Water Sensitive Urban Design

Parramatta Road & 11-13 Columbia Lane

Homebush

Report Number 610.10150.00150

8 July 2011

P D Mayoh Pty Ltd Architects

Version: Revision 0

Water Sensitive Urban Design

Parramatta Road & 11-13 Columbia Lane

Homebush

PREPARED BY:

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
125 Edward Street Perth WA 6000

T: 61 8 9370 0100 F: 61 8 9370 0101
E: perth@slrconsulting.com www.slrconsulting.com

DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
610.10150.00150	Final	8 July 2011	Will Legg	John Postlethwaite	Neihad Al-Khalidy

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

1.1 Engagement

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by PD Mayoh Pty Ltd to prepare a Water Sensitive Urban Design (WSUD) assessment and provide preliminary design advice during the Concept Planning phase of the proposed mixed used development located at 2-20 Parramatta Road and 11-13 Columbia Lane, Homebush.

The proposed initiatives suggested on the following sections have been included as opportunities for the Project Team to adopt WSUD strategies that provide both a direct and indirect benefit to the proposed development and enhance the local catchment in regard to integrated water management and water quality improvement in to the Powell's Creek waterway corridor.

1.2 Development Site

The proposed development site is bounded by Parramatta Road to the north, the railway line to the east through to the south of the site and Powell's' Creek to the west, refer **Figure 1**. The area surrounding the development site comprises:

- The Bakehouse Quarter heritage precinct along George Street to the north of Parramatta Road
- Proposed Part 3A Major Project Application for a 13 storey hotel/function development between the Bakehouse Quarter and the Parramatta road (north to the site)
- A group of 6-storey to 12-storey residential flat buildings to the immediate west of the development site and east across the northern train line.
- Low-rise residential flat premises on the east clockwise through to the south and further west

Figure 2 shows the proposed development and surrounding buildings. It is proposed that there will be approximately 600 - 700 residential dwellings on the site. The proposed development site is surrounded by low and medium rise residential and commercial buildings.

The proposed Columbia Precinct development consists of 7 residential towers and 1 commercial tower (some connected) on a series of typically 3-storey podiums (refer **Figure 3**). The concept design proposes a range of building heights, from the 2-storey podiums to 21-storey residential buildings. There is an increase in building height from the north (facing Parramatta Road) towards the south. It is proposed to extend George Street towards the south so that it runs through the proposed development and to create public parks with pedestrian and bicycle links throughout the development site.

1.3 Scope of Works

In response to the Director-General's Requirements issued 11 November 2010 for the proposed Mixed Use Development and to support the Concept Plan application, an assessment has been undertaken to ascertain the likely impacts upon the local catchment in regard to stormwater characteristics and drainage. The assessment also investigates any constraints and opportunities for the implementation of Water Sensitive Urban Design and water conservation measures.

This report comprises a preliminary Water Sensitive Urban Design assessment for Masterplanning purposes with reference to the PD Mayoh Pty Ltd Site Plan (Dwg No. A.002 Issue 2) and associated building drawings and the conceptual Landscape Masterplan (22.05.2011) provided by Site Image.

The assessment considers the potential impact of the proposed development on the stormwater and flood risk characteristics of the site and identifies potential stormwater management devices to either maintain or improve the quality of stormwater being discharged from the site post-development. This report also assesses potential options for water re-use with regards to the proposed operations on site.

The assessment has been based on the requirements of the following documents:

- *Director-General's Requirements, November, 2010*
- *Strathfield Council – WSUD Reference Guideline 2010*
- *Interim Reference Guideline for the South East Queensland Concept Design Guidelines for WSUD (with Sydney specific references)*
- *NSW EPA, Managing Urban Stormwater: Treatment Techniques 1997*
- *Department of Environment and Conservation NSW, Managing Urban Stormwater: Harvesting and Re-Use (2006)*
- *Strathfield Council Stormwater Management Code 1994*

The scope of work included:

- Preliminary assessment of site characteristics including topography, ground conditions, downstream receptors;
- Desk based assessment of the flood risk on site and any potential increase in flood risk as a result of the development;
- Assessment of the potential change in stormwater runoff generated as a result of the development and any retention or detention requirements with regards to pre-development and comparative surface water runoff constraints;
- Preliminary assessment of groundwater resources and impacts as a result of the proposed development;
- Optioneering assessment for re-use of local water to reduce and conserve potable water, including roof water harvesting, grey water re-use;
- Preliminary assessment of potential options for inclusion of vegetation and soft constructed devices for water quality improvement devices;
- Assessment of treatment measures to reduce the transportation of pollutant loads from impervious urban surfaces within the site such as roads and pavements to receiving waters mitigate the potential pollution increase; and
- Water re-use options appraisal.

2 SITE IDENTIFICATION

2.1 Site Location

The site is commonly referred to as 2-20 Parramatta Road and 11-13 Columbia Lane, Homebush and consists of four sites owned by three different landowners, hereby referred to as Lhuede, Kennards and Four All Clothing. The total site covers an area of approximately 3.45ha. The proposed total development footprint equates to approximately 2.9ha. The site location is presented in **Figure 1.** A satellite image of the existing site is presented in **Figure 2**.

Figure 1 Site Location Plan

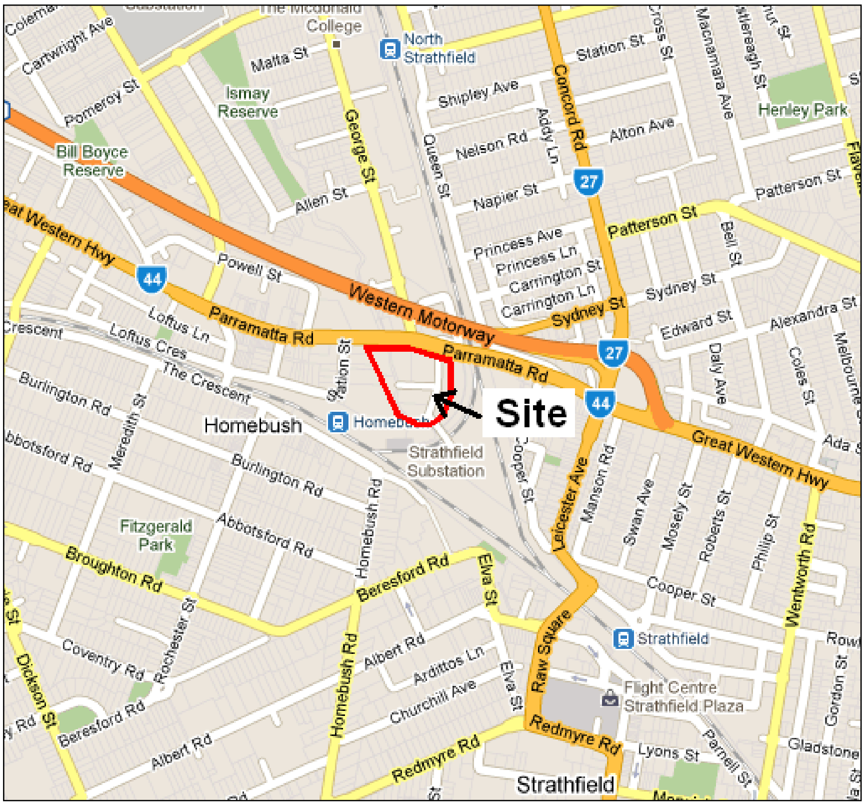
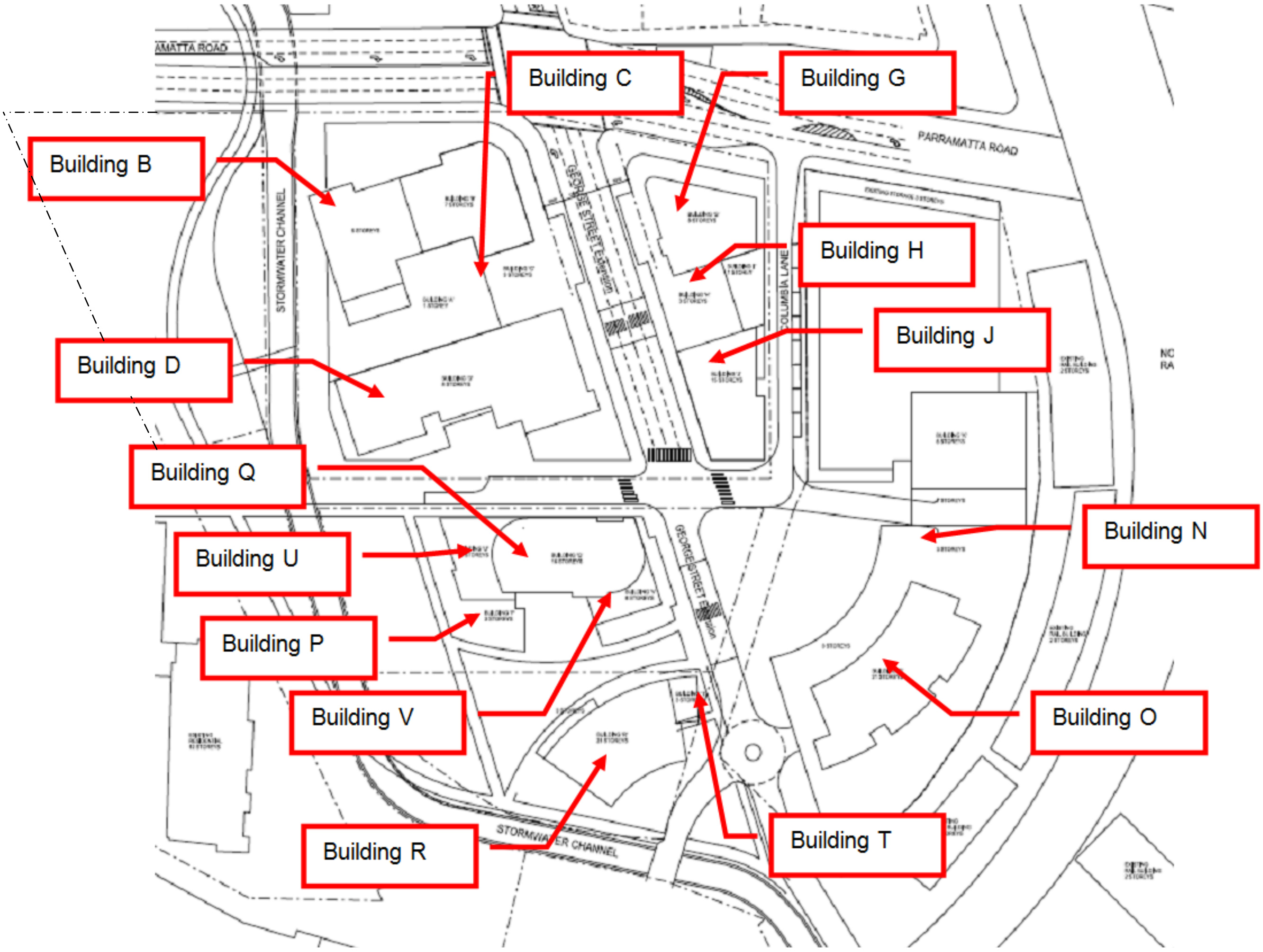


Figure 2 Aerial Photo Image of Existing Site

Figure 3 Proposed Concept Plan



2.2 Existing Land Use and Topography

SLR Consulting personnel inspected the site on 20/01/2011. The vast majority of the site comprised impervious surfaces including buildings; bitumen roadways and concrete hardstanding (refer to **Figure 2**). There are some minor vegetated / landscape areas situated adjacent to Powell's Creek, which flows within a concrete drainage channel through the site, and an access lane which runs west between Columbia Lane and Powell's Creek. Powell's Creek flows north westerly beneath the railway bridge into the site before flowing adjacent to the south-western boundary of the site and then northerly through the north-western portion of the site. The creek eventually flows through a concrete bridge culvert beneath Parramatta Road. The site is currently used for industrial and commercial purposes.

Based on topographical survey information provided, the ground levels onsite generally fall from Parramatta Road towards Powell's Creek. Columbia Lane rises slightly from 8.5mAHD at the Parramatta Road entrance before falling towards the intersection in the centre of the site, which is elevated at approximately 8.21mAHD. Columbia Lane then continues to fall towards the culvert bridge over Powell's Creek elevated at 6.55mAHD. The access lane which runs west from the intersection with Columbia Lane falls from 8.21mAHD to 4.49mAHD at the eastern end of the lane adjacent to Powell's Creek channel. The eastern fringes of the site are raised in elevation in comparison to Columbia Lane and Parramatta Road. A driveway runs from the central intersection to the east between two buildings, rising to approximately 9.1mAHD. A concrete ramp rises up from the driveway to the raised area which runs adjacent to the eastern boundary of the site elevated at approximately 11.3mAHD.

2.3 Geology and Hydrogeology

2.3.1 Regional Geological Information

The Geological Survey of New South Wales, Sydney 9130 (1983) 1:100,000 regional geological map shows the underlying geology to comprise Ashfield Shale of the Wianamatta Group. Ashfield Shale is characterised by black to dark grey shale and laminate.

2.3.2 Site Conditions

A *Preliminary Contamination and Geotechnical Investigation* was undertaken by WSP (March 2011). Ten (10) soil bores were advanced across the site. A review of this document has been undertaken as part of this assessment with a summary of typical ground conditions presented below:

- Fill – 0.3-4.5mbgl but typically less than 1.0mbgl. Fill was classified as a mixture of brown, black, grey and orange silty clay. Brick and asphalt fragments were noted in some bores;

- Natural soil comprising grey, black and orange non-plastic silty clay was observed below the fill;

- Shale / siltstone bedrock encountered below silty clay, typically between depths of 3m to 6m, shallowest in the northeast corner of the site and increasing in depth to the southwest. Shale was extremely weathered.

Three (3) monitoring wells were installed as part of the investigation. Groundwater levels were observed to range between 3.01 to 3.64mbgl, equating to approximately 2.01 to 4.24m AHD (Australian Height Datum). From the findings of the WSP report, the inferred groundwater flow at the site was considered to be in a north-west direction.

2.3.3 Potential Contamination

Soil and groundwater samples were analysed as part of the WSP (Mar 2011) investigation. The results are summarised below:

- Ecological Investigation Level (EIL) exceedences for copper and zinc in BH4 in the west of the northern Lhuede site.
- Total TPH (C10-C36) was reported in excess of the adopted criteria for BH6 in the north of the Four All Clothing site at 1.0mbgl.
- Heavy metal exceedences of ANZECC (2000) Marine Water criteria were recorded at one location (MW2) in the west of the northern Lhuede site. The elevated concentrations are not considered to present a risk to the environment and are likely to represent background concentrations;

- Volatile organic carbons (VOCs) were detected in MW3 in the south-east corner of the Kennards' site. MW3 is deemed to represent up-gradient groundwater quality at the site and the VOCs are deemed to be the result of offsite sources.

3 FLOOD RISK

The primary flood risk to the site is from Powell's Creek which flows around the south western boundary of the site, continuing north through the western fringes of the site before flowing offsite beneath Parramatta Road.

A number of Hydrological and Flooding studies have been undertaken previously. This section provides a review of the flooding studies available at the time of this assessment and outlines potential risks of flooding and impacts upon the local catchment resulting from the proposed development.

3.1 Review of Flooding Studies and Site Impacts

Brown Consulting prepared a flood study in September 2007 for the proposed development of the north-western portion of the site, namely 6-18 Parramatta Road (ref. Flood Study for Residential Development, 6-18 Parramatta Road Report No. X05098.01-01B). Modelling of Powell's Creek was undertaken by Brown Consulting, which adopted modelling data used within a previous flood study conducted by Webb McKeown (1998). The results were compared to those of a flood study conducted by Perrens Consulting (2003).

The Perrens Consulting's study determined the 100 year ARI flood level of 5.36mAHD for the site. The flood extents were limited to the eastern banks, extending between 3 and 10m into the site. Strathfield Council required the habitable floor level to be set at 5.86mAHD, 500mm above the 100 year ARI flood level.

The Brown Consulting study determined the 1 in 100 year flood level upstream of the previous development to be 5.44mAHD. Therefore, 5.44mAHD + 0.06m (as per previous conservative approach) equating to approximately 5.5mAHD is considered to be more representative of the 100 year ARI flood level within the southern part of the current site.

The western fringes of the proposed development (as per the Concept Masterplan) located to the east of Powell's Creek, currently lie within the 100 year ARI floodplain determined by Brown Consulting. The extent of the potential 1 in 100 year flood is shown in **Appendix A.**

Further clarification of the flood levels was sought from Strathfield City Council. According to their drainage department an Areas Laser Scan (ALS) within the site's catchment was undertaken in 2010 to provide detailed topographical information for the Council to further assess flood risk. The data gathered during the ALS was assessed by WMA Water to supplement the findings of the 1998 Webb McKeown flooding study. The detailed 1 in 100 year flood level information was also incorporated into the Council's GIS database. The Council confirmed that the 1 in 100 year flood level is 5.4m AHD for the Site and that a minimum freeboard off 500mm above this level should be adopted for the habitable floor level. Based on the Council's 1 in 100 year flood level of RL 5.4m AHD, the minimum floor level and crest level for access ramps or stairs to underground basement areas of RL 5.9m AHD should be adopted.

Therefore, the proposed development footprint currently encroaches slightly into the estimated 1 in 100 year flooding envelope. This would result in a minor displacement of fluvial floodplain storage. There may be the requirement to allow for the displaced floodplain storage to be compensated for within the site on a level for level basis. This could be accommodated in the proposed landscaped areas adjacent to Powell's Creek to ensure the proposed development does not impact on flood conveyance or flood storage during the critical 100 year ARI flood event. Depending upon the results of further detailed analysis, if required the compensation area could be accommodated within the area west of Powell's Creek as part of the re-development and landscaping.

The proposed site levels and building habitable floor levels can be designed to ensure that more than adequate freeboard is available above the predicted 1 in 100 flood levels. Crest levels to basement carparks shall also be set to ensure that flood waters arising from the major storm event do not enter the below ground areas. All below ground structures shall be designed to withstand impacts resulting from potential groundwater ingress.

It is considered that once the compensation area has been developed and the detail ground and building levels have been set, that there will be negligible impacts upon the site occupants and building elements nor will there be adverse impacts upon the existing water course due to the development under flood conditions.

3.2 Overland Flow Routing

There is a potential flood risk associated with overland flow from Parramatta Road progressing onto site during a rainfall event which exceeds the Parramatta Road drainage criteria. The large proportion of the northern boundary of the site is raised in relation to Parramatta Road, with Columbia Lane and a narrow passage between two of the fronting buildings rising south of Parramatta Road preventing ingress of floodwater.

At present some overland flow could potentially ingress through the entrance into the fringes of the car lot fronting Parramatta Road in the north west of the site. However flows would tend to be routed into Powell's Creek rather than being conveyed further into the site. The site levels shall be designed in the detail phase of the project to ensure that flood routing is adequately addressed to ensure that no adverse impacts occur within the site and that there are no worsening effects upon adjoining properties.

4 ONSITE STORMWATER DETENTION (OSD) STORAGE

In accordance with the Strathfield Council Stormwater Management Code (1994) the proposed development / building work must not cause an adverse impact on adjoining or any other properties. This includes preserving surface flow paths and not increasing water levels. Site discharges will need to be restricted to pre-development discharges using On-site Stormwater Detention (OSD) storage for events up to and including the 100 year Average Recurrence Interval (ARI) event.

In accordance with the Council's guidelines, other than for single residential dwelling projects OSD is required for all developments where the proposed increased paved and/or roofed areas (impermeable area) exceed 100m^2. The need or not for Onsite Detention measures varies significantly depending upon the pre-development site characteristics and existing drainage network capacity. If sites are 'greenfield', where no development has previously occurred, the need to reduce flows off site after development may be far greater than if the site has had a previous use.

The existing Site is fully developed with buildings, roadways and hardstand areas. Therefore, it is considered that the Site (and sub-catchment areas) in its current form is substantially impermeable. The proposed development, which incorporates new landscaped areas, provides an opportunity to significantly reduce the fraction of impermeable area within the Site. The resulting change in land form, topography and stormwater runoff characteristics will offer many benefits to the local catchment by providing opportunities to enhance stormwater discharge quality and to reduce the runoff characteristics from the Site into the receiving water, Powell's Creek. The section of the creek that bounds the Site is a concrete lined open drain.

This section provides an assessment of the 'pre' and 'post' development runoff characteristics of the Site to determine the change in stormwater discharge from the Site over a series of storm events. This preliminary assessment aims to ascertain the requirement for OSD to be incorporated in the proposed development when compared to the existing pre-development site conditions.

A summary of the 'pre' and 'post' development stormwater flows and OSD requirements is provided within **Table 1** below. Full OSD calculations are provided within Calculation Sheet 1 in **Appendix B.**

Table 1 'Pre-development' OSD Storage Requirements

Catchment	Owner	Pre-development Q_{100} Stormwater flows (l/s)	Post-development Q_{100} Stormwater flows (l/s)	100yr ARI Storage Required (m^3)
Whole site	-	1628	1564	No OSD required
1	Lhuede	456	423	No OSD required
2	Kennards	423	405	No OSD required
3	Four All Clothing	179	166	No OSD required
4	Lhuede	244	218	No OSD required
5	Roads	326	352	Minor OSD required

The preliminary assessment undertaken to establish the requirements for Onsite Stormwater Detention has shown that due to the change in the site and sub-catchment flow characteristics resulting from the enhancement of landscaping will significantly increase permeable areas across the site and sub-catchments. The resulting stormwater discharge off-site during all storm events up to the 1 in 100 year (Q_{100}) has reduced.

It is also considered that as the site is adjoining the Powell's Creek open drain, that it would be beneficial on a catchment wide basis, not to detain flows from this sub-catchment.

Based on the current Masterplan, there will be an increase in area of internal roads. The increase in discharge from the new roads will be controlled by the implementation of WSUD measures such as rain gardens and other bio-retention such as swales. Sizing and final arrangement of such will be determined in the detail design phase.

5 WATER SENSITIVE URBAN DESIGN STRATEGY

5.1 Water Sensitive Urban Design Objectives

Water Sensitive Urban Design (WSUD) involves planning and designing urban environments that are sensitive to the issues of water sustainability and environmental protection.

The key objectives of WSUD include:

- Reducing potable water demand through water efficient appliances, rainwater reuse and greywater reuse;
- Minimising wastewater generation and treatment of wastewater to a standard suitable for effluent reuse opportunities and/or release to receiving waters;
- Protect and restore aquatic ecosystems and habitats;
- Providing treatment for urban stormwater to meet water quality objectives for reuse and/or discharge to surface waters;
- Preserving / replicating the natural hydrological regime of catchments;
- Protect the scenic, landscape and recreational values of waterways; and
- Reducing minor flood risks in urban areas.

5.2 Water Demand

The water demand and wastewater discharges for the proposed development were calculated for both the proposed residential and commercial units. Calculations were undertaken using the 'Greenstar' calculator and the Department of Natural Resources and Mines planning guidelines for water supply and sewerage for the various proposed uses. Water demand calculation results and assumptions are provided within **Appendix C**.

The Masterplan proposes approximately 630 units for the residential component of the development, but based on floor area could be as high as 700 units depending upon final design. For the purposes of this preliminary assessment the number of units has been based on an average number of 667 units.

In summary, the daily water demand for the proposed development is as follows:

Table 2 Water Demand

Area	Owner	Residential Water Demand (L/day)	Commercial Water Demand (L/day)	Total Daily Water Demand (L/day)
Whole site	-	215065	61120	276185
1	Lhuede	81769	51984	133753
2	Kennards	48620	2904	51524
3	Four All Clothing	44665	6232	50897
4	Lhuede	40012	0	40012

5.3 Water Conservation

A widespread reduction in water consumption is required to conserve water resources and offset the rising demand from an increasing population and minimising the affects of depleting resources during times of low rainfall conditions.

The use of water efficient fixtures, appliances and equipment, such as water efficient shower heads and washing machines for example, can provide long term benefits in terms of conserving water. Rainwater harvesting and reuse of Greywater can also significantly reduce the demand for mains supplied potable water, which is addressed in **Section 5.3.1 and 5.3.2**.

As a minimum and where possible, it is proposed to use the following water efficient fixtures throughout the development:

- 4A Shower head
- 4A WCs
- 4A kitchen and bathroom taps; and
- Waterless urinals in commercial / retail areas

5.3.1 Water Re-use Options

5.3.1.1 Rainwater Harvesting

The capturing or harvesting of rainwater from roof areas can contribute to water conservation and water quality objectives in terms of reducing potable water use and reducing the volume of water and thereby nutrient and suspended solid load being discharged to sewer and ultimately the receiving watercourse.

There is potential to reticulate and reuse the harvested rainwater (as per **Section 5.3.1**) for irrigation purposes. Any remaining water could also potentially be used to subsidise potable water demand for flushing toilets or supplementary supply to water features on site.

It is proposed to harvest rainwater from roof areas within the development. Collected rainwater will be directed to an underground cellular storage system made up of 'storm crates' prior to reticulation and re-use.

A preliminary rainwater harvesting assessment was undertaken in MUSIC to compare the proportion of re-use demand from each site which can potentially be met by supply from a range of rainwater harvesting tank volumes. **Graph 1** to **Graph 4** in **Appendix D** compare percentage of total demand (assumed for the purposes of this assessment to be toilet flushing + irrigation demand) and irrigation demand with a range of rainwater harvesting tank volumes.

Table 3 provides details of the tank volumes selected for implementation into the overall water quality model with consideration to the ratio between 'percentage of demand met' and tank volume, onsite space requirements and capital cost of tank installation.

Table 3 Rainwater harvesting tank size used in MUSIC modelling

Catchment	Owner	Selected Tank Size (m^3)
1	Lhuede	150
2	Kennards	175
3	Four All Clothing	100
4	Lhuede	50

Benefits

- Reduce potable water demand providing operating cost savings and water conservation;
- Comply with BASIX Water Section
- Minimal treatment required prior to re-use
- Reduce the need for water restrictions; and
- Reduce flows to drainage system during periods of heavy rainfall.

Risks

- Water born disease in the stored water tanks due to stagnation and poor management
- Overflows out of system causing damage
- Pumping failure due to poor management

Environmental Issues

- Cost of electricity for pumping

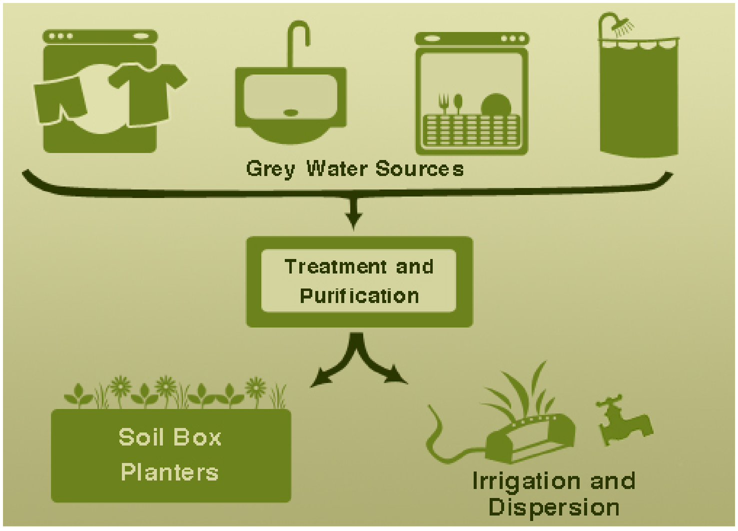
Maintenance and Infrastructure

- Requires storage system
- Requires reticulation system

5.3.1.2 Greywater Re-use

Greywater includes all domestic wastewater other than effluent from the toilet (blackwater) and kitchens and includes wastewater from bathrooms and laundries. Approximately 50% of all domestic wastewater is made up greywater discharge, which may be re-used for various uses depending upon demand.

There is potential to divert greywater to an onsite greywater diversion device or greywater treatment system and treated and stored prior to being reticulated via a dedicated dual system for reuse. Reuse options include surface and subsurface irrigation of proposed landscaped areas and toilet flushing,.



Benefits

- Reduce potable water demand providing operating cost savings and water conservation;
- Reduce the need for water restrictions;
- Reduce load on existing sewerage systems; and
- Recycling or balancing of nutrients onsite.

Risks

Although not as contaminated as raw sewage, if not managed well, the re-use of untreated greywater could present a risk to public health and the environment in terms of:

- Containing faecal coliforms or micro-organisms;
- Being high in concentration of dissolved salts from detergents and cleaning products, nutrients or oils and fats,;
- Containing particles of dirt, food, lint and human waste products; and
- Chemicals contained in greywater could also be harmful to vegetation, soils and receiving waters.

Therefore, adequate treatment and monitoring may be required depending on the potential re-use option(s).

Maintenance, Infrastructure and other potential issues

- Greywater diversion device required for sub-surface irrigation use
- Greywater treatment system required for surface and subsurface irrigation, toilet flushing or washing machine water use
- Treatment systems require council approval; and
- Regular monitoring and maintenance

5.3.1.3 Blackwater

Blackwater, comprising wastewater from toilets and kitchens, could be potentially treated and re-used onsite. On-site treatment systems include septic tanks with absorption trenches or aerated wastewater treatment systems. However, given that septic tanks are not deemed to be appropriate for the urban environment; aerated wastewater treatment systems are expensive to operate and maintain; and that there is higher risk to human health and the groundwater from the re-use of blackwater, it is considered that that this option would not be feasible for this development.

5.4 Stormwater Quality Assessment

This section focuses on the potential increase in stormwater pollutants as a result of the development and recommends treatment measures to mitigate the potential pollution increase. This assessment has harnessed the objectives set out in the Development Control Plan prepared by Strathfield Council and supports the implementation of Best Management Practices (BMP) to ensure that no adverse impacts occur directly from the proposed development.

The aim of the stormwater quality assessment is to ensure the proposed development activities do not lead to an increase in the concentration of pollutants being discharged from the site.

Pollutants include:

- Gross pollutants (e.g. trash)
- Nutrients
- Suspended solids
- Oxygen demanding materials
- Micro-organisms

Gross pollutants (trash) are commonly washed from pavements and can be at high levels in urban runoff.

Increases in nutrients can promote growth of aquatic plants, particularly algae which can lead to a reduction in light penetration of the water and cause the oxygen levels in the water to decrease.

Increases in suspended solids (particularly sediment) leads to an increase in the concentration of nutrients being transported downstream as well as impacting on downstream water turbidity. Finer suspended sediment particles (<0.005mm) tend to transport pollutants such as nutrients where as relatively coarse particles (>0.02mm) hold very few pollutants.

Oxygen-demanding materials can deplete levels of dissolved oxygen in the water leading to anaerobic conditions which can cause aquatic plants and other aquatic organisms to be adversely impacted.

Micro-organisms frequently occur at high levels in urban runoff, associated with sewage/septic outfalls, animal faeces, soil, decaying vegetation and putrescible matter.

5.4.1 Design Objectives

The following design objectives for stormwater quality (in terms of reduction in pollutant load compared to untreated stormwater from the same development) have been obtained from the Interim Reference Guideline for WSUD practitioners in Sydney, which is based on the South East Queensland Concept Design Guidelines for WSUD.

Required reductions are as follows:

- 90% of the post development mean annual load of total gross pollutant loads (greater than 5mm)
- 85% of the post development mean annual load of total suspended solids
- 65% of the post development mean annual load of total phosphorus; and
- 45% of the post development mean annual load of total nitrogen

5.4.2 Water Quality Treatment Model

The Model for Urban Stormwater Improvement Conceptualisation (MUSIC) has been used to assess and estimate stormwater quality improvement elements and model the 'Pre' and 'Post' development pollutant loading.

Modelling parameters have been determined in accordance with the *Draft NSW Water Sensitive Urban Design MUSIC Modelling Guideline* and the *Strathfield Council WSUD Reference Guideline (Nov 2010)*.

In order to calculate the target pollutant concentrations in accordance with the design objectives (refer to **Section 5.4.1**) a post development model was created that incorporated no treatment systems.

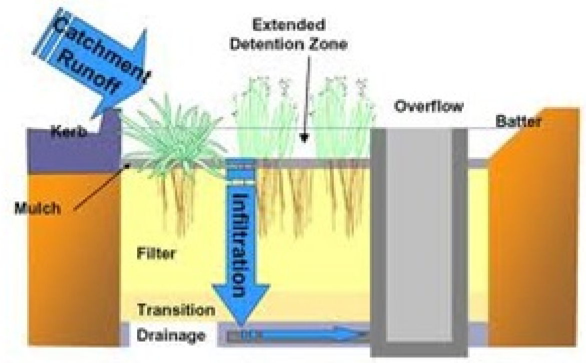
Various water quality treatment measures were then modelled either individually or in combination (a treatment train) to assess the most appropriate means of achieving the stormwater quality targets presented in **Section 5.4.1** whilst taking account of development constraints and the conceptual landscape design by Site Image.

Proposed Water Quality Treatment Strategy

It is the intention of the Client and Design team to ensure that measures are assessed and where appropriate, implemented to ensure that the quality of the stormwater and groundwater are not adversely impacted, and are improved by the enhancement of site features such as landscaping and appropriate site management. The proposed landscaping will introduce 'green' corridors for wildlife, this coupled with stormwater quality improvement, will ultimately enhance biodiversity across the site.

It is proposed to collect roof runoff within rainwater harvesting tanks for re-use across the site. This water could be used for irrigation supply and other uses. Overflow from the storage tanks would be directed to the drainage network, eventually discharging to the receiving watercourse in a controlled manner.

Surface water runoff generated from within the proposed landscaped pedestrian areas will be diverted to grass filter strips and bioretention systems, such as 'rain gardens' and vegetated swales for filtration treatment. The treated water will be captured at the base of the system, percolating into perforated pipes prior to discharge to the receiving watercourse.



Detail - Generic Rain Garden Section

Detail – Vegetated Swale Drain

Surface water runoff generated from within road areas will be diverted to bioretention systems such as 'rain gardens', swales or a combination of treatment measures for treatment incorporating filter media and subsurface perforated pipes with discharge of treated stormwater to the receiving watercourse. Where bio-retention measures are not able to be incorporated, at source Gross Pollutant Traps have been considered to collect and remove litter, oils and grease and sediment from the runoff.

There is potential opportunity to connect the road bioretention systems to swale drains or a water quality improvement pond located within the landscape areas prior to a controlled release to the receiving watercourse. The vegetated swale drains would provide further water quality treatment and additional attenuation during heavy rainfall events. The Landscape plan also incorporates ornamental garden areas adjoining the water course. Depending upon final site levels and drainage requirements, there may be further opportunities to direct runoff to these areas for final 'polishing' before entering the open drain. However this potential option has not been incorporated within the existing MUSIC model at this stage.

The WSUD treatment strategy is shown in the Stormwater Drainage Concept Plan in **Appendix E**.

MUSIC Modelling – Development Assumptions

The following assumptions were applied during the modelling process.

Assumed Catchment Inputs

Catchment	**Total Catchment (m^2)**	**Impermeable (%)**	**Permeable (%)**
Pre-Development	27884	95	5
Post-Development	27884	82	18

Rainfall and evaporation inputs, rainfall runoff parameters, pollutant generation parameters and stormwater treatment parameters were selected in accordance with *Strathfield Council WSUD Reference Guideline (Nov 2010)*.

MUSIC - Modelling Results

The water quality modelling results are provided within Table and Table 5

Full modelling results are provided within **Appendix G**.

Table 4 Water Quality Modelling - Daily Results

Parameter	Total Suspended Solids	Total Phosphorus	Total Nitrogen	Total Gross Pollutants
Daily 'Untreated' Post Development Mean Outflow	1210mg/L	0.174mg/L	1.51mg/L	1.55kg/day
Target Reduction	85%	65%	45%	90%
Daily 'Treated' Post Development Mean Outflow	2.21mg/L	0.0389mg/L	0.406mg/L	0kg/day
Daily 'Treated' Post Development Standard Deviation	4.68mg/L	0.0317mg/L	0.398mg/L	0kg/day
Mean Daily Reduction Achieved	99.9%	77.6%	73.1%	100%
Target Reduction Met	Yes	Yes	Yes	Yes

Table 5 Water Quality Modelling - Annual Results

Parameter	Total Suspended Solids	Total Phosphorus	Total Nitrogen	Total Gross Pollutants
Post-development 'Untreated' Annual Load	390,000kg/yr	5.33kg/yr	47.3kg/yr	565 kg/yr
Target Reduction	85%	65%	45%	90%
Post-development 'Treated' Annual Load	219kg/yr	1.57kg/yr	19.6kg/yr	0kg/yr
Reduction Achieved	99.8%	70.5%	58.6%	100%
Target Achieved	Yes	Yes	Yes	Yes

In summary, the preliminary WSUD and stormwater quality improvement assessment has shown that by implementing appropriate treatment measures and water re-user facilities, that the development in the operation phase will not adversely impact the local water environment. The proposed landscaping, incorporating WSUD will ultimately enhance the local catchment and encourage bio-diversity.

5.5 Cost

It is envisaged that the capital, operation and maintenance cost estimates for the proposed WSUD measures will be undertaken during the detailed design phase.

5.6 Maintenance Plan

A maintenance plan outlining how the WSUD elements will be maintained should be undertaken as part of the detailed design phase following discussions with relevant land owners and those parties who will adopt elements of the water quality treatment and drainage system.

6 CONCLUSION

SLR Consulting Australia Pty Ltd (SLR) was commissioned by P D Mayoh Pty Ltd Architects to conduct a Water Sensitive Urban Design assessment in relation to the proposed development at 2-20 Parramatta Road and 11-13 Columbia Lane, Homebush, NSW. The proposed development includes multi-unit residential and commercial development and associated infrastructure across four different 'sub' sites within the overall development site.

The aim of the assessment was to address the Director-General's Requirements and undertake a preliminary Water Sensitive Urban Design appraisal for Masterplanning purposes with reference to the PD Mayoh Pty Ltd Site Plan (Dwg No. A.002 Issue 2), associated building drawings and the conceptual Landscape Plan (22.05.2011) provided by Site Image.

The assessment considers the potential impact of the proposed development on the stormwater and flood risk characteristics of the site and identifies potential stormwater management devices to either maintain or improve the quality of stormwater being discharged from the site post-development on a site by site basis for the four sub-sites as described in Table 1.

This report also assesses potential options for water conservation and re-use appropriate for the proposed site uses and associated operations. There are many opportunities to re-use roof water and greywater for purposes such as irrigation and toilet flushing, thus harnessing water conservation across the site.

The primary flood risk to the site is from Powell's Creek which flows around the south western boundary of the site, continuing north through the western fringes of the site before flowing offsite beneath Parramatta Road. The 100 year Average Recurrence Interval (ARI) flood level of 5.36m AHD was deemed to be appropriate for the purposes of this assessment.

The proposed development enhances the site's characteristics by the inclusion of landscaped areas. The increase in 'green space' results in a significant reduction in impermeable area when compared to the existing pre-developed site, thus resulting in a decrease in stormwater runoff from the site during rainfall events. Based on the results of the stormwater analysis, it is considered that no Onsite Detention (OSD) storage is deemed to be required, other than for controlling flows from new roadways.

A stormwater quality assessment has been undertaken to ensure the proposed development in operation does not lead to an increase in the concentration of pollutants being discharged from the site. The assessment included the concept design of water quality treatment measures to manage and treat surface water runoff and roof runoff at source prior to a controlled release to the receiving watercourse.

The Model for Urban Stormwater Improvement Conceptualisation (MUSIC) was used to size stormwater quality elements and model the Pre and Post development pollutant loading. Various water quality treatment measures were modelled independently or in combination to assess the most appropriate means of achieving the stormwater quality targets presented in **Section 5.4.1,** whilst taking account of development constraints and the conceptual landscape design sketch provided by Site Image. The WSUD assessment has shown that the proposed development, which incorporates a significant increase in landscaped areas and implementation of water quality improvement measures will not adversely affect the surface water or groundwater environment.

The development will enhance the local catchment and provide 'green' corridors, which will ultimately improve bio-diversity.

The MUSIC modelling results showed that the proposed water quality treatment strategy meets the adopted stormwater quality treatment targets.

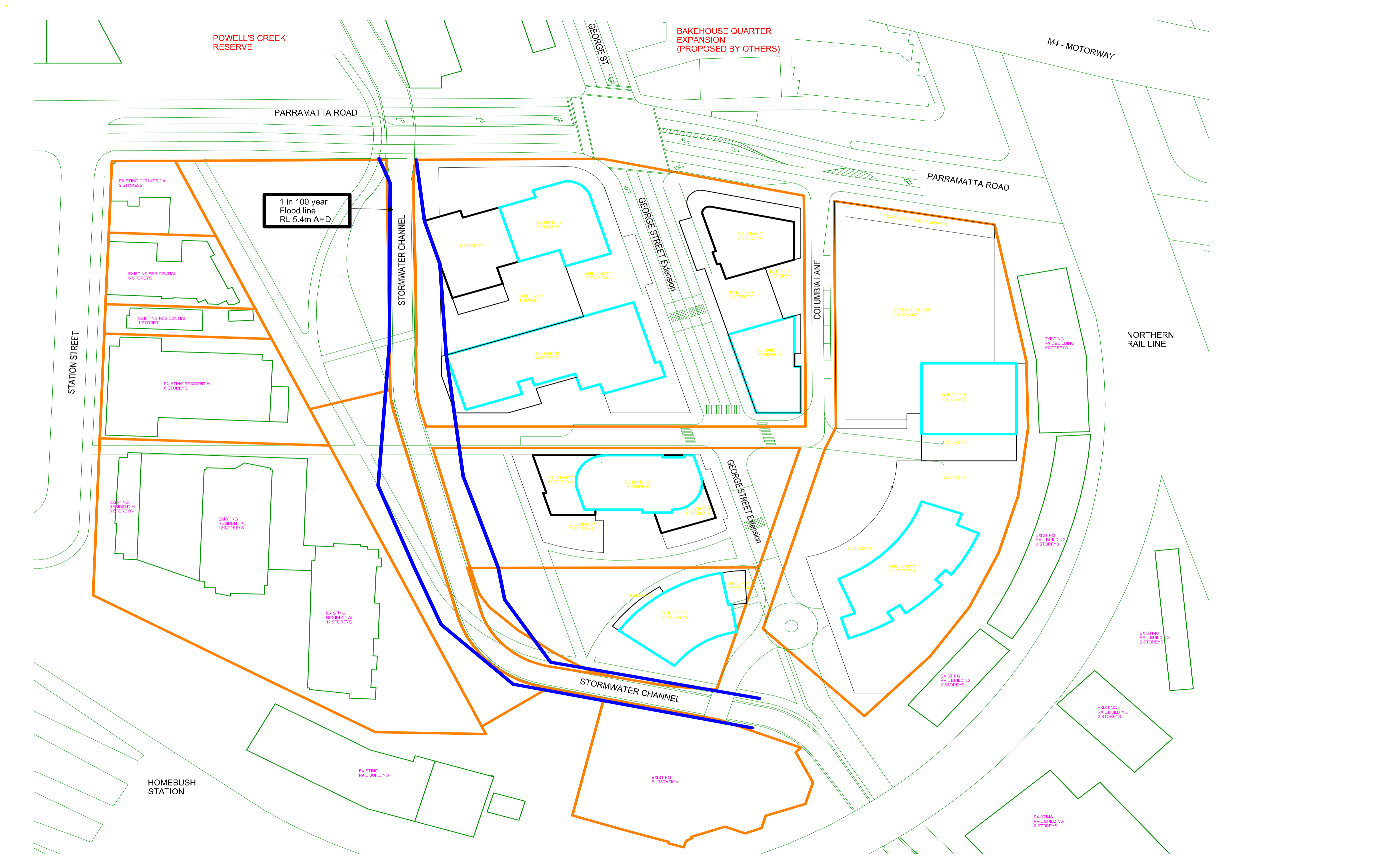
7 CLOSURE

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of P D Mayoh Pty Ltd Architects. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR Consulting.

SLR Consulting disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

1 in 100 yr Flood Extent of Powell's Creek



NOTES	LEGEND
NOTES TEXT	1 in 100 year flood level extent

Revision	Drawn By	Chkd By	Date	Comments
	KK	JP		

SLR
2 LINCOLN STREET
LANE COVE
NEW SOUTH WALES 2066
AUSTRALIA
T: 61 2 9427 8100
F: 61 2 9427 8200
www.slrconsulting.com

Site: Paramatta Road, Homebush

Project: Columbia Precinct

Drawing: **Site plan showing 1 in 100 year floor level**

Date	Drawing Number	Revision
08/07/2011	1	

Scale: NTS

ACAD Title Block A (A3-A4) v6 2004.1.dwg

Appendix B

OSD Calculation

Job: 610.10150.00150
Calculation Sheet 1
OSD - Greenfield runoff requirements

Whole Site Catchment

Pre-Development Runoff Rate Calculation

Component	Area	runoff coefficient
Green	3450	0.6
Impervious	31000	1
Total Site	34450	0.96

Time of Concentration Formulas

tc1 = 0.76 x A^0.38 A in square km

Time of Conc	tc (hrs)	tc (mins)	
tc1	0.211	13	Assume tc = 10 mins

Rational Method

Q = fy.cy.I.A / 360
Q = Flow
c = Runoff Coefficient
i = intensity
A = Area

Pre-development Runoff

			Permable Fraction of Site						Impermeable Fraction of Site						Total Q(l/s)
ARI	Duration	I (BOM)	c	Fy	Cy	A	Q (m3/s)	Q (L/s)	c	Fy	Cy	A	Q (m3/s)	Q (L/s)	
1	10	70.7	0.60	0.80	0.48	0.345	0.033	32.5	0.90	1.00	0.90	3.1	0.548	547.9	580.4
5	10	116	0.60	0.95	0.57	0.345	0.063	63.4	0.90	1.00	0.90	3.1	0.899	899.0	962.4
10	10	130	0.60	1.00	0.60	0.345	0.075	74.8	0.90	1.00	0.90	3.1	1.008	1007.5	1082.3
100	10	193	0.60	1.20	0.72	0.345	0.133	133.2	0.90	1.00	0.90	3.1	1.496	1495.8	1628.9

Road Catchment

Road Catchment	Area
North	2444
South	1055
Total	3499

Post-Development Catchment Runoff Rates

Catchment	Roof	Pedestrian	Green
1	6900	2109.6	527.4
2	7205	1498.4	374.6
3	1581	834.4	1291.6
4	745	831.2	1476.8
TOTAL	16431	5273.6	3670.4

Component	Area	runoff coefficient
Green	10350	0.6
Impervious	24150	1.00
Total Site	34500	0.97

Post-Development

ARI	Duration	I (BOM)	Permable Fraction of Site c	Fy	Cy	A	Q (m3/s)	Q (L/s)	Impermeable Fraction of Site c	Fy	Cy	A	Q (m3/s)	Q (L/s)	Total Q(l/s)
1	10	70.7	0.60	0.80	0.48	1.035	0.098	97.6	0.90	1.00	0.90	2.415	0.427	426.9	524.4
5	10	116	0.60	0.95	0.57	1.035	0.190	190.1	0.90	1.00	0.90	2.415	0.700	700.4	890.4
10	10	130	0.60	1.00	0.60	1.035	0.224	224.3	0.90	1.00	0.90	2.415	0.785	784.9	1009.1
100	10	193	0.60	1.20	0.72	1.035	0.400	399.5	0.90	1.00	0.90	2.415	1.165	1165.2	1564.7

Predicted Storage Requirements 1:100yr

Duration	ARI	Cy	I	A	Qi	Vi
5	**100**	**0.7**	**248**	1.035	0.499	150
10	100	0.7	193	1.035	0.400	240
20	100	0.7	145	1.035	0.300	360
30	100	0.7	119	1.035	0.246	443
60	100	0.7	82.6	1.035	0.171	616
180	100	0.7	54.7	1.035	0.113	1223
240	100	0.7	42.4	1.035	0.088	1264

Duration	ARI	Cy	I	A	Qi	Vi
5	100	**1**	**248**	2.415	1.664	499
10	100	1.0	193	2.415	1.295	777
20	100	1.0	145	2.415	0.973	1167
30	100	1.0	119	2.415	0.798	1437
60	100	1.0	82.6	2.415	0.554	1995
180	100	1.0	54.7	2.415	0.367	3963
240	100	1.0	42.4	2.415	0.284	4096

Duration	Total Storage	Allowable Discharge Volume	Difference In Storage	
5	649	-	-	No Storage required
10	1017	-	-	No Storage required
20	1527	-	-	No Storage required
30	1880	-	-	No Storage required
60	2610	-	-	No Storage required
180	5186	-	-	No Storage required
240	5360	-	-	No Storage required

Predicted Storage Requirements 1:10yr

Duration	ARI	Cy	I	A	Qi	Vi
5	10	0.6	**168**	1.035	0.290	87
10	10	0.6	130	1.035	0.224	135
20	10	0.6	96.7	1.035	0.167	200
30	10	0.6	79.3	1.035	0.137	246
60	10	0.6	54.4	1.035	0.094	338
180	10	0.6	35.8	1.035	0.062	667
240	10	0.6	27.7	1.035	0.048	688

Duration	ARI	Cy	I	A	Qi	Vi
5	10	**1**	**168**	2.415	1.127	338
10	10	1.0	130	2.415	0.872	523
20	10	1.0	96.7	2.415	0.649	778
30	10	1.0	79.3	2.415	0.532	958
60	10	1.0	54.4	2.415	0.365	1314
180	10	1.0	35.8	2.415	0.240	2594
240	10	1.0	27.7	2.415	0.186	2676

Duration	Total Storage	Allowable Discharge Volume	Difference In Storage	
5	425	-	-	No Storage required
10	658	-	-	No Storage required
20	979	-	-	No Storage required
30	1204	-	-	No Storage required
60	1652	-	-	No Storage required
180	3261	-	-	No Storage required
240	3364	-	-	No Storage required

Return Period	Storm Duration (mins)	Storage Required
10yr	5.0	
10yr	10.0	
100yr	5.0	
100yr	10.0	

Time of Concentration = 12mins so 227m3 is deemed appropriate.

Water Demand Calculation

Job No: 610.10150.00150
Task: Water Demand

Residential Unit Distribution

Site	Studio	1 Bedroom	2 Bedroom	3 Bedroom	Total per Ownership
Lhuede 1	85	99	51	16	251
Kennards 2	40	74	18	22	154
Four all clothing 3	54	76	12	0	142
Lhuede 4	38	60	22	0	120
Total	217	309	103	38	667

Greenstar Residential Water Usage Estimate

Site	Toilets (L/day)	Bathroom Taps (L/day)	Kitchen Taps (L/day)	Showerheads (L/day)	Washer (L/day)	Total Water Demand (L/day)
Lhuede 1	9842	2953	5624	42180	21170	81769
Kennards 2	5852	1756	3344	25080	12588	48620
Four all clothing 3	5376	1613	3072	23040	11564	44665
Lhuede 4	4816	1445	2752	20640	10359	40012
Total	25886	7766	14792	110940	55681	215065

All assumptions are taken from Greenstar Calculator. The potable water demand is calculated based on the following assumed daily usage rates per person:

Toilets: 4

Wash basins: 7 x 0.15 minutes

Kitchen taps: 4 x 0.5 minutes

Showers: 1 x 8 minutes

Clothes Washers: 2 washes per week per person

Greenstar assumes that sewage flow equates to water demand for each appliance.

Appliance usage data was provided by manufacturers

Department of Natural Resources & Mines Residential Water Usage Estimate

Site	Min Water Demand (L/day)	Peak Water Demand (L/day)	Min Sewage Flow (L/day)	Peak Sewage Flow (L/day)
1 Lhuede	148800	202200	63100	125400
2 Kennards	93400	128600	39850	78600
3 Four all clothing	74600	103000	32850	65700
4 Lhuede	66600	90600	28650	57300
Total	234600	322200	101350	201600

All assumptions are taken from Table A of Department of Natural Resources and Mines Planning guidelines for water supply and sewerage Chapter 5 - summarised below

Department of Natural Resources & Mines Commercial Water Usage Estimate

Site	Retail / Commercial Area (m2)	Min Water Demand (L/day)	Peak Water Demand (L/day)	Min Sewage Flow (L/day)	Peak Sewage Flow (L/day)
1 Lhuede	6498	32490	51984	9747	19494
2 Kennards	363	1815	2904	545	1089
3 Four all clothing	779	3895	6232	1169	2337
4 Lhuede	0	0	0	0	0
Total	7640	38200	61120	11460	22920

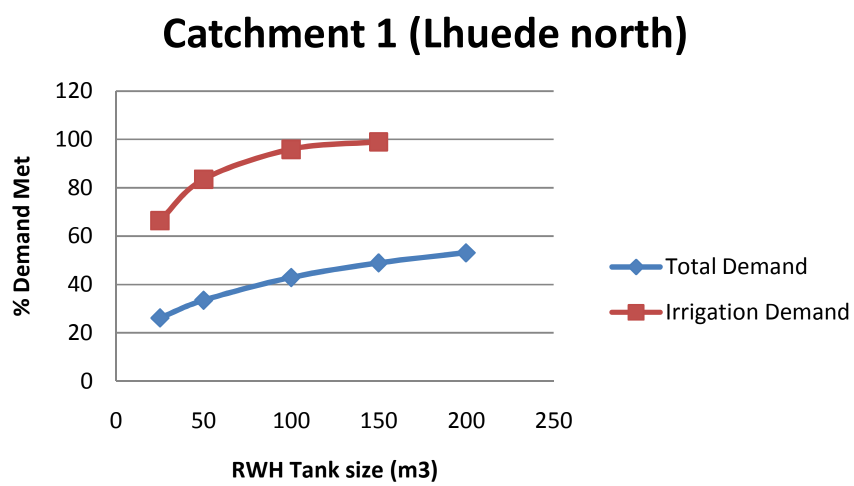
All assumptions are taken from Table A of Department of Natural Resources and Mines Planning guidelines for water supply and sewerage Chapter 5 - summarised below

Department of Natural Resources and Mines Planning guidelines for water supply and sewerage assumptions:

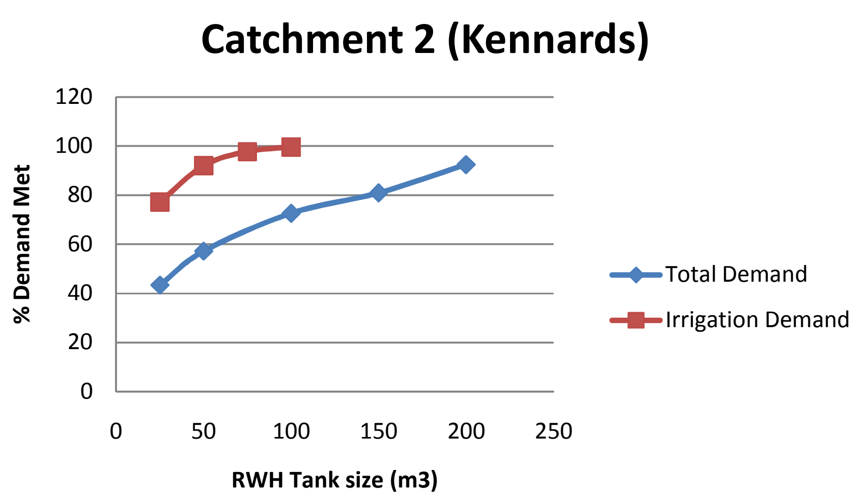
Development	Water Demand	Sewage Flow	Unit
Multiple Units	500 to 700	225 to 450	1 bed unit
Multiple Units	800 to 1000	300 to 600	2 bed unit
Multiple Units	1000 to 1400	400 to 750	3 bed unit
Commercial Premises	500 to 800	150 to 300	$100m^2$ gross floor area

Preliminary Rainwater Harvesting Assessment Graphs

Graph 1

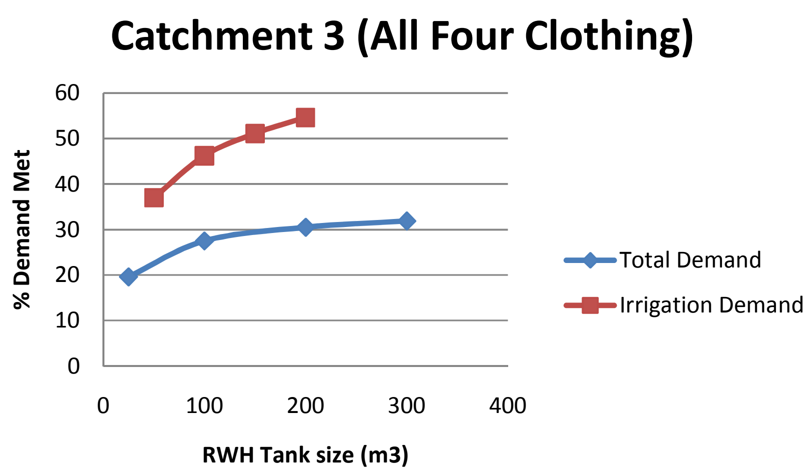


Graph 2

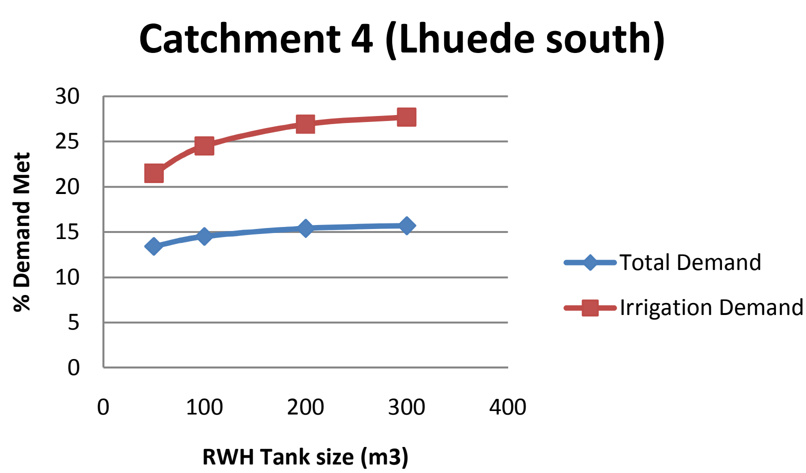


Preliminary Rainwater Harvesting Assessment Graphs

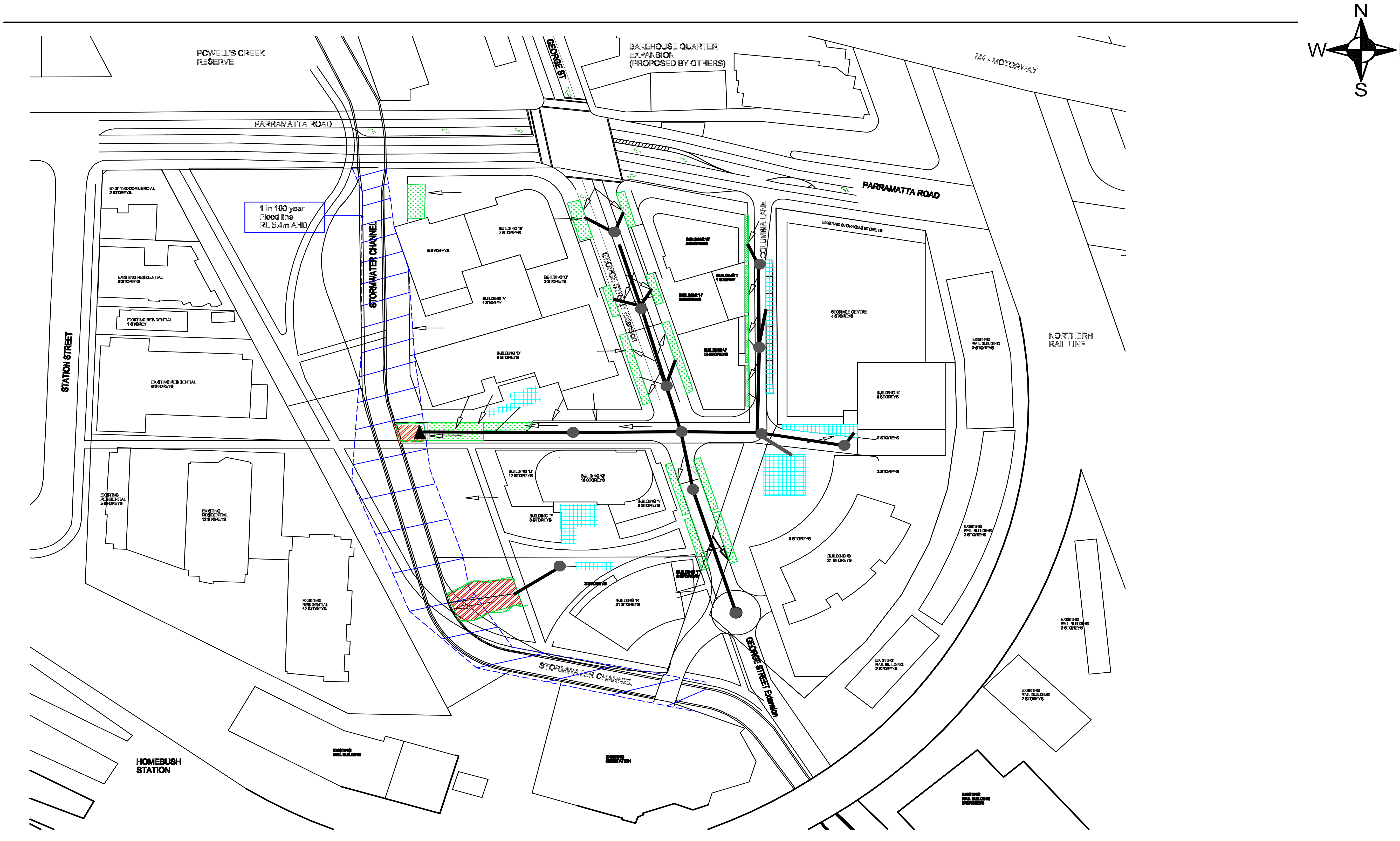
Graph 3



Graph 4



Stormwater Drainage Concept Plan



NOTES

1. Outline stormwater design for concept plan stage
2. Not for construction
3. Do not scale from drawing

LEGEND

- Rain Gardens/Bio-retention
- Vegetated Swale
- Direction of surface water flow
- 1 in 100 year flood level extent RL=5.4m
- Roof water harvest tanks (underground)
- Proposed stormwater drainage
- Gross pollutant trap

Revision	Drawn By	Chkd By	Date	Comments
	KK	JP	08/07/2011	

2 LINCOLN STREET
LANE COVE
NEW SOUTH WALES 2066
AUSTRALIA
T: 61 2 9427 8100
F: 61 2 9427 8200
www.slrconsulting.com

Site: Paramatta Road, Homebush

Project: Columbia Precinct

Drawing: **Stormwater Drainage Concept Plan**

Date: 08/07/2011

Drawing Number: **SDCP-01**

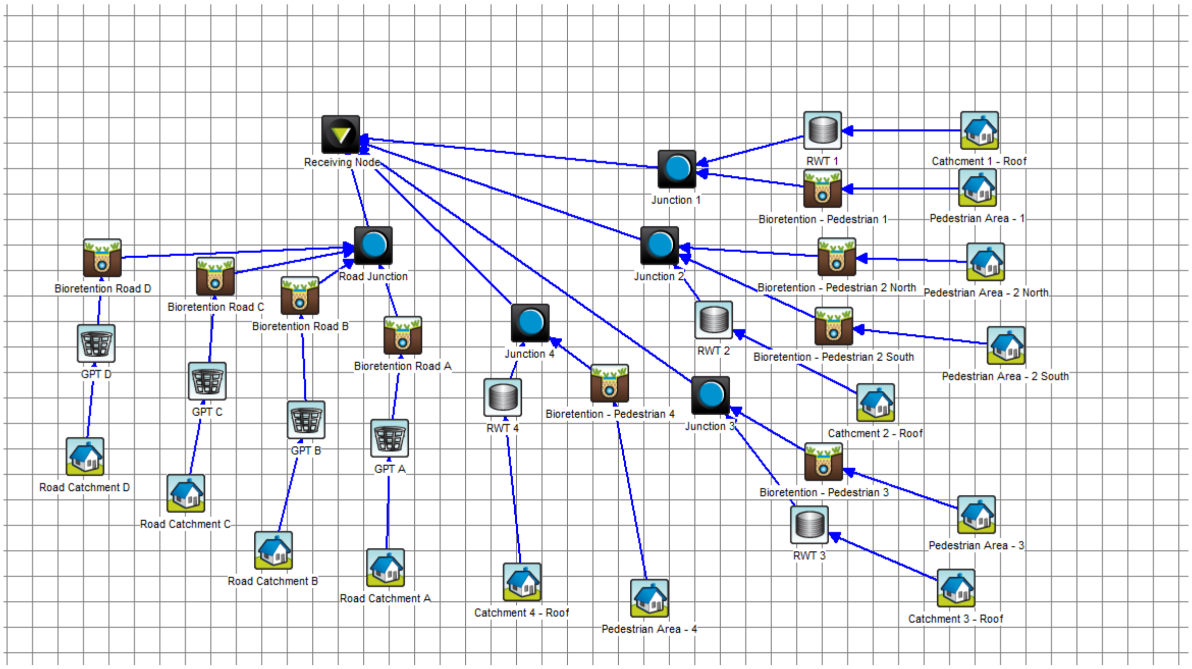
Revision: **1**

Scale: NTS

ACAD Title Block A (A3-A4) v6 2004.1.dwg

Full Modelling Results

MUSIC Treatment Train



MUSIC - Water Quality Modelling Results
Proposed Development - Untreated

Source nodes

Location	Catchment 4 - Roof	Road Catchment A	Pedestrian Area - 2 South	Pedestrian Area - 3	Pedestrian Area - 1	Pedestrian Area - 4	Catchment 3 - Roof	Cathcment 2 - Roof	Cathcment 1 - Roof	Road Catchment B	Pedestrian Area - 2 North	Road Catchment C	Road Catchment D
ID	2	3	4	5	6	7	8	9	10	11	12	13	14
Node Type	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode
Total Area (ha)	0.067	0.118	0.162	0.104	0.264	0.104	0.142	0.648	0.621	0.046	0.025	0.08	0.106
Area Impervious (ha)	0.067	0.118	0.130013921	0.083465727	0.211874537	0.083002996	0.142	0.648	0.621	0.046	0.020063877	0.08	0.106
Area Pervious (ha)	0	0	0.031986079	0.020534273	0.052125463	0.020997004	0	0	0	0	0.004936123	0	0
Field Capacity (mm)	70	70	70	70	70	70	70	70	70	70	70	70	70
Pervious Area Infiltration Capacity coefficient - a	210	210	210	210	210	210	210	210	210	210	210	210	210
Pervious Area Infiltration Capacity exponent - b	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
Impervious Area Rainfall Threshold (mm/day)	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Pervious Area Soil Storage Capacity (mm)	170	170	170	170	170	170	170	170	170	170	170	170	170
Pervious Area Soil Initial Storage (% of Capacity)	30	30	30	30	30	30	30	30	30	30	30	30	30
Groundwater Initial Depth (mm)	10	10	10	10	10	10	10	10	10	10	10	10	10
Groundwater Daily Recharge Rate (%)	50	50	50	50	50	50	50	50	50	50	50	50	50
Groundwater Daily Baseflow Rate (%)	4	4	4	4	4	4	4	4	4	4	4	4	4
Groundwater Daily Deep Seepage Rate (%)	0	0	0	0	0	0	0	0	0	0	0	0	0
Stormflow Total Suspended Solids Mean (log mg/L)	1.3	2.43	0.32	0.32	0.32	0.32	1.3	1.3	1.3	2.43	0.32	2.43	2.43
Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	2.15	2.15	2.15	2.15	0.32	0.32	0.32	0.32	2.15	0.32	0.32
Stormflow Total Suspended Solids Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic
Stormflow Total Suspended Solids Serial Correlation	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-0.6	-0.6	-0.6	-0.6	-0.89	-0.89	-0.89	-0.3	-0.6	-0.3	-0.3
Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Stormflow Total Phosphorus Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic
Stormflow Total Phosphorus Serial Correlation	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.34	0.3	0.34	0.34
Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Stormflow Total Nitrogen Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic
Stormflow Total Nitrogen Serial Correlation	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
Baseflow Total Suspended Solids Mean (log mg/L)	0	0	0.17	0.17	0.17	0.17	0	0	0	0	0.17	0	0
Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0	0	1.2	1.2	1.2	1.2	0	0	0	0	1.2	0	0
Baseflow Total Suspended Solids Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Mean	Stochastic	Stochastic	Stochastic
Baseflow Total Suspended Solids Serial Correlation	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
Baseflow Total Phosphorus Mean (log mg/L)	0	0	-0.85	-0.85	-0.85	-0.85	0	0	0	0	-0.85	0	0
Baseflow Total Phosphorus Standard Deviation (log mg/L)	0	0	0.19	0.19	0.19	0.19	0	0	0	0	0.19	0	0
Baseflow Total Phosphorus Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Mean	Stochastic	Stochastic	Stochastic
Baseflow Total Phosphorus Serial Correlation	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
Baseflow Total Nitrogen Mean (log mg/L)	0	0	0.11	0.11	0.11	0.11	0	0	0	0	0.11	0	0
Baseflow Total Nitrogen Standard Deviation (log mg/L)	0	0	0.12	0.12	0.12	0.12	0	0	0	0	0.12	0	0
Baseflow Total Nitrogen Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Mean	Stochastic	Stochastic	Stochastic
Baseflow Total Nitrogen Serial Correlation	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
OUT - Mean Annual Flow (ML/yr)	0.608	1.07	1.28	0.824	2.09	0.824	1.29	5.89	5.64	0.418	0.198	0.727	0.963
OUT - TSS Mean Annual Load (kg/yr)	18.6	443	1.34E+05	8.63E+04	7.48E+04	8.63E+04	39.5	180	153	139	7.09E+03	266	342
OUT - TP Mean Annual Load (kg/yr)	9.20E-02	0.631	0.368	0.236	0.587	0.236	0.195	0.89	0.811	0.254	5.56E-02	0.406	0.569
OUT - TN Mean Annual Load (kg/yr)	1.31	2.53	2.71	1.74	4.46	1.74	2.78	12.7	12	0.996	0.422	1.69	2.26
OUT - Gross Pollutant Mean Annual Load (kg/yr)	15.6	27.5	34.2	21.9	55.7	21.9	33.1	151	145	10.7	5.27	18.7	24.7
Rain In (ML/yr)	0.699172	1.23138	1.69054	1.08528	2.75495	1.08528	1.48183	6.76215	6.48039	0.480029	0.260885	0.834833	1.10615
ET Loss (ML/yr)	0.0906883	0.15972	0.405745	0.260479	0.661216	0.260479	0.192208	0.877104	0.840566	0.0622641	0.0626147	0.108284	0.143478
Deep Seepage Loss (ML/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
Baseflow Out (ML/yr)	0	0	0.0673676	0.0432483	0.109784	0.0432483	0	0	0	0	0.0103962	0	0
Imp. Stormflow Out (ML/yr)	0.608483	1.07166	1.17701	0.75561	1.91809	0.75561	1.28962	5.88504	5.63982	0.417765	0.181637	0.726548	0.962676
Perv. Stormflow Out (ML/yr)	0	0	0.0385454	0.0247452	0.0628147	0.0247452	0	0	0	0	0.0059484	0	0
Total Stormflow Out (ML/yr)	0.608483	1.07166	1.21555	0.780355	1.9809	0.780355	1.28962	5.88504	5.63982	0.417765	0.187585	0.726548	0.962676
Total Outflow (ML/yr)	0.608483	1.07166	1.28292	0.823603	2.09069	0.823603	1.28962	5.88504	5.63982	0.417765	0.197982	0.726548	0.962676
Change in Soil Storage (ML/yr)	0	0	0.0018695	0.0012002	0.0030466	0.0012002	0	0	0	0	0.0002885	0	0
TSS Baseflow Out (ML/yr)	0	0	3.13592	2.01319	6.47916	2.01319	0	0	0	0	0.613557	0	0
TSS Total Stormflow Out (ML/yr)	18.631	442.633	134399	86280.8	74827.2	86280.8	39.4867	180.193	153.282	138.946	7085.91	266.372	342.236
TSS Total Outflow (ML/yr)	18.631	442.633	134402	86282.8	74833.7	86282.8	39.4867	180.193	153.282	138.946	7086.52	266.372	342.236
TP Baseflow Out (ML/yr)	0	0	0.0106591	0.0068429	0.0166251	0.0068429	0	0	0	0	0.0015743	0	0
TP Total Stormflow Out (ML/yr)	0.0920273	0.630556	0.356928	0.229139	0.570371	0.229139	0.195043	0.890054	0.810819	0.253836	0.0540124	0.40637	0.568668
TP Total Outflow (ML/yr)	0.0920273	0.630556	0.367587	0.235982	0.586996	0.235982	0.195043	0.890054	0.810819	0.253836	0.0555867	0.40637	0.568668
TN Baseflow Out (ML/yr)	0	0	0.0905779	0.0581488	0.146718	0.0581488	0	0	0	0	0.0138937	0	0
TN Total Stormflow Out (ML/yr)	1.30981	2.52939	2.62104	1.68265	4.31177	1.68265	2.77602	12.668	11.9563	0.996049	0.408312	1.68887	2.2555
TN Total Outflow (ML/yr)	1.30981	2.52939	2.71162	1.74079	4.45849	1.74079	2.77602	12.668	11.9563	0.996049	0.422205	1.68887	2.2555
GP Total Outflow (ML/yr)	15.6311	27.5295	34.1748	21.9394	55.6922	21.9394	33.1287	151.179	144.879	10.7318	5.27389	18.664	24.7298

No Imported Data Source nodes

No USTM treatment nodes

No Generic treatment nodes

Other nodes

Location	Receiving Node
ID	1

Node Type	ReceivingNode
IN - Mean Annual Flow (ML/yr)	21.8
IN - TSS Mean Annual Load (kg/yr)	3.90E+05
IN - TP Mean Annual Load (kg/yr)	5.33
IN - TN Mean Annual Load (kg/yr)	47.3
IN - Gross Pollutant Mean Annual Load (kg/yr)	565
OUT - Mean Annual Flow (ML/yr)	0
OUT - TSS Mean Annual Load (kg/yr)	0
OUT - TP Mean Annual Load (kg/yr)	0
OUT - TN Mean Annual Load (kg/yr)	0
OUT - Gross Pollutant Mean Annual Load (kg/yr)	0

Links

Location	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link
Source node ID	14	13	11	2	3	7	8	5	9	4	12	6	10
Target node ID	1	1	1	1	1	1	1	1	1	1	1	1	1
Muskingum-Cunge Routing	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed
Muskingum K													
Muskingum theta													
IN - Mean Annual Flow (ML/yr)	0.963	0.727	0.418	0.608	1.07	0.824	1.29	0.824	5.89	1.28	0.198	2.09	5.64
IN - TSS Mean Annual Load (kg/yr)	342	266	139	18.6	443	8.63E+04	39.5	8.63E+04	180	1.34E+05	7.09E+03	7.48E+04	153
IN - TP Mean Annual Load (kg/yr)	0.569	0.406	0.254	9.20E-02	0.631	0.236	0.195	0.236	0.89	0.368	5.56E-02	0.587	0.811
IN - TN Mean Annual Load (kg/yr)	2.26	1.69	0.996	1.31	2.53	1.74	2.78	1.74	12.7	2.71	0.422	4.46	12
IN - Gross Pollutant Mean Annual Load (kg/yr)	24.7	18.7	10.7	15.6	27.5	21.9	33.1	21.9	151	34.2	5.27	55.7	145
OUT - Mean Annual Flow (ML/yr)	0.963	0.727	0.418	0.608	1.07	0.824	1.29	0.824	5.89	1.28	0.198	2.09	5.64
OUT - TSS Mean Annual Load (kg/yr)	342	266	139	18.6	443	8.63E+04	39.5	8.63E+04	180	1.34E+05	7.09E+03	7.48E+04	153
OUT - TP Mean Annual Load (kg/yr)	0.569	0.406	0.254	9.20E-02	0.631	0.236	0.195	0.236	0.89	0.368	5.56E-02	0.587	0.811
OUT - TN Mean Annual Load (kg/yr)	2.26	1.69	0.996	1.31	2.53	1.74	2.78	1.74	12.7	2.71	0.422	4.46	12
OUT - Gross Pollutant Mean Annual Load (kg/yr)	24.7	18.7	10.7	15.6	27.5	21.9	33.1	21.9	151	34.2	5.27	55.7	145

675.10150 MUSIC -Water Quality Modelling
Proposed Development - Treated Results

Source nodes

Location	Catchment 4 - Roof	Road Catchment A	Pedestrian Area - 2 South	Pedestrian Area - 3	Pedestrian Area - 1	Pedestrian Area - 4	Catchment 3 - Roof	Cathcment 2 - Roof	Cathcment 1 - Roof	Road Catchment B	Pedestrian Area - 2 North	Road Catchment C	Road Catchment D
ID	2	4	5	8	9	11	14	15	16	17	21	26	27
Node Type	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode
Total Area (ha)	0.067	0.118	0.162	0.104	0.264	0.104	0.142	0.648	0.621	0.046	0.025	0.08	0.106
Area Impervious (ha)	0.067	0.118	0.130013921	0.083465727	0.211874537	0.083002996	0.142	0.648	0.621	0.046	0.020063877	0.08	0.106
Area Pervious (ha)	0	0	0.031986079	0.020534273	0.052125463	0.020997004	0	0	0	0	0.004936123	0	0
Field Capacity (mm)	70	70	70	70	70	70	70	70	70	70	70	70	70
Pervious Area Infiltration Capacity coefficient - a	210	210	210	210	210	210	210	210	210	210	210	210	210
Pervious Area Infiltration Capacity exponent - b	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
Impervious Area Rainfall Threshold (mm/day)	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Pervious Area Soil Storage Capacity (mm)	170	170	170	170	170	170	170	170	170	170	170	170	170
Pervious Area Soil Initial Storage (% of Capacity)	30	30	30	30	30	30	30	30	30	30	30	30	30
Groundwater Initial Depth (mm)	10	10	10	10	10	10	10	10	10	10	10	10	10
Groundwater Daily Recharge Rate (%)	50	50	50	50	50	50	50	50	50	50	50	50	50
Groundwater Daily Baseflow Rate (%)	4	4	4	4	4	4	4	4	4	4	4	4	4
Groundwater Daily Deep Seepage Rate (%)	0	0	0	0	0	0	0	0	0	0	0	0	0
Stormflow Total Suspended Solids Mean (log mg/L)	1.3	2.43	0.32	0.32	0.32	0.32	1.3	1.3	1.3	2.43	0.32	2.43	2.43
Stormflow Total Suspended Solids Standard Deviation (log mg/L)	0.32	0.32	2.15	2.15	2.15	2.15	0.32	0.32	0.32	0.32	2.15	0.32	0.32
Stormflow Total Suspended Solids Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic
Stormflow Total Suspended Solids Serial Correlation	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
Stormflow Total Phosphorus Mean (log mg/L)	-0.89	-0.3	-0.6	-0.6	-0.6	-0.6	-0.89	-0.89	-0.89	-0.3	-0.6	-0.3	-0.3
Stormflow Total Phosphorus Standard Deviation (log mg/L)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Stormflow Total Phosphorus Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic
Stormflow Total Phosphorus Serial Correlation	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
Stormflow Total Nitrogen Mean (log mg/L)	0.3	0.34	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.34	0.3	0.34	0.34
Stormflow Total Nitrogen Standard Deviation (log mg/L)	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Stormflow Total Nitrogen Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic
Stormflow Total Nitrogen Serial Correlation	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
Baseflow Total Suspended Solids Mean (log mg/L)	0	0	0.17	0.17	0.17	0.17	0	0	0	0	0.17	0	0
Baseflow Total Suspended Solids Standard Deviation (log mg/L)	0	0	1.2	1.2	1.2	1.2	0	0	0	0	1.2	0	0
Baseflow Total Suspended Solids Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Mean	Stochastic	Stochastic	Stochastic
Baseflow Total Suspended Solids Serial Correlation	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
Baseflow Total Phosphorus Mean (log mg/L)	0	0	-0.85	-0.85	-0.85	-0.85	0	0	0	0	-0.85	0	0
Baseflow Total Phosphorus Standard Deviation (log mg/L)	0	0	0.19	0.19	0.19	0.19	0	0	0	0	0.19	0	0
Baseflow Total Phosphorus Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Mean	Stochastic	Stochastic	Stochastic
Baseflow Total Phosphorus Serial Correlation	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
Baseflow Total Nitrogen Mean (log mg/L)	0	0	0.11	0.11	0.11	0.11	0	0	0	0	0.11	0	0
Baseflow Total Nitrogen Standard Deviation (log mg/L)	0	0	0.12	0.12	0.12	0.12	0	0	0	0	0.12	0	0
Baseflow Total Nitrogen Estimation Method	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Stochastic	Mean	Stochastic	Stochastic	Stochastic
Baseflow Total Nitrogen Serial Correlation	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
OUT - Mean Annual Flow (ML/yr)	0.608	1.07	1.28	0.824	2.09	0.824	1.29	5.89	5.64	0.418	0.198	0.727	0.963
OUT - TSS Mean Annual Load (kg/yr)	17.4	402	6.18E+03	8.09E+04	1.09E+05	7.69E+04	35.1	148	140	147	1.26E+03	248	339
OUT - TP Mean Annual Load (kg/yr)	8.90E-02	0.621	0.358	0.251	0.628	0.229	0.185	0.865	0.907	0.25	5.51E-02	0.406	0.53
OUT - TN Mean Annual Load (kg/yr)	1.48	2.53	2.69	1.74	4.79	1.96	2.73	12.6	12.2	1.04	0.389	1.7	2.31
OUT - Gross Pollutant Mean Annual Load (kg/yr)	15.6	27.5	34.2	21.9	55.7	21.9	33.1	151	145	10.7	5.27	18.7	24.7
Rain In (ML/yr)	0.699172	1.23138	1.69054	1.08528	2.75495	1.08528	1.48183	6.76215	6.48039	0.480029	0.260885	0.834833	1.10615
ET Loss (ML/yr)	0.0906883	0.15972	0.405745	0.260479	0.661216	0.260479	0.192208	0.877104	0.840566	0.0622641	0.0626147	0.108284	0.143478
Deep Seepage Loss (ML/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
Baseflow Out (ML/yr)	0	0	0.0673676	0.0432483	0.109784	0.0432483	0	0	0	0	0.0103962	0	0
Imp. Stormflow Out (ML/yr)	0.608483	1.07166	1.17701	0.75561	1.91809	0.75561	1.28962	5.88504	5.63982	0.417765	0.181637	0.726548	0.962676
Perv. Stormflow Out (ML/yr)	0	0	0.0385454	0.0247452	0.0628147	0.0247452	0	0	0	0	0.0059484	0	0
Total Stormflow Out (ML/yr)	0.608483	1.07166	1.21555	0.780355	1.9809	0.780355	1.28962	5.88504	5.63982	0.417765	0.187585	0.726548	0.962676
Total Outflow (ML/yr)	0.608483	1.07166	1.28292	0.823603	2.09069	0.823603	1.28962	5.88504	5.63982	0.417765	0.197982	0.726548	0.962676
Change in Soil Storage (ML/yr)	0	0	0.0018695	0.0012002	0.0030466	0.0012002	0	0	0	0	0.0002885	0	0
TSS Baseflow Out (ML/yr)	0	0	2.70627	1.55944	4.32092	1.3713	0	0	0	0	0.598283	0	0
TSS Total Stormflow Out (ML/yr)	17.3578	402.113	6173.27	80896.1	109035	76899.4	35.098	148.372	140.383	146.682	1262.48	247.584	339.462
TSS Total Outflow (ML/yr)	17.3578	402.113	6175.97	80897.7	109039	76900.7	35.098	148.372	140.383	146.682	1263.08	247.584	339.462
TP Baseflow Out (ML/yr)	0	0	0.0105432	0.0065945	0.0171757	0.0067232	0	0	0	0	0.0015973	0	0
TP Total Stormflow Out (ML/yr)	0.0889659	0.621444	0.347549	0.24487	0.610436	0.222512	0.184579	0.864681	0.907481	0.250335	0.053493	0.405757	0.530015
TP Total Outflow (ML/yr)	0.0889659	0.621444	0.358092	0.251465	0.627612	0.229236	0.184579	0.864681	0.907481	0.250335	0.0550903	0.405757	0.530015
TN Baseflow Out (ML/yr)	0	0	0.0911317	0.0584569	0.147812	0.0579592	0	0	0	0	0.013958	0	0
TN Total Stormflow Out (ML/yr)	1.47554	2.5345	2.59462	1.68082	4.64529	1.89714	2.72789	12.5857	12.1799	1.04198	0.374639	1.70051	2.31008
TN Total Outflow (ML/yr)	1.47554	2.5345	2.68575	1.73927	4.7931	1.9551	2.72789	12.5857	12.1799	1.04198	0.388597	1.70051	2.31008
GP Total Outflow (ML/yr)	15.6311	27.5295	34.1748	21.9394	55.6922	21.9394	33.1287	151.179	144.879	10.7318	5.27389	18.664	24.7298

No Imported Data Source nodes

USTM treatment nodes

Location	Bioretention Road B	Bioretention - Pedest	Bioretention - Pedestrian 3	Bioretention - Pedestri	Bioretention - Pedest	RWT 2	Bioretention Road A	Bioretention Road C	Bioretention Road D	RWT 1	RWT 3	RWT 4	Bioretention - Pedestrian 2 North
ID	3	6	7	10	12	13	23	25	29	30	31	32	36
Node Type	BioRetentionNodeV4	BioRetentionNodeV4	BioRetentionNodeV4	BioRetentionNodeV4	BioRetentionNodeV4	RainWaterTankNode	BioRetentionNodeV4	BioRetentionNodeV4	BioRetentionNodeV4	RainWaterTankNode	RainWaterTankNode	RainWaterTankNode	BioRetentionNodeV4
Lo-flow bypass rate (cum/sec)	0	0	0	0	0	0	0	0	0	0	0	0	0
Hi-flow bypass rate (cum/sec)	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.1	0.3	0.3	0.3	0.1
Inlet pond volume						0				0	0	0	
Area (sqm)	9	24	15	36	12.5	87.5	20	15	18	75	50	15	5
Extended detention depth (m)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Permanent pool volume (cum)						175				150	100	50	
Proportion vegetated						0				0	0	0	
Equivalent pipe diameter (mm)						50				50	50	50	
Overflow weir width (m)	1	0.2	0.2	1	1	10	1	1	1	10	10	10	1
Notional Detention Time (hrs)						1.87				1.6	1.07	0.32	
Orifice discharge coefficient						0.6				0.6	0.6	0.6	
Weir coefficient	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Number of CSTR cells	3	3	3	3	3	2	3	3	3	2	2	2	3
Total Suspended Solids k (m/yr)	8000	8000	8000	8000	8000	400	8000	8000	8000	400	400	400	8000
Total Suspended Solids C* (mg/L)	20	20	20	20	20	12	20	20	20	12	12	12	20
Total Suspended Solids C** (mg/L)						12				12	12	12	
Total Phosphorus k (m/yr)	6000	6000	6000	6000	6000	300	6000	6000	6000	300	300	300	6000
Total Phosphorus C* (mg/L)	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Total Phosphorus C** (mg/L)						0.13				0.13	0.13	0.13	
Total Nitrogen k (m/yr)	500	500	500	500	500	40	500	500	500	40	40	40	500
Total Nitrogen C* (mg/L)	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Total Nitrogen C** (mg/L)						1.4				1.4	1.4	1.4	
Threshold hydraulic loading for C** (m/yr)						3500				3500	3500	3500	
Horizontal Flow Coefficient	3	3	3	3	3		3	3	3				3
Extraction for Re-use	Off	Off	Off	Off	Off	On	Off	Off	Off	On	On	On	Off
Annual Re-use Demand - scaled by daily PET (ML)						0				0	0	0	
Annual Re-use Demand - scaled by daily PET - Rain (ML)						0.585				0.824	2.018	2.307	

Constant Daily Re-use Demand (kL)						5.852				9.842	5.376	0	
User-defined Annual Re-use Demand (ML)						0				0	0	0.004816	
Percentage of User-defined Annual Re-use Demand Jan						23.97				23.97	23.97	23.97	
Percentage of User-defined Annual Re-use Demand Feb						0.38				0.38	0.38	0.38	
Percentage of User-defined Annual Re-use Demand Mar						0.29				0.29	0.29	0.29	
Percentage of User-defined Annual Re-use Demand Apr						0.11				0.11	0.11	0.11	
Percentage of User-defined Annual Re-use Demand May						0.03				0.03	0.03	0.03	
Percentage of User-defined Annual Re-use Demand Jun						0.3				0.3	0.3	0.3	
Percentage of User-defined Annual Re-use Demand Jul						0.29				0.29	0.29	0.29	
Percentage of User-defined Annual Re-use Demand Aug						0.29				0.29	0.29	0.29	
Percentage of User-defined Annual Re-use Demand Sep						7.99				7.99	7.99	7.99	
Percentage of User-defined Annual Re-use Demand Oct						18.17				18.17	18.17	18.17	
Percentage of User-defined Annual Re-use Demand Nov						19.6				19.6	19.6	19.6	
Percentage of User-defined Annual Re-use Demand Dec						28.58				28.58	28.58	28.58	
User-defined Re-use File													
Filter area (sqm)	6.75	18	11.25	27	9.4		15	11.25	13.5				3.75
Filter perimeter (m)	6.75	18	11.25	27	9.4		15	11.25	13.5				3.75
Filter depth (m)	0.6	0.6	0.6	0.6	0.6		0.6	0.6	0.6				0.6
Filter median particle diameter (mm)													
Saturated hydraulic conductivity (mm/hr)	200	200	200	200	200		200	200	200				200
Infiltration Media Porosity	0.35	0.35	0.35	0.35	0.35		0.35	0.35	0.35				0.35
Length (m)													
Bed slope													
Base Width (m)													
Top width (m)													
Vegetation height (m)													
Vegetation Type	Vegetated with Effectiv	Vegetated with Effect	Vegetated with Effective Nutri	Vegetated with Effecti	Vegetated with Effect		Vegetated with Effectiv	Vegetated with Effectiv	Vegetated with Effect				Vegetated with Effective Nutrient Removal Plants
Total Nitrogen Content in Filter (mg/kg)	800	800	800	800	800		800	800	800				800
Proportion of Organic Material in Filter (%)	<5	<5	<5	<5	<5		<5	<5	<5				<5
Orthophosphate Content in Filter (mg/kg)	<55	<55	<55	<55	<55		<55	<55	<55				<55
Is Base Lined?	No	No	No	No	No		No	No	No				No
Is Underdrain Present?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes				Yes
Is Submerged Zone Present?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes				Yes
Submerged Zone Depth (m)	0.29	0.29	0.29	0.29	0.29	-9999	0.29	0.29	0.29	-9999	-9999	-9999	0.29
B for Media Soil Texture	13	13	13	13	13		13	13	13				13
Proportion of upstream impervious area treated						0				0	0	0	
Exfiltration Rate (mm/hr)	0	0	0	0	0	0	0	0	0	0	0	0	0
Evap Loss as proportion of PET													
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	0.61	0.61	0.61	0.61	0.61		0.61	0.61	0.61				0.61
S*	0.37	0.37	0.37	0.37	0.37		0.37	0.37	0.37				0.37
Sw	0.11	0.11	0.11	0.11	0.11		0.11	0.11	0.11				0.11
Sh	0.05	0.05	0.05	0.05	0.05		0.05	0.05	0.05				0.05
Emax (m/day)	0.008	0.008	0.008	0.008	0.008		0.008	0.008	0.008				0.008
Ew (m/day)	0.001	0.001	0.001	0.001	0.001	5.89	0.001	0.001	0.001	5.64	1.29	0.608	0.001
IN - Mean Annual Flow (ML/yr)	0.418	1.28	0.824	2.09	0.824	148	1.07	0.727	0.963	140	35.1	17.4	0.198
IN - TSS Mean Annual Load (kg/yr)	146	6.18E+03	8.09E+04	1.09E+05	7.69E+04	0.865	401	249	337	0.907	0.185	8.90E-02	1.26E+03
IN - TP Mean Annual Load (kg/yr)	0.25	0.358	0.251	0.628	0.229	12.6	0.621	0.406	0.53	12.2	2.73	1.48	5.51E-02
IN - TN Mean Annual Load (kg/yr)	1.04	2.69	1.74	4.79	1.96	151	2.53	1.7	2.31	145	33.1	15.6	0.389
IN - Gross Pollutant Mean Annual Load (kg/yr)	3.52E-03	34.2	21.9	55.7	21.9	3.61	9.02E-03	6.11E-03	8.10E-03	3.06	0.204	0.116	5.27
OUT - Mean Annual Flow (ML/yr)	0.4	1.23	0	2.01	0.797	58.9	1.03	0.698	0.928	55.1	2.82	2.26	0.188
OUT - TSS Mean Annual Load (kg/yr)	3.74	5.87	0	164	504	0.493	9.67	5.16	7.17	0.439	2.58E-02	1.56E-02	0.769
OUT - TP Mean Annual Load (kg/yr)	2.78E-02	7.83E-02	0	0.135	5.45E-02	7	7.70E-02	4.66E-02	6.58E-02	5.99	0.385	0.309	1.12E-02
OUT - TN Mean Annual Load (kg/yr)	0.324	0.819	0	1.5	0.661	0	0.836	0.566	0.76	0	0	0	0.104
OUT - Gross Pollutant Mean Annual Load (kg/yr)	0	0	0	0	0	5.88504	0	0	0	5.63982	1.28962	0.608483	0
Flow In (ML/yr)	0.417765	1.28292	0	2.09069	0.823603	0	1.07166	0.726548	0.962676	0	0	0	0.197982
ET Loss (ML/yr)	0.0172102	0.0502341	0	0.0754936	0.0263506	0	0.0383317	0.0287042	0.0344975	0	0	0	0.0103713
Infiltration Loss (ML/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
Low Flow Bypass Out (ML/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
High Flow Bypass Out (ML/yr)	0	0	0	0	0	2.75657	0	0	0	2.30143	0.186597	0.116323	0
Orifice / Filter Out (ML/yr)	0.357289	1.06857	0	1.71889	0.662354	0.851035	0.899611	0.618491	0.808337	0.75364	0.0178541	0	0.169389
Weir Out (ML/yr)	0.0431771	0.163825	0	0.295866	0.134743	0	0.133521	0.0792067	0.119666	0	0	0	0.018159
Transfer Function Out (ML/yr)	0	0	0	0	0	2.28464	0	0	0	2.59352	1.09517	0.497185	0
Reuse Supplied (ML/yr)	0	0	0	0	0	2.72321	0	0	0	3.59526	3.98353	2.3137	0
Reuse Requested (ML/yr)	0	0	0	0	0	83.8954	0	0	0	72.1372	27.4923	21.4887	0
% Reuse Demand Met	0	0	0	0	0	38.6987	0	0	0	45.8305	84.1465	80.8831	0
% Load Reduction	4.14099	3.93833	0	3.63206	3.21827	148.372	3.59497	3.97092	3.60171	140.383	35.098	17.3578	5.26973
TSS Flow In (kg/yr)	146.353	6175.95	0	109039	76900.5	0	400.776	249.446	336.926	0	0	0	1263.07
TSS ET Loss (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
TSS Infiltration Loss (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
TSS Low Flow Bypass Out (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
TSS High Flow Bypass Out (kg/yr)	0	0	0	0	0	44.5523	0	0	0	39.1451	2.59894	2.255	0
TSS Orifice / Filter Out (kg/yr)	0.714577	2.13714	0	3.43777	1.32471	14.3876	1.79922	1.23698	1.61667	15.9297	0.222809	0	0.338779
TSS Weir Out (kg/yr)	3.02647	3.73748	0	160.409	502.957	0	7.8667	3.91889	5.55092	0	0	0	0.429748
TSS Transfer Function Out (kg/yr)	0	0	0	0	0	28.9287	0	0	0	33.1964	13.5178	6.41198	0
TSS Reuse Supplied (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
TSS Reuse Requested (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
TSS % Reuse Demand Met	0	0	0	0	0	60.2755	0	0	0	60.7682	91.9604	87.0088	0
TSS % Load Reduction	97.4438	99.9049	0	99.8497	99.3442	0.86468	97.5882	97.9331	97.8727	0.907482	0.184579	0.088966	99.9392
TP Flow In (kg/yr)	0.250337	0.358093	0	0.627611	0.229236	0	0.621447	0.405759	0.530019	0	0	0	0.0550903
TP ET Loss (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
TP Infiltration Loss (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
TP Low Flow Bypass Out (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
TP High Flow Bypass Out (kg/yr)	0	0	0	0	0	0.376903	0	0	0	0.328746	0.0238033	0.0156389	0
TP Orifice / Filter Out (kg/yr)	0.0198296	0.0534305	0	0.0859444	0.0331203	0.116539	0.0499665	0.0343176	0.0448978	0.110148	0.0019488	0	0.0084695
TP Weir Out (kg/yr)	0.0080098	0.0249012	0	0.0492807	0.0214142	0	0.0269954	0.0122797	0.0209261	0	0	0	0.0027415
TP Transfer Function Out (kg/yr)	0	0	0	0	0	0.299591	0	0	0	0.344479	0.143085	0.0653094	0
TP Reuse Supplied (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
TP Reuse Requested (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
TP % Reuse Demand Met	0	0	0	0	0	42.9335	0	0	0	51.636	86.0482	82.4215	0
TP % Load Reduction	88.8792	78.1253	0	78.454	76.2103	12.5857	87.6157	88.516	87.5808	12.1799	2.72789	1.47554	79.6498
TN Flow In (kg/yr)	1.04199	2.68575	0	4.7931	1.9551	0	2.53451	1.70051	2.31009	0	0	0	0.388597
TN ET Loss (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
TN Infiltration Loss (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
TN Low Flow Bypass Out (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0

TN High Flow Bypass Out (kg/yr)	0	0	0	0	0	5.33463	0	0	0	4.57013	0.345253	0.309192	0
TN Orifice / Filter Out (kg/yr)	0.228147	0.502291	0	0.807878	0.311386	1.665	0.576474	0.394765	0.518012	1.41953	0.040046	0	0.0796132
TN Weir Out (kg/yr)	0.0954196	0.316896	0	0.694619	0.349205	0	0.259695	0.171059	0.241701	0	0	0	0.0243557
TN Transfer Function Out (kg/yr)	0	0	0	0	0	3.96018	0	0	0	4.66722	1.86936	0.94273	0
TN Reuse Supplied (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
TN Reuse Requested (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
TN % Reuse Demand Met	0	0	0	0	0	44.3843	0	0	0	50.8234	85.8756	79.0454	0
TN % Load Reduction	68.9471	69.4988	0	68.653	66.2119	151.179	67.0086	66.7262	67.1132	144.879	33.1286	15.6311	73.2451
GP Flow In (kg/yr)	0.0035151	34.1748	0	55.6923	21.9394	0	0.0090169	0.0061132	0.0081	0	0	0	5.27389
GP ET Loss (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
GP Infiltration Loss (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
GP Low Flow Bypass Out (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
GP High Flow Bypass Out (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
GP Orifice / Filter Out (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
GP Weir Out (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
GP Transfer Function Out (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
GP Reuse Supplied (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
GP Reuse Requested (kg/yr)	0	0	0	0	0	0	0	0	0	0	0	0	0
GP % Reuse Demand Met	0	0	0	0	0	100	0	0	0	100	100	100	0
GP % Load Reduction	100	100	100	100	100	100	100	100	100				

Generic treatment nodes

Location	GPT B	GPT A	GPT C	GPT D
ID	18	22	24	28
Node Type	GPTNode	GPTNode	GPTNode	GPTNode
Lo-flow bypass rate (cum/sec)	0	0	0	0
Hi-flow bypass rate (cum/sec)	0.1	0.1	0.1	0.1
Flow Transfer Function				
Input (cum/sec)	0	0	0	0
Output (cum/sec)	0	0	0	0
Input (cum/sec)	10	10	10	10
Output (cum/sec)	10	10	10	10
Input (cum/sec)				
Output (cum/sec)				
Input (cum/sec)				
Output (cum/sec)				
Input (cum/sec)				
Output (cum/sec)				
Input (cum/sec)				
Output (cum/sec)				
Input (cum/sec)				
Output (cum/sec)				
Input (cum/sec)				
Output (cum/sec)				
Input (cum/sec)				
Output (cum/sec)				
Input (cum/sec)				
Output (cum/sec)				
Gross Pollutant Transfer Function				
Input (kg/ML)	0	0	0	0
Output (kg/ML)	0	0	0	0
Input (kg/ML)	15.18696037	15.18696037	15.18696037	15.18696037
Output (kg/ML)	0.004974302	0.004974302	0.004974302	0.004974302
Input (kg/ML)				
Output (kg/ML)				
Input (kg/ML)				
Output (kg/ML)				
Input (kg/ML)				
Output (kg/ML)				
Input (kg/ML)				
Output (kg/ML)				
Input (kg/ML)				
Output (kg/ML)				
Input (kg/ML)				
Output (kg/ML)				
Input (kg/ML)				
Output (kg/ML)				
Input (kg/ML)				
Output (kg/ML)				
Total Nitrogen Transfer Function				
Input (mg/L)	0	0	0	0
Output (mg/L)	0	0	0	0
Input (mg/L)	50	50	50	50
Output (mg/L)	50	50	50	50
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
Total Phosphorus Transfer Function				
Input (mg/L)	0	0	0	0
Output (mg/L)	0	0	0	0
Input (mg/L)	5.0123604	5.0123604	5.0123604	5.0123604
Output (mg/L)	5.012387512	5.012387512	5.012387512	5.012387512
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				

Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
Total Suspended Solids Transfer Function				
Input (mg/L)	0	0	0	0
Output (mg/L)	0	0	0	0
Input (mg/L)	1014.439423	1005.790646	1018.845759	1054.18154
Output (mg/L)	1012.168518	1002.447284	1026.506174	1046.306332
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
Input (mg/L)				
Output (mg/L)				
IN - Mean Annual Flow (ML/yr)	0.418	1.07	0.727	0.963
IN - TSS Mean Annual Load (kg/yr)	147	402	248	339
IN - TP Mean Annual Load (kg/yr)	0.25	0.621	0.406	0.53
IN - TN Mean Annual Load (kg/yr)	1.04	2.53	1.7	2.31
IN - Gross Pollutant Mean Annual Load (kg/yr)	10.7	27.5	18.7	24.7
OUT - Mean Annual Flow (ML/yr)	0.418	1.07	0.727	0.963
OUT - TSS Mean Annual Load (kg/yr)	146	401	249	337
OUT - TP Mean Annual Load (kg/yr)	0.25	0.621	0.406	0.53
OUT - TN Mean Annual Load (kg/yr)	1.04	2.53	1.7	2.31
OUT - Gross Pollutant Mean Annual Load (kg/yr)	3.52E-03	9.02E-03	6.11E-03	8.10E-03
Flow In (ML/yr)	0.417765	1.07166	0.726548	0.962676
ET Loss (ML/yr)	0	0	0	0
Infiltration Loss (ML/yr)	0	0	0	0
Low Flow Bypass Out (ML/yr)	0	0	0	0
High Flow Bypass Out (ML/yr)	0	0	0	0
Orifice / Filter Out (ML/yr)	0	0	0	0
Weir Out (ML/yr)	0	0	0	0
Transfer Function Out (ML/yr)	0.417765	1.07166	0.726548	0.962676
Reuse Supplied (ML/yr)	0	0	0	0
Reuse Requested (ML/yr)	0	0	0	0
% Reuse Demand Met	0	0	0	0
% Load Reduction	0	0	0	0
TSS Flow In (kg/yr)	146.682	402.112	247.584	339.462
TSS ET Loss (kg/yr)	0	0	0	0
TSS Infiltration Loss (kg/yr)	0	0	0	0
TSS Low Flow Bypass Out (kg/yr)	0	0	0	0
TSS High Flow Bypass Out (kg/yr)	0	0	0	0
TSS Orifice / Filter Out (kg/yr)	0	0	0	0
TSS Weir Out (kg/yr)	0	0	0	0
TSS Transfer Function Out (kg/yr)	146.353	400.776	249.445	336.926
TSS Reuse Supplied (kg/yr)	0	0	0	0
TSS Reuse Requested (kg/yr)	0	0	0	0
TSS % Reuse Demand Met	0	0	0	0
TSS % Load Reduction	0.22379	0.3324	-0.751886	0.747011
TP Flow In (kg/yr)	0.250335	0.621444	0.405757	0.530015
TP ET Loss (kg/yr)	0	0	0	0
TP Infiltration Loss (kg/yr)	0	0	0	0
TP Low Flow Bypass Out (kg/yr)	0	0	0	0
TP High Flow Bypass Out (kg/yr)	0	0	0	0
TP Orifice / Filter Out (kg/yr)	0	0	0	0
TP Weir Out (kg/yr)	0	0	0	0
TP Transfer Function Out (kg/yr)	0.250337	0.621447	0.405759	0.530018
TP Reuse Supplied (kg/yr)	0	0	0	0
TP Reuse Requested (kg/yr)	0	0	0	0
TP % Reuse Demand Met	0	0	0	0
TP % Load Reduction	-0.00055925	-0.000563205	-0.000517552	-0.000603757
TN Flow In (kg/yr)	1.04198	2.5345	1.7005	2.31008
TN ET Loss (kg/yr)	0	0	0	0
TN Infiltration Loss (kg/yr)	0	0	0	0
TN Low Flow Bypass Out (kg/yr)	0	0	0	0
TN High Flow Bypass Out (kg/yr)	0	0	0	0
TN Orifice / Filter Out (kg/yr)	0	0	0	0
TN Weir Out (kg/yr)	0	0	0	0
TN Transfer Function Out (kg/yr)	1.04198	2.5345	1.7005	2.31008
TN Reuse Supplied (kg/yr)	0	0	0	0
TN Reuse Requested (kg/yr)	0	0	0	0
TN % Reuse Demand Met	0	0	0	0
TN % Load Reduction	0	0	0	0
GP Flow In (kg/yr)	10.7318	27.5294	18.664	24.7298
GP ET Loss (kg/yr)	0	0	0	0
GP Infiltration Loss (kg/yr)	0	0	0	0
GP Low Flow Bypass Out (kg/yr)	0	0	0	0
GP High Flow Bypass Out (kg/yr)	0	0	0	0
GP Orifice / Filter Out (kg/yr)	0	0	0	0
GP Weir Out (kg/yr)	0	0	0	0
GP Transfer Function Out (kg/yr)	0.00351507	0.00901694	0.00611317	0.00809997
GP Reuse Supplied (kg/yr)	0	0	0	0
GP Reuse Requested (kg/yr)	0	0	0	0
GP % Reuse Demand Met	0	0	0	0
GP % Load Reduction	100	100	100	100

Other nodes

Location	Receiving Node	Junction 1	Road Junction	Junction 3	Junction 4	Junction 2
ID	1	19	20	33	34	35
Node Type	ReceivingNode	JunctionNode	JunctionNode	JunctionNode	JunctionNode	JunctionNode
IN - Mean Annual Flow (ML/yr)	0	5.07	3.06	0	0.913	5.03
IN - TSS Mean Annual Load (kg/yr)	0	219	25.7	0	507	65.6
IN - TP Mean Annual Load (kg/yr)	0	0.574	0.217	0	7.02E-02	0.583
IN - TN Mean Annual Load (kg/yr)	0	7.49	2.49	0	0.97	7.92
IN - Gross Pollutant Mean Annual Load (kg/yr)	0	0	0	0	0	0
OUT - Mean Annual Flow (ML/yr)	0	5.07	3.06	0	0.913	5.03
OUT - TSS Mean Annual Load (kg/yr)	0	219	25.7	0	507	65.6
OUT - TP Mean Annual Load (kg/yr)	0	0.574	0.217	0	7.02E-02	0.583
OUT - TN Mean Annual Load (kg/yr)	0	7.49	2.49	0	0.97	7.92
OUT - Gross Pollutant Mean Annual Load (kg/yr)	0	0	0	0	0	0

Links

Location	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link
Source node ID	5	8	9	11	10	20	17	18	4	22
Target node ID	6	7	10	12	19	1	18	3	22	23
Muskingum-Cunge Routing	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed
Muskingum K										
Muskingum theta										
IN - Mean Annual Flow (ML/yr)	1.28	0.824	2.09	0.824	2.01	3.06	0.418	0.418	1.07	1.07
IN - TSS Mean Annual Load (kg/yr)	6.18E+03	8.09E+04	1.09E+05	7.69E+04	164	25.7	147	146	402	401
IN - TP Mean Annual Load (kg/yr)	0.358	0.251	0.628	0.229	0.135	0.217	0.25	0.25	0.621	0.621
IN - TN Mean Annual Load (kg/yr)	2.69	1.74	4.79	1.96	1.5	2.49	1.04	1.04	2.53	2.53
IN - Gross Pollutant Mean Annual Load (kg/yr)	34.2	21.9	55.7	21.9	0	0	10.7	3.52E-03	27.5	9.02E-03
OUT - Mean Annual Flow (ML/yr)	1.28	0.824	2.09	0.824	2.01	3.06	0.418	0.418	1.07	1.07
OUT - TSS Mean Annual Load (kg/yr)	6.18E+03	8.09E+04	1.09E+05	7.69E+04	164	25.7	147	146	402	401
OUT - TP Mean Annual Load (kg/yr)	0.358	0.251	0.628	0.229	0.135	0.217	0.25	0.25	0.621	0.621
OUT - TN Mean Annual Load (kg/yr)	2.69	1.74	4.79	1.96	1.5	2.49	1.04	1.04	2.53	2.53
OUT - Gross Pollutant Mean Annual Load (kg/yr)	34.2	21.9	55.7	21.9	0	0	10.7	3.52E-03	27.5	9.02E-03

Location	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link
Source node ID	26	24	27	28	2	14	15	16	30	32
Target node ID	24	25	28	29	32	31	13	30	19	34
Muskingum-Cunge Routing	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed
Muskingum K										
Muskingum theta										
IN - Mean Annual Flow (ML/yr)	0.727	0.727	0.963	0.963	0.608	1.29	5.89	5.64	3.06	0.116
IN - TSS Mean Annual Load (kg/yr)	248	249	339	337	17.4	35.1	148	140	55.1	2.26
IN - TP Mean Annual Load (kg/yr)	0.406	0.406	0.53	0.53	8.90E-02	0.185	0.865	0.907	0.439	1.56E-02
IN - TN Mean Annual Load (kg/yr)	1.7	1.7	2.31	2.31	1.48	2.73	12.6	12.2	5.99	0.309
IN - Gross Pollutant Mean Annual Load (kg/yr)	18.7	6.11E-03	24.7	8.10E-03	15.6	33.1	151	145	0	0
OUT - Mean Annual Flow (ML/yr)	0.727	0.727	0.963	0.963	0.608	1.29	5.89	5.64	3.06	0.116
OUT - TSS Mean Annual Load (kg/yr)	248	249	339	337	17.4	35.1	148	140	55.1	2.26
OUT - TP Mean Annual Load (kg/yr)	0.406	0.406	0.53	0.53	8.90E-02	0.185	0.865	0.907	0.439	1.56E-02
OUT - TN Mean Annual Load (kg/yr)	1.7	1.7	2.31	2.31	1.48	2.73	12.6	12.2	5.99	0.309
OUT - Gross Pollutant Mean Annual Load (kg/yr)	18.7	6.11E-03	24.7	8.10E-03	15.6	33.1	151	145	0	0

Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link	Drainage Link
12	29	25	3	23	34	19	7	31	33	13	6	35	21	36
34	20	20	20	20	1	1	33	33	1	35	35	1	36	35
Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed	Not Routed
0.797	0.928	0.698	0.4	1.03	0.913	5.07	0	0.204	0	3.61	1.23	5.03	0.198	0.188
504	7.17	5.16	3.74	9.67	507	219	0	2.82	0	58.9	5.87	65.6	1.26E+03	0.769
5.45E-02	6.58E-02	4.66E-02	2.78E-02	7.70E-02	7.02E-02	0.574	0	2.58E-02	0	0.493	7.83E-02	0.583	5.51E-02	1.12E-02
0.661	0.76	0.566	0.324	0.836	0.97	7.49	0	0.385	0	7	0.819	7.92	0.389	0.104
0	0	0	0	0	0	0	0	0	0	0	0	0	5.27	0
0.797	0.928	0.698	0.4	1.03	0.913	5.07	0	0.204	0	3.61	1.23	5.03	0.198	0.188
504	7.17	5.16	3.74	9.67	507	219	0	2.82	0	58.9	5.87	65.6	1.26E+03	0.769
5.45E-02	6.58E-02	4.66E-02	2.78E-02	7.70E-02	7.02E-02	0.574	0	2.58E-02	0	0.493	7.83E-02	0.583	5.51E-02	1.12E-02
0.661	0.76	0.566	0.324	0.836	0.97	7.49	0	0.385	0	7	0.819	7.92	0.389	0.104
0	0	0	0	0	0	0	0	0	0	0	0	0	5.27	0