SCHOOLS INFRASTRUCTURE NSW

ALEX AVENUE PUBLIC SCHOOL – CORNER FARMLAND DRIVE AND FUTURE REALIGNMENT OF PELICAN ROAD, SCHOFIELDS NSW

STORMWATER MANAGEMENT, HYDROLOGY AND WATER QUALITY REPORT

CONFIDENTIAL

PROJECT NO 2304785T
DATE: JANUARY 2019

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REV	DATE	DETAILS
A	14/12/2018	ISSUED FOR SSDA
B	11/01/2019	RE-ISSUED FOR SSDA
C	25/01/2019	UPDATED ARCHITECTRURAL LAYOUT

	NAME	DATE	SIGNATURE
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Reviewed by:	Eric Lam	11/01/2019	E.L
Approved by:	Stefan Spirig	25/01/2019	S.S

1 INTRODUCTION

This Stormwater Management, Hydrology and Water Quality Report has been prepared by WSP on behalf of the Schools Infrastructure NSW (the Applicant). It accompanies an Environmental Impact Statement (EIS) in support of State Significant Development Application (SSD 18_9368) for the new Alex Avenue Public School at the corner of Farmland Drive and future realignment of Pelican Road in Schofields (the site). The site is legally described as proposed Lots 1 and 2, being part of existing Lot 4 in DP1208329 and Lot 121 in DP1203646.

The new school will cater for approximately 1,000 primary school students and 70 full-time staff upon completion. The proposal seeks consent for:

- Construction of a 2-storey library, administration and staff building (Block A) comprising:
  - School administrative spaces including reception;
  - Library with reading nooks, makers space and research pods;
  - Staff rooms and offices;
  - Special programs rooms;
  - Amenities;
  - Canteen;
  - Interview rooms; and
  - Presentation spaces.
- Construction of four 2-storey classroom buildings (Block B) containing 40 homebases comprising:
  - Collaborative learning spaces;
  - Learning studios;
  - Covered outdoor learning spaces;
  - Practical activity areas; and
  - Amenities.
- Construction of a single storey assembly hall (Block C) with a performance stage and integrated covered outdoor learning area (COLA). The assembly hall will have OOSH facilities, store room areas and amenities;
- Associated site landscaping and open space including associated fences throughout and games courts;
- Pedestrian access points along both Farmland Drive and the future Pelican Road;
- Substation on the north-east corner of the site; and
- School signage to the front entrance.

All proposed school buildings will be connected by a covered walkway providing integrated covered outdoor learning areas (COLAs). School staff will use the Council car park for the adjacent sports fields pursuant to a Joint Use agreement. The proposed School pick up and drop off zone will also be contained within the future shared car park and will be accessed via Farmland Drive.

This report outlines the stormwater drainage and water quality treatment proposed for the site and how the proposed stormwater works will achieve compliance with relevant stormwater management and water quality policies.

1.1 SITE DESCRIPTION

The site is in Blacktown Local Government area, in the developing suburb of Schofields and is part of the Sydney's North West Growth Centre (NWGC) precinct. The site is currently undeveloped. It is bordered by greenfield sites to the west and east, a future residential area to the north and a vegetated creek approximately 170m to the south. Figure 1-1 shows the location of the site.

1.1.1 RECEIVING WATERWAYS

The site slopes downwards to the south and it is likely excess surface water flows drain to the unnamed creek at the southern boundary of the site. This creek runs to Eastern Creek and then into South Creek as part of the Hawkesbury-Nepean catchment.

Source: NearMaps

Figure 1-1 Site location

1.1.2 EXISTING LOCAL AND REGIONAL WATER CYCLE MANAGEMENT

The site is located within the Alex Avenue Precinct of the North West Growth Centre (NWGC). The NWGC consists of precincts of land identified by the NSW State Government for increased and integrated development of residential housing, business and infrastructure. Precinct specific plans have been developed to managed the development and control of environmental issues within the growth precincts. The Alex Avenue Precinct Development Control Plan (DCP) (Department of Planning and Environment, BCC Growth Centre DCP, Schedule 1, 2016) and the Blacktown Council 'S94 Contributions Plan no. 20' (2015) describes the water cycle management strategy that applies to the site. The precinct mapping indicates that a detention basin is located downstream of the Alex Avenue Public School site as shown in Figure 1-2.

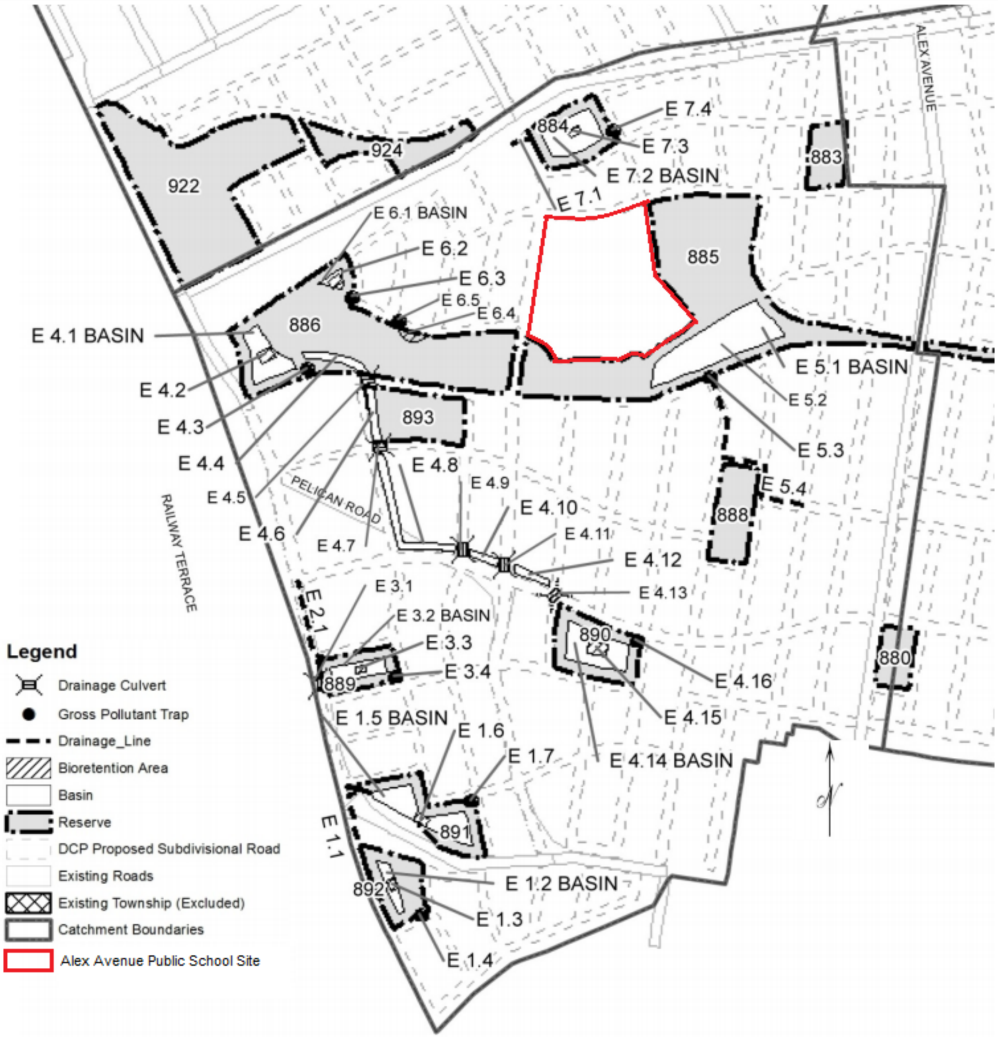


Figure 1-2 Alex Avenue Water Cycle Management Facilities (S94 Contributions Plan no. 20, 2015, Blacktown Council)

2 WATER QUALITY MANAGEMENT REQUIREMENTS AND LEGISLATION

2.1 COUNCIL DEVELOPMENT CONTROL PLAN TARGETS

Part J of the Blacktown Council Development Control Plan 2015 provides direction on water sensitive urban design and integrated water cycle management within the Blacktown City Council area. It includes design principles and targets and controls for water conservation, water quality, on-site stormwater detention, erosion, sediment and pollution control. The DCP identifies the following storm water quality targets for all new developments:

- Total suspended solids - 85% average annual load reduction
- Total phosphorus - 65% average annual load reduction
- Total nitrogen - 45% average annual load reduction
- Gross pollutants – 90% average annual load reduction.

These targets apply to the Alex Avenue Public School development.

2.2 STATE POLICIES

The site is located within the Alex Avenue Precinct of the North West Growth Centre. The Department of Planning and Environment have prepared an overarching Blacktown City Council Growth Centre Precincts Development Control Plan (BCC Growth Centre Precincts DCP, 2018).

The BCC Growth Centre Precincts DCP confirms that stormwater is to be managed in accordance with the Council's Water Sensitive Urban Design Development Control Plan.

3 IMPACT ASSESSMENT

3.1 CONSTRUCTION

Construction activities have the potential to Excavation, other earthworks and use of water for construction activities may cause runoff and sedimentation and erosion impacts to the local waterway if not appropriately managed. Potential adverse impacts would include:

— Inadequate containment of spills or leaks of fuels and/or oils from construction plant and equipment and/or from vehicle/trucks that may result in pollutants entering the local waterway

— Excavation, vegetation clearing and grading that may cause increased sediment and pollutant load in runoff

— Stockpiling of spoil and construction materials may lead to dirty water runoff and sedimentation of waterways

— Uncontrolled water use for construction activities resulting in pollutants entering the receiving waterway and potential increased scour and erosion effects

— Litter from construction activities entering waterways

— Exposure of soils containing acid sulphides to oxygen resulting in the production of sulfuric acid, which may become bioavailable in the environment and affect waterways.

Erosion and sediment control measures would be implemented during construction as described in Section 4.1. Implementation of these measures would mitigate off-site impacts to the downstream water quality of the site during construction of the school.

3.2 OPERATION

Urban developments have the potential to increase gross pollutants, sediments, hydrocarbons and nutrient concentrations in stormwater runoff. As such a Model for Urban Storm Water Conceptualisation (MUSIC) model was developed for the site to assess the pre- and post-development flow and water quality conditions and the effectiveness of the proposed water quality treatment on the site.

3.2.1 MUSIC MODELLING

Model for Urban Storm Water Conceptualisation predicts the performance of storm water quality management systems. A MUSIC model was prepared for the site to assess the pre-and post-development stormwater conditions for the site and to assess the effectiveness of the water quality treatment devices against the Blacktown Council targets. The model was prepared in line with Blacktown City Council's Development Control Plan, Part J, 2015 and the Developer's Handbook for Water Sensitive Urban Design.

The MUSIC software was deemed suitable for this assessment because it can estimate volumes and pollutant loads for stormwater based on historic continuous rainfall data. Stormwater management typically deals with regular rainfall events so use of a continuous rainfall provides and understanding of how the system behaves over a year or more. This can help inform the water balance model for the site.

The MUSIC model was set-up with source nodes to account for roof area, road, paved and landscaped area which all have a rainfall runoff relationship that is based on research of real site (BMT WBM, 2015). MUSIC-link was used to link the model the Blacktown City Council recommended input parameters for the rainfall-runoff data.

The treatment nodes, including gross pollutant traps and other treatment devices were then linked to the source nodes. Details of the model source nodes, treatment devices and input parameters are provided in Appendix A.

3.2.2 PRE-DEVELOPMENT CONDITIONS

Table 3-1 shows the site pre-development conditions as assessed by the MUSIC model.

Table 3-1 Pre-development conditions

POLLUTANT	PRE-DEVELOPMENT CONDITIONS
Flow (ML/yr)	4.17
Total suspended solids (kg/yr)	337
Total phosphorus (kg/yr)	0.865
Total nitrogen (kg/yr)	6.8
Gross pollutants (kg/yr)	0

3.2.3 STORMWATER DRAINAGE AND MANAGEMENT SYSTEM

Stormwater controls are included in the concept design to ensure that the proposed Alex Avenue Public School does not adversely impact on stormwater flows and water quality of the receiving waterways. The proposed stormwater drainage and water quality treatment system has been designed in accordance with the following guidance documents:

- AS3500 – 'National Plumbing and Drainage Code' – Part 3: Stormwater Drainage
- Australian Rainfall and Runoff, 2016 – Parts 1 & 2
- Blacktown City Council's Engineering Guide for Development
- Blacktown Development Control Plan, Part J, 2015
- Blacktown City Council, Developer Handbook for Water Sensitive Urban Design, Version 1.1, November 2013
- Guidelines for development adjoining land and water managed by DECCW (OEH, 2013).

A piped stormwater drainage system will be provided to collect all concentrated flows from the proposed buildings and hardstand surfaces. The site will drain to a bioretention basin on the south-eastern boundary, which will be sized for the 1 in 20 ARI event as per the requirements of the Blacktown Development Control Plan 2015, with provision for overflow in the event of a 100 year ARI event.

The bioretention basin will then discharge to the creek at the southern boundary of the site. Scour protection of rock rip rap, gravel and vegetation are provided at the outlet of the drainage system to act as energy dissipators to reduce scour potential.

Blacktown City Council confirmed that on-site detention is not required for the development as the site is catered for in a regional basin downstream as part of development of the North West Growth Centre (refer to Figure 1-2).

3.2.4 STORMWATER QUALITY TREATMENT SYSTEM

A series of stormwater treatment devices have been provided in the design including:

- Gross pollutant traps installed on surface inlet pits and grated drains

- 65m^3 rainwater tank to collect water from the roof catchment for re-use on site
- A 190m^2 (necessary flat area) bioretention basin at the south-western boundary of the site.

It is proposed to provide gross pollutant traps for all grated pits within the walkways. These traps will assist in the water quality treatment for the site by capturing a large portion or gross pollutants, large sediment particles and organic matter that may also contain nutrients.

The bioretention basin is included to filter further sediments and contaminants from stormwater flow the filtered water is directed via perforated pipes to the existing stormwater system, natural waterway or a detention basin for reuse.

3.2.5 POST-DEVELOPMENT CONDITIONS

The MUSIC model is used to assess effectiveness of the water quality treatment devices by assessing the post-development condition (no treatment) against the post-development condition (including water quality treatment devices) to identify the average annual pollutant load reduction.

The achieved post-development pollutant reduction for the Alex Avenue MUSIC model are shown against the Blacktown pollutant reduction targets in Table 3-2.

Table 3-2 Post-development pollutant reduction

POLLUTANT	REDUCTION TARGET	MODELLED % REDUCTION
Total suspended solids (TSS)	90%	87.8%
Total phosphorus	65%	65.4%
Total nitrogen	45%	58.7%
Gross pollutants	90%	100%

The MUSIC model shows that the proposed water quality treatment devices meet the Blacktown Council reduction targets for post development pollutant load for total phosphorus, total nitrogen and gross pollutants.

The modelled pollutant reduction for total suspended solids is slightly below the target, however, it is noted the post-development TSS load is 148kg/year compared to 337kg/year in the pre-development conditions which represents a 189kg/year reduction to TSS load. This represents a 56% reduction in total suspended solids runoff from the site.

3.2.6 WATER AVAILABILITY AND RE-USE

The MUSIC model shows the post-development outflow from the site as 9.84 ML/year. This is an increase of 5.67ML/year from the pre-development site condition. As the site forms part of the broader Alex Avenue Precinct this increase is considered to be accounted for in the precinct wide water cycle management strategy (Blacktown City Council, 2015) and is considered a minor addition to the overall precinct outflow volume.

A 65m^3 rainwater re-use tank was provided to meet the water conservation targets stipulated under Blacktown City Council's Development Control Plan, Part J, WSUD Guidelines, 2015. The rainwater tank was shown to meet a re-use rate of 0.87ML/year which meets the 80% re-use rate required by the Council.

4 MITIGATION

4.1 CONSTRUCTION

Erosion and sediment control measures will be provided in accordance with the "Blue Book" – Managing Urban Stormwater – Soils and Construction (Landcom, 2004) and the Blacktown Engineering Guide to Development to mitigate potential impacts to the downstream water quality from construction activities. Controls would include:

- Sediment management devices, such as fencing, hay bales or sand bags
- Measures to divert or capture and filter water prior to discharge, such as drainage channels and first flush and sediment basins
- Installation of measures at work entry and exit points to minimise movement of material onto adjoining roads, such as rumble grids or wheel wash bays
- Appropriate location and storage of construction materials, fuels and chemicals, including bunding where appropriate.
- All refuelling of vehicles and equipment on site would be undertaken a minimum of 50 metres away from water bodies and surface drains, where possible.
- Any fuel, oil or other liquids stored onsite would be stored in an appropriately sized impervious bunded area.

An Erosion and Sediment Control Plan would also be prepared as part of the Construction Environmental Management Plan.

4.2 OPERATION

No further monitoring is proposed for this development.

5 CONCLUSIONS

There is potential for impacts to the receiving waterway during construction of the Alex Avenue Public School due to potential increase sediment and pollutant laden run-off from the construction activities. Implementation of standard and well-understood sediment and erosion control measures would mitigate impacts to the receiving waterway during construction.

After construction of the school, there will be an increase in stormwater run-off volume from the site, however this is considered to be accounted for in the Alex Avenue Precinct wide water cycle management strategy.

The proposed stormwater drainage system will collect and treat stormwater run-off before discharging to the nearby creek. The stormwater drainage system has been designed to cater for the 1 in 20 ARI storm event as per the requirements of the Blacktown Development Control Plan 2015, with provision for overflow up to the 1 in 100 year ARI.

Although the reduction efficiency of the proposed water quality treatment devices marginally fall short of the TSS reduction target, the treatment devices for the site provide a 189kg/year (56%) reduction to the total suspended solid load outflow compared to pre-development conditions. The proposed water quality treatment devices meet the Blacktown Council pollutant reduction requirements for all other pollutants.

REFERENCES

- Blacktown City Council Development Control Plan 2015
- Blacktown City Council, 2015, Section 94 Contributions Plan No.20 – Riverstone & Alex Avenue Precincts
- Blacktown City Council, 2013, Developer Handbook for Water Sensitive Urban Design, Version 1.1
- Blacktown City Council, 2005, Blacktown City Council's Engineering Guide for Development, 2005
- BMT WBM, 2015, NSW MUSIC Modelling Guidelines. Sydney: Local Land Services Greater Sydney,
- Department of Planning and Environment, 2018, Blacktown City Council Growth Centre Precincts Development Control Plan
- Landcom, 2004, Managing Urban Stormwater – Soils and Construction Volume 1 – 4th Edition

APPENDIX A
MUSIC MODEL

This appendix outlines the MUSIC model that was prepared for the Alex Avenue stormwater quality assessment.

A.1 BASE PARAMETERS

MUSIC-link was used to link the model the Blacktown City Council recommended input parameters for the rainfall-runoff data. MUSIC-link provides the following input parameters:

— Modelling Time-step: 6 Minutes

— Modelling Period: 1/01/1967 - 31/12/1976 11:54:00 PM

— Mean Annual Rainfall: 857mm

— Evapotranspiration: 1261mm

A.1.1.1 SOURCE NODES

A.1.1.1.1 PRE-DEVELOPMENT

As the site is a greenfield site the pre-development condition was modelled as a 1.995ha Revegetated land Urban node. Table A 1 shows the pollutant concentrations for the pre-development source node.

Table A 1 Pre-development pollutant concentrations (BMT WBM, 2015)

LAND USE	TSS (MG/L)		TP (MG/L)		TN (MG/L)	
	Mean log	SD log	Mean log	SD log	Mean log	SD log
Baseflow						
Re-vegetated land	1.15	0.17	-1.22	0.19	-0.05	0.12
Stormflow						
Re-vegetated land	1.95	0.32	-0.66	0.25	0.3	0.19

A.1.1.1.2 POST-DEVELOPMENT

The site was divided into roof, pavement, road and landscaped areas as shown in Figure A 1. Input parameters and pollutant concentrations for source nodes used within the model are in the tables below in accordance with MUSIC guidelines (2015). The source nodes for the model are shown in Table A 2.

Table A 2 Post-development source nodes key input parameters

NODE	SURFACE TYPE	SIZE (HA)	% IMPERVIOUS	% PERVIOUS
Pavement	Mixed	0.717	100	0
Landscaped area	Revegetated land	0.302	0	100
Road	Sealed road	0.010	100	0
Urban	Roof	0.607	100	0
Landscaped area	Revegetated land	0.359	0	100

A rainfall threshold of 1.4mm/day was included for all source nodes.

The source node pollutant concentrations are shown in Table A 3.

Table A 3 Post-development pollutant concentrations (BMT WBM, 2015)

LAND USE	TSS (MG/L)		TP (MG/L)		TN (MG/L)	
	Mean log	SD log	Mean log	SD log	Mean log	SD log
Baseflow						
Sealed roads	1.2	0.17	-0.85	0.19	0.11	0.12
Roofs	n/a	n/a	n/a	n/a	n/a	n/a
Mixed	1.2	0.17	-0.85	0.19	0.11	0.12
Re-vegetated land	1.15	0.17	-1.22	0.19	-0.05	0.12
Stormflow						
Sealed roads	2.43	0.32	-0.3	0.25	0.34	0.19
Roofs	1.3	0.32	-0.89	0.25	0.3	0.19
Mixed	2.15	0.32	-0.6	0.25	0.3	0.19
Re-vegetated land	1.95	0.32	-0.66	0.25	0.3	0.19

A.1.1.2 WATER QUALITY TREATMENT NODES

The model included the following water quality treatment nodes:

- Gross pollutant traps installed on surface inlet pits and grated drains
- 65m^3 rainwater tank to collect water from the roof catchment for re-use on site
- A bio-retention basin at the south-western boundary of the site.

The full model and treatment train is shown in Figure A 2

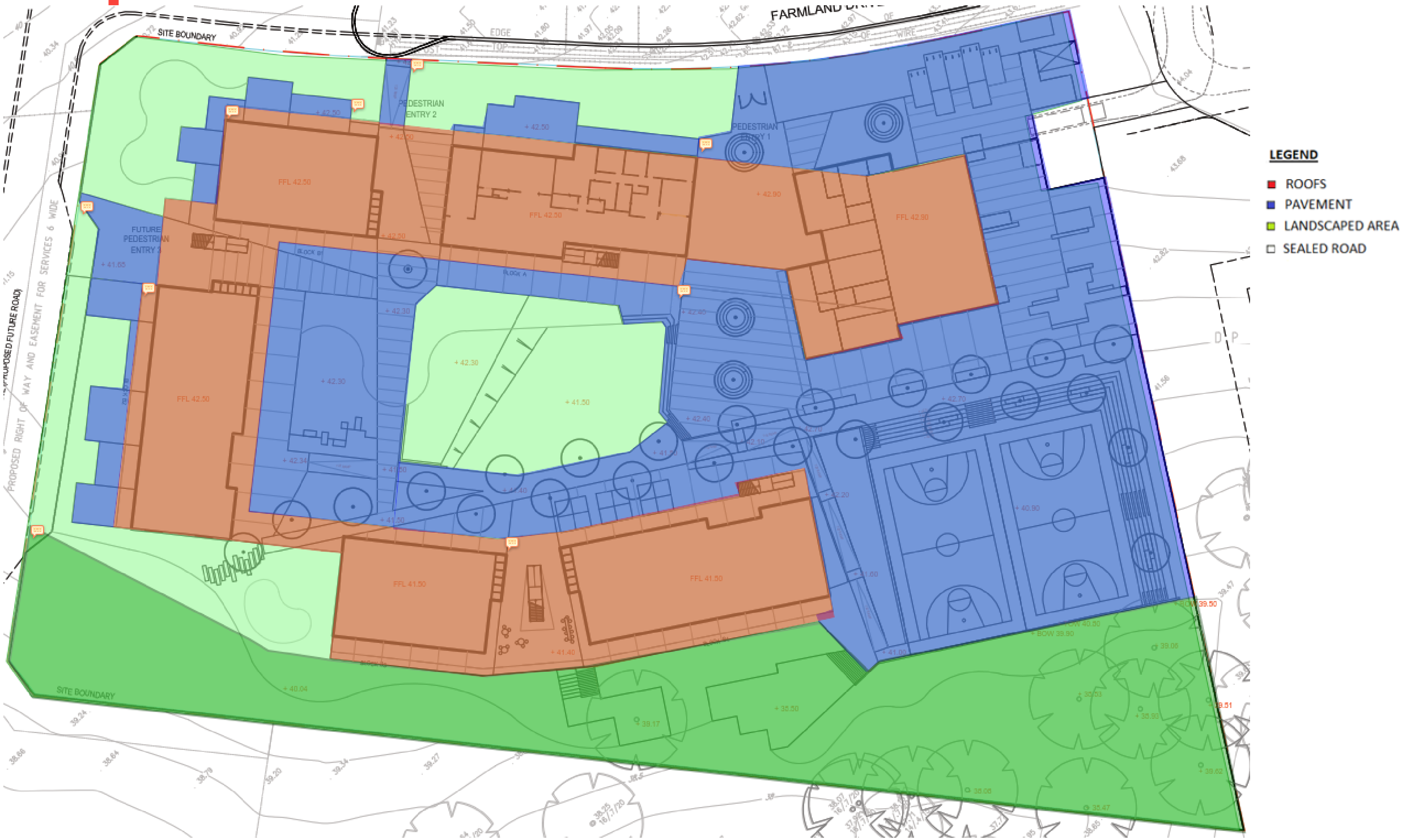
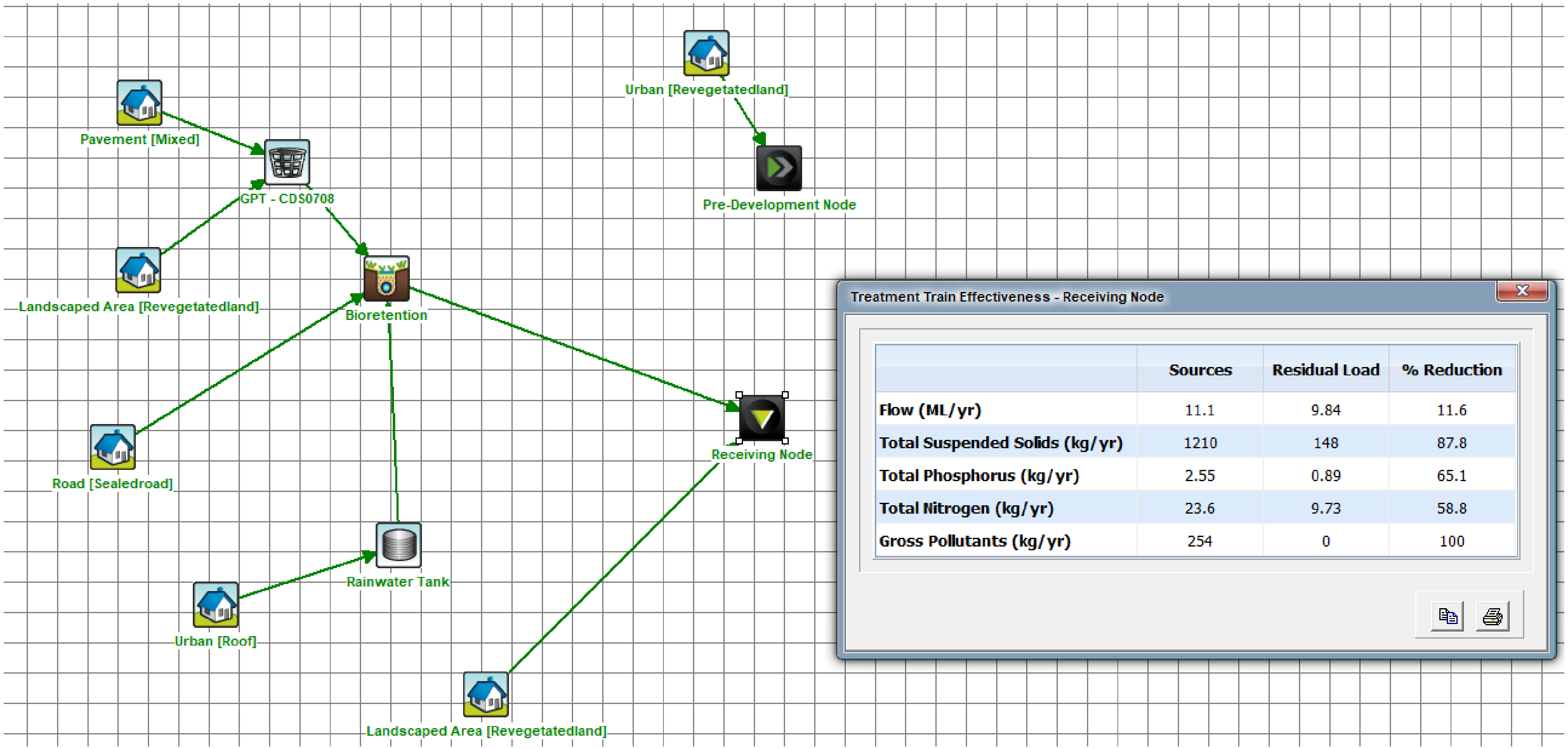

SITE BOUNDARY
PEDESTRIAN ENTRY 2
PEDESTRIAN ENTRY 1
FUTURE PEDESTRIAN ENTRY 3
FFL 42.50
FFL 42.80
FFL 41.50
LEGEND
ROOFS
PAVEMENT
LANDSCAPED AREA
SEALED ROAD

Figure A 1 Catchment distribution



	Sources	Residual Load	% Reduction
Flow (ML/yr)	11.1	9.84	11.6
Total Suspended Solids (kg/yr)	1210	148	87.8
Total Phosphorus (kg/yr)	2.55	0.89	65.1
Total Nitrogen (kg/yr)	23.6	9.73	58.8
Gross Pollutants (kg/yr)	254	0	100

Figure A 2 MUSIC Model

A.2 WATER QUALITY TREATMENT DEVICES

A.2.1 GROSS POLLUTANT TRAPS

Gross pollutant traps (GPTs) are treatment devices used remove litter, organic debris and coarse sediment prior to further treatment measures for fine particulates and nutrients.

A CDS0708 unit, a GPT which uses a vortex flow regime, was included in the model prior to the bioretention basin. Table A 4 shows the parameters adopted for the GPT CDS0708 treatment node.

Table A 4 GPT input parameters

PARAMETER	INPUT VALUE	
Low flow bypass (m^3/s)	0	
High flow bypass (m^3/s)	0.054	
Transfer Function properties		
	Input	**Output**
TSS (mg/L)[1]	0	0
	100	30
TP (mg/L)[2]	0.00	0.00
	100	70
TN (mg/L)[3]	0.0	0.0
	50	50
Gross pollutants (kg/ML)	0	0
	100	2

1. *TSS removal can be up to 70 per cent for inflow concentrations greater than 75 mg/L for effective vortex type system*
2. *TP removal can be up to 30 per cent for inflow concentrations greater than 0.5 mg/L for effective vortex type system*
3. *TN removal = 0*

A.2.2 RAINWATER TANK

A $65m^3$ rainwater re-use tank was provided to meet the water conservation targets stipulated under Blacktown City Council's Development Control Plan, Part J, WSUD Guidelines, 2015. The water quality modelling software program, MUSIC, was used to establish the effectiveness of the rainwater tank. The parameters adopted in the MUSIC modelling include:

— The entire roof catchment of $6,070m^2$ is to drain to the rainwater tank

- The 65m^3 rainwater tank modelled as a 55m^3 volume tank to account for losses (as per the Blacktown Developer Handbook for Waster Sensitive Urban Design)
- Low flow bypass as 0 m^3/s
- High flow bypass as 100 m^3/s
- A 150mm diameter overflow pipe

The tank will service the 32 toilets in the new buildings (ground floor toilets only). A reuse rate of 2.3kL/day was adopted in the model, that is, 32 x 0.1kL/day/toilet x 5/7 proportionate to ratio of site occupation. The accessible toilets were excluded as advised in the DCP.

The tank will be required to service 661 m^2 of landscaped area plus 190m^2 of bioretention area. A re-use rate of 200kL/year as PET-Rain was adopted in the model (using a rate of 0.24kL/year/m^2).

A.2.3 BIORETENTION BASIN

A bioretention basin is include downstream of the GPT and rainwater tank. Table A 5 shows the parameters adopted for the bioretention basin.

Table A 5 Bioretention basin input parameters

PARAMETER	INPUT VALUE
Low flow bypass (m^3/s)	0
High flow bypass (m^3/s)	100
Extended Detention Depth (m)	0.30
Surface Area (m^2)	190
Filter Area (m^2)	190
Unlined Filter Media Perimeter (m)	0.10
Saturated Hydraulic Conductivity (mm/hr)[1]	200
Filter Depth (m)	0.70
TN Content of Filter Media (mg/kg)	800
Orthophosphate Content of Filter Media (mg/kg)	40.0
Exfiltration Rate (mm/hr)	0

[1] *typical for sandy loam filter media*

A.3 SEDIMENT BASIN CALCUATIONS

SEDIMENT BASIN VOLUME CALCULATION

JOB: Alex Ave
DATE: 11.12.2018

Basin Volume = Settling Zone Volume [A] + Sediment Storage Zone Volume [B]

- Settling Zone Volume [A]

Calculated to provide capacity for all runoff expected from the y-percentile rainfall event. The volume of the basin's settling zone (V) can be determined as a function of the basin's surface area and depth to allow for particles to settle and can be determined by the following equation:

$$V = 10 \times C_v \times A \times R_{y\text{-}\%ile,\ x\text{-}day} \quad (m^3)$$

Where:

10 =		a unit conversion factor
C_v =	0.5	volumetric runoff coefficient defined as that portion of rainfall that runs off as stormwater over the x-day period
R =	24.6	x-day total rainfall depth (mm) that is not exceeded in y percent of rainfall events. *(See Sections 6.3 4(d), (e), (f), (g) and (h))*
A =	2	total catchment area (ha)

=> V = 246 m^3 [A]

- Sediment Storage Zone Volume [B]

In the standard calculation, the sediment storage zone is 50% of the settling zone volume:

=> V = V [A] x 0.5

V = 123 m^3 [B]

Basin Volume = V [A] + V [B]

Basin Volume = 369 m3