MOTT MACDONALD

4-6 Bligh Street, Sydney

Stormwater Management Report

December 2022

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Stormwater Management Report

December 2022

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	09.12.22	S.Saiara	A.Tarshan	D.Fettell	Draft Issue
B	14.12.22	S.Saiara	A.Tarshan	Jeffrey Mail	Issue For Information

Document reference: B

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Executive summary

Holdmark NSW Pty Ltd (Holdmark) intends to redevelop the existing property at 4-6 Bligh Street, Sydney NSW 2000 (the site) into a mixed-use development. Mott MacDonald has been engaged by Holdmark to develop a stormwater management plan for the development of the site. This report aims to support the delivery of the site as it will identify opportunities, constraints and risks related to civil design. The scope of this report summarises the existing and proposed stormwater drainage design, as well as the design approach, key assumptions, relevant references, and standards applied to the development of the concept civil design document for the site.

The site involves construction of a 59-storey mixed-use hotel and commercial high-rise building with four basement levels occupying a site footprint of approximately 1,200m^2.

The existing site is occupied by a multi-storey commercial building with a two-level basement that was used for car parking and building plant storage.

Mott MacDonald undertook a full unsteady numerical hydraulic model based on the Horton/ISLAX type hydrological model using DRAINS software to identify pits and pipes flow as well as the overland flow characteristics.

In addition, a water quality analysis has been conducted using MUSIC software to undertake the analysis of the Water Sensitive Urban Design (WSUD) assessment.

This stormwater management report discusses the following:

- Stormwater Drainage
- Water Sensitive Urban Design

1 Introduction

1.1 4-6 Bligh Street Development

This report has been prepared to accompany a detailed State Significant Development Application (SSDA) for the mixed-use redevelopment proposal located at 4-6 Bligh Street, Sydney (SSD-48674209).

The Council of the City of Sydney (the Council), as delegate for the Minister for Planning and Public Spaces (the Minister), is the Consent Authority for the SSDA under an Instrument of Delegation issued by the Minister on 3 October 2019.

The application seeks consent for the construction of a 59-storey mixed-use hotel and commercial development. The purpose of the project is to revitalise the site and deliver new commercial floorspace and public realm improvements consistent with the City's vision to strengthen the role of Central Sydney as an international tourism and commercial destination.

A separate development consent (D/2018/892) relating to early works for the proposed application was granted for the site on 31 January 2020. Consent was granted for the demolition of the existing site structures, excavation, and shoring of the site for three basement levels (to a depth of RL9.38m) to accommodate the proposed mixed-use hotel and commercial development. As such, this application does not seek consent for these components and instead seeks to rely upon and activate D/2018/892 for early works.

Specifically, development consent is sought for:

- Site establishment, including removal of three existing trees along the Bligh Street frontage and de-commissioning and removal of an existing substation (s2041) on the site.
- Construction of a 59-storey hotel and commercial office tower. The tower will have a maximum building height of RL225.88 (205m) and a total gross floor area (GFA) provision of 26,796sqm, and will include the following elements:
  - Five basement levels accommodating a substation, rainwater tank, hotel back of house, plant and services. A porte-cochere and four service bays will be provided on basement level 1, in addition to 137 bicycle spaces and end of trip facilities on basement level 2, and 28 car parking spaces.
  - A 12-storey podium accommodating hotel concierge and arrival at ground level, conference facilities, eight levels of commercial floor space and co-working facilities, and hotel amenities including a pool and gymnasium at level 12.
  - 42 tower levels of hotel facilities including 417 hotel keys comprising standard rooms, suites and a penthouse.
  - Two tower levels accommodating restaurant, bar, back of house and a landscaped terrace at level 57.
  - Plant, servicing and BMU at level 59 and rooftop.
- Increase to the width of the existing Bligh Street vehicular crossover to 4.25m and provision of an additional 4m vehicular crossover on Bligh Street to provide one-way access to the porte-cochere and service bays on basement level 1.
- Landscaping and public domain improvements including:
  - Replacement planting of three street trees in the Bligh Street frontage,
  - Construction of a landscape pergola structure on the vertical façade of the north-eastern and south-eastern podium elevations,
  - Awning and podium planters, and

  - Provision of a feature tree at the level 57 terrace.
- Identification of two top of awning building identification signage zones with a maximum dimension of 1200mm x 300mm. Consent for detailed signage installation will form part of a separate development application.
- Utilities and service provision.
- Installation of public art on the site, indicatively located at ground level.

1.2 Purpose of Report

This report further intends to summarise the design approach, key assumptions, and relevant references and standards applied to the development of the concept civil design documentation for the development at 4-6 Bligh Street.

The report discusses the two main sections:

- Stormwater Drainage
- Water sensitive Urban Design

This report has been developed to:

- Describe how input data has been obtained, collected and interpreted.
- Discuss the key design standards used for the design
- Present the civil and stormwater strategies that have been developed for this site.

1.3 Existing Site Conditions

The site for the purposes of this SSDA is a single allotment identified as 4-6 Bligh Street, Sydney and known as Lot 1 in Deposited Plan 1244245. The site has an area of 1,218sqm, and is identified in Figure 1-1.

The site is relatively flat, with a slight slope ranging from 21m AHD in the north-western corner to 19.5m AHD in the south-western corner.

The site is located within the north-eastern part of Central Sydney in a block bound by Bligh Street to the west, Hunter Street to the south, Chifley Square/Phillip Street to the east, and Bent Street to the north. The surrounding buildings are generally characterised by a mix of commercial office and hotel uses with ground level retail, restaurant and café uses and are of varying heights, ages and styles, including a number of State and local listed heritage buildings.

The site is also located in proximity to a number of Sydney Metro City & Southwest (opening 2024) and Sydney Metro West (opening 2030) station sites.

Specifically, the site is located to the immediate east of the Sydney Metro Hunter Street station (east site), which is located on the corner of Hunter Street and Bligh Street, and approximately 350m east of the Sydney Metro Hunter Street station (west site). The Hunter Street station sites are part of the Sydney Metro West project. SEARs for the preparation of Concept SSDAs for the sites were issued in August 2022.

Approximately 150m to the south of the site is Sydney Metro Martin Place Station site, located to the south of Hunter Street between Castlereagh Street and Elizabeth Street. The Martin Place Station site is currently under construction and forms part of the Sydney Metro City & Southwest project.

The site is occupied by a vacant commercial office building with ground floor retail and basement car parking known as “Bligh House”. Completed in 1964, Bligh House is a 17-storey tower inclusive of a three-storey podium with the podium levels built to the Bligh Street alignment and

the tower setback from the street frontage. The building was designed by Peddle Thorp and Walker and was constructed as part of the post-World War II development boom in the Sydney CBD. The podium overhang along the footpath provides continuous pedestrian protection. Vehicle access to the site is off Bligh Street via a single 2.6m wide driveway that is restricted by a security gate under one-lane, two-way access arrangements. The driveway provides access to the basement car park, containing 21 car parking spaces.

The site contains no vegetation; however, two existing street trees are located adjacent to the site boundary on Bligh Street.

Development consent for the demolition of the existing site structures, excavation and shoring of the site for three basement levels (to a depth of RL9.38m) was granted by City of Sydney on 31 January 2022 (D/2018/892).

Figure 1-1: Site Boundary Location

1.4 Existing Stormwater Network Conditions

In its existing state, the site is comprised entirely of impervious surfaces with one driveway flushed to the footpath and a layback graded towards the street. There is a crest on Bligh Street approximately 10m south of the intersection of Bligh and Bent Street, indicating that a small portion of the Bligh Street catchment runoff will discharge to Bent Street and the remaining area to Hunter Street.

The existing stormwater network on Bligh Street is comprised of circular and oviform pipes that drain away from the site to the intersecting streets in the north and south.

2 Methodology

2.1 Methodology and Approach

- A desktop study was undertaken using Before You Dig Australia (BYDA) to determine existing services encompassing the proposed development site.
- Detailed survey information has been provided by C.M.S Surveyors Pty Limited for 4-6 Bligh St, Sydney, Survey Instruction 15857A, Issue 7, dated 27/04/2017.
- Review of the architectural layout provided on 8th December 2022.
- City of Sydney Council DCP and relevant guidelines were reviewed to prepare a design criteria.
- A coordination meeting was undertaken on 12th December 2022 with the architects (Woods Bagot) and hydraulic consultant (Stantec) to discuss the internal design elements.

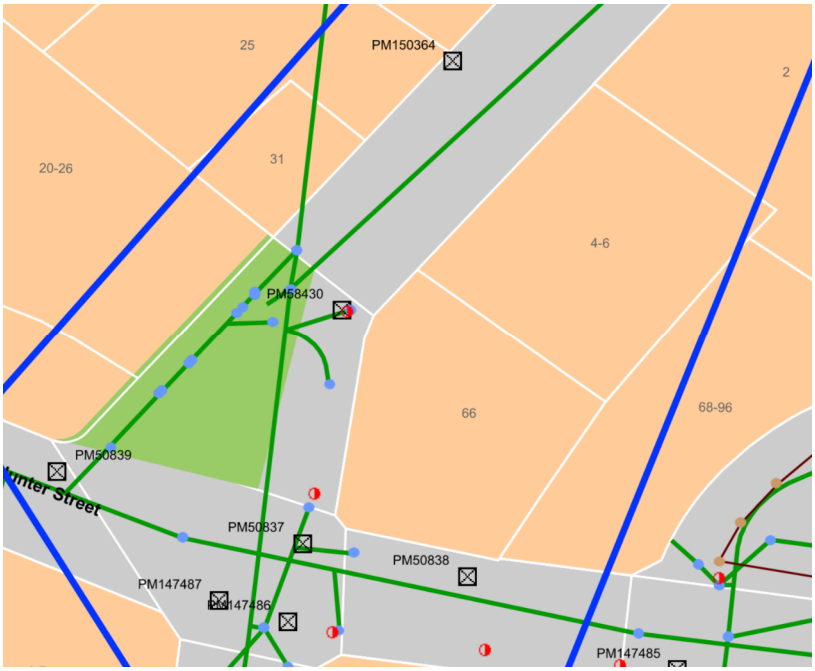
2.2 Existing Stormwater Assets

The desktop study and survey information indicate the presence of several stormwater assets within and adjacent to the development site. These are summarised in Table 2-1below:

Table 2-1:Existing Stormwater Assets

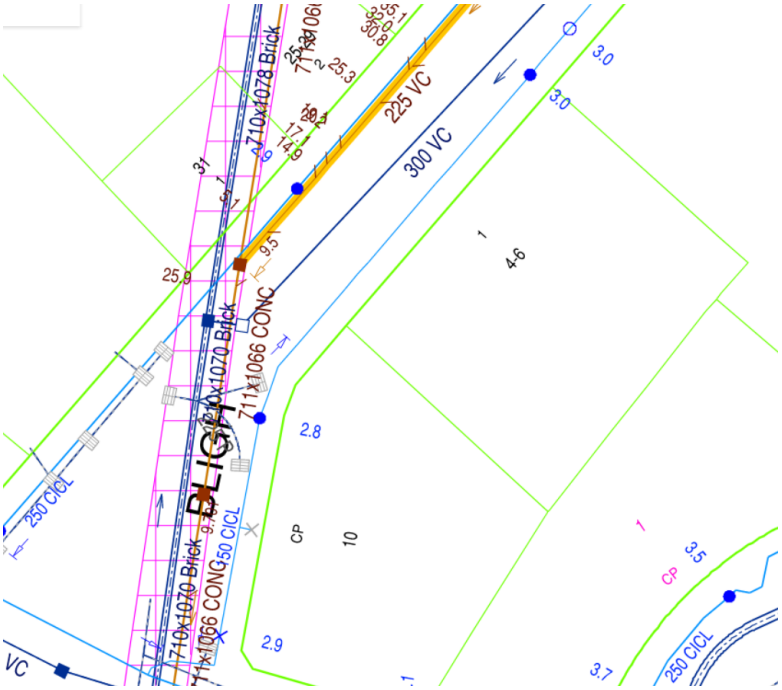
Owner	HLFC	Size (DN)	Configuration	Material	Location
City of Sydney	Stormwater	TBC	TBC	TBC	Frontage of the property
Sydney Water	Stormwater	710x1078	TBC	Brick	Transecting lot 16-18, 12-14

Figure 2-1:City of Sydney Stormwater Asset



Source: City of Sydney DBYD plan

Figure 2-2: Sydney Water Asset



Source: Sydney Water DBYD plan

3 Design Inputs and Guidelines

3.1 Consultation

Mott Macdonald has consulted with the project team during the design phase to obtain a feasible design solution for the proposed development site. The proposed stormwater drainage design will be carried out in accordance with the City of Sydney Council's Development Control Plan (DCP).

3.2 Codes and Guidelines

The design has been undertaken in compliance with the relevant Australian Standards, and local government guidelines. Key documents used as guidance for the design are summarised below in Table 3-1.

Table 3-1:Summary of design standards

Reference	Title	Version or Date
AS/NZS 3500.3	Plumbing and Drainage – Stormwater Drainage	2021
ARQ	Australian Runoff Quality – A Guide to Water Sensitive Urban Design (National Committee for Water Engineering)	2006
BCA	Building Code of Australia	2019
Blue Book	Managing Urban Stormwater - Soils and Construction, Volume 1, 4th edition, March 2004, Landcom	Mar 2004
Engineers Australia	Australian Rainfall and Runoff Climate Change Workshop No. 2, UNSW Water Research Centre, Westra, S	2011
eWater	MUSIC User Manual	V5
City of Sydney Council	Sydney Development Control Plan	2011
City of Sydney Council	City of Sydney's Interim Floodplain Management Policy	2014
City of Sydney Council	A4-Drainage Design	
City of Sydney Council	Water Cycle Management Plan	

3.3 Other Consultant Inputs

The proposed stormwater design is based on:

- Architectural design information provided by Woods Bagot Architects.
- Coordination advice (12th December 2022) by hydraulic consultant (Stantec) regarding rainwater tank position, basement sump collection and pump out configuration and treatment pit position.

3.4 Stormwater Management Design

3.5 Design Storm Events

Proposed stormwater drainage system is to be designed to cater for the minor storm event of 20 year Average Recurrence Interval (ARI) and for overland flow for major storms up to 100 year ARI.

3.6 Design Requirements

City of Sydney Council A4-Drainage guideline indicates the design considerations in relation to stormwater drainage design for developments. A design criterion has been developed to ensure the proposed design adhere to what has been denoted in City of Sydney guidelines. Table 3-2 have summarised the design criteria for hydrology and hydraulic analysis:

Table 3-2: Hydrology and Hydraulic Design Criteria

Item	Standard	Adopted
Hydrological Model	City of Sydney	DRAINS file (ILSAX type time-area method)
Minor Design Storm	City of Sydney	20 year Average Recurrence Interval (5% AEP)
Major Design Storm	City of Sydney	100 year Average Recurrence Interval (1% AEP)
Design Rainfall	City of Sydney	AR&R 2019 values
Urban Rainfall Losses	*NA*	Paved (impervious) area depressions storage (mmm)=1 Supplementary area depression storage (mm) =1 Grassed (pervious) area depression storage (mm) = 5
Pipe Size	City of Sydney	Pipelines – 375mm nominal diameter Box culverts – 450mm width by 300mm height nominal.
Retardance Coefficient	AR&R 2019	Impervious = 0.01 Industrial/commercial = 0.2-0.5 Residential (low density) = 0.1-0.2 Residential (high density) = 0.2-0.5 Open pervious areas, minimal vegetation (grassed) = 0.03-0.05 Open pervious areas, moderate vegetation (shrubs) = 0.05-0.07 Open previous areas, thick vegetation (trees) = 0.07-0.12
Pit Spacing	City of Sydney	Conduit diameter/width=375mm - 40m 750mm≤diameter/width<1500mm – 60m Diameter/width ≥ 1500mm – 100m
Pit Losses	City of Sydney	Missouri charts
Pit Blockage Factors	City of Sydney AR&R 2019	Sag blockage factor: kerb inlet <= 1.0m – 0.7 kerb inlet > 1.0m – 0.5 v grate or grate only – 0.9 strip drain or other – 0.95 On grade blockage factor: kerb inlet <= 1.0m – 0.5 kerb inlet > 1.0m – 0.2 v grate or grate only – 0.9 strip drain or other – 0.95
Tail water level/sea water level	City of Sydney	Minor Storm: Higher of the • obvert of the pipe • Ocean Boundary Conditions • Hydraulic Grade Line of the downstream connection conduit • 150mm below the surface, where the downstream conduit capacity is less than the 20yr ARI. For the impacts of a proposed network:

Item	Standard	Adopted
		• The obvert of the pipe • The hydraulic grade line of the downstream network for the same storm event • For flood prone land, flood levels reported in the relevant City of Sydney flood study • Ocean boundary conditions consistent with the relevant City of Sydney flood study.
Overland Flow Safety Criteria	City of Sydney	Max Depth x Velocity = 0.4m2/s Maximum flow width 1.5m Maximum depth 50mm
Pollution reduction targets	City of Sydney	Gross Pollutants 90% TSS 85% TP 65% TN 45%
Stream Erosion Metrics	AR&R 2019	Maximum 3.5

4 Stormwater Management Design

4.1 Proposed Development

The proposed new development site has a total area of 1,218 sqm, with a significant portion of impervious roof area similarly to the existing development, as such, the percentage of the post-development impervious area is negligible. The site does not require an on-site detention as per Sydney Water's advice, therefore the discharge from the site will be to a proposed new grated inlet pit which is to connect to the existing drainage network along Bligh Street.

4.2 Tailwater Assumption

As per the flooding assessment report undertaken by Mott Macdonald, October 2022 it is confirmed the development site is well elevated from the neighbouring streets and is not recognised as flood prone, which is further confirmed by the city area study flood maps indicating the site is not prone to flooding. As per City of Sydney guideline Sydney Streets Technical Specifications section 4.7.3.5 the downstream tailwater level has been adopted as the obvert of the pipe in the minor storm event to determine any backwater effect in the proposed 375mm pipe.

In the major storm event, flow in excess of the stormwater pipe capacity will surcharge from the new grated inlet pit at the kerb line into the road reserve.

4.3 Hydraulic Modelling

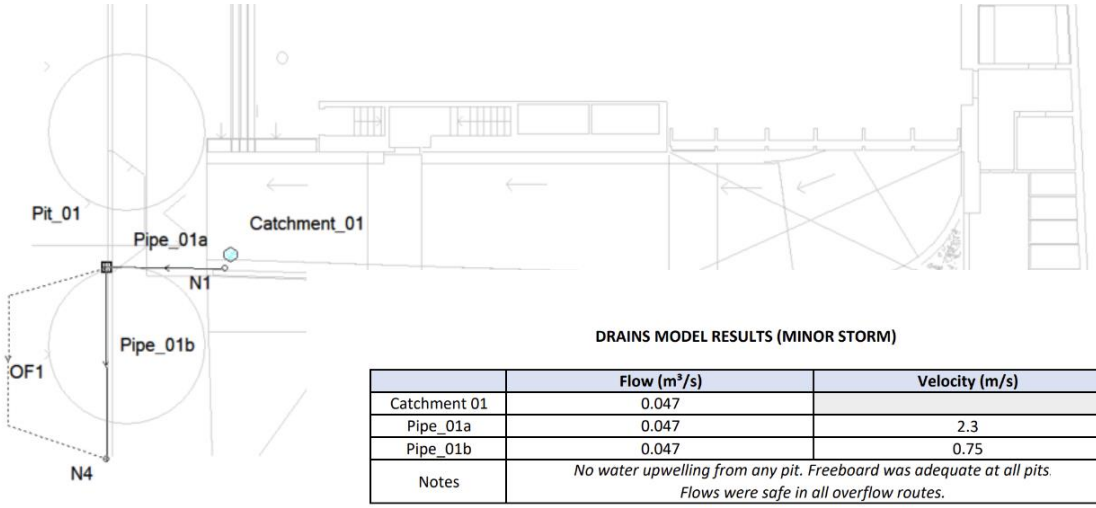
A DRAINS modelling assessment has been undertaken to determine the hydraulic grade line (HGL) with the adopted tailwater level, which concludes the proposed 375mm pipe and 900x900 pit will be adequate to accommodate the flow generated from the development site. The proposed pit has been designed to closely resemble the existing downstream pit to adequately capture contributing road runoff.

A hydrological model of the catchment is formulated using the DRAINS software package to assess the performance of the site stormwater network. The DRAINS program typically performs design and analysis calculations for urban stormwater systems and models the flood behaviour on both rural and urban catchments.

The user data inputs required by DRAINS include catchment areas, time of concentration, pervious and impervious areas, IFD rainfall intensities, and flow path roughness. Modelling is performed through the development of a network of pipes, pits, and nodes to represent the proposed flow generated from the development site.

Other design criteria, which include tail water levels, blockage factors, and climate change factors, are summarised in Table 3-2.

Figure 4-1:Hydraulic Assessment in DRAINS



DRAINS MODEL RESULTS (MINOR STORM)

	Flow (m^3/s)	Velocity (m/s)
Catchment 01	0.047	
Pipe_01a	0.047	2.3
Pipe_01b	0.047	0.75
Notes	*No water upwelling from any pit. Freeboard was adequate at all pits. Flows were safe in all overflow routes.*	

4.4 Overland Flow Path

As discussed in section 4.1 above, the proposed site is not identified as a flood-prone area due to its high elevation compared to its adjacent properties, however a portion of the site is dedicated to raised planters on ground. Potential flows within the building ramp areas and landscaped area overflow are to be captured by grated trench drains at the base of basement entry ramps. This will experience very minimal flow which will be captured within the internal building drainage system designed and coordinated from the trench drain collection system by hydraulic consultants.

4.5 Point of Discharge

The current development is noted to be discharging into the kerb, no existing stormwater pits have been identified along the frontage of the property. However, in accordance with the City of Sydney, A4 Stormwater Drainage Design clause 4.15.2.2, it is stated that the maximum kerb discharge shall not exceed 25L/s for minor storm events up to 20-year ARI. Therefore, abiding by this policy, and hence the proposed development will generate more than 25L/s approximately 47L/s which will be discharged through proposed new stormwater pit. The survey information provided does not indicate the invert level of the existing next downstream pit located to the southwest of the site on the eastern side of Bligh Street, as such, assumptions regarding the invert levels have been made at this stage which will be further confirmed upon receiving the required information.

5 Stormwater Quality Improvements

To ensure that the development improves the quality of stormwater leaving the development site. Mott Macdonald have reviewed the site, formulated a Water Sensitive Urban Design Concept modelled the treatment train performance and have summarised the results in the following sections:

5.1 Design Objective

According to the City of Sydney DCP, section 3.7.3 the following reduction targets are to be achieved for water quality:

Table 5-1: City of Sydney Reduction Targets

Stormwater Quality Design Criteria	
Pollutant	Average Annual Pollutant Load Reduction Objective (%)
Gross Pollutant	90%
Total Suspended Solids	85%
Total Phosphate	65%
Total Nitrogen	45%

5.2 Proposed Water Quality Modelling Strategy

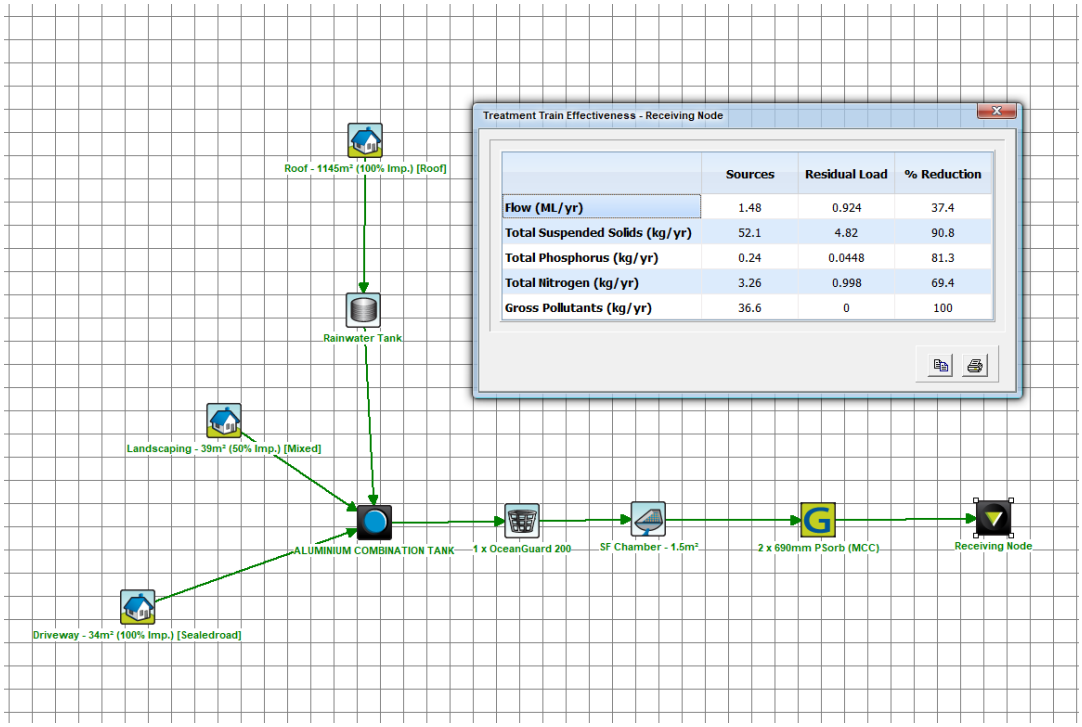
Modelling of the proposed development was undertaken using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) software. The software was utilised to simulate urban stormwater systems operating at a range of temporal and spatial scales. MUSIC models the total amounts of gross pollutants, phosphorus, nitrogen, and total suspended solids produced within various types of catchments. It allows the user to simulate the removal rates expected when implementing water quality treatment devices to reduce the increased gross pollutant and nutrient levels created by the proposed development.

A MUSIC modelling assessment was undertaken for the proposed development to determine the treatment measure required to achieve the pollutant reduction targets.

The following proprietary products are to be incorporated within the proposed stormwater infrastructure:

- 2 x 690mm storm filter cartridges and 3x OceanGuard to be installed within a ground level aluminium combination tank to aid in treating all captured site water.
- 1 x 20kL Rainwater Tank to be installed on level 2 to capture runoff generated from the roof. Captured water to be used for landscape irrigation and to meet toilet reuse demands.

Figure 5-1: MUSIC Modelling Assessment and Results



6 Erosion and Sediment Control

The erosion and sediment control measures will be undertaken with reference to the Landcom Blue Book: Managing Urban Stormwater Soil for best practice through the construction phase to limit any sediments generated from the site from entering the existing stormwater network and creek. As such the following measures are to be undertaken as part of the proposed construction works:

- Sediment Fence to be installed around the site perimeter to trap any sediment.
- Shaker grid/wash down facility to be installed at the site egress to limit any sediments from being carried outside of the construction site.
- Stockpile location to be confirmed by contractor on-site during the construction phase, preferably to be located at the high point of the site.

7 Conclusion

This stormwater management report discusses the proposed stormwater drainage along with water-sensitive urban design and erosion and sediment control measures that are specific to the proposed development site 4-6 Bligh Street. The proposed measures combined to achieve the City of Sydney requirements. This report is to be read in conjunction with the civil drawing set issued alongside with this report.

A. Appendix A: MUSIC Link Report

MUSIC-*link* Report

Project Details		Company Details	
Project:	4-6 Bligh Street	**Company:**	Mott MacDoald
Report Export Date:	12/12/2022	**Contact:**	Luke Squire
Catchment Name:	Bligh_Street_04	**Address:**	
Catchment Area:	0.121ha	**Phone:**	
Impervious Area*:	98.76%	**Email:**	luke.squire@mottmac.com
Rainfall Station:	66062 SYDNEY		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1982 - 31/12/1986 11:54:00 PM		
Mean Annual Rainfall:	1278mm		
Evapotranspiration:	1265mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.34		
Study Area:	City of Sydney Sandy Loam Soil		
Scenario:	City of Sydney 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	37.4%	Sedimentation Basin Node	1	Urban Source Node	3
TSS	90.2%	Rain Water Tank Node	1		
TP	81.1%	Generic Node	1		
TN	69%	GPT Node	1		
GP	100%				

Comments

The 'SFChamber' node has been modified to represent the filtration chamber. Default 'K' values have been manuallyadjusted to 1 to eliminate anyperformance from the actual tank,which would alreadybe accounted for in the FilterGenericNode Target Elements.Not doing this would represent a duplication of the chamber attenuation effect. (For anyquestions, please ContactOcean Protect on 1300 354 722

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
GPT	1 x OceanGuard 200	Hi-flow bypass rate (cum/sec)	None	99	0.02
Rain	Rainwater Tank	% Reuse Demand Met	None	None	57.21
Receiving	Receiving Node	% Load Reduction	None	None	37.4
Receiving	Receiving Node	GP % Load Reduction	90	None	100
Receiving	Receiving Node	TN % Load Reduction	45	None	69
Receiving	Receiving Node	TP % Load Reduction	65	None	81.1
Receiving	Receiving Node	TSS % Load Reduction	85	None	90.2
Sedimentation	SF Chamber - 1.5m^2	% Reuse Demand Met	None	None	0
Sedimentation	SF Chamber - 1.5m^2	Exfiltration Rate (mm/hr)	0	0	0
Sedimentation	SF Chamber - 1.5m^2	Extended detention depth (m)	0.25	1	0.77
Sedimentation	SF Chamber - 1.5m^2	High Flow Bypass Out (ML/yr)	None	None	0
Urban	Driveway - 34m^2 (100% Imp.)	Area Impervious (ha)	None	None	0.003
Urban	Driveway - 34m^2 (100% Imp.)	Area Pervious (ha)	None	None	0
Urban	Driveway - 34m^2 (100% Imp.)	Total Area (ha)	None	None	0.003
Urban	Landscaping - 39m^2 (50% Imp.)	Area Impervious (ha)	None	None	0.001
Urban	Landscaping - 39m^2 (50% Imp.)	Area Pervious (ha)	None	None	0.001
Urban	Landscaping - 39m^2 (50% Imp.)	Total Area (ha)	None	None	0.003
Urban	Roof - 1145m^2 (100% Imp.)	Area Impervious (ha)	None	None	0.115
Urban	Roof - 1145m^2 (100% Imp.)	Area Pervious (ha)	None	None	0
Urban	Roof - 1145m^2 (100% Imp.)	Total Area (ha)	None	None	0.115

Only certain parameters are reported when they pass validation

Failing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Sedimentation	SF Chamber - 1.5m³	Notional Detention Time (hrs)	8	12	0.0961
Sedimentation	SF Chamber - 1.5m³	Total Nitrogen - k (m/yr)	500	500	1
Sedimentation	SF Chamber - 1.5m³	Total Phosphorus - k (m/yr)	6000	6000	1
Sedimentation	SF Chamber - 1.5m³	Total Suspended Solids - k (m/yr)	8000	8000	1

Only certain parameters are reported when they pass validation