UMBRELLA CIVIL
CONSULTING ENGINEERS

Stormwater Quality Management Plan
Proposed Multi-Unit Development
1 Garner Street, Saint Marys NSW

Prepared For
Penrith City Council

Client
Baini Design

Issue A April 2016

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1 INTRODUCTION

Umbrella Consulting have been commissioned by Baini Design to undertake a Stormwater Quality Management Plan to accompany the Development Application of the proposed Multi-Unit Development at 1 Garner Street, Saint Marys NSW.

Currently the site is occupied by a single storey residential dwelling and a large vacant open grassy area with a total site area of approximately 663.9m².

As part of the Stormwater Quality Management Plan, Penrith City Council require Water Sensitive Urban Design measures in place for developments of this scale.

This report addresses the Water Sensitive Urban Design requirements for the proposed development to ensure compliance with the Penrith City Council requirements.

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2 SITE DETAILS

2.1 Location

The proposed development site is located within the municipality of Penrith City Council and is identified as:

- Lot 3 on DP508698

The site is bounded by Garner Street to the East and residential allotments to the North, South & West.

Figure 1 below shows the site's location.

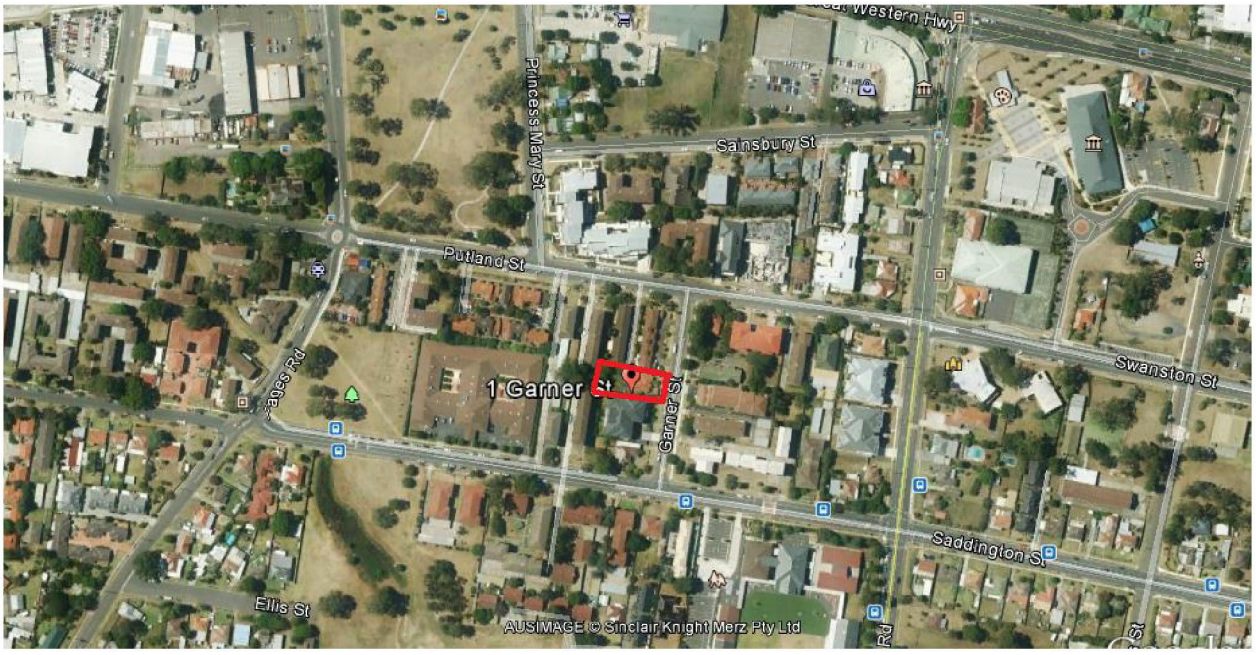

Figure 1 – Approximate Location of site (source: maps.google)

N

3 Water Sensitive Urban Design (WSUD)

Water quality parameters and the proposed limits applicable to this site have been selected in accordance with Penrith City Council's "*Water Sensitive Urban Design Policy" Dated December 2013* and *"Draft NSW MUSIC Modelling Guidelines*" dated August 2010 by Sydney Metropolitan Catchment Management Authority

3.1 Water Quality Objectives

3.1.1 Construction Phase

Control measures will be put in place to protect downstream properties of nuisance including the incorporation of sediment control fences to intercept runoff prior to leaving the site and a shaker grid at the construction access point. Re-vegetation of landscaped and exposed areas will be completed by means of seeding, turfing or mulching.

3.1.2 Operational Phase

The following load reduction targets must be achieved when assessing the post-developed sites treatment train (comparison of unmitigated developed case versus developed mitigated case):

- Total Suspended Solids (TSS) 85% reduction is average annual load
- Total Phosphorus (TP) 60% reduction is average annual load
- Total Nitrogen(TN) 45% reduction is average annual load
- Litter/gross pollutants 90% reduction is average annual load

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3.2 MUSIC Modelling

3.2.1 Modelling Guidelines

MUSIC Version 6 was used to assess pollutant generation and the performance of stormwater treatment measures for the proposed development. Selection and testing of stormwater management options was undertaken in accordance with "*Draft NSW MUSIC Modelling Guidelines*" dated August 2010 by Sydney Metropolitan Catchment Management Authority (CMA) and Penrith City Council WSUS Guidelines.

3.2.2 Rainfall Data

MUSIC Modelling Guidelines provide advice on meteorological data for different climatic regions of New South Wales.

As per the Penrith City Council WSUD Guidelines, rainfall data from Penrith Lakes AWS (station 67113) were obtained from the MUSIC-Link setup section within MUSIC. This is the nearest station from the site. Six-minute time step rainfall data was obtained for the period of 1999 to 2008. This is the most recent 10 years period of completed data available.

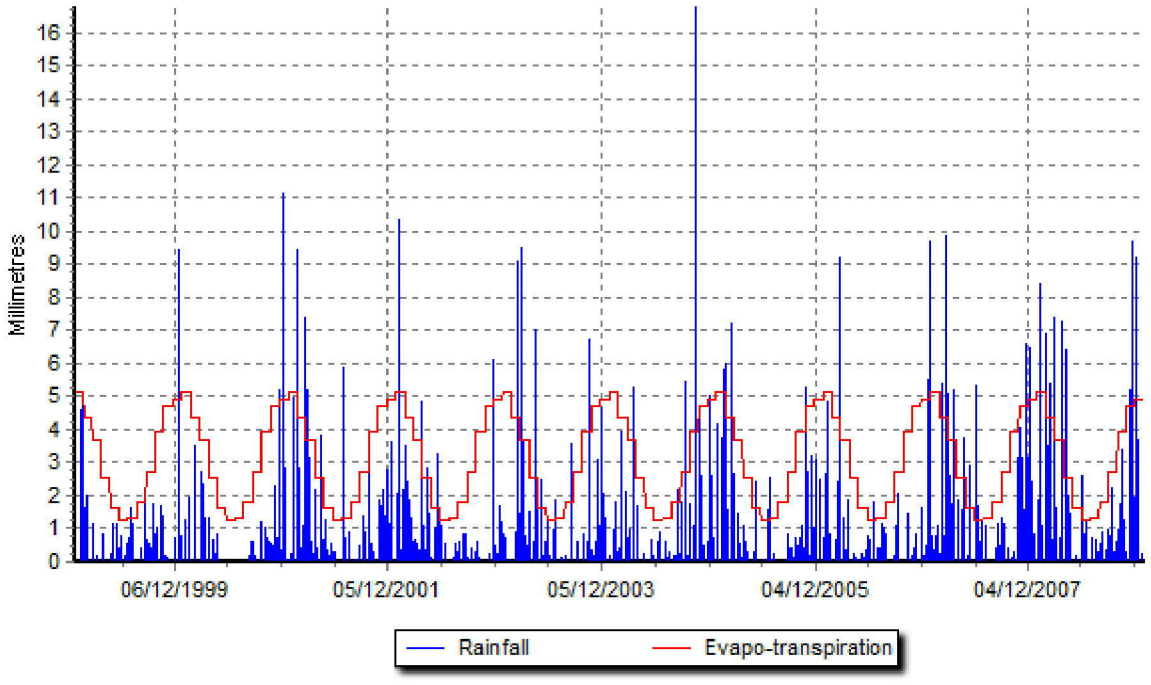


Figure 2 - Bureau of Meteorology Rainfall Data

3.2.3 Model Selection, assumption and removal effectiveness

In accordance with the Penrith City Council MUSIC Modelling Guidelines, split catchment methods were used for the source Nodes utilizing modified % impervious area. Also rainfall threshold, soil properties & pollutant concentration input values were sourced from the guideline.

The MUSIC modelling inputs for the rainfall source nodes are shown below.

Source Node Parameters – Sub Catchments		Urban Residential
Rainfall-Runoff	Rainfall Threshold (mm/day)	1.4
	Soil Storage Capacity (mm)	105
	Initial Storage (% of Capacity)	30
	Field Capacity	70
	Infiltration Capacity Coefficient - a	150
	Infiltration Capacity Exponent - b	3.5
	Initial Depth (mm)	10
	Daily Recharge Rate (%)	25
	Daily Base flow Rate (%)	10
	Daily Deep Seepage Rate (%)	0

Table 1 MUSIC Source Parameters

Base flow and Storm flow parameters for TSS, TP and TN for Roofs, roads and ground level were sourced from the Penrith City Council MUSIC Modelling Guidelines. Refer Below.

Land-use category		Log10 TSS (mg/L)		Log10 TP (mg/L)		Log10 TN (mg/L)	
		Storm Flow	Base Flow	Storm Flow	Base Flow	Storm Flow	Base Flow
General urban (incl. public open space)	Mean	2.15	1.20	-0.60	-0.85	0.30	0.11
Residential	Std Dev	0.32	0.17	0.25	0.19	0.19	0.12
Industrial							
Commercial							
Road Areas	Mean	2.43	---*	-0.30	---*	0.34	---*
	Std Dev	0.32	---*	0.25	---*	0.19	---*
Roof Areas	Mean	1.30	---*	-0.89	---*	0.30	---*
	Std Dev	0.32	---*	0.25	---*	0.19	---*

Figure 3 Source Node MUSIC Input Parameters – Base Flow

3.2.4 Treatment Trains

The proposed stormwater treatment train shall include specific devices aimed at achieving the water quality objectives before discharging into The Cresent Stormwater pipe system.

The stormwater treatment train shall include the following treatment device:

- 2-Cartridge (690mm) Detention StormFilter System by Stormwater360 (x1)
- EnviroPods Series 200 Filters By Stormwater360 (x1)

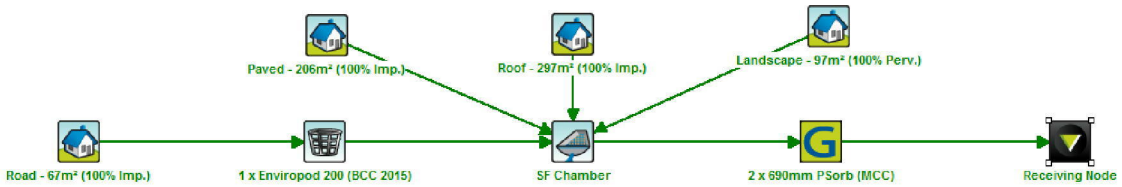
3.2.5 Rainwater Tanks

As part of the water saving initiatives for New South Wales, rainwater tanks are being installed in all new developments. These systems will provide the development with re-use water for toilet flushing and landscape watering instead of using potable water. Rainwater requirements are determined by BASIX.

The inclusion of the rainwater tanks based on BASIX will improve the pollutant reductions. Rainwater tank parameters were set in accordance with the Penrith City Council WSUD Policy.

3.2.6 MUSIC Model Layout

The layout of the site and the proposed drainage pattern were considered in the creation of the MUSIC model. Figure below presents the layout of source, treatment and receiving nodes used in the modelling.



Treatment Train Effectiveness - Receiving Node

	Sources	Residual Load	% Reduction
Flow (ML/yr)	0.352	0.352	0
Total Suspended Solids (kg/yr)	42.8	6.32	85.3
Total Phosphorus (kg/yr)	0.0906	0.0204	77.4
Total Nitrogen (kg/yr)	0.775	0.383	50.6
Gross Pollutants (kg/yr)	9.61	0	100

MUSIC Model Site Area Breakup

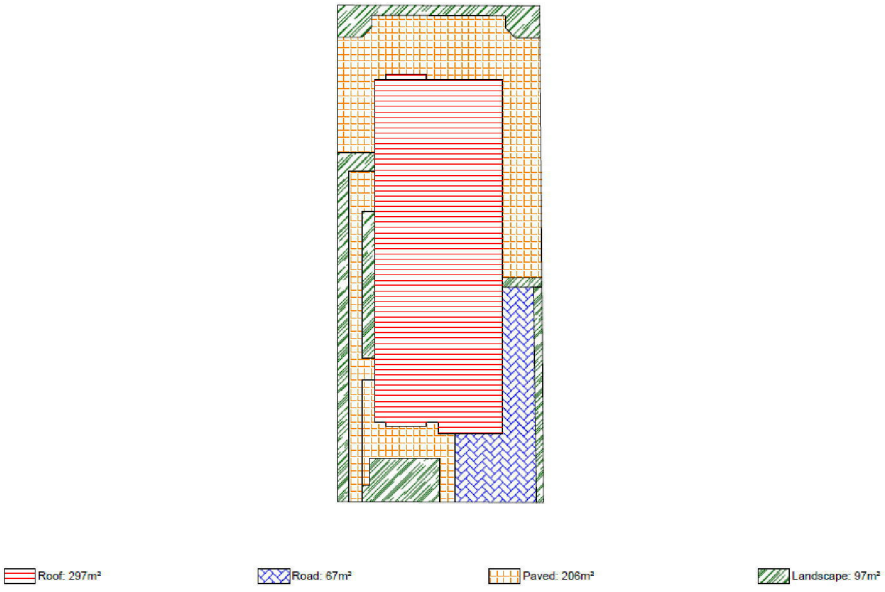


Figure 6 MUSIC Model Layout

3.2.7 Modelling results, comparisons and compliance

The MUSIC modelling results are shown on the tables below. They are in the form of % reduction achieved with the proposed stormwater quality treatment train.

Source Pollutants	Targeted Reduction	Treatment Train Reduction*
Total Suspended Solids (kg/yr)	85%	85.3%
Total Phosphorus (kg/yr)	60%	77.4%
Total Nitrogen (kg/yr)	45%	50.6%
Gross Pollutants (kg/yr)	90%	100%

Table 3 MUSIC Modelling Results

As seen above, it is apparent that the proposed stormwater quality treatment devices would be adequate to meet the Council stormwater quality objectives.

4 Erosion and Sediment Control

Prior to any earthworks associated with Site commencement, on site erosion and siltation control measures are to be put in place in accordance with the Landcom Publication "Managing Urban Stormwater – Soils and Construction" March 2004 (refer to the accompanying sediment and erosion control drawing). These measures include:

- The installation of a 1.8m high chain wire perimeter fence covered with shade cloth or solid A class hoarding, to the perimeter of the work site area,
- The construction of a silt fence on the low side of all site areas to be disturbed,
- All water leaving each site will be processed through a sediment control basin, where applicable;
- Swales and hay bales are to be used to assist with sediment control for overland flow paths leading into sedimentation control basins.
- The erosion and sediment control measures will be inspected at least once a week or after rainfall events to check their integrity

The following information is provided to identify controls and procedures, and who is responsible for them, which will be incorporated into the Erosion and Sediment Control Program:

4.1.1 Pre Construction

- Establish a single stabilised entry/exit point (rumble pad) for each stage of construction. This point should also include a vehicle shakedown device to mitigate the transportation of dust and dirt.
- Sediment fences are to be placed along the low side of the site to slow flows, reduce scour and capture some sediment runoff.
- Sediment fences are to be constructed at the base of fill embankments.
- Divert up-slope water around the work site and appropriately stabilise any drainage channels.
- Areas for plant and construction material storage are to be designated along with associated diversion drains and spillage holding ponds.
- Diversion banks are to be created at the upstream boundary of construction activities to ensure upstream runoff is diverted around any areas to be exposed. Catch drains are to be created at the downstream boundary of construction activities.
- Construction of temporary sediment basins, where required.
- Site personnel are to be educated to the sediment and erosion control measures implemented on site.

4.1.2 During Construction

- Progressive re-vegetation of filled areas and fill batters, if applicable.
- Construction activities are to be confined to the necessary construction areas.
- The provision of a construction exit to prevent the tracking of debris from tyres of vehicles onto public roads. Only one construction exit will be nominated to limit the movement of construction equipment.
- The topsoil stockpile location will be nominated to coincide with areas previously disturbed. A sediment fence is to be constructed around the bottom of the stockpile to trap sediment. A diversion drain is to be installed upstream of the stockpile if required.

- Roof downpipes should be installed as soon as practicable after the roof is laid.
- Transport loads that are subject to loss through wind or spillage shall be covered or sealed to prevent entry of pollutants to the stormwater system.
- Regular inspection and maintenance of silt fences, sediment basins and other erosion control measures. Following rainfall events greater than 50mm inspection of erosion control measures and removal of collected material should be undertaken. Replacement of any damaged equipment should be performed immediately.

4.2 Water Quality Monitoring Program

This development does propose the use of water sensitive practices and the associated stormwater quality management practices at the outlet areas. The stormwater runoff will eventually discharge into sensitive waterways, but there is no proposal for water quality monitoring within the drainage infrastructure downstream of the site to be undertaken.

A form for release of sediment-laden stormwater from the site and an inspection record of stormwater quality improvement devices will be developed. It is intended that each release resulting from a storm event generating more than 100mm in a twenty-four hour period be recorded on the form to ensure ongoing monitoring, management and reporting of releases from the site.

4.3 Maintenance

Particular care has been taken in the design of the proposed stormwater treatment train to reduce the maintenance requirements as much as possible.

It is strongly recommended that inspections are performed on the Stormfilters & EnviroPods upon completion of construction and at regular maintenance intervals of a maximum of 6 months. Regular maintenance of the Stormfilters & EnviroPods should be completed to ensure that the outlet structures and associated infrastructure is operating at full design specification. Any construction amendments that are required should be completed in accordance with the most recent guidelines.

It is generally understood that On-Maintenance acceptance of the Stormfilters & EnviroPods will only occur upon 80% completion of development of the upstream catchment area.

5 CONCLUSION

The proposed stormwater treatment devices have been assessed using MUSIC v6 software. This modelling shows that the proposed stormwater treatment strategy meets the Council's stormwater Quality Objectives in accordance with NSW Draft MUSIC Modelling Guidelines (2010).

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6 REFERENCES

- Draft NSW Music Modelling Guidelines (prepared for the Sydney Metropolitan CMA)
- WSUD Conceptual Design Information (prepared by Water by Design)
- WSUD Technical Design Guidelines (prepared by Water by Design)
- Typical Drawings (prepared for the Sydney Metropolitan CMA)
- Penrith City Council WSUS Guidelines

7 Appendix

Appendix A – Penrith City Council MUSIC LINK report

Appendix B – Maintenance Schedule

APPENDIX A

Penrith City Council MUSIC LINK Report

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MUSIC-*link* Report

Project Details		Company Details	
Project:	1 Garner St, ST Marys	**Company:**	Umbrella Civil Consulting Engineers
Report Export Date:	19/04/2016	**Contact:**	Michael Bou Rada
Catchment Name:	07183 - 1 Garner St	**Address:**	Suite 1-4,143-145 Parramatta Rd Concord NSW 2137
Catchment Area:	0.068ha	**Phone:**	02 8607 5051
Impervious Area*:	85.29%	**Email:**	michael.bourada@umbrellaconsulting.com.au
Rainfall Station:	67113 PENRITH		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1999 - 31/12/2008 11:54:00 PM		
Mean Annual Rainfall:	691mm		
Evapotranspiration:	1158mm		
MUSIC Version:	6.1.0		
MUSIC-link data Version:	6.0		
Study Area:	Penrith		
Scenario:	Penrith Development		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: Receiving Node	**Reduction**	**Node Type**	**Number**	**Node Type**	**Number**
Flow	0.0022%	Sedimentation Basin Node	1	Urban Source Node	4
TSS	85.3%	GPT Node	1		
TP	77.4%	Generic Node	1		
TN	50.6%				
GP	100%				

Comments

- Roof node base flow values are as per the MUSIC modelling guidelines which indicate base flow has no effect for impervious areas and therefore no value is needed.

- GPT reflects Stormwater360's EnviroPod and has the correct values

- The 'SF Chamber' detention node has been modified to represent a tank to hold volume for use with the Stormwater360 filter. k values has been set to 1 to prevent the tank from "treating" the flow as it would within a grassed above ground OSD

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Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
GPT	1 x Enviropod 200 (BCC 2015)	Hi-flow bypass rate (cum/sec)	None	99	0.02
Receiving	Receiving Node	% Load Reduction	None	None	0.0022
Receiving	Receiving Node	GP % Load Reduction	90	None	100
Receiving	Receiving Node	TN % Load Reduction	45	None	50.6
Receiving	Receiving Node	TP % Load Reduction	60	None	77.4
Receiving	Receiving Node	TSS % Load Reduction	85	None	85.3
Urban	Landscape - 97m² (100% Perv.)	Area Impervious (ha)	None	None	0
Urban	Landscape - 97m² (100% Perv.)	Area Pervious (ha)	None	None	0.01
Urban	Landscape - 97m² (100% Perv.)	Total Area (ha)	None	None	0.01
Urban	Paved - 206m² (100% Imp.)	Area Impervious (ha)	None	None	0.021
Urban	Paved - 206m² (100% Imp.)	Area Pervious (ha)	None	None	0
Urban	Paved - 206m² (100% Imp.)	Total Area (ha)	None	None	0.021
Urban	Road - 67m² (100% Imp.)	Area Impervious (ha)	None	None	0.007
Urban	Road - 67m² (100% Imp.)	Area Pervious (ha)	None	None	0
Urban	Road - 67m² (100% Imp.)	Total Area (ha)	None	None	0.007
Urban	Roof - 297m² (100% Imp.)	Area Impervious (ha)	None	None	0.03
Urban	Roof - 297m² (100% Imp.)	Area Pervious (ha)	None	None	0
Urban	Roof - 297m² (100% Imp.)	Total Area (ha)	None	None	0.03

Only certain parameters are reported when they pass validation

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Failing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
GPT	1 x Enviropod 200 (BCC 2015)	TN % Load Reduction	0	0	21.0001
GPT	1 x Enviropod 200 (BCC 2015)	TP % Load Reduction	0	0	29.9997
GPT	1 x Enviropod 200 (BCC 2015)	TSS % Load Reduction	0	0	54
Sedimentation	SF Chamber	Notional Detention Time (hrs)	8	12	0.151
Sedimentation	SF Chamber	Total Nitrogen - k (m/yr)	500	500	1
Sedimentation	SF Chamber	Total Phosphorus - k (m/yr)	6000	6000	1
Sedimentation	SF Chamber	Total Suspended Solids - k (m/yr)	8000	8000	1
Urban	Roof - 297m² (100% Imp.)	Baseflow Total Nitrogen Mean (log mg/L)	0.11	0.11	0
Urban	Roof - 297m² (100% Imp.)	Baseflow Total Nitrogen Standard Deviation (log mg/L)	0.12	0.12	0
Urban	Roof - 297m² (100% Imp.)	Baseflow Total Phosphorus Mean (log mg/L)	-0.85	-0.85	0
Urban	Roof - 297m² (100% Imp.)	Baseflow Total Phosphorus Standard Deviation (log mg/L)	0.19	0.19	0
Urban	Roof - 297m² (100% Imp.)	Baseflow Total Suspended Solids Mean (log mg/L)	1.2	1.2	0
Urban	Roof - 297m² (100% Imp.)	Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0.17	0.17	0

Only certain parameters are reported when they pass validation

APPENDIX B

Maintenance Schedule

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