Report

Western Sydney University, Milperra Rezoning Stormwater Concept Plan

Prepared for Mirvac

22 June 2020

Calibre Professional Services Pty Ltd
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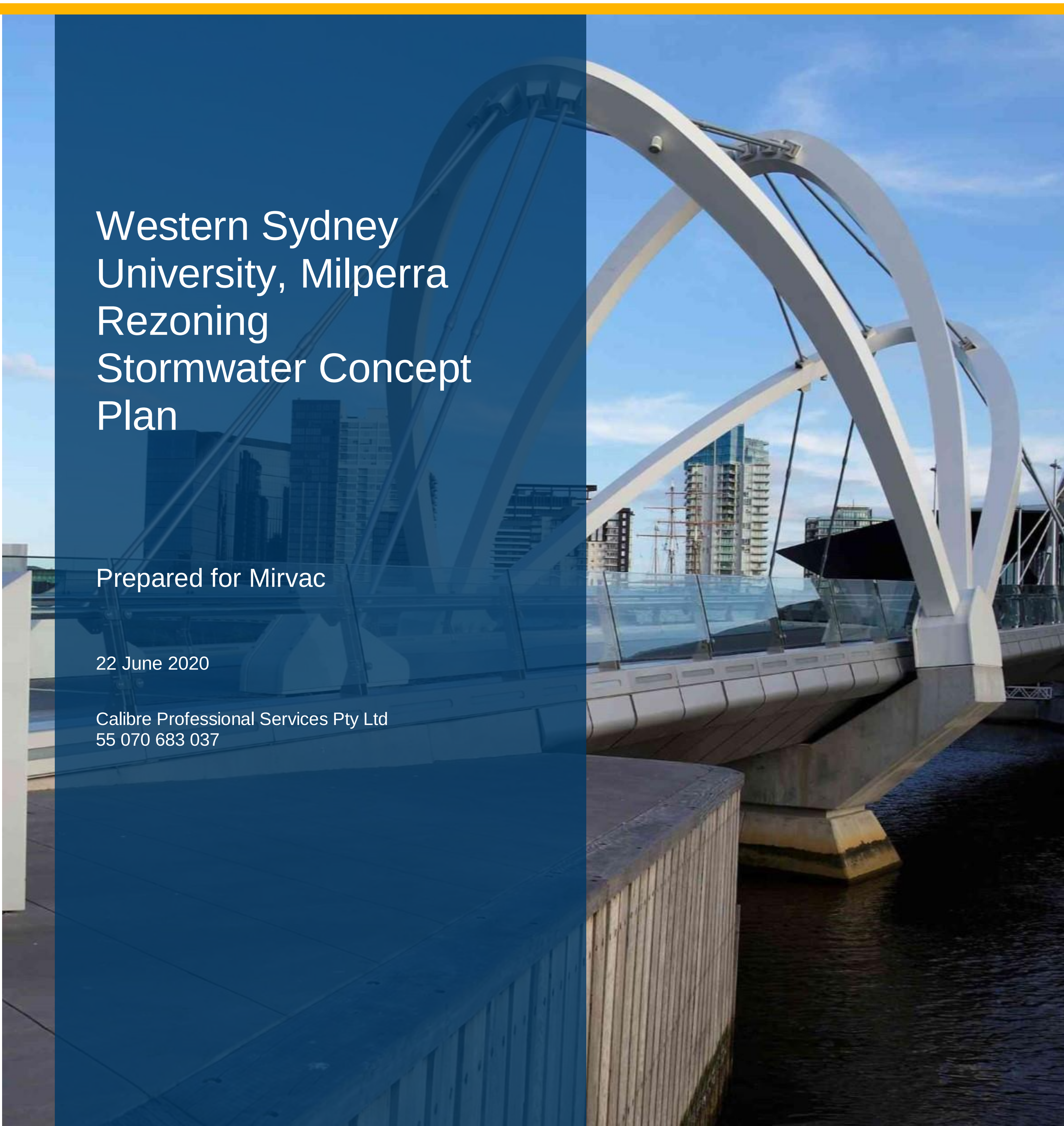

QUALITY ASSURANCE STATEMENT

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ISSUE	DATE	ISSUE DETAILS	AUTHOR	CHECKED	APPROVED
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02	22/06/20	Rezoning Application	NL/TE	TE	JZ

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1. Introduction and Development

This report has been prepared by Calibre Professional Services NSW to support the rezoning application for the Western Sydney University (WSU).

This report details a stormwater strategy based on Water Sensitive Urban Design (WSUD) principles. The key objectives of the strategy are to:

- Link stormwater infrastructure effectively to minimise the impact of the development upon the water cycle.
- Attenuate peak storm flows up to the 1% AEP (100 year ARI) event to existing peak flows rates
- Protect receiving water quality.
- Provide a design consistent with requirements specified in this report at Section 2 – Relevant Policies and Guidelines.

The stormwater strategy for the proposed rezoning is to provide basins to attenuate stormwater flow and reduce the pollutant runoff from the site to standards set by the Botany Bay & Catchment Water Quality Improvement Plan.

This report presents the stormwater quantity and flooding management for WSU Milperra. Its objectives are to provide a stormwater management strategy that ensures that the proposed development adequately considers and manages flooding within the local and Georges River.

The proposal provides for stormwater detention within the development of WSU Milperra. This will take the form of detention storage within basins associated with stormwater quality improvement features and manage major flows up to the 100 year average recurrence interval (ARI). The storages located through the site will be used to attenuate bank-full flows to mitigate erosion, manage common storm events downstream of the site. Furthermore the basin will manage the larger storm event to ensure that flooding in Georges River is not worsened as a result of the development in WSU Milperra.

The level of detention storage required in WSU Milperra was estimated using the XP-RAFT hydrological model. This model is widely accepted in the industry and is suitable for conducting investigations on development sites, whereby existing versus developed scenarios are modelled. This model estimated stormwater detention requirements for the proposed development to manage flows off the developed catchment and ensure that peak flows and flood levels are not increased. The required stormwater detention capacity totals 6,100m3. Stormwater quality benchmarks are achieved through appropriately sized bioretention facilities within the proposed basins.

1.1 Site Description

The site locality general arrangement is shown in Figure 1.1. Western Sydney University, Milperra is the subdivision of the site shown below (referenced by Lot 103 DP874035). The site is bounded to the north by Bullecourt Avenue, Horsley Road to the east, the M5 to the south and Ashford Avenue to the west. A tributary of the Georges River is also situated further to the South (south of M5).

Figure 1.1 Locality Plan

Generally the site slopes to the south towards the existing oval and the M5, there is a portion of the site that drains to Bullecourt Avenue and some localised areas grade directly to Ashford Ave.

The site generally drains to a tributary of the Georges River through a culvert under the M5.

2. Relevant Policies and Guidelines

2.1 Development Engineering Standards (Bankstown City Council, 2009)

The standard contains technical design requirements for site stormwater drainage and on-site detention (OSD) systems. OSD systems must be designed and constructed to control stormwater runoff from development sites such that, for 5 to 100 year ARI events, peak stormwater discharges from the site do not exceed pre-development stormwater discharges. Notwithstanding that, Council considers the need for OSD on a case-by-case basis where justified by sound engineering principles. The proposed stormwater strategy has provided detention basins.

2.2 Bankstown Local Environmental Plan (2015)

This plan sets local environmental planning provisions for land in Bankstown Council. Clause 6.4A of the LEP correlates with Riparian land and water courses. The objective of this clause is to protect and maintain water quality within watercourses, among other related items. Water quality from the development will be managed by three bio-retention basins to protect the water course downstream, as discussed under Section 5.

Any development on this site must take into consideration the environmental capabilities and constraints that affect the area, and all adverse stormwater impacts are properly managed and mitigated.

2.3 Bankstown Development Control Plan 2015

2.3.1 Precinct Control – Part A3 – Key Infill Development Sites

This document acts as a supplement to the Local Environmental Plan by providing additional objectives and development controls of key infill sites in the Bankstown Council area. The intended outcome of that section is to ensure that the subdivision and development of the site achieves high quality urban design and built form outcomes consistent with the environmental characteristics and ecological values of the site.

Water sensitive urban design principles are to be incorporated in the street and development design to attenuate runoff and promote water quality. In the case of this stormwater strategy, Calibre has adopted use of three bio-retention basins for treating stormwater runoff, which will be placed to the west of the development, downstream of all urbanised flows. Reduction targets are set out in the Botany Bay and Catchment Water Quality Improvement Plan. Other water sensitive urban design principles include protection and enhancement of natural waterways and minimisation of harmful impacts or urban development on water balance and on surface and groundwater flow regimes.

2.3.2 General Control – Part B12 – Flood Risk Management

This document acts as a supplement to the Local Environmental Plan by providing additional objectives and development controls to control the development of flood liable land in the Bankstown Council area. Based on Map 1 provided within this document, The WSU Site sits within the Low Flood Risk area. In this precinct, the risk of damages due to flood events is considered low for most land uses. Any land within a low flood risk will be built above the flood planning level.

2.4 Greater Metropolitan Regional Environmental Plan No.2 – Georges River Catchment (2020)

The WSU site sits within the Georges River Catchment, which is a sub-catchment of the Botany Bay Catchment area. The aim of this plan is to maintain and improve the water quality and river flows of the Georges River and its tributaries. The impacts of stormwater runoff is to be minimised and mitigation measures that address urban stormwater runoff are to be implemented in accordance with the local council requirements. It is important to ensure that the level of nutrients entering the waterways and creeks is not increased by the development.

The pollutant runoff from the development will be reduced to the target percentage specified by the 'Botany Bay & Catchment Water Quality Improvement Plan', in accordance with the local council requirements specified by the Precinct Control Part A3 from Bankstown Council.

2.5 Botany Bay & Catchment Water Quality Improvement Plan (Sydney Metropolitan Catchment Management Authority, 2011)

The main objective of this plan is to set targets for pollutant load reductions (in terms of total nitrogen [TN], total phosphorus [TP] and suspended sediment [TSS]) required to protect the condition of Botany Bay, its estuaries and waterways. This plan has been used to set the pollutant reduction targets for the stormwater quality strategy of this report, in accordance with Precinct Control – Part A3. The three bio-retention basins will ensure these targets are met.

2.6 Water Management Act 2000

The key NSW legislation governing the management of the state's water resources are the Water Management Act 2000 and the Water Act 1912. The Water Management Act 2000 is progressively replacing the Water Act 1912 which represented outdated principles in water management.

The objective of the Water Management Act 2000 is to provide sustainable and integrated management of water resources for the benefit of both present and future generations (NSW Office of Water, 2014). The NSW Office of Water administers the Water Management Act 2000 and regulates controlled activities carried out around and on waterfront land.

Amendments have been made to the legislation since it was passed by NSW parliament in December 2000. In 2012, the Guidelines for Riparian Corridors on Waterfront Land (NSW Office of Water, 2012) allowed construction of online detention basins in riparian corridors. The revision also streamlined the categorisation of streams and permitted activities around the riparian corridors.

2.7 Other Relevant Specifications

- AS/NZ3500.3 Plumbing and Drainage - Stormwater Drainage
- Australian Rainfall & Runoff (Engineers Australia)
- Australian Runoff Quality (Engineers Australia)
- Technical Note: Interim Recommended Parameters for Stormwater Modelling – North-West and South-West Growth Centres
- Building Code of Australia Housing Provisions (current edition)
- Managing Urban Stormwater - Soils and Construction (current edition)
- Water Sensitive Urban Design in the Sydney Region Resource Kit (2003)
- Water Sensitive Urban Design Technical Guidelines for Western Sydney (2004)
- Map of Salinity Potential in Western Sydney (2002)
- WSROC Western Sydney Salinity Code of Practice (2004)
- DNR Local Government Salinity Initiative Publications (various)
- NSW Floodplain Development Manual (2005)
- MUSIC Manual (Version 6)

3. Stormwater Management Strategy

The stormwater strategy proposes the creation of three detention/bio-retention basins. The strategy also includes rainwater tanks, the tanks will be provided in accordance with BASIX. The basin locations are shown on Figure 3.1.

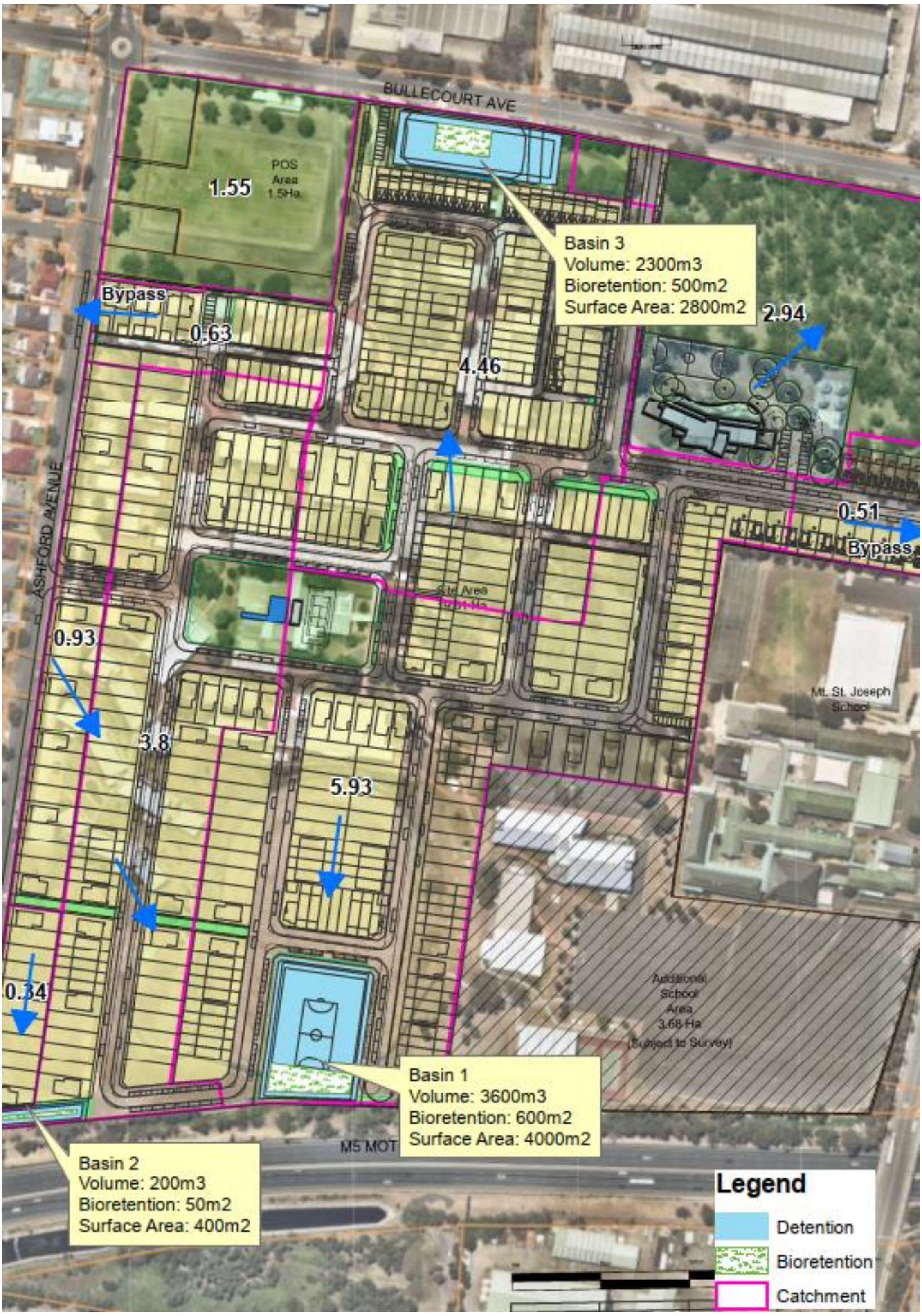


Figure 3.1 Basin Plan

4. Stormwater Quantity Management Strategy

The stormwater strategy for Western Sydney University aims to match post-development peak runoff to the permissible site discharge (PSD) in storm events of up to 100 year to meet the requirements as outlined in Section 2. The stormwater strategy has provided an estimated basin volume required to attenuate the flows from the developed site.

The stormwater quantity management strategy for WSU is designed to mitigate large scale flooding impacts on Georges River and meet guidelines for reducing potential erosion within the local tributaries.

The stormwater quantity management strategy for WSU is shown in Figure 3.1. The objectives of the stormwater detention strategy will require the use of strategically placed detention basins, as shown in those figures. These detention basins will generally include a water quality component (bioretention) with the stormwater detention occupying approximately 1 m to 1.5 m of detention depth above the basin floor.

The specific objectives for the stormwater quantity management strategy for WSU include:

- Management of ‘minor’ flows using piped systems for the 10 year ARI (residential landuse) as per Council’s Engineering and Drainage Standards.
- Management of ‘major’ flows using dedicated overland flow paths such as open space areas, roads and riparian corridors for all flows in excess of the 10 year ARI.
- Facilitation of stormwater retention including the use of rainwater tanks and other water quality improvement features.
- Integration of stormwater quality and stormwater quantity management techniques.
- Provision of appropriate infrastructure to enable conveyance of 100 year ARI flows off the development to proposed detention storages.

4.1 Grading Strategy

The proposed grading strategy proposes to direct the majority of the catchment to the proposed basins (Figure 4.1). A generous portion of the catchment has been directed to the basin to the north (Basin 3) to utilise the storage within the open space. Basin 3 has been designed to provide additional volume to ensure the existing peak flow draining to the north is not aggravated as a result of the development.

Majority of the development has been graded to the large detention basin upstream of the M5 crossing. Basin 1 and 2 have been designed to ensure no exceedance of existing flows to the south. Some minor bypass catchments have been shown in order to match to existing levels at the boundary. The basins have been over compensated to allow for these bypass flows.

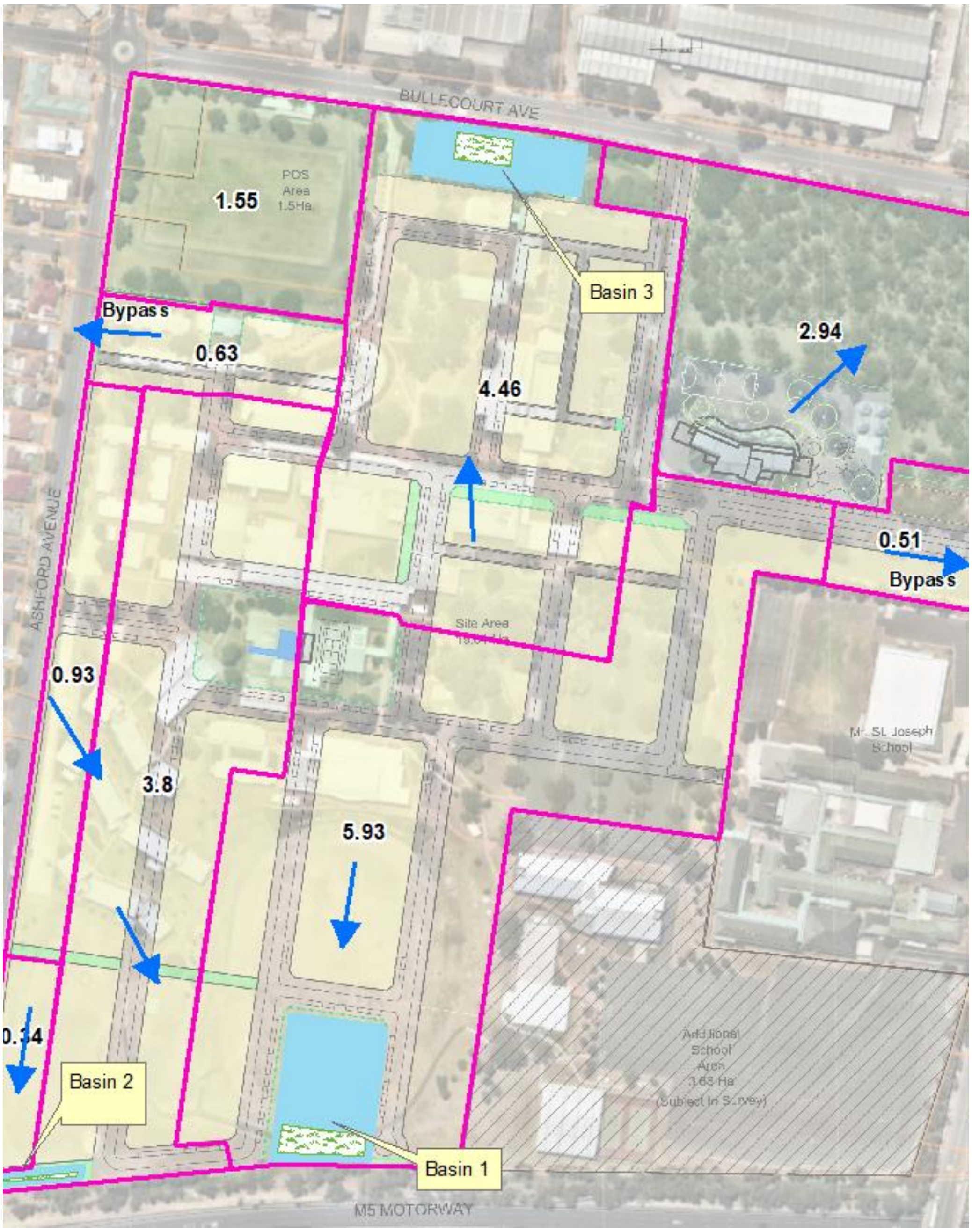


Figure 4.1 Catchment Plan

4.2 Detention Basins

A stormwater runoff routing model was carried out in XP-RAFTS 2018 to estimate peak flows in the pre and post development conditions. A detention basin was designed in the model to attenuate the post-development flow to pre-development conditions.

The peak flows for the storm events was determined by finding the storm duration with the highest peak flow; this approach is consistent with the methodology for using ARR1987.

Peak flow rates for the pre and post developed scenario (including bypass catchments) for the 100 year ARI storm event are presented in Table 4.1.

Table 4.1 Peak Flow Rates

Basin	Pre-development flows (m^3/s)	Post-development - no basin (m^3/s)	Post-development with basin (m^3/s)	Active Storage (m^3)
Basin 1	2.2	6.01	2.15	3550
Basin 2				180
Basin 3	1.40	3.17	1.39	2280

Based on the hydrological modelling, the basin storage for detention Basins 1, 2 and 3 are given in Table 4.2.

Table 4.2 Detention Basin Configurations

Attributes	Basin 1	Basin 2	Basin 3
Live storage (m^3)	3,600	200	2,300

The total detention storage for the basins amounts to 6,100 m^3. These serve as an indicative value for the purposes of rezoning the site – the final basin storage volume will depend upon the more detailed developed catchment breakdown, land slope, and ratio of impervious and pervious areas. The basin sizing and developed catchment will be confirmed and finalised as part of the design process.

Based on the existing topography of the site and the surrounding land, it is expected that Basin 1 and 2 will drain towards the m5 culvert crossing, and Basin 3 towards Bullecourt Avenue.

5. Stormwater Quality Management Strategy

The stormwater quality objectives established in the Botany Bay & Catchment Water Quality Improvement Plan (shown in Table 5.1) will be achieved by treating stormwater runoff flows.

Table 5.1 Stormwater Reduction Targets for Botany Bay Catchment

Stormwater reduction targets recommended for urban development in the Botany Bay Catchment.

Stormwater Pollutant	Greenfield Developments Large re-developments	Multi-unit dwellings. Commercial developments. Industrial developments. Small re-developments.
Gross pollutants	90%	90%
Total suspended solids (TSS)	85%	80%
Total phosphorus (TP)	60%	55%
Total nitrogen (TN)	45%	40%

Bio-retention basins will be utilised as part of the water quality treatment strategy for the site and to receive flows from the minor drainage system. Bio-retention basins remove sediments and attached pollutants through filtration via an engineered filter media and nutrient uptake via plant and vegetation root areas.

The bio-retention basins incorporate an extended detention storage above the filter media. The basin configurations are nominated in Table 5.2.

Plantings within bio-retention basins must be complementary to the adjacent local native plant communities of the riparian corridor and be able to withstand periods of inundation and some long dry periods between rain events. Suitable littoral or transitional plant species (DLWC, 1998) for the bio-retention basins could include species such as: Baumea juncea, Carex appressa, Carex fascicularis, Cyperus exaltatus, Carex polystachyus, Gahnia sieberana, Juncus prismatocarpus, Juncus usitatus, Lomandra longifolia, Paspalum distichum, and Schoenus brevifolius.

Sediment must be controlled during construction at the source to prevent the filter from being clogged prematurely from construction run-off. Prior to installation of the filter media, the bio-retention basin will typically be used as a sediment control basin and be turfed.

5.1 Quality Modelling

The performance of the proposed water quality treatment has been modelled using the MUSIC water quality program (Version 6.3.0). Canterbury-Bankstown Council do not specify MUSIC modelling parameters. As a result, the MUSIC modelling was undertaken based on parameters and land use types specified in the Developer Handbook for Water Sensitive Urban Design (Blacktown City Council, 2013). The nodes in the MUSIC model were based from ‘Liverpool Council’s – Clay’ MUSIC-LINK data, as that is the council adjacent to this development and utilises the rainfall station (6-minute data) that best represent this catchment. Refer to Appendix B for the MUSIC model summary results.

The MUSIC model layout is shown in Figure 5.1.

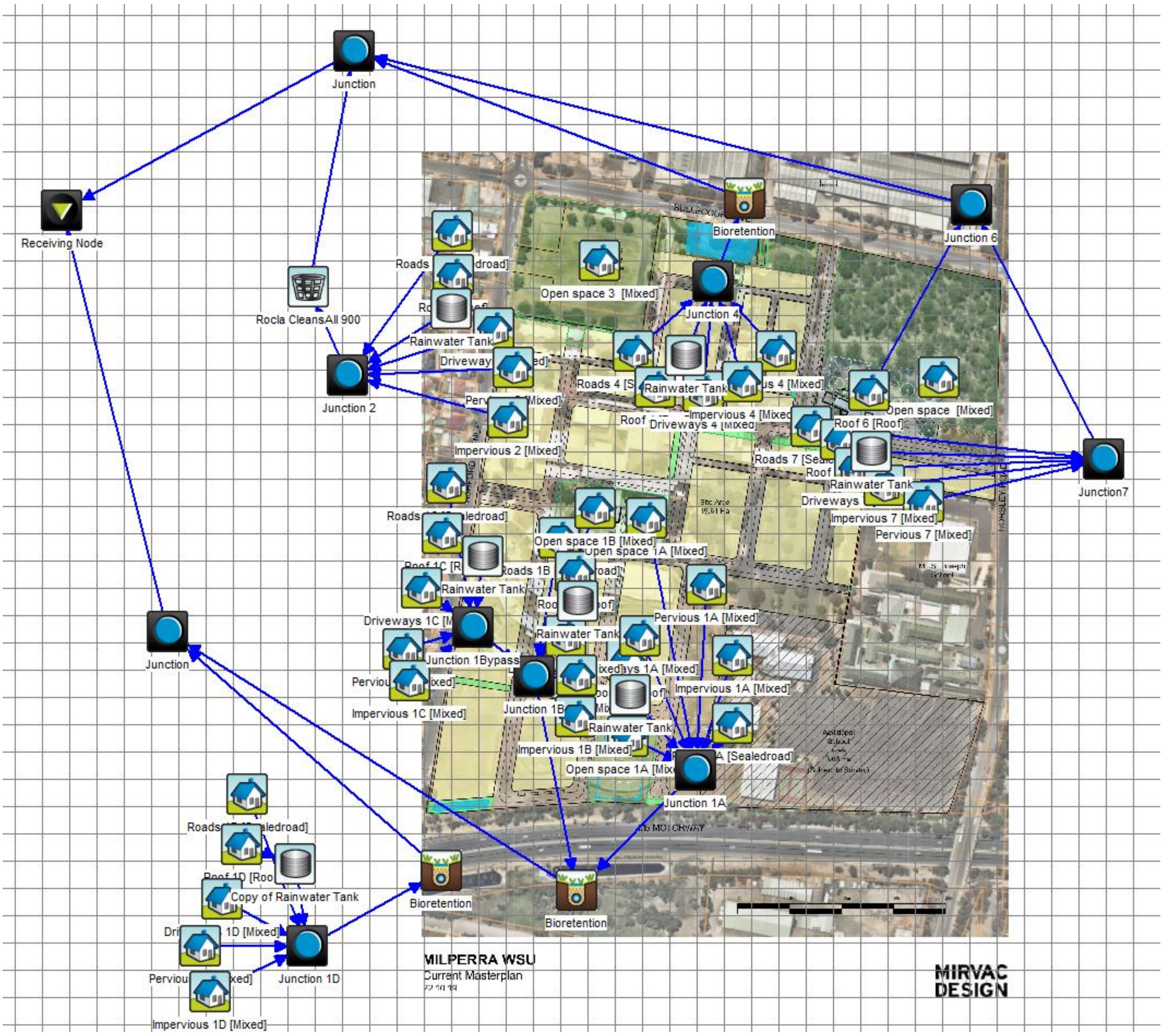


Figure 5.1 MUSIC Model Layout

The bio-retention configurations are summarised in Table 5.2. The locations of the basins are shown in Figure 5.1. The nominated bio-retention filter areas are the minimum required to achieve the stormwater quality objectives. Each stage will have a rainwater tank to reuse runoff from minimum 50% of the roof areas. Final rainwater tank sizing and configuration will be in accordance with BASIX.

Table 5.2 Bio-retention basin summary

Bio-retention	Filter Area (m^2)	Surface Area (m^2)	Extended Detention Depth (m)	Filter Media Depth (m)
Basin No.1	600	700	0.3	0.6
Basin No.2	50	50	0.3	0.6
Basin No.3	500	500	0.3	0.6

The results of modelling the water quality treatment system are shown in Table 5.3

Table 5.3 Pollutant Removal Rates

Bio-retention Basin	Water Quality Targets (% removal)	Pre-Treatment Pollutant Load (kg/year)	Post-Treatment Pollutant Load (kg/year)	Removal Rate Achieved (%)
		Basin No.1		
Total Suspended Solids	85	4,000	19,000	88.3
Total Phosphorus	60	7.82	35.6	66.9
Total Nitrogen	45	54.3	224	47.5
Gross Pollutants	90	624	2,530	100
		Basin No.2		
Total Suspended Solids	85	6,660	80.8	88.6
Total Phosphorus	60	13	11.2	66.7
Total Nitrogen	45	83.4	56.1	46
Gross Pollutants	90	950	57.9	100
		Basin No.3		
Total Suspended Solids	85	10,800	3,650	88.4
Total Phosphorus	60	21.1	68.4	67
Total Nitrogen	45	135	98.5	45.8
Gross Pollutants	90	1,550	97.7	100

The results of the MUSIC modelling outlined in this report demonstrate that the designed treatment train has been designed in accordance with the water quality objectives outlined in Table 5.1.

6. Flooding

6.1 Previous Flood Studies

The existing flood behaviour for the Georges River and associated catchments, including the WSU site has been identified in a number of regional flood studies. Such studies include;

- Georges River Floodplain Risk Management Study and Plan (Brewsher Consulting 2004)
- Kelso Stormwater Catchment Flood Study (Bewsher Consulting, 2009)
- Milperra Catchment Flood Study Update (BMT WBM 2015)
- Floodplain Risk Management Study and Plan for Sub-Catchments of the Mid Georges River Report (2017)

Our review of the studies suggest that the majority of the existing site remain flood free with some of the lower southern portions identified as low flood risk. Majority of the existing flood depths occur in the existing playing field (Figure 6.1).

The proposed works will regrade the site and ensure the finished floor levels meet the minimum flood planning levels (500mm freeboard above 100 year ARI). The pit and pipe and road network will manage the minor and major flow through the site. The detention basin will manage flows within the development up to the 100 year ARI.

The proposed level will provide a rising grade above the PMF flood level for evacuation.

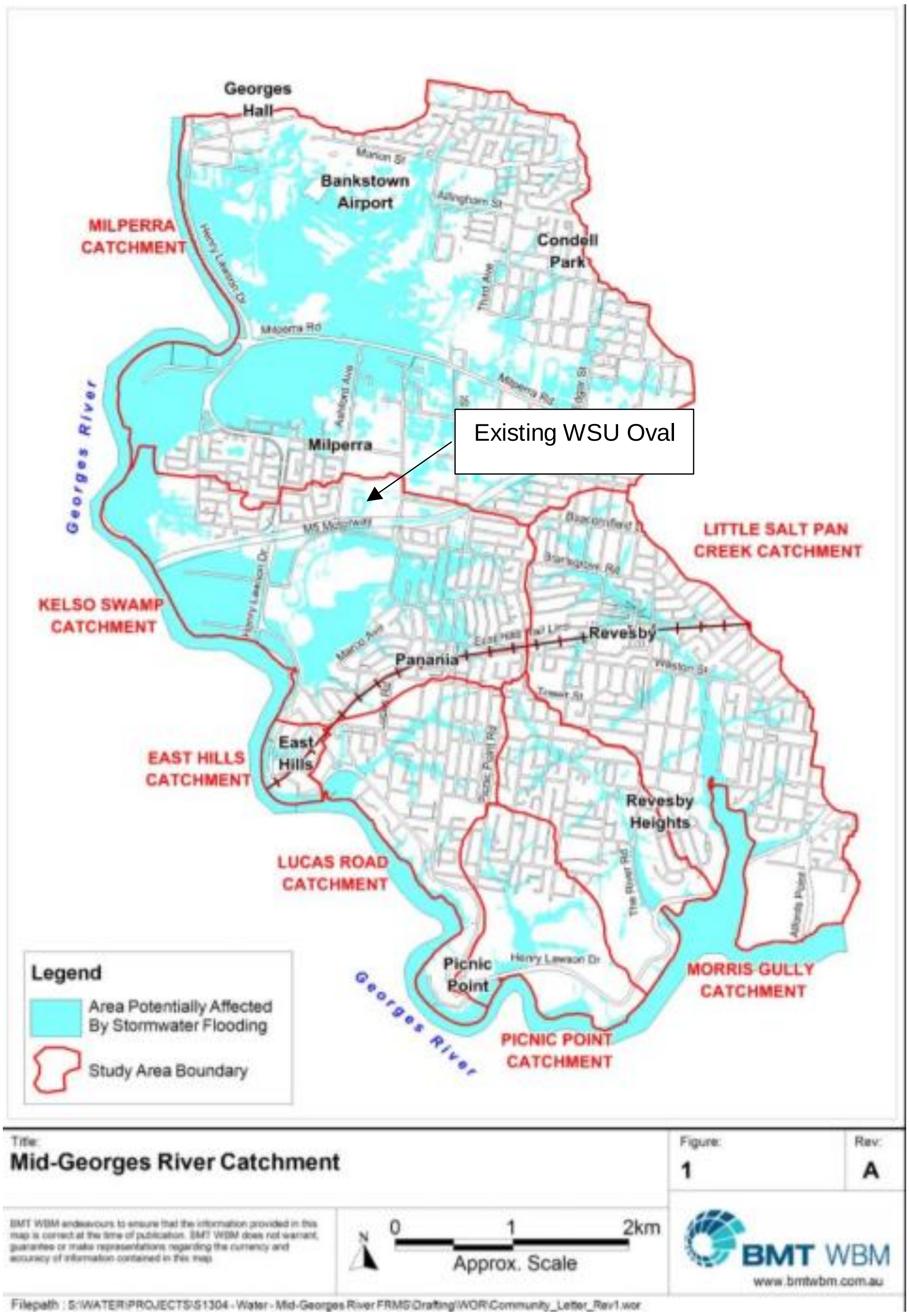


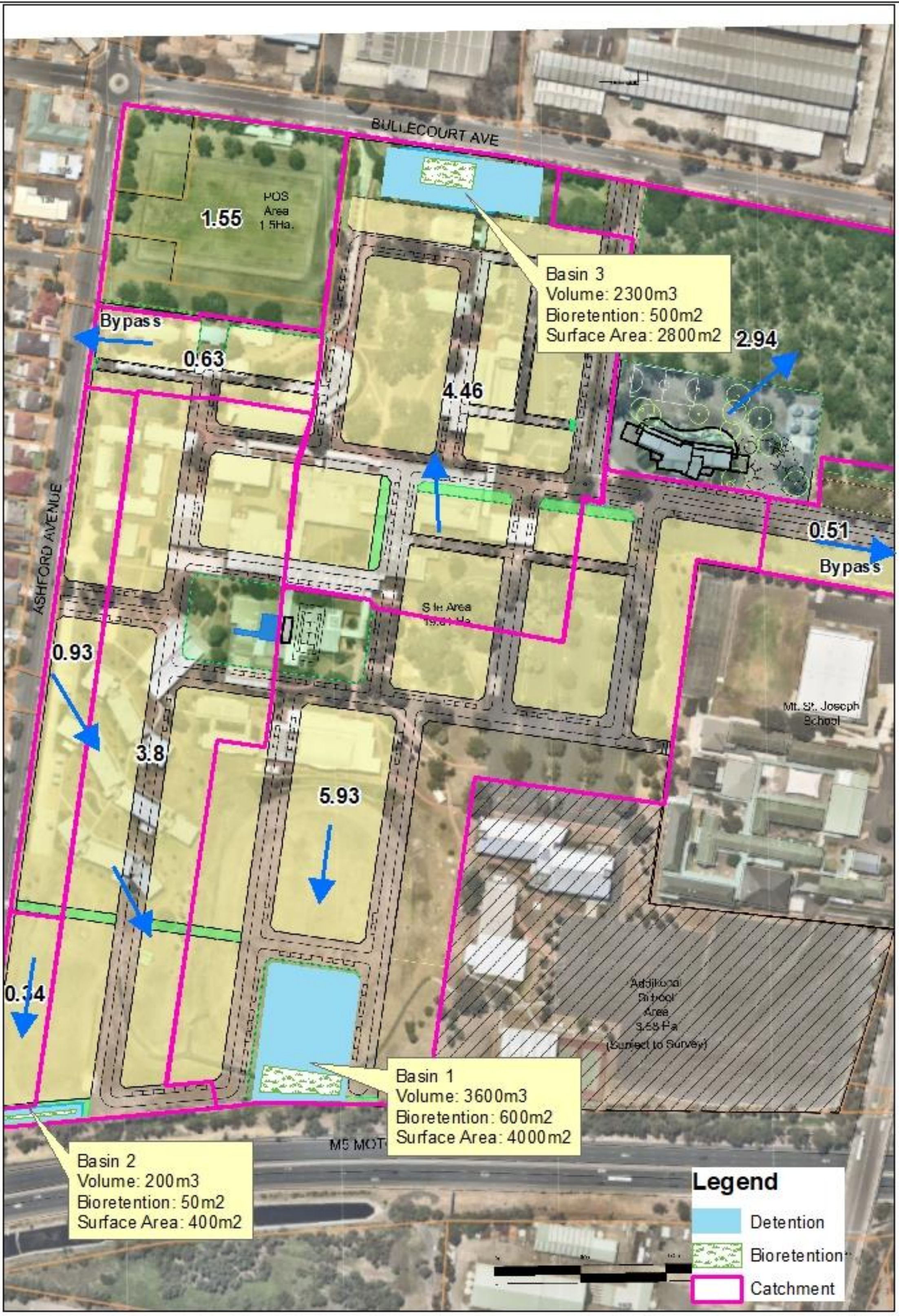
Figure 6.1 Potential Flood Affected Areas (BMT WBM 2015)

7. Conclusion

The stormwater management strategy for this proposed subdivision has been developed to provide 3 detention/bio-retention basins to provide adequate water quantity and quality treatment for the stormwater runoff. The basin provide a total of 6,100m^3 of detention volume and bio-retention areas of 600m^2, 50m^2 and 500m^2. The basins along with rainwater tanks are deemed adequate to provide sufficient water quality treatment to meet the target levels.

The proposed development will consider the stormwater and flood management and ensure the flood planning level controls are met.

Appendix A Stormwater Management Strategy



WSU MILPERRA

APPENDIX A
STORMWATER STRATEGY

Appendix B MUSIC Model Results

LIVERPOOL CITY COUNCIL

MUSIC-*link* Report

Project Details		Company Details	
Project:	Milperra WSU	**Company:**	Calibre
Report Export Date:	12-Jun-20	**Contact:**	
Catchment Name:	19000928 200518 Basins Opt5_200610	**Address:**	
Catchment Area:	16.021ha	**Phone:**	
Impervious Area*:	76.48%	**Email:**	
Rainfall Station:	67035 LIVERPOOL(WHITLAM		
Modelling Time-step:	6 Minutes		
Modelling Period:	1-01-1967 - 31-12-1976 11:54:00 PM		
Mean Annual Rainfall:	857mm		
Evapotranspiration:	1171mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.32		
Study Area:	Liverpool Clay Soil		
Scenario:	Liverpool Development		

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

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: Receiving Node	**Reduction**	**Node Type**	**Number**	**Node Type**	**Number**
Flow	28.3%	Bio Retention Node	3	Urban Source Node	41
TSS	80.8%	Rain Water Tank Node	7		
TP	68.3%	GPT Node	1		
TN	56%				
GP	97.7%				

Comments

Targets address the targets set by Botany Bay Catchment

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	Bioretention	Exfiltration Rate (mm/hr)	0	None	0
Bio	Bioretention	Exfiltration Rate (mm/hr)	0	None	0
Bio	Bioretention	Exfiltration Rate (mm/hr)	0	None	0
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	0	None	100
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	0	None	100
Bio	Bioretention	Hi-flow bypass rate (cum/sec)	0	None	100
Bio	Bioretention	Orthophosphate Content in Filter (mg/kg)	0	55	40
Bio	Bioretention	Orthophosphate Content in Filter (mg/kg)	0	55	40
Bio	Bioretention	Orthophosphate Content in Filter (mg/kg)	0	55	40
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	PET Scaling Factor	2.1	2.1	2.1
Bio	Bioretention	Total Nitrogen Content in Filter (mg/kg)	1	800	800
Bio	Bioretention	Total Nitrogen Content in Filter (mg/kg)	1	800	800
Bio	Bioretention	Total Nitrogen Content in Filter (mg/kg)	1	800	800
GPT	Rocla CleansAll 900	Hi-flow bypass rate (cum/sec)	None	99	0.928
Rain	Copy of Rainwater Tank	% Reuse Demand Met	None	None	18.721
Rain	Rainwater Tank	% Reuse Demand Met	None	None	9.241
Rain	Rainwater Tank	% Reuse Demand Met	None	None	35.20
Rain	Rainwater Tank	% Reuse Demand Met	None	None	33.9077
Rain	Rainwater Tank	% Reuse Demand Met	None	None	26.565
Rain	Rainwater Tank	% Reuse Demand Met	None	None	35.63
Rain	Rainwater Tank	% Reuse Demand Met	None	None	19.7279
Receiving	Receiving Node	% Load Reduction	None	None	28.3
Receiving	Receiving Node	GP % Load Reduction	90	None	97.7
Receiving	Receiving Node	TN % Load Reduction	45	None	56
Receiving	Receiving Node	TP % Load Reduction	65	None	68.3
Urban	Driveways 1A	Area Impervious (ha)	None	None	0.326
Urban	Driveways 1A	Area Pervious (ha)	None	None	0
Urban	Driveways 1A	Total Area (ha)	None	None	0.326
Urban	Driveways 1B	Area Impervious (ha)	None	None	0.251
Urban	Driveways 1B	Area Pervious (ha)	None	None	0
Urban	Driveways 1B	Total Area (ha)	None	None	0.251
Urban	Driveways 1C	Area Impervious (ha)	None	None	0.06
Urban	Driveways 1C	Area Pervious (ha)	None	None	0
Urban	Driveways 1C	Total Area (ha)	None	None	0.06
Urban	Driveways 1D	Area Impervious (ha)	None	None	0.022
Urban	Driveways 1D	Area Pervious (ha)	None	None	0
Urban	Driveways 1D	Total Area (ha)	None	None	0.022
Urban	Driveways 2	Area Impervious (ha)	None	None	0.057

Only certain parameters are reported when they pass validation

Node Type	Node Name	Parameter	Min	Max	Actual
Urban	Driveways 2	Area Pervious (ha)	None	None	0
Urban	Driveways 2	Total Area (ha)	None	None	0.057
Urban	Driveways 4	Area Impervious (ha)	None	None	0.255
Urban	Driveways 4	Area Pervious (ha)	None	None	0
Urban	Driveways 4	Total Area (ha)	None	None	0.255
Urban	Driveways 7	Area Impervious (ha)	None	None	0.033
Urban	Driveways 7	Area Pervious (ha)	None	None	0
Urban	Driveways 7	Total Area (ha)	None	None	0.033
Urban	Impervious 1A	Area Impervious (ha)	None	None	0.489
Urban	Impervious 1A	Area Pervious (ha)	None	None	0
Urban	Impervious 1A	Total Area (ha)	None	None	0.489
Urban	Impervious 1B	Area Impervious (ha)	None	None	0.377
Urban	Impervious 1B	Area Pervious (ha)	None	None	0
Urban	Impervious 1B	Total Area (ha)	None	None	0.377
Urban	Impervious 1C	Area Impervious (ha)	None	None	0.091
Urban	Impervious 1C	Area Pervious (ha)	None	None	0
Urban	Impervious 1C	Total Area (ha)	None	None	0.091
Urban	Impervious 1D	Area Impervious (ha)	None	None	0.033
Urban	Impervious 1D	Area Pervious (ha)	None	None	0
Urban	Impervious 1D	Total Area (ha)	None	None	0.033
Urban	Impervious 2	Area Impervious (ha)	None	None	0.086
Urban	Impervious 2	Area Pervious (ha)	None	None	0
Urban	Impervious 2	Total Area (ha)	None	None	0.086
Urban	Impervious 4	Area Impervious (ha)	None	None	0.384
Urban	Impervious 4	Area Pervious (ha)	None	None	0
Urban	Impervious 4	Total Area (ha)	None	None	0.384
Urban	Impervious 7	Area Impervious (ha)	None	None	0.049
Urban	Impervious 7	Area Pervious (ha)	None	None	0
Urban	Impervious 7	Total Area (ha)	None	None	0.049
Urban	Open space	Area Impervious (ha)	None	None	0
Urban	Open space	Area Pervious (ha)	None	None	2.66
Urban	Open space	Total Area (ha)	None	None	2.66
Urban	Open space 1A	Area Impervious (ha)	None	None	0
Urban	Open space 1A	Area Impervious (ha)	None	None	0
Urban	Open space 1A	Area Pervious (ha)	None	None	0.588
Urban	Open space 1A	Area Pervious (ha)	None	None	0.279
Urban	Open space 1A	Total Area (ha)	None	None	0.588
Urban	Open space 1A	Total Area (ha)	None	None	0.279
Urban	Open space 1B	Area Impervious (ha)	None	None	0
Urban	Open space 1B	Area Pervious (ha)	None	None	0.293

Only certain parameters are reported when they pass validation

LIVERPOOL CITY COUNCIL

music link

Node Type	Node Name	Parameter	Min	Max	Actual
Urban	Open space 1B	Total Area (ha)	None	None	0.293
Urban	Open space 3	Area Impervious (ha)	None	None	0
Urban	Open space 3	Area Pervious (ha)	None	None	1.55
Urban	Open space 3	Total Area (ha)	None	None	1.55
Urban	Pervious 1A	Area Impervious (ha)	None	None	0
Urban	Pervious 1A	Area Pervious (ha)	None	None	0.653
Urban	Pervious 1A	Total Area (ha)	None	None	0.653
Urban	Pervious 1B	Area Impervious (ha)	None	None	0
Urban	Pervious 1B	Area Pervious (ha)	None	None	0.503
Urban	Pervious 1B	Total Area (ha)	None	None	0.503
Urban	Pervious 1C	Area Impervious (ha)	None	None	0
Urban	Pervious 1C	Area Pervious (ha)	None	None	0.121
Urban	Pervious 1C	Total Area (ha)	None	None	0.121
Urban	Pervious 1D	Area Impervious (ha)	None	None	0
Urban	Pervious 1D	Area Pervious (ha)	None	None	0.044
Urban	Pervious 1D	Total Area (ha)	None	None	0.044
Urban	Pervious 2	Area Impervious (ha)	None	None	0
Urban	Pervious 2	Area Pervious (ha)	None	None	0.115
Urban	Pervious 2	Total Area (ha)	None	None	0.115
Urban	Pervious 4	Area Impervious (ha)	None	None	0
Urban	Pervious 4	Area Pervious (ha)	None	None	0.511
Urban	Pervious 4	Total Area (ha)	None	None	0.511
Urban	Pervious 7	Area Impervious (ha)	None	None	0
Urban	Pervious 7	Area Pervious (ha)	None	None	0.066
Urban	Pervious 7	Total Area (ha)	None	None	0.066
Urban	Roads 1A	Area Impervious (ha)	None	None	1.866
Urban	Roads 1A	Area Pervious (ha)	None	None	0.208
Urban	Roads 1A	Total Area (ha)	None	None	2.075
Urban	Roads 1B	Area Impervious (ha)	None	None	1.217
Urban	Roads 1B	Area Pervious (ha)	None	None	0.136
Urban	Roads 1B	Total Area (ha)	None	None	1.354
Urban	Roads 1C	Area Impervious (ha)	None	None	0.292
Urban	Roads 1C	Area Pervious (ha)	None	None	0.032
Urban	Roads 1C	Total Area (ha)	None	None	0.325
Urban	Roads 1D	Area Impervious (ha)	None	None	0.107
Urban	Roads 1D	Area Pervious (ha)	None	None	0.011
Urban	Roads 1D	Total Area (ha)	None	None	0.119
Urban	Roads 2	Area Impervious (ha)	None	None	0.275
Urban	Roads 2	Area Pervious (ha)	None	None	0.030
Urban	Roads 2	Total Area (ha)	None	None	0.306

Only certain parameters are reported when they pass validation

Node Type	Node Name	Parameter	Min	Max	Actual
Urban	Roads 4	Area Impervious (ha)	None	None	1.403
Urban	Roads 4	Area Pervious (ha)	None	None	0.156
Urban	Roads 4	Total Area (ha)	None	None	1.56
Urban	Roads 7	Area Impervious (ha)	None	None	0.161
Urban	Roads 7	Area Pervious (ha)	None	None	0.017
Urban	Roads 7	Total Area (ha)	None	None	0.179
Urban	Roof 1A	Area Impervious (ha)	None	None	1.796
Urban	Roof 1A	Area Pervious (ha)	None	None	0
Urban	Roof 1A	Total Area (ha)	None	None	1.796
Urban	Roof 1B	Area Impervious (ha)	None	None	1.383
Urban	Roof 1B	Area Pervious (ha)	None	None	0
Urban	Roof 1B	Total Area (ha)	None	None	1.383
Urban	Roof 1C	Area Impervious (ha)	None	None	0.332
Urban	Roof 1C	Area Pervious (ha)	None	None	0
Urban	Roof 1C	Total Area (ha)	None	None	0.332
Urban	Roof 1D	Area Impervious (ha)	None	None	0.122
Urban	Roof 1D	Area Pervious (ha)	None	None	0
Urban	Roof 1D	Total Area (ha)	None	None	0.122
Urban	Roof 2	Area Impervious (ha)	None	None	0.318
Urban	Roof 2	Area Pervious (ha)	None	None	0
Urban	Roof 2	Total Area (ha)	None	None	0.318
Urban	Roof 4	Area Impervious (ha)	None	None	0.255
Urban	Roof 4	Area Pervious (ha)	None	None	0
Urban	Roof 4	Total Area (ha)	None	None	0.255
Urban	Roof 6	Area Impervious (ha)	None	None	0.028
Urban	Roof 6	Area Pervious (ha)	None	None	0
Urban	Roof 6	Total Area (ha)	None	None	0.028
Urban	Roof 7	Area Impervious (ha)	None	None	0.183
Urban	Roof 7	Area Pervious (ha)	None	None	0
Urban	Roof 7	Total Area (ha)	None	None	0.183

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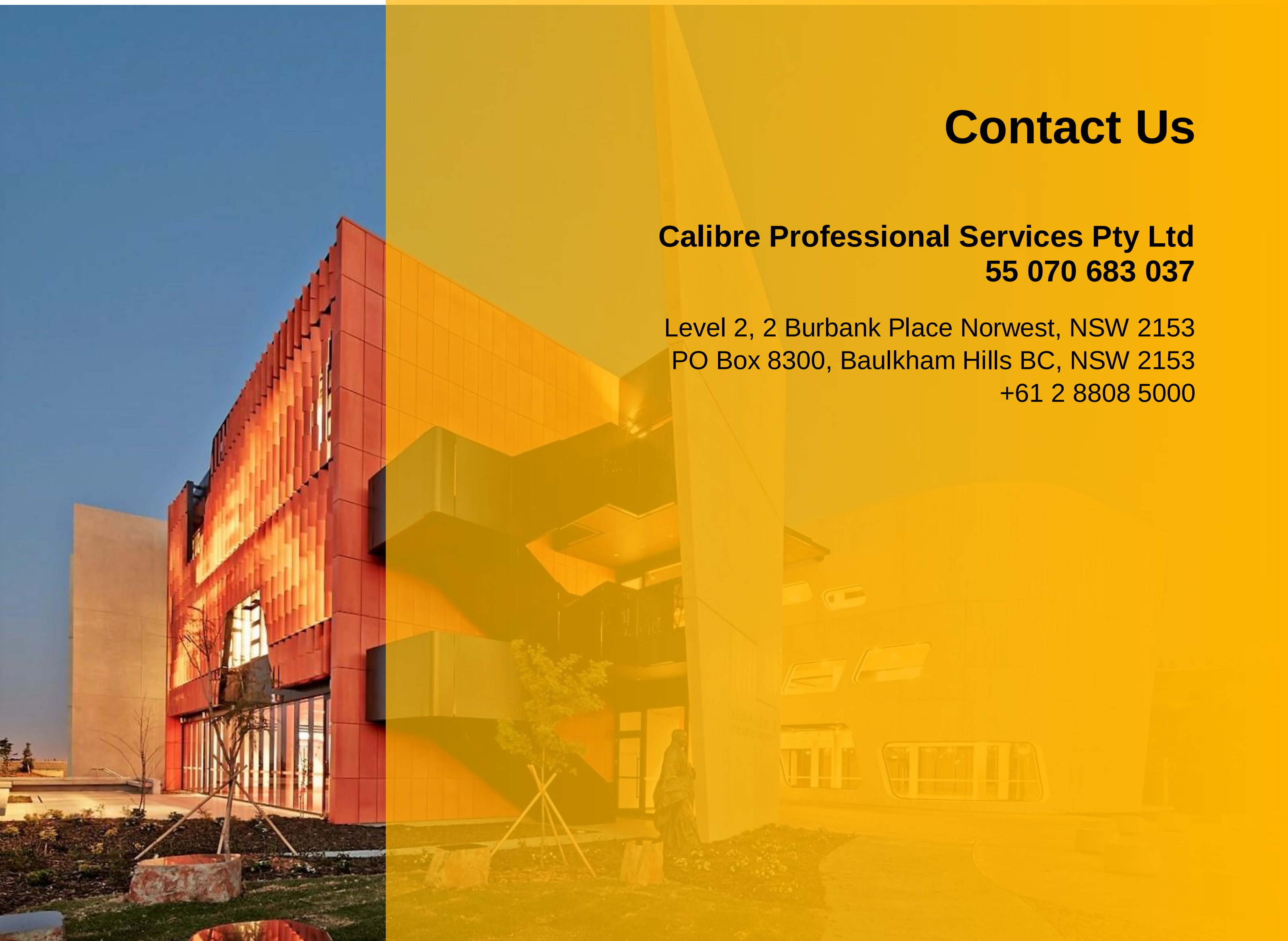
Failing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Receiving	Receiving Node	TSS % Load Reduction	85	None	80.8

Only certain parameters are reported when they pass validation



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