

CRC

**COSTIN ROE
CONSULTING**

**CIVIL &
STRUCTURAL
ENGINEERS**



CIVIL ENGINEERING REPORT INCORPORATING WATER CYCLE MANAGEMENT STRATEGY

SSD-35962232

**1-3 BURROWS ROAD
ST PETERS NSW 2044**

Prepared for:

Goodman Property Services (Aust) Pty Ltd
The Hayesbery
1-11 Hayes Road
ROSEBERRY NSW 2018
ABN: 40 088 981 793

Prepared by:

Costin Roe Consulting
Level 4, 8 Windmill Street
WALSH BAY NSW 2000

DOCUMENT VERIFICATION	
Project Title	SSD-35962232: Burrows Road Multi-level Warehouse, St Peters
Document Title	Civil Engineering Report Incorporating Water Cycle Management Strategy
Project No.	Co11035.04
Description	SSD Report for proposed industrial development
Client Contact	Goodman Property Services, Mr Cameron Rubenach

	Name	Signature
Prepared by	Nelson Zeng	
Checked by	Mark Wilson Xavier Cure	
Issued by	Denis Webber	
File Name	11035.04-02c.rpt.docx	

Document History

Date	Revision	Issued to	No. Copies
19 Aug 2022	Draft1	Goodman – Mr Cameron Rubenach	PDF
31 Aug 2022	Draft2	Goodman – Mr Cameron Rubenach	PDF
19 Sept 2022	A	Goodman – Mr Cameron Rubenach	PDF
31 Oct 2022	B	Goodman – Mr Cameron Rubenach	PDF
02 Nov 2022	C	Goodman – Mr Cameron Rubenach	PDF

EXECUTIVE SUMMARY

This Civil Engineering Report Incorporating Water Cycle Management Strategy has been prepared by Costin Roe Consulting to accompany a State significant development application (SSDA) for a proposed multi-level warehouse and distribution centre located at 1-3 Burrows Road, St Peters (the site).

This Water and Hydrology Assessment has been prepared by Costin Roe Consulting to support the preparation of the Environmental Impact Statement (EIS) and assess the Proposal's impact on the surrounding environment in relation to soils and water including stormwater and stormwater management for both construction and operational phases of the development.

This report has also been prepared to address the relevant Secretary's Environmental Assessment Requirements (SEARs) issued by the Department of Planning and Environment (DPE) for SSD-35962232 on 7 February 2022.

Proposal overview

The vision for the project is to transform the site into a functional and adaptable multi-storey industrial warehouse building that will support industrial expansion in this highly accessible location and build upon strong ecommerce drivers close to Sydney Airport, Port Botany, Cooks River Intermodal Terminal and the Sydney CBD.

The proposed development is for an industrial development on a 3.3 Ha parcel of land. Works will include erosion and sediment controls, bulk earthworks, provision of services, stormwater management, and finished surface levels.

Access to the development would be made via Burrows Road and Canal Road.

Purpose of this assessment

This Water and Hydrology Impact Assessment has been prepared to address the following Secretary's Environmental Assessment Requirements (SEARs):

- Item Number 12: Ground and Water Conditions
- Item Number 13: Stormwater and Wastewater
- Item Number 14: Flooding Risk

Construction impacts

During the construction phase, a Sediment and Erosion Control Plan will be in place to ensure the downstream drainage system and receiving waters are protected from sediment laden runoff.

Operational impacts

During the operational phase of the development, the proposed stormwater quality treatment system incorporating the use of a treatment train of gross pollutant traps (GPT's), proprietary filtration, and bio-retention swales is proposed to mitigate any increase in stormwater pollutant load generated by the development. Best management practices have been applied to the development to ensure that the quality of stormwater runoff is not detrimental to the receiving environment.

Further it has been confirmed that the development considers flood and overland flow planning requirements. The development does not impact or encroach on existing

flood affected areas. The development does not increase runoff from existing conditions as such the site discharge will not adversely affect any land, drainage system or watercourse as a result of the development.

Conclusion

The hydrological assessment of the local site drainage confirms that recommended water quality and quantity measures will ensure that no adverse impacts result on receiving waterways as a result of the development.

The detail contained in this report provides sufficient information to show the consent authority that legal points of discharge and a suitable stormwater management strategy is available for the development and the requirements associated with the strategy. It is recommended the management strategies in this report be approved and incorporated into the future detailed design.

TABLE OF CONTENTS

1	INTRODUCTION & SCOPE	1
1.1	Introduction	1
1.2	Consultation	1
1.3	SEAR’s Responses	1
2	DEVELOPMENT SITE	7
2.1	Location	7
2.2	Existing Site Description	8
2.3	Project Background	9
2.4	Proposed Development	9
3	SITE WORKS	13
3.1	Soil and Geological Conditions	13
3.2	Bulk Earthworks	14
3.3	Retaining Walls	14
3.4	Embankment Stability	15
3.5	Groundwater	15
3.6	Acid Sulphate Soils and Salinity	15
4	WATER CYCLE MANAGEMENT STRATEGY & DRAINAGE METHODOLOGY	17
4.1	Key Areas and Objectives	17
4.2	Existing Drainage System & Overland Flows	19
4.3	Proposed Drainage System	19
4.4	Hydrologic Modelling and Analysis	20
4.4.1	Rainfall Data	20
4.4.2	Runoff Models	20
4.5	Hydraulics	21
4.5.1	General Requirements	21
4.5.2	Freeboard	21

4.5.3	Public Safety	21
4.5.4	Inlet Pit Spacing	22
4.5.5	Overland Flow (development lots)	22
5	WATER QUANTITY MANAGEMENT	23
6	STORMWATER QUALITY, REUSE AND MAINTENANCE	24
6.1	Stormwater Quality Objectives	24
6.2	Proposed Stormwater Treatment System	24
6.3	Stormwater Quality Modelling	24
6.4	Stormwater Harvesting	26
6.4.1	Rainwater Tank Sizing	26
6.5	Maintenance and Monitoring	27
7	FLOODING AND OVERLAND FLOW	28
7.1	Introduction	28
7.2	Alexandria Canal Flood Study	28
7.3	M5 EIS Flood Study SSI-6788	34
7.4	City of Sydney Floodplain Management Requirements & NSW Floodplain Management Manual Requirements	36
7.5	Flood Assessment Conclusion	37
8	CONSTRUCTION SOIL AND WATER MANAGEMENT	38
8.1	Soil and Water Management General	38
8.2	Typical Management Measures	38
8.3	Other Management Measures	39
9	CONCLUSION	40
10	REFERENCES	41

1 INTRODUCTION & SCOPE

1.1 Introduction

Costin Roe Consulting Pty Ltd has been commissioned by Goodman Property Services Pty Ltd to prepare this *Civil Engineering Report & Water Cycle Management Strategy* (WCMS) in accordance with the technical requirements of the Secretary's Environmental Assessment Requirements (SEARs), and in support of the State Significant Development Application (SSD-35962232) for the proposed warehouse and distribution centre development at 1-3 Burrows Road, St Peters (the site).

This report provides an assessment of the civil engineering characteristics of the development site and technical considerations of the following aspects:

- Earthworks & geotechnical considerations;
- Water Cycle Management Strategy (WCMS).

The WCMS comprises several key areas of stormwater and water management which are provided below. These key areas have been established with the aim to reduce impacts from the development on the surrounding environment and neighbouring properties. The water cycle management strategy identifies the management measures required to meet the targets set. The key water cycle management areas assessed in this report are:

- Storm Water Quantity;
- Storm Water Quality;
- Water Supply and Reuse;
- Flooding; and
- Erosion and Sediment Control

A request for Planning Secretary's Environmental Assessment Requirements (SEAR's) to the NSW Department of Planning, Industry and Environment (DPIE) has been made by the applicant. Reference to **Appendix C** should be made for SSD-35962232 SEAR's dated 07/02/2022. **Section 1.3** of this report for specific responses to civil engineering and water management related items included in the SEAR's.

1.2 Consultation

Consideration to the various stakeholders has been made in relation to the development, including Council and Sydney Water.

Consultation with Sydney Water has been made to assist with coordination of the proposed stormwater drainage and water quantity/ on-site detention (OSD) requirements. Reference should be made to **Appendix E** and **Section 5** of this report for correspondence and OSD requirements respectively.

1.3 SEAR's Responses

This report supports the EIS for the proposal and to address the NSW Department of Planning and Environment SEARS letter dated 07/02/2022, reference SSD-35962232, NSW Department of Primary Industries (DPI) and NSW Office of Environment & Heritage (OEH).

We note the below “key issues and documentation” assessments are based on the Warehouse and Distribution Centre SEAR’s document and following key areas in the document:

- Item 12. Ground and Water Conditions,
- Item 13. Stormwater and Wastewater
- Item 14. Flooding Risk

Further reference to the EIS prepared by Urbis should be made for confirmation of how the SEAR’s have been addressed for non-civil engineering related items.

Table 1.1 provides a summary of the SEARs Requirements which relate to water and hydrology, and where these have been addressed in this report.

Table 1.2 provides responses to agency specific items as included in the SEAR’s Requirements.

Table 1.1. SEARs Warehouse and Distribution Centres Key Areas

SEAR’s Key Item No. & Description	Issue & Assessment Requirements	How It Is Addressed	Report Reference
12. Ground and Water Conditions	Provide an assessment of the potential impacts on soil resources, including related infrastructure and riparian lands on and near the site.	<p>We note the site is a long-standing developed site comprising a total of four warehouse/distribution facilities with associated hardstand and car parking areas. The existing buildings will be demolished and the existing slab removed prior to redevelopment of the properties.</p> <p>The proposed works involve demolition of existing buildings and infrastructure, removal of building spoil off site, and minor earthworks. The majority of excavation works are above the water table.</p> <p>Based on the existing nature of the site, the impact potential on groundwater and soils is considered low.</p>	Refer to Section 3 and geotechnical assessments by PSM for confirmation of soil resources and potential impacts.
	Provide an assessment of the potential impacts on surface and groundwater resources (quality and quantity), including	The site comprises two existing industrial facilities with significant remnant concrete/ impervious surfaces. The redevelopment of the land will not result in unacceptable	Refer to Section 4, 5 & 6 for assessment of water resources, hydrology (including quality

SEAR's Key Item No. & Description	Issue & Assessment Requirements	How It Is Addressed	Report Reference
	<p>related infrastructure, hydrology, aquatic and groundwater dependent ecosystems, drainage lines, downstream assets and watercourses.</p>	<p>impacts to any resources noting similar water quantity discharge and improved stormwater quality.</p> <p>We note no riparian lands or watercourses are located within the property boundary.</p> <p>Refer to Section 8 for soil and water management measures during construction, drawings in Appendix A for associated erosion and sediment control drawings, and Appendix C for a Draft Soil and Water Management Plan.</p> <p>These sections show proposed measures, based on the Landcom document <i>Managing Urban Stormwater – Soils & Construction Volume 1 ('Blue Book')(Landcom, 2004)</i>, are proposed during the construction of the development. Measures proposed will limit potential for offsite impact associated with water runoff and soils during construction. Consideration to management of salinity and acid sulphate has been made based on the recommendations of the geotechnical investigations and noted Landcom document.</p>	<p>and quantity), watercourses and riparian lands during operation.</p>
	<p>Identify predicted water discharge points to surface/groundwater and consider discharge quality against</p>	<p>A surface water runoff assessment including water quality and water quantity has been completed. The key stormwater objectives, based on relevant water sensitive urban design criteria, have been</p>	<p>Refer to Sections 4 & 6</p>

SEAR's Key Item No. & Description	Issue & Assessment Requirements	How It Is Addressed	Report Reference
	relevant water quality criteria.	<p>set out in Section 4.1 and Section 6.1 of the report.</p> <p>Discharge from the site is noted to be made to existing street drainage in Burrows Road, ultimately discharging to the Alexandria Canal.</p> <p>Section 6 provides demonstration of the key criteria being met, based on MUSIC modelling.</p> <p>Configuration of the proposed measures are shown on the Civil Design Drawings included in Appendix A.</p>	
	Provide a detailed site water balance including identification of water requirements for the life of the development, and measures to ensure an adequate and secure water supply.	Refer to infrastructure report for water supply and wastewater assessments.	Refer to Section 4, 5 & 6 for assessment of water resources, hydrology (including quality and quantity), watercourses and riparian lands.
	Provide an assessment of salinity and acid sulfate soil impacts.	Refer to Section 3 for confirmation of soil resources and potential impacts.	Refer to Section 3 and separate <i>Soil Salinity Investigation and Management Plan</i> by PSM Geotechnical Engineering (ref: PSM2808-012R & PSM2808-013L).
13. Stormwater and Wastewater	Provide an Integrated Water Management Plan for the development that:	A surface water and management assessment including, water quality and water quantity has been completed in consultation with	Refer to Section 4, 5 & 6 for assessment of water resources, hydrology

SEAR's Key Item No. & Description	Issue & Assessment Requirements	How It Is Addressed	Report Reference
	<ul style="list-style-type: none"> is prepared in consultation with the local council and any other relevant drainage or water authority. details the proposed drainage design for the site including any on-site detention facilities, water quality management measures and the nominated discharge points, on-site sewage management, and measures to treat, reuse or dispose of water. demonstrates compliance with the local council or other drainage or water authority requirements and avoids adverse impacts on any downstream properties. 	<p>City of Sydney and Sydney Water.</p> <p>The key stormwater objectives, based on relevant water sensitive urban design criteria, have been set out in Section 4.1 and Section 6.1 of the report.</p> <p>The site comprises two lots, both with existing industrial facilities with most of the surface being impervious. The redevelopment of the land will not result in unacceptable impacts to any resources noting similar water quantity discharge and improved stormwater quality.</p> <p>Discharge from the site is noted to be made to the existing street drainage in Burrows Road that then discharges to the Alexandria Canal.</p>	<p>(including quality and quantity), watercourses and riparian lands during operation.</p>
	<p>Where drainage infrastructure works are required that would be handed over to the local council, or other drainage or water authority, provide full hydraulic details and detailed plans and specification of proposed works</p>	<p>There are no works which are required to be handed over to Council or other drainage or water authority as part of the proposal.</p> <p>Refer Section 4 and drawings in Appendix A for detailed assessment of the existing and post development conditions.</p>	<p>Refer to Section 4 and Appendix A</p>

SEAR's Key Item No. & Description	Issue & Assessment Requirements	How It Is Addressed	Report Reference
	that have been prepared in consultation with, and comply with the relevant standards of, the local council or other drainage or water authority		
14. Flooding Risk	Identify any flood risk on-site having regard to adopted flood studies, the potential effects of climate change, and any relevant provisions of the NSW Floodplain Development Manual.	<p>The proposal requires consideration to overland flow within Burrow Road, which is mainly associated with gutter runoff.</p> <p>Review of the Council's Flood reports from 2014 and 2020, and the TfNSW M5 Flood Assessment indicate there is minor flooding in the 1% AEP local event. The undercroft carpark is noted to be higher than the 1% AEP as required of City of Sydney Policy.</p> <p>The requirements of council and NSW Floodplain Development Manual are met for this development.</p>	Refer Section 7 for assessments pertaining to flooding and overland flow.
	Assess the impacts of the development, including any changes to flood risk on-site or off-site, and detail design solutions and operational procedures to mitigate flood risk where required.	<p>The development footprint does not impact any existing flooding to the 1% AEP event. As such no impact to flooding per the defined flood event will occur.</p> <p>Flood planning considerations are met and the site has suitable flood immunity to the known flood behaviour, acceptable flood risk has been demonstrated.</p>	Refer Section 7 for assessments pertaining to flooding and overland flow.

2 DEVELOPMENT SITE

2.1 Location

The site is located at 1-3 Burrows Road, St Peters and comprises two parcels of land, Lot 1 DP 1227450 and Lot 11 DP 606737. The site is bounded by Burrows Road to the south-east, Canal Road to the south-west, and existing industrial developments to the north-east and north-west, as shown in **Figures 1.1 & 1.2**.



Figure 1.1. Location Plan (Source: Urbis)

An aerial image of the site is provided in Figure 1.2 below.



Figure 1.2. Site Locality Plan (Nearmap, 2022)

2.2 Existing Site Description

The site comprises an irregular shaped allotment with an area of approximately 3.58 Ha. The site adjoins Burrows Road with a primary curved frontage of approximately 528m and adjoins Canal Road with a secondary frontage of approximately 289m.

The site is located in the City of Sydney Local Government Area (LGA), at the junction with the Inner West and Bayside LGA's.

The site is currently occupied by older low-rise industrial units that are largely consistent with development in the surrounding area which is predominantly of an industrial nature. The industrial units comprise four large format steel framed warehouse / distribution facilities. These buildings no longer meet the requirements of contemporary industrial users in this market.

The site is situated within an established largely industrial area to the immediate south of the St Peters WestConnex Interchange and well-connected to the Sydney Airport. The locality surrounding the site is characterised by existing industrial and commercial developments, as well as new road and other major transport infrastructure. The Alexandra Canal is located approximately 100 metres to the south-east and east.

The site is relatively flat, grading slightly to the corner of Burrows Road and Canal Road. The highest level on the site at RL 4.9m AHD at the northern corner and the lowest level at RL 2.2m AHD at the southern corner.

. Vehicular access to the site from the local road network is available from Burrows Road.

2.3 Project Background

Planning Proposal PP-2020-298

The applicant recently obtained approval on 16 September 2020 for a Planning Proposal (PP-2020-298) at the site. The approved Planning Proposal amended the Sydney Local Environmental Plan 2012 (SLEP 2012) by increasing the applicable maximum building height for the site from 18 metres to 30 metres. The Planning Proposal also introduced a set of site-specific controls for 1-3 Burrows Road, St Peters, in the SLEP 2012, including a 6-metre setback control to Burrows Road and Canal Road for landscaping purposes.

Competitive Design Alternatives Process

Goodman undertook a Competitive Design Alternatives Process (competitive design process) with three selected architectural firms following an expression of interest process.

The Jury resolved that the Welsh and Major scheme best demonstrated the ability to achieve design excellence as per Clause 6.21 of the Sydney LEP 2012 and the scheme which best met the design, planning and commercial objectives of the Competition Brief. The Welsh and Major scheme was subsequently awarded the winner of the Competitive Design Process.

Costin Roe Consulting have been working in close collaboration with Goodman and the Welsh and Major throughout the preparation of this SSDA and generally as part of the ongoing detailed design phase of the project.

2.4 Proposed Development

The vision for the project is to transform the site into a functional and adaptable multi-storey industrial warehouse building that will support industrial expansion in this highly accessible location and build upon strong ecommerce drivers close to Sydney Airport, Port Botany, Cooks River Intermodal Terminal and the Sydney CBD.

This detailed SSDA follows on from the Competitive Design Alternatives Process (**competitive design process**) undertaken between January and April 2022, whereby, the winning project architects Welsh and Major (**W&M**) were announced by the Selection Jury (**Jury**).

This proposed SSDA seeks approval for the following:

- Demolition of all existing structures and buildings on site.
- Tree removal both on site and for a limited number of trees in the public domain and adjoining lot.
- Site remediation, and establishment works, including minor excavation / bulk earthworks.
- Design, construction and operation of a three-storey industrial warehouse and distribution centre building with an ancillary office building, including:
 - Approximately 52,150sqm of total GFA, comprising:
 - 47,076sqm of warehouse and distribution centre GFA; and
 - 5,014sqm of GFA for ancillary office space.

- Café tenancy within the ground floor lobby space of 60sqm GFA
- Maximum building height of RL 33.18 (30.14 height in metres).
- 24 hours per day seven days a week.
- Provision of a single storey undercroft basement car parking area accessed off Burrows Road which provides 224 car parking spaces (including 12 accessible bays), 17 service vehicle spaces for vans/Utes, 19 motorcycle spaces, and bicycle parking (15 visitor spaces) and end-of-trip facilities (including 58 bicycle parking spaces, showers, lockers and change rooms).
- New crossings to Burrows Road for truck and car access.
- Single fire and utilities services ingress crossing off Canal Road.
- Site landscaping works totalling approximately 7,464sqm (or 21.6% of the site), including two 6-metre landscaped setback areas to both the Burrows and Canal Roads site frontages, and the following provisions:
 - 5,293sqm or 15.3% deep soil landscaping; and
 - 5,074.82sqm or 14.7% tree canopy coverage.
- Provision of building / business identification signage.
- Provision of two chamber substations

This report has been prepared for proposed civil works and provides details on the earthworks, construction of retaining walls, landscaping, stormwater drainage and management, overland flow/ flood management, pavements and road upgrades.

The indicative layout has been prepared by Welsh & Majors and is shown in **Figures 2.1 & 2.2**.

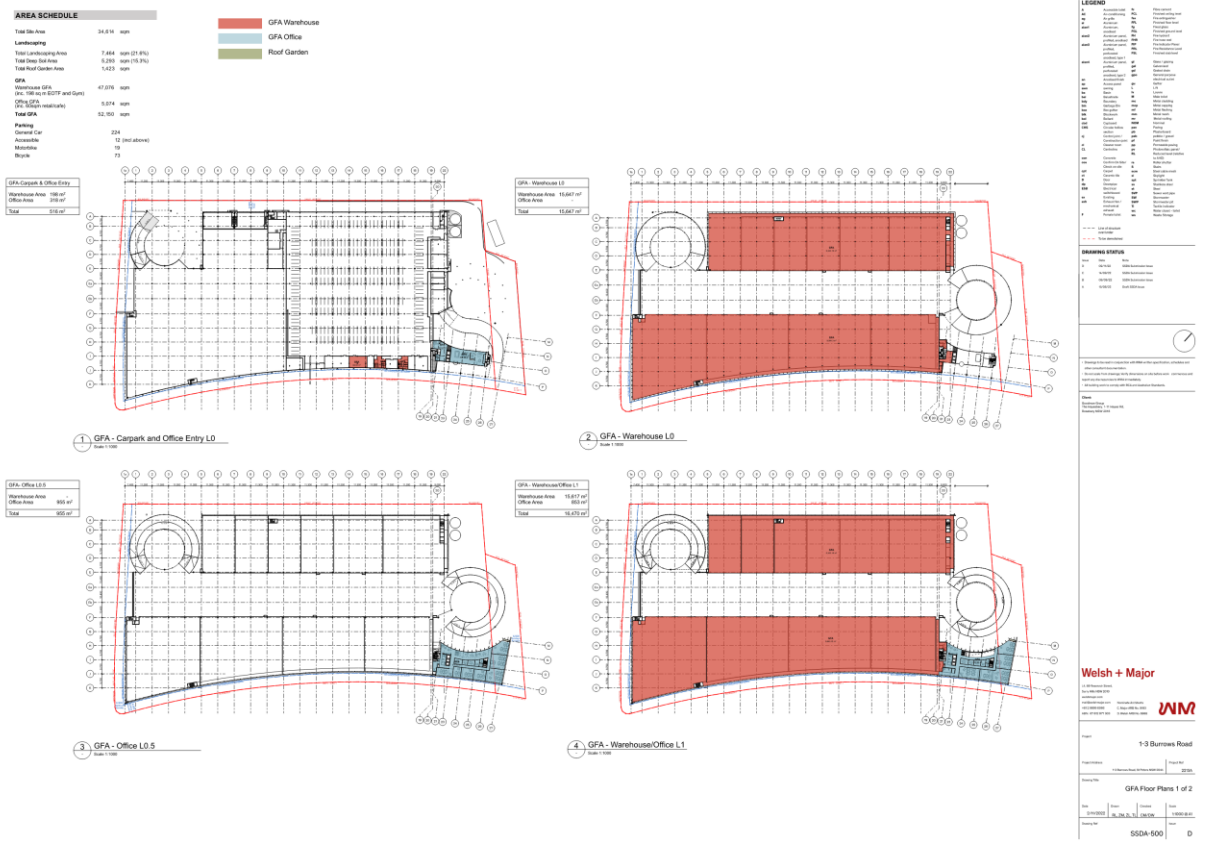


Figure 2.1. Proposed Development – GFA Floor Plans Sheet 1

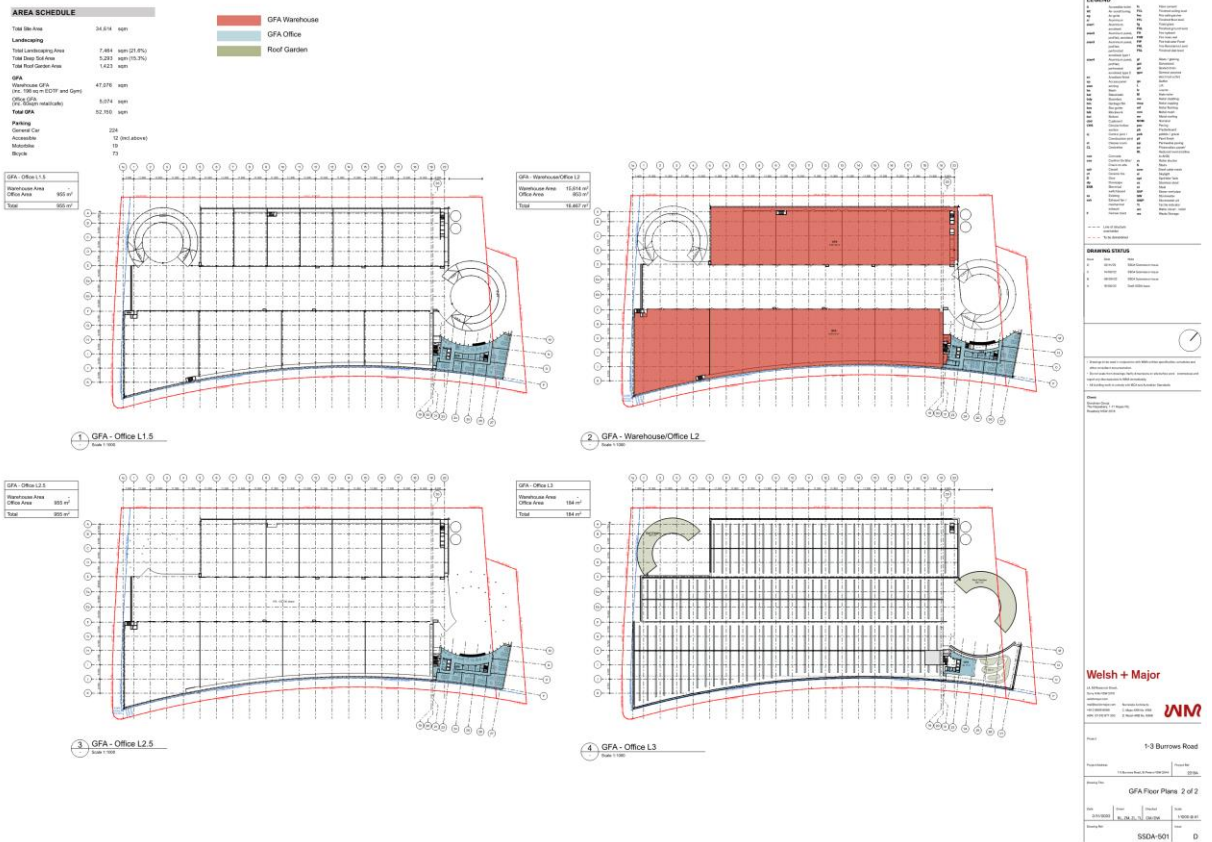


Figure 2.2. Proposed Development – GFA Floor Plans Sheet 2

3 SITE WORKS

3.1 Soil and Geological Conditions

Assessments & investigation relating to soil have been undertaken by PSM (geotechnical investigation – PSM2808-005R REV1 dated 13 May 2019). Further investigations pertaining to salinity and sodicity have also been undertaken by PSM in their reports *Soil Salinity Investigation and Management Plan* (ref: PSM2808-012R & PSM2808-013L).

The PSM Geotechnical report confirms the subsoil profile as comprising pavements, fill, upper sand and clays, and lower sand and clays, over bedrock. A summary of the subsoil units is included in Figure 3, being an excerpt of Table 2 of the PSM report.

**TABLE 2
SUMMARY OF SUBSURFACE UNITS ENCOUNTERED AT CPT LOCATIONS**

UNIT NAME	APPROXIMATE DEPTH TO THE TOP OF UNIT (m)	DESCRIPTION
PAVEMENT	0.0	Pavement comprises asphalt and concrete slab or concrete slab only.
FILL	0.2 to 0.3	Gravelly SAND to Clayey SAND. Density index ranges from medium dense to very dense.
UPPER SAND	1.0 to 3.0	Silty SAND. Density index ranges from loose to dense.
UPPER CLAY	2.8 to 5.2	CLAY to Silty CLAY. Soft to firm clay.
LOWER SAND	5.8 to 8.7	SAND to Silty Sand. Density index ranges from dense to very dense.
LOWER CLAY	7.9 to 10.7	CLAY to Silty Clay. Consistency stiff to very stiff.
BEDROCK	10.8 to 13.5	Inferred from CPT refusal.

Figure 3.1. subsurface units (Source: PSM Table 2)

3.2 Bulk Earthworks

Bulk earthworks on the site will be conducted to suit the proposed building layout including warehousing, office and undercroft parking areas. The undercroft parking area is proposed at RL 2.3m (BEL = 2.0m approx..) and warehousing at a level of RL 5.5m AHD (BEL = 5.2m approx.). The proposed levels and bulk levels will ensure suitable flood immunity and ensure cut to fill does not result in exported soil from the site. Final levels would be subject to a +/-0.5m variance to allow for variations in allowances for geotechnical conditions, final building layout and allowable building height, and drainage considerations.

Soil Erosion and Sediment Control measures, including sedimentation basins are to be placed in accordance with submitted drawings and the *Soil and Water Management Plan* in **Section 8** and **Appendix C** of this report.

All geotechnical testing and inspections performed during the filling operations will be undertaken to Level 1 geotechnical control, in accordance with AS3798-2007.

High level earthworks and volume estimates have been completed and are shown on drawing in **Appendix A**.

The earthworks analysis has been completed to a level of detail to enable general pad levels to be set and to obtain an order of magnitude cut and fill volume estimate for the planning application. Furthermore, detailed assessments would be completed as part of future development application and construction certificate phases of the development.

The earthworks volume estimates are as follows:

Cut	- 18,600 m ³
Fill	+ 41,600 m ³
Building Spoil	- 6,000 m ³
Difference	+17,000 m ³ (<i>excess fill over cut</i>)

The volume estimate is based on 6,900 m³ of removal and crushing of existing slabs on the site. This could be reused on site subject to suitable assessments and confirmation of suitability.

An import of cut and fill earthworks of 17,000 m³ has been shown in the concept analysis. Allowances for building and service excavation during the building works has been made to avoid excessive exports during the project. An allowance of 1,750m³/Ha has been provisioned for on the site. The actual amount would vary depending on the final site layouts, foundation design and service designs.

3.3 Retaining Walls

The civil engineering objective is to minimise retaining walls within the constraints of the masterplan layout, allowable grading to suit industrial development and batters in landscaped areas where possible.

Retaining walls will be required around the undercroft carparking area as well as along the site boundary where it meets adjacent properties.

Location and indicative heights of retaining walls are shown on drawing **CO11035.04-DA50**.

3.4 Embankment Stability

To assist in maintaining embankment stability permanent batters in clay will be no steeper than 3 horizontal to 1 vertical while temporary batters will be no steeper than 2 horizontal to 1 vertical. Based on the existing landform and minor changes to landform required for the proposal, it is anticipated that batters and landscaped areas will be generally less than 1V:3H.

Permanent batters will also be adequately vegetated or turfed which will assist in maintaining embankment stability.

Stability of batters and reinstatement of vegetation shall be in accordance with the submitted drawings and the *Soil and Water Management Plan* in **Section 8** and **Appendix C** of this report.

3.5 Groundwater

Groundwater was identified by PSM at depths between 1.6m and 4.0m below ground level. As there is limited excavation required for the development and the site is currently full developed, impact from groundwater and on groundwater systems are considered negligible.

Surface water management, including conveyance of surface runoff, management of water quantity (through on-site detention) and water quantity (through on-site management systems using WSUD principles and best practice pollution reduction objectives) has been proposed in the design.

3.6 Acid Sulphate Soils and Salinity

An assessment of the potential for acid sulphate soils has been requested as part of the SEAR's requirements and has been assessed in the *Soil Salinity Investigation and Management Plan* by PSM Geotechnical Engineering (ref: PSM2808-012R & PSM2808-013L). The report references soils as being slightly to moderately saline sands.

Discussion on Acid Sulfate Soils assessments references the the NSW SEED portal risk map (Figure 3.2) which shows the area has not been assessed.

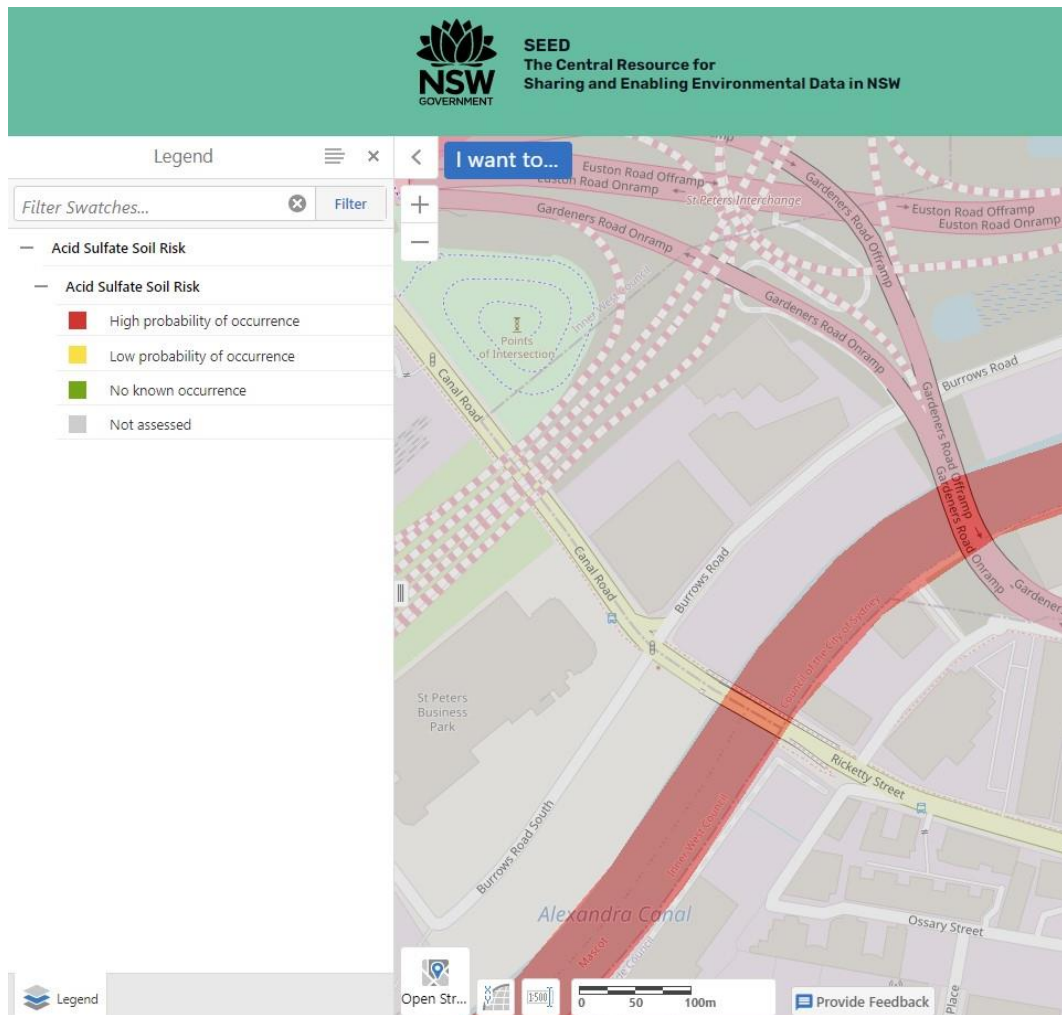


Figure 3.2. SEED Acid Sulfate Map

4 WATER CYCLE MANAGEMENT STRATEGY & DRAINAGE METHODOLOGY

4.1 Key Areas and Objectives

Water Cycle Management (WCM) is a holistic approach that addresses competing demands placed on a region’s water resources, whilst optimising the social and economic benefits of development in addition to enhancing and protecting the environmental values of receiving waters.

Developing a WCMS at the SSD stage of the land development process provides guidance on urban water management issues to be addressed for the development as a whole.

This WCMS has been prepared to inform DPIE that the development is able to provide and integrate WCM measures into the stormwater management strategy for the development. It presents guiding principles for WCM across the development which includes establishing water management targets and identifying management measures required.

Several WCM measures have been included in the WCMS and engineering design, which are set out in this report and the attached drawings. The key WCM elements and targets which have been adopted in the design are included in **Table 4.1** following.

Table 4.1. WCM Targets

Element	Target	Reference
Water Quantity	Minimise flooding from increased stormwater runoff due to development Water Quantity and Management to be provided as directed by Sydney Water, the waterway manager.	Council DCP 2012.
Water Quality	Load-based pollution reduction targets based on an untreated urbanised catchment: Gross Pollutants 90% Total Suspended Solids 85% Total Phosphorus 65% Total Nitrogen 45% Total Hydrocarbons 90%	Section 3.7.3 Council DCP 2012
Flooding	Buildings set above the 1% AEP.	City of Sydney’s <i>Floodplain Management Policy</i> NSW Floodplain Development Manual.
Water Supply	Reduce Demand on non-potable water uses.	

Element	Target	Reference
Construction Stormwater Management & Erosion and Sediment Control	A construction stormwater management plan and appropriate associated erosion and sedimentation control measures must be described in the environmental assessment for all stages of construction to mitigate potential impacts to surrounding properties.	Landcom Blue Book Council DPIE

A summary of the how each of the WCM objectives will be achieved are described below. Reference to the relevant sections of the report should be made for further and technical details relating to the WCM measures:

- *Stormwater Quantity Management (Refer Section 5)*

The intent of this criterion is to reduce the impact of urban development on existing drainage system by limiting post-development discharge within the receiving waters to the pre-development peak, and to ensure no affectation of upstream, downstream or adjacent properties.

Attenuation of stormwater runoff from the development is not required as the site is currently fully developed, existing drainage systems available for discharge based on the fully developed site and the site drains to the Alexandra Canal which is a tidal waterway which is not influenced by urban drainage runoff. Sydney Water, the waterway manager, has confirmed that on-site detention is not required for this development.

Refer to **Section 5** of the document for further discussion pertaining to water quantity management.

- *Stormwater Quality Management (Refer Section 6)*

There is a need to target pollutants that are present in stormwater runoff to minimise the adverse impact these pollutants could have on downstream receiving waters.

The required pollutant reductions are included in **Table 4.1** of this document and MUSIC modelling has been completed to confirm the reduction objectives can be met for the development.

A series of Stormwater quality improvement devises (SQID's) have been incorporated in the design of the development. The proposed management strategy will include the following measures:

- Primary treatment of external paved areas will be made via pit inserts.
- Tertiary treatment of the development will be made via bio-retention swales, or proprietary stormwater treatment system housed in an underground tank. Refer to drawing **Co11035.04-DA40**.
- Some treatment will also be present by provision of rainwater reuse tanks on development site through reuse and settlement within the tanks. Allowance for this treatment is noted to not be included in MUSIC modelling produced for the development.

Reference to **Section 6** of this document should be made for detailed Stormwater Quality modelling and measures.

- *Flood Management (refer Section 7)*

The proposed development considered flooding and large rainfall events in relation to the nearby Alexandra Canal, and local runoff and overland flow paths. We note that the site is shown to be clear of any significant local overland flow paths for events up to the 1% AEP event.

Consideration to flood requirements has been made per Council Flood Management Policy. Refer **Section 7** for details.

The following measures have been incorporated in the design:

- All buildings are sited 500mm above the 1% AEP design flood level of local flow paths.
- Overland flow paths to manage runoff in large storm events have been made including achieving at least 500mm freeboard to building levels from the flow paths, noting that a greater level of flood immunity is provided to the building than that required by planning to ensure an appropriate level of risk to the building for the intended use.
- *Water Demand Reduction/ Rainwater Reuse (refer Section 6.6)*
Rainwater reuse measures will be provided as part of this development design. Rainwater reuse will be required to reduce demand on non-potable uses subject to Greenstar requirements. The reduction in demand will target non-potable uses such as toilet flushing and irrigation. Refer to **Section 6.6**.
- *Stormwater Management During Construction (refer Section 8)*
A construction stormwater management plan and associated erosion and sediment control measures is proposed based on Landcom Blue Book and Council requirements. The management measures take a staged approach from initial site establishment, construction stages and the completion of the development site.

4.2 Existing Drainage System & Overland Flows

The site is currently a developed industrial property which has been described in **Section 2.2**.

An existing formal inground drainage system is currently on the site which carries stormwater runoff from the existing warehouse buildings and surrounds offsite for discharge into trunk drainage that leads to the Alexandria Canal.

The site is not affected by any overland flow paths, though overland flow paths are present along Canal Road to the south-west and Burrows Road to the south-east.

4.3 Proposed Drainage System

As per general engineering practice and the guidelines of Council, the proposed stormwater drainage system for the development will comprise a minor and major system to safely and efficiently convey collected stormwater run-off from the development to the legal point of discharge.

The minor system is to consist of a piped drainage system which has been designed to accommodate the 1 in 20-year ARI storm event (Q20). This results in the piped system being

able to convey all stormwater runoff up to and including the Q20 event. The major system will be designed to cater for storms up to and including the 1 in 100-year ARI storm event (Q100). The major system will employ the use of defined overland flow paths, such as roads and open channels, to safely convey excess run-off from the site.

The design of the stormwater system for this site will be based on relevant national design guidelines, Australian Standard Codes of Practice, the standards of PCC and accepted engineering practice. Runoff from buildings will generally be designed in accordance with *AS 3500.3 National Plumbing and Drainage Code Part 3 – Stormwater Drainage*. Overall site runoff and stormwater management will generally be designed in accordance with the Institution of Engineers, Australia publication “*Australian Rainfall and Runoff*” (2019 Edition), Volumes 1 and 2 (AR&R).

Water quality and re-use are to be considered in the design to ensure that any increase in the detrimental effects of pollution are mitigated, Council Water Quality Objectives are met and that the demand on potable water resources is reduced.

The legal point of discharge is a point specified by Council where stormwater from a property can be discharged. The legal point of discharge is usually Council's stormwater infrastructure (where available), the street kerb and channel for smaller developments or downstream receiving waters like an existing stream or gully, lake, pond or waterbody. Legal discharge for this site is via the existing street drainage in Burrows Road and in Canal Road which leads to the Alexandria Canal.

The drainage system proposed can be described as follows:

- Site drainage system designed to the 5% AEP (1 in 20yr ARI);
- Connection of the new drainage system
- Treatment of stormwater as described in **Section 4.1** and **6**;
- Site discharge to public drainage system via the existing street drainage system.

4.4 Hydrologic Modelling and Analysis

4.4.1 Rainfall Data

Rainfall intensity Frequency Duration (IFD) data used as a basis for DRAINS modelling for the 2 to 100 Year ARI events, was taken from The Bureau of Meteorology Online IFD Tool.

4.4.2 Runoff Models

In accordance with the recommendations and standards of Council, the calculation of the runoff from storms of the design ARI has been calculated with the catchment modelling software DRAINS for internal drainage only.

Detailed hydraulic assessment of the internal drainage system will be calculated at detail/ construction certificate stage.

The design parameters for the DRAINS model are to be based on the recommendations as defined by council and parameters for the area and are as follows:

Table 4.1. DRAINS Parameters

Model	Model for Design and analysis run	Rational method	
	Rational Method Procedure	ARR2019	
	Soil Type-Normal	3.0	
	Paved (Impervious) Area Depression Storage	1	mm
	Supplementary Area Depression Storage	1	mm
	Grassed (Pervious) Area Depression Storage	5	mm
AMC	Antecedent Moisture Condition (ARI=1-5 years)	2.5	
AMC	Antecedent Moisture Condition (ARI=10-20 years)	3.0	
AMC	Antecedent Moisture Condition (ARI=50-100 years)	3.5	
	Sag Pit Blocking Factor (Minor Systems)	0	
	On Grade Pit Blocking Factor (Minor Systems)	0	
	Sag Pit Blocking Factor (Major Systems)	0.5	
	On Grade Pit Blocking Factor (Major Systems)	0.2	

4.5 Hydraulics

4.5.1 General Requirements

Hydraulic calculations will be carried out utilising DRAINS modelling software during the detail design stage to ensure that all surface and subsurface drainage systems perform to or exceed the required standard.

4.5.2 Freeboard

The calculated water surface level in open junctions of the piped stormwater system will not exceed a freeboard level of 150mm below the finished ground/ grate level, for the peak runoff from the Minor System runoff.

The calculated water surface for the peak runoff from the Major System runoff will not exceed a freeboard level of 500mm below the finished floor level of the building.

4.5.3 Public Safety

For all areas subject to pedestrian traffic, the product (dV) of the depth of flow d (in metres) and the velocity of flow V (in metres per second) will be limited to 0.4, for all storms up to the 100-year ARI.

For other areas, the dV product will be limited to 0.6 for stability of vehicular traffic (whether parked or in motion) for all storms up to the 100-year ARI.

4.5.4 Inlet Pit Spacing

The spacing of inlets throughout the site will be such that the depth of flow, for the Major System design storm runoff, will not exceed the top of the kerb (150mm above gutter invert).

4.5.5 Overland Flow (development lots)

Dedicated flow paths have been designed to convey all storms up to and including the 100-year ARI. These flow paths will convey stormwater from the site to the detention systems prior to discharge.

5 WATER QUANTITY MANAGEMENT

City of Sydney Council's DCP 2012 and Sydney Water's On-Site Detention (OSD) policy require consideration of stormwater quantity management with the intent of minimising flooding from the increased stormwater run-off due to the development. Water quantity management may be made by providing a stormwater detention system (i.e. on-site detention), to limit the runoff discharged from private property or to provide an assessment which confirms on-site detention is not necessary for the development. Further, that areas within Alexandria require confirmation as to OSD requirements from Sydney Water who are the waterway managers for the area.

Consultation with Sydney Water has been undertaken and it has been confirmed that any development at 1-3 Burrows Road, Alexandria does not require on-site detention. Refer to **Appendix E** for email correspondence with Sydney Water and confirmation of the OSD requirements for the site.

Management of Stormwater Quantity has been considered for the site. It is noted that the existing site is currently fully developed and does not contain a detention system. There is no increase in impervious site coverage hence no increased runoff as part of the proposal. As such the development will not adversely impact flooding upstream or downstream of the property without OSD.

The site is located in the lower end of the catchment and will discharge directly to the adjacent tidally influenced Alexandria Canal. Given the position in the catchment, local un-attenuated flows will peak well in advance of the main flood hydrograph in Alexandria Canal coming from the upstream catchments. The combined hydrograph in this situation will result in a double peak (small initial peak followed by larger extended peak) in the shorter duration storms. If traditional OSD were to be included, although local flows from the site would be reduced, the peak of flow from the site is drawn out over a longer period which would coincide with that of the larger and delayed peak flow within the Alexandria Canal. This will result in an overall increase in peak flows, hence an adverse effect would be achieved if OSD were to be provided.

It is considered that the combined peak flow runoff (from the local site catchment and larger Alexandria Canal catchment) in the Alexandria Canal will not increase as a result of the development (with the proposed flood management measures and without traditionally sized on-site detention).

Given there is no change to the runoff volume or peak flows and it has been confirmed by Sydney Water that OSD is not required for this site, none has been proposed for the development.

6 STORMWATER QUALITY, REUSE AND MAINTENANCE

6.1 Stormwater Quality Objectives

There is a need to provide a design which incorporates the principles of Water Sensitive Urban Design (WSUD) and to target pollutants that are present in the stormwater so as to minimise the adverse impact these pollutants could have on receiving waters and to also meet the requirements specified by Council.

City of Sydney Council have nominated, in *Section 3.7.3* of their *DCP 2012*, the requirements for stormwater quality to be performed on a catchment wide basis. These are presented in terms of annual percentage pollutant reductions on a developed catchment and are as follows:

Gross Pollutants	90%
Total Suspended Solids	85%
Total Phosphorus	65%
Total Nitrogen	45%

6.2 Proposed Stormwater Treatment System

Developed impervious areas including roof, hardstand, car parking, roads and other extensive impervious areas are required to be treated by the Stormwater Treatment Measures (STM's). The STM's shall be sized according to the whole catchment area of the development. The STM's for the development shall be based on a treatment train approach to ensure that all the objectives above are met.

Components of the treatment train for the development are as follows:

- Primary treatment to the parking, roof, and hardstand areas is to be performed via the provision of pit inserts to all grated pits;
- Tertiary treatment is to be performed via bio-retention swales or Ocean Protect Stormfilters (or approved equivalent) prior to discharge from the site. The majority of the site catchments are noted to be treated via bio-retention, with only the rear truck entry drive being treated via the proprietary system;
- A portion of the roof will also be treated via rainwater reuse and settlement within the rainwater tank.

6.3 Stormwater Quality Modelling

The MUSIC model was chosen to model water quality. By simulating the performance of stormwater management systems, MUSIC can be used to predict if the proposed systems and changes to land use are appropriate for their catchments and capable of meeting specified water quality objectives (CRC 2002). The water quality constituents modelled in MUSIC, of relevance to this report, include Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN).

The pollutant retention criteria set as required by Council and nominated in **Section 4.1** of this report were used as a basis for assessing the effectiveness of the selected treatment trains.

The parameters used in the MUSIC model are presented in **Appendix B**. **Figure 6.1** below shows the MUSIC model layout.

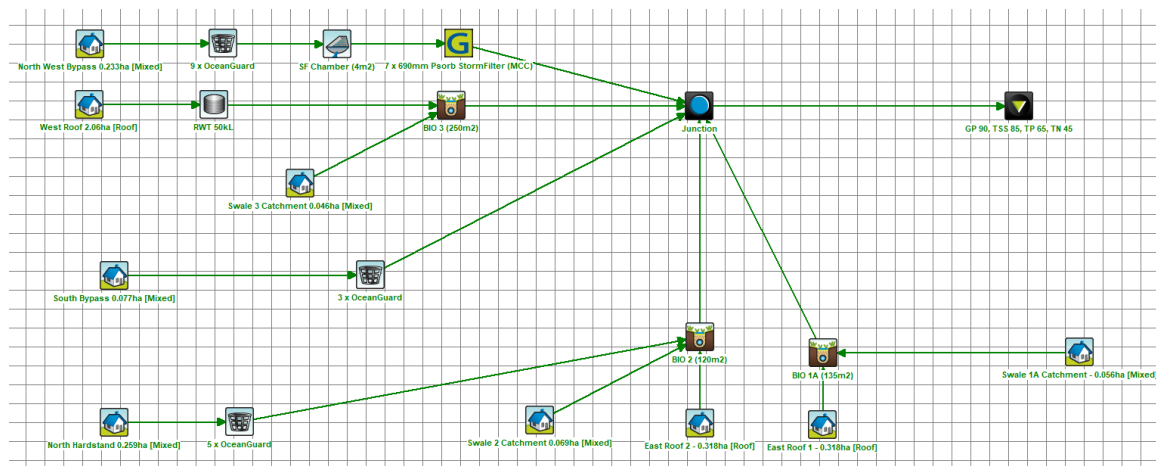


Figure 6.1. MUSIC model layout

Table 6.1 shows the results of the MUSIC analysis. The reduction rate is expressed as a percentage and compares the post-development pollutant loads without treatment versus post-development loads with treatment.

Table 6.1. MUSIC analysis results - % reductions

	Source	Residual Load	% Reduction
Total Suspended Solids (kg/yr)	1990	292	85.4
Total Phosphorus (kg/yr)	6.9	2.42	65
Total Nitrogen (kg/yr)	87.7	37.8	56.9
Gross Pollutants (kg/yr)	979	0	100

MUSIC modelling has been performed to assess the effectiveness of the selected treatment trains and to ensure that the pollutant retention requirements of Council’s DCP 2012 have been met.

The MUSIC modelling has shown that the proposed treatment train of STM will provide stormwater treatment which will meet Council’s and typical growth centre water quality reduction objective requirements in an effective and economical manner.

Given the expected low source loadings of hydrocarbons and oil/grease and removal efficiencies of the treatment devices we consider that the requirements of the Council have been met. Further discussion on hydrocarbons can be found in **Appendix B**.

6.4 Stormwater Harvesting

Stormwater harvesting refers to the collection of stormwater from the developments internal stormwater drainage system for re-use in non-potable applications. Stormwater from the stormwater drainage system can be classified as either rainwater where the flow is from roof areas, or stormwater where the flow is from all areas of the development.

For the purposes of this development, we refer to a rainwater harvesting system, where benefits of collected stormwater from roof areas over a stormwater harvesting system can be made as rainwater is generally less polluted than stormwater drainage.

Rainwater harvesting is proposed for this development with re-use for non-potable applications. Internal uses include such applications as toilet flushing while external applications will be used for irrigation. The aim is to reduce the water demand for the development in the range of 50-70%, subject to detail design.

In general terms the rainwater harvesting system will be an in-line tank for the collection and storage of rainwater. At times when the rainwater storage tank is full rainwater can pass through the tank and continue to be discharged via gravity into the stormwater drainage system. Rainwater from the storage tank will be pumped for distribution throughout the development in a dedicated non-potable water reticulation system. This however would be subject to future detail design.

Rainwater tanks have been designed, using MUSIC software to balance the supply and demand, based on the below base water demands and to provide 50-70% reduction in non-potable water demand. Rainwater tank reuse demands were calculated based on typical water demands of toilets and irrigation of landscaped areas. Water demands for toilets was calculated using 0.1kL/day/ toilet. Water demands for irrigation of landscaped areas was calculated using 0.3kL/year/m².

The above rates result in the following internal non-potable demand:

10 Toilets	0.1 kL/day
------------	------------

The above regime for the landscaped area for the site gives the following yearly outdoor water demand:

Irrigated Area (0.3kL/year/m ²)	7166m ²	2150 kL/year
TOTAL		2150 kL/year

6.4.1 Rainwater Tank Sizing

The use of rainwater reduces the mains water demand and the amount of stormwater runoff. By collecting the rainwater run-off from roof areas, rainwater tanks provide a valuable water source suitable for flushing toilets and landscape irrigation.

Rainwater tanks have been designed, using MUSIC software to balance the supply and demand, based on the calculated base water demands and proposed roof catchment areas. Allowances in the MUSIC model have been made for high flow bypass which will be managed by 300mm downpipe roofwater collection configuration along a portion of the south-west of the warehouse.

Roof Catchment (m ²)	Highflow Bypass (L/s)	Tank Size in MUSIC (kL)	Predicted Demand Reduction (%)	Provided Tank (kL)
20600	1*10 ⁵	40.00	70.02	50.00

Table 6.4. Rainwater Reuse Requirements

The MUSIC model, results summarised in **Table 6.4**, predicts that the reuse demands of 50-70% will be met for the development with the provision of a minimum 40 kL rainwater tank.

We note that the final configuration and sizing of the rainwater tanks is subject to detail design considerations and optimum site utilisation.

6.5 Maintenance and Monitoring

It is important that each component of the stormwater system and water quality treatment train is properly operated and maintained. In order to achieve the design treatment objectives, an indicative maintenance schedule has been prepared and included as **Appendix D** to assist in the effective operation and maintenance of the various water quality components.

Inspection frequency may vary depending on site specific attributes and rainfall patterns in the area. In addition to the nominated frequency, it is recommended that inspections are made prior to and following large storm events.

7 FLOODING AND OVERLAND FLOW

7.1 Introduction

An assessment of overland flow and flooding in relation to the proposed development, and confirmation of that the requirements of City of Sydney's *Floodplain Management Policy* and assessments as required of the SEAR's have been made.

Our review and assessment have been based, review of detail survey, the proposed development and an assessment of the site in relation to the flood modelling and documented flood behaviour included in the *Alexandra Canal Catchment Flood Study Model Update – ARR2019 Hydrology* completed by WMA Water (Ref: 117049-04) dated September 2020. It is noted that the 2020 report by WMA Water supersedes the 2014 *Alexandra Canal Catchment Flood Study Report Final* (Ref: W4785) prepared by Cardno on behalf of the City of Sydney Council (20 May 2014). The WMA Water report however does not include the subject site which was included in the 2014 study.

The WMA report will be referred to as the *Alexandra Canal 2020 Flood Study* from hereon, whilst the Carndo report as the *Alexandra Canal 2014 Flood Study*.

We have also obtained an electronic copy of the modelling output from the *Alexandra Canal 2020 Flood Study*. Costin Roe Consulting Pty Ltd (being engineers who specialise in stormwater engineering and flooding assessments) have prepared this report and associated drawings utilising the above information.

We have included the following items as part of our review:

- *Alexandra Canal Catchment 2014 Flood Study*
- *Alexandra Canal Catchment 2020 Flood Study*;
- *M5 EIS SSI-6788 Flood Impact Assessment*;
- City of Sydney Councils *Floodplain Management Policy* in relation to the development including review of potential impacts of the development on existing flooding, and potential impacts on the development from flooding.

7.2 Alexandria Canal Flood Study

A flood study of the Alexandra Canal catchment was undertaken in 2014 by Cardno for The City of Sydney Council. This has now been superseded by an updated study undertaken in 2020 by WMA Water as noted above. The study involved a hydrological and hydraulic assessment of the catchment at a regional level. The hydraulic model utilising the two-dimensional hydraulic model (TUFLOW), including one-dimension pits and pipes for the significant council pipe infrastructure. Flow output from contributing catchments is based on "rain-on-grid" and it is noted that no drainage infrastructure in individual lots has been included in the model, unless this forms part of council trunk or significant inter-allotment drainage infrastructure.

Figure 7.1 is an excerpt of the 2020 study which shows the subject property is majority clear of the study area.

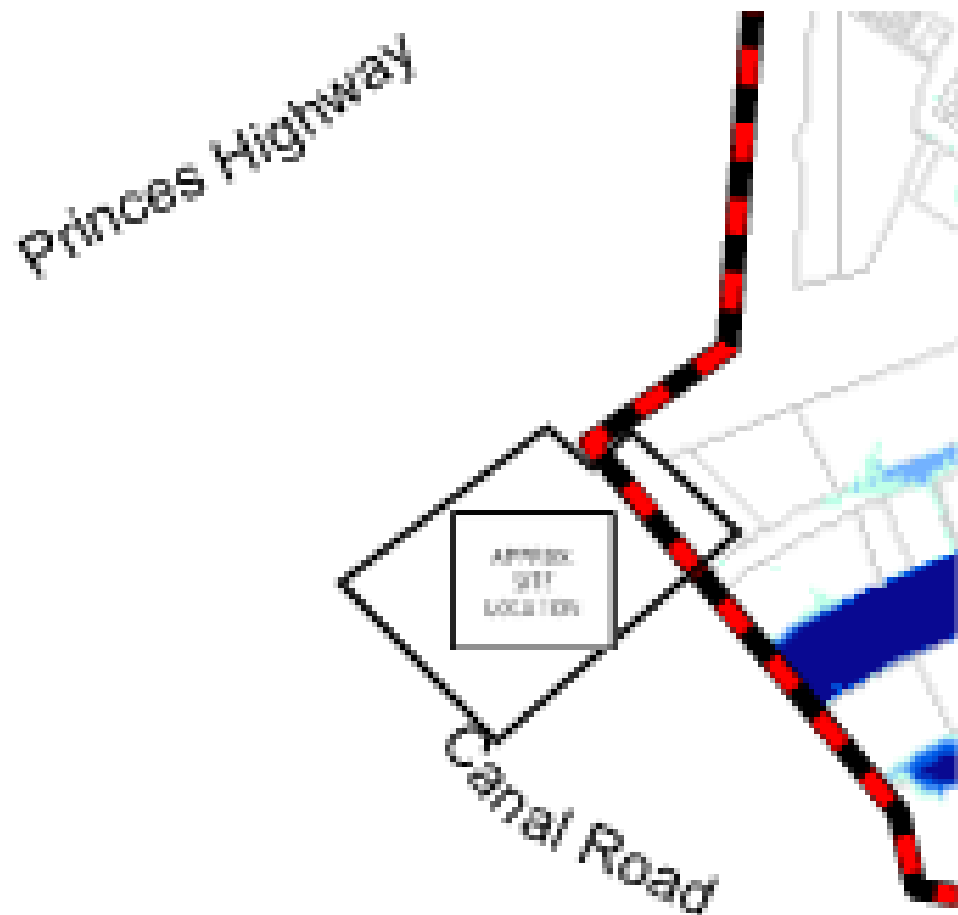


Figure 7.1. Excerpt of the 2020 study

We provide excerpts of flooding associated with the 1% AEP storm events from the *Alexandra Canal 2014 Flood Study* in **Figures 7.2** and **7.3** below. **Figure 7.2** is noted to be an excerpt of 2014 *Flood Study Figure 6.13* and **Figure 7.3** an excerpt of 2014 *Flood Study Figure 6.20*.

We provide excerpts of flooding associated with the PMF storm event from the *Alexandra Canal 2014 Flood Study* in **Figures 7.5** and **7.5** below. **Figure 7.4** is noted to be an excerpt of 2014 *Flood Study Figure 6.14* and **Figure 7.5** an excerpt of 2014 *Flood Study Figure 6.21*.

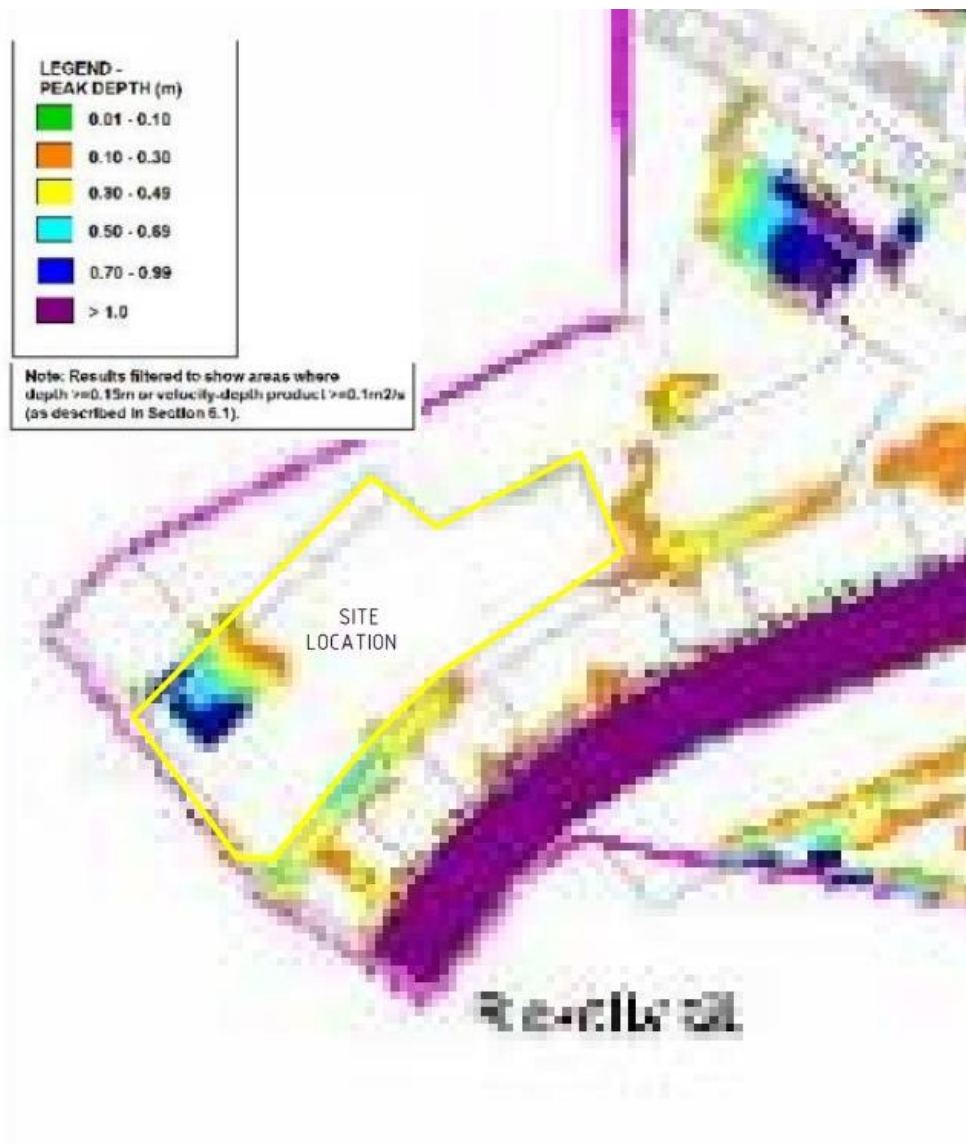


Figure 7.2. Alexandra Canal 2014 - 1% AEP Flood Extent and Depths

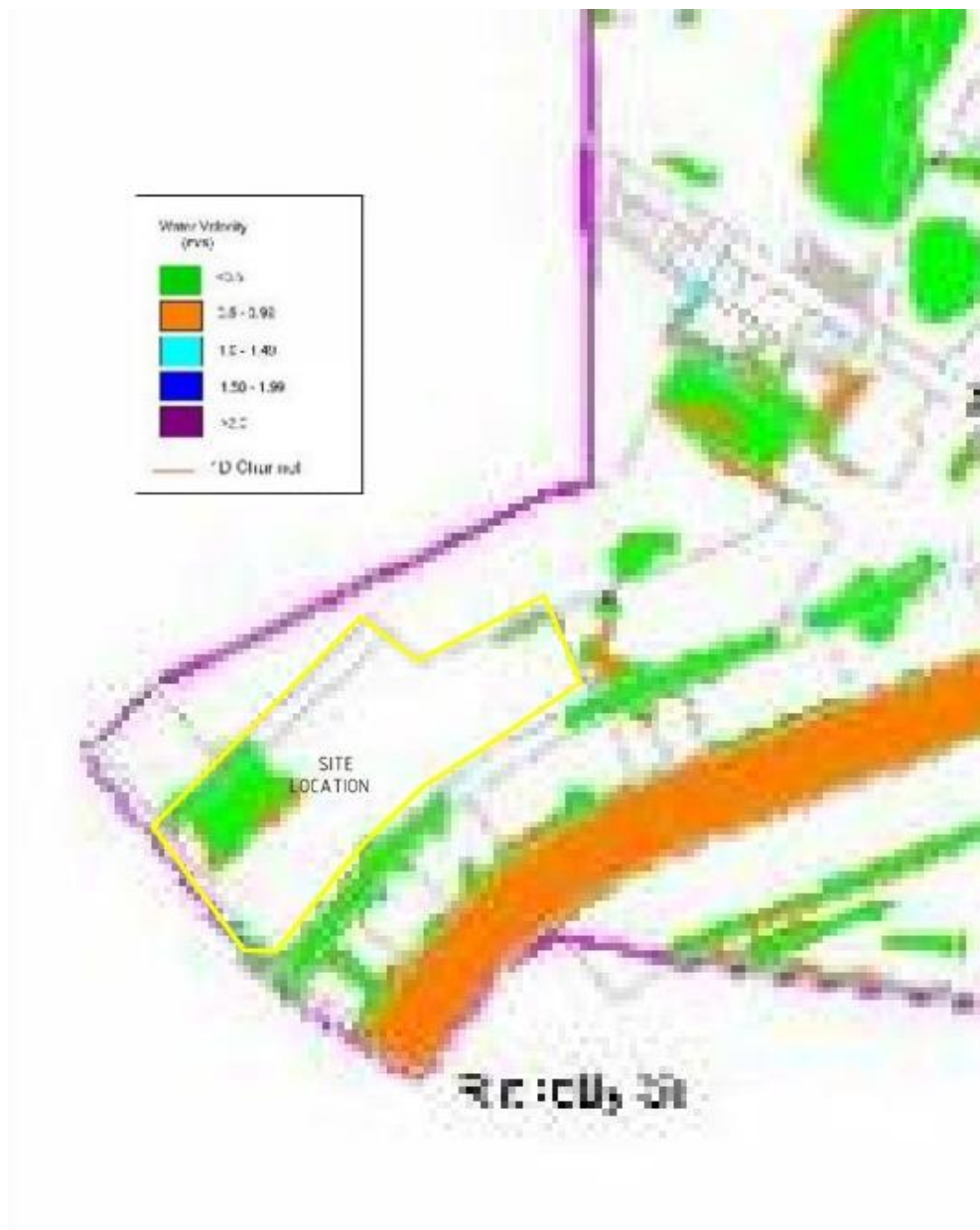


Figure 7.3. Alexandra Canal - 1% AEP Flood Velocity

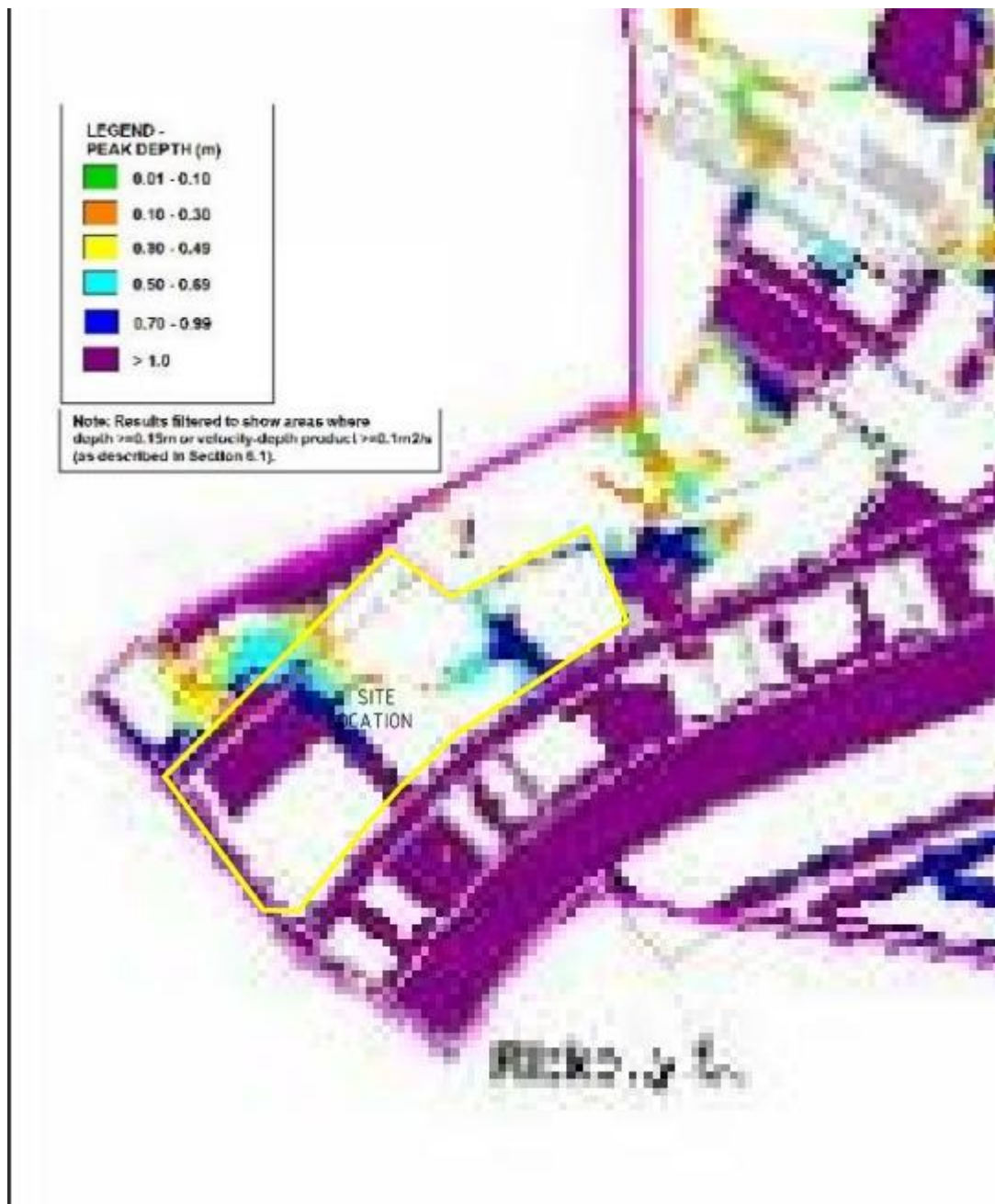


Figure 7.4. Alexandra Canal - PMF Flood Extent and Depths



Figure 7.5. Alexandra Canal - PMF Flood Velocity

With reference to **Figures 7.2 & 7.3**, some flooding (depth ranging from 0.1-1m with velocity below than 0.5m/s) is observed on the north-western edge of the site adjacent to the neighbouring property. The ponding water demonstrated in the plan is considered to be a function of the modelling and indicative of surface water runoff which would be collected by site drainage systems which are not included in the regional model.

The site is shown to be clear of any significant flow paths and is not affected by mainstream flooding associated with the Alexandra Canal.

With reference to **Figures 7.4 & 7.5**, significant flooding is shown to be within the property extent. Ponding with depth greater than 1m and velocity less than 1m/s is shown in council's regional flood study to be present throughout the site and on the edge bordering the property to the north-west. The ponding water demonstrated in the plan is considered to be a function of the modelling and indicative of surface water runoff which would be collected by site drainage systems which are not included in the regional model.

7.3 M5 EIS Flood Study SSI-6788

A flood study was completed by Lyall and Associates on behalf of TfNSW for the construction of the M5 Motorway and WestConnex Interchange. The interchange and lead in construction required works to Canal Road and Burrows Road. The study involved a hydrological and hydraulic assessment of the catchment at a regional level. The hydraulic model utilising the two-dimensional hydraulic model (TUFLOW), including one-dimension pits and pipes for the significant council pipe infrastructure. Flow output from contributing catchments is based on "rain-on-grid" and it is noted that no drainage infrastructure in individual lots has been included in the model, unless this forms part of council trunk or significant inter-allotment drainage infrastructure.

We provide excerpts of flooding associated with the 1% AEP storm event in **Figures 7.6 and 7.7** below. **Figure 7.6** is noted to be an excerpt of *Flood Study Figure 4.8* and **Figure 7.7** an excerpt of *Flood Study Figure 4.13*.

We provide excerpts of flooding associated with the PMF storm event in **Figure 7.8**. **Figure 7.8** is noted to be an excerpt of *Flood Study Figure 4.10*.

The figures show the site to be clear of flooding and flood hazard areas for the 1% AEP but subject to heavy inundation of depths greater than 1m during the PMF event.



Figure 7.6. M5 EIS - 1% AEP Flood Extent and Depths



Figure 7.7. M5 EIS - 1% AEP Provisional Flood Hazard

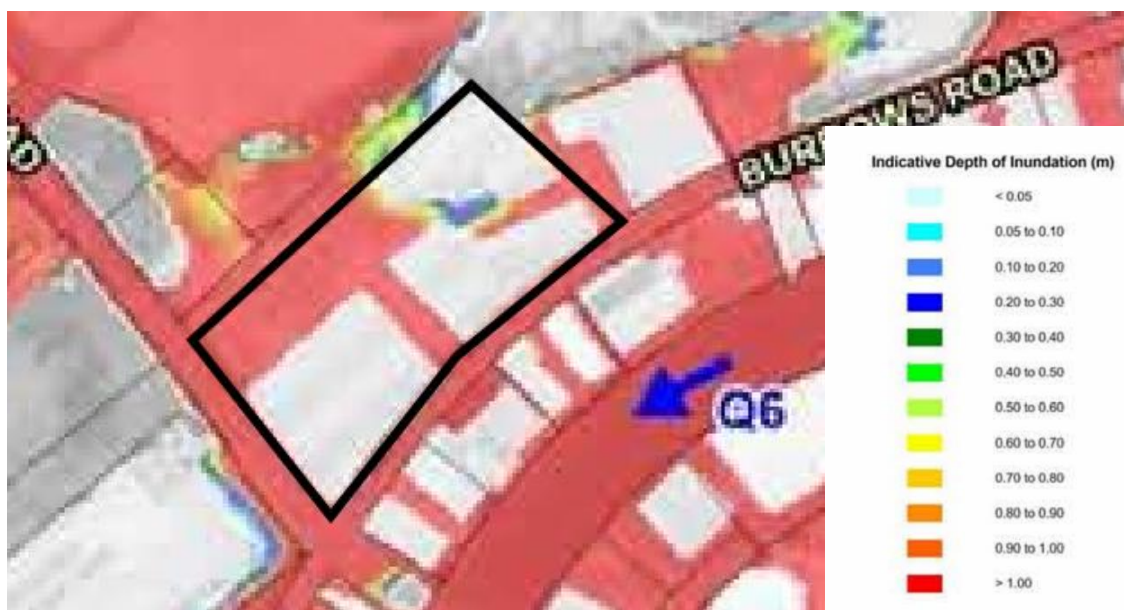


Figure 7.8. M5 EIS - PMF Flood Extent and Depths

7.4 City of Sydney Floodplain Management Requirements & NSW Floodplain Management Manual Requirements

Councils *Floodplain Management Policy* provides relevant policy requirements relating to development in and around identified flood affected development sites.

The intent of the document is to ensure that new developments do not experience undue flood risk and that existing development is not adversely flood affected through increased damage or hazard as a result of new development.

Section 5 of the Floodplain Management Policy notes the flood planning level for business/ industrial to be at or above the 1% AEP (1 in 100-year ARI) flood level.

The PMF or extreme event provides an upper limit of flooding and associated consequences for the problem being investigated. It is used for emergency response planning purposes to address the safety of people.

As discussed in earlier sections of this report, there is minor flooding on the site and on Burrows Road and Canal Road.

We note the FFL of the proposed building has been sited a minimum of 0.5m above the gutter level to ensure the site is not affected by nuisance runoff and gutter flows in Burrows Road and Canal Road.

In relation to flood impact on the development or impact from the development on flooding, it is noted that the modelled 1% AEP flood extent by Council, shows some encroachment on the north side of the subject property. This modelled ponding is considered to be a function of the modelling and indicative of surface water runoff which would be collected by site drainage systems which are not included in the regional model, and emanating from an area offsite which now has a functioning drainage system installed by TfNSW as part of the their M5 interchange works. As noted, there is no flooding in the 1% AEP in the TfNSW flood study.

Overall flood risk for the development is considered low to negligible, and the development meets current council flood policy. It is considered there is no impact on flooding for all events to the 1% AEP.

7.5 Flood Assessment Conclusion

A review of available flood studies has been made to determine flood behaviour in relation to the proposal.

Review of the available information, including Councils adopted flood study and new M5 EIS SSI-6788, shows the site is not subject to flooding or overland flow paths. As the site is not subject to flooding or overland flow, no detailed modelling or flood impact assessments are necessary for the development.

We note the floor level of the building has been set 0.5m above the gutter level, above the 1% AEP level, to ensure nuisance flooding and gutter flows do not affect the operation of the development when operational.

8 CONSTRUCTION SOIL AND WATER MANAGEMENT

8.1 Soil and Water Management General

Without any mitigation measures and during typical construction activities, site runoff would be expected to convey a significant sediment load. A *Soil and Water Management Plan* (SWMP) and *Erosion and Sediment Control Plan* (ESCP), or equivalent, would be implemented for the construction of the Proposal. The SWMP and ESCPs would be developed in accordance with the principles and requirements of *Managing Urban Stormwater – Soils & Construction Volume 1 ('Blue Book')* (Landcom, 2004) with a staged approach.

In accordance with the principles included in the Blue Book, a number of controls have been incorporated into a preliminary Staged ESCP (refer to accompanying Drawings in **Appendix A**) and draft SWMP in **Appendix C**. The Staged ESCP considers initial site establishment, requirements during construction of development and, completion of development works.

Section 1 provides a summary of the construction works for the Proposal. While all construction activities have the potential to impact on water quality, the key activities are:

- Erosion and sediment control installation.
- Grading of existing earthworks to suit building layout, drainage layout and pavements.
- Stormwater and drainage works.
- Service installation works.
- Building construction works.

The sections below outline the proposed controls for management of erosion and sedimentation during construction of the Proposal. The staged approach is noted to consider initial site establishment, construction of the development and the completion of the development, as included in the ESCP drawings **Appendix A**.

8.2 Typical Management Measures

Sediment Basins

Sediment basins are to be sized and located to ensure sediment concentrations in site runoff are within acceptable limits. Preliminary basin sizes will be calculated in accordance with the Blue Book and are based on 'Type F' soils. These soils are fine grained and require a relatively long residence time to allow settling.

Sediment basins for 'Type F' soils are typically wet basins which are pumped out following a rainfall event when suspended solids concentrations of less than 50 mg/L have been achieved.

Sediment Fences

Sediment fences are to be located around the perimeter of the site to ensure no untreated runoff leaves the site. They have should also be located around the existing drainage channels to minimise sediment migration into waterways and sediment basins.

Stabilised Site Access

For the proposal, stabilised site access is proposed at any designated site entry to the works area. This will limit the risk of sediment being transported on Burrows Road, Canal Road and other public roads.

8.3 Other Management Measures

Other management measures that will be employed are expected to include:

- Minimising the extent of disturbed areas across the site at any one time.
- Progressive stabilisation of disturbed areas or previously completed earthworks to suit the proposal once trimming works are complete.
- Regular monitoring and implementation of remedial works to maintain the efficiency of all controls.

It is noted that the controls included in the preliminary ESCP are expected to be reviewed and updated as the design, staging and construction methodology is further developed for the Proposal.

9 CONCLUSION

This Civil Engineering Report has been prepared to support the State Significant Development Application for a Proposed Development at 1-3 Burrows Road, Alexandria, NSW.

A civil engineering strategy for the site has been developed which provides a best practice solution within the constraints of the existing landform and proposed development layout. Within this strategy a stormwater quantity and quality management strategy has been developed to consider peak flows and reduce pollutant loads in stormwater leaving this site. The stormwater management for the development has been designed in accordance with City of Sydney Council requirements and ensuring acceptable impacts relating to the development.

The hydrological assessment shows local post development flows from the site will be consistent with pre-development flows and demonstrates that the site discharge will not adversely affect any land, drainage system or watercourse as a result of the development.

During the construction phase, a Sediment and Erosion Control Plan will be in place to ensure the downstream drainage system and receiving waters are protected from sediment laden runoff.

During the operational phase of the development, a treatment train incorporating the use of a proprietary filtration system is proposed to mitigate any increase in stormwater pollutant load generated by the development. MUSIC modelling results indicate that the proposed STM are effective in reducing pollutant loads in stormwater discharging from the site and meet the requirements of Council's pollution reduction targets. Best management practices have been applied to the development to ensure that the quality of stormwater runoff is not detrimental to the receiving environment.

It is recommended the management strategies in this report be approved and incorporated into the future detailed design.

10 REFERENCES

- Managing Urban Stormwater: Harvesting and Reuse – 2006 (NSW DEC);
- Managing Urban Stormwater: Source Control – 1998 (NSW EPA);
- Managing Urban Stormwater: Treatment Techniques – 1997 (NSW EPA);
- Managing Urban Stormwater: Soils & Construction – 2004 (LANDCOM);
- Water Sensitive Urban Design – “Technical Guidelines for Western Sydney” by URS Australia Pty Ltd, May 2004

Appendix A
DRAWINGS BY COSTIN ROE CONSULTING

PROPOSED DEVELOPMENT

1-3 BURROWS ROAD, ST PETERS, NSW, 2044

STATE SIGNIFICANT DEVELOPMENT APPLICATION

DRAWING LIST:

DRAWING NO.	DRAWING TITLE
CO11035.04-SSDA10	DRAWING LIST & GENERAL NOTES
CO11035.04-SSDA20	EROSION AND SEDIMENT CONTROL PLAN
CO11035.04-SSDA25	EROSION AND SEDIMENT CONTROL DETAILS - SHEET 1
CO11035.04-SSDA26	EROSION AND SEDIMENT CONTROL DETAILS - SHEET 2
CO11035.04-SSDA30	BULK EARTHWORKS PLAN
CO11035.04-SSDA35	BULK EARTHWORKS SECTIONS
CO11035.04-SSDA40	STORMWATER DRAINAGE PLAN
CO11035.04-SSDA45	STORMWATER DRAINAGE DETAILS - SHEET 1
CO11035.04-SSDA46	STORMWATER DRAINAGE DETAILS - SHEET 2
CO11035.04-SSDA47	STORMWATER DRAINAGE DETAILS - SHEET 3
CO11035.04-SSDA48	TYPICAL BIO-RETENTION DETAILS
CO11035.04-SSDA50	FINISHED LEVELS PLAN
CO11035.04-SSDA55	TYPICAL SECTIONS
CO11035.04-SSDA65	RETAINING WALL DETAILS

GENERAL NOTES:

- THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL AND OTHER CONSULTANTS' DRAWINGS AND SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT. ANY DISCREPANCY SHALL BE REFERRED TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.
- ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT AND CURRENT STANDARDS AUSTRALIA CODES AND WITH THE BY-LAWS AND ORDINANCES OF THE RELEVANT BUILDING AUTHORITIES EXCEPT WHERE VARIED BY THE PROJECT SPECIFICATION.
- ALL DIMENSIONS SHOWN SHALL BE VERIFIED BY THE BUILDER ON SITE. ENGINEER'S DRAWINGS SHALL NOT BE SCALED FOR DIMENSIONS. ENGINEER'S DRAWINGS ISSUED IN ANY ELECTRONIC FORMAT MUST NOT BE USED FOR DIMENSIONAL SETOUT. REFER TO THE ARCHITECT'S DRAWINGS FOR ALL DIMENSIONAL SETOUT INFORMATION. DURING CONSTRUCTION THE STRUCTURE SHALL BE MAINTAINED IN A STABLE CONDITION AND NO PART SHALL BE OVERSTRESSED. TEMPORARY BRACING SHALL BE PROVIDED BY THE BUILDER TO KEEP THE WORKS AND EXCAVATIONS STABLE AT ALL TIMES.
- UNLESS NOTED OTHERWISE ALL LEVELS ARE IN METRES AND ALL DIMENSIONS ARE IN MILLIMETRES.
- ALL WORKS SHALL BE UNDERTAKEN IN ACCORDANCE WITH ACCEPTABLE SAFETY STANDARDS & APPROPRIATE SAFETY SIGNS SHALL BE INSTALLED AT ALL TIMES DURING THE PROGRESS OF THE JOB.

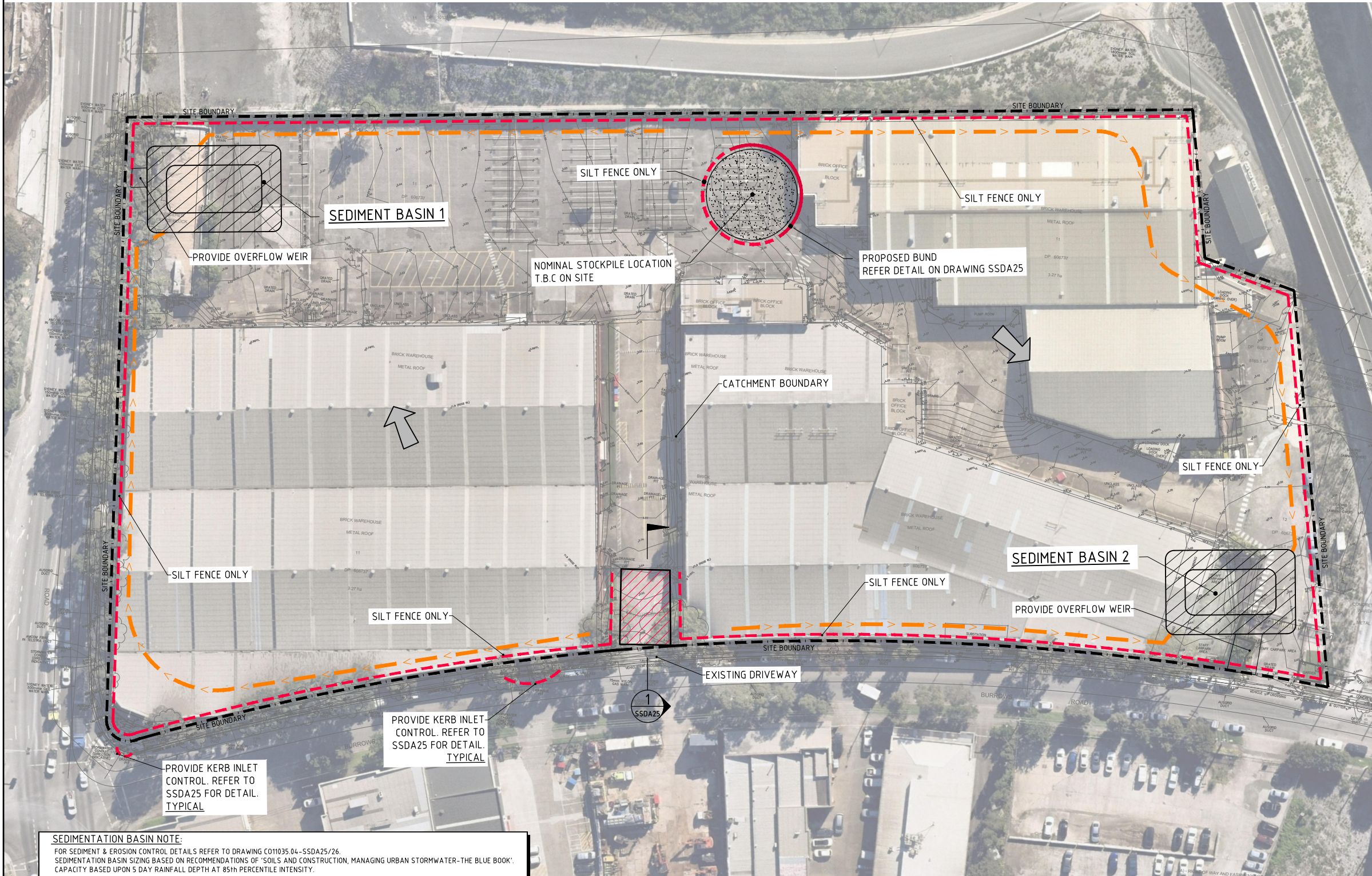
ELECTRONIC INFORMATION NOTES:

- THE ISSUED DRAWINGS IN HARD COPY OR PDF FORMAT TAKE PRECEDENCE OVER ANY ELECTRONICALLY ISSUED INFORMATION, LAYOUTS OR DESIGN MODELS.
- THE CONTRACTOR'S DIRECT AMENDMENT OR MANIPULATION OF THE DATA OR INFORMATION THAT MIGHT BE CONTAINED WITHIN AN ENGINEER-SUPPLIED DIGITAL TERRAIN MODEL AND ITS SUBSEQUENT USE TO UNDERTAKE THE WORKS WILL BE SOLELY AT THE DISCRETION OF AND THE RISK OF THE CONTRACTOR.
- THE CONTRACTOR IS REQUIRED TO HIGHLIGHT ANY DISCREPANCIES BETWEEN THE DIGITAL TERRAIN MODEL AND INFORMATION PROVIDED IN THE CONTRACT AND/OR DRAWINGS AND IS REQUIRED TO SEEK CLARIFICATION FROM THE SUPERINTENDENT.
- THE ENGINEER WILL NOT BE LIABLE OR RESPONSIBLE FOR THE POSSIBLE ON-GOING NEED TO UPDATE THE DIGITAL TERRAIN MODEL, SHOULD THERE BE ANY AMENDMENTS OR CHANGES TO THE DRAWINGS OR CONTRACT INITIATED BY THE CONTRACTOR.



FOR APPROVAL

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>ISSUED FOR APPROVAL</td> <td>19.09.22</td> <td>C</td> </tr> <tr> <td>REVISED AS CLOUDED</td> <td>31.08.22</td> <td>B</td> </tr> <tr> <td>ISSUED FOR INFORMATION ONLY</td> <td>15.07.22</td> <td>A</td> </tr> <tr> <td>AMENDMENTS</td> <td>DATE</td> <td>ISSUE</td> </tr> </table>	ISSUED FOR APPROVAL	19.09.22	C	REVISED AS CLOUDED	31.08.22	B	ISSUED FOR INFORMATION ONLY	15.07.22	A	AMENDMENTS	DATE	ISSUE	<p>ARCHITECT Welsh + Major</p> <p>L4, 69 Reservoir Street, Surry Hills NSW 2010 welshmajor.com mail@welshmajor.com +61 2 9699 6066 ABN: 67 612 977 303</p>	<p>CLIENT</p> <p>Goodman</p> <p>LEVEL 17, 60 Castlereagh Street SYDNEY NSW, 2000, Australia Tel (02) 9230 7400 Fax (02) 9230 7444</p>	<p>PROJECT 1-3 BURROWS ROAD 1-3 BURROWS ROAD, ST PETERS NSW, 2044</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>DESIGNED</td> <td>DRAWN</td> <td>DATE</td> <td>CHECKED</td> <td>SIZE</td> <td>SCALE</td> <td>CAD REF:</td> </tr> <tr> <td>DW</td> <td>RN</td> <td>JULY '22</td> <td>MW</td> <td>A1</td> <td>AS SHOWN</td> <td>CO11035.04-SSDA10</td> </tr> </table>	DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:	DW	RN	JULY '22	MW	A1	AS SHOWN	CO11035.04-SSDA10	<p>CONSULT AUSTRALIA</p> <p>Costin Roe Consulting Pty Ltd. ABN 50 003 696 446</p> <p>PO Box 8419 Sydney NSW 1220 Level 4, 8 Windmill Street, Millers Point NSW 2000 p: +61 2 9251 7699 f: +61 2 9241 3731 e: mail@costinroe.com.au w: costinroe.com.au</p>	<p>CRC COSTIN ROE CONSULTING</p> <p>CIVIL & STRUCTURAL ENGINEERS</p>	<p>DRAWING TITLE DRAWING LIST & GENERAL NOTES</p> <p>DRAWING No CO11035.04-SSDA10</p> <p>ISSUE C</p>
ISSUED FOR APPROVAL	19.09.22	C																														
REVISED AS CLOUDED	31.08.22	B																														
ISSUED FOR INFORMATION ONLY	15.07.22	A																														
AMENDMENTS	DATE	ISSUE																														
DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:																										
DW	RN	JULY '22	MW	A1	AS SHOWN	CO11035.04-SSDA10																										



- EROSION CONTROL NOTES:**
- ALL CONTROL WORK INCLUDING DIVERSION BANKS AND CATCH DRAINS, V-DRAINS AND SILT FENCES SHALL BE COMPLETED DIRECTLY FOLLOWING THE COMPLETION OF THE EARTHWORKS.
 - SILT FENCES AND SILT FENCE RETURNS SHALL BE ERECTED CONVEX TO THE CONTOUR TO POND WATER.
 - HAY BALE BARRIERS AND GEOFABRIC FENCES ARE TO BE CONSTRUCTED TO TOE OF BATTER, PRIOR TO COMMENCEMENT OF EARTHWORKS, IMMEDIATELY AFTER CLEARING OF VEGETATION AND BEFORE REMOVAL OF TOP SOIL.
 - ALL TEMPORARY EARTH BERMS, DIVERSION AND SILT DAM EMBANKMENTS ARE TO BE MACHINE COMPACTED, SEEDED AND MULCHED FOR TEMPORARY VEGETATION COVER AS SOON AS THEY HAVE BEEN FORMED.
 - CLEAR WATER IS TO BE DIVERTED AWAY FROM DISTURBED GROUND AND INTO THE DRAINAGE SYSTEM.
 - THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING AND PROVIDING ON GOING ADJUSTMENT TO EROSION CONTROL MEASURES AS REQUIRED DURING CONSTRUCTION.
 - ALL SEDIMENT TRAPPING STRUCTURES AND DEVICES ARE TO BE INSPECTED AFTER STORMS FOR STRUCTURAL DAMAGE OR CLOGGING, TRAPPED MATERIAL IS TO BE REMOVED TO A SAFE, APPROVED LOCATION.
 - ALL FINAL EROSION PREVENTION MEASURES INCLUDING THE ESTABLISHMENT OF GRASSING ARE TO BE MAINTAINED UNTIL THE END OF THE DEFECTS LIABILITY PERIOD.
 - ALL EARTHWORKS AREAS SHALL BE ROLLED ON A REGULAR BASIS TO SEAL THE EARTHWORKS.
 - ALL FILL AREAS ARE TO BE LEFT WITH A BUND AT THE TOP OF THE SLOPE AT THE END OF EACH DAY'S EARTHWORKS. THE HEIGHT OF THE BUND SHALL BE A MINIMUM OF 200mm.
 - ALL CUT AND FILL SLOPES ARE TO BE SEEDED AND HYDROMULCHED WITHIN 10 DAYS OF COMPLETION OF FORMATION.
 - AFTER REVEGETATION OF THE SITE IS COMPLETE AND THE SITE IS STABLE IN THE OPINION OF A SUITABLY QUALIFIED PERSON ALL TEMPORARY WORK SUCH AS SILT FENCE, DIVERSION DRAINS ETC SHALL BE REMOVED.
 - ALL TOPSOIL STOCKPILES ARE TO BE SUITABLY COVERED TO THE SATISFACTION OF THE SITE MANAGER TO PREVENT WIND AND WATER EROSION.
 - ANY AREA THAT IS NOT APPROVED BY THE CONTRACT ADMINISTRATOR FOR CLEARING OR DISTURBANCE BY THE CONTRACTOR'S ACTIVITIES SHALL BE CLEARLY MARKED AND SIGN POSTED, FENCED OFF OR OTHERWISE APPROPRIATELY PROTECTED AGAINST ANY SUCH DISTURBANCE.
 - ALL STOCKPILE SITES SHALL BE SITUATED IN AREAS APPROVED FOR SUCH USE BY THE SITE MANAGER. A 6m BUFFER ZONE SHALL EXIST BETWEEN STOCKPILE SITES AND ANY STREAM OR FLOW PATH. ALL STOCKPILES SHALL BE ADEQUATELY PROTECTED FROM EROSION AND CONTAMINATION OF THE SURROUNDING AREA BY USE OF THE MEASURES APPROVED IN THE EROSION AND SEDIMENTATION CONTROL PLAN.
 - ACCESS AND EXIT AREAS SHALL INCLUDE SHAKE-DOWN OR OTHER METHODS APPROVED BY THE SITE MANAGER FOR THE REMOVAL OF SOIL MATERIALS FROM MOTOR VEHICLES.
 - THE CONTRACTOR IS TO ENSURE RUNOFF FROM ALL AREAS WHERE THE NATURAL SURFACE IS DISTURBED BY CONSTRUCTION, INCLUDING ACCESS ROADS, DEPOT AND STOCKPILE SITES, SHALL BE FREE OF POLLUTANTS BEFORE IT IS EITHER DISPERSED TO STABLE AREAS OR DIRECTED TO NATURAL WATERCOURSES.
 - THE CONTRACTOR SHALL PROVIDE AND MAINTAIN SLOPES, CROWNS AND DRAINS ON ALL EXCAVATIONS AND EMBANKMENTS TO ENSURE SATISFACTORY DRAINAGE AT ALL TIMES WATER SHALL NOT BE ALLOWED TO POND ON THE WORKS UNLESS SUCH PONDING IS PART OF AN APPROVED ESC / SWMP.

- SEDIMENT CONTROL BASIN NOTES:**
- TYPE D BASIN IS REQUIRED.
 - VOLUME OF THE BASINS SHALL BE AS NOMINATED ON DRAWING. NOMINAL POND LOCATIONS AND NOMINAL DIMENSIONS.
 - SEDIMENT BUILD UP TO NOT EXCEED 33% TOTAL CAPACITY OF BASIN.
 - DEWATERING OF BASIN TO BE PERFORMED TO THE BOTTOM OF THE SEDIMENT SETTLING ZONE FOLLOWING ACHIEVEMENT OF WQO'S. MANAGEMENT OF DOSAGE AND DISCHARGE TO BE ACHIEVED WITHIN 5 DAYS OF THE INITIAL RAINFALL EVENT.
 - FOLLOWING DEWATERING PER NOTE 4, WATER LEVEL TO BE MAINTAINED AT 20% CAPACITY AFTER A FOUR DAY SETTLING PERIOD FOLLOWING A STORM EVENT.
 - WATER TO BE DOSED WITH GYPSUM TO ACCELERATE SETTLEMENT OF SUSPENDED SOLIDS AS REQUIRED.
 - GYPSUM DOSAGE RATE TO BE APPLIED AT APPROX. 32kg PER 100 CUBIC METRE OF COLLECTED RUNOFF.
 - THE USE OF ALUM (OR ANY OTHER ALTERNATIVE) AS A FLOCCULANT IS NOT RECOMMENDED. ALUM OR ANY OTHER FLOCCULANT IS TO BE USED ONLY FOLLOWING CONSULTATION WITH AND ACCEPTANCE FROM COUNCIL ESC OFFICERS.
 - DISCHARGE FROM POND IS PERMISSIBLE WHEN THE WATER PH IS 6.5-8.5 AND IS CLARIFIED TO AT OR BELOW A TSS OF 50mg/L. CLARIFICATION WOULD GENERALLY BE ACHIEVED IN 36-72 HOURS WITH THE USE OF GYPSUM. CORRELATION TESTS MUST BE UNDERTAKEN ON SITE TO ENSURE THIS IS ACHIEVED.
 - DEWATERING SHALL BE DONE IN SUCH A MANNER AS TO REMOVE THE CLEAN WATER (BEING WATER WITHIN THE ADOPTED CRITERIA) WITHOUT REMOVING OR DISTURBING THE SEDIMENT THAT HAS SETTLED. THE PUMP INTAKE PIPE IS NOT TO REST ON THE SETTLED SEDIMENT LAYER.
 - IF WATER EXCEEDS TSS OF 50mg/L DURING DEWATERING, PUMPING IS TO CEASE. RECORDS ARE TO BE KEPT (ON-SITE AT ALL TIMES) OF ALL MEASUREMENT PRIOR TO, DURING AND AFTER DISCHARGE. RECORDS TO BE MADE AVAILABLE TO COUNCIL OFFICERS UPON REQUEST.
 - PROVIDE SECURITY FENCE TO BASIN FOR SAFETY.

SEDIMENTATION BASIN NOTE:
 FOR SEDIMENT & EROSION CONTROL DETAILS REFER TO DRAWING C011035.04-SSDA25/26.
 SEDIMENTATION BASIN SIZING BASED ON RECOMMENDATIONS OF 'SOILS AND CONSTRUCTION, MANAGING URBAN STORMWATER-THE BLUE BOOK'.
 CAPACITY BASED UPON 5 DAY RAINFALL DEPTH AT 85th PERCENTILE INTENSITY.

APPROXIMATE AREA OF DISTURBED SITE = 3.45ha

SEDIMENT BASIN 1:	SEDIMENT BASIN 2:
CATCHMENT AREA = 1.65ha	CATCHMENT AREA = 1.80ha
REQUIRED BASIN VOLUME = 554m ³	REQUIRED BASIN VOLUME = 605m ³
BASE DIMENSIONS (L X W) = 21.0m x 10.5m	BASE DIMENSIONS (L X W) = 22.0m x 11.0m
TOP DIMENSIONS (L X W) = 30.0m x 19.5m	TOP DIMENSIONS (L X W) = 31.0m x 20.0m
MAX SIDE SLOPE = 1V:3H	MAX SIDE SLOPE = 1V:3H
DEPTH = 1.5m	DEPTH = 1.5m
PROVIDED BASIN VOLUME = 582m ³	PROVIDED BASIN VOLUME = 625m ³

SEDIMENTATION BASINS TO COLLECT RUN-OFF IN EXTREME RAINFALL EVENTS. COLLECTED RUN-OFF TO BE ASSESSED BY A QUALIFIED LABORATORY FOR DOSING RATES OF ALUM OR GYPSUM TO ENSURE COAGULATION OF SEDIMENTS PRIOR TO WATER BEING DISCHARGED TO COUNCIL STORMWATER SYSTEM.

EACH BASIN IS TO HAVE A MARKER PLACED AS PER THE DETAIL TO INDICATE WHEN SEDIMENT IS TO BE REMOVED. REMOVED SEDIMENT IS TO BE CLASSED AND DEWATERED PRIOR TO REMOVAL FROM SITE.

ALLOWANCE TO BE MADE DURING BENCHING OF SITE TO ENSURE RUN-OFF IS DIRECTED TO SEDIMENTATION BASINS.

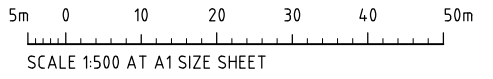
NOTES:

- ASSUME TYPE D SOIL (CLAY/SILTY CLAY)
- ASSUME GROUP D SOIL (HIGH PLASTICITY AND SHRINK/SWELL PROPERTIES)

EROSION & SEDIMENT CONTROL PLAN
 SCALE 1:500

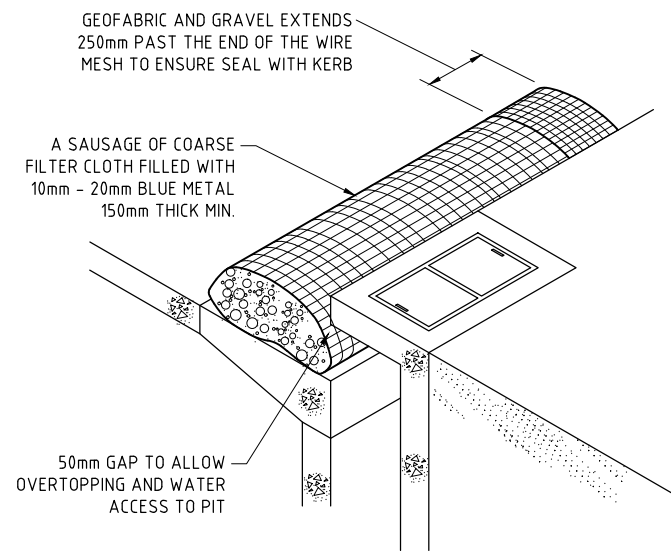
LEGEND:

- PROVIDE 1m RETURNS TO SILT FENCE AT 30m MAX. INTERVALS. TYPICAL (N.S.O.P.)
- DENOTES DIVERSION DRAIN
- - - - DENOTES SILT FENCE WITH CATCH DRAIN
- - - - DENOTES SILT FENCE ONLY
- [Hatched Box] DENOTES CONSTRUCTION ENTRY
- [Arrow] DENOTES OVERLAND FLOW PATH

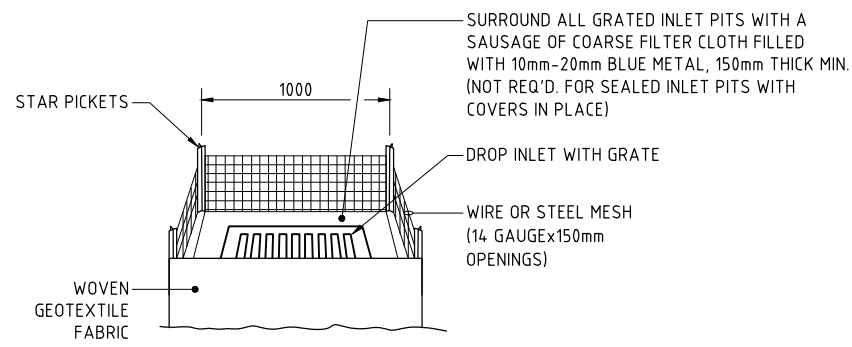


FOR APPROVAL

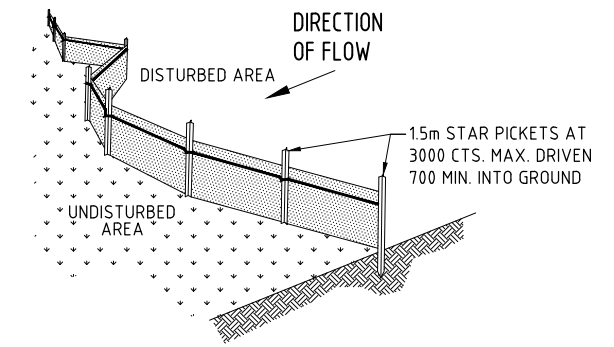
ARCHITECT Welsh + Major L4, 69 Reservoir Street, Surry Hills NSW 2010 welshmajor.com mail@welshmajor.com +61 2 9699 6066 ABN: 67 612 977 303		CLIENT Goodman LEVEL 17, 60 Castlereagh Street SYDNEY NSW, 2000, Australia Tel: (02) 9230 7400 Fax: (02) 9230 7444		PROJECT 1-3 BURROWS ROAD 1-3 BURROWS ROAD, ST PETERS NSW, 2044		Costin Roe Consulting Pty Ltd. ABN 50 003 696 446 PO Box N419 Sydney NSW 1220 Level 4, 8 Windmill Street, Millers Point NSW 2000 p: +61 2 9251 7699 e: mail@costinroe.com.au f: +61 2 9241 3731 w: costinroe.com.au		CRC CIVIL & STRUCTURAL ENGINEERS DRAWING TITLE EROSION & SEDIMENT CONTROL PLAN DRAWING No C011035.04-SSDA20		ISSUE A
ISSUED FOR APPROVAL	19.09.22	A	DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:	C011035.04-SSDA20
AMENDMENTS	DATE	ISSUE	DW	RN	JULY '22	MW	A1	AS SHOWN		



KERB INLET CONTROL
N.T.S



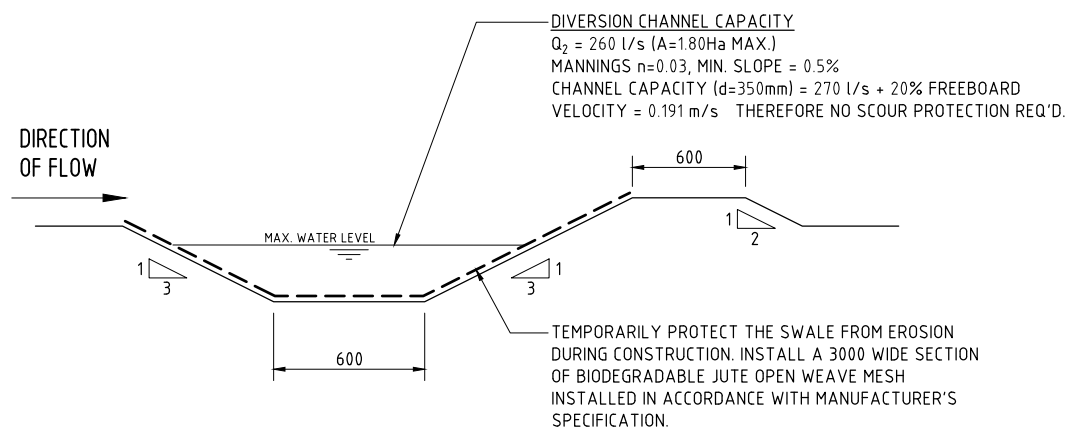
GRADED INLET PIT FILTER DETAIL
N.T.S



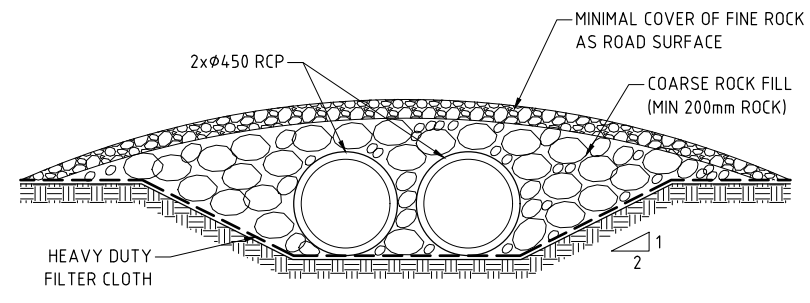
TYPICAL SILT FENCE DETAIL
N.T.S

NOTE: PROVIDE 1m RETURNS AT 30m INTERVALS. TYPICAL

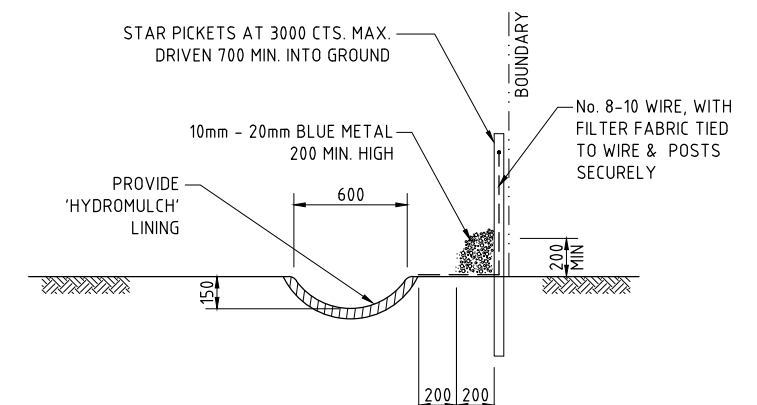
NOTE :
ADOPT ABOVE DETAILS AROUND ALL PITS WITHIN AREA ENCOMPASSED BY SILT FENCE & TO PITS ON THE ROAD ADJACENT TO SITE BOUNDARY.



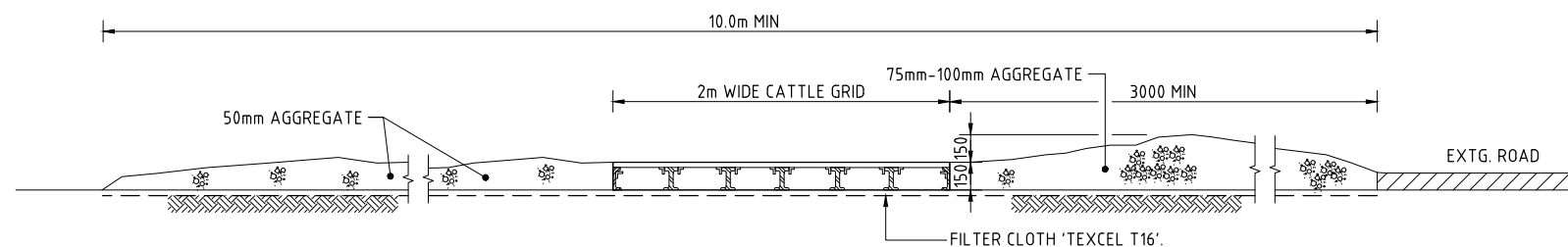
DIVERSION DRAIN SECTION
SCALE 1:20



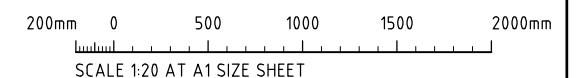
TYPICAL CROSSING OVER DIVERSION CHANNEL
SCALE 1:20



TYPICAL OPEN DRAIN & SILT FENCE
SCALE 1:20

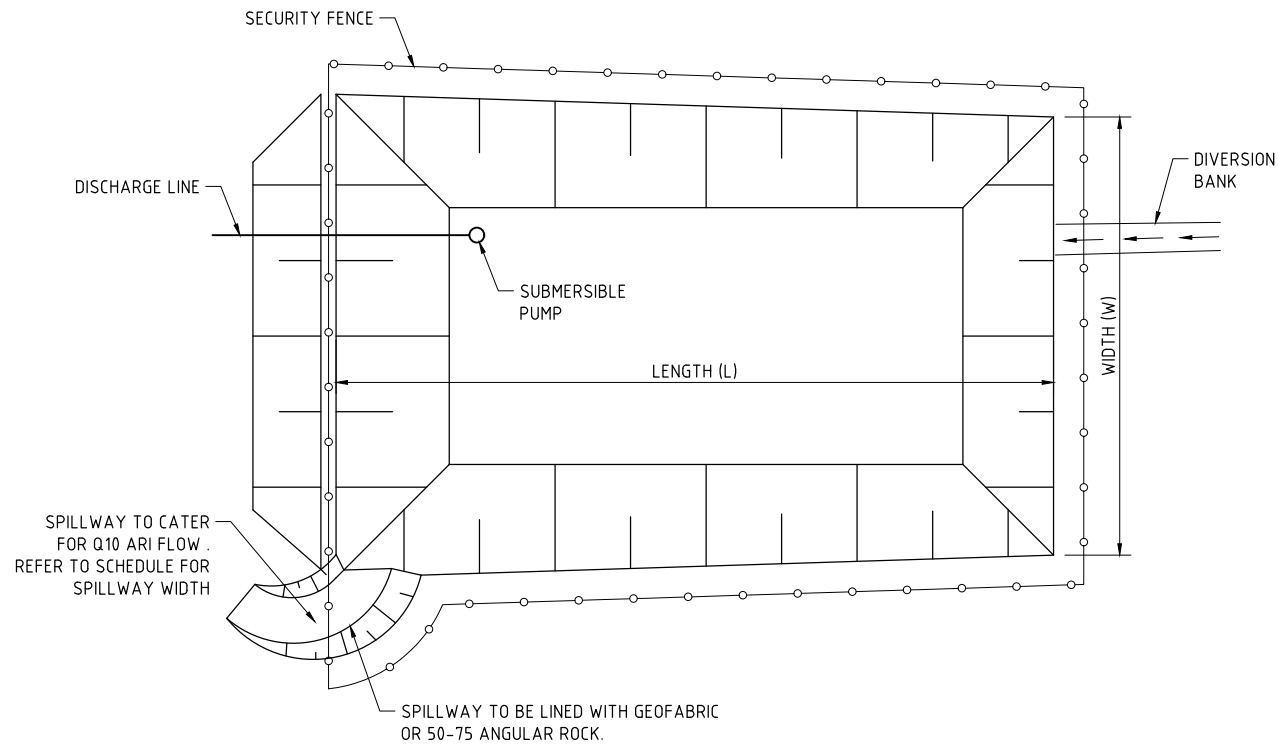


SECTION 1:20 (1) : STABILISED CONSTRUCTION ENTRANCE 'TRUCK SHAKER'

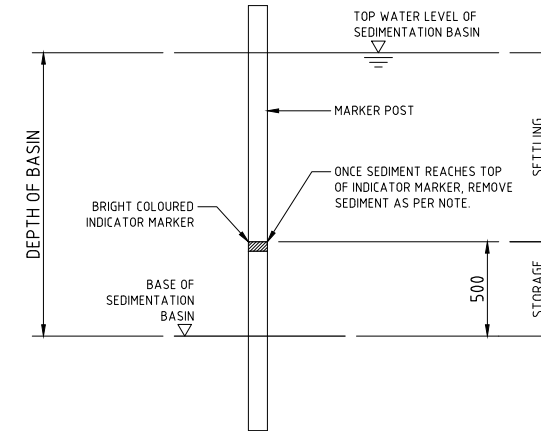


FOR APPROVAL

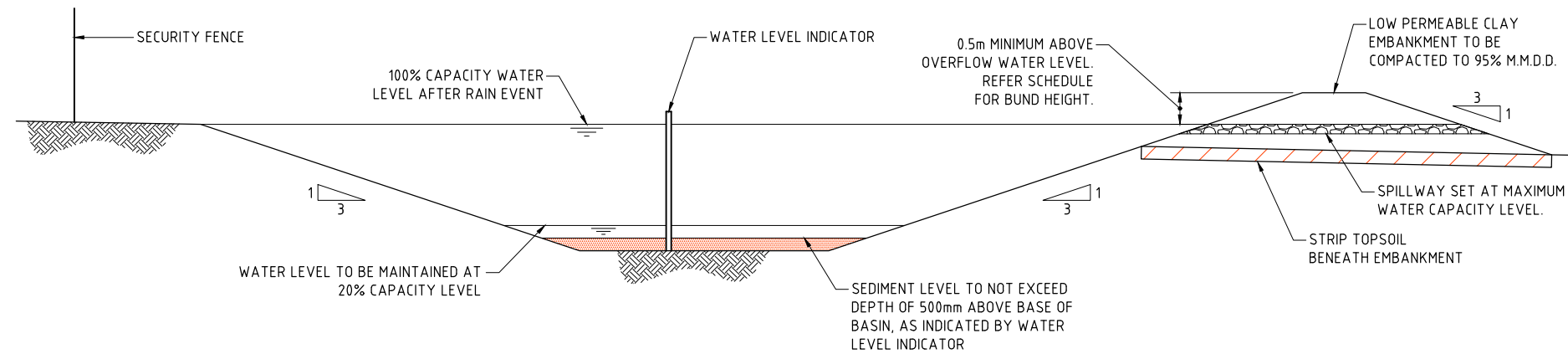
ISSUED FOR APPROVAL AMENDMENTS	19.09.22 A	ARCHITECT Welsh + Major L4, 69 Reservoir Street, Surry Hills NSW 2010 welshmajor.com mail@welshmajor.com +61 2 9699 6066 ABN: 67 612 977 303	CLIENT Goodman LEVEL 17, 60 Castlereagh Street SYDNEY NSW, 2000, Australia Tel (02) 9230 7400 Fax (02) 9230 7444	PROJECT 1-3 BURROWS ROAD 1-3 BURROWS ROAD, ST PETERS NSW, 2044	CONSULT AUSTRALIA Costin Roe Consulting Pty Ltd. ABN 50 003 696 446 PO Box N419 Sydney NSW 1220 Level 4, 8 Windmill Street, Millers Point NSW 2000 p: +61 2 9251 7699 e: mail@costinroe.com.au f: +61 2 9241 3731 w: costinroe.com.au	CRC COSTIN ROE CONSULTING CIVIL & STRUCTURAL ENGINEERS	DRAWING TITLE EROSION & SEDIMENT CONTROL DETAILS SHEET 1 DRAWING No C011035.04-SSDA25	ISSUE A
	DATE 19.09.22								ISSUE A



TYPICAL SEDIMENT CONTROL POND PLAN
SCALE 1:250



SEDIMENT STORAGE MARKER
SCALE 1:20



TYPICAL SEDIMENT CONTROL BASIN SECTION
SCALE 1:50

2m 0 5 10 15 20 25m

SCALE 1:250 AT A1 SIZE SHEET

500mm 0 1 2 3 4 5m

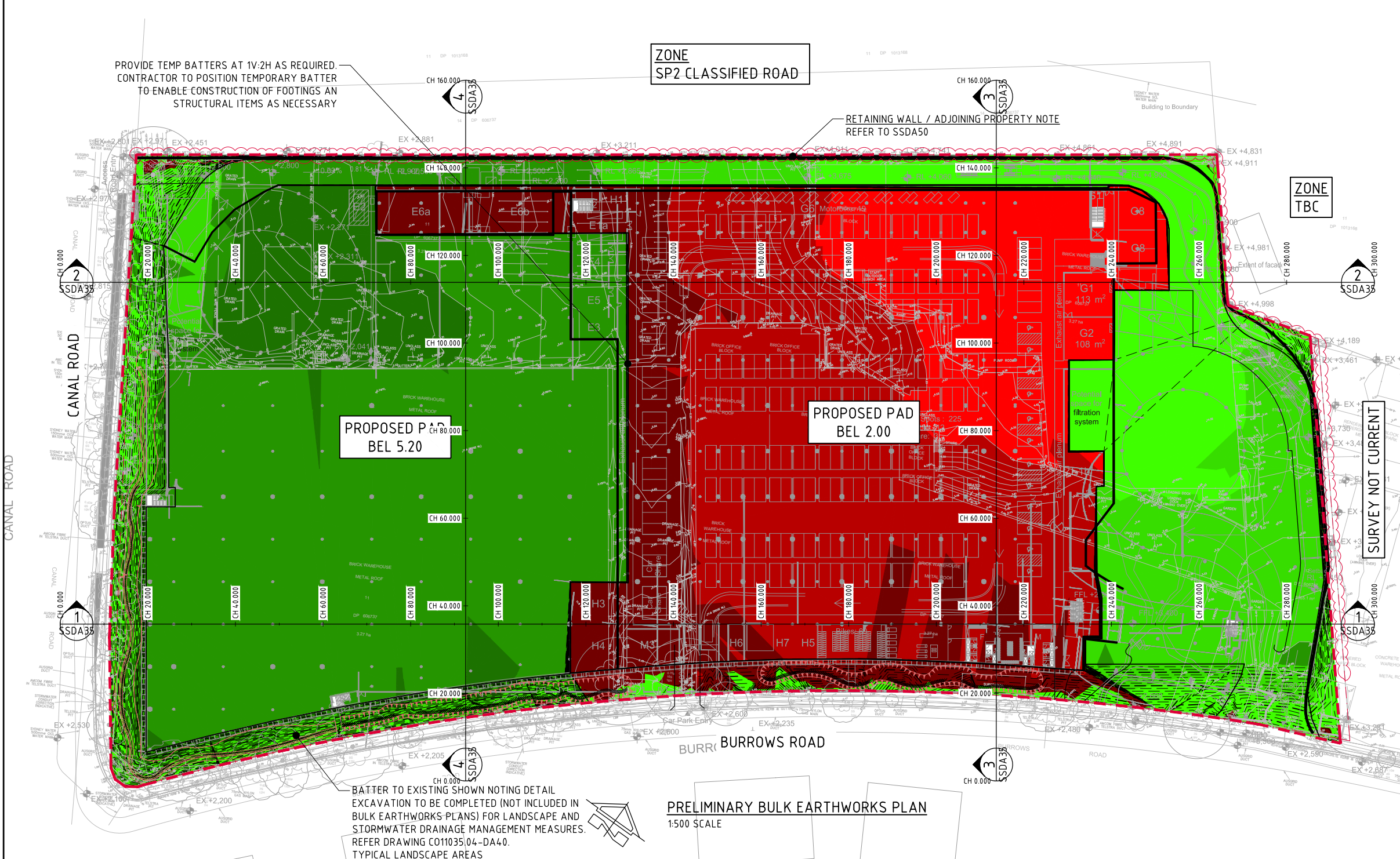
SCALE 1:50 AT A1 SIZE SHEET

200mm 0 500 1000 1500 2000mm

SCALE 1:20 AT A1 SIZE SHEET

FOR APPROVAL

ARCHITECT Welsh + Major L4, 69 Reservoir Street, Surry Hills NSW 2010 welshmajor.com mail@welshmajor.com +61 2 9699 6066 ABN: 67 612 977 303		CLIENT LEVEL 17, 60 Castlereagh Street SYDNEY NSW, 2000, Australia Tel (02) 9230 7400 Fax (02) 9230 7444		PROJECT 1-3 BURROWS ROAD 1-3 BURROWS ROAD, ST PETERS NSW, 2044		CONSULT AUSTRALIA Costin Roe Consulting Pty Ltd. ABN 50 003 696 446 PO Box N419 Sydney NSW 1220 Level 4, 8 Windmill Street, Millers Point NSW 2000 p: +61 2 9251 7699 f: +61 2 9241 3731 e: mail@costinroe.com.au w: costinroe.com.au		CRC CIVIL & STRUCTURAL ENGINEERS		DRAWING TITLE EROSION & SEDIMENT CONTROL DETAILS SHEET 2 DRAWING No C011035.04-SSDA26		ISSUE A
ISSUED FOR APPROVAL 19.09.22 A AMENDMENTS DATE ISSUE				DESIGNED DW DRAWN RN DATE JULY '22 CHECKED MW SIZE A1 SCALE AS SHOWN CAD REF: C011035.04-SSDA26								



- SITE PREPARATION NOTES:**
- ALL EARTHWORKS SHALL BE COMPLETED GENERALLY IN ACCORDANCE WITH THE GUIDELINES SPECIFIED BY THE GEOTECHNICAL ENGINEER.
 - EXISTING LEVELS ARE BASED ON INFORMATION PROVIDED BY CARDNO TITLED '117708001' DATED 19/08/2015.
 - STRIP ANY TOP SOIL OR DELETERIOUS MATERIAL AND DISPOSE OF FROM SITE OR STORE AS DIRECTED.
 - COMPLETE CUT TO FILL EARTHWORKS TO ACHIEVE THE REQUIRED LEVELS AS INDICATED ON THE DRAWINGS WITHIN A TOLERANCE OF +0mm/-10mm THROUGH BUILDING PADS/PAVEMENTS AND +0mm/-20mm ELSEWHERE.
 - PREPARE STEEP BATTERS TO RECEIVE FILL BY CONSTRUCTING BENCHING TO FACILITATE FILL PLACEMENT AND COMPACTION.
 - AREAS TO RECEIVE FILL (THAT ARE NOT ON BENCHED BATTERS) AND AREAS IN CUT SHALL BE PROOF ROLLED TO IDENTIFY ANY SOFT HEAVING MATERIAL. SOFT MATERIAL SHALL BE BOXED OUT AND REMOVED PRIOR TO FILL PLACEMENT. PROOF ROLLING TO BE INSPECTED BY A GEOTECHNICAL ENGINEER OR THE EARTHWORKS DESIGNER.
 - SITE WON FILL SHALL BE COMPACTED IN MAXIMUM 300mm LAYERS AND TO DRY OR HILF DENSITY RATIOS (STANDARD COMPACTION) OF BETWEEN 98% AND 103%. THE PLACEMENT MOISTURE VARIATION OR HILF MOISTURE VARIATION SHALL BE CONTROLLED TO BE BETWEEN 2% DRY AND 2% WET.
 - IMPORTED FILL SHALL BE COMPACTED IN MAXIMUM 300mm LAYERS AND TO DRY OR HILF DENSITY RATIOS (STANDARD COMPACTION) OF BETWEEN 98% AND 103%. THE PLACEMENT MOISTURE VARIATION OR HILF MOISTURE VARIATION SHALL BE CONTROLLED TO BE BETWEEN 2% DRY AND 2% WET.
 - ALL ENGINEERED FILL PARTICLES SHALL BE ABLE TO BE INCORPORATED WITHIN A SINGLE LAYER. FURTHER, LESS THAN 30% OF PARTICLES SHALL BE RETAINED ON THE 37.5 mm SIEVE. ENGINEERED FILL SHALL BE ABLE TO BE TESTED IN ACCORDANCE WITH THE STANDARD COMPACTION METHOD (AS1289.5.4.1) OR HILF TEST METHOD (AS1289.5.7.1). THESE METHODS REQUIRE LESS THAN 20% RETAINED ON THE 37.5 mm SIEVE. WHERE BETWEEN 20% AND 30% OF PARTICLES ARE RETAINED ON THE 37.5 mm SIEVE THE ABOVE TEST METHODS SHALL STILL BE ADOPTED AND TEST REPORTS ANNOTATED APPROPRIATELY. THESE REQUIREMENTS SHOULD BE MET BY THE MATERIAL AFTER PLACEMENT AND COMPACTION.
 - ALL THE EARTHWORKS UNDERTAKEN AND THE SUBGRADE CONDITION IN THE CUT AREAS (IN THE STATED PERIOD) ARE DOCUMENTED IN THE REPORTS AND HAVE BEEN UNDERTAKEN IN ACCORDANCE WITH THE SPECIFICATION.
 - PRIOR TO ANY EARTHWORKS, EROSION CONTROL AS OUTLINED IN THE EROSION AND SEDIMENTATION CONTROL PLAN SHALL BE COMPLETED.
 - EXISTING ROCK, IF ANY, SHALL BE REMOVED BY HEAVY ROCK BREAKING OR RIPPING.
 - MATCH EXISTING LEVELS AT BATTER INTERFACE.
 - CONTRACTOR TO MATCH EXISTING LEVELS AT THE INTERFACE OF EARTHWORKS AND EXISTING SURFACE AT BATTER LOCATIONS OR WHERE NO RETAINING WALLS ARE PRESENT. ANY DISCREPANCY BETWEEN DESIGN AND EXISTING LEVELS TO BE REFERRED TO THE ENGINEER FOR DIRECTION OR ADJUSTMENTS TO DESIGN LEVELS.
 - DURING EARTHWORKS THE CONTRACTOR IS TO ENSURE ALL AREAS ARE FREE DRAINING & WILL NOT RETAIN WATER DURING RAINFALL. PROVIDE TEMPORARY MEASURES AS REQUIRED TO ENSURE FREE FLOWING RUNOFF THROUGH MANAGED DRAINAGE PATHS, DIVERSION DRAINS OR OTHER SUITABLE DISPOSAL METHOD AS AGREED DURING THE WORKS. REFER ANY CONCERNS TO THE ENGINEER. REFER TO EROSION AND SEDIMENT CONTROL DRAWINGS AND NOTES.

BATTER TO EXISTING SHOWN NOTING DETAIL EXCAVATION TO BE COMPLETED (NOT INCLUDED IN BULK EARTHWORKS PLANS) FOR LANDSCAPE AND STORMWATER DRAINAGE MANAGEMENT MEASURES. REFER DRAWING CO11035.04-DA40. TYPICAL LANDSCAPE AREAS

PRELIMINARY BULK EARTHWORKS PLAN
1:500 SCALE

LEGEND

LEVELS DATUM IS AHD.

- 30.50 - EXISTING CONTOUR
- 30.50 - B.E.L. CONTOUR (MAJOR - 0.5m)
- 30.40 - B.E.L. CONTOUR (MINOR - 0.1m)

NOMINATED B.E.L. DETAIL
N.T.S.

SITE AREA = 3.45 Ha

TOPSOIL / PAVEMENT STRIP = (-6,900m³)
(200mm OVER 3.45 Ha)

TOPSOIL AND EXISTING PAVEMENT MAY BE RE-USED ON SITE SUBJECT TO CONFIRMATION FROM GEOTECHNICAL ENGINEER

CUT = -18,600m³

FILL = +41,600m³

ALLOWANCES

DETAILED EXCAVATION = -6,000m³ (1,750m³/Ha)

DIFFERENCE = +17,000m³ (i.e. IMPORT)

NOTE:
EARTHWORKS VOLUMES ARE APPROXIMATE ONLY. NO ALLOWANCE HAS BEEN MADE FOR DELETERIOUS MATERIAL, EROSION AND SEDIMENT CONTROL, BULKING OR COMPACTION OF FILLED SOILS, THE REMOVAL OF UNCONTROLLED OR CONTAMINATED MATERIAL OR ANY OTHER UNSPECIFIED EXCAVATION RELATED TO CONSTRUCTION ACTIVITIES. DETAILED EXCAVATION ALLOWANCE IS APPROXIMATE ONLY AND ACCOUNTS FOR STORMWATER/SERVICES TRENCHING AND FOUNDATIONS. THE DETAILED EXCAVATION VOLUMES ARE TO BE CONFIRMED BY THE CONTRACTOR. REFER ANY CONCERNS TO ENGINEER.

DEPTH RANGE

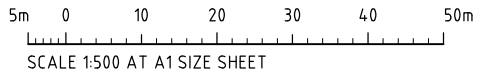
No.	FROM DEPTH	TO DEPTH	COLOUR
1	-3.000	-2.000	Red
2	-2.000	-1.000	Dark Red
3	-1.000	0.000	Brown
4	0.000	1.000	Light Green
5	1.000	2.000	Green
6	2.000	3.000	Dark Green
7	3.000	4.000	Very Dark Green

CONTAMINATION NOTE:

THE SUBJECT PROPERTY HAS BEEN IDENTIFIED TO CONTAIN CONTAMINATED MATERIAL. CONTAMINATED MATERIAL ENCOUNTERED DURING THE WORKS ARE TO BE RETAINED ON SITE AND A CAPPING LAYER CONSISTING OF COMPACTED CLAY FILL TO A MINIMUM DEPTH OF 500mm IS TO BE PROVIDED OVER THE SITE TO ALL EXTERNAL AREAS.

FILL IMPORT NOTE:

ALL FILL IMPORT MATERIAL SHALL BE VENM OR ENM



FOR APPROVAL

ISSUED FOR APPROVAL	19.09.22	C
REVISED AS CLOUDED	31.08.22	B
ISSUED FOR INFORMATION ONLY	15.07.22	A
AMENDMENTS	DATE	ISSUE

ARCHITECT
Welsh + Major
L4, 69 Reservoir Street, Surry Hills NSW 2010
welshmajor.com
mail@welshmajor.com
+61 2 9899 6066
ABN: 67 612 977 303

CLIENT
Goodman
LEVEL 17, 60 Castlereagh Street SYDNEY NSW, 2000, Australia
Tel (02) 9230 7400
Fax (02) 9230 7444

PROJECT
1-3 BURROWS ROAD
1-3 BURROWS ROAD, ST PETERS NSW, 2044

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	JULY '22	MW	A1	AS SHOWN	CO11035.04-SSDA30

CONSULT AUSTRALIA

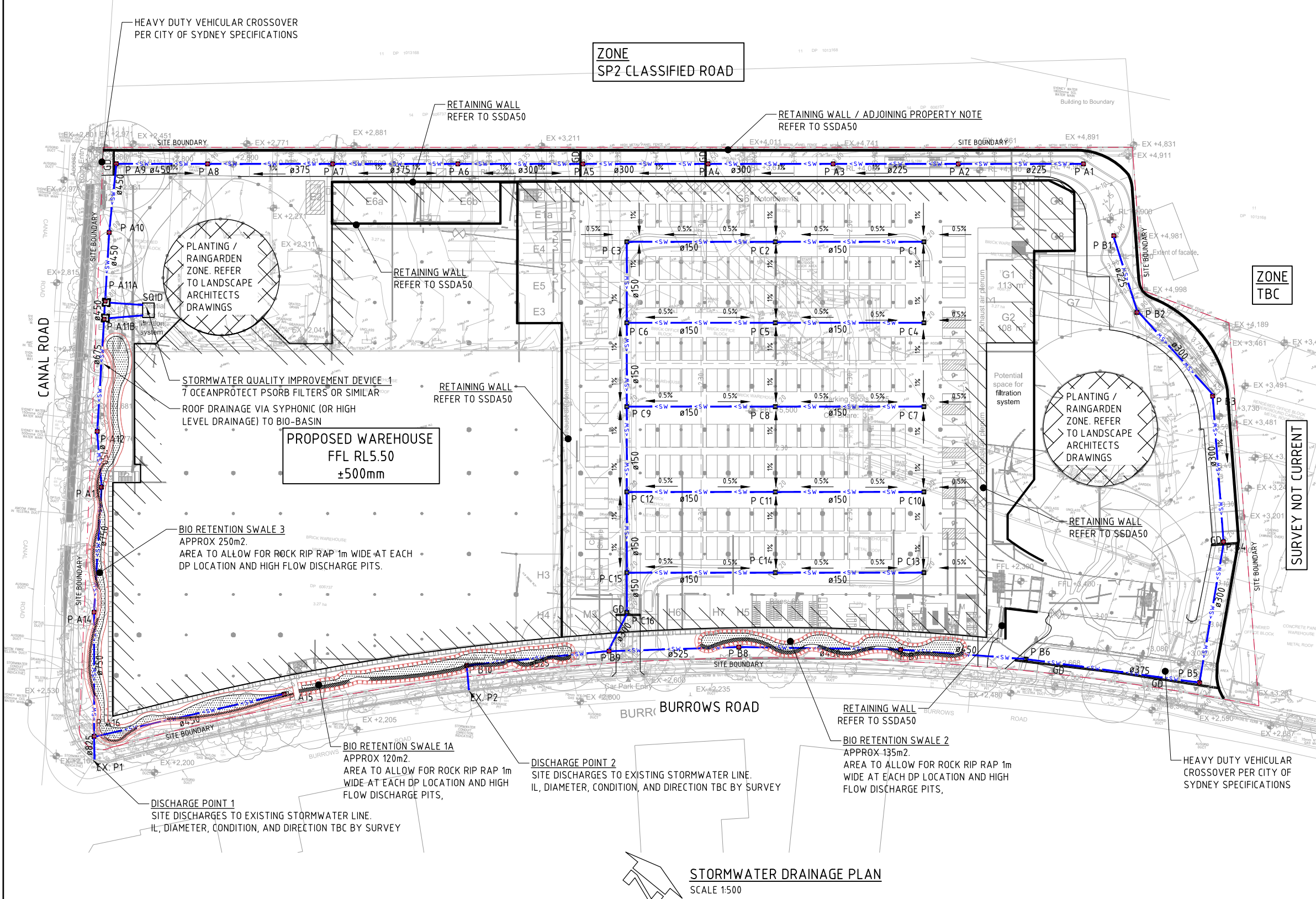
Costin Roe Consulting Pty Ltd.
ABN 50 003 696 446
PO Box N419 Sydney NSW 1220
Level 4, 8 Windmill Street, Millers Point NSW 2000
p: +61 2 9251 7699 f: +61 2 9241 3731
e: mail@costinroe.com.au w: costinroe.com.au

CRC CIVIL & STRUCTURAL ENGINEERS

DRAWING TITLE
BULK EARTHWORKS PLAN

DRAWING No
CO11035.04-SSDA30

ISSUE
C



- STORMWATER DRAINAGE NOTES:**
- ALL STORMWATER WORKS TO BE COMPLETED IN ACCORDANCE WITH AUSTRALIAN STANDARD AS3500.3 PLUMBING AND DRAINAGE, PART 3: STORMWATER DRAINAGE. THE MINOR (PIPED) SYSTEM HAS BEEN DESIGNED FOR THE 1 IN 20 YEAR ARI STORM EVENT AND THE MAJOR (OVERLAND) SYSTEM HAS BEEN DESIGNED FOR THE 1 IN 100 YEAR ARI STORM EVENT.
 - ALL FINISHED PAVEMENT LEVELS SHALL BE AS INDICATED ON FINISHED LEVELS PLANS SSSA50.
 - PIT SIZES SHALL BE AS INDICATED IN THE SCHEDULE WHILE PIPE SIZES AND DETAILS ARE PROVIDED ON PLAN.
 - EXISTING STORMWATER PIT LOCATIONS AND INVERT LEVELS TO BE CONFIRMED BY SURVEY PRIOR TO COMMENCING WORKS ON SITE.
 - ALL STORMWATER PIPES Ø375 OR GREATER SHALL BE CLASS 2 (WITH HS2 SUPPORT) REINFORCED CONCRETE WITH RUBBER RING JOINTS UNLESS NOTED OTHERWISE.
 - ALL PIPES UP TO AND INCLUDING Ø300 TO BE uPVC GRADE SN8 UNO.
 - PIPE CLASS NOMINATED ARE FOR IN-SERVICE LOADING CONDITIONS ONLY. CONTRACTOR IS TO MAKE ANY NECESSARY ADJUSTMENTS REQUIRED FOR CONSTRUCTION CONDITIONS. ALL CONCRETE PITS GREATER THAN 1000mm DEEP SHALL BE REINFORCED USING N12-200 EACH WAY CENTERED IN WALL AND BASE. LAP MINIMUM 300mm WHERE REQUIRED. ALL CONCRETE FOR PITS SHALL BE F'c=25 MPa. PRECAST PITS MAY BE USED WITH THE APPROVAL OF THE ENGINEER.
 - IN ADDITION TO ITEM 9 ABOVE, ALL CONCRETE PITS GREATER THAN 3000mm DEEP SHALL HAVE WALLS AND BASE THICKNESS INCREASED TO 200mm.
 - PIPES SHALL BE LAID AS PER PIPE LAYING DETAILS. PARTICULAR CARE SHALL BE TAKEN TO ENSURE THAT THE PIPE IS FULLY AND EVENLY SUPPORTED. RAM AND PACK FILLING AROUND AND UNDER BACK OF PIPES AND PIPE FAUCETS, WITH NARROW EDGED RAMMERS OR OTHER SUITABLE TAMPING DETAILS.
 - CONCRETE PIPES UNDER, OR WITHIN THE ZONE OF INFLUENCE OF PAVED AREAS SHALL BE LAID USING HS2 TYPE SUPPORT, AS A MINIMUM, IN ACCORDANCE WITH AS 3725. AGGREGATE BACKFILL SHALL NOT BE USED FOR PIPE BEDDING AND OR HAUNCH/SIDE SUPPORT.
 - WHERE PIPE LINES ENTER PITS, PROVIDE 2m LENGTH OF STOCKING WRAPPED SLOTTED Ø100 uPVC TO EACH SIDE OF PIPE.
 - ALL SUBSOIL DRAINAGE LINES SHALL BE Ø100 SLOTTED uPVC WITH APPROVED FILTER WRAP LAID IN 300mm WIDE GRANULAR FILTER UNLESS NOTED OTHERWISE. LAY SUBSOIL LINES TO MATCH FALLS OF LAND AND/OR 1 IN 200 MINIMUM. PROVIDE CAPPED CLEANING EYE (RODDING POINT) AT UPSTREAM END OF LINE AND AT 30m MAX. CTS. PROVIDE SUBSOIL LINES TO ALL PAVEMENT / LANDSCAPED INTERFACES, TO REAR OF RETAINING WALLS (AS NOMINATED BY STRUCTURAL ENGINEER) AND AS SHOWN ON PLAN.
 - WHERE SUBSOIL DRAINAGE PASSES UNDER A PAVEMENT OR A SLAB, UNSLOTTED uPVC ARE TO BE PROVIDED UNLESS NOTED OTHERWISE.
 - ALL PIPE GRADES 1 IN 200 MINIMUM UNO.
 - PROVIDE STEP IRONS IN PITS DEEPER THAN 1000mm.
 - MIN 600 COVER TO PIPE OBVERT BENEATH ROADS & MIN 400 COVER BENEATH LANDSCAPED AND PEDESTRIAN AREAS.
 - PIT COVERS IN TRAFFICABLE PAVEMENT SHALL BE CLASS D 'HEAVY DUTY', THOSE LOCATED IN NON-TRAFFICABLE AREAS SHALL BE CLASS B 'MEDIUM DUTY' UNO. PROVIDE CLEANING EYES (RODDING POINTS) TO PIPES AT ALL CORNERS AND T-JUNCTIONS WHERE NO PITS ARE PRESENT.
 - DOWN PIPES (DP) TO BE AS PER HYDRAULIC ENGINEERS DETAILS WITH CONNECTOR TO MATCH DP SIZE UNO. ON PLAN PROVIDE CLEANING EYE AT GROUND LEVEL.
 - PIPE LENGTHS NOMINATED ON PLAN OR LONGSECTIONS ARE MEASURED FROM CENTER OF PITS TO THE NEAREST 0.5m AND DO NOT REPRESENT ACTUAL LENGTH. THE CONTRACTOR IS TO ALLOW FOR THIS.
 - WHERE CONNECTION TO EXISTING INGROUND DRAINAGE SYSTEMS, OPEN SWALES, CHANNELS OR ANY OTHER EXISTING SYSTEM, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION AND INVERT ON SITE AT THE BEGINNING OF THE CONSTRUCTION PERIOD. REFER ANY VARIANCE FROM DOCUMENTATION OR SURVEYS TO THE ENGINEER FOR CLARIFICATION.

LEGEND:

LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED BY CARDNO TITLED '117708001' DATED 19 08 2015.

- SGGP, SINGLE GRATED GULLY PIT
- SJP, SEALED JUNCTION PIT
- KIP, KERB INLET PIT
- GD, GRATED DRAIN (300W x 225D UNO)
- PROPOSED DRAINAGE LINE
- EXISTING DRAINAGE LINE
- DP, ROOFWATER DOWNPIPE (INDICATIVE)
- RW, ROOFWATER LINE
- SS, SUBSOIL LINE
- OVERLAND FLOW DIRECTION
- FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS

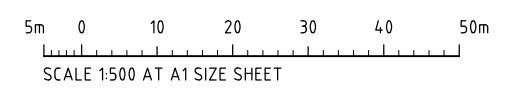
SURVEY NOTE:
THE SURVEY UTILISED IS OUTDATED.
REVISED SURVEY TO BE ISSUED.

TREATMENT NOTE:
PITS TO BE FITTED WITH OCEAN PROTECT OCEAN GUARD OG200 PIT INSERTS SHOWN THUS

LEVELS NOTE:
LEVELS SHOWN TO BE +/-500mm FROM THOSE SHOWN FINAL LEVELS SUBJECT TO FINAL GEOTECHNICAL INVESTIGATIONS, ARCHITECTURAL LAYOUT AND ACHIEVING A CUT TO FILL EARTHWORKS BALANCE OVER THE PROPERTY.

STORMWATER DRAINAGE PLAN
SCALE 1:500

FOR APPROVAL



ISSUED FOR APPROVAL	DATE	ISSUE
PRELIMINARY ISSUE ONLY	19.09.22	C
PRELIMINARY ISSUE ONLY	31.08.22	B
PRELIMINARY ISSUE ONLY	15.07.22	A
AMENDMENTS	DATE	ISSUE

ARCHITECT
Welsh + Major

L4, 69 Reservoir Street, Surry Hills NSW 2010
welshmajor.com
mail@welshmajor.com
+61 2 9699 6066
ABN: 67 612 977 303

CLIENT

LEVEL 17,
60 Castlereagh Street
SYDNEY
NSW, 2000, Australia
Tel: (02) 9230 7400
Fax: (02) 9230 7444

PROJECT
1-3 BURROWS ROAD
1-3 BURROWS ROAD, ST PETERS
NSW, 2044

DESIGNED	DATE	CHECKED	SCALE	CAD REF:
DW	JULY '22	MW	AS SHOWN	C011035.04-SSDA4.0

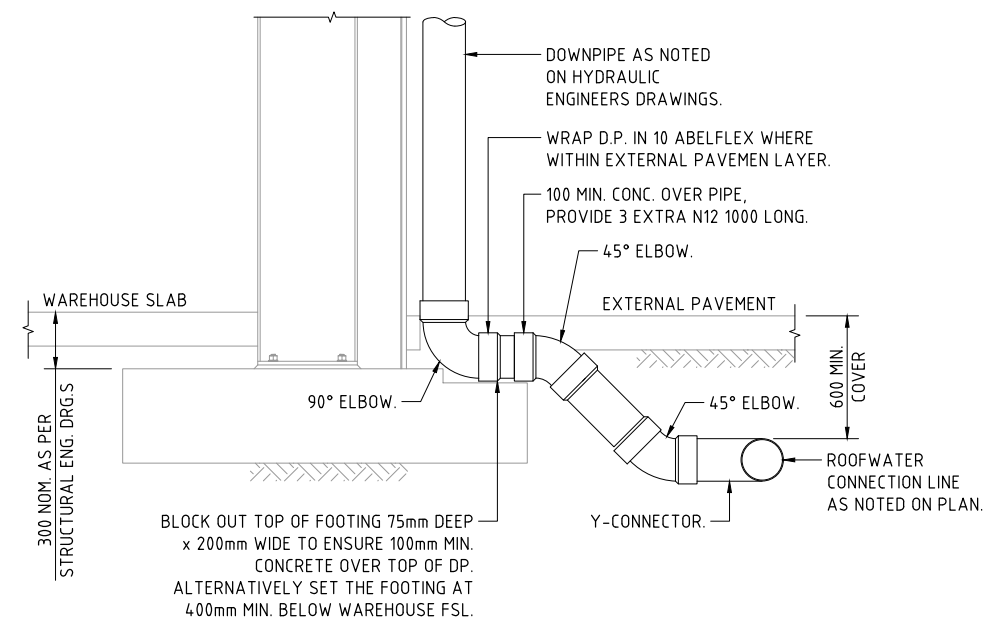
CONSULT AUSTRALIA

Costin Roe Consulting Pty Ltd.
ABN 50 003 696 446
PO Box N419 Sydney NSW 1220
Level 4, 8 Windmill Street, Millers Point NSW 2000
p: +61 2 9251 7699 e: mail@costinroe.com.au
f: +61 2 9241 3731 w: costinroe.com.au

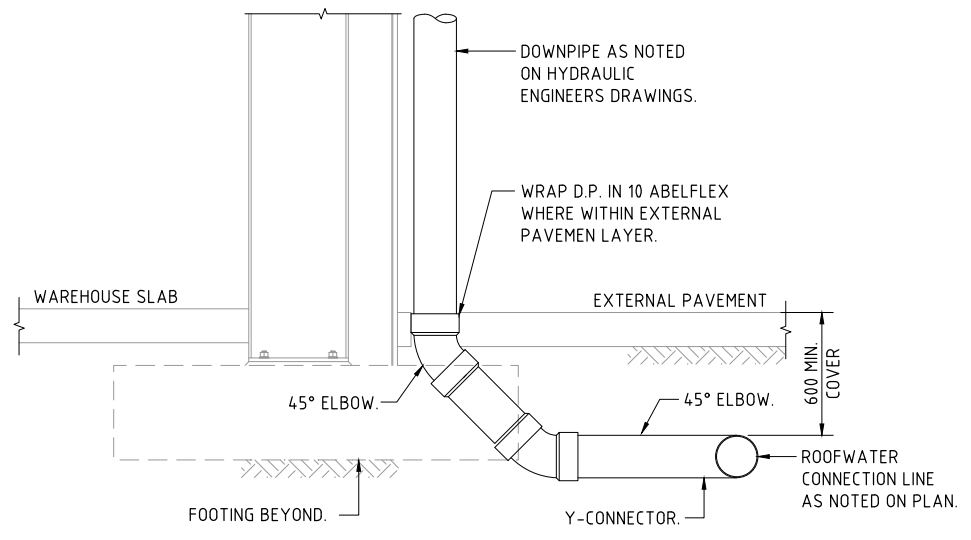
CRC COSTIN ROE CONSULTING

CIVIL & STRUCTURAL ENGINEERS

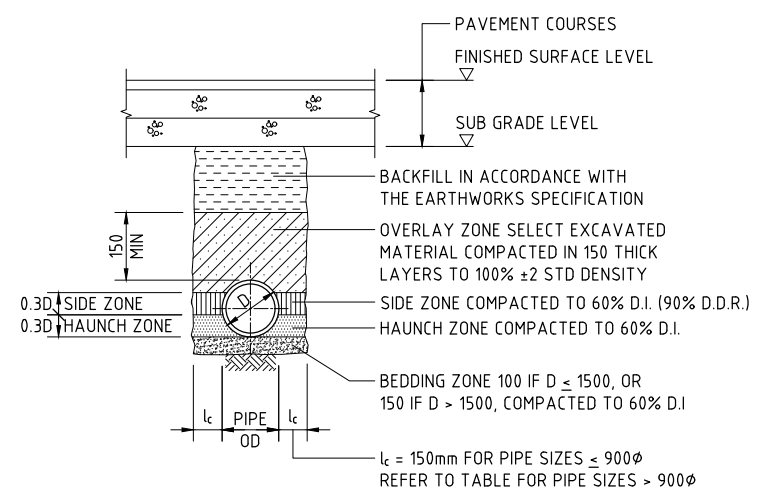
DRAWING TITLE
STORMWATER DRAINAGE PLAN
DRAWING No
C011035.04-SSDA4.0
ISSUE
C



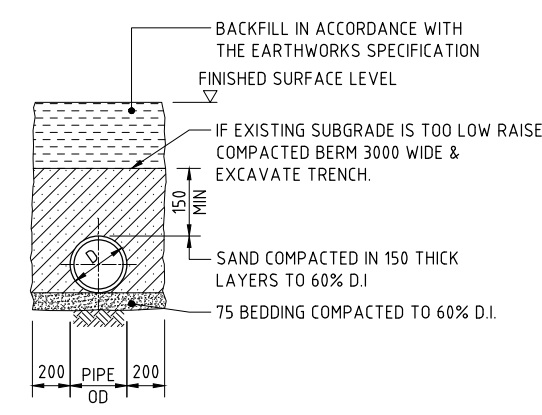
DOWNPIPE TURN-UP DETAIL A
(AT FOOTING LOCATION)
SCALE 1:20



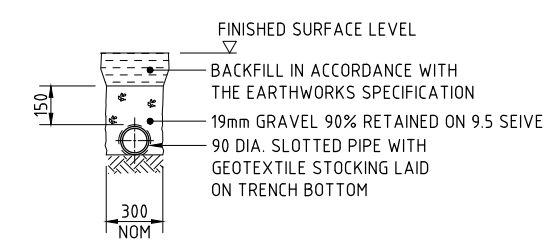
DOWNPIPE TURN-UP DETAIL B
(CLEAR OF FOOTING)
SCALE 1:20



TYPE HS2 SUPPORT TO CONCRETE PIPES UNDER PAVEMENT
SCALE 1:20
D ≤ 1350, MAX FILL = 4.0m
D > 1350, MAX FILL = 3.0m

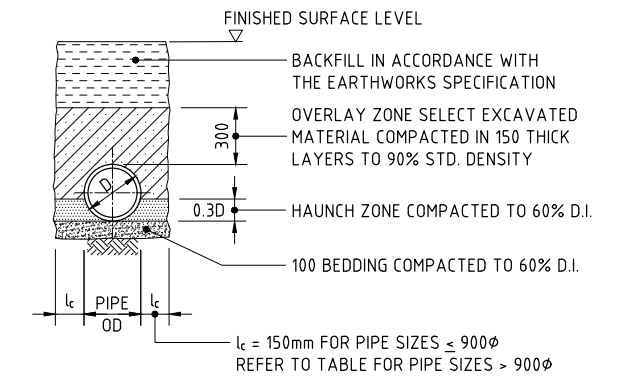


SUPPORT TO uPVC PIPES
SCALE 1:20



SUPPORT TO AGRICULTURAL DRAIN
SCALE 1:20

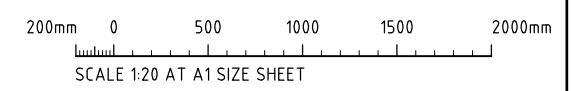
SIDE ZONE MATERIAL GRADING	
SIEVE SIZE (mm)	WEIGHT PASSING (%)
19.0	100
9.5	100 TO 50
2.6	100 TO 30
0.60	50 TO 15
0.075	25 TO 0



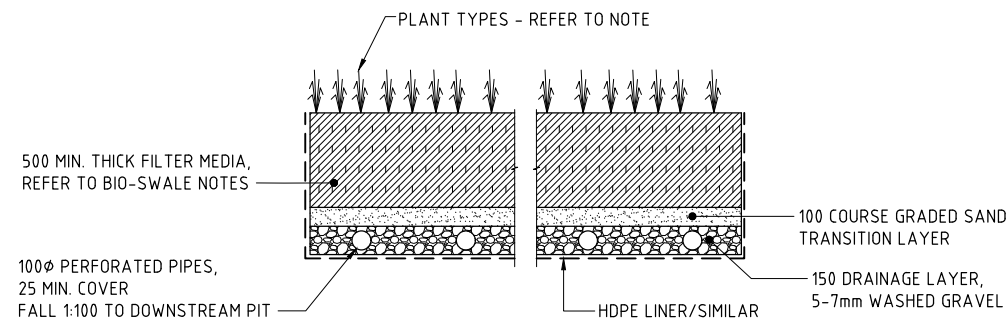
TYPE H1 SUPPORT TO CONCRETE PIPES AT LANDSCAPED AREAS
SCALE 1:20

BEDDING & HAUNCH MATERIAL GRADING	
SIEVE SIZE (mm)	WEIGHT PASSING (%)
19.0	100
2.36	100 TO 50
0.60	90 TO 20
0.30	60 TO 10
0.15	20 TO 0

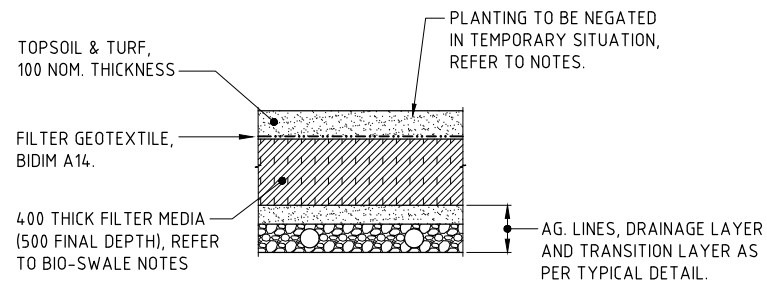
SIDE ZONE WIDTH	
PIPE SIZE (mm)	l _c (mm)
≤ 900φ	150
1050φ	175
1200φ	200
1350φ	225
1500φ	250
1650φ	275
1800φ	300
ENGINEER TO SPECIFY TRENCH WIDTHS FOR PIPE SIZES GREATER THAN 1800φ	



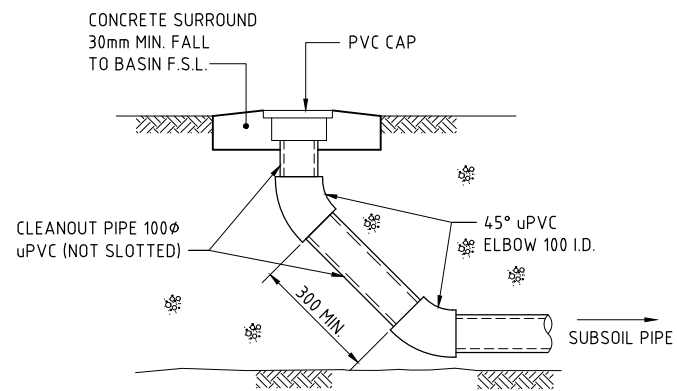
FOR APPROVAL



TYPICAL BIO-RETENTION DETAIL
SCALE 1:20



TEMPORARY BIO-RETENTION PROTECTION DETAIL
SCALE 1:20
TEMPORARY CONSTRUCTION REQUIREMENT DETAIL - REFER TO NOTES FOR IMPLEMENTATION PERIODS.



BIORETENTION CLEANOUT EYE ELEVATION
SCALE 1:20
DENOTED C.E. ON PLAN

BIO-RETENTION BASIN DETAILS

BIO-RETENTION NOTES :

FILTER MEDIA TO BE LOAMY SAND WITH A PERMEABILITY NOT LESS THAN 200mm/hr. FILTER MEDIA TO BE FREE OF RUBBISH, DELETERIOUS MATERIAL, TOXICANTS, DECLARED PLANTS AND LOCAL WEEDS, AND IS TO NOT BE HYDROPHOBIC.

FILTER MEDIA TO HAVE THE FOLLOWING COMPOSITION RANGE:

CLAY & SILT (<0.05mm)	<3%
VERY FINE SAND (0.05-0.15mm)	5-30%
FINE SAND (0.15-0.25mm)	10-30%
MEDIUM TO COARSE SAND (0.25-1.00mm)	40-60%
COARSE SAND (1.0-2.0mm)	7-10%
FINE GRAVEL (2.0-3.4mm)	<3%

- FILTER MEDIA THAT DOES NOT MEET THE FOLLOWING CRITERIA SHALL BE REJECTED:
- ORGANIC MATTER CONTENT TO BE IDEALLY WITHIN 1% TO 3% (W/W) AND TO BE NO GREATER THAN 5%(W/W).
 - PH TO BE BETWEEN 5.5 AND 7.5
 - PHOSPHOROUS CONTENT TO BE NO GREATER THAN 35mg/kg

FILTER MEDIA TO BE ASSESSED BY QUALIFIED HORTICULTURALIST TO ENSURE CAPABILITY OF SUPPORTING PLANT LIFE.

DRAINAGE LAYER TO BE CLEAN GRAVEL 5-7mm.

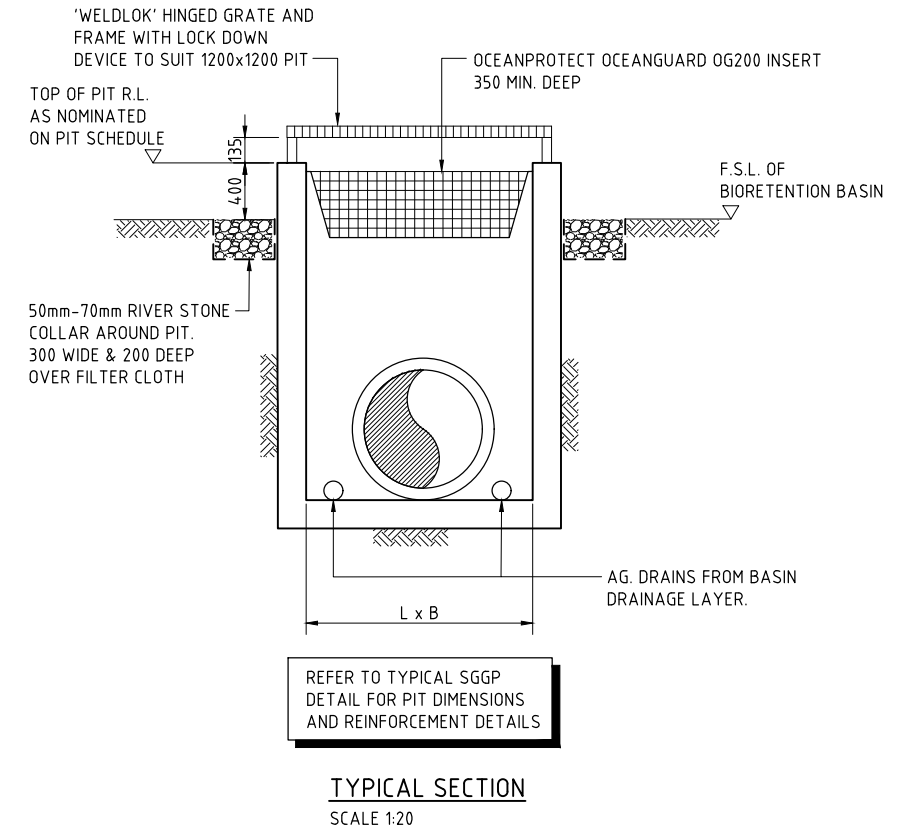
PLANTS TO BE IN ACCORDANCE WITH CITY OF SYDNEY COUNCIL WSUD.

PROVIDE 100mm TOPSOIL AND TEMPORARY EROSION PROTECTION (JUTEMASTER OR EQUIV) TO SWALE BATTER SLOPES AND ADJACENT LANDSCAPED AREAS. NOTE THAT NO TOPSOIL IS TO BE PLACED OVER FILTRATION MEDIA. PROVIDE SILT FENCE TO TOP OF BANK UNTIL SUCH TIME AS THIS STABILISING AND VEGETATION HAS BEEN COMPLETED.

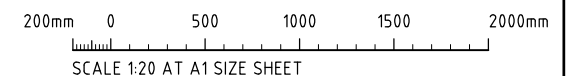
BIORETENTION TO BE PARTIALLY INSTALLED, FOLLOWING COMPLETION OF THE ROAD, WITH THE TOP 75-100mm OF FILTER MEDIA REPLACED WITH A FINE TO COARSE SAND UNDERLAIN WITH A GEOTEXTILE LAYER (REFER TO DETAIL). FOLLOWING COMPLETION OF THE UPSTREAM DEVELOPMENT AND SITE STABILISATION, THE SAND IS TO BE REMOVED, REPLACED WITH FILTER MATERIAL AND PLANTED OUT. REFER TO TEMPORARY BIO-BASIN DETAIL

PRIOR TO PLANTING, THE TOP 100mm OF THE BIORETENTION FILTER MEDIA IS TO BE AMELIORATED WITH APPROPRIATE ORGANIC MATTER, FERTILISER AND TRACE ELEMENTS TO AID PLANT ESTABLISHMENT AS PER THE TABLE BELOW:

TABLE: RECIPE FOR AMELIORATING TOP 100mm OF BIORETENTION FILTER MEDIA	
CONSTITUENT	QUANTITY (kg/m ² OF FILTER AREA)
GRANULATED POULTRY MANURE FINES	50
SUPERPHOSPHATE	2
MAGNESIUM SULPHATE	3
POTASSIUM SULPHATE	2
TRACE ELEMENT MIX	1
FERTILISER NPK (16.4.14)	4
LIME	20

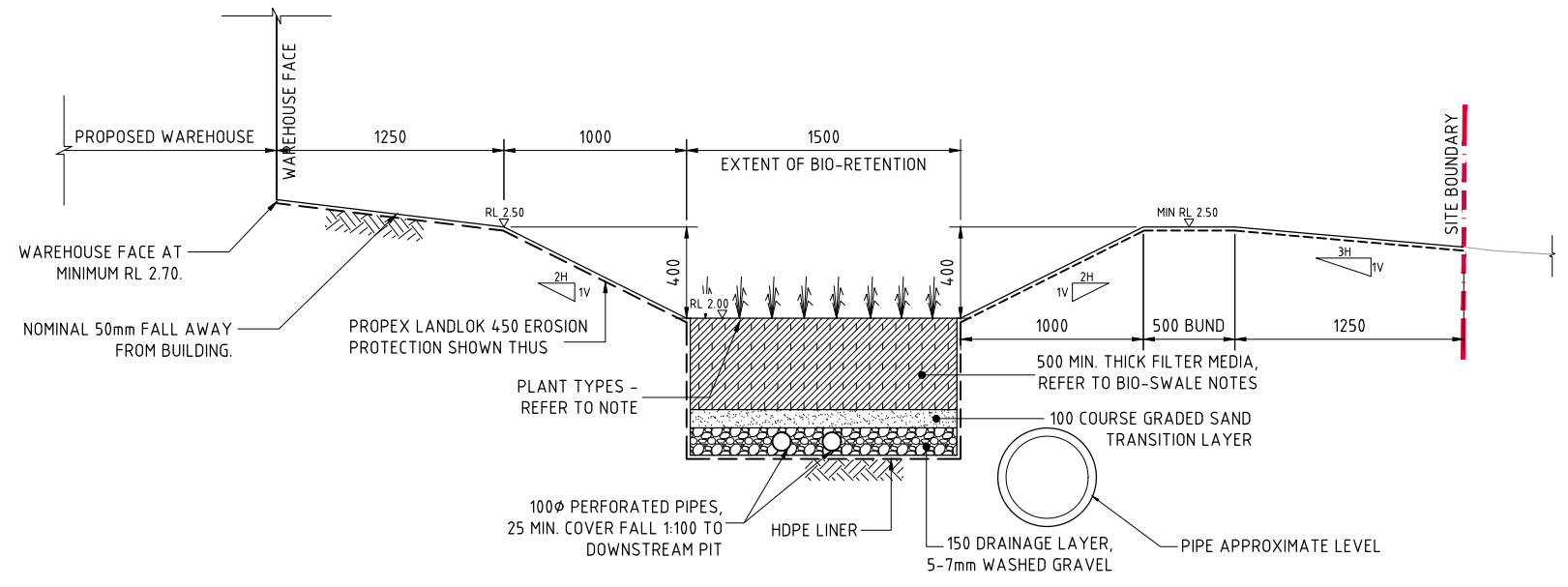


TYPICAL SECTION
SCALE 1:20
BASIN INLET PIT - BIP

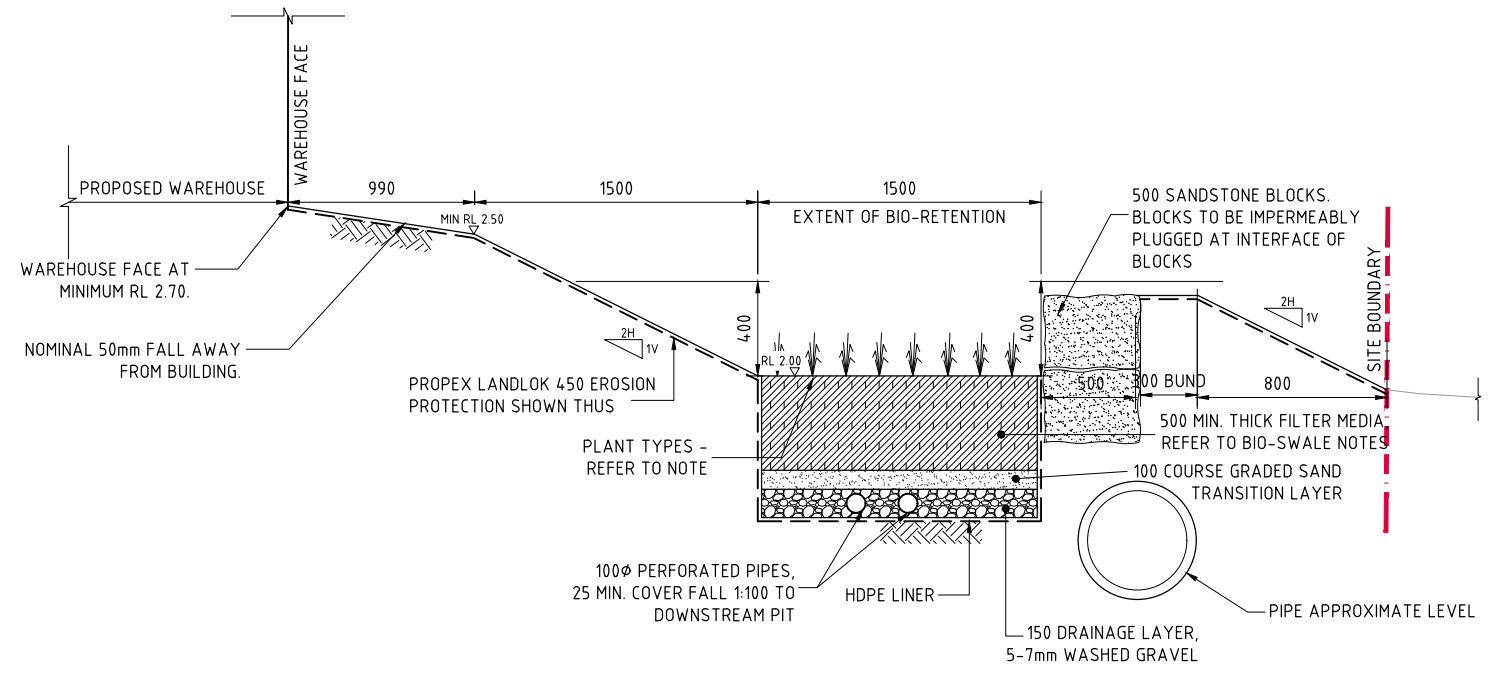


FOR APPROVAL

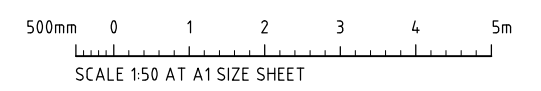
ISSUED FOR APPROVAL 19.09.22 B ISSUED FOR INFORMATION ONLY 15.07.22 A AMENDMENTS DATE ISSUE	ARCHITECT Welsh + Major L4, 69 Reservoir Street, Surry Hills NSW 2010 welshmajor.com mail@welshmajor.com +61 2 9699 6066 ABN: 67 612 977 303	CLIENT Goodman LEVEL 17, 60 Castlereagh Street SYDNEY NSW, 2000, Australia Tel: (02) 9230 7400 Fax: (02) 9230 7444	PROJECT 1-3 BURROWS ROAD 1-3 BURROWS ROAD, ST PETERS NSW, 2044	CONSULT AUSTRALIA Costin Roe Consulting Pty Ltd. ABN 50 003 696 446 PO Box N419 Sydney NSW 1220 Level 4, 8 Windmill Street, Millers Point NSW 2000 p: +61 2 9251 7699 e: mail@costinroe.com.au f: +61 2 9241 3731 w: costinroe.com.au	CRC CIVIL & STRUCTURAL ENGINEERS Costin Roe Consulting DRAWING No C011035.04-SSDA47	DRAWING TITLE STORMWATER DRAINAGE DETAILS SHEET 3 ISSUE B
	DESIGNED DW DRAWN RN DATE JULY '22 CHECKED MW SIZE A1 SCALE AS SHOWN CAD REF: C011035.04-SSDA47					



DETAIL 1:20 **1** TYPICAL THRU' BIO-RETENTION BATTER ONLY
SSDA4.0



DETAIL 1:20 **2** TYPICAL THRU' BIO-RETENTION BLOCKS AND BATTER
SSDA4.0



FOR APPROVAL

ISSUED FOR APPROVAL	19.09.22	B
PRELIMINARY ISSUE ONLY	31.08.22	A
AMENDMENTS	DATE	ISSUE

ARCHITECT
Welsh + Major
L4, 69 Reservoir Street, Surry Hills NSW 2010
welshmajor.com
mail@welshmajor.com
+61 2 9699 6066
ABN: 67 612 977 303

CLIENT
Goodman
LEVEL 17, 60 Castlereagh Street SYDNEY NSW, 2000, Australia
Tel (02) 9230 7400
Fax (02) 9230 7444

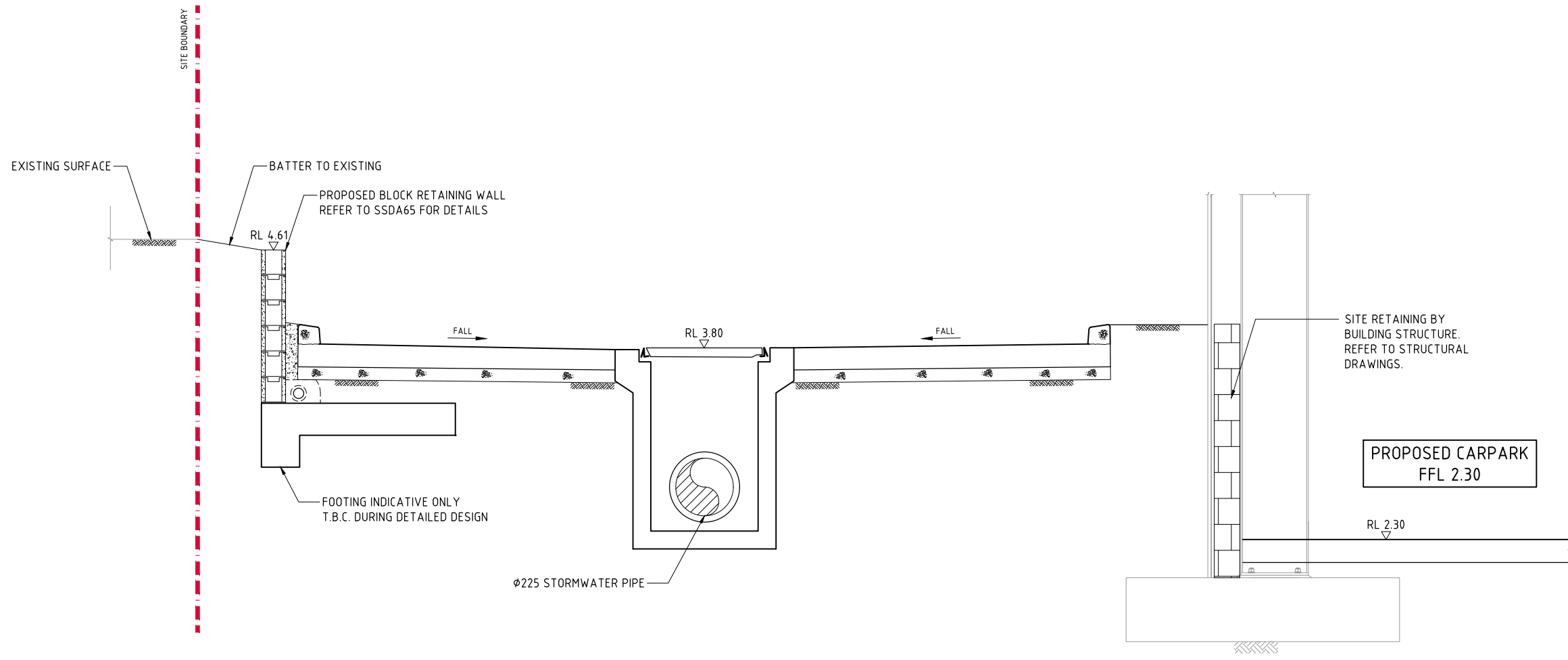
PROJECT
1-3 BURROWS ROAD
1-3 BURROWS ROAD, ST PETERS NSW, 2044

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
DW	RN	JULY '22	MW	A1	AS SHOWN	C011035.04-SSDA4.8

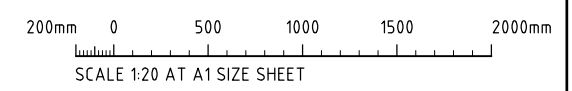
CONSULT AUSTRALIA
Costin Roe Consulting Pty Ltd.
ABN 50 003 696 446
PO Box N419 Sydney NSW 1220
Level 4, 8 Windmill Street, Millers Point NSW 2000
p: +61 2 9251 7699
e: mail@costinroe.com.au
f: +61 2 9241 3731
w: costinroe.com.au

CRC
COSTIN ROE CONSULTING
CIVIL & STRUCTURAL ENGINEERS

DRAWING TITLE
TYPICAL BIO-RETENTION DETAILS
DRAWING No
C011035.04-SSDA4.8
ISSUE
B

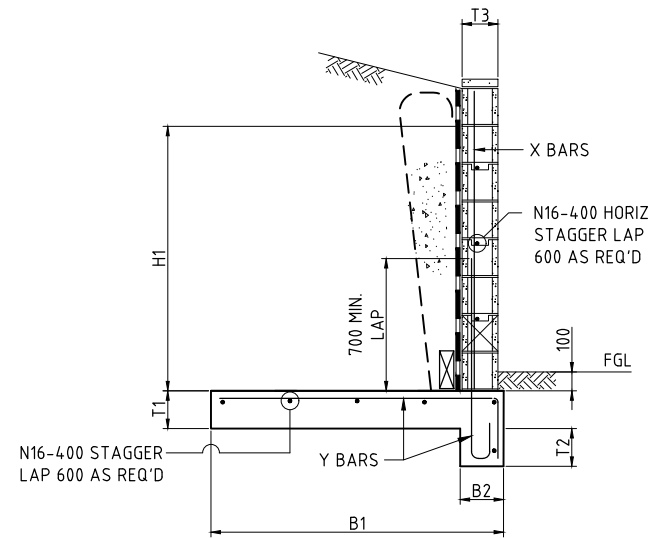


TYPICAL SECTION 1:20 1
SSDA50



FOR APPROVAL

<p>ISSUED FOR APPROVAL</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">AMENDMENTS</td> <td style="width: 25%;">DATE</td> <td style="width: 25%;">ISSUE</td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> </table>	AMENDMENTS	DATE	ISSUE				<p>ARCHITECT Welsh + Major</p> <p>WM</p> <p>L4, 69 Reservoir Street, Surry Hills NSW 2010 welshmajor.com mail@welshmajor.com +61 2 9699 6066 ABN: 67 612 977 303</p>	<p>CLIENT</p> <p>Goodman</p> <p>LEVEL 17, 60 Castlereagh Street SYDNEY NSW, 2000, Australia</p> <p>Tel (02) 9230 7400 Fax (02) 9230 7444</p>	<p>PROJECT 1-3 BURROWS ROAD 1-3 BURROWS ROAD, ST PETERS NSW, 2044</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>DESIGNED</td> <td>DRAWN</td> <td>DATE</td> <td>CHECKED</td> <td>SIZE</td> <td>SCALE</td> <td>CAD REF:</td> </tr> <tr> <td>DW</td> <td>RN</td> <td>JULY '22</td> <td>MW</td> <td>A1</td> <td>AS SHOWN</td> <td>C011035.04-SSDA55</td> </tr> </table>	DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:	DW	RN	JULY '22	MW	A1	AS SHOWN	C011035.04-SSDA55	<p>CONSULT AUSTRALIA</p> <p>Costin Roe Consulting Pty Ltd. ABN 50 003 696 446</p> <p>PO Box N419 Sydney NSW 1220 Level 4, 8 Windmill Street, Millers Point NSW 2000 p: +61 2 9251 7699 f: +61 2 9241 3731 e: mail@costinroe.com.au w: costinroe.com.au</p>	<p>CRC COSTIN ROE CONSULTING</p> <p>CIVIL & STRUCTURAL ENGINEERS</p>	<p>DRAWING TITLE TYPICAL SECTIONS</p> <p>DRAWING No C011035.04-SSDA55</p> <p>ISSUE A</p>
AMENDMENTS	DATE	ISSUE																								
DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:																				
DW	RN	JULY '22	MW	A1	AS SHOWN	C011035.04-SSDA55																				

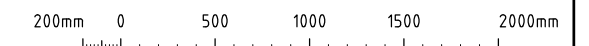


WALL WITH SINGLE STEM OF 190 BLOCK
1:20 SCALE

CANTILEVER BLOCK WALL SPECIFICATIONS FOR 20kPa SURCHARGE:								
RETAINED HEIGHT H1	290 STEM HEIGHT H2	BASE THICKNESS T1	BASE KEY DEPTH T2	(THIN) STEM THICKNESS T3	BASE WIDTH B1	BASE KEY WIDTH B2	REINF'T. X BARS	REINF'T. Y BARS
3000	1400	300	200	190	2500	300	N20-200	N20-200
2800	1200	300	200	190	2400	300	N16-200	N16-200
2600	1000	300	200	190	2200	300	N16-200	N16-200
2400	800	300	200	190	2100	300	N16-200	N16-200
2200	600	300	200	190	2000	300	N16-400	N16-400
2000	400	300	200	190	1900	300	N16-400	N16-400
1800	400	300	200	190	1800	300	N16-400	N16-400
1600	N/A	200	200	190	1600	200	N16-400	N16-400
1400	N/A	200	200	190	1500	200	N16-400	N16-400
1200	N/A	200	200	190	1300	200	N16-400	N16-400
1000	N/A	200	200	190	1100	200	N16-400	N16-400
800	N/A	200	200	190	1000	200	N16-400	N16-400
600	N/A	200	200	190	800	200	N16-400	N16-400

NOTE :
ALL BLOCK CORES TO BE FULLY GROUTED.
NOTES SHOWN ARE TYPICAL FOR ALL WALLS.
ALL BASE KEYS TO BE POURED AGAINST
UNDISTURBED NATURAL GROUND.

CONCRETE QUALITY					
ELEMENT	SLUMP	AGGREGATE (MAX. SIZE)	CEMENT TYPE	ADMIXTURE	F _c (MPa)
CORE FILL	230	10	GP	NIL	20
FOOTING	80	20	GP	NIL	32



SCALE 1:20 AT A1 SIZE SHEET

FOR APPROVAL

ISSUED FOR APPROVAL AMENDMENTS	ARCHITECT Welsh + Major L4, 69 Reservoir Street, Surry Hills NSW 2010 welshmajor.com mail@welshmajor.com +61 2 9699 6066 ABN: 67 612 977 303	CLIENT LEVEL 17, 60 Castlereagh Street SYDNEY NSW, 2000, Australia Tel (02) 9230 7400 Fax (02) 9230 7444	PROJECT 1-3 BURROWS ROAD 1-3 BURROWS ROAD, ST PETERS NSW, 2044	Costin Roe Consulting Pty Ltd. ABN 50 003 696 446 PO Box N419 Sydney NSW 1220 Level 4, 8 Windmill Street, Millers Point NSW 2000 p: +61 2 9251 7699 e: mail@costinroe.com.au f: +61 2 9241 3731 w: costinroe.com.au		DRAWING TITLE RETAINING WALL DETAILS DRAWING No C011035.04-SSDA65	ISSUE A
	DESIGNED DW DRAWN RN DATE JULY '22 CHECKED MW SIZE A1 SCALE AS SHOWN CAD REF: C011035.04-SSDA65						

Appendix B
MUSIC MODEL CONFIGURATION & PARAMETERS

B.1 Introduction

The MUSIC modelling software was chosen to model water quality. This model has been released by the Cooperative Research Centre for Catchment Hydrology (CRCCH) and is a standard industry model for this purpose. MUSIC (the Model for Urban Stormwater Improvement Conceptualisation) is suitable for simulating catchment areas of up to 100 km² and utilises a continuous simulation approach to model water quality.

By simulating the performance of stormwater management systems, MUSIC can be used to predict if these proposed systems and changes to land use are appropriate for their catchments and are capable of meeting specified water quality objectives (CRC 2002). The water quality constituents modelled in MUSIC and of relevance to this report include Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN).

The pollutant retention criteria set out in Section 3 of City of Sydney’s DCP2012 and nominated in **Section 6.1** of this report were used as a basis for assessing the effectiveness of the selected treatment trains.

The MUSIC model “11035.04-Rev1.sqz” was set up to examine the effectiveness of the water quality treatment train and to predict if council requirements have been achieved. The model was set up using the latest City of Sydney Council *MUSICLINK* parameters for sandy loam soil and the layout of the MUSIC model is presented in **Appendix B.8**.

Modelling parameters used are based on those nominated in the Sydney Catchment Management Authority (SCA) document *Using Music in Sydney’s Drinking Water Catchment – A Sydney Catchment Authority Standard (2012)* and *Draft NSW MUSIC Modelling Guidelines (2011)*.

B.2 Rainfall Data

As per the recommendation of Table 3-1 of *Draft NSW MUSIC Modelling Guidelines (2011)*, six-minute pluviographic data for the Sydney Meteorological Office Station was sourced from the Bureau of Meteorology (BOM) as nominated below. Evapo-transpiration data for the period was sourced from the Sydney Monthly Areal PET data set supplied with the MUSIC software.

Input	Data Used
Rainfall Station	66062 Sydney
Rainfall Period	1 January 1982 – 31 December 1986 (4 years)
Mean Annual Rainfall (mm)	1278
Evapo- transpiration	Sydney Monthly Areal PET
Model Time step	6 minutes

B.3 Rainfall Runoff Parameters

Parameter	Value
Rainfall Threshold for roads/paths	1.50
Rainfall Threshold for roofs	0.30
Soil Storage Capacity (mm)	195
Initial Storage (% capacity)	30
Field Capacity (mm)	135
Infiltration Capacity Coefficient a	250

Infiltration Capacity exponent b	1.3
Initial Depth (mm)	10
Daily Recharge Rate (%)	60
Daily Baseflow Rate (%)	45
Daily Seepage Rate (%)	0

B.4 Pollutant Concentrations & Source Nodes

Pollutant concentrations for source nodes are based on parameters adopted by the SCA as per **Table B.1**.

Flow Type	Surface Type	TSS (log ₁₀ values)		TP (log ₁₀ values)		TN (log ₁₀ values)	
		Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.
Baseflow	Roof	-*	-*	-*	-*	-*	-*
	Roads	-*	-*	-*	-*	-*	-*
	Other Impervious Areas	-*	-*	-*	-*	-*	-*
	Pervious Areas	1.20	0.17	-0.85	0.19	0.11	0.12
Stormflow	Roof	1.30	0.32	-0.89	0.25	0.30	0.19
	Roads	2.43	0.32	-0.30	0.25	0.34	0.19
	Other Impervious Areas	2.15	0.32	-0.60	0.25	0.30	0.19
	Pervious Areas	2.15	0.32	-0.60	0.25	0.30	0.19

Table B.1. Pollutant Concentrations

The MUSIC model has been setup with a treatment train approach based on the pollutant concentrations in **Table B.1** above.

The relevant stormwater catchment sizes are listed below in **Table B.2** and their configuration within the MUSIC model.

Catchment	Area (Ha)	Source Node	% Impervious
CAT 1 – Roof	0.406	Roof	100
CAT 1 – Hardstand	0.015	Sealedroad	100
CAT 1 – Landscape	0.021	Mixed	100
CAT 2 – Carpark	0.818	Mixed	100
CAT 3 - Carpark	0.550	Mixed	100
BYPASS - Landscape	0.087	Bypass	0
Total			

Table B.2. Music Model Source Nodes

B.5 Treatment Nodes

Gross Pollutant Trap and Siphon-Actuated Filtration device treatment nodes have been used in the modelling of the development as provided by the suppliers of the products based on testing completed by the product manufacturers. Detention basin nodes were also introduced to the model using typical parameters contained in MUSIC modelling guidelines.

Pit Baskets – OceanGaurd

Parameter	Value
Treatable Flow	0.02m ³ /s (per Filter)
<u>Pollutant Reductions</u>	
Per Technical Guidelines	

Filtration Device (StormFilters)

Parameter	Value
Treatable Flow	0.0009m ³ /s (per PSorb Cartridge)
<u>Pollutant Reductions</u>	
Per Technical Guidelines	

B.6 Results

Table B.3 shows the results of the MUSIC analysis. The reduction rate is expressed as a percentage and compares the post-development pollutant loads without treatment versus post-development loads with treatment.

	Source	Residual Load	% Reduction
Total Suspended Solids (kg/yr)	1960	292	85.1
Total Phosphorus (kg/yr)	7.03	2.45	65.1
Total Nitrogen (kg/yr)	88	38	56.8
Gross Pollutants (kg/yr)	979	0	100

Table B.3. MUSIC analysis results

The model results indicate that, through the use of the STM in the treatment train, pollutant load reductions for Total Suspended Solids, Total Phosphorous, Total Nitrogen and Gross Pollutants will meet the requirements of Council's *DCP 2012* on an overall catchment basis.

B.7 Modelling Discussion

MUSIC modelling has been performed to assess the effectiveness of the selected treatment trains and to ensure that the pollutant retention requirements of Council have been met.

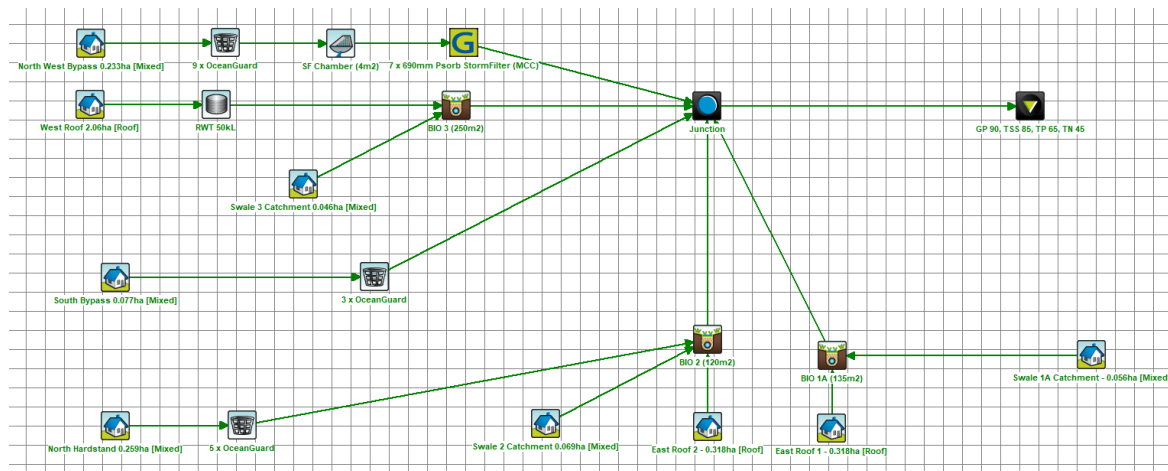
The MUSIC modelling has shown that the proposed treatment train of STM will provide stormwater treatment which will meet Councils requirements in an effective and economical manner.

Hydrocarbon and oil & grease removal cannot be modelled with MUSIC software. As an industrial development with users, the exact levels of hydrocarbons would not be known however given the expected use of the site as a warehouse distribution centre these pollutants would not be expected to be large. Potential sources of hydrocarbons and/or oil & grease which drain to the stormwater system would be limited to leaking engine sumps or for accidental fuel spills/leaks and leaching of bituminous pavements (car parking only). The potential for these pollutants is low and published data from the CSIRO indicates that average concentrations from industrial sites are in the order of 10mg/L and we would expect source loading from this site to be near to or below this concentration. Hydrocarbon pollution would also be limited to surface areas which will be treated via OceanProtect OceanGuard absorbent material which are predicted to reduce this pollutant.

Given the expected low source loadings of hydrocarbons and oil/grease and removal efficiencies of the treatment devices and bio-retention systems we consider that the requirements of the Council have been met.

B.8 MUSIC Model Layout

The model was set up using the latest City of Sydney Council *MUSICLINK* parameters for sandy loam soil and the layout of the MUSIC model is presented below.



	Sources	Residual Load	% Reduction
Flow (ML/yr)	40.3	37.4	7.2
Total Suspended Solids (kg/yr)	1990	292	85.4
Total Phosphorus (kg/yr)	6.9	2.42	65
Total Nitrogen (kg/yr)	87.7	37.8	56.9
Gross Pollutants (kg/yr)	979	0	100

Figure B.8 MUSIC Model Layout

Appendix C
DRAFT SOIL AND WATER MANAGEMENT PLAN

C.1 Introduction

An erosion and sediment control plan (ESCP) is shown on drawing **Co11035.04-DA20** with details on **DA25**. These are conceptual plans only providing sufficient detail to clearly show that the works can proceed without undue pollution to receiving waters. A detailed plan will be prepared once consent is given and before works start.

The Staged ESCP considers initial site establishment, requirements during construction of development, completion of development.

C.2 General Conditions

1. The ESCP will be read in conjunction with the engineering plans, and any other plans or written instructions that may be issued in relation to development at the subject site.
2. Contractors will ensure that all soil and water management works are undertaken as instructed in this specification and constructed following the guidelines stated in *Managing Urban Stormwater, Soils and Construction (1998) "The Blue Book"* and Penrith City Council specifications.
3. All subcontractors will be informed of their responsibilities in minimising the potential for soil erosion and pollution to down slope areas.

C.3 Land Disturbance

1. Where practicable, the soil erosion hazard on the site will be kept as low as possible and as recommended in Table C.1.

Land Use	Limitation	Comments
Construction areas	Limited to 5 (preferably 2) metres from the edge of any essential construction activity as shown on the engineering plans.	All site workers will clearly recognise these areas that, where appropriate, are identified with barrier fencing (upslope) and sediment fencing (downslope), or similar materials.
Access areas	Limited to a maximum width of 5 metres	The site manager will determine and mark the location of these zones onsite. They can vary in position so as to best conserve existing vegetation and protect downstream areas while being considerate of the needs of efficient works activities. All site workers will clearly recognise these boundaries.
Remaining lands	Entry prohibited except for essential management works	

Table C.1 Limitations to access

C.4 Erosion Control Conditions

1. Clearly visible barrier fencing shall be installed as shown on the plan and elsewhere at the discretion of the site superintendent to ensure traffic control and prohibit unnecessary site disturbance. Vehicular access to the site shall be limited to only those essential for construction work and they shall enter the site only through the stabilised access points.
2. Soil materials will be replaced in the same order they are removed from the ground. It is particularly important that all subsoils are buried and topsoils remain on the surface at the completion of works.
3. Where practicable, schedule the construction program so that the time from starting land disturbance to stabilisation has a duration of less than six months.
4. Notwithstanding this, schedule works so that the duration from the conclusion of land shaping to completion of final stabilisation is less than 20 working days.
5. Land recently established with grass species will be watered regularly until an effective cover has properly established and plants are growing vigorously. Further application of seed might be necessary later in areas of inadequate vegetation establishment.
6. Where practical, foot and vehicular traffic will be kept away from all recently established areas
7. Earth batters shall be constructed in accordance with the Geotechnical Engineers Report or with as low a gradient as practical but not steeper than:
 - 2H:1V where slope length is less than 7 metres
 - 2.5H:1V where slope length is between 7 and 10 metres
 - 3H:1V where slope length is between 10 and 12 metres
 - 4H:1V where slope length is between 12 and 18 metres
 - 5H:1V where slope length is between 18 and 27 metres
 - 6H:1V where slope length is greater than 27 metres
8. All earthworks, including waterways/drains/spillways and their outlets, will be constructed to be stable in at least the design storm event.
9. During windy weather, large, unprotected areas will be kept moist (not wet) by sprinkling with water to keep dust under control. In the event water is not available in sufficient quantities, soil binders and/or dust retardants will be used or the surface will be left in a cloddy state that resists removal by wind.

C.5 Pollution Control Conditions

1. Stockpiles will not be located within 5 metres of hazard areas, including likely areas of high velocity flows such as waterways, paved areas and driveways. Silt/ sediment fences and appropriate stabilisation of stockpiles are to be provided as detailed on the drawings.
2. Sediment fences will:
 - a) Be installed where shown on the drawings, and elsewhere at the discretion of the site superintendent to contain the coarser sediment fraction (including aggregated fines) as near as possible to their source.
 - b) Have a catchment area not exceeding 720 square meters, a storage depth (including both settling and settled zones) of at least 0.6 meters, and internal dimensions that provide maximum surface area for settling, and
 - c) Provide a return of 1 metre upslope at intervals along the fence where catchment area exceeds 720 square meters, to limit discharge reaching each section to 10 litres/second in a maximum 20-year t_c discharge.
3. Sediment removed from any trapping device will be disposed in locations where further erosion and consequent pollution to down slope lands and waterways will not occur.
4. Water will be prevented from directly entering the permanent drainage system unless it is relatively sediment free (i.e. the catchment area has been permanently landscaped and/or likely sediment has been treated in an approved device). Nevertheless, stormwater inlets will be protected.
5. Temporary soil and water management structures will be removed only after the lands they are protecting are stabilised.

C.6 Waste Management Conditions

Acceptable bind will be provided for any concrete and mortar slurries, paints, acid washings, lightweight waste materials and litter. Clearance service will be provided at least weekly.

C.7 Site Inspection and Maintenance

1. A self-auditing program will be established based on a Check Sheet. A site inspection using the Check Sheet will be made by the site manager:
 - At least weekly.
 - Immediately before site closure.
 - Immediately following rainfall events in excess of 5mm in any 24-hour period.

The self-audit will include:

- Recording the condition of every sediment control device
- Recording maintenance requirements (if any) for each sediment control device
- Recording the volumes of sediment removed from sediment retention systems, where applicable

- Recording the site where sediment is disposed
 - Forwarding a signed duplicate of the completed Check Sheet to the project manager/developer for their information
2. In addition, a suitably qualified person will be required to oversee the installation and maintenance of all soil and water management works on the site. The person shall be required to provide a short monthly written report. The responsible person will ensure that:
- The plan is being implemented correctly
 - Repairs are undertaken as required
 - Essential modifications are made to the plan if and when necessary

The report shall carry a certificate that works have been carried out in accordance with the plan.

3. Waste bins will be emptied as necessary. Disposal of waste will be in a manner approved by the Site Superintendent.
4. Proper drainage will be maintained. To this end drains (including inlet and outlet works) will be checked to ensure that they are operating as intended, especially that,
- No low points exist that can overtop in a large storm event
 - Areas of erosion are repaired (e.g. lined with a suitable material) and/or velocity of flow is reduced appropriately through construction of small check dams or installing additional diversion upslope.
 - Blockages are cleared (these might occur because of sediment pollution, sand/soil/spoil being deposited in or too close to them, breached by vehicle wheels, etc.).
5. Sand/soil/spoil materials placed closer than 2 meters from hazard areas will be removed. Such hazard areas include and areas of high velocity water flows (e.g. waterways and gutters), paved areas and driveways.
6. Recently stabilised lands will be checked to ensure that erosion hazard has been effectively reduced. Any repairs will be initiated as appropriate.
7. Excessive vegetation growth will be controlled through mowing or slashing.
8. All sediment detention systems will be kept in good, working condition. In particular, attention will be given to:
- a) Recent works to ensure they have not resulted in diversion of sediment laden water away from them
 - b) Degradable products to ensure they are replaced as required, and
 - c) Sediment removal, to ensure the design capacity or less remains in the settling zone.
9. Any pollutants removed from sediment basins or litter traps will be disposed of in areas where further pollution to down slope lands and waterways should not occur.
10. Additional erosion and/or sediment control works will be constructed as necessary to ensure the desired protection is given to down slope lands and waterways, i.e. make ongoing changes to the plan where it proves inadequate in practice or is subjected to changes in conditions at the work site or elsewhere in the catchment.

11. Erosion and sediment control measures will be maintained in a functioning condition until all earthwork activities are completed and the site stabilised
12. Litter, debris and sediment will be removed from the gross pollutant traps and trash racks as required.

**EROSION AND SEDIMENT CONTROL
WEEKLY SITE INSPECTION SHEET**

LOCATION
INSPECTION OFFICER **DATE**
SIGNATURE

Legend: OK Not OK N/A Not applicable

Item	Consideration	Assessment
1	Public roadways clear of sediment.	.....
2	Entry/exit pads clear of excessive sediment deposition.	.....
3	Entry/exit pads have adequate void spacing to trap sediment.	.....
4	The construction site is clear of litter and unconfined rubbish.	.....
5	Adequate stockpiles of emergency ESC materials exist on site.	.....
6	Site dust is being adequately controlled.	.....
7	Appropriate drainage and sediment controls have been installed prior to new areas being cleared or disturbed.	.....
8	Up-slope "clean" water is being appropriately diverted around/through the site.	.....
9	Drainage lines are free of soil scour and sediment deposition.	.....
10	No areas of exposed soil are in need of erosion control.	.....
11	Earth batters are free of "rill" erosion.	.....
12	Erosion control mulch is not being displaced by wind or water.	.....
13	Long-term soil stockpiles are protected from wind, rain and stormwater flow with appropriate drainage and erosion controls.	.....
14	Sediment fences are free from damage.	.....
15	Sediment-laden stormwater is not simply flowing "around" the sediment fences or other sediment traps.	.....
16	Sediment controls placed up-slope/around stormwater inlets are appropriate for the type of inlet structure.	.....
17	All sediment traps are free of excessive sediment deposition.	.....
18	The settled sediment layer within a sediment basin is clearly visible through the supernatant prior to discharge such water.	.....
19	All reasonable and practicable measures are being taken to control sediment runoff from the site.	.....
20	All soil surfaces are being appropriately prepared (i.e. pH, nutrients, roughness and density) prior to revegetation.	.....
21	Stabilised surfaces have a minimum 70% soil coverage.	.....
22	The site is adequately prepared for imminent storms.	.....
23	All ESC measures are in proper working order.	.....

Appendix D
STORMWATER SYSTEM
DRAFT MAINTENANCE SCHEDULE

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
SWALES/ LANDSCAPED AREAS			
Check density of vegetation and ensure minimum height of 150mm is maintained. Check for any evidence of weed infestation	Six monthly	Maintenance Contractor	Replant and/or fertilise, weed and water in accordance with landscape consultant specifications
Inspect swale for excessive litter and sediment build up	Six monthly	Maintenance Contractor	Remove sediment and litter and dispose in accordance with local authorities' requirements.
Check for any evidence of channelisation and erosion	Six monthly/ After Major Storm	Maintenance Contractor	Reinstate eroded areas so that original, designed swale profile is maintained
Weed Infestation	Three Monthly	Maintenance Contractor	Remove any weed infestation ensuring all root ball of weed is removed. Replace with vegetation where required.
Inspect swale surface for erosion	Six Monthly	Maintenance Contractor	Replace top soil in eroded area and cover and secure with biodegradable fabric. Cut hole in fabric and revegetate.
INLET & JUNCTION PITS			
Inside of pits	Six Monthly	Maintenance Contractor	Remove grate and inspect internal walls and base, repair where required. Remove any collected sediment, debris, litter.
Outside of pits	Four Monthly/ After Major Storm	Maintenance Contractor	Clean grate of collected sediment, debris, litter and vegetation.
PROPRIETARY TREATMENT DEVICES (OceanProtect Stormfilters)			

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
Refer to Manufacturers Operation and Maintenance Manuel	Annually	Maintenance Contractor	Refer to Manufacturers Operation and Maintenance Manuel
FUTURE RAINWATER TANK			
Check for any clogging and blockage of the first flush device	Monthly	Maintenance Contractor	First flush device to be cleaned out
Check for any clogging and blockage of the tank inlet -leaf/litter screen	Six monthly	Maintenance Contractor	Leaves and debris to be removed from the inlet leaf/litter screen
Check the level of sediment within the tank	Every two years	Maintenance Contractor	Sediment and debris to be removed from rainwater tank floor if sediment level is greater than the maximum allowable depth as specified by the hydraulic consultant
STORMWATER SYSTEM			
General Inspection of complete stormwater drainage system	Bi-annually	Maintenance Contractor	Inspect all drainage structures noting any dilapidation in structures and carry out required repairs.
TANKS			
Inspect and remove any blockage from orifice	Six Monthly	Maintenance Contractor/ Owner	Remove grate and screen to inspect orifice.
Inspect trash screen and clean	Six Monthly	Maintenance Contractor/ Owner	Remove grate and screen if required to clean it.
Inspect flap valve and remove any blockage.	Six Monthly	Maintenance Contractor/ Owner	Remove grate. Ensure flap valve moves freely and remove any blockages or debris.
Inspect pit sump for damage or blockage.	Six Monthly	Maintenance Contractor/ Owner	Remove grate & screen. Remove sediment/

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
			sludge build up and check orifice and flap valve are clear.
Inspect storage areas and remove debris/ mulch/ litter etc likely to block screens/ grates.	Six Monthly	Maintenance Contractor/ Owner	Remove debris and floatable materials.
Check attachment of orifice plate and screen to wall of pit	Annually	Maintenance Contractor	Remove grate and screen. Ensure plate or screen mounted securely, tighten fixings if required. Seal gaps if required.
Check orifice diameter is correct and retains sharp edge.	Five yearly	Maintenance Contractor	Compare diameter to design (see Work-as-Executed) and ensure edge is not pitted or damaged.
Check screen for corrosion	Annually	Maintenance Contractor	Remove grate and screen and examine for rust or corrosion, especially at corners or welds.
Inspect overflow weir and remove any blockage	Six monthly	Maintenance Contractor/ Owner	Ensure weir is free of blockage.
Inspect walls for cracks or spalling	Annually	Maintenance Contractor	Remove grate to inspect internal walls, repair as necessary.
Check step irons	Annually	Maintenance Contractor	Ensure fixings are secure and irons are free from corrosion.


Appendix E

SYDNEY WATER OSD REQUIRMENTS

RE: [External] 1-3 Burrows Road, Alexandria OSD



Stormwater <Stormwater@sydneywater.com.au>
To Denis Webber

 Click here to download pictures. To help protect your privacy, Outlook prevented automatic download of some pictures in this message.

Denis,

On Site Detention is not required for any development at this location as per Sydney Water's policy and guideline for On Site Detention.

Best Regards

Jeya Jeyadevan
Senior Capability Assessor
Business Development

Mobile 0409 318 827
jeya.jeyadevan@sydneywater.com.au

Level 13, 1 Smith Street
Parramatta NSW 2150



We're working on something big

Every drop brings us one step closer to transforming our customers' online experience with Sydney Water



Sydney Water respectfully acknowledges the traditional custodians of the land and waters on which we work, live and learn. We pay respect to Elders past and present.

[Read more](#) about our commitment to reconciliation.

