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KING + CAMPBELL

Stormwater Management Plan for Staged 204 Lot Community Title Residential Estate Part Lot 3115 DP 1233800, Boambee Street, Boambee Street, Harrington.

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Executive Summary

This Stormwater Management Plan (the Plan) has been prepared to support a Development Application for a Staged 204 Lot Community Title Residential Estate upon Part of Lot 3115 DP1233800, Boambee Street, Harrington.

The preparation of this report has involved a review of geotechnical information, consideration of the proposed development layout, modelling of the existing and proposed water quality discharging from the proposed development and discussion with Council staff.

In accordance with the pre-lodgement meeting minutes provided by Council, due the proximity of the site to the Manning River, we understand that no detention would be required. This report has therefore focussed on providing stormwater quality improvement only within the development site prior to discharge to the Council drainage system.

In accordance with further discussions with Council, stormwater quality modelling using the MUSIC software was undertaken. Treatment devices were implemented at the subdivision/trunk drainage level in preference to the provision of treatment measures on individual lots.

The proposed development site features sand fill placed following dredging of the adjacent Manning River. The presence of this sand fill provides the opportunity to implement stormwater quality improvement via infiltration.

The investigations undertaken in preparing this report has confirmed the following:

- That the proposed development layout is capable of conveying stormwater drainage to the legal points of discharge, being the existing stormwater infrastructure within Boambee Street; and

- The provision of infiltration facilities within the site are required to provide for the orderly management of stormwater quality from the proposed development.

- That the number and location of infiltration facilities will be determined during the detailed design phase following permeability testing of in-situ soils and detailed stormwater modelling.

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Section 1
Introduction

This Stormwater Management Plan (the Plan) has been prepared to support a Development Application for a Staged 204 Lot Community Title development within Part of Lot 3115 DP1233800, Boambee Street, Harrington.

Section 2 of this report includes a brief description of the existing site conditions.

Sections 3 of this report provides a detailed analysis of the pre-development stormwater quality matters associated with the proposed subdivision layout.

The post-development stormwater quality modelling and proposed site Stormwater Management Plan is discussed at **Section 4** of this report.

Section 4 also attends to the following matters:

- Illustrates how the proposed development layout conveys stormwater to the approved end of line stormwater facilities;
- Considers the stormwater management facilities necessary to adequately provide for the proposed development.

Concluding comments with respect to stormwater management are provided in **Section 5**.

Section 2
Site Conditions

2.1 Location

The subject land is located at the western edge of the township of Harrington, within the Midcoast Council local government area, and lies within the catchment of the Manning River. A Site Locality Plan is provided in **Figure 1** below.

The land is comprised of a part of Lot 3115 DP 1233800, bounded by Boambee Street, Rocklily Street, Mary Ann Court and Caledonia Street.

The surrounding uses are primarily residential in nature, with a small commercial area to the west of Rocklily Street.

Lot 3115 currently has a total land area of 21.61ha. That part of the site subject to this application includes a land area of 10.6ha.

Figure 1 - Site Locality Plan. The subject site is bound in red and highlighted yellow. That portion of the site the subject of this application is within the dashed area (Source: maps.six.nsw.gov.au, date accessed 8 August 2017)

2.2 Legal Point of Discharge

In accordance with established conventions in determining the lawful point of discharge, a point of discharge in considered "*lawful*" if it satisfies the following two point test[1]:

a. That the location of the discharge is under the lawful control of the local government or other statutory authority from whom permission to discharge

[1] Queensland Urban Drainage Manual – volume 1 second edition 2007 – pp 3-3 - http://www.derm.qld.gov.au/water/regulation/pdf/guidelines/flood_risk_management/qudm_3.pdf (Accessed 24 February 2012)

has been received. This will includes parks, drainage or road reserves, stormwater drainage easements and natural watercourses.

b. That in discharging in that location, the discharge will not cause an actionable nuisance (i.e. a nuisance for which the current or some future neighbouring proprietor may bring an action or claim for damages arising out of the nuisance). In general terms this implies no worsening as a result of the discharge.

The proposed outlets for the development are existing pits within the stormwater network within Boambee Street, discharging to the existing waterbodies to the north within Lot 1 DP1230485 via existing easements in favour of Council. The subject land consists of two main sub-catchments, discharging to separate existing stormwater pits, linked to separate outlets within the stormwater ponds located within Lot 1 DP1230485.

A point of discharge for runoff from Catchment 1.1 is located at pits within Caledonia Street, draining via Rocklily Street to the existing drainage ponds to the north of the site. A fourth outlet for a small catchment consisting mainly inter-allotment drainage for lots adjoining Beach Street (to the south of the subject land) is able to discharge to the Manning River via the existing Council stormwater network within Beach Street.

2.3 Topography

The proposed development is located on flat level terrain, which slopes gently to the north. The existing topography is the result of filling works following dredging of the Manning River. The filling works were undertaken to facilitate the residential development of the site under approval DA 358/2009.

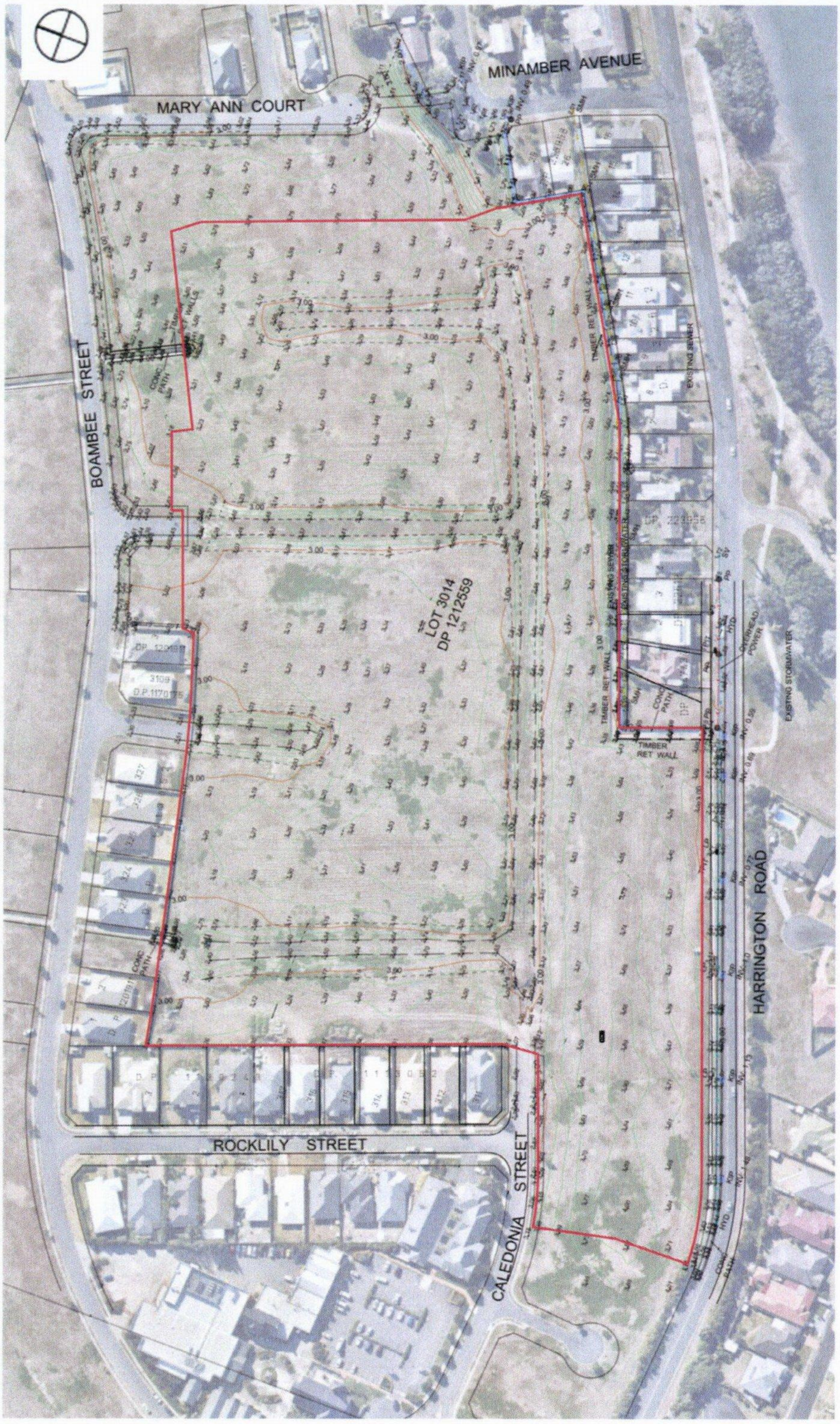

Figure 2 - Extract from Topographic Survey of Part Lot 3014 DP1212559. Note the proposed development site is located within the red edge.

2.4 Soils

Existing soils on the subject land are noted as consisting of site filling "*using soil dredged from the Manning River and creation of a series of connected artificial lakes.*" (Douglas Partners, February 2016)

The report continues:

"*The site was generally filled by dredging sand (which also contained varying proportions of silt) from the Manning River and placing them in a series of receiving ponds… The ponds were formed by building bund walls of topsoil and organic materials. The water was decanted from pond to pond in order to drain the dredged materials. Once a pond was filled, the internal bund walls between ponds were removed and later used for topsoil over the finished area.*"

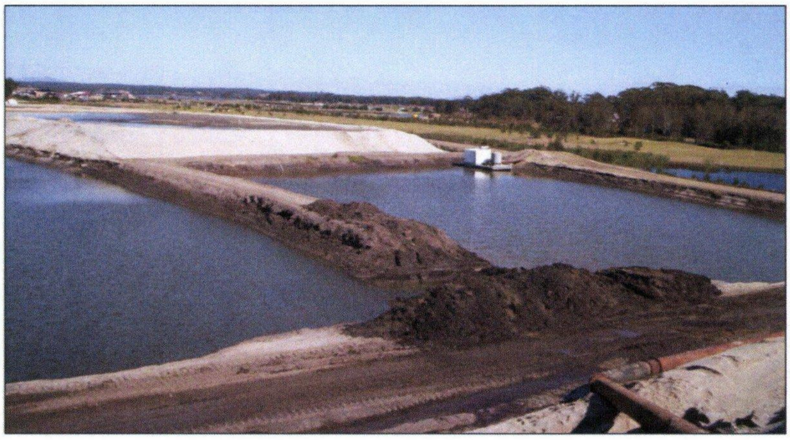

Figure 3 - Receiving Ponds for Dredged Material in September 2005 (Douglas Partners, 2016)

From the description contained within the report, and the photographs shown above, it is apparent that the fill material consisted largely of clean river sand, which is typically of high permeability, and provides the opportunity to utilise infiltration as a stormwater quality treatment measure for the site.

2.5 Groundwater

The presence of a stable groundwater surface under the subject land is likely given the proximity of the Manning River, and existing ponds adjoining the site.

Given existing water levels within the adjoining ponds and Manning River, groundwater can be expected to be encountered at approximately 0.8 – 0.9m RL AHD. This may result in groundwater entering the drainage layer below infiltration devices, but should not enter the pits themselves.

The location of the groundwater below the infiltration pit will not greatly affect the performance of the overall system, given that substantial exfiltration occurs horizontally from each soak well. Finally, sand materials typically feature similar horizontal and vertical permeabilities, allowing the hydraulic head generated by water levels within each soak well to be sufficient to allow infiltration to occur.

Pavement layers are protected from groundwater infiltration through the design of the soak well system allowing infiltration at depths of at least 1m below the surface, well below the proposed pavement subgrade. Higher flows are directed to the conventional style drainage pipe system to the downstream point of discharge, providing further protection to road pavements within the development.

Section 3
Pre-Development Water Quality

3.1 Site and Receiving Water Quality

All stormwater quality modelling was undertaken in accordance with recommended procedures within Chapter 13 – Modelling Urban Stormwater Management Systems within Australian Runoff Quality (ARQ, 2006). Given the "*highly non-linear*" and "*highly stochastic*" characteristics involved in stormwater management systems, there is an obvious requirement for the use of sophisticated computer modelling packages to estimate the likely pollutant export from the development.

The computer software MUSIC Version 6.2 (Build 1.1592) developed by eWater was utilised to determine the likely stormwater runoff quality for pre-development and post development scenarios for the approved and proposed catchment extents.

Design parameters for the software were obtained and adopted from the Draft NSW MUSIC Modelling Guidelines (BMT WBM Pty Ltd, August 2010) along with local rainfall and evaporation parameters for the Harrington area from the Bureau of Meteorology website.

3.2 Pre Development Modelled Pollutant Loads

The existing case was modelled as a single catchment discharging to the existing downstream drainage system.

The existing catchment was considered as undeveloped, with 20% impervious areas adopted in accordance with the former Greater Taree City Council AUS-SPEC D5 Specification (being the lower level for Urban Open Space and Parks)

The existing soils within the catchment are described as being predominantly sand with varying proportions of silt and is consistent for its status following filling via dredging activities. For the purpose of stormwater modelling, the soils within the catchment are considered to be moderately high permeability typical for a sandy loam (120mm/hr), allowing for large amounts of infiltration. It is noted that this rate has been deliberately discounted to provide a conservative estimate to account for the presence of silt and surface topsoil.

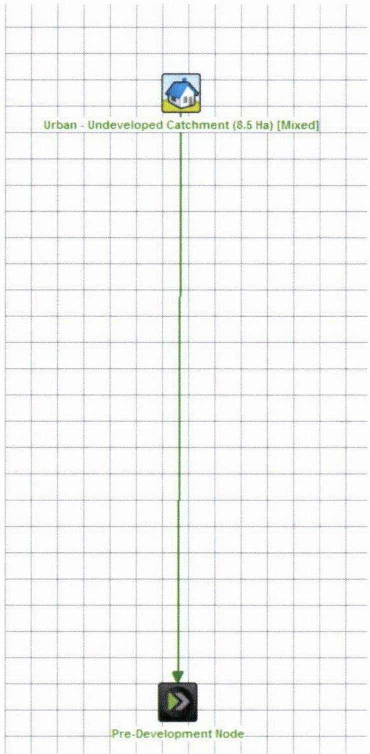

Figure 4 - Treatment Train representation of existing conditions.

Results of the pre development modelling are as follows:

Table 1 - Existing Condition Annual Export Loads

Area (Ha)	Flow (ML/yr)	Total Suspended Solids (kg/year)	Total Phosphorous (kg/yr)	Total Nitrogen (kg/yr	Gross Pollutants (kg/yr)
8.5	5.99	879	1.56	12.2	187

The existing levels for the downstream stormwater infrastructure constructed as part of earlier stages of Harrington Waters Estate, included the provision of a large lagoon to the north of Boambee Street adjacent to the golf course to provide water quality treatment and improvement. As such the existing infrastructure was not designed nor intended to cater for additional stormwater basins upstream. Standing water levels within the existing drainage system prevent the implementation of conventional bio-retention basin treatment based on the current site levels.

The requirement to provide additional water quality treatment over and above the existing facilities provided, without the use of proprietary systems, leaves infiltration as the only viable option to provide the required stormwater treatment for the development.

Section 4
Post Development Stormwater Quality

4.1 Proposed Treatment Train

As a result of the existing downstream conditions referred to previously, the proposed treatment train utilises infiltration pits (commonly known as "soakaway" pits) to encourage infiltration of stormwater into the subsoil in smaller events, within individual stormwater pits in preference to a single end-of-line bio-retention basin. A schematic of the proposed pit configuration is contained within Figure 5 below.

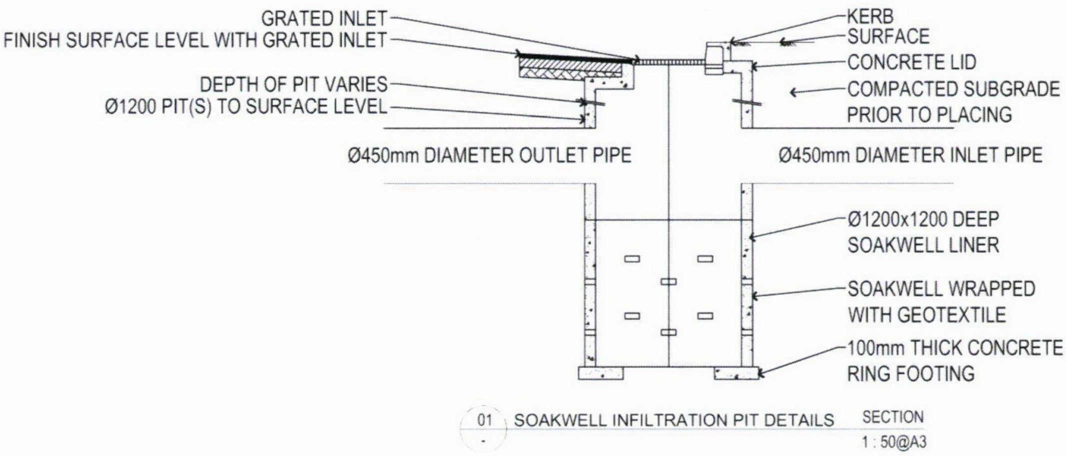

Figure 5 - Soakwell Infiltration pit - Typical Detail

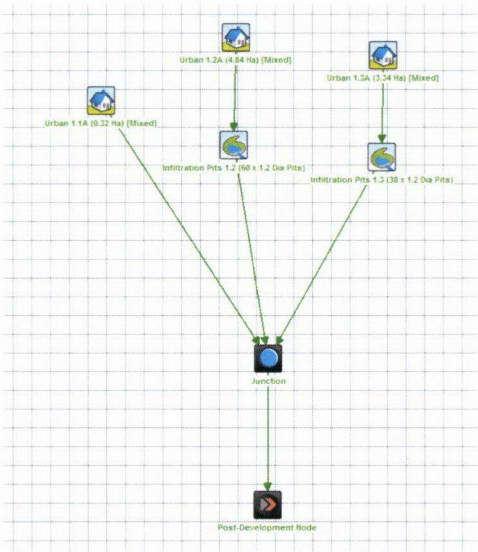

Figure 6 - Proposed Post-Development Treatment Train

4.2 Stormwater Management Plan

The stormwater management plan has been determined based on the proposed infiltration based treatment train, the legal points of discharge, the post development catchments 1.1 to 1.3 (and the additional interlot network connecting to Beach Street), and the proposed development layout.

The stormwater management plan indicates the proposed locations of the stormwater infrastructure required to service the development, the four proposed points of discharge from the development, being two separate stormwater systems to the north of the site within Boambee Street, stormwater infrastructure within Caledonia Street, and a smaller network located to the south within Beach Street for potential roof water drainage from lots adjoining Beach Street.

Permeability testing of the in-situ soils undertaken during the detailed design phase of the development will inform the required number and location of infiltration soakaways, with the remainder constructed as conventional stormwater drainage pit and pipe drainage.

The stormwater network has been designed to provide for direct pipe connections to the trunk drainage network for all roof water downpipes, removing the requirement for the provision of kerb converters within the development, and supporting the provision of one-way crossfall roads.

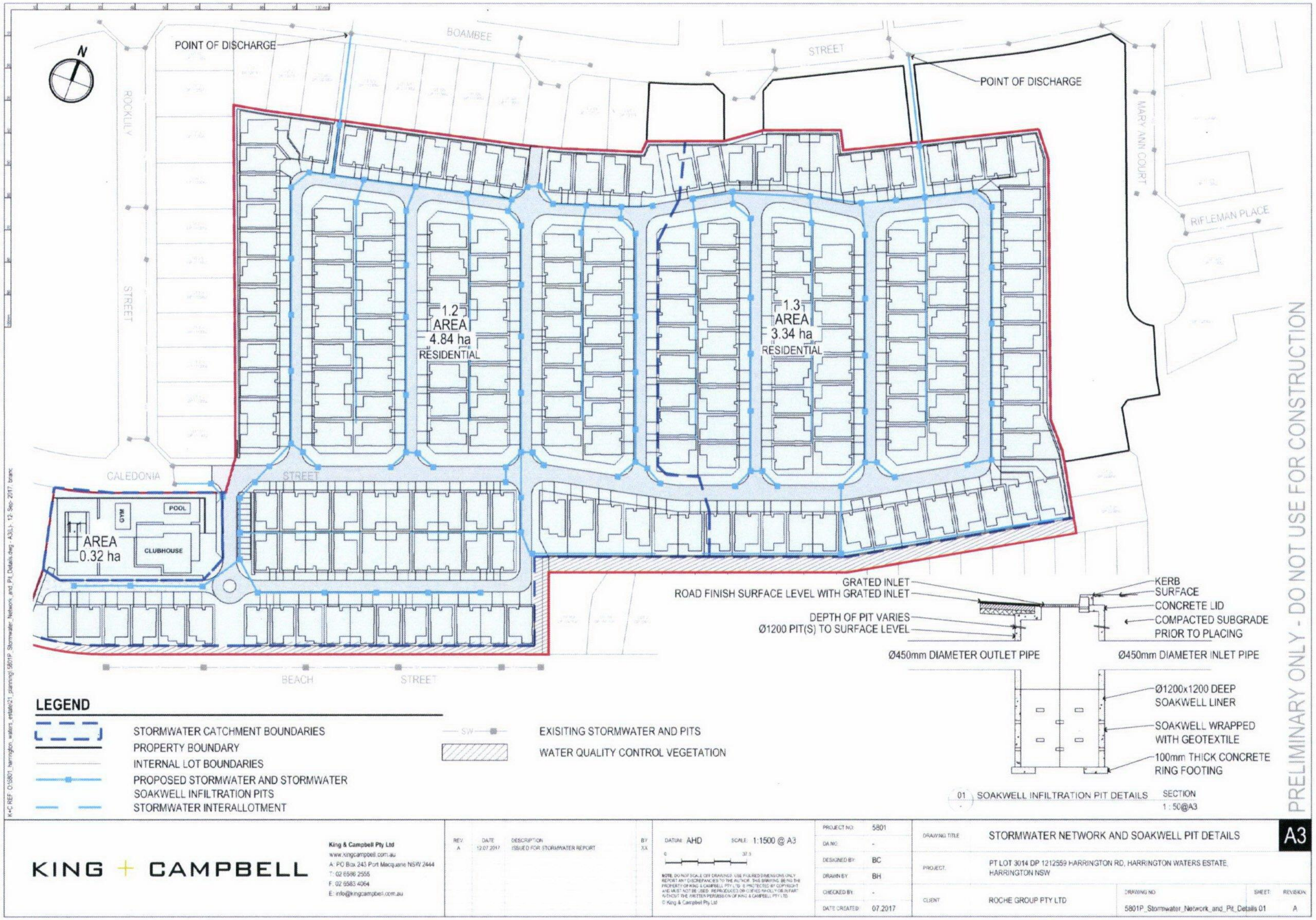

Figure 7 - Stormwater Management Plan

4.3 Post Development Modelled Pollutant Loads

AUS-SPEC specifies the stormwater quality objectives as being in accordance with the requirements of the Australian Runoff Quality (ARQ) requirements for stormwater treatment.

A precautionary approach has been adopted whereby the developed stormwater concentrations should be **no worse** or not exceed the existing concentrations to ensure minimal impact on the receiving waters.

Current industry best practice dictates that the following water quality objectives be adopted for the water quality modelling undertaken for the proposed development.

Table 2 – Adopted Water Quality Objectives.

Pollutant	Objective
Suspended Solids (SS)	80% retention of average annual load
Total Phosphorous (TP)	45% retention of average annual load
Total Nitrogen (TN)	45% retention of average annual load
Litter	100% retention of litter greater than 5mm for flows up to the 3 months ARI peak flow
Sediment	100% retention of sediment greater than 0.125mm for flows up to the 3 month ARI peak flow
Oil and Grease	No visible oils for flows up to the 3 month ARI peak flow

Table 3 – Treatment Train Effectiveness and Water Quality Objective Compliance.

Parameter	Area (Ha)	Source	Residual Load	% Retention	Water Quality Objective	Compliance?
Total Susp. Solids (kg/yr)	8.5	3120	687	78	80%	X
Total Phos. (kg/yr)		5.27	1.18	77.6	45%	✓
Total Nitrogen (kg/yr)		39.3	9.11	76.8	45%	✓
Gross Pollutants (kg/yr)		596	25.9	95.7	90-100%	✓

Table 4 - Comparison of Pre and Post Development Annual Loads

Parameter	Pre Development	Post Development	Compliance?
Total Susp. Solids (kg/yr)	879	687	✓
Total Phosphorus (kg/yr)	1.56	1.18	✓
Total Nitrogen (kg/yr)	12.2	9.11	✓
Gross Pollutants (kg/yr)	187	25.9	✓

As illustrated in the above tables, the pollutant outflow concentrations as reported by the MUSIC modelling software generally comply with the adopted water quality objectives, with the exception of Total Suspended Solids, being less than 2% under the specified 80% reduction target.

It should be noted however, that the comparison of pre to post values for the Total Suspended Solids shows compliance with the post development case shown to be no worse than the existing case.

It should be further noted that the final number and location of the proposed infiltration pits will be determined subject to the in-situ soil permeability within the site, and the capacity of that soil to accept infiltration. For the purposes of this initial modelling, a conservative estimate permeability of approximately 120mm/hr was adopted. Published documentation however indicates that typical sand permeabilities are approximately three (3) times that rate (up to 360mm/hr). Higher in-situ soil permeabilities will result in increased pollutant removal performance for the treatment train system.

It is therefore considered that the proposed stormwater treatment will meet the objectives of the stormwater quality improvement for the site, and demonstrate that the subject land has sufficient capacity to provide adequate stormwater quality improvement, prior to discharge to the existing stormwater treatment facilities provided downstream of the development.

Appendix 1 of this report contains the graphical and numerical parameters and output from the software.

Section 5
Conclusion

This Stormwater Management Plan (the Plan) has been prepared to support a Development Application for a community title subdivision of the subject land.

The Plan has considered the proposed development layout which will provide for a community title subdivision development of the site to create the following:

- 203 single storey 2 and 3 bedroom dwelling houses;
- Community title subdivision creating 204 separate allotments (each dwelling will be located on an individual lot (being Lots 2 through 204) with the roads and community facilities located on proposed Lot 1);
- Community facilities including:
    - Club house;
    - Swimming pool;
    - Gymnasium; and
    - Tennis court.

This report has confirmed the following:

- That the subject land has the capacity to provide sufficient stormwater treatment facilities for the improvement of stormwater runoff quality prior to discharge from the site based on conservative assumptions of in-situ site conditions and stormwater device performance.
- The proposed subdivision layout is compatible with the topography, and the ability to provide the above stormwater improvement concept for the development.
- That the number and location of infiltration facilities will be determined during the detailed design phase following permeability testing of in-situ soils and detailed stormwater modelling.

Bibliography

BMT WBM Pty Ltd. (August 2010). *Draft MUSIC Modelling Guidelines for New South Wales.* Broadmeadow NSW: Sydney Metropolitan Catchment Management Authority.

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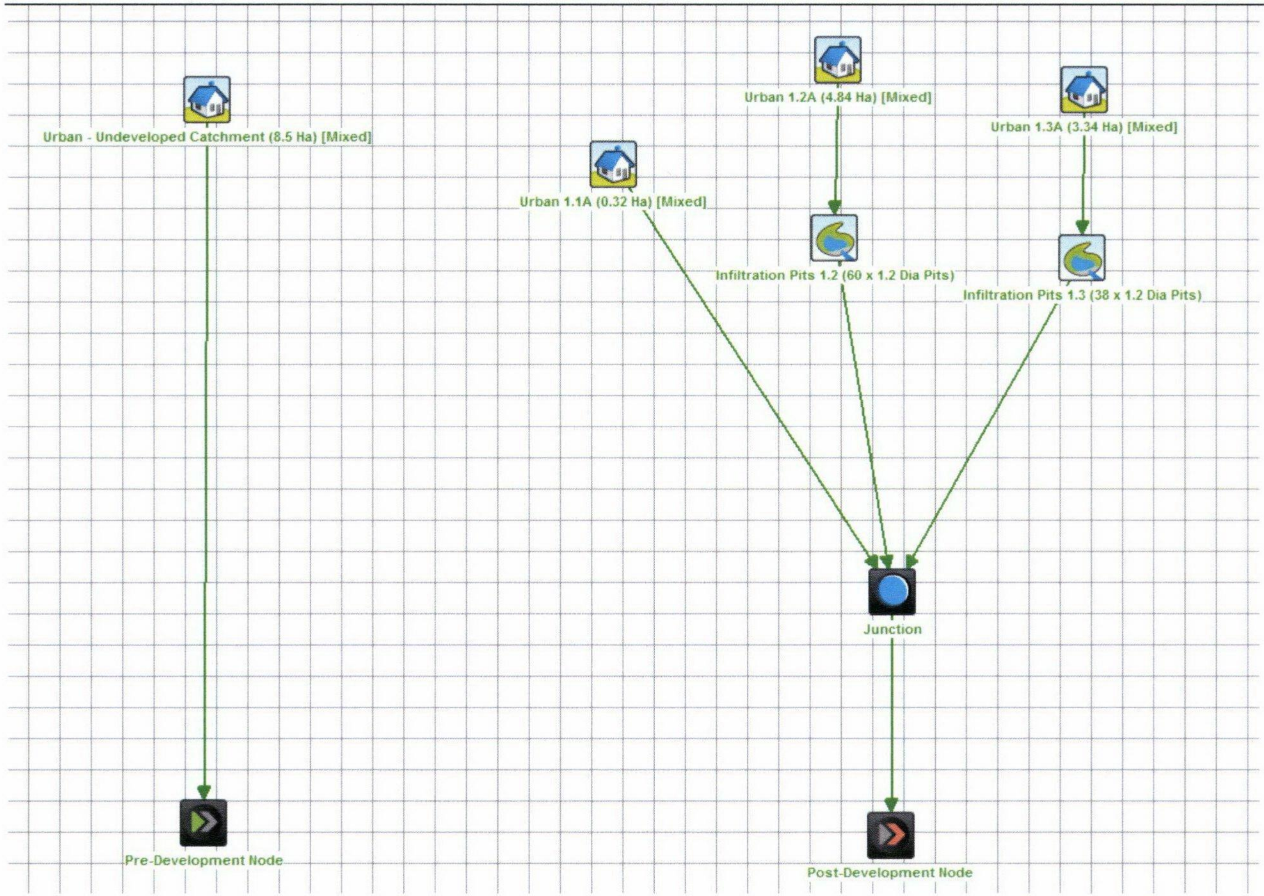
Port Macquarie Hastings Council. (February 2004). *AUS-SPEC Development Design Specification D7 - Stormwater Management.* Retrieved from http://www.hastings.nsw.gov.au/resources/documents/D07-Stormwater_Management-_HC.03.R1.pdf

APPENDIX 1.



Source nodes							
Location	Urban - Undeveloped Catchment (8.5 Ha)	Urban 1.1A (0.32 Ha)	Urban 1.2A (4.84 Ha)	Urban 1.3A (3.34 Ha)			
ID	1	3	4	5			
Node Type	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode			
Zoning Surface Type	Mixed	Mixed	Mixed	Mixed			
Total Area (ha)	8.5	0.32	4.84	3.34			

Area Impervious (ha)	1.719347015	0.303510448	3.623859701	2.500762687			
Area Pervious (ha)	6.780652985	0.016489552	1.216140299	0.839237313			
Field Capacity (mm)	94	94	94	94			
Pervious Area Infiltration Capacity coefficient - a	250	250	250	250			
Pervious Area Infiltration Capacity exponent - b	1.3	1.3	1.3	1.3			
Impervious Area Rainfall Threshold (mm/day)	1	1	1	1			
Pervious Area Soil Storage Capacity (mm)	142	142	142	142			
Pervious Area Soil Initial Storage (% of Capacity)	25	25	25	25			
Groundwater Initial Depth (mm)	10	10	10	10			
Groundwater Daily Recharge Rate (%)	60	60	60	60			
Groundwater Daily Baseflow Rate (%)	45	45	45	45			
Groundwater Daily Deep Seepage Rate (%)	0	0	0	0			
Stormflow Total Suspended Solids Mean (log mg/L)	2.15	2.15	2.15	2.15			
Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	0.32	0.32			
Stormflow Total Suspended Solids Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic			
Stormflow Total Suspended Solids Serial Correlation	0	0	0	0			
Stormflow Total Phosphorus Mean (log mg/L)	-0.6	-0.6	-0.6	-0.6			
Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.25	0.25			
Stormflow Total Phosphorus Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic			
Stormflow Total Phosphorus Serial Correlation	0	0	0	0			
Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.3	0.3	0.3			
Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.19	0.19			
Stormflow Total Nitrogen Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic			
Stormflow Total Nitrogen Serial Correlation	0	0	0	0			
Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	1.2	1.2			
Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0.17	0.17			
Baseflow Total Suspended Solids Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic			
Baseflow Total Suspended Solids Serial Correlation	0	0	0	0			
Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	-0.85	-0.85			
Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0.19	0.19			
Baseflow Total Phosphorus Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic			

Baseflow Total Phosphorus Serial Correlation	0	0	0	0			
Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0.11	0.11			
Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0.12	0.12			
Baseflow Total Nitrogen Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic			
Baseflow Total Nitrogen Serial Correlation	0	0	0	0			
Flow based constituent generation - enabled	Off	Off	Off	Off			
Flow based constituent generation - flow file							
Flow based constituent generation - base flow column							
Flow based constituent generation - pervious flow column							
Flow based constituent generation - impervious flow column							
Flow based constituent generation - unit							
OUT - Mean Annual Flow (ML/yr)	5.99	0.832	10.1	7			
OUT - TSS Mean Annual Load (kg/yr)	879	146	1.76E+03	1.21E+03			
OUT - TP Mean Annual Load (kg/yr)	1.56	0.242	2.98	2.05			
OUT - TN Mean Annual Load (kg/yr)	12.2	1.78	22.2	15.3			
OUT - Gross Pollutant Mean Annual Load (kg/yr)	187	25.9	338	233			
Rain In (ML/yr)	26.5352	0.998973	15.1095	10.4268			
ET Loss (ML/yr)	22.0878	0.170556	5.24564	3.61993			
Deep Seepage Loss (ML/yr)	0	0	0	0			
Baseflow Out (ML/yr)	1.35854	0.00319642	0.24174	0.16682			
Imp. Stormflow Out (ML/yr)	4.63506	0.828857	9.89721	6.82989			
Perv. Stormflow Out (ML/yr)	0	0	0	0			
Total Stormflow Out (ML/yr)	4.63506	0.828857	9.89721	6.82989			
Total Outflow (ML/yr)	5.9936	0.832053	10.139	6.99671			
Change in Soil Storage (ML/yr)	-1.54623	-0.00363778	-0.275137	-0.189867			
TSS Baseflow Out (kg/yr)	23.3134	0.0552799	4.07374	2.81122			
TSS Total Stormflow Out (kg/yr)	855.814	146.004	1754.54	1210.78			
TSS Total Outflow (kg/yr)	879.127	146.059	1758.61	1213.59			
TP Baseflow Out (kg/yr)	0.21039	0.000494812	0.0374805	0.0258646			
TP Total Stormflow Out (kg/yr)	1.35249	0.241048	2.93943	2.02845			
TP Total Outflow (kg/yr)	1.56288	0.241543	2.97691	2.05431			
TN Baseflow Out (kg/yr)	1.83086	0.00431891	0.325261	0.224457			

TN Total Stormflow Out (kg/yr)	10.366	1.7726	21.9046	15.116			
TN Total Outflow (kg/yr)	12.1969	1.77692	22.2298	15.3404			
GP Total Outflow (kg/yr)	189.075	25.8888	337.915	233.19			
No Imported Data Source nodes							
USTM treatment nodes							
Location	Infiltration Pits 1.2 (60 x 1.2 Dia Pits)	Infiltration Pits 1.3 (38 x 1.2 Dia Pits)					
ID	8	9					
Node Type	InfiltrationSystemNodeV4	InfiltrationSystemNodeV4					
Lo-flow bypass rate (cum/sec)	0	0					
Hi-flow bypass rate (cum/sec)	100	100					
Inlet pond volume							
Area (sqm)	70	43					
Initial Volume (m^3)							
Extended detention depth (m)	1.2	1.2					
Number of Rainwater tanks							
Permanent Pool Volume (cubic metres)							
Proportion vegetated							
Equivalent Pipe Diameter (mm)							
Overflow weir width (m)	0.5	0.5					
Notional Detention Time (hrs)							
Orifice Discharge Coefficient							
Weir Coefficient	1.7	1.7					
Number of CSTR Cells	1	1					
Total Suspended Solids - k (m/yr)	400	400					
Total Suspended Solids - C* (mg/L)	12	12					
Total Suspended Solids - C** (mg/L)	12	12					
Total Phosphorus - k (m/yr)	300	300					
Total Phosphorus - C* (mg/L)	0.09	0.09					
Total Phosphorus - C** (mg/L)	0.09	0.09					
Total Nitrogen - k (m/yr)	40	40					

Total Nitrogen - C* (mg/L)	1	1						
Total Nitrogen - C** (mg/L)	1	1						
Threshold Hydraulic Loading for C** (m/yr)	3500	3500						
Horizontal Flow Coefficient	3	3						
Reuse Enabled	Off	Off						
Max drawdown height (m)								
Annual Demand Enabled	Off	Off						
Annual Demand Value (ML/year)								
Annual Demand Distribution								
Annual Demand Monthly Distribution: Jan								
Annual Demand Monthly Distribution: Feb								
Annual Demand Monthly Distribution: Mar								
Annual Demand Monthly Distribution: Apr								
Annual Demand Monthly Distribution: May								
Annual Demand Monthly Distribution: Jun								
Annual Demand Monthly Distribution: Jul								
Annual Demand Monthly Distribution: Aug								
Annual Demand Monthly Distribution: Sep								
Annual Demand Monthly Distribution: Oct								
Annual Demand Monthly Distribution: Nov								
Annual Demand Monthly Distribution: Dec								
Daily Demand Enabled	Off	Off						
Daily Demand Value (ML/day)								
Custom Demand Enabled	Off	Off						
Custom Demand Time Series File								
Custom Demand Time Series Units								
Filter area (sqm)	70	43						
Filter perimeter (m)	225	143						
Filter depth (m)	0.5	0.5						
Filter Median Particle Diameter (mm)								
Saturated Hydraulic Conductivity (mm/hr)								
Infiltration Media Porosity	0.35	0.35						

Length (m)							
Bed slope							
Base Width (m)							
Top width (m)							
Vegetation height (m)							
Vegetation Type							
Total Nitrogen Content in Filter (mg/kg)							
Orthophosphate Content in Filter (mg/kg)							
Is Base Lined?							
Is Underdrain Present?							
Is Submerged Zone Present?							
Submerged Zone Depth (m)							
B for Media Soil Texture	-9999	-9999					
Proportion of upstream impervious area treated							
Exfiltration Rate (mm/hr)	120	120					
Evaporative Loss as % of PET	100	100					
Depth in metres below the drain pipe							
TSS A Coefficient							
TSS B Coefficient							
TP A Coefficient							
TP B Coefficient							
TN A Coefficient							
TN B Coefficient							
Sfc							
S*							
Sw							
Sh							
Emax (m/day)							
Ew (m/day)							
IN - Mean Annual Flow (ML/yr)	10.1	7					
IN - TSS Mean Annual Load (kg/yr)	1.76E+03	1.21E+03					
IN - TP Mean Annual Load (kg/yr)	2.98	2.05					

IN - TN Mean Annual Load (kg/yr)	22.2	15.3					
IN - Gross Pollutant Mean Annual Load (kg/yr)	338	233					
OUT - Mean Annual Flow (ML/yr)	1.72	1.36					
OUT - TSS Mean Annual Load (kg/yr)	303	238					
OUT - TP Mean Annual Load (kg/yr)	0.529	0.413					
OUT - TN Mean Annual Load (kg/yr)	4.11	3.22					
OUT - Gross Pollutant Mean Annual Load (kg/yr)	0	0					
Flow In (ML/yr)	10.1387	6.99659					
ET Loss (ML/yr)	0.000484121	0.000320711					
Infiltration Loss (ML/yr)	8.41412	5.6402					
Low Flow Bypass Out (ML/yr)	0	0					
High Flow Bypass Out (ML/yr)	0	0					
Orifice / Filter Out (ML/yr)	0	0					
Weir Out (ML/yr)	1.72486	1.35678					
Transfer Function Out (ML/yr)	0	0					
Reuse Supplied (ML/yr)	0	0					
Reuse Requested (ML/yr)	0	0					
% Reuse Demand Met	0	0					
% Load Reduction	82.9875	80.6081					
TSS Flow In (kg/yr)	1758.6	1213.58					
TSS ET Loss (kg/yr)	0	0					
TSS Infiltration Loss (kg/yr)	1314.63	886.4					
TSS Low Flow Bypass Out (kg/yr)	0	0					
TSS High Flow Bypass Out (kg/yr)	0	0					
TSS Orifice / Filter Out (kg/yr)	0	0					
TSS Weir Out (kg/yr)	302.53	238.171					
TSS Transfer Function Out (kg/yr)	0	0					
TSS Reuse Supplied (kg/yr)	0	0					
TSS Reuse Requested (kg/yr)	0	0					
TSS % Reuse Demand Met	0	0					
TSS % Load Reduction	82.7971	80.3746					
TP Flow In (kg/yr)	2.97688	2.0543					

TP ET Loss (kg/yr)	0	0					
TP Infiltration Loss (kg/yr)	2.30863	1.55116					
TP Low Flow Bypass Out (kg/yr)	0	0					
TP High Flow Bypass Out (kg/yr)	0	0					
TP Orifice / Filter Out (kg/yr)	0	0					
TP Weir Out (kg/yr)	0.529154	0.413096					
TP Transfer Function Out (kg/yr)	0	0					
TP Reuse Supplied (kg/yr)	0	0					
TP Reuse Requested (kg/yr)	0	0					
TP % Reuse Demand Met	0	0					
TP % Load Reduction	82.2246	79.8911					
TN Flow In (kg/yr)	22.2297	15.3403					
TN ET Loss (kg/yr)	0	0					
TN Infiltration Loss (kg/yr)	18.0123	12.0351					
TN Low Flow Bypass Out (kg/yr)	0	0					
TN High Flow Bypass Out (kg/yr)	0	0					
TN Orifice / Filter Out (kg/yr)	0	0					
TN Weir Out (kg/yr)	4.10715	3.22219					
TN Transfer Function Out (kg/yr)	0	0					
TN Reuse Supplied (kg/yr)	0	0					
TN Reuse Requested (kg/yr)	0	0					
TN % Reuse Demand Met	0	0					
TN % Load Reduction	81.524	78.9952					
GP Flow In (kg/yr)	337.534	232.927					
GP ET Loss (kg/yr)	0	0					
GP Infiltration Loss (kg/yr)	0	0					
GP Low Flow Bypass Out (kg/yr)	0	0					
GP High Flow Bypass Out (kg/yr)	0	0					
GP Orifice / Filter Out (kg/yr)	0	0					
GP Weir Out (kg/yr)	0	0					
GP Transfer Function Out (kg/yr)	0	0					
GP Reuse Supplied (kg/yr)	0	0					

GP Reuse Requested (kg/yr)	0	0					
GP % Reuse Demand Met	0	0					
GP % Load Reduction	100	100					
PET Scaling Factor							
No Generic treatment nodes							
Other nodes							
Location	Pre-Development Node	Junction	Post-Development Node				
ID	2	6	7				
Node Type	PreDevelopmentNode	JunctionNode	PostDevelopmentNode				
IN - Mean Annual Flow (ML/yr)	5.99	3.91	3.91				
IN - TSS Mean Annual Load (kg/yr)	879	687	687				
IN - TP Mean Annual Load (kg/yr)	1.56	1.18	1.18				
IN - TN Mean Annual Load (kg/yr)	12.2	9.11	9.11				
IN - Gross Pollutant Mean Annual Load (kg/yr)	187	25.9	25.9				
OUT - Mean Annual Flow (ML/yr)	5.99	3.91	3.91				
OUT - TSS Mean Annual Load (kg/yr)	879	687	687				
OUT - TP Mean Annual Load (kg/yr)	1.56	1.18	1.18				
OUT - TN Mean Annual Load (kg/yr)	12.2	9.11	9.11				
OUT - Gross Pollutant Mean Annual Load (kg/yr)	187	25.9	25.9				
% Load Reduction	0	78.2	78.2				
TSS % Load Reduction	0	78	78				
TN % Load Reduction	0	76.9	76.9				
TP % Load Reduction	0	77.5	77.5				
GP % Load Reduction	0	95.7	95.7				
Links							
Location	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link
Source node ID	1	6	4	5	8	9	3
Target node ID	2	7	8	9	6	6	6

Muskingum-Cunge Routing	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed
Muskingum K							
Muskingum theta							
IN - Mean Annual Flow (ML/yr)	5.99	3.91	10.1	7	1.72	1.36	0.832
IN - TSS Mean Annual Load (kg/yr)	879	687	1.76E+03	1.21E+03	303	238	146
IN - TP Mean Annual Load (kg/yr)	1.56	1.18	2.98	2.05	0.529	0.413	0.242
IN - TN Mean Annual Load (kg/yr)	12.2	9.11	22.2	15.3	4.11	3.22	1.78
IN - Gross Pollutant Mean Annual Load (kg/yr)	187	25.9	338	233	0	0	25.9
OUT - Mean Annual Flow (ML/yr)	5.99	3.91	10.1	7	1.72	1.36	0.832
OUT - TSS Mean Annual Load (kg/yr)	879	687	1.76E+03	1.21E+03	303	238	146
OUT - TP Mean Annual Load (kg/yr)	1.56	1.18	2.98	2.05	0.529	0.413	0.242
OUT - TN Mean Annual Load (kg/yr)	12.2	9.11	22.2	15.3	4.11	3.22	1.78
OUT - Gross Pollutant Mean Annual Load (kg/yr)	187	25.9	338	233	0	0	25.9
Catchment Details							
Catchment Name	5801-DA-Harrington						
Timestep	6 Minutes						
Start Date	15/12/2009						
End Date	10/08/2010 23:54						
Rainfall Station	60141 TAREE						
ET Station	User-defined monthly PET						
Mean Annual Rainfall (mm)	312						
Mean Annual ET (mm)	1475						