STORMWATER MANAGEMENT PLAN FOR KINGS FOREST SERVICE STATION, TWEED COAST ROAD

Planit Consulting

WGM Consulting

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Contents

1 Introduction

1.1 Background

WGM Consulting has been engaged by Planit Consulting to prepare a Stormwater Management Plan (SMP) for the proposed development at Kings Forest, Kingscliff (Lot 7 DP875447), known here in as the subject site.

1.2 Scope

Specifically, this report details the following:

- Prepare a conceptual stormwater network diagram over the proposed service station footprint including indicative locations of trunk pipe system, open channel flow paths and treatment areas.
- Identify stormwater discharge locations
- Report on opportunities for Water Sensitive Urban Design (WSUD) principles to be utilised and options for water quality treatment 'in train' or 'end of line' solutions.
- Provide 'Music' software results for the treatment devices to determine nutrient removal & suspended solids removal & stormwater flow reduction rates.
- Provide a sediment and erosion control plan for the site.
- Identify advantages & disadvantages of stormwater management options presented in the report and final recommendations for the preferred stormwater management strategy.

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

1.3 Objectives

The objective of this SMP is to ensure that there is no worsening of stormwater quality nor any reduction in the environmental values of the downstream receiving waters as a result of activities on the subject site in compliance with Tweed Shire Council *Development Control Plan*.

This objective will be achieved through the implementation of:

- Management strategies designed to minimise water pollution from the development of the subject site
- Specific construction phase controls to minimise erosion and control sediment loss

1.4 Description of Subject Site

The subject site is located on Lot 7 DP875447, Tweed Coast Road, Kings Forest, NSW. The site area occupies approximately 10,878m^2. Refer to *Figure 1* location of subject site.

Figure 1 Subject site

1.5 Topography and Stormwater Conveyance

The site is relatively flat with an approximate slope of < 1% and elevations ranging from 5.89m AHD in the north western corner to 6.28m AHD in the centre of the development. Stormwater generally collects within the depressions on site and infiltrates due to the sandy soils present (as described in Mortons Urban Solutions Engineering Report, December 2014). The elevations indicate any excess runoff will travel towards the existing creek located to the south east of the proposed development and along an existing swale adjacent to Tweed Coast Road.

There are no upstream catchments influencing this site.

1.6 Rainfall

The six minute rainfall data and evapotranspiration values has been taken from Tweed Shire Councils website for MUSIC modelling (The Tweed Standard Rainfall Data Set) and was applied to the water quality model as described in the Tweed shire council Development Design Specification D7.

1.7 Description of Development

The applicant proposes to construct a service station which will include space for multiple food outlets, dining space, internal road network, multiple car parking sections and entry/exit driveways.

This will result in an increase in roof and other impervious areas over the pre-developed case. Development will include a multiuse service station and eatery (assumed 2160m^2 roof area), entry/exit driveways, internal roads, car parking and landscaping for the remainder of the site. The total site area is approximately 10,878m^2.

For the purposes of assessment, the subject site remains as one lot with a significant increase of impervious area post development.

The development proposes to use Water Sensitive Urban Design (WSUD) measures to control and treat stormwater as per Councils planning guidelines. The proposed development layout is illustrated in Figure 2 below. The proposed drainage network has been designed by Mortons Urban solutions and is shown below indicatively only.

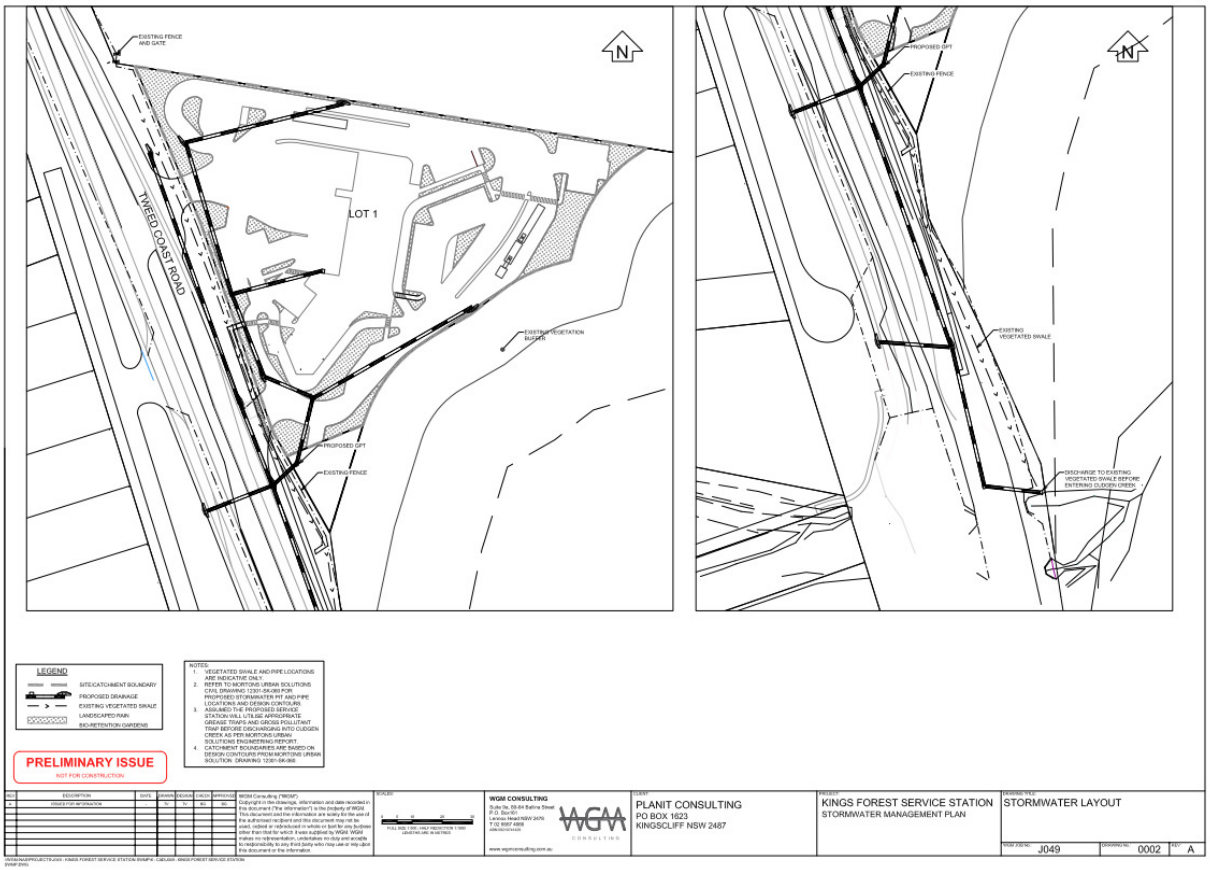

Figure 2 Proposed Development Layout

2 Stormwater Quality

The Model for Urban Stormwater Improvement Conceptualisation (MUSIC) has been utilised as the key water quality modelling tool for this project. MUSIC is a continuous simulation water quality model used to evaluate the short and long-term performance of stormwater improvement devices that are configured in series or in parallel to form a 'treatment train'. MUSIC enables the end-user to determine if proposed systems can meet specified water quality objectives.

The MUSIC model considers suspended solids, total nitrogen and total phosphorus, which are typical components and key indicators of stormwater runoff. The key MUSIC model inputs are:

- Rainfall and evaporation data (As provided from Tweed Shire Council)
- Catchment area and percentage impervious
- Soil storage parameters
- Pollutant event mean concentrations for source nodes (As provided from Tweed Shire Council D7)

All input parameters to the MUSIC model were derived from either climate data supplied by Tweed Shire Council or estimated from the MUSIC model manual (2014) and other published papers.

MUSIC model outputs include:

- Average annual pollutant export rates
- Treatment train effectiveness, expressed in terms of pollutant reduction.

2.1 Water Quality Objectives

The water quality objectives as listed in Table A5-4 Stormwater Treatment Objectives, as per Tweed Shire Council DCP, Section A5.4.7 Stormwater Runoff, Drainage, Waterways and Flooding, must be satisfied as per Figure 3 below.

Pollutant			
Nutrients	**Maximum permissible load that may be discharged kg/ha/year**		
	Average year (1719mm)	**Wet Year (2185mm)**	**Dry Year (929mm)**
Suspended solids (SS)	300	400	120
Total Phosphorus (TP)	0.8	1.1	0.35
Total Nitrogen (TN)	4.5	6	1.5
Litter	Retention 70% of annual litter load greater than 5mm		
Coarse sediment	Retention of 90% of annual load of sediment coarser than 0.125 mm		
Oil and grease (hydrocarbons)	<10 mg/litre in flows up to 40% of Q1 peak.		

Figure 3 Tweed Shire Council Water Quality Objectives

The pre and post development water quality objectives provided by MUSIC show the proposed development can effectively achieve the council specific quality requirements through onsite mitigation.

	Inflow	
	Pre	Post
Flow (ML/yr)	7.23	1.92
Total Suspended Solids (kg/yr)	534	1.24
Total Phosphorus (kg/yr)	0.570	0.330
Total Nitrogen (kg/yr)	6.50	1.47
Gross Pollutants (kg/yr)	26.2	0.00

Figure 4 MUSIC Pre and Post Development Water Quality

In order to achieve the quality objectives it is proposed to utilise a combination of garden bio-retention devices and a gross pollutant trap (GPT) as on site stormwater quality mitigation.

The total garden area for the post developed site is approximately 1,843m2, however due to the layout it has been assumed only 50% of the garden will be suitable for bio-retention devices.

A humeceptor has been used in the MUSIC model for the proposed GPT with a reduced (conservative) capture rate of 50% as opposed to the 80% nominated in the technical manual.

Through the combination of the bio-retention gardens and GPT the post developed site is able to achieve to the following treatment train results for Total Suspended Solids (TSS), Total Phosphorous (TP) and Total Nitrogen (TN) which identify a significant reduction.

	Sources	Residual Load	% Reduction
Flow (ML/yr)	15.5	1.92	87.6
Total Suspended Solids (kg/yr)	108	1.24	98.8
Total Phosphorus (kg/yr)	2.12	0.33	84.5
Total Nitrogen (kg/yr)	12.4	1.47	88.2
Gross Pollutants (kg/yr)	345	0	100

Figure 5 MUSIC Post Development Treatment Train Results

2.2 Service Station Specific Treatment

We note the proposed fuel pumping area is under cover and therefore only the roof water has been included in this assessment. We have assumed the undercover pumping area will require its own oil/grease trap to cater for fuel spills (Hydro Carbons) being washed into the system, however this will be covered as part of the detailed design of the proposed development.

3 Hydrological and Hydraulic Assessment

3.1 Hydrological Objectives

As indicated in the Tweed Shire Councils Development Control Plan D5, Section D5.09 Minor system Criteria, all stormwater drainage systems shall be designed to achieve the following as per Figure 6 taken from QUDM 2007.

Table 7.11.1 Acceptable flow velocities for pipes and box sections

Flow Condition	Absolute Minimum [1] (m/s)	Desirable Minimum [1] (m/s)	Desirable Maximum [2] (m/s)	Absolute Maximum [2] (m/s)
Partially full	0.7	1.2	4.7	7.0
Full	0.6	1.0	4.0	6.0

Figure 6 – Stormwater Velocity Targets (QUDM 2007)

Initial DRAINS modelling using the proposed stormwater layout by Mortons Urban Solutions has indicated the above flow rates can be achieved, however the full extent will be covered in the detailed design. The site is assumed to discharge into Cudgen Creek as shown in Mortons Urban Solutions drawings 12301-SK-060.

3.2 On Site Detention

We have assumed there is no mandatory requirement for onsite detention because the site will be discharging its treated stormwater into the tidal Cudgen Creek and therefore have undertaken the MUSIC and DRAINS modelling without storage nodes. Some on site detention is recommended, however this will be discussed further as part of the detailed design.

3 Erosion & Sediment Control

In accordance with Council's requirements, the site shall implement the sediment controls nominated within the Sediment and Erosion plans. Refer to drawings *Appendix 1 Stormwater Management Drawings.* The contractor is to obtain Erosion and Sediment Control Signage from Council to attach to the most prominent structure at the site, and to be visible at all times when entering the site for the duration of construction.

The control of stormwater quality during construction activities shall be achieved by the implementation of Erosion and Sediment Controls in accordance with the requirements of the Landcom 'Soils and Construction Volume 1 – Managing Urban Stormwater: Soils and Construction' (i.e. Blue Book). The measures are to be implemented before the commencement of any construction works and should be inspected regularly, and after heavy storm events to ensure they are achieving their desired purpose.

The measures to be used on site include:

- Minimise the number of site access points and provide stabilised site access
- Stabilised site access to be provided at access to shake down all vehicles entering and leaving the site, minimising the transport of sediment off-site. All vehicles must use the designated site access to enter or leave the site.
- Installation of downstream sediment barriers prior to commencement of any works.
- Sediment fences are to be installed downstream of works and exposed soils to ensure contaminated run-off is filtered and sediment captured before it can make its way into the downstream receiving environment.
- Turf Strips.
- Stabilise and seed earthwork areas immediately once earthwork profiles are achieved.
- Exposed areas on site are to be stabilised with either turf or grass seeding as construction works progress. Erosion control matting or mulching may be used as a temporary measure until permanent stabilisation is able to be undertaken if deemed required by the site engineer.
- Stockpile materials in protected locations away from overland flow paths and protected by sediment fence boundaries.
- Stockpile locations will be located in an elevated, level area nominally 5m from any water body or channel. Upslope protection measures (i.e. sandbags or equal) are to be used to divert run-off in the event of rain, and sediment fences are to be installed downstream of any erodible stockpile. At the end of each day or in the event of rain or high winds, stockpiles are to be covered and secured. Appropriate locations of stockpiles are to be determined by the site manager at the time of construction.

Once the civil earthworks are complete, the site shall be re-topsoiled, seeded and turf strips installed on the downward area of the disturbed site so as to act as a surface filter of any sediments prior to reaching the sediment fences. Once 80% grass cover is achieved (or the site landscaped), the sediment fences shall be removed.

The following inspection program shall be established by the Site Contractor and monthly Check Sheet reports submitted to the Supervising Engineer.

- Daily inspection of the site Stabilised Access point and amendments as necessary
- Formal weekly inspection of erosion and sediment controls
- Inspections after 10mm rainfall events in 24 hours
- Testing of runoff after significant rainfall events to ensure a maximum discharge of 50mg/L suspended solids

4 Summary

This Stormwater Management Plan (SMP) has been designed in accordance with Tweed Shire Council *Development design specification D5 and D7*.

Specifically the development will incorporate:

- Bio-retention gardens approx. 920m^2
- Gross Pollutant Trap (GPT)

Two scenarios were investigated in MUSIC include the existing and developed cases. The proposed stormwater management strategy for the developed case was found to provide adequate pollutant removal efficiencies with respect to Tweed Shire Council limits.

In conclusion, the above design complies with Tweed Shire Councils Development Design Specification for stormwater water quality, quantity and erosion sediment control.

Final location and arrangement of stormwater infrastructure is to be confirmed during detail design/construction certificate approval.

5 References

The information presented herein has been prepared with reference to the following:

- Natural Resources and Water 2007, *Queensland Urban Drainage Design Manual 2nd Ed.*
- Music by eWater 2014, User Manual
- *Tweed Shire Council A5 DCP, D5 and D7*
- *Kings Forest – Precinct 1 Proposed Service Station, 2014, Mortons Urban Solutions*
- *Humeceptor Technical Manual 2007. Humes*

Appendix 1 – Stormwater Management Drawings

PLANIT CONSULTIING

KINGS FOREST SERVICE STATION

STORMWATER MANAGEMENT PLAN
LOT 7 DP875447

ISSUED FOR INFORMATION

DRAWING NUMBER	TITLE	REVISION
J049 - 0001	LOCALITY AND INDEX	A
J049 - 0002	STORMWATER LAYOUT PLAN	A
J049 - 0003	EROSION AND SEDIMENT CONTROL PLAN	A
J049 - 0004	EROSION AND SEDIMENT NOTES	A

LOCALITY PLAN
SCALE: N.T.S

PRELIMINARY ISSUE
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A	ISSUED FOR INFORMATION	11/05/2015	TV	TV	BG	BG

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PROJECT:
KINGS FOREST SERVICE STATION
STORMWATER MANAGEMENT PLAN

DRAWING TITLE:
LOCALITY AND INDEX

WGM JOB No.: J049 | DRAWING No.: 0001 | REV: A

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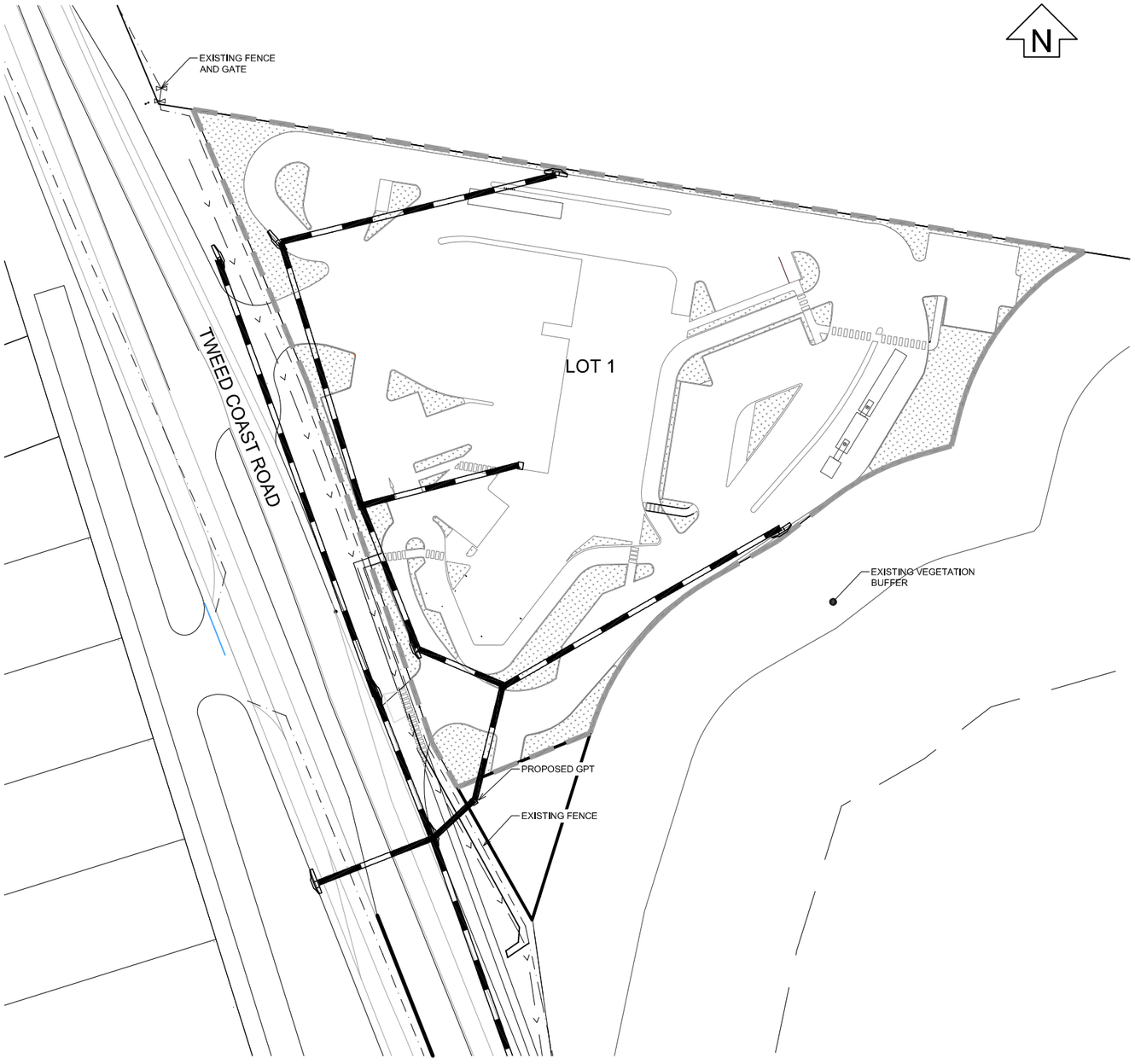

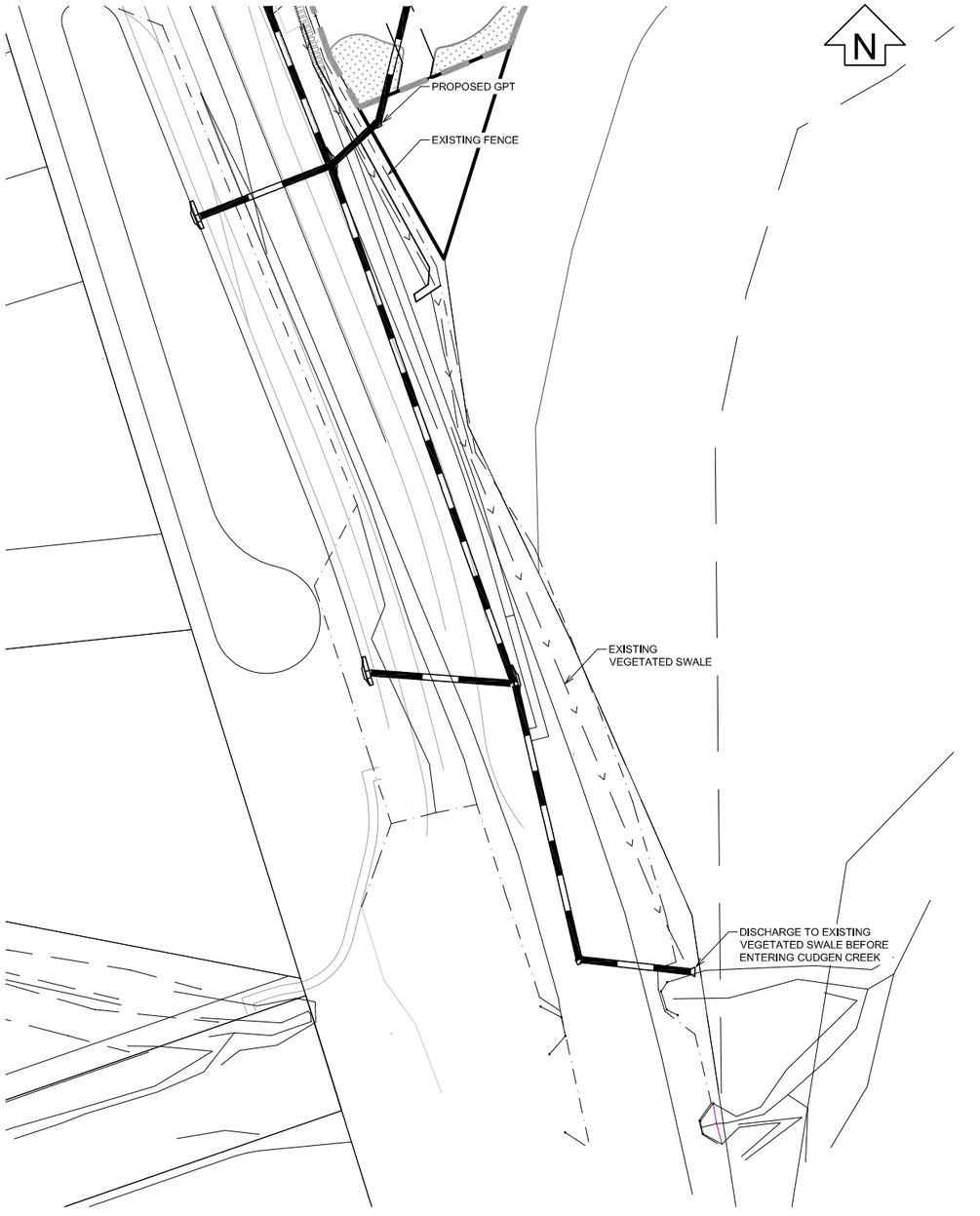

LEGEND

- SITE/CATCHMENT BOUNDARY
- PROPOSED DRAINAGE
- EXISTING VEGETATED SWALE
- LANDSCAPED RAIN BIO-RETENTION GARDENS

NOTES:

1. VEGETATED SWALE AND PIPE LOCATIONS ARE INDICATIVE ONLY.
2. REFER TO MORTONS URBAN SOLUTIONS CIVIL DRAWING 12301-SK-060 FOR PROPOSED STORMWATER PIT AND PIPE LOCATIONS AND DESIGN CONTOURS.
3. ASSUMED THE PROPOSED SERVICE STATION WILL UTILISE APPROPRIATE GREASE TRAPS AND GROSS POLLUTANT TRAP BEFORE DISCHARGING INTO CUDGEN CREEK AS PER MORTONS URBAN SOLUTIONS ENGINEERING REPORT.
4. CATCHMENT BOUNDARIES ARE BASED ON DESIGN CONTOURS FROM MORTONS URBAN SOLUTION DRAWING 12301-SK-060.

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DRAWING TITLE:
STORMWATER LAYOUT

WGM JOB No.:	DRAWING No.:	REV:
J049	0002	A

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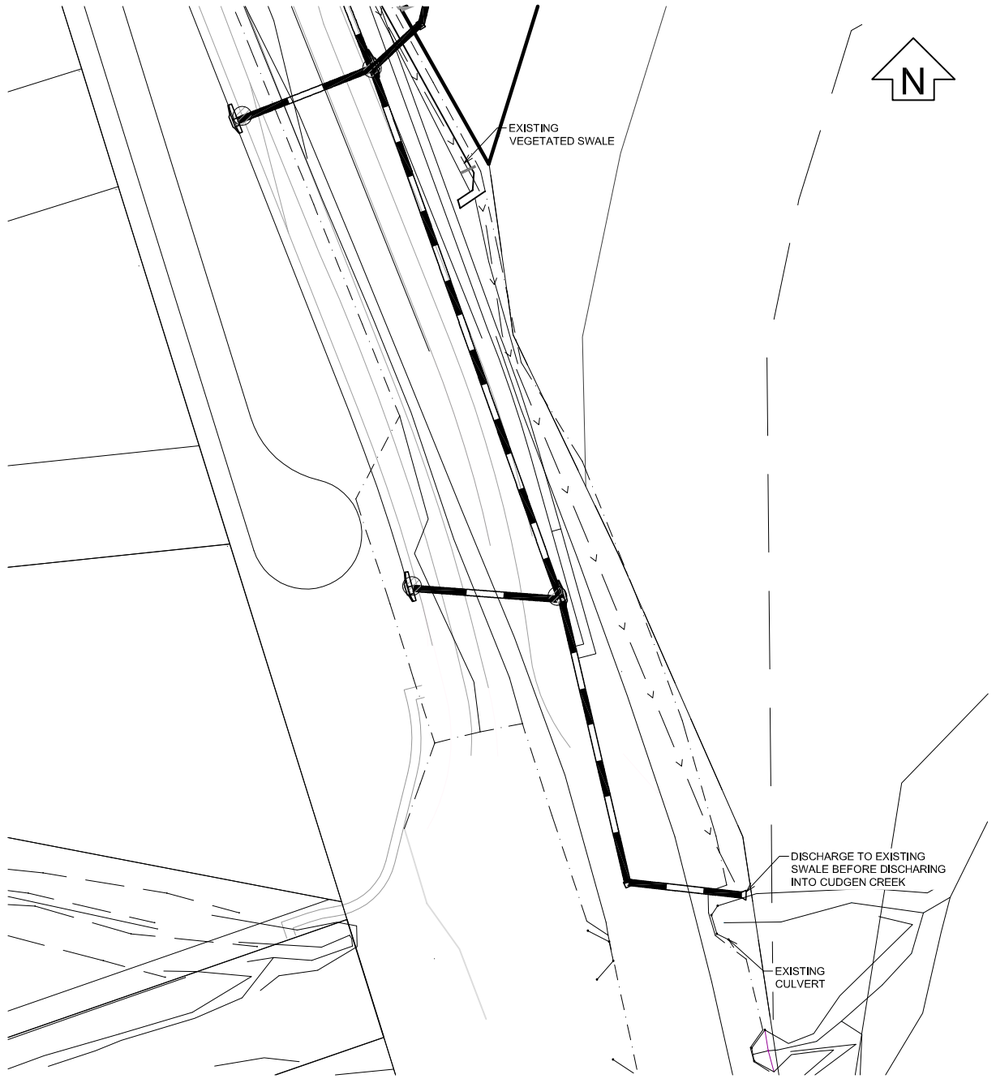

NOTES:
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2. REFER TO MORTONS URBAN SOLUTIONS CIVIL DRAWING 12301-SK-060 FOR PROPOSED STORMWATER PIT AND PIPE LOCATIONS AND DESIGN CONTOURS.
3. ASSUMED THE PROPOSED SERVICE STATION WILL UTILISE APPROPRIATE GREASE TRAPS AND GROSS POLLUTANT TRAP BEFORE DISCHARGING INTO CUDGEN CREEK AS PER MORTONS URBAN SOLUTIONS ENGINEERING REPORT.
4. THIS DRAWINGS IS PROVIDED AS A GUIDE ONLY AND IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE ADEQUATE EROSION AND SEDIMENT CONTROL OF THE SITE DURING ALL PHASES OF WORKS TO THE SATISFACTION OF THE SUPERINTENDENT AND LOCAL COUNCIL

LEGEND

- SITE/CATCHMENT BOUNDARY
- CHECK DAM
- PROPOSED DRAINAGE NETWORK
- SEDIMENT FENCE
- ASSUMED OVERLAND FLOW PATH
- FILTER BAG

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EROSION AND SEDIMENT CONTROL PLAN

WGM JOB No.:	DRAWING No.:	REV:
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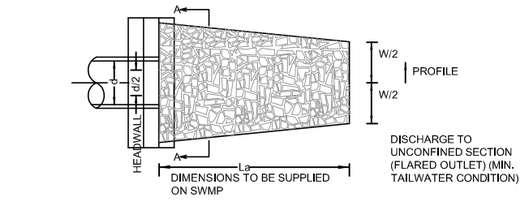
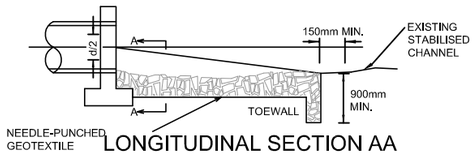
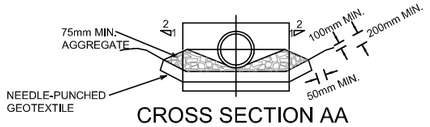


PLAN VIEW



LONGITUDINAL SECTION AA



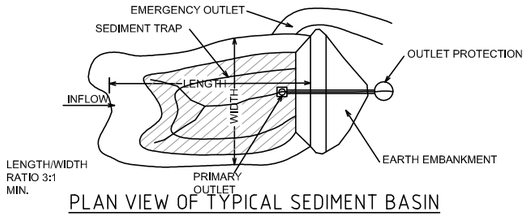
CROSS SECTION AA

ENERGY DISSIPATER

NOT TO SCALE

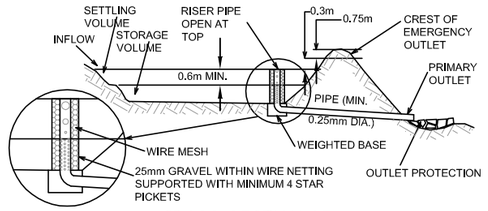
CONSTRUCTION NOTES

1. COMPACT THE SUBGRADE FILL TO THE DENSITY OF THE SURROUNDING UNDISTURBED MATERIAL.
2. PREPARE A SMOOTH, EVEN FOUNDATION FOR THE STRUCTURE THAT WILL ENSURE THAT THE NEEDLE-PUNCHED GEOTEXTILE DOES NOT SUSTAIN SERIOUS DAMAGE WHEN COVERED WITH ROCK.
3. SHOULD ANY MINOR DAMAGE TO THE GEOTEXTILE OCCUR, REPAIR IT BEFORE SPREADING ANY AGGREGATE. FOR REPAIRS, PATCH ONE PIECE OF FABRIC OVER THE DAMAGE, MAKING SURE THAT ALL JOINTS AND PATCHES OVERLAP MORE THAN 300mm.
4. LAY ROCK FOLLOWING THE DRAWING, ACCORDING TO TABLE 5.2 OF LANDCOM (2004) AND WITH MIN. DIAMETER OF 75mm.
5. ENSURE THAT ANY CONCRETE OR RIPRAP USED FOR THE ENERGY DISSIPATER OR THE OUTLET PROTECTION CONFORMS TO THE GRADING LIMITS SPECIFIED ON THE SWMP.



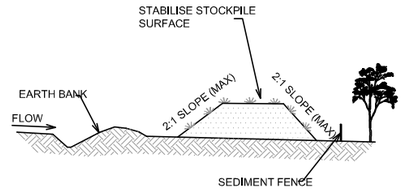
PLAN VIEW OF TYPICAL SEDIMENT BASIN

NOT TO SCALE



CROSS SECTION OF TYPICAL SEDIMENT BASIN

NOT TO SCALE

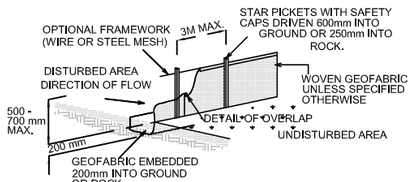


TOPSOIL STOCKPILE

NOT TO SCALE

CONSTRUCTION NOTES

1. WHERE POSSIBLE LOCATE STOCKPILE AT LEAST 5m FROM EXISTING VEGETATION, CONCENTRATED WATER FLOWS, ROADS AND HAZARD AREAS.
2. CONSTRUCT ON THE CONTOUR AS A LOW, FLAT, ELONGATED MOUND.
3. WHERE THERE IS SUFFICIENT AREA TOPSOIL STOCKPILE SHALL BE LESS THAN 2m IN HEIGHT.
4. REHABILITATE IN ACCORDANCE WITH THE SWMP/ESCP.
5. CONSTRUCT EARTH BANK (STANDARD DRAWING 5-5) ON THE UPSLOPE SIDE TO DIVERT RUNOFF AROUND THE STOCKPILE AND A SEDIMENT FENCE (STANDARD DRAWING 6-8) 1 TO 2m DOWNSLOPE OF STOCKPILE.



SEDIMENT FENCE

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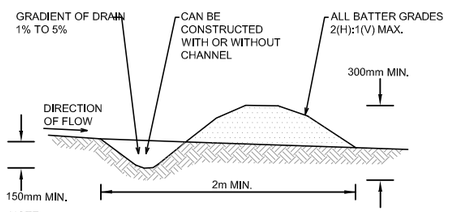


NOTE

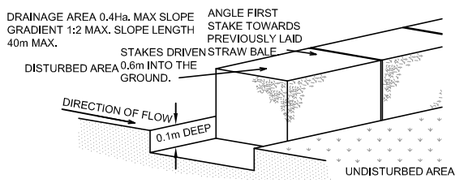
ONLY TO BE USED AS TEMPORARY BANK WHERE MAX. UPSLOPE LENGTH IS 80m.

EARTH BANK (LOW FLOW)

NOT TO SCALE

CONSTRUCTION NOTES

1. CONSTRUCT WITH GRADIENT OF 1% TO 5%.
2. AVOID REMOVING TREES AND SHRUBS IF POSSIBLE.
3. DRAINS TO BE CIRCULAR, PARABOLIC OR TRAPEZOIDAL CROSS SECTION NOT V-SHAPED.
4. EARTH BANKS TO BE ADEQUATELY COMPACTED IN ORDER TO PREVENT FAILURE.
5. PERMANENT OR TEMPORARY STABILISATION OF THE EARTH BANK TO BE COMPLETED WITHIN 10 DAYS OF CONSTRUCTION.
6. ALL OUTLETS FROM DISTURBED LANDS ARE TO FEED INTO A SEDIMENT BASIN OR SIMILAR.
7. DISCHARGE RUNOFF COLLECTED FROM UNDISTURBED LANDS ONTO EITHER A STABILISED OR AN UNDISTURBED DISPOSAL SITE WITHIN THE SAME SUBCATCHMENT AREA FROM WHICH THE WATER ORIGINATED.
8. COMPACT BANK WITH A SUITABLE IMPLEMENT IN SITUATIONS WHERE THEY ARE REQUIRED TO FUNCTION FOR MORE THAN FIVE DAYS.
9. EARTH BANKS TO BE FREE OF PROJECTIONS OR OTHER IRREGULARITIES THAT WILL IMPEDE NORMAL FLOW.



STRAW BALE SEDIMENT FILTER

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KINGS FOREST SERVICE STATION
STORMWATER MANAGEMENT PLAN

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EROSION AND SEDIMENT NOTES

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