

6. Conclusion

The SMP developed by Bana Consulting demonstrates compliance with Council's requirements with respect to stormwater quantity and quality.

The main objective of the stormwater quantity analysis was to limit the post–development peak discharge to the equivalent pre-developed peak flow discharging off-site for rainfall events up to and including a 1% AEP event. It is apparent from the modelling results that there will be no increase in peak flows discharging from the developed site.

It is proposed to capture all runoff generated from the building roof area and driveway and direct it to a combined detention and bio-retention basin with volume of 700 m^3. The basin will be connected to a 450 mm drainage pipe, which will discharge low flows to the north side of the site. A drainage pit with grated inlet within the basin will manage high flow events. Additionally, an emergency spillway in the form of a broad crest weir with a 15-meter base width will be installed to operate in the event the grated pit becomes blocked

As the investigations for this conceptual stormwater management plan were preliminary only, all analysis will be confirmed during the detailed design stage of the development to ensure compliance and avoid clash with other utilities such as sewer main.

7. References

Bureau of Meteorology website, IFD chart creation tool

Department of Natural Resources and Water, Queensland Urban Drainage Manual, 4th Edition, Brisbane, QLD. (2017)

Geoffrey O'Loughlin and Bob Stack, Drains User Manual, Watercom PTY Ltd, August, 2018.

Healthy Waterways 2006, Water Sensitive Urban Design- Technical Design Guidelines for South East Queensland, Version 1 -June 2006, Brisbane, QLD.

State Planning Policy, July 2016, Department of State Development, Infrastructure and Planning

8. Appendices

- Appendix 1 Time of Concentration and Rational Method
- Appendix 2 DRAINS Schematic
- Appendix 3 Drawings
- Appendix 4 Water Quality

Attachment 1: Time of Concentration and Rational Method

Project : 782 Greenbank Road- Maclean

Rational Method - Catchment Runoff

Time of concentration - Friend's equation - Overland sheet flow- Gravel

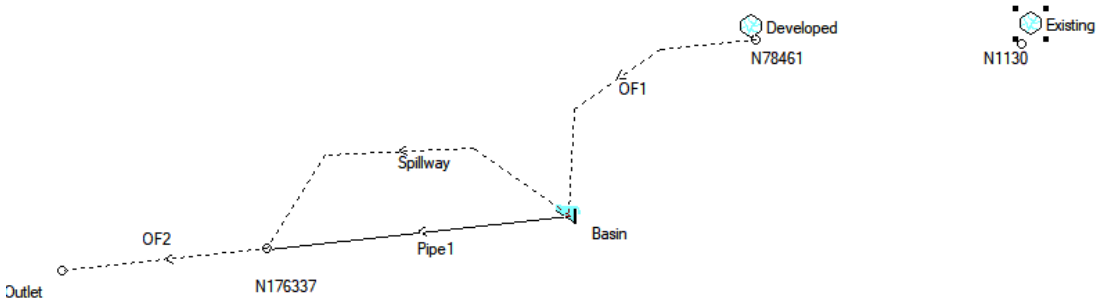
Hydrological parameters	Value	Unit	Description
Overland sheet fow length, L	180	m	
Hortons roughness, n	0.035		from Table 1
Slope of surface, S	5.5	%	
Time of concentration, Tc =	15	min	

Tc = 15 **mins** overland sheet flow

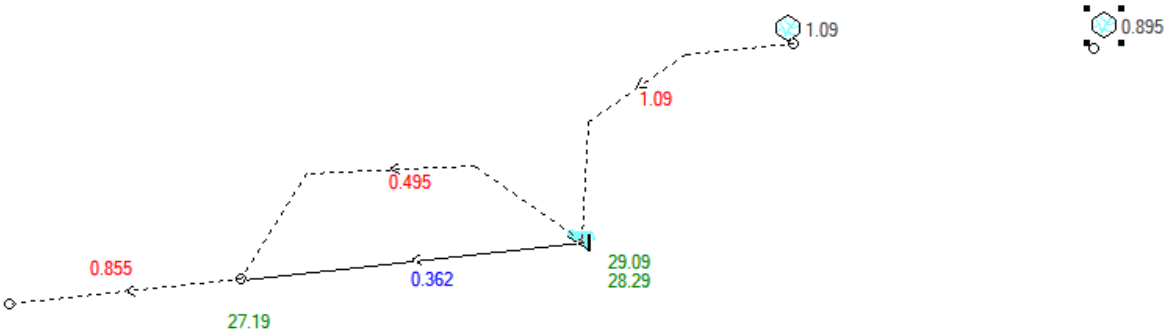
Parameter	Value	Unit	Description
Catchment Area	1.5000	ha	
1 yr discharge coefficient, C_1	0.56		
2 yr discharge coefficient, C_2	0.595		from equation 4.4, QUDM ($C_y = F_y \cdot C_{10}$)
5 yr discharge coefficient,C_5	0.665		
10 yr discharge coefficient, C_{10}	0.7		from Tables 4.5.3 and 4.5.4, QUDM
20 yr discharge coefficient,C_{20}	0.735		
50 yr discharge coefficient,C_{50}	0.805		
100 yr discharge coefficient,C_{100}	0.84		
T_c =	15	minutes	Friend's equation
1 yr rainfall intensity, I_1	70.3	mm/hr	from IFD curves - using BOM database
2 yr rainfall intensity, I_2	80.3	mm/hr	from IFD curves - using BOM database
5 yr rainfall intensity, I_5	111	mm/hr	from IFD curves - using BOM database
10 yr rainfall intensity, I_{10}	131	mm/hr	from IFD curves - using BOM database
20 yr rainfall intensity, I_{20}	151	mm/hr	from IFD curves - using BOM database
50 yr rainfall intensity, I_{50}	177	mm/hr	from IFD curves - using BOM database
100 yr rainfall intensity, I_{100}	196	mm/hr	from IFD curves - using BOM database
1 yr runoff value, Q1 =	0.164	m^3/s	
2 yr runoff value, Q2 =	0.199	m^3/s	
5 yr runoff value, Q5 =	0.308	m^3/s	
10 yr runoff value, Q10 =	0.382	m^3/s	
20 yr runoff value, Q20 =	0.462	m^3/s	
50 yr runoff value, Q50 =	0.594	m^3/s	
100 yr runoff value, Q100 =	0.686	m^3/s	

Appendix 2: DRAINS Modelling

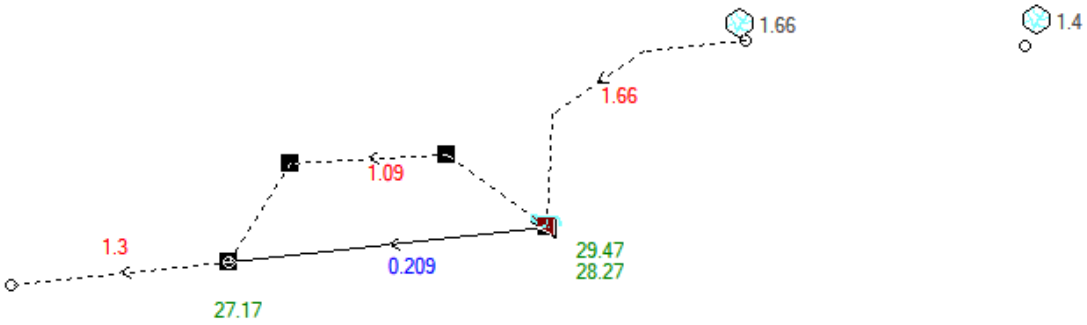
- Schematic

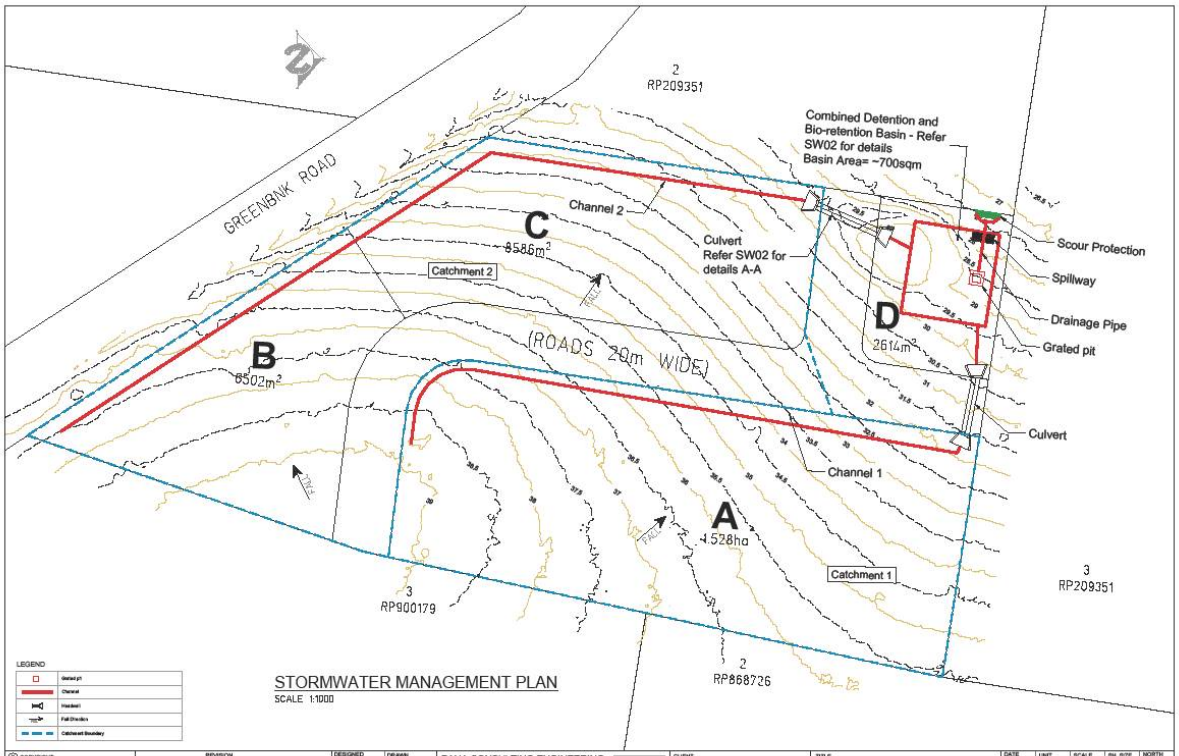


- Results – 20%AEP



Results – 1% AEP





STORMWATER MANAGEMENT PLAN

SCALE 1:1000

REVISION NO.	DESCRIPTION	DATE
A	Preliminary	

DESIGNED F.Sadeghi | DRAWN F.Sadeghi | CONTROLLED | APPROVED S. Maboudi | SAJID MABOUDI RPEQ No. 10051

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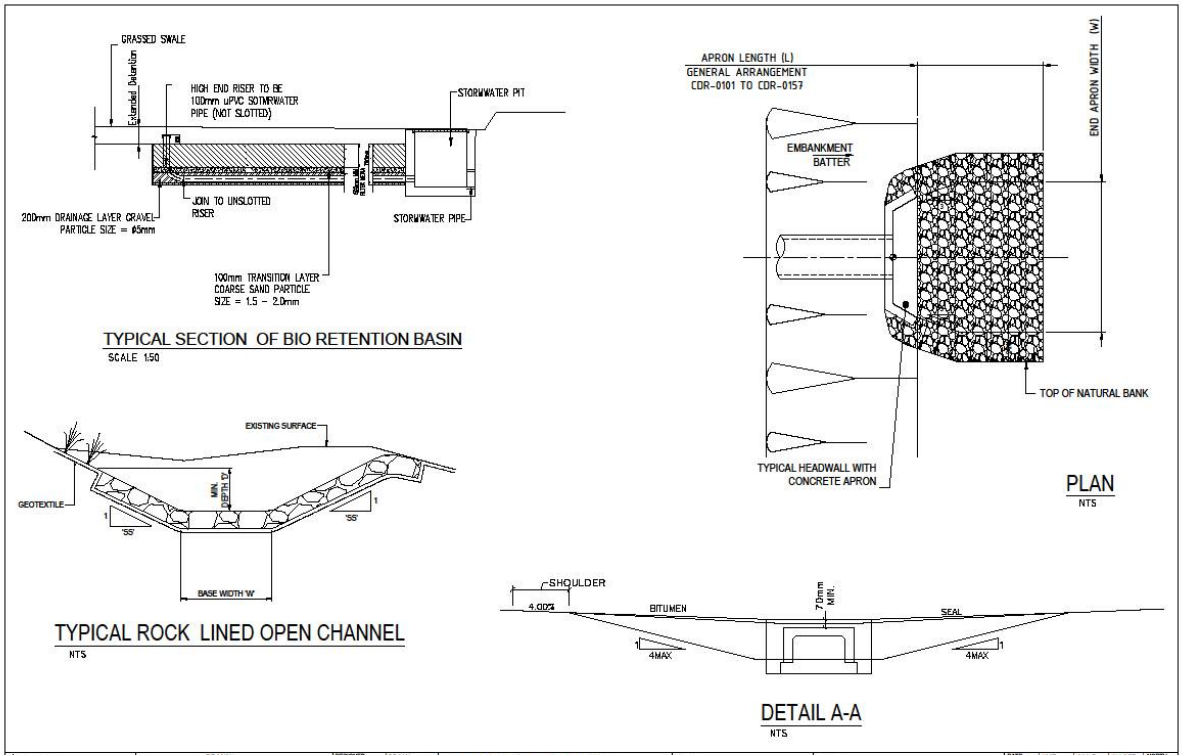
CLIENT	TITLE	DATE	UNIT	SCALE	SH. SIZE	NORTH
Amit Dhaka	Stormwater Management Plan	Sep.28 2025	m	As shown	A3	
LOCAL GOVT. AREA: Logan City Council	PROJECT: 782-804 Greenbank Road North Maclean QLD 4280 Australia	SHEET NO. 01	DRAWING NO. SW-01			REVISION A



TYPICAL SECTION OF BIO RETENTION BASIN

SCALE 1:50

PLAN

NTS

TYPICAL ROCK LINED OPEN CHANNEL

NTS

DETAIL A-A

NTS

REVISION NO.	DESCRIPTION	DATE
A	Preliminary	

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CLIENT	TITLE	DATE	UNIT	SCALE	SH. SIZE	NORTH
Amit Dhaka	Drainage Details	Sep.28 2025	m	As shown	A3	
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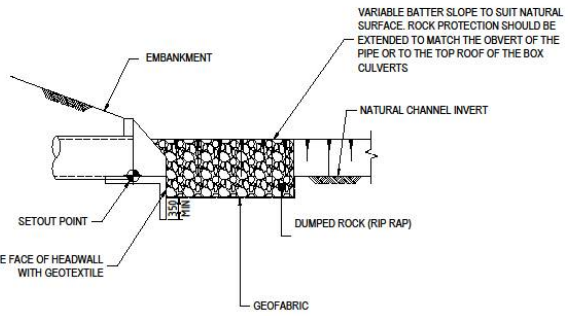

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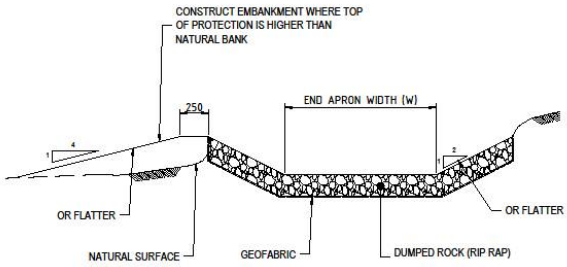

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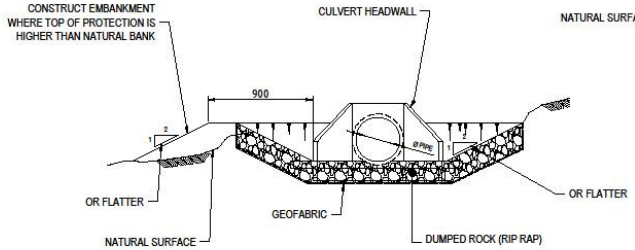

SECTION 2
NTS

REVISION NO	DESCRIPTION	DATE
A	Preliminary	

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LOCAL GOVT. AREA: Logan City Council
TITLE: Drainage Details
PROJECT: 782-804 Greenbank Road North Maclean QLD 4280 Australia
DATE: Sep,28 2025
UNIT: m
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SH. SIZE: A3
NORTH
SHEET NO.: 03
DRAWING NO.: SW-03
REVISION: A