



CIVIL ENGINEERING REPORT
INCORPORATING WATER CYCLE
MANAGEMENT STRATEGY

SSD-84467726 ▲

**KOGARAH GOLF CLUB
REDEVELOPMENT
13-19A MARSH STREET, ARNCLIFFE, NSW**

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Document Verification	
Project	Kogarah Golf Club Redevelopment
Document Title	Civil Engineering Report Incorporating Water Cycle Management Strategy
Project Number	CO9919.06
Description	SSD Report for proposed multi-level industrial precinct development
File Name	CO9919.06-12c.rpt

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Document History		
Date	Revision	Issued to
20 Oct 2025	DRAFT	Mr Daniel Lorenzetto, Stockland Corporation Pty Ltd
9 Dec 2025	A	Mr Daniel Lorenzetto, Stockland Corporation Pty Ltd
17 Dec 2025	B	Mr Daniel Lorenzetto, Stockland Corporation Pty Ltd
17 Apr 2025	C	Mr Daniel Lorenzetto, Stockland Corporation Pty Ltd

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1 EXECUTIVE SUMMARY

Stockland Development Pty Limited (the Applicant) is seeking approval for a Concept Masterplan and Early Works associated with the Kogarah Golf Club Redevelopment, located at 13–19A Marsh Street, Arncliffe, within the Bayside Council Local Government Area. The proposal forms part of the broader Cooks Cove Masterplan area and involves the redevelopment of the former Kogarah Golf Club site for industrial and related uses.

The proposal is considered State Significant Development (SSD), and an Environmental Impact Statement (EIS) has been prepared to support the SSD Application. Costin Roe Consulting has prepared this Water and Hydrology Assessment to address the Secretary's Environmental Assessment Requirements (SEARs) relevant to water, flooding, and stormwater management, with consideration of both the Concept Masterplan and Early Works components of the development.

1.1 Proposal overview

The proposed development comprises a Concept Masterplan and Early Works for a world-class precinct that leverages the site's strategic location adjacent to Sydney Airport and strong transport connections. The Concept Masterplan provides for up to five major buildings accommodating a range of potential uses, including warehousing, data centre, trade-related enterprises, office premises, and ancillary facilities such as food and drink premises and accommodation.

The total site area is approximately 32 hectares, with a developable zone of approximately 17.8 hectares and the remaining area allocated for drainage corridors, road infrastructure, and landscaped flood channels. The Early Works component includes site preparation activities such as demolition, bulk earthworks, ground improvement, and the delivery of key infrastructure including diversion channel works and Flora Street East.

Indicative infrastructure associated with the Concept Masterplan includes internal roads, stormwater drainage systems, and utility services, which will be subject to further detailed design as part of future development applications.

Heavy vehicle access is proposed via Gertrude Street and Flora Street, with light vehicle access via Levey Street and Flora Street. The layout and siting of the development have been planned to respond to the site's topography, access requirements, and flood planning constraints.

1.2 Purpose of this assessment

This Water and Hydrology Impact Assessment has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) relevant to water and hydrology for the Concept Masterplan and Early Works components of the proposed development.

The assessment considers the following key matters:

- Stormwater management, including conceptual assessment of stormwater quantity and quality;
- Flooding and overland flow behaviour; and

- Stormwater management during construction, including erosion and sediment control.

1.3 Construction impacts

During the construction phase, a Construction Stormwater Management Plan (CSWMP) will be prepared and implemented as part of the Early Works, in accordance with the Landcom Blue Book (4th Edition) and Bayside Council guidelines. The plan will incorporate appropriate erosion and sediment control measures to ensure that the downstream drainage system and the Cooks River Estuary are protected from sediment-laden runoff throughout all construction stages.

1.4 Operational impacts

During the operational phase of development under the Concept Masterplan, the proposed Early Works and future development stages stormwater management strategy is intended to incorporate the following key elements:

- Flood-mitigation measures, including a landscaped diversion channel, culverts beneath Gertrude Street and Flora Street, and a southern flood-protection bund to prevent tidal backflow from the Cooks River;
- Stormwater quantity management consistent with *Bayside Council's Part 10 Stormwater Management Technical Guidelines (2021)*. Given the site's tidally influenced floodplain, on-site detention (OSD) is not proposed, as it would not reduce downstream flood risk and could instead delay discharges and synchronise peak flows; and
- Stormwater quality treatment for future development in accordance with Water Sensitive Urban Design (WSUD) principles, achieved through a treatment train of Gross Pollutant Traps (GPTs) and Ocean Protect PSORB filtration systems, designed to meet pollutant reduction targets from the *Botany Bay Water Quality Improvement Plan (2011)*;

Comprehensive hydraulic and flood modelling, as documented in the *Flood Impact Risk Assessment for the Kogarah Golf Club Redevelopment (Ref: CO9919.06-15, Costin Roe Consulting, 2026)*, demonstrates that the Concept Masterplan and Early Works can be delivered without adverse impacts on upstream or downstream flood behaviour, while maintaining overland flow continuity across the site.

1.5 Conclusion

The hydrological and flood assessments undertaken confirm that the proposed Concept Masterplan and Early Works stormwater and flood management measures will ensure no adverse impacts on surrounding properties or the Cooks River Estuary as a result of the development.

The information contained in this report demonstrates that appropriate legal points of discharge and a fit-for-purpose stormwater management strategy are available for the development, satisfying Council and State planning requirements. It is therefore recommended that the proposed stormwater, flood management, and water quality strategies outlined herein be endorsed and incorporated into future detailed design documentation.

2 INTRODUCTION

2.1 Introduction

Costin Roe Consulting Pty Ltd has been commissioned by Stockland Development Pty Limited ('Stockland' or 'the Applicant') to support a State Significant Development Application (SSDA) (SSD-84467726) for a Concept Masterplan and Early Works associated with the Kogarah Golf Club Redevelopment located on land identified as 13-19A Marsh Street, Arncliffe (the site).

The vision for the Kogarah Golf Club Redevelopment is to create a world-class precinct that leverages the site's strategic location adjacent to Sydney Airport and strong transport connections by delivering multi-level logistics development, trade-related enterprise and supporting uses with publicly accessible open space. It seeks to deliver state-of-the-art facilities that will redefine the logistics landscape in Australia, setting new benchmarks for scale, efficiency, sustainability and innovation.

The Concept & Early Works SSDA seeks consent for an overarching Concept Masterplan that establishes maximum building envelopes, Gross Floor Area (GFA), land uses, and other parameters through Urban Design Guidelines and technical reporting. It also seeks consent for the carrying out of Early Works to facilitate the initial site preparation and infrastructure works required to support future development and publicly accessible open space.

This report provides an assessment of the civil engineering characteristics of the site and key technical considerations associated with the Concept Masterplan and Early Works, including:

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

The WCMS considers the following key areas of stormwater and water management:

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

These elements have been assessed at a conceptual level to demonstrate that the site can be developed without adverse impacts on the surrounding environment and neighbouring properties, with detailed design to be progressed at subsequent stages.

This engineering assessment is based on the indicative Masterplan provided by Stockland Development Pty Limited for a range of potential uses, including logistics, trade-related enterprises, hotel, serviced apartments, office and data centres.

A request for Planning Secretary's Environmental Assessment Requirements (SEAR's) to the DPHI has been made by the applicant. Reference to **Appendix H** should be made for SSD-84467726 SEAR's dated 17 June 2025 of this report for specific responses to civil engineering and water management related items included in the SEAR's.

2.2 Consultation

Consideration of the various stakeholders has been made in relation to the development, including the Bayside Council, during the assessment period.

2.3 SEAR's Responses

This report supports the EIS for the proposal and addresses the NSW Department of Planning, Housing and Infrastructure SEARS letter dated 17 June 2025, reference SSD-84467726

We note that the below "key issues and documentation" assessments are based on the standard Warehouse and Distribution Centre SEARs document, and the following key areas in the document:

- Water Management
- Soils,
- Flooding

Table 2.1 provides a summary of the SEARs Requirements for the Cooks Cove, which relate to water and hydrology, and where these have been addressed in this report.

Further agency consultation and advice has been sought by Stockland for the submission and includes agency responses from Bayside Council, Transport for New South Wales (TfNSW), Department of Planning and Environment, Sydney Trains, Endeavour Energy, Fire & Rescue NSW and Sydney Water.

2.3.1 SEAR's Response Items

Table 2.1 - SEARs Kogarah Golf Club Redevelopment

SEAR's Key Item	Response and how it is addressed
Water Management - an integrated water management strategy, including: - a detailed site water balance including a description of the likely water demands and breakdown of water supplies, measures to minimise water use and any water licensing requirements - an assessment of potential surface and groundwater impacts (both quality and quantity) associated with the development, including potential impacts on watercourses, riparian areas, groundwater, and groundwater-dependent communities nearby in accordance with relevant water quality guidelines and the Department of Climate Change, Energy, the	An integrated Water Cycle Management Strategy (WCMS) has been developed addressing stormwater quantity, quality, reuse and flooding. The strategy is consistent with <i>Bayside Council DCP Part 10 (2021)</i>, the <i>Technical Specification for Stormwater Management (2023)</i> and the <i>Botany Bay & Catchment Water Quality Improvement Plan (2011)</i>. • For the Early Works, stormwater will be managed via surface-based systems, including overland flow paths and a diversion channel, with erosion and sediment control measures implemented during construction.

Environment and Water - Water Group (DCCEEW-Water) Groundwater Toolkit - conceptual details of the proposed stormwater/wastewater drainage design including the capacity of onsite detention system(s), onsite sewage management and measures to treat, reuse or dispose of water - a surface water discharge assessment in accordance with relevant EPA guidelines, including an assessment of potential impacts on watercourses and riparian areas, and characterisation of water quality at the point of discharge against the relevant water quality criteria using a MUSIC water quality model - details of any surface or groundwater mitigation, management and monitoring activities and methodologies - identification of all works located on waterfront land and demonstration that the proposal meets the Guideline for Controlled Activities on Waterfront Land.	• Surface and groundwater conditions have been assessed based on Douglas Partners geotechnical investigations; the site is characterised by shallow, tidally influenced groundwater, and no infiltration systems are proposed as part of the Early Works. • Stormwater drainage for the Early Works maintains existing discharge conditions to the Cooks River without the need for on-site detention, consistent with Council policy for tidally influenced catchments. • For future development, an indicative stormwater strategy has been developed, including water reuse and water quality treatment measures. Rainwater harvesting is expected to reduce non-potable water demand by approximately 50–70%. • Indicative stormwater quality treatment measures demonstrate that Council pollutant-reduction targets (90% GP, 85% TSS, 60% TP, 45% TN) can be achieved, subject to detailed design. • All works comply with the EPA (Environment Protection Authority) surface-water discharge and WSUD design guidance. Refer to Sections 5, 6, 7 and Appendix C for further details.
Flooding - a flood impact risk assessment (FIRA) in accordance with the Flood risk management guideline LU01 - Flood impact and risk assessment (2023). The FIRA must: - align with the advice received in letters received from the NSW Department of Climate Change, Energy, the Environment and Water	A Flood Impact and Risk Assessment (FIRA) has been completed in accordance with the <i>NSW Flood Risk Management Manual (2023)</i> and the <i>Flood Risk and Impact Assessment Guideline LU01 (2023)</i>. Flood modelling undertaken using the Bayside Council / Arup (2024) Cooks River hydraulic model demonstrates that the proposed works do not result in

dated 12 June 2025 and Bayside Council dated 12 June 2025 - identify any flood risk on-site (mainstream and overland) having regard to adopted flood studies, the potential effects of climate change, and any relevant provisions of the NSW Flood Risk Management Manual (2023) - 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 - identify flood behaviour, flood constraints and risks on the site and adjoining areas including the potential impacts of climate change for the full range of events up to and including the probable maximum flood (PMF) event - include details of proposed management measures to minimise the impacts of flooding on the development and flood risk to the community	adverse flood impacts to upstream, downstream or adjoining properties. The flood management strategy includes a landscaped diversion channel, culverts beneath Gertrude and Flora Streets, and a southern bund to manage overland flow and prevent tidal backflow from the Cooks River. Model results indicate that flood behaviour under the proposed development scenario remains generally consistent with existing conditions for events ranging from the 1% AEP up to the Probable Maximum Flood (PMF), including climate change scenarios. Refer to Section 5.4 and Appendix G for further details.
Soils - an assessment of potential impacts on soil resources and riparian land on and near the site, including: - impacts on soil erosion, salinity and acid sulfate soils - details of earthworks, including cut and fill volumes - description of the proposed erosion and sediment controls during construction.	Soil and landform impacts have been addressed through geotechnical assessment. Acid sulfate soils and salinity risks have been identified and will be managed in accordance with the relevant management plans during earthworks. Erosion and sediment control measures will be implemented in accordance with <i>Landcom's Managing Urban Stormwater: Soils and Construction</i> (4th Edition) (the Blue Book) and Bayside Council requirements. Bulk earthworks will be undertaken in a controlled manner to manage cut and fill activities and minimise the potential for erosion and sediment transport to the Cooks River.

	Refer to Sections 4, 8 and Appendix E for further details.
Infrastructure Requirements – an infrastructure delivery, management and staging plan that includes: – an assessment of impacts of the development on existing utility infrastructure and service provider assets surrounding the site – a detailed written and/or graphical description of infrastructure required on the site, including any electrical substation/s and on-site switch yard/s – details of the existing capacity of the site to service the proposed development and any extension or augmentation, property tenure or staging requirements for the provision of utilities, including arrangements for electrical network requirements, drinking water, wastewater and recycled water – details of interaction with Sydney Desalination Plant's pipeline – a description of how any upgrades will be co-ordinated, funded and delivered on time and be maintained to facilitate the development – identification of any existing infrastructure or easements on or off the site which may be impacted by construction or operation of the development and details of measures to be implemented to address any impacts.	Existing major utilities, including the Sydney Desalination Pipeline and Ethane Gas Pipeline, have been identified within the site. The Concept Masterplan and Early Works have been developed to maintain appropriate clearances and comply with relevant utility authority requirements. Stormwater infrastructure for the Early Works is limited to surface-based drainage, including overland flow paths and the diversion channel. Future stormwater infrastructure requirements, including internal drainage systems, will be confirmed during detailed design. Electrical and water servicing requirements will be coordinated with relevant authorities and confirmed as part of future detailed design stages. Refer to Section 3.2.1, 5 and Appendix C for further details.

3 DEVELOPMENT SITE

3.1 Location

The proposed development is situated in the suburb of Arncliffe on Lot 21, DP1231954, within Bayside Council. The site is bordered on the northwest by Marsh Road, on the southwest by the M5 East motorway, and along the western boundary by Cooks River.

The land comprises a total area of approximately 36.3 Ha, with a developable area of 17.8 Ha. The current land use is a golf course that is no longer in operation.



Figure 3.1 – Site Aerial Map (Source: Nearmaps, edited by Colliers Urban Planning)

3.2 Existing Site

The site is identified as 13-19A Marsh Street, Arncliffe within the Bayside Local Government Area (LGA). It is situated to the immediate west of the Cooks River and Sydney Airport, located approximately 6km west of Port Botany and 10km south of the Sydney Central Business District (CBD). It includes frontages to Marsh Street, providing direct access to the M5 Motorway, Sydney Airport and St Peters Interchange (via the Sydney Gateway).

The site comprises land associated with nine (9) allotments and a total area of approximately 32 hectares. The existing uses include the previous Kogarah Golf Club (vacated in March 2025) accessed via Levey Street and the temporary M6 Stage 1 construction compound accessed directly from Marsh Street.

The development area represents Lot 31 DP1231486 and Lot 100 DP1231954, excluding land subject to future dedication to Bayside Council. It comprises an area of approximately 16.7 hectares and is zoned SP4 Enterprise and C2 Environmental Conservation under the Bayside LEP 2021.

The site is described in **Table 3.1**, with the extent of the site and development area depicted in **Figure 3.1**.

Table 3.1 – Site Description

Lot / DP	Address	Ownership
Lot 31 DP1231486	19 Marsh Street, Arncliffe	Cook Cove Nominees No 1 Pty Ltd as trustee of Cook Cove Property Trust 1
Lot 100 DP1231954	19A Marsh Street, Arncliffe	Cook Cove Nominees No 2 Pty Ltd as trustee of Cook Cove Property Trust 2
Lot 60 DP1301057	13 Marsh Street, Arncliffe	Bayside Council
Lot 61 DP1301057	19 Marsh Street, Arncliffe	
Lot 62 DP1301057	Marsh Street, Arncliffe	Transport for NSW
Lot 63 DP1301057	Marsh Street, Arncliffe	
Lot 12 DP570900	Marsh Street, Arncliffe	
Lot 102 DP1231954	Marsh Street, Arncliffe	
Lot 103 DP1231954	Marsh Street, Arncliffe	

3.2.1 Existing Services

The site is traversed by several major underground utilities that impose design and construction constraints.

The Sydney Desalination Pipeline easement crosses the central-western portion of the site and forms part of Sydney Water's critical potable water infrastructure network. The alignment and protection requirements of this asset restrict deep excavation and impose load limits on overlying structures and pavements.

In addition, an Ethane Gas Pipeline corridor runs through the site within a defined easement. This asset is managed under strict statutory conditions requiring preservation of access and protection of pipeline integrity.

Both pipelines have been identified and considered in the development of the Concept Masterplan and conceptual stormwater strategy. All proposed works will maintain required clearances, comply with utility authority requirements, and avoid impacts to the integrity or operation of these critical assets.

3.3 Proposed Development

The Concept & Early Works SSDA seeks consent for the following:

- Concept Masterplan to support the staged delivery of the Kogarah Golf Club Redevelopment, including:
 - Maximum building envelopes, including maximum building heights and minimum building setbacks;
 - Maximum Gross Floor Area (GFA) up to 343,250m², comprising:
 - 3,250m² of GFA (FSR of 1.25:1) on Lot 31 DP1231486; and
 - 340,000m² of GFA on Lot 100 DP1231954.
 - Conceptual primary land uses, including:
 - Block 1 – Mixed-use and advertising structures;
 - Block 2 – Logistics and mixed-use;
 - Block 3A – Logistics;
 - Block 3B – Logistics; and
 - Block 3C – Logistics and Data centre.
 - Urban Design Guidelines to guide future development of the built form and public domain; and
 - Strategies and mitigation measures to manage potential environmental impacts.
- Early Works to support the future delivery of built form and publicly accessible open space, including:
 - Site preparation works, comprising:
 - Demolition of existing structures;
 - Clearing of existing vegetation;
 - Remediation works; and
 - Bulk earthworks, including ground improvement and flood mitigation works.
 - Site servicing and infrastructure works, including:
 - Construction of the Flora Street East extension consistent with Item 3 of the executed Voluntary Planning Agreement with Bayside Council;

- Construction of stormwater infrastructure; and
- Construction and augmentation of service and utility infrastructure as necessary.

For a detailed description, refer to the Environmental Impact Statement prepared by Colliers Urban Planning.

The Concept Masterplan is supported by Indicative Reference Schemes that present as 'proof of concepts' within the proposed planning framework. The schemes demonstrate suitable primary land use, built form and public domain outcomes that align with the vision for a world-class precinct that leverages the site's strategic location adjacent to Sydney Airport and strong transport connections.

The Indicative Reference Schemes consider different potential development outcomes enabled by the Concept Masterplan to support the delivery of the highest and best use at the time of redevelopment. This includes a Logistics scheme and Alternative Uses scheme, which facilitate the potential for four (4) different primary land use outcomes across the Site. The alternative land use outcomes enabled by the Concept Masterplan include an alternative mixed-use outcome on Block 2 and alternative data centre outcome on Block 3C.

The Indicative Reference Schemes are established in **Figure 3.2**, with the Logistics scheme and Alternative Uses scheme prepared by Grimshaw depicted in **Figure 3.3** and **Figure 3.4**.

It is noted that the Indicative Reference Schemes are indicative only and the development of future built form and publicly accessible open space will be subject to future Development Applications. The Indicative Reference Schemes demonstrate the ability to support different potential outcomes, consistent with the proposed framework under the Concept Masterplan including Urban Design Guidelines.



Figure 3.2 – Indicative Reference Scheme – Logistics (Source: Grimshaw Architects)



Figure 3.3 – Indicative Reference Scheme – Logistics Scheme (Source: Grimshaw Architects)



Figure 3.4 – Indicative Reference Scheme – Alternative Uses Scheme (Source: Grimshaw Architects)

3.4 Cooks River Interface and Waterfront Land

The site adjoins the Cooks River and is subject to the 40 m waterfront land provisions under the Water Management Act. Portions of the site, including areas subject to bulk earthworks, extend within the nominated waterfront land area.

The early works package primarily comprises bulk earthworks and erosion and sediment control measures, with sediment basins and associated controls generally located outside the waterfront land area.

The only infrastructure element proposed within the waterfront land is the drainage channel at its discharge point to the Cooks River. This connection is required to enable the discharge of stormwater runoff from the site and represents the minimum extent of works within the waterfront land.

The extent and detailed design of works within the waterfront land will be confirmed during subsequent design stages and will be subject to the relevant approval requirements.

4 SOILS, GEOLOGY AND EARTHWORKS

4.1 Soil and Geological Conditions

Assessments relating to soil and geology have been undertaken by Douglas Partners Pty Ltd under the report "223528.01.R.001.Rev1 – Report on Preliminary Geotechnical Investigation, Kogarah Golf Course, Cooks Cove, Arncliffe NSW," dated November 2025.

As referenced in the Douglas Partners investigation, the site occupies the former Kogarah Golf Course area and covers approximately 18 hectares of relatively flat low-lying terrain located off Marsh Street, Arncliffe. The ground surface generally ranges between RL 1 m and RL 3 m AHD, with localised mounds reaching up to RL 6 m AHD at the clubhouse area.

According to published geological and soil mapping and the investigation results, the site conditions can be summarised as follows:

Geology:

The site is primarily underlain by Quaternary estuarine and marine sediments, consisting of fine- to medium-grained lithic-carbonate-quartz sands, silts, clays, shell material and polymictic gravels deposited within a tidal delta-flat environment. The northern portion of the site transitions to Hawkesbury Sandstone, comprising medium- to coarse-grained quartz sandstone with minor shale and laminite lenses.

Soil Landscapes:

The site is mapped as disturbed terrain, representing areas that have been extensively re-worked by previous human activity such as filling and grading for the former golf course. These areas are characterised by variable fill thickness (0.5 m–2.4 m) of sandy and silty sand material containing rubble and occasional buried obstructions.

Subsurface Profile:

Typical subsurface conditions encountered across the site consist of:

- Fill (0.5–2.4 m): sandy and silty sand fill of variable density.
- Soft to Firm Clay and Silty Clay (1.7–8.6 m depth): alluvial and marine clays with occasional sand bands.
- Loose to Medium-Dense Sand Layers: interspersed below the clay units to depths of 12–25 m.
- Interbedded Clay and Sand: stiff to hard clay alternating with medium-dense to very dense sand.
- Bedrock: inferred at depths between 7.9 m and 21.1 m AHD, representing the top of Hawkesbury Sandstone.

Groundwater:

Groundwater was observed at shallow depths across the site, generally ranging between approximately 0.5 m and 2.0 m below ground surface, consistent with the site's proximity to the Cooks River and Botany Bay estuarine environment. Groundwater levels are influenced by rainfall and tidal fluctuations and are expected to vary spatially and temporally across the site, with higher levels occurring during wet weather and flood events.

Acid Sulfate Soils (ASS):

The site is mapped within an area of high probability of ASS occurrence from depths of 1 m to 3 m below the ground surface. Excavated or disturbed material from below the groundwater table should be treated as potentially acid-sulfate-affected until proven otherwise.

Salinity and Aggressivity:

Regional mapping indicates low salinity risk, although the near-coastal setting and shallow groundwater warrant classification as moderately aggressive toward buried concrete and steel elements.

Hydrogeological and Geotechnical Summary:

The site comprises compressible marine and estuarine soils of variable thickness overlying interbedded sand and clay and, locally, Hawkesbury Sandstone. Ground improvement or deep foundations will be required in areas underlain by soft clays to control settlement and ensure adequate bearing capacity.

4.2 Bulk Earthworks

Bulk earthworks will be required to facilitate the development of the estate for industrial purposes. These earthworks will be undertaken to provide large, flat building pads at RL 1.60m $\pm$ 1.0m AHD, along with hardstand, car parking areas and access roads. A high-level estimate of earthwork volumes has been completed for the site. The estimated volumes are shown on the Costin Roe drawings in **Appendix A**.

Final levels would be subject to $\pm$ 1.0m variance to allow for variations in allowances for geotechnical conditions, final building layout and allowable building height, and drainage conditions.

The earthwork analysis has been completed to a level of detail to enable general pad levels to be set and obtain an order of magnitude cut and fill volume estimate. Given the preliminary nature of the assessment, an upper and lower bound of earthworks volumes has been included to allow for contingency in cost planning estimates. The assessment in **Appendix A** is based on the earthworks using a building pad BEL of RL 1.60 $\pm$ 1.0 AHD.

The earthworks volume estimates are included in **Table 4.1 & 4.2**.

Table 4.1 - Earthwork Volume Estimates – Estate Roads and Pads

	Lower Bound (-15%)	Apparent Volume	Upper Bound (+15%)
Cut (m ³)	-26,223	-30,850	-35,478
Fill (m ³)	+88,783	+104,450	+120,118
Detail Excavation (@1500m ³ /Ha)	-18,955	-22,300	-25,645
Balance (m ³)	+43,605	+51,300	+58,995

Table 4.2- Earthwork Volume Estimates – Drainage Channel

	Lower Bound (-15%)	Apparent Volume	Upper Bound (+15%)
Cut (m ³)	-18,785	-22,100	-25,415
Fill (m ³)	+7,225	+8,500	+9,775
Balance (m ³)	-11,560	-13,600	-15,640

Given the order of magnitude of the volume of earthworks and the conceptual nature of earthworks modelling, fill importation is expected to be achievable through a detailed modelling exercise. Consideration should be given to the bulking of cut materials, including sand, rock, and clay materials. Typically, clay bulking is expected to be around 4% of the removed volume, while rock bulking can range from 8% to 12%.

Spoil allowances for services trenches, retaining walls and detailed building excavation should also be made to avoid excessive unknown exports during later stages of the project. Allowances in the range of 1,250-2,500m³/Ha can be expected depending on the type of development and final site layouts. This allowance is included in the earthworks assessment. As noted, an upper and lower bound of earthworks volumes has been included to allow for some of these items.

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 E** 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.

4.3 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.

It is noted that minor retaining structures may be required at later stages of design to accommodate detailed building layouts, infrastructure interfaces and final grading

constraints. Any such structures would be subject to detailed design and approval as part of future development stages.

4.4 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. Steeper batters in shale can be considered subject to geotechnical advice.

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 **Appendix E** of this report.

4.5 Supervision of Earthworks

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

4.6 Groundwater

Groundwater conditions at the Cooks Cove site were assessed by Douglas Partners Pty Ltd as part of their geotechnical investigation (Report No. 223528.01.R.001 Rev1, November 2025).

Groundwater was encountered at shallow depth across the site, generally between approximately 0.5 m and 2.0 m below existing ground level, with levels varying spatially and temporally. Douglas Partners noted that groundwater levels are influenced by rainfall, tidal fluctuations, and prevailing climatic conditions, and may temporarily rise during major rainfall and flooding events.

No long-term groundwater monitoring was undertaken as part of the investigation. However, given the site's low-lying position adjacent to the Cooks River floodplain and estuarine environment, groundwater levels are expected to fluctuate and respond to changes in rainfall and tidal conditions.

The proposed Early Works, including bulk earthworks and diversion channel construction, may result in localised interception of groundwater, particularly where channel invert levels extend below the prevailing groundwater table.

These effects are expected to be limited in extent and are not anticipated to result in significant adverse impacts.

In accordance with Bayside Council's Stormwater Management Technical Guidelines (2021), construction within close proximity to the groundwater table requires consideration of groundwater seepage and structural stability. The Guidelines specify that underground structures are to maintain integrity through appropriate waterproofing measures, and that subsoil drainage systems should not be installed in sandy soils where infiltration systems are present.

While the proposed Early Works do not include enclosed underground structures or infiltration systems, these principles will be considered during detailed design to ensure

that any groundwater interaction associated with the open channel is appropriately managed and that the stability of the works is maintained.

Any detailed groundwater management or drainage requirements will be addressed during detailed design and construction planning.

4.7 Acid Sulphate Soils and Salinity

An assessment of the potential for acid sulphate soils has been requested as part of the SEAR's requirements.

Reference to the NSW 1:25,000 Acid Sulphate Soils (ASS) Risk Map indicates that the Cooks Cove site lies within an area of high potential for acid-sulfate-soil occurrence, typically between 1 m and 3 m below ground surface.

Douglas Partners (2024) notes that soils excavated from below the groundwater table should be treated as potentially acid-sulfate-affected unless testing confirms otherwise. The influence of these materials on the durability of buried or structural elements should be considered in detailed design.

Given the site's low-lying estuarine setting and shallow groundwater, Douglas Partners also advises that the subsurface conditions are likely to exhibit slightly to moderately aggressive characteristics toward buried concrete and steel. It is recommended that confirmatory soil aggressivity testing be undertaken in subsequent investigation stages to define exposure conditions and inform appropriate material selection and protection measures.

4.8 Ground Conditions and Ground Improvement Considerations

Available geotechnical investigations undertaken across the site indicate the presence of fill materials overlying soft to firm compressible clays associated with the Cooks River estuarine environment. Groundwater levels are generally shallow and influenced by tidal conditions, which may affect construction methodologies and subgrade performance.

Based on this information, ground improvement may be required in parts of the site to support future development, particularly within the central to eastern areas extending generally in a north-south direction parallel to the Cooks River, where subsurface conditions are anticipated to be less favourable and structural loading and settlement tolerances are more critical. The extent, location and requirements for any ground improvement will be confirmed during detailed design.

Ground improvement, where required, will be further assessed and designed as part of detailed design. The selection of appropriate ground improvement methods, extent of treatment and performance criteria will be determined based on detailed geotechnical design and specific building requirements.

5 WATER CYCLE MANAGEMENT STRATEGY & DRAINAGE METHODOLOGY

5.1 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 estate and development as a whole. This assists urban rezoning and estate infrastructure planning for the industrial development proposed on the land.

This Water Cycle Management Strategy has been prepared to demonstrate that the proposed Kogarah Golf Club Redevelopment can incorporate and integrate water cycle management measures across both the Early Works and future development stages. It establishes guiding principles for water management across the site, including the definition of performance targets and the identification of measures to be implemented during future detailed design.

WCM principles have been incorporated into the proposed strategy, with measures for the Early Works and indicative approaches for future development outlined in this report and the associated appendices. The key WCM elements and targets were adopted in the design in accordance with Bayside Council (BC) DCP 2022 and accepted engineering practice.

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

- Stormwater Quantity Management (Refer **Section 6**)

The development is located within the Cooks River Estuary floodplain, where tidal influence controls discharge behaviour. As the proposal does not increase impervious area or alter existing catchments, on-site detention (OSD) is not required. The design maintains existing flow paths and discharge timing to ensure no increase in downstream flooding or adverse hydraulic impacts.

Refer to **Section 6** of the document for further discussion pertaining to water quantity management

- Stormwater Quality Management (Refer **Section 7**)

Stormwater quality management has been considered in accordance with Bayside Council requirements and Water Sensitive Urban Design (WSUD) principles.

No permanent stormwater treatment measures are required for the Early Works, as the site will remain predominantly undeveloped and permeable. Erosion and sediment control measures will be implemented during construction to protect downstream receiving waters, as discussed in **Section 7**.

For future development, stormwater quality, reuse and maintenance measures are proposed and are discussed in **Appendix C**.

- Flood Management (refer **Appendix G**)

A detailed TUFLOW 2D model based on the Bayside Council/Arup Cooks River hydraulic model assesses flooding for PMF and 1% AEP events, including climate-change tailwater effects. The flood strategy introduces a diversion channel, culverts at Gertrude and Flora Streets, and a southern bund to manage overland flow and prevent backflow, ensuring no adverse impacts on adjacent land.

Refer to the separate report CO9919.06-15.rpt included in **Appendix G** for a detailed discussion on overland flow and flooding

- Water Demand Reduction/ Rainwater Reuse (refer **Appendix C**)

Rainwater reuse is not required as part of the Early Works.

Rainwater reuse measures will be incorporated into future development designs. Rainwater reuse will be required to reduce demand on non-potable uses by 50-70%. The reduction in demand will target non-potable uses such as toilet flushing and irrigation. Tank sizing will follow the NSW Department of Environment and Conservation guidelines using a water balance analysis to match supply and demand.

Refer to **Appendix C**.

- Stormwater Management During Construction (refer **Section 8**)

A construction stormwater management plan and associated erosion and sediment control measures are proposed based on Landcom Blue Book and council requirements. The management measures take a staged approach from initial site establishment, construction stages and the period between the completion of the proposed infrastructure works and the development of the site.

- Existing Drainage System & Overland Flows (refer **Section 5.4** and **Appendix G**)

Overland flow from Marsh Street / Gertrude Street corridors enters the site and traverses low-lying areas toward the Cooks River. The site currently conveys external upstream catchments and local runoff through informal channels under tidal tailwater influence. The proposal retains and formalises these paths via a landscaped diversion channel and culverts at Gertrude and Flora Streets, maintaining existing discharge locations to the Cooks River and avoiding obstruction or redirection of established overland flow routes.

5.2 Existing Site Drainage

The site is currently a former golf course, which has been described in **Section 3.2**. No existing formal in-ground drainage is expected on the site other than carpark areas, which would carry stormwater runoff to the Cooks River. Any existing drainage infrastructure within the site will be decommissioned or removed as part of the

proposed works, with a new stormwater management system implemented to formalise flow paths and integrate with the proposed development.

The existing drainage layout and contributing upstream catchments are shown on the indicative stormwater management drawings in **Appendix B**.

5.3 Proposed Surface Water Drainage System

The proposed stormwater strategy has been developed to respond to the site's low-lying topography and tidally influenced conditions within the Cooks River floodplain.

Early Works

As part of the Early Works, stormwater will be managed primarily through surface-based systems, including overland flow paths and a naturalised diversion channel. These elements will convey runoff across the site toward the Cooks River while maintaining existing drainage patterns.

Due to the flat grades and downstream tidal influence, the system is expected to operate as a combination of flow conveyance and temporary storage, with localised ponding occurring during storm events. Erosion and sediment control measures will be implemented during construction in accordance with **Section 8** to manage runoff and protect downstream water quality.

No permanent piped drainage system is proposed as part of the Early Works. Stormwater will be managed via surface-based systems only.

Future Development

Future stages of development are expected to incorporate a conventional minor and major drainage system, including a piped drainage network to convey frequent storm events and overland flow paths for larger storm events.

Conceptual layouts of the future drainage system are provided in **Appendix C** for information and are subject to refinement during detailed design.

The legal point of discharge for both Early Works and future development is the Cooks River, consistent with existing conditions.

Stormwater design will be undertaken in accordance with Australian Rainfall and Runoff (2019), AS/NZS 3500.3, and relevant Council requirements.

Stormwater quality treatment and water reuse measures are incorporated into the overall design and are discussed in **Appendix C**, respectively.

5.4 External Catchment and Flooding

The development site forms part of a floodplain system that receives runoff from external upstream catchments located primarily along Marsh Street and the surrounding urban areas to the north and north-west. Under existing conditions, overland flow enters the site from Marsh Street, traversing the land via low-lying areas and open spaces before discharging towards the Cooks River downstream.

Hydraulic investigations undertaken by Arup Group for the original planning proposal, and further modelling now commissioned under this SSDA, confirm that the site is

influenced by both local overland flow and regional backwater effects from the Cooks River during high tide or extreme flood events. The Council's adopted flood model forms the basis for the current Flood Impact and Risk Assessment (FIRA) being prepared for the roadworks and development areas.

To ensure that the natural conveyance of these upstream flows is maintained, the proposed stormwater and flood management strategy includes:

- Establishment of an open diversion channel running through the site to safely direct overland flows around proposed buildings and infrastructure.
- Provision of culverts beneath Gertrude Street and Flora Street intersections to maintain continuity of upstream flow paths.
- Construction of a bund along the southern boundary to prevent backflow from the Cooks River during high water or tidal conditions.
- Integration of the proposed drainage network with Council's existing trunk system, maintaining flow continuity under both existing and developed conditions.

For the Early Works, stormwater and flood conveyance will be managed primarily through surface-based systems, including the diversion channel and overland flow paths, consistent with the site's low-gradient and tidally influenced conditions.

The diversion channel is intended to function as a landscaped flood corridor, combining hydraulic capacity with environmental and public amenity outcomes. Its geometry will allow for baseflow conveyance under normal conditions and increased capacity during major flood events.

Flood modelling has been undertaken using the Bayside Council Cooks River hydraulic model (Arup, 2024), which represents the adopted floodplain model for the Cooks River catchment. The modelling assesses existing and proposed flood behaviour and evaluates the PMF, 1%, 5%, and 10% AEP events, including climate-change tailwater conditions in the Cooks River, to confirm there are no adverse impacts on upstream, downstream, or adjoining properties as a result of the proposed works.

Overall, the flood management approach ensures that all external catchment flows are safely conveyed through the site, preserving existing flood behaviour while accommodating the planned development.

A detailed two-dimensional hydraulic and overland-flow assessment using TUFLOW confirms that the proposed diversion channel, culvert system, and flood bund maintain flood-conveyance capacity for all modelled events (PMF, 1%, 5%, 10% AEP plus climate-change scenarios). Refer to the separate Flood Impact & Risk Assessment report CO9919.06-15.rpt included in **Appendix G** for a detailed discussion on overland flow and flooding. Overall, once the above factors are duly considered, it can be confirmed that the works can commence without affecting upstream, downstream, or adjoining properties in relation to overland flow.

6 WATER QUANTITY MANAGEMENT

6.1 General Design Principles

The Bayside Council “*Part 10 Stormwater Management Technical Guidelines*” (2021) establishes requirements for stormwater quantity management within the local government area.

In general, the guidelines require new developments to ensure that post-development runoff does not exceed pre-development discharge conditions and that all stormwater is appropriately managed on-site where feasible.

Section 6.1 of the *Guidelines* specifies that on-site detention (OSD) systems are required where increases in impervious area would otherwise result in higher downstream flows. However, the same section recognises that OSD may be omitted in specific hydraulic contexts, particularly in low-lying, tidally influenced catchments discharging directly to major waterways, such as the Cooks River.

The subject site lies within the Cooks River Estuary floodplain and discharges directly into the regional drainage system. The site’s hydraulic behaviour is primarily influenced by tidal fluctuations and regional flood levels rather than by localised site discharges. Under these conditions, the introduction of OSD would not provide a measurable benefit and could, in fact, exacerbate flooding by delaying discharge and synchronising local runoff with regional flood peaks.

Accordingly, no on-site detention is proposed for this development. The stormwater management strategy focuses on generally preserving the existing catchment boundaries, maintaining natural drainage routes, and ensuring that pre- and post-development discharge characteristics remain consistent.

The key considerations supporting this approach are summarised below:

- **No increase in runoff:** With reference to the drawing contained in Appendix A of this report, the site discharges directly to the Cooks River, a major receiving waterway with high conveyance capacity. The regional system, as represented in the Council’s adopted flood model (originally developed by Arup Group), governs the downstream hydraulic performance.
- **Floodplain interactions:** The development area receives overland flows from upstream catchments along Marsh Street and is subject to potential backwater effects from the Cooks River. Detaining local runoff would alter hydrograph timing, increasing the risk of flood level coincidence within the regional floodplain.
- **Compliance with Council Guidelines:** In accordance with Section 6.1 of the Bayside Council Stormwater Management Technical Guidelines (2021), OSD is not required where detention would not reduce peak flows or would have adverse impacts on downstream hydraulics. The proposed strategy satisfies this exemption.
- **Integration with Flood and Drainage Strategy:** The proposed diversion channel and culvert system at Gertrude and Flora Streets preserve natural conveyance of both external and on-site flows, ensuring that Council’s downstream trunk system continues to operate as intended.

6.2 Water Quantity Management Features

6.2.1 Existing

The existing site, a former golf course, currently conveys overland flow from Marsh Street through low-lying areas to the Cooks River. No on-site detention or formal quantity control measures are in place. The site's runoff is characterised by gradual sheet flow and shallow surface drainage typical of vegetated open space within a floodplain setting.

6.2.2 Proposed

No stormwater quantity measures are proposed as described in **Section 6.1**.

For the Early Works, stormwater quantity management will be achieved through surface-based systems, including overland flow paths and a naturalised diversion channel. This approach maintains existing flow paths and discharge behaviour, consistent with the site's current drainage regime.

Stormwater runoff from the site will continue to discharge to the Cooks River via existing outlet locations, in accordance with the established catchment drainage pattern.

For future development, an indicative stormwater quantity management strategy is provided in **Appendix B** (indicative layouts) and **Appendix C** (future stormwater strategy). This demonstrates that a suitable drainage approach can be implemented at the detailed design stage, consistent with the principles outlined in this report.

7 STORMWATER QUALITY, REUSE, AND MAINTENANCE

Stormwater quality management for the development has been considered in accordance with Water Sensitive Urban Design (WSUD) principles and Bayside Council requirements, with the objective of minimising pollutant export to downstream receiving waters.

For the Early Works, the site will remain predominantly undeveloped and permeable, with runoff characteristics generally consistent with existing conditions and limited potential to generate urban pollutants. As such, no permanent stormwater quality treatment measures are required at this stage.

During construction, erosion and sediment control measures will be implemented in accordance with the strategy outlined in **Section 8** to minimise sediment transport and protect downstream receiving waters.

Stormwater quality, reuse and maintenance measures will be addressed as part of future development stages. An indicative Water Sensitive Urban Design (WSUD) strategy, including stormwater treatment, rainwater reuse and maintenance considerations, is provided in **Appendix C**. This demonstrates that the future development can achieve compliance with Bayside Council water quality objectives and relevant guidelines at the detailed design stage.

8 CONSTRUCTION SOIL AND WATER MANAGEMENT

A preliminary erosion and sediment control approach has been developed for the Early Works associated with the proposed development. This includes measures to manage runoff, minimise soil disturbance, and prevent the discharge of sediment-laden water to downstream receiving environments, particularly the Cooks River.

The Early Works will be undertaken predominantly through surface-based drainage and temporary control measures, as outlined in the Erosion and Sediment Control Plans (ESCP) included in drawings **CO9919.06-SSDA200** to **SSDA260**. These drawings demonstrate that the proposed works can proceed with appropriate controls in place to protect water quality.

These measures address site establishment, demolition activities, and associated disturbance areas, and are consistent with the overall soil and water management principles adopted for the Early Works.

A detailed Construction Soil and Water Management Plan (CSWMP) will be prepared following development consent and prior to the commencement of works. This plan will be developed in accordance with Managing Urban Stormwater – Soils and Construction (Landcom, 2004) and relevant Council requirements, and will incorporate staging, monitoring, and maintenance procedures to ensure the effectiveness of all controls throughout the construction period.

8.1 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) and Bayside Council specifications.
3. All subcontractors will be informed of their responsibilities in minimising the potential for soil erosion and pollution to down slope areas.

8.2 Land Disturbance

Land disturbance will be minimised to reduce the potential for soil erosion and sediment transport. Disturbed areas will be limited to those necessary for construction activities and managed in accordance with the erosion and sediment control measures outlined in **Table 8.1**.

Table 8.1 - Limitations to access

Land Use	Limitation	Comments
Construction areas	Limited to 5 (preferably 2) metres from the edge of any essential construction	All site workers will clearly recognise these areas that, where appropriate, are identified with

	activity as shown on the engineering plans.	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	

8.3 Erosion Control Conditions

Section 2 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 and filling of the existing site to suit building layout, drainage layout and pavements.
- Stormwater and drainage works.
- Service installation works.
- Building construction works.

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

In accordance with the principles included in the Blue Book, a number of controls have been incorporated into the ESCP (refer to accompanying Drawings in **Appendix A**) and CSWMP in **Appendix E**.

8.4 Typical Management Measures

Sediment Basins

Sediment basins have been sized (based on 5-day 85th percentile rainfall) and located to ensure sediment concentrations in site runoff are within acceptable limits. Preliminary basin sizes have been calculated in accordance with the Blue Book and are based on 'Type D' soils.

Sediment Fences

Sediment fences are located around the perimeter of the site to ensure no untreated runoff leaves the site. They have also been 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 one location at the entry to the works area. This will limit the risk of sediment being transported onto public roads.

8.5 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 Water and Hydrology Assessment has been prepared to support the State Significant Development Application (SSDA) for the Concept Masterplan and Early Works associated with the Kogarah Golf Club Redevelopment, located at 13–19A Marsh Street, Arncliffe, within the Bayside Council Local Government Area.

A comprehensive civil and stormwater management strategy has been developed that provides a best-practice solution within the constraints of the existing landform, flooding regime, and proposed development layout. For the Early Works, stormwater will be managed primarily through surface-based systems, including overland flow paths and a naturalised diversion channel. The strategy also establishes a framework for future development, demonstrating that a suitable stormwater drainage system, incorporating stormwater quantity, quality and reuse measures, can be implemented at the detailed design stage in accordance with Council and State requirements.

In relation to stormwater management, the following key outcomes have been demonstrated:

- Stormwater quantity objectives are achieved without the need for on-site detention, as the site is located within the Cooks River Estuary floodplain, where detention would not provide hydraulic benefit. The proposed system maintains existing discharge locations and timing, ensuring no increase in downstream flows or adverse floodplain interactions.
- Stormwater quality objectives will be achieved through a treatment train approach incorporating gross pollutant traps (GPTs) and proprietary filtration systems (e.g. Ocean Protect PSORB units), as demonstrated by MUSIC modelling. These measures are proposed for future development stages and will be implemented during the future developments detailed design to achieve compliance with Bayside Council pollutant reduction targets in accordance with the Botany Bay & Catchment Water Quality Improvement Plan (2011).
- Water reuse measures are proposed through rainwater harvesting systems supplying non-potable demands such as toilet flushing and irrigation, reducing reliance on potable water and aligning with Water Sensitive Urban Design (WSUD) principles. These measures will be implemented as part of future development stages and refined during detailed design.
- Flooding and overland flow behaviour have been assessed through a detailed flood impact assessment. The proposed Early Works, including the naturalised diversion channel, are designed to maintain overland flow connectivity and existing flood behaviour. The broader concept, including culverts beneath Gertrude Street and Flora Street and the southern bund, demonstrates that no adverse impacts to upstream, downstream or adjoining properties are expected under all modelled events.
- Construction-phase management will be implemented through erosion and sediment control measures in accordance with Landcom's Blue Book (4th Edition) and Bayside Council guidelines, protecting downstream waterways throughout bulk earthworks and site establishment.

The flooding and flood-impact assessments demonstrate that the proposed Early Works and Concept Masterplan do not adversely affect existing flood conditions and that safe and reliable access can be achieved during major storm events, including the Probable Maximum Flood (PMF).

It is concluded that the proposed stormwater and flood-management strategy provides a suitable and robust framework for the staged development of the site, ensuring no adverse hydraulic or environmental impacts are expected as a result of the Early Works and that future development can be accommodated in accordance with the principles outlined in this report.

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

10 REFERENCES

- **Arup (2024).** *Cooks Cove Planning Proposal – Flood Risk and Impact Assessment*. Prepared for Stockland Corporation Ltd, March 2024.
- **Douglas Partners (2025).** *Cooks Cove Geotechnical Investigation Report*, Ref. 223528.01.R.001.Rev1. Prepared for Stockland Corporation Ltd.
- **Bayside Council (2023).** *Technical Specification for Stormwater Management*.
- **Bayside Council (2021).** *Development Control Plan 2021 – Part 10 Stormwater Management Technical Guidelines*.
- **Bayside Council (2018).** *Development Engineering Design Guidelines*.
- **Engineers Australia (2019).** *Australian Rainfall and Runoff 2019 – A Guide to Flood Analysis*.
- **Sydney Coastal Councils Group (2011).** *Botany Bay & Catchment Water Quality Improvement Plan (BBWQIP)*.
- **NSW Department of Environment and Conservation (2006).** *Managing Urban Stormwater: Harvesting and Reuse*. Sydney.
- **NSW Government (2005).** *Floodplain Development Manual – The Management of Flood Liable Land*. Department of Infrastructure, Planning and Natural Resources, Sydney.
- **Landcom (2004).** *Managing Urban Stormwater: Soils and Construction (4th Edition) – The Blue Book*.
- **NSW Environment Protection Authority (1998).** *Managing Urban Stormwater: Source Control*. Sydney.
- **NSW Environment Protection Authority (1997).** *Managing Urban Stormwater: Treatment Techniques*. Sydney.

11 APPENDICES

APPENDIX A
DRAWINGS BY COSTIN ROE CONSULTING FOR APPROVAL

STATE SIGNIFICANT DEVELOPMENT APPLICATION
KOGARAH GOLF CLUB REDEVELOPMENT
MARSH STREET ARNCLIFFE, NSW 2205

DRAWING LIST

DRAWING NO.	DRAWING TITLE
<u>GENERAL</u>	
C09919.06- SSDA 100	DRAWING LIST AND LOCALITY PLAN
C09919.06- SSDA 101	GENERAL NOTES
C09919.06- SSDA 110	SITE KEY PLAN

EROSION AND SEDIMENT CONTROL

C09919.06- SSDA 200	EROSION AND SEDIMENT CONTROL PLAN
C09919.06- SSDA 210	EROSION AND SEDIMENT CONTROL PLAN - ENGINEERING NOTES
C09919.06- SSDA 250	EROSION AND SEDIMENT CONTROL DETAILS - SHEET 1
C09919.06- SSDA 260	EROSION AND SEDIMENT CONTROL DETAILS - SHEET 2

EARTHWORKS PLANS

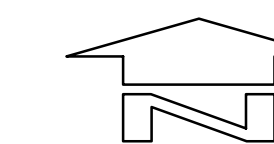
C09919.06- SSDA 300	BULK EARTHWORKS INDICATIVE STAGING PLAN
C09919.06- SSDA 301	BULK EARTHWORKS PLAN - SHEET 1
C09919.06- SSDA 302	BULK EARTHWORKS PLAN - SHEET 2
C09919.06- SSDA 303	BULK EARTHWORKS PLAN - SHEET 3
C09919.06- SSDA 350	BULK EARTHWORKS SECTIONS - SHEET 1
C09919.06- SSDA 351	BULK EARTHWORKS SECTIONS - SHEET 2

FINISHED LEVELS

C09919.06- SSDA 500 CIVIL WORKS PLAN-FLORA STREET EAST

TRUNK DRAINAGE CHANNEL DESIGN

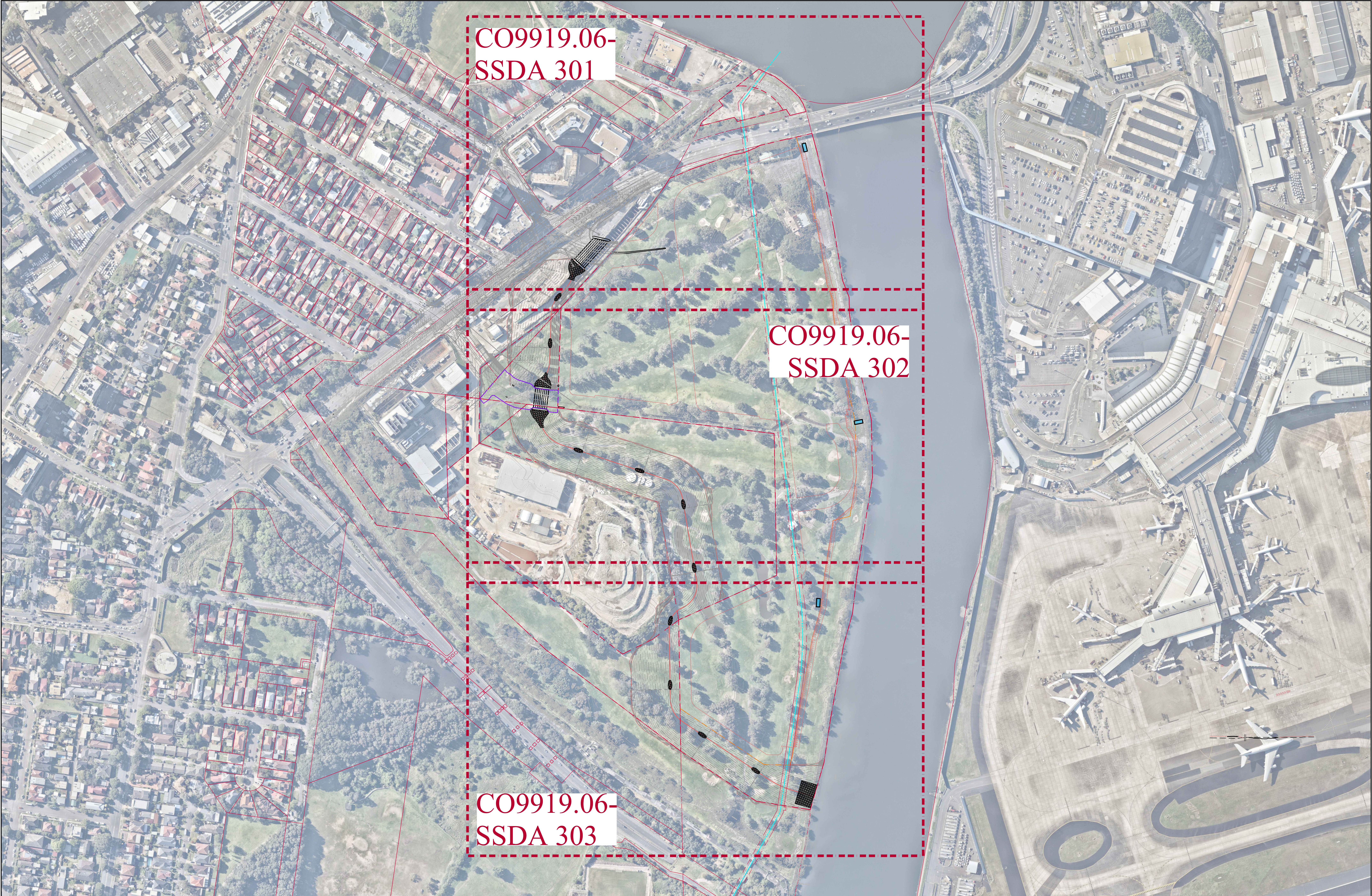
C09919.06-SSDA	901	TRUNK DRAINAGE CHANNEL LONG SECTION - SHEET 1
C09919.06-SSDA	902	TRUNK DRAINAGE CHANNEL LONG SECTION - SHEET 2
C09919.06-SSDA	903	TRUNK DRAINAGE CHANNEL TYPICAL CROSS SECTION
C09919.06-SSDA	951	TRUNK DRAINAGE CHANNEL DETAILS - SHEET 1
C09919.06-SSDA	952	TRUNK DRAINAGE CHANNEL DETAILS - SHEET 2

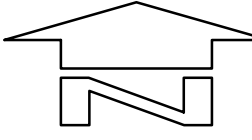


LOCALITY PLAN
NTS

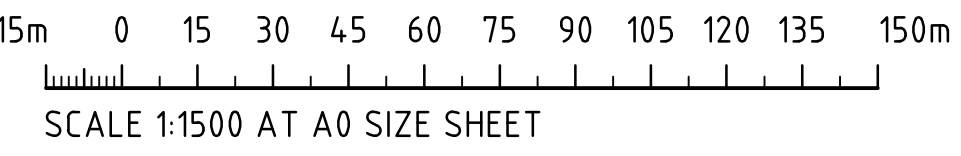
FOR DEVELOPMENT APPLICATION

ISSUED FOR DEVELOPMENT APPLICATION 13.04.26 E ISSUED FOR DEVELOPMENT APPLICATION 10.04.26 D ISSUED FOR DEVELOPMENT APPLICATION 15.12.25 C ISSUED FOR DEVELOPMENT APPLICATION 08.02.25 B ISSUED FOR DEVELOPMENT APPLICATION 20.10.25 A										PROJECT KOGARAH GOLF CLUB DEVELOPMENT PROPOSED WAREHOUSE DISTRIBUTION & OFFICE MARSH STREET, ARCHFIELD, NSW 2205										CLIENT  Stockland										PROJECT KOGARAH GOLF CLUB DEVELOPMENT PROPOSED WAREHOUSE DISTRIBUTION & OFFICE MARSH STREET, ARCHFIELD, NSW 2205										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 9254 1371 e mail@costinroe.com.au w costinroe.com.au										 CIVIL & STRUCTURAL ENGINEERS										DRAWING TITLE DRAWING LIST AND LOCALITY PLAN DRAWING NO C09916.06-SSDA100									
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 **SITE KEY PLAN**
SCALE 1:1500

FOR DEVELOPMENT APPLICATION



ISSUED FOR DEVELOPMENT APPLICATION				17.04.26	F					ARCHITECT				CLIENT				PROJECT				CONSULTANT				DRAWING TITLE			
ISSUED FOR DEVELOPMENT APPLICATION				10.04.26	E													KOGARAH GOLF CLUB DEVELOPMENT				COSTIN ROE CONSULTING				SITE KEY PLAN			
ISSUED FOR DEVELOPMENT APPLICATION				15.12.25	D													PROPOSED WAREHOUSE DISTRIBUTION & OFFICE				PO Box N419 Sydney NSW 1220							
ISSUED FOR DEVELOPMENT APPLICATION				08.12.25	C													MARSH STREET, ARNCLEIFFE, NSW 2205				Lewis & 8 Woodhill Street, Millers Point NSW 2000							
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TABLE 1 – STABILISATION REQUIREMENTS AND TREATMENT METHODS				
DURING CONSTRUCTION – TEMPORARY STABILISATION (REFER SECTIONS 5.6, 5.7 & 5.8 OF THE CSWMP FOR STABILISATION REQUIREMENTS)				
LANDS	STABILISATION REQUIREMENT	TIMEFRAMES	TREATMENT METHODS – PRODUCTS	REMARKS
ALL LANDS	C-FACTOR = 0.15 (50% EQUIVALENT GROUND COVER ^[1])	APPLIES AFTER 20 WORKING DAYS OF INACTIVITY (EVEN THOUGH WORKS MIGHT CONTINUE LATER)	SOIL BINDER (I.E. VITAL P47/STONEWALL OR EQUIVALENT ^[1]) GEOTEXTILE, JUTE MATTING, BLACK PLASTIC OR EQUIVALENT ^[1]	- SPRAY ALL SURFACES WITH VITAL P47/STONEWALL OR EQUIVALENT ^[1] - VITAL DILUTION RATE = 1:10(VITAL:WATER). -RE-APPLY/MAINTAIN AS NECESSARY (APPROX. EVERY 3-6 MONTHS WITHOUT SUITABLE VEGETATION COVER) TO ENSURE THE REQUIRED COVER IS PROVIDED. - COVER ALL EXPOSED SOILS. - RE-APPLY/MAINTAIN AS NECESSARY TO ENSURE THE REQUIRED COVER IS PROVIDED.
WATERWAYS, DRAINAGE LINES AND CONCENTRATED FLOW AREAS	C-FACTOR = 0.05 (70% GRASS COVER OR EQUIVALENT GROUND COVER ^[1])	APPLIES AFTER 10 WORKING DAYS FROM COMPLETION OF FORMATION AND BEFORE THEY ARE ALLOWED TO CARRY CONCENTRATED FLOWS.	REFER TO THE DRAIN SPECIFICATIONS DETAILED ON THE PLAN FOR SPECIFIC LINING/STABILISATION REQUIREMENTS. EXAMPLE TREATMENT METHODS ARE SHOWN BELOW.	
			TEMPORARY LINING - GEOTEXTILE (I.E. BIDIM A24 OR EQUIVALENT ^[1])	- COMPLETE ANY SUBSOIL TREATMENT BEFORE LAYING THE MATTING. - INSTALL MATTING IN ACCORDANCE WITH SD 5-7. - RE-APPLY/MAINTAIN AS NECESSARY TO ENSURE THE REQUIRED COVER IS PROVIDED.
			JUTE MESH, SEEDING AND SOIL BINDER (I.E. VITAL P47/STONEWALL OR EQUIVALENT ^[1]) - LOW FLOWS TO MODERATE	- COMPLETE SUBSOIL TREATMENT (I.E. GYPSUM LIGHTLY RIPPED INTO SUBGRADE AT A RATE OF 5 TONNES/Ha). - PLACE TOPSOIL TO A DEPTH OF AT LEAST 75mm. - COMPLETE ANY FERTILISATION AND SEEDING BEFORE LAYING THE MATTING. - INSTALL MATTING IN ACCORDANCE WITH SD 5-7. - SPRAY ALL SURFACES WITH VITAL P47/STONEWALL OR EQUIVALENT ^[1] - VITAL DILUTION RATE = 1L / m ² OF DILUTED VITAL MIXTURE. - RE-APPLY/MAINTAIN AS NECESSARY TO ENSURE THE REQUIRED COVER IS PERMANENTLY MAINTAINED.
			JUTE MATTING (~350gsm) AND SEEDING OR EQUIVALENT ^[1]) - LOW FLOWS TO MODERATE	- COMPLETE SUBSOIL TREATMENT (I.E. GYPSUM LIGHTLY RIPPED INTO SUBGRADE AT A RATE OF STONNES/Ha). - PLACE TOPSOIL TO A DEPTH OF AT LEAST 75mm. - COMPLETE ANY FERTILISATION AND SEEDING BEFORE LAYING THE MATTING. - INSTALL MATTING IN ACCORDANCE WITH SD 5-7. - RE-APPLY/MAINTAIN AS NECESSARY TO ENSURE THE REQUIRED COVER IS PERMANENTLY MAINTAINED.
			TURF REINFORCEMENT MATTING (TRM) (E.G. TERRAMAT OR EQUIVALENT ^[1]) - MODERATE FLOWS	- COMPLETE SUBSOIL TREATMENT (I.E. GYPSUM LIGHTLY RIPPED INTO SUBGRADE AT A RATE OF STONNES/Ha). - PLACE TOPSOIL TO A DEPTH OF AT LEAST 75mm. - COMPLETE ANY FERTILISATION AND SEEDING BEFORE LAYING THE MATTING. - INSTALL MATTING IN ACCORDANCE WITH SD 5-7. - RE-APPLY/MAINTAIN AS NECESSARY TO ENSURE THE REQUIRED COVER IS PERMANENTLY MAINTAINED.
			ROCK LINING - HIGH FLOWS	- COMPLETE SUBSOIL TREATMENT (I.E. GYPSUM LIGHTLY RIPPED INTO SUBGRADE AT A RATE OF STONNES/Ha). - INSTALL GEOTEXTILE UNDERLAY (IF SPECIFIED) IN ACCORDANCE WITH SD 5-7. - INSTALL ROCK ARMOURING (TO THE DEPTH AND SIZE AS SPECIFIED ON THE PLAN).
STOCKPILES	C-FACTOR = 0.10 (60% GRASS COVER OR EQUIVALENT GROUND COVER ^[1])	APPLIES AFTER 10 WORKING DAYS FROM COMPLETION OF FORMATION	SEEDING AND SOIL BINDER (I.E. VITAL P47/STONEWALL OR EQUIVALENT ^[1])	- APPLY SEED TO ALL STOCKPILE SURFACES (NOTE: SEEDING MAY NOT BE REQUIRED IF EXISTING SEEDBED IS PRESENT). -SPRAY ALL STOCKPILE SURFACES WITH VITAL P47/STONEWALL OR EQUIVALENT ^[1] - VITAL DILUTION RATE = 1:10 (VITAL:WATER). - APPLICATION RATE = 1L / m ² OF DILUTED VITAL MIXTURE. - RE-APPLY/MAINTAIN AS NECESSARY TO ENSURE THE REQUIRED COVER IS PERMANENTLY MAINTAINED.
			GEOTEXTILE, JUTE MATTING, BLACK PLASTIC OR EQUIVALENT ^[1]	- COVER ALL EXPOSED SOILS. - RE-APPLY/MAINTAIN AS NECESSARY TO ENSURE THE REQUIRED COVER IS PROVIDED.
GENERAL SURFACES	C-FACTOR = 0.10 / 0.05 (60% / 70% GRASS COVER OR EQUIVALENT GROUND COVER ^[1])	C-FACTOR = 0.1 APPLIES AFTER 10 WORKING DAYS FROM COMPLETION OF FORMATION AND C-FACTOR = 0.05 APPLIES WITHIN A FURTHER 60 DAYS	TOPSOIL, SEEDING AND SOIL BINDER (I.E. VITAL P47/STONEWALL OR EQUIVALENT ^[1])	- REFER TO SD 7-1 - COMPLETE SUBSOIL TREATMENT (I.E. GYPSUM LIGHTLY RIPPED INTO SUBGRADE AT A RATE OF STONNES/Ha). - PLACE GYPSUM TREATED TOPSOIL TO A DEPTH OF AT LEAST 75mm. - APPLY ANY FERTILISERS REQUIRED. - APPLY SEED TO ALL SURFACES. - SPRAY ALL SURFACES WITH VITAL P47/STONEWALL OR EQUIVALENT ^[1] . - VITAL DILUTION RATE = 1:10 (VITAL:WATER). - APPLICATION RATE = 1L / m ² OF DILUTED VITAL MIXTURE. - RE-APPLY/MAINTAIN AS NECESSARY TO ENSURE THE REQUIRED COVER IS PERMANENTLY MAINTAINED.
			HYDROMULCH OR EQUIVALENT ^[1]	- REFER TO SD 7-1 - COMPLETE SUBSOIL TREATMENT (I.E. GYPSUM LIGHTLY RIPPED INTO SUBGRADE AT A RATE OF STONNES/Ha). - PLACE GYPSUM TREATED TOPSOIL TO A DEPTH OF AT LEAST 75mm. - APPLY HYDROMULCH WITH APPROVED SEED MIX TO SOIL SURFACE. - RE-APPLY/MAINTAIN AS NECESSARY TO ENSURE THE REQUIRED COVER IS PERMANENTLY MAINTAINED.
[1] - EQUIVALENT COVER/PRODUCT MUST ACHIEVE THE EQUIVALENT C-FACTOR WITH PROVEN RESEARCH/DOCUMENTATION TO VERIFY THIS. STANDARD DRAWINGS REFERENCED CAN BE LOCATED IN THE 'SOILS & CONSTRUCTION, MANAGING URBAN STORMWATER – VOLUME 1' BOOK BY LANDCOM. ALTERNATIVE DETAILS MAY BE SOUGHT IN CONSULTATION WITH THE ENGINEER				

DUST CONTROL NOTES:

- IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE DUST CONTROL MEASURES ARE APPLIED AND MAINTAINED IN ACCORDANCE WITH THE GOVERNING AUTHORITIES REQUIREMENTS.
- THE APPLICATION OF LIQUID BASED DUST SUPPRESSION MEASURES MUST BE SUCH THAT SEDIMENT LADEN RUNOFF RESULTING FROM SUCH MEASURES DOES NOT CREATE A TRAFFIC OR ENVIRONMENTAL HAZARD. (EG UTILISING SEDIMENT CONTROLS)
- DUST GENERATION ASSOCIATED WITH WIND EROSION TO BE CONTROLLED USING WATER TRUCKS, DUST SUPPRESSING FOG, MIST GENERATORS, SEALANT PLACED OVER THE SOIL, SURFACE ROUGHENING OR RE-VEGETATION.
- THE FOLLOWING ACTIVITIES SHALL BE ADOPTED, IF NECESSARY, TO MANAGE DUST CONTROL ON SITE:
 - LIMITING THE AREA OF SOIL DISTURBANCE AT ANY GIVEN TIME
 - REPLACING TOPSOIL AFTER COMPLETION OF EARTHWORKS.
 - PROGRAMMING WORK TO MINIMISE THE LIFE OF STOCKPILES.
 - TEMPORARILY STABILISING LONG-TERM STOCKPILES.
 - GRAVELLING UNSEALED ACCESS AND HAUL ROADS.
 - MINIMISING TRAFFIC MOVEMENT ON EXPOSED SURFACES.
 - LIMITING VEHICULAR TRAFFIC TO 15km/h.
 - RETAINING EXISTING VEGETATION AS WIND BREAKS.
 - UTILISING A WATER CART WITH POTABLE WATER OR SEDIMENT CONTROL BASIN WATER
- OIL, LANDFILL GAS CONDENSATE OR ANY CONTAMINATED LEACHATE IS NOT TO BE USED FOR DUST SUPPRESSION.

EROSION CONTROL NOTES

ALL SEDIMENT CONTROL WORK INCLUDING DIVERSION BANKS, CATCH DRAINS, DIVERSION DRAINS AND SEDIMENT FENCES SHALL BE COMPLETED IN ACCORDANCE WITH THE STAGED PLANS PRESENTED AND SHALL FACILITATE A STAGED CONSTRUCTION METHODOLOGY.

- ALL EROSION & SEDIMENT CONTROLS SHALL BE COMPLETED IN ACCORDANCE WITH THE 'SOILS AND CONSTRUCTION, MANAGING URBAN STORMWATER – THE BLUE BOOK' BY LANDCOM.
- SEDIMENT FENCES AND SEDIMENT FENCE RETURNS SHALL BE ERRECTED CONVEX TO THE CONTOUR TO POND WATER.
- STRAW BALE BARRIERS & GEOFABRIC FENCES OR SEDIMENT 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 SEDIMENT BASIN EMBANKMENTS ARE TO BE MACHINE COMPACTED, SEEDED AND MULCHED FOR TEMPORARY VEGETATION COVER AS SOON AS THEY HAVE BEEN FORMED. REFER TO TABLE 1 FOR APPROVED STABILISATION METHODS.
- CLEAN OR NON-SITE WATER IS TO BE DIVERTED AWAY FROM DISTURBED GROUND AND INTO THE DRAINAGE SYSTEM OVER STABLE SURFACES.
- 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 OF 5mm OR GREATER WITHIN A 24 HOUR PERIOD FOR STRUCTURAL DAMAGE OR CLOGGING. TRAPPED MATERIAL IS TO BE REMOVED TO A SAFE, APPROVED LOCATION.
- THE SITE IS TO BE INSPECTED FOLLOWING A RAINFALL EVENT OF 5mm OR GREATER WITHIN A 24 HOUR PERIOD FOR EVIDENCE OF EROSION AND RESPOND WITH INCREASED CONTROL IF REQUIRED.
- 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 TO DIRECT WATER TO A STABLE OUTLET OVER THE BATTER OR INTERNALLY TOWARDS SEDIMENT CONTROL. 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 PERMANENT STABILISATION OF THE SITE IS COMPLETE (I.E. BY TOPSOILING, PAVING ETC.) AND THE SITE IS DEEMED TO BE STABLE IN THE OPINION OF A SUITABLY QUALIFIED PERSON ALL TEMPORARY WORK SUCH AS SEDIMENT FENCE, DIVERSION DRAINS ETC SHALL BE REMOVED.
- ALL STOCKPILES ARE TO BE SUITABLY COVERED AND STABILIZED 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 INDICATED ON THE APPROVED EROSION AND SEDIMENTATION CONTROL PLAN OR APPROVED FOR SUCH USE BY THE SITE MANAGER. A BUFFER ZONE SHALL EXIST BETWEEN STOCKPILE SITES AND ANY STREAM OR FLOW PATH IN ACCORDANCE WITH THE CSWMP. ALL STOCKPILES SHALL BE ADEQUATELY PROTECTED FROM EROSION AND CONTAMINATION OF THE SURROUNDING AREA BY USE OF THE MEASURES IN THE APPROVED ESCP.
- ACCESS AND EXIT AREAS SHALL INCLUDE TRUCK SHAKER GRID OR OTHER METHODS APPROVED BY THE SITE MANAGER FOR THE REMOVAL OF SOIL MATERIALS FORM 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 SEDIMENTS 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 ESCP / 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 WOO'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 SUCH THAT THE BASIN HAS SUFFICIENT CAPACITY TO CONTAIN RUNOFF AND SEDIMENT FROM SUBSEQUENT RAINFALL EVENTS.
- WATER TO BE DOSED WITH GYPSUM TO ACCELERATE SETTLEMENT OF SUSPENDED SOLIDS AS REQUIRED.
- GYPSUM DOSAGE RATE TO BE APPLIED AT APPROX. 32-50kg 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 PLUS NO VISIBLE OIL OR GREASE. 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.

INSTREAM WORKS:

- SEDIMENT FENCES AND SEDIMENT FENCE RETURNS TO BE ERRECTED PRIOR TO THE COMMENCEMENT OF ANY WORK. SEDIMENT FENCES TO REMAIN UNTIL COMPLETION OF INSTREAM WORK IN THESE LOCATION TO PROTECT EXISTING DOWNSTREAM PROPERTIES AND ROAD PAVEMENT. (REFER TO DRG-EW204 FOR DETAILS).
- UNDERTAKE WORK DURING A PERIOD OF DRY FORECASTED WEATHER.
- PROTECT DISTURBED AREA WITH COFFERDAMS AS REQUIRED.
- TEMPORARY LOW FLOW DIVERSION PIPE OR PUMPED SYSTEM MAY BE INSTALLED AT THE BASE OF CHANNEL TO DIVERT CLEAN WATER FROM UPSTREAM BASEFLOW.
- UNDERTAKE ALL INSTREAM WORK IN THE SPECIFIED SECTION OF THE CHANNEL IN ACCORDANCE WITH APPROVED PLANS AND IMMEDIATELY PLANT TO STABILISE THE WORKS.
- PLANT WITH APPROPRIATE SPECIES, AT A DENSITY THAT WOULD NATURALLY OCCUR.

INSPECTION & MAINTENANCE NOTES:

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE ADEQUATE INSPECTIONS AND MAINTENANCE ARE CARRIED OUT DURING SITE WORKS. DAILY AND WEEKLY INSPECTION CHECKLISTS HAVE BEEN PROVIDED IN THE COSTIN ROE CIVIL ENGINEERING REPORT C09919-06-12.rpt.

AS NOTED, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE ADEQUATE MAINTENANCE OF EROSION & SEDIMENT CONTROL MEASURES ARE UNDERTAKEN DURING THE WORKS PERIOD. DAMAGED, DISLOGGED OR FAULTY ESC MEASURES ARE TO BE IMMEDIATELY RECTIFIED AND THE SURROUNDING AREA IS TO BE REMEDIATED AS PER NOTES ON THIS DRAWING, THE SWMP AND THE LANDCOM 'BLUE BOOK'.

SEDIMENTATION BASIN NOTE:

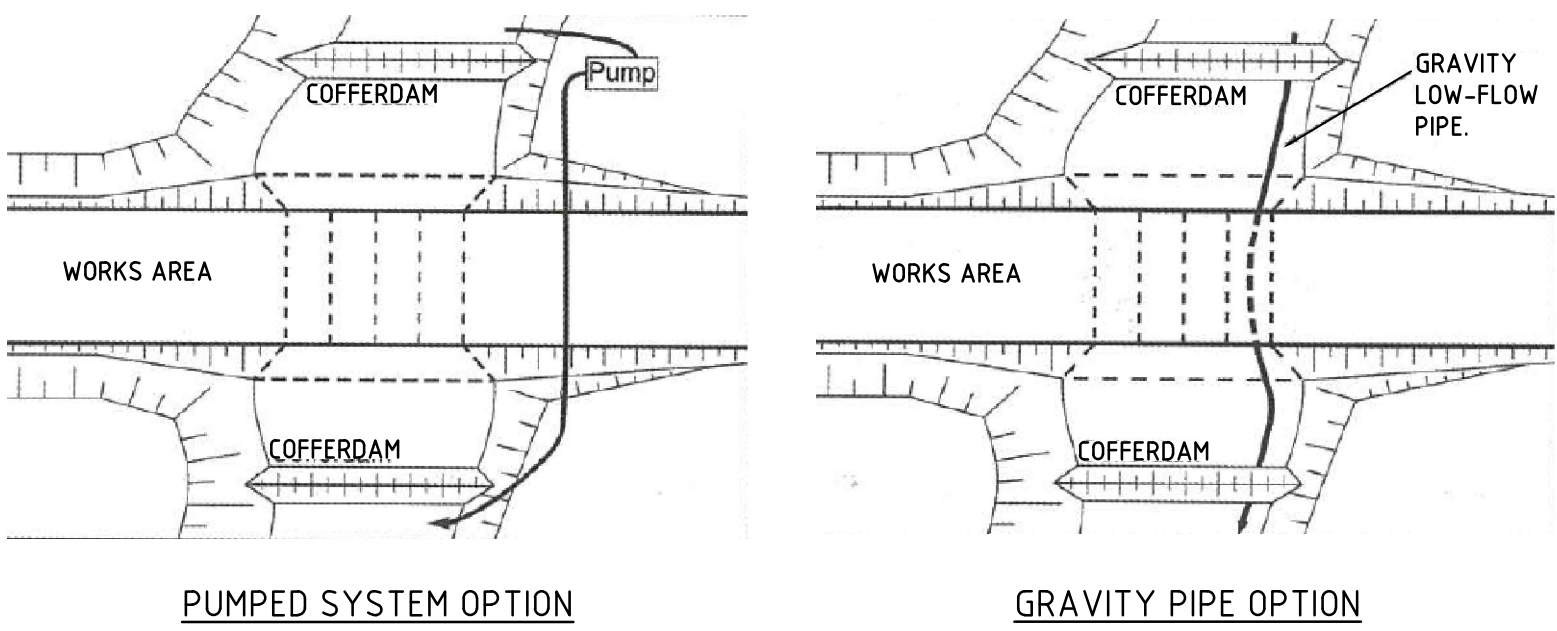
REFER TO SEDIMENT & EROSION CONTROL NOTES.

FOR SEDIMENT AND EROSION CONTROL DETAILS, REFER TO THE LANDCOM 'BLUE BOOK' AND EXTRACTS ON DRAWING C013362.16-C250.

SEDIMENTATION BASIN SIZING BASED ON RECOMMENDATIONS OF 'SOILS AND CONSTRUCTION, MANAGING URBAN STORMWATER- THE BLUE BOOK'. CAPACITY BASED ON 5-DAY RAINFALL DEPTHS AT 85th PERCENTILE INTENSITY (35mm) IN THE PENRITH CATCHMENT AREA.

NOTES:

- ASSUME TYPE D SOIL (CLAY/SILT/CLAY)
- ASSUME GROUP D SOIL (HIGH PLASTICITY AND SHRINK/SWELL PROPERTIES)
- REFER TO DRAWING C013362.02-C206 FOR SEDIMENTATION BASIN CALCULATIONS

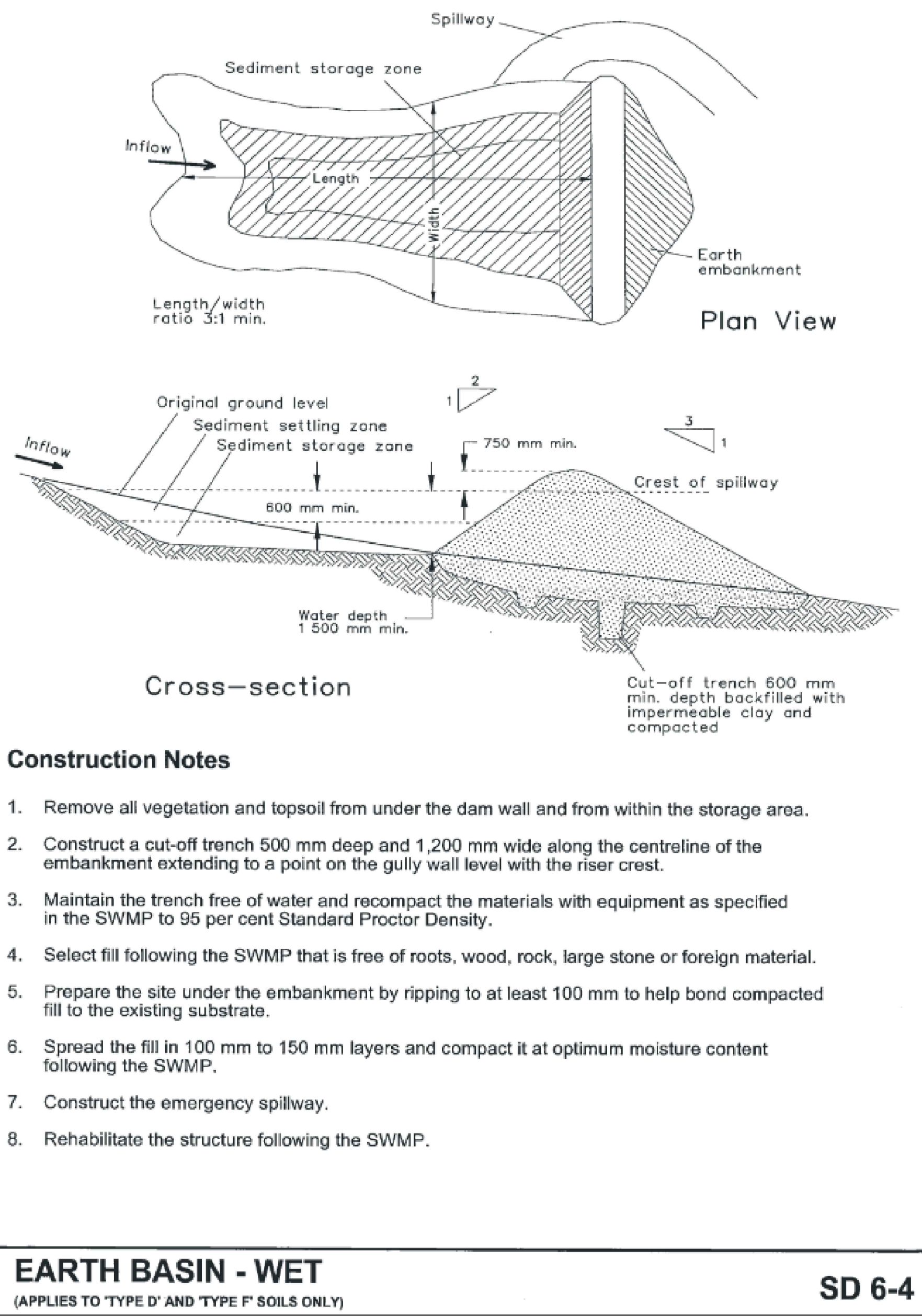


INSTREAM WORKS COFFERDAM ARRANGEMENT

SITE PREPARATION NOTES:

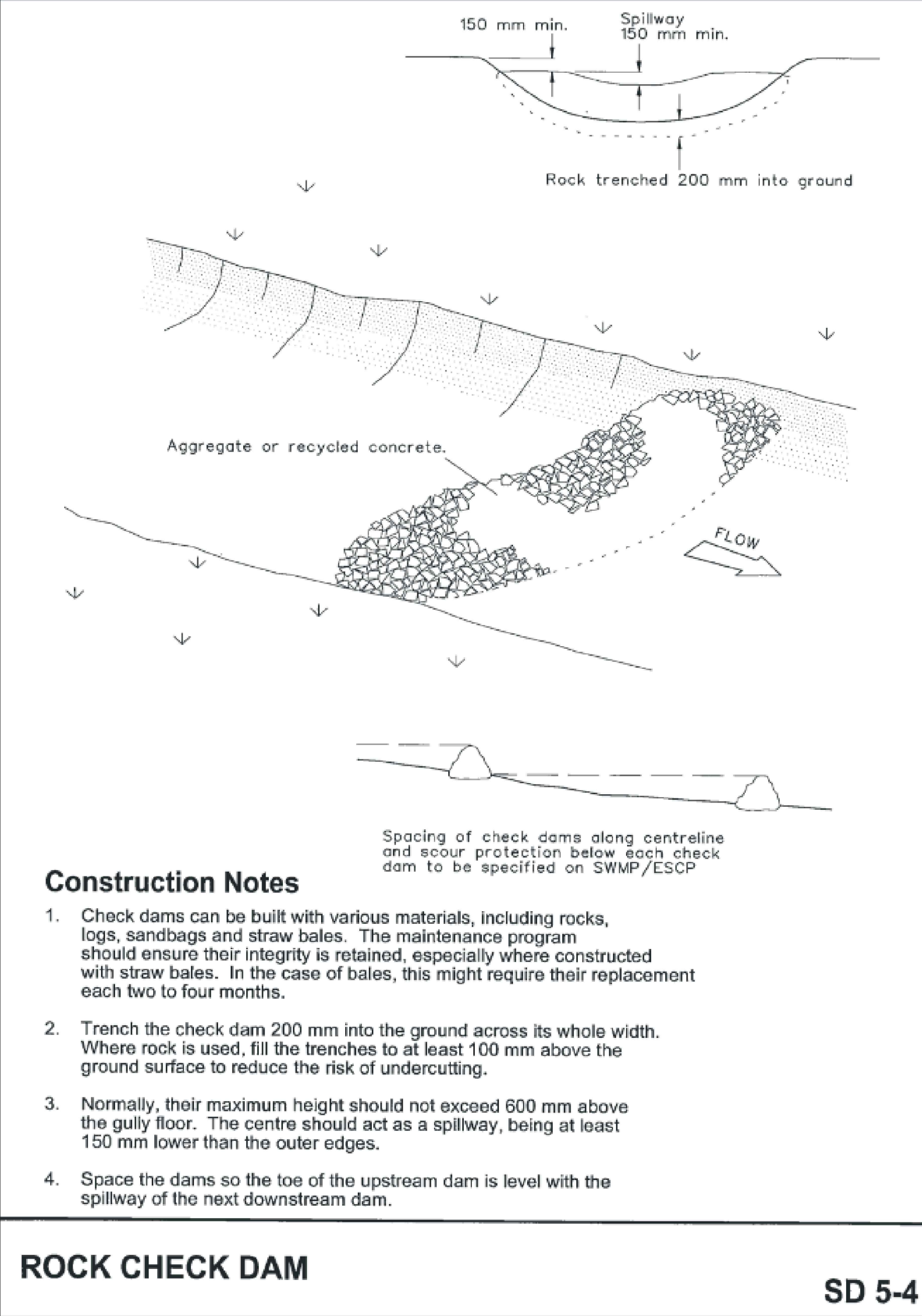
- ALL EARTHWORKS SHALL BE COMPLETED GENERALLY IN ACCORDANCE WITH THE GUIDELINES SPECIFIED BY THE GEOTECHNICAL REPORT #5204.00 & 73624.03 PROVIDED BY DOUGLAS PARTNERS DATED DEC 2015 & MAY 2017.
- EXISTING LEVELS ARE BASED ON INFORMATION PROVIDE BY THE FOLLOW SOURCE:
 - G&B SURVEY SOLUTIONS DRG No. 5288-001 DATED 08.09.25
 - MNG LANDPARTNERS DRG No. SY075733.001 DATED 24.01.25
 - 75733.00 COMBINED ANNOTATION DTM DATED 28.03.23
 - DEGOTARDI SMITH & PARTNERS #28431a02 DATED 10.08.01
- STRIP ANY TOP SOIL OR DELETERIOUS MATERIAL AND DISPOSE OF FROM SITE OR STORE AS DIRECTED. TOPSOIL BLENDING IS NOT ACCEPTABLE. ANY BLENDING PROPOSAL IS TO BE REFERRED TO THE ENGINEER.
- 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/-210mm ELSEWHERE.
- PREPARE STEEP BATTERS TO RECEIVE FILL BY CONSTRUCTING BENCHING TO FACILITATE FILL PLACEMENT AND COMPACTION. WHERE EXPOSED ROCK (WEATHERED SHALE OR SANDSTONE) IS ENCOUNTERED AT CUT SUBGRADE LEVEL, THE EARTHWORKS CONTRACTOR IS TO ALLOW TO RIP THE SURFACE TO A NOMINAL 0.3-0.4m DEPTH AND RECOMPACT (PER THE ENGINEERING SPEC) AS REQUIRED.
- 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 EARTHWORKS SHALL BE COMPLETED UNDER LEVEL 1 CONTROL IN ACCORDANCE WITH AS 3798-2007.
- 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.

TABLE 2 – LIMITATIONS TO ACCESS DURING CONSTRUCTION		
LAND USE	LIMITATION	REMARKS
CONSTRUCTION AREAS	LIMITED TO 5 (PREFERABLE 2) METRES FROM THE EDGE OF ANY ESSENTIAL CONSTRUCTION ACTIVITY AS SHOWN ON ENGINEERING PLANS	ALL SITE WORKERS SHOULD CLEARLY RECOGNISE THESE AREAS THAT, WHERE APPROPRIATE, ARE IDENTIFIED WITH BARRIER FENCING (UPSLOPE) AND SEDIMENT FENCE (DOWNSLOPE) OR SIMILAR MATERIALS.
ACCESS CORRIDORS	LIMITED TO A MAXIMUM WIDTH OF 7 METERS	THE SITE MANAGER WILL DETERMINE AND MARK THE LOCATION OF THESE ZONES ON SITE. THEY CAN VARY IN POSITION SO AS TO BEST CONSERVE EXISTING VEGETATION AND PROTECT DOWNSTREAM AREAS WHILE BEING CONSIDERATE OF THE NEEDS EFFICIENT WORKS ACTIVITIES. ALL SITE WORKERS WILL CLEARLY RECOGNISE THESE BOUNDARIES.
REMAINING LANDS, INCLUDING REVEGETATION AREA	ENTRY PROHIBITED EXCEPT FOR ESSENTIAL MANAGEMENT WORKS	THINNING OF GROWTH MIGHT BE NECESSARY, FOR EXAMPLE, FOR FIRE REDUCTION OR WEED REMOVAL.



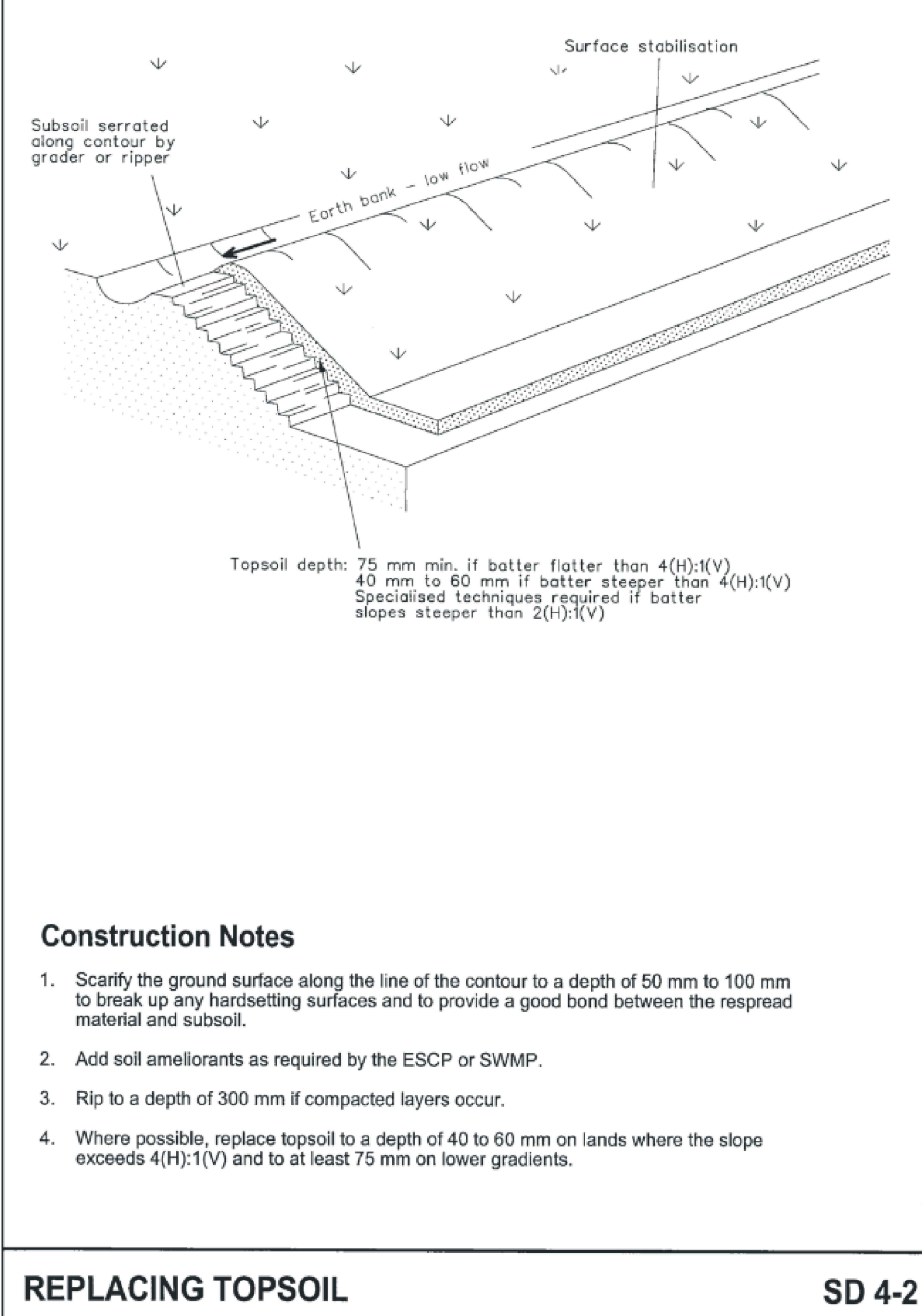
- Construction Notes**
1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
 2. Construct a cut-off trench 500 mm deep and 1,200 mm wide along the centreline of the embankment extending to a point on the gully wall level with the riser crest.
 3. Maintain the trench free of water and recompact the materials with equipment as specified in the SWMP to 95 per cent Standard Proctor Density.
 4. Select fill following the SWMP that is free of roots, wood, rock, large stone or foreign material.
 5. Prepare the site under the embankment by ripping to at least 100 mm to help bond compacted fill to the existing substrate.
 6. Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP.
 7. Construct the emergency spillway.
 8. Rehabilitate the structure following the SWMP.

EARTH BASIN - WET
(APPLIES TO TYPE D' AND TYPE F' SOILS ONLY) **SD 6-4**



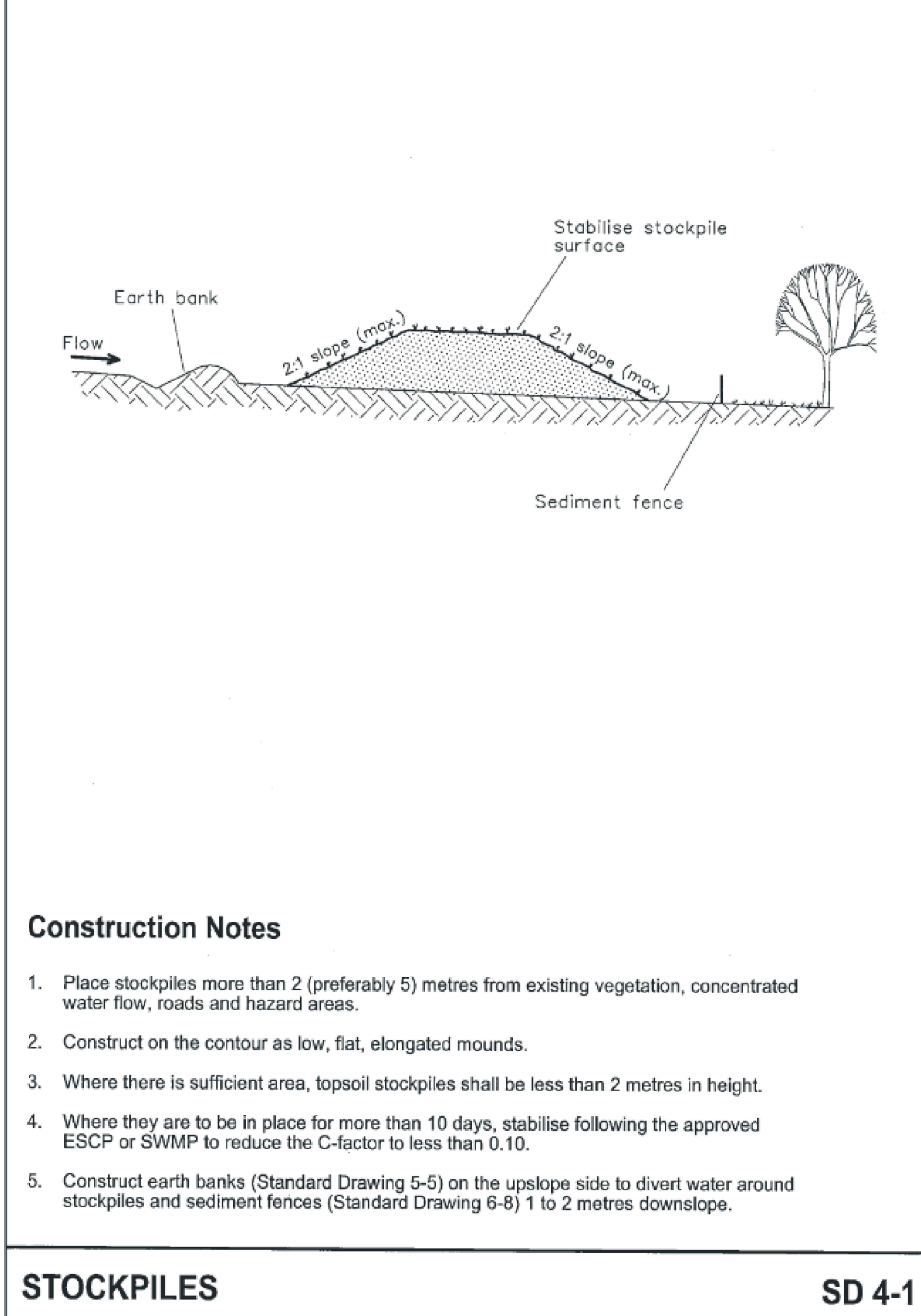
- Construction Notes**
1. Check dams can be built with various materials, including rocks, logs, sandbags and straw bales. The maintenance program should ensure their integrity is retained, especially where constructed with straw bales. In the case of bales, this might require their replacement each two to four months.
 2. Trench the check dam 200 mm into the ground across its whole width. Where rock is used, fill the trenches to at least 100 mm above the ground surface to reduce the risk of undercutting.
 3. Normally, their maximum height should not exceed 600 mm above the gully floor. The centre should act as a spillway, being at least 150 mm lower than the outer edges.
 4. Space the dams so the toe of the upstream dam is level with the spillway of the next downstream dam.

ROCK CHECK DAM **SD 5-4**



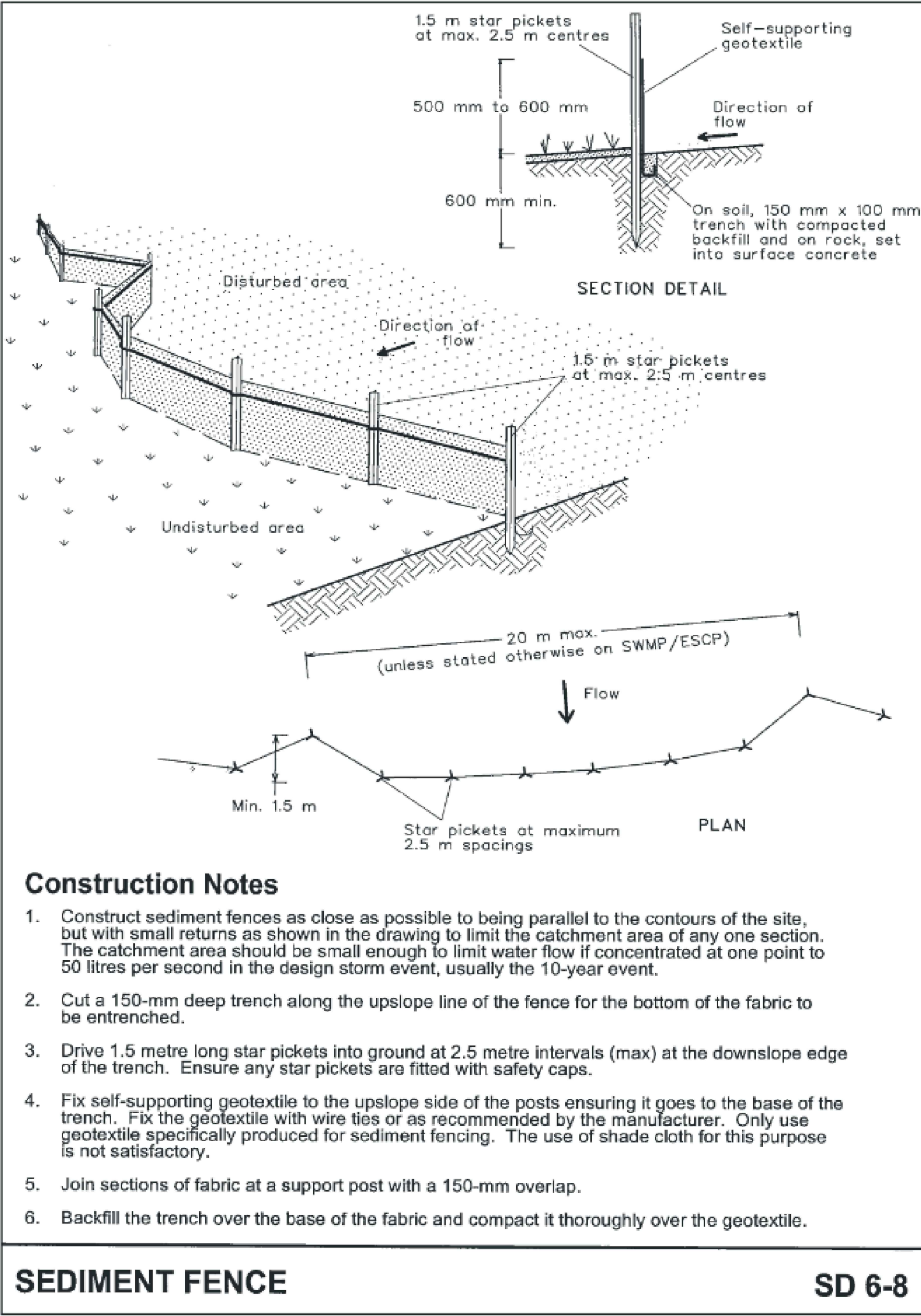
- Construction Notes**
1. Scarify the ground surface along the line of the contour to a depth of 50 mm to 100 mm to break up any handsetting surfaces and to provide a good bond between the respread material and subsoil.
 2. Add soil ameliorants as required by the ESCP or SWMP.
 3. Rip to a depth of 300 mm if compacted layers occur.
 4. Where possible, replace topsoil to a depth of 40 to 60 mm on lands where the slope exceeds 4(H):1(V) and to at least 75 mm on lower gradients.

REPLACING TOPSOIL **SD 4-2**



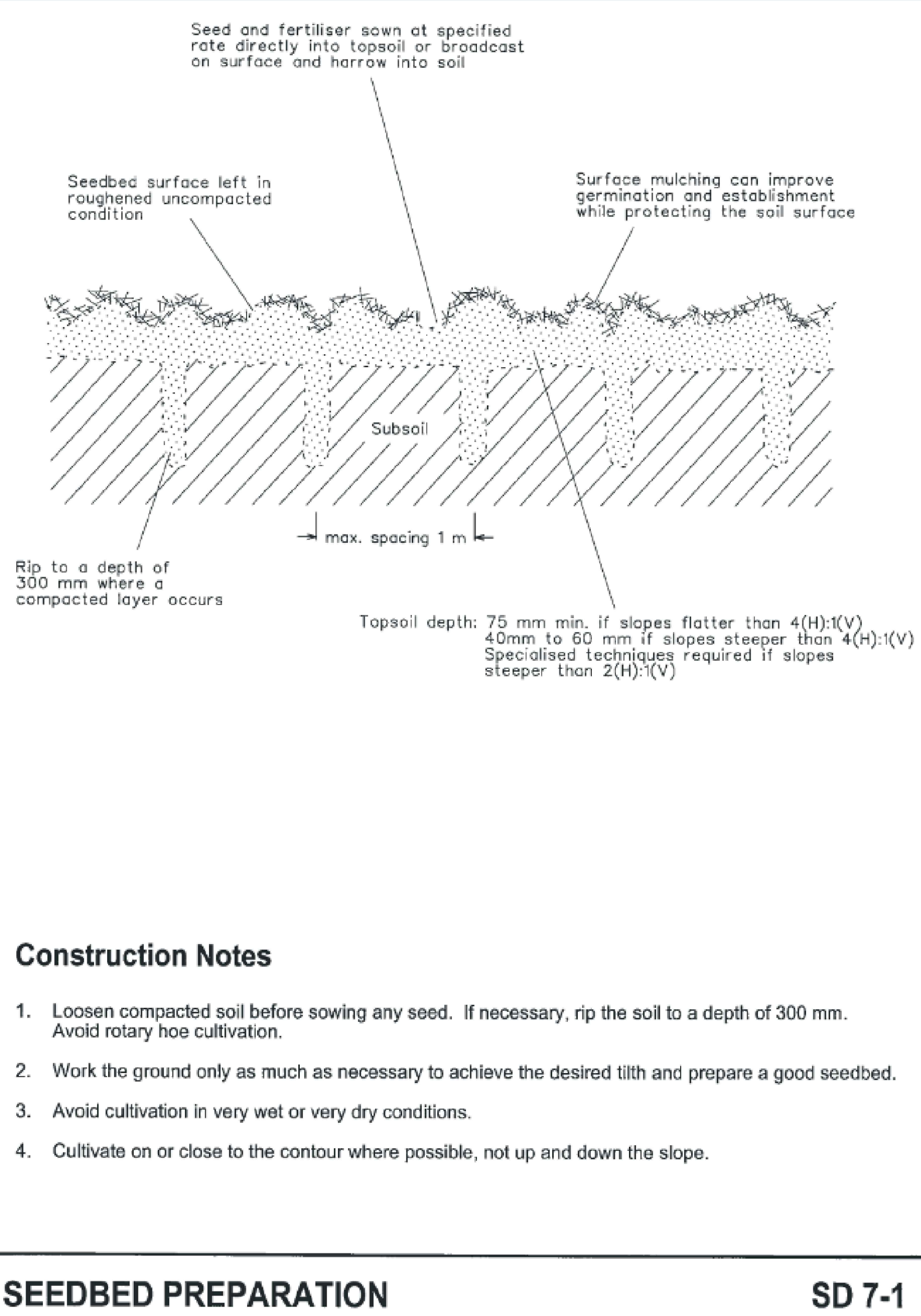
- Construction Notes**
1. Place stockpiles more than 2 (preferably 5) metres from existing vegetation, concentrated water flow, roads and hazard areas.
 2. Construct on the contour as low, flat, elongated mounds.
 3. Where there is sufficient area, topsoil stockpiles shall be less than 2 metres in height.
 4. Where they are to be in place for more than 10 days, stabilise following the approved ESCP or SWMP to reduce the C-factor to less than 0.10.
 5. Construct earth banks (Standard Drawing 5-5) on the upslope side to divert water around stockpiles and sediment fences (Standard Drawing 6-8) 1 to 2 metres downslope.

STOCKPILES **SD 4-1**



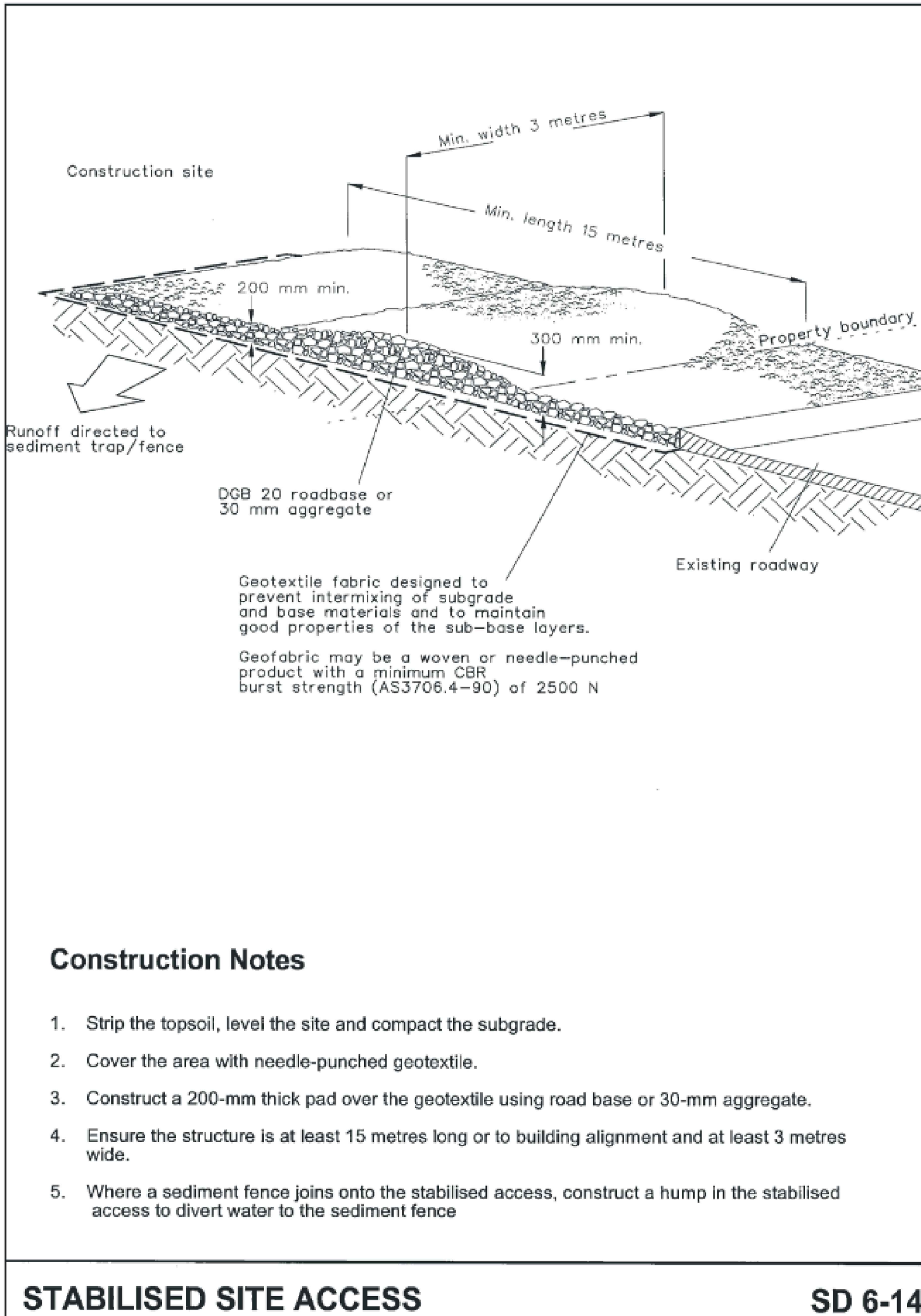
- Construction Notes**
1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.
 2. Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
 3. Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
 4. Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.
 5. Join sections of fabric at a support post with a 150-mm overlap.
 6. Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

SEDIMENT FENCE **SD 6-8**



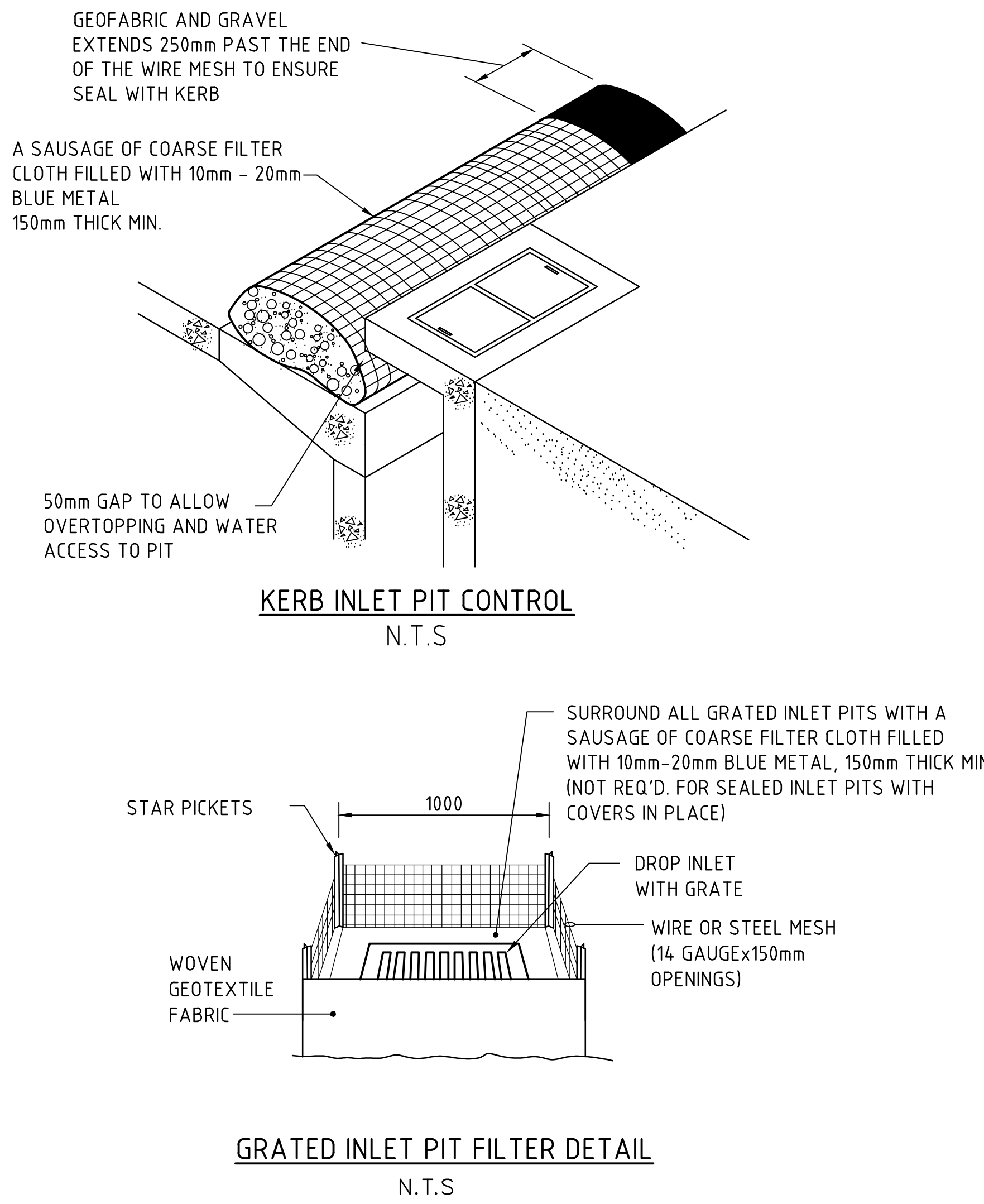
- Construction Notes**
1. Loosen compacted soil before sowing any seed. If necessary, rip the soil to a depth of 300 mm. Avoid rotary hoe cultivation.
 2. Work the ground only as much as necessary to achieve the desired tillth and prepare a good seedbed.
 3. Avoid cultivation in very wet or very dry conditions.
 4. Cultivate on or close to the contour where possible, not up and down the slope.

SEEDBED PREPARATION **SD 7-1**



- Construction Notes**
1. Strip the topsoil, level the site and compact the subgrade.
 2. Cover the area with needle-punched geotextile.
 3. Construct a 200-mm thick pad over the geotextile using road base or 30-mm aggregate.
 4. Ensure the structure is at least 15 metres long or to building alignment and at least 3 metres wide.
 5. Where a sediment fence joins onto the stabilised access, construct a hump in the stabilised access to divert water to the sediment fence

STABILISED SITE ACCESS **SD 6-14**

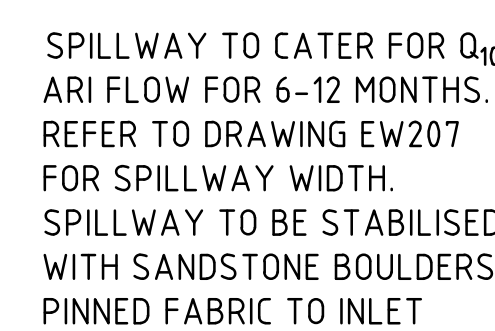
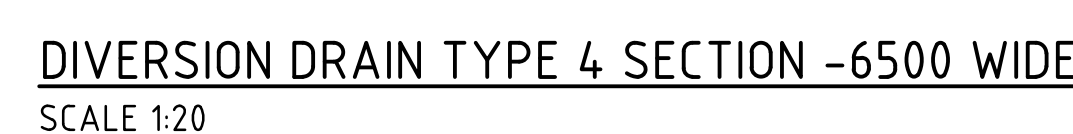
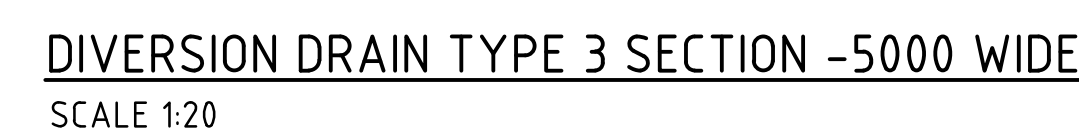
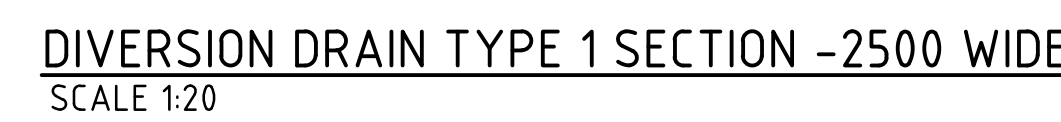
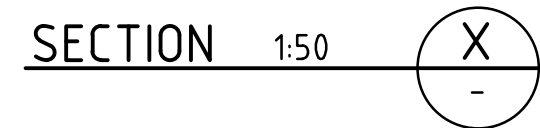


NOTE: ADOPT ABOVE DETAILS AROUND ALL PITS WITHIN AREA ENCOMPASSED BY SILT FENCE & TO PITS ON THE ROAD ADJACENT TO SITE BOUNDARY.

EROSION & SEDIMENT CONTROL NOTES:
REFER TO DRAWING SSDA200 FOR EROSION & SEDIMENT CONTROL NOTES

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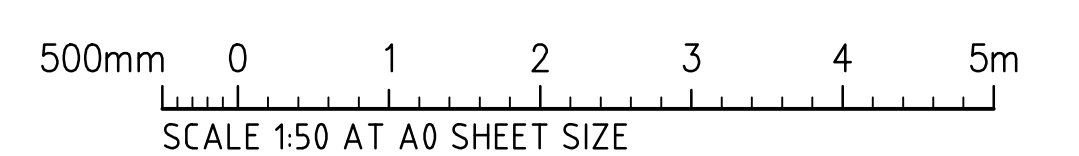
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ISSUED FOR DEVELOPMENT APPLICATION				08.12.25				A				GRIMSHAW				Stockland				KOGARAH GOLF CLUB DEVELOPMENT				PO Box N419 Sydney NSW 1220				EROSION & SEDIMENT CONTROL				DETAILS - SHEET 1			
AMENDMENTS				DATE				ISSUE				AMENDMENTS				DATE				DESIGNED | DRAWN | DATE				CHECKED | SIZE | SCALE | CAD REF.				DRAWING No				C09916.06- SSDA250			
																				MARSH STREET, ARNCLIFFE, NSW 2205				Levin & N Woodmill Street, Millers Point NSW 2000				CIVIL & STRUCTURAL ENGINEERS				B			
																				p: +61 2 9251 7699				e: mail@costinroe.com.au											
																				f: +61 2 9241 3731				w: costinroe.com.au											



TYPICAL SEDIMENT CONTROL BASIN PLAN
SCALE 1:250



EROSION & SEDIMENT CONTROL NOTES:
REFER TO DRAWING SSDA200 FOR EROSION & SEDIMENT CONTROL NOTES



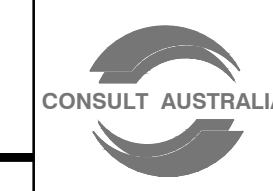
FOR DEVELOPMENT APPLICATION

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GRIMSHAW



PROJECT
KOGARAH GOLF CLUB DEVELOPMENT
PROPOSED WAREHOUSE DISTRIBUTION & OFFICE
MARSH STREET, ARNCLIFFE, NSW 2205



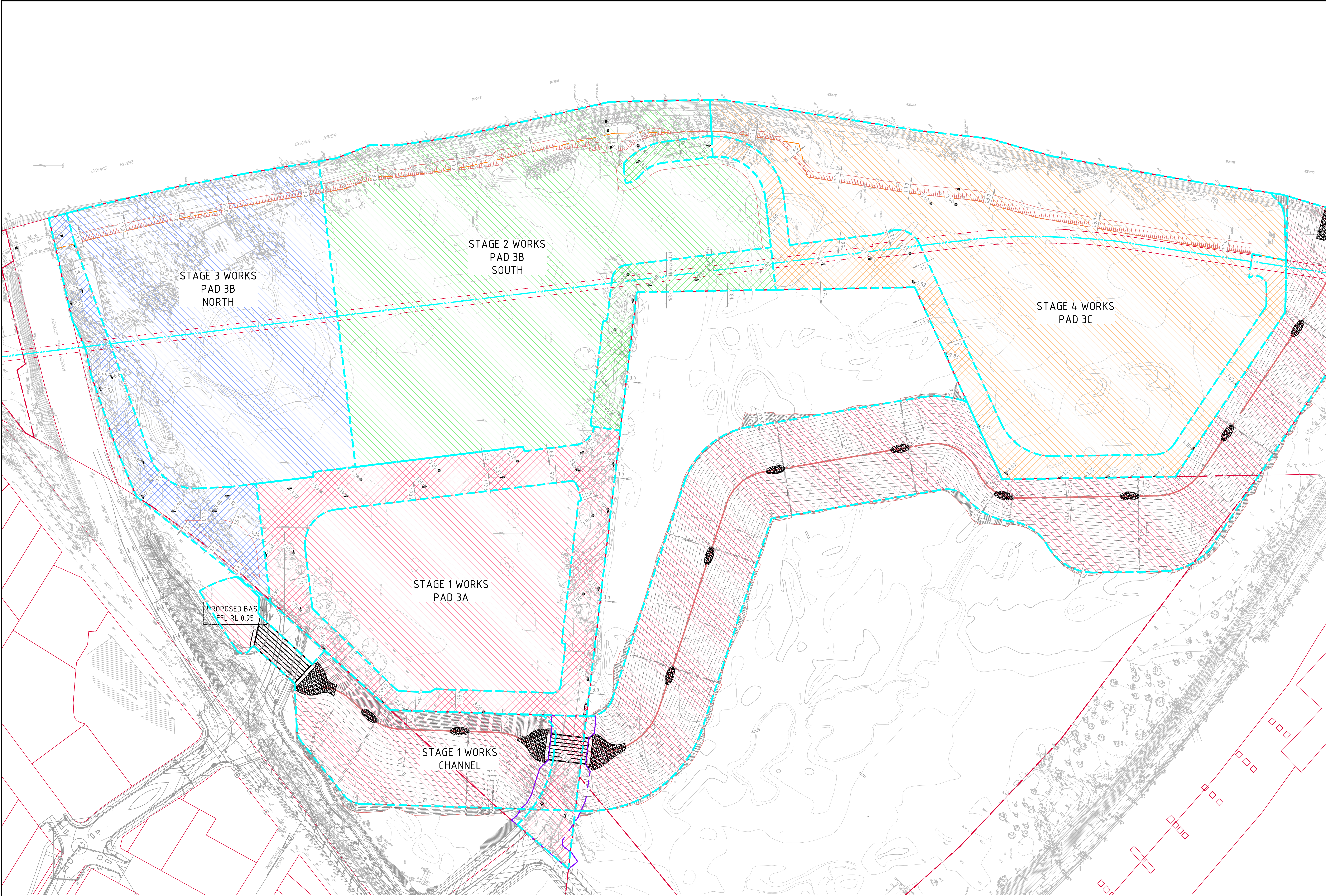
Costin Roe Consulting Pty Ltd.
 ABN 50 003 696 446
 PO Box N419 Sydney NSW 1220
 Level 4, 8 Windmill Street, Millers Point NSW 2000
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 e: mail@costinroe.com.au w: costinroe.com.au



DRAWING TITLE
EROSION & SEDIMENT CONTROL
DETAILS - SHEET 2

DRAWING No C09916.06- SS DA260

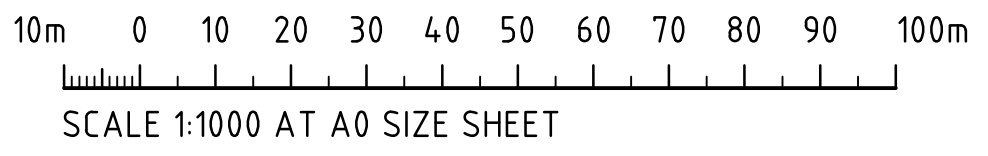
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 **BULK EARTHWORKS STAGING PLAN**
SCALE 1:1000

EARTHWORK ESTIMATES -STAGED PLAN			
STAGE 1 PAD		STAGE 3 PAD	
WORKS AREA	= 1.87 Ha	WORKS AREA	= 2.50 Ha
TOPSOIL STRIP (TO BE EXPORTED/REUSED) (150mm OVER 1.87 Ha)	=(-2,805m³)	TOPSOIL STRIP (TO BE EXPORTED/REUSED) (150mm OVER 2.50 Ha)	=(-3,750m³)
DELETERIOUS MATERIAL STRIP (TO BE EXPORTED) (150mm OVER 1.87 Ha)	=(-2,805m³)	DELETERIOUS MATERIAL STRIP (TO BE EXPORTED) (150mm OVER 2.50 Ha)	=(-3,750m³)
CUT	= -0m³	CUT	= -26,150m³
FILL	= +9,950m³	FILL	= +3,850m³
ALLOWANCES DETAILED EXCAVATION (1,500m³/Ha)	= -2,800m³	ALLOWANCES DETAILED EXCAVATION (1,500m³/Ha)	= -3,750m³
DIFFERENCE	= +7,150m³ (i.e. FILL OVER CUT)	DIFFERENCE	= -26,050m³ (i.e. CUT OVER FILL)
STAGE 1 ROAD		STAGE 3 ROAD	
WORKS AREA	= 1.05 Ha	WORKS AREA	= 0.65 Ha
TOPSOIL STRIP (TO BE EXPORTED/REUSED) (150mm OVER 1.05 Ha)	=(-1,575m³)	TOPSOIL STRIP (TO BE EXPORTED/REUSED) (150mm OVER 0.65 Ha)	=(-975m³)
DELETERIOUS MATERIAL STRIP (TO BE EXPORTED) (150mm OVER 1.05 Ha)	=(-1,575m³)	DELETERIOUS MATERIAL STRIP (TO BE EXPORTED) (150mm OVER 0.65 Ha)	=(-975m³)
CUT	= -0m³	CUT	= -1,400m³
FILL	= +16,650m³	FILL	= +7,200m³
ALLOWANCES DETAILED EXCAVATION (1,500m³/Ha)	= -1,575m³	ALLOWANCES DETAILED EXCAVATION (1,500m³/Ha)	= -975m³
DIFFERENCE	= +15,075m³ (i.e. FILL OVER CUT)	DIFFERENCE	= +4,825m³ (i.e. FILL OVER CUT)
STAGE 2 PAD		STAGE 4 PAD	
WORKS AREA	= 3.79 Ha	WORKS AREA	= 3.00 Ha
TOPSOIL STRIP (TO BE EXPORTED/REUSED) (150mm OVER 3.79 Ha)	=(-5,685m³)	TOPSOIL STRIP (TO BE EXPORTED/REUSED) (150mm OVER 3.00 Ha)	=(-4,500m³)
DELETERIOUS MATERIAL STRIP (TO BE EXPORTED) (150mm OVER 3.79 Ha)	=(-5,685m³)	DELETERIOUS MATERIAL STRIP (TO BE EXPORTED) (150mm OVER 3.00 Ha)	=(-4,500m³)
CUT	= -750m³	CUT	= -2,100m³
FILL	= +27,050m³	FILL	= +11,500m³
ALLOWANCES DETAILED EXCAVATION (1,500m³/Ha)	= -5,685m³	ALLOWANCES DETAILED EXCAVATION (1,500m³/Ha)	= -4,500m³
DIFFERENCE	= +20,615m³ (i.e. FILL OVER CUT)	DIFFERENCE	= +4,900m³ (i.e. FILL OVER CUT)
STAGE 2 ROAD		STAGE 4 ROAD	
WORKS AREA	= 0.77 Ha	WORKS AREA	= 0.93 Ha
TOPSOIL STRIP (TO BE EXPORTED/REUSED) (150mm OVER 0.77 Ha)	=(-1,155m³)	TOPSOIL STRIP (TO BE EXPORTED/REUSED) (150mm OVER 0.93 Ha)	=(-1,395m³)
DELETERIOUS MATERIAL STRIP (TO BE EXPORTED) (150mm OVER 0.77 Ha)	=(-1,155m³)	DELETERIOUS MATERIAL STRIP (TO BE EXPORTED) (150mm OVER 0.93 Ha)	=(-1,395m³)
CUT	= -50m³	CUT	= -300m³
FILL	= +12,300m³	FILL	= +12,400m³
ALLOWANCES DETAILED EXCAVATION (1,500m³/Ha)	= -1,155m³	ALLOWANCES DETAILED EXCAVATION (1,500m³/Ha)	= -1,395m³
DIFFERENCE	= +11,095m³ (i.e. FILL OVER CUT)	DIFFERENCE	= +10,705m³ (i.e. FILL OVER CUT)
NOTE: VOLUMES BASED ON 150mm TOPSOIL STRIP AND 150mm DELETERIOUS MATERIAL STRIP OVER THE NOMINATED AREA. 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.			

FOR DEVELOPMENT APPLICATION



ISSUED FOR DEVELOPMENT APPLICATION ISSUED FOR DEVELOPMENT APPLICATION ISSUED FOR DEVELOPMENT APPLICATION ISSUED FOR DEVELOPMENT APPLICATION 17.04.26 10.04.26 23.02.26 15.12.25 D C B A	AMENDMENTS DATE ISSUE AMENDMENTS DATE ISSUE AMENDMENTS DATE ISSUE	ARCHITECT GRIMSHAW	CLIENT  Stockland	PROJECT KOGARAH GOLF CLUB DEVELOPMENT PROPOSED WAREHOUSE DISTRIBUTION & OFFICE MARSH STREET, ARNCLIFFE, NSW 2205	DESIGNED DRAWN DATE CHECKED SIZE SCALE CAD REF. MC MC OCT 2025 DS A0 AS SHOWN C09916-06-SSDA300	 CONSULT AUSTRALIA	Costin Roe Consulting Pty Ltd. ABN 50 003 696 446 PO Box 2419 Sydney NSW 1220 Level 4 & 9 Woodmill 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 COSTIN ROE CONSULTING  CIVIL & STRUCTURAL ENGINEERS	DRAWING TITLE BULK EARTHWORKS INDICATIVE STAGING PLAN DRAWING No: C09916.06-SSDA300	ISSUE D
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SITE PREPARATION NOTES:

- ALL EARTHWORKS SHALL BE COMPLETED GENERALLY IN ACCORDANCE WITH THE GUIDELINES SPECIFIED BY THE GEOTECHNICAL REPORT 85204.00 & 73624.03 PROVIDED BY DOUGLAS PARTNERS DATED DEC 2015 & MAY 2017.
- EXISTING LEVELS ARE BASED ON INFORMATION PROVIDED BY THE FOLLOW SOURCE:
 - G&B SURVEY SOLUTIONS DRG No. 5288-001 DATED 08.09.25
 - MNG LANDPARTNERS DRG No. SY075733.001 DATED 24.01.25
 - 75733.00 COMBINED ANNOTATION DTM DATED 28.03.23
 - DEGOTARDI SMITH & PARTNERS #28431a02 DATED 10.08.01
- STRIP ANY TOP SOIL OR DELETERIOUS MATERIAL AND DISPOSE OF FROM SITE OR STORE AS DIRECTED. TOPSOIL BLENDING IS NOT ACCEPTABLE. ANY BLENDING PROPOSAL IS TO BE REFERRED TO THE ENGINEER.
- 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. WHERE EXPOSED ROCK (WEATHERED SHALE OR SANDSTONE) IS ENCOUNTERED AT CUT SUBGRADE LEVEL, THE EARTHWORKS CONTRACTOR IS TO ALLOW TO RIP THE SURFACE TO A NOMINAL 0.3-0.4m DEPTH AND RECOMPACT (PER THE ENGINEERING SPEC) AS REQUIRED. AREAS TO RECEIVE FILL (THAT ARE NOT ON BENCHMARK 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 EARTHWORKS SHALL BE COMPLETED UNDER LEVEL 1 CONTROL IN ACCORDANCE WITH AS 3798-2007.
- 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.

EARTHWORK ESTIMATES - ROADS AND PADS

WORKS AREA	= 14.83 Ha
SITE STRIP	=(-4.4,4.90m ³) (TO BE EXPORTED/REUSED) (300mm OVER 14.83 Ha)
CUT	= -30,850m ³
FILL	= +104,450m ³
ALLOWANCES	
DETAILED EXCAVATION	= -22,300m ³ (1,500m ³ /Ha)
DIFFERENCE	= +51,300m ³ (i.e. FILL OVER CUT)

NOTE:
VOLUMES BASED ON 300mm SITE STRIP OVER THE NOMINATED AREA. 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.

EARTHWORK ESTIMATES - CHANNEL

WORKS AREA	= 5.36 Ha
SITE STRIP	=(-16,080m ³) (TO BE EXPORTED/REUSED) (300mm OVER 5.36 Ha)
CUT	= -22,100m ³
FILL	= +8,500m ³
DIFFERENCE	= -13,600m ³ (i.e. CUT OVER FILL)

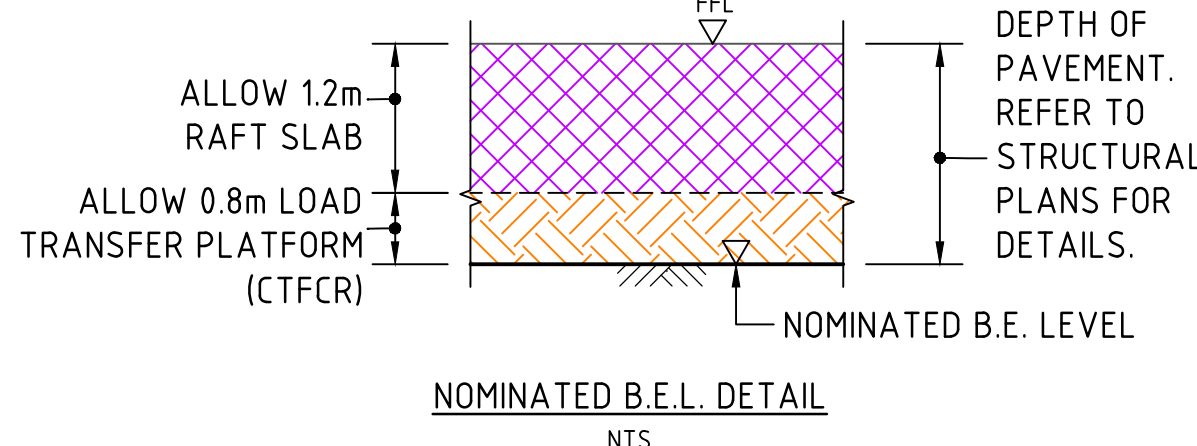
NOTE:
VOLUMES BASED ON 300mm SITE STRIP OVER THE NOMINATED AREA. EARTHWORKS VOLUMES ARE APPROXIMATE ONLY. NO ALLOWANCE HAS BEEN MADE FOR DELETERIOUS MATERIAL, EROSION AND SEDIMENT CONTROL, BULKING OR COMPACTION OF FILLED SOILS, THE REMOVAL OF UNCONTROLLED OR CONTAMINATED MATERIAL OR ANY OTHER UNSPECIFIED 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.

LEGEND:

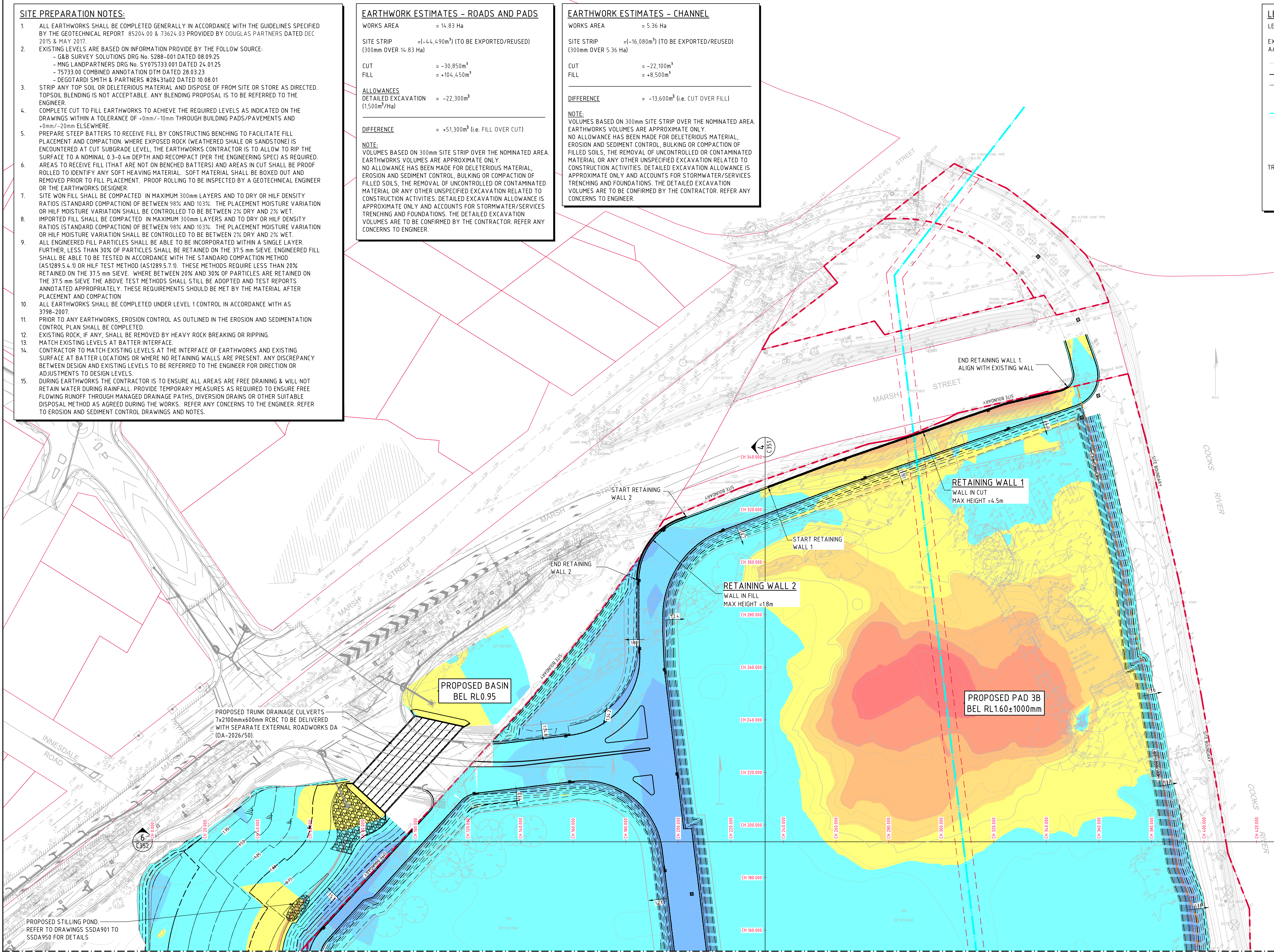
LEVELS DATUM IS AHD.

EXISTING CONTOURS ARE BASED ON SURVEY INFORMATION BY 'RPS AAP CONSULTING PTY LTD' DATED 10/10/2025.

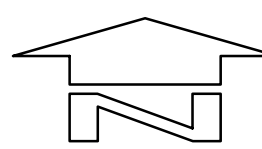
- 50.00 - EXISTING CONTOUR (0.5m INTERVAL)
- 50.00 - B.E.L. CONTOUR (MAJOR 1.0m)
- 50.25 - B.E.L. CONTOUR (MINOR 0.25m)
- 50.00 - B.E.L. SPOT LEVEL
- DENOTES EXISTING WATER MAIN



DEPTH RANGE			
No.	FROM DEPTH	TO DEPTH	COLOUR
1	-9.000	-8.000	Dark Red
2	-8.000	-7.000	Red
3	-7.000	-6.000	Red
4	-6.000	-5.000	Red
5	-5.000	-4.000	Red
6	-4.000	-3.000	Orange
7	-3.000	-2.000	Orange
8	-2.000	-1.000	Yellow
9	-1.000	0.000	Yellow
10	0.000	1.000	Light Blue
11	1.000	2.000	Light Blue
12	2.000	3.000	Light Blue
13	3.000	4.000	Light Blue



BREAKLINE - REFER TO DRAWING SSDA302 FOR CONTINUATION



BULK EARTHWORKS PLAN - SHEET 2
SCALE 1:500

FOR DEVELOPMENT APPLICATION

5m 0 10 20 30 40 50m
SCALE 1:500 AT A0 SIZE SHEET

ISSUED FOR DEVELOPMENT APPLICATION	17.04.25	F
ISSUED FOR DEVELOPMENT APPLICATION	10.04.25	E
ISSUED FOR DEVELOPMENT APPLICATION	15.12.25	D
ISSUED FOR DEVELOPMENT APPLICATION	08.12.25	C
ISSUED FOR INFORMATION	17.11.25	B
ISSUED FOR INFORMATION	20.10.25	A
AMENDMENTS	DATE	ISSUE

AMENDMENTS	DATE	ISSUE	AMENDMENTS	DATE	ISSUE
------------	------	-------	------------	------	-------

ARCHITECT	CLIENT
-----------	--------

GRIMSHAW

Stockland

PROJECT
KOGARAH GOLF CLUB DEVELOPMENT
PROPOSED WAREHOUSE DISTRIBUTION & OFFICE
MARSH STREET, ARNCLIFFE, NSW 2205

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF.
MC	MC	OCT 2025	DS	A0	AS SHOWN	C09916.06-SSDA302

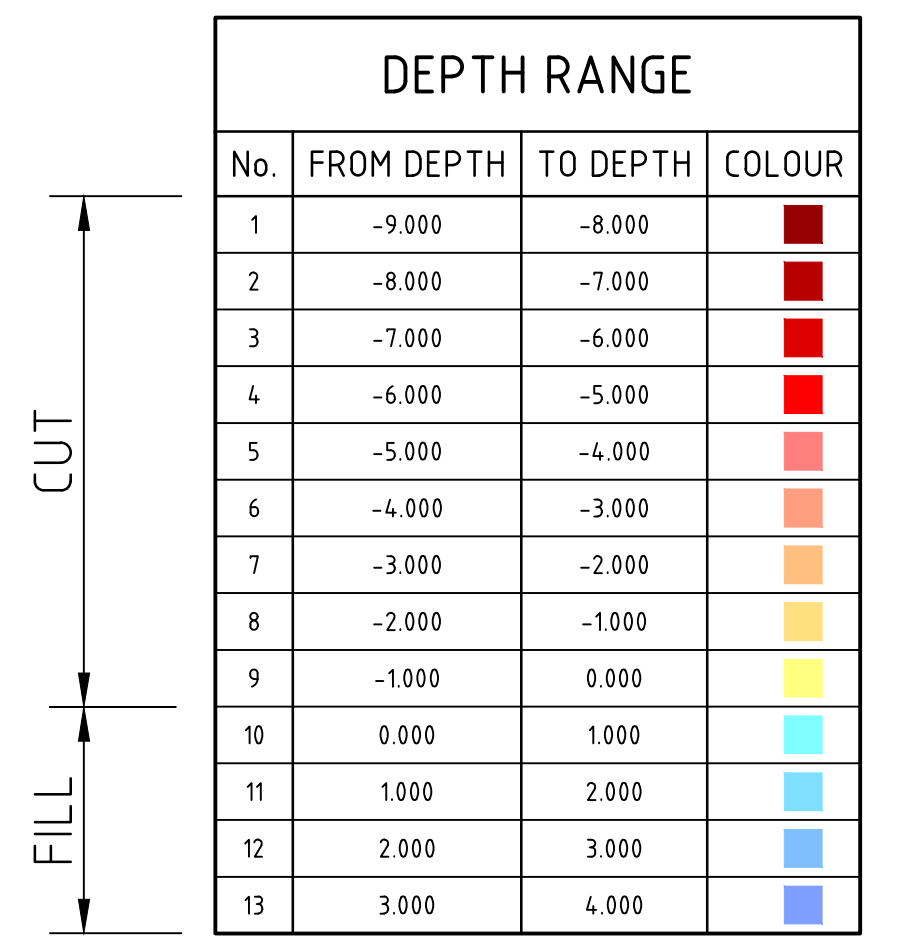
CONSULT AUSTRALIA

Costin Roe Consulting Pty Ltd.
ABN 50 003 696 446
PO Box 2419 Sydney NSW 1220
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p: +61 2 9251 7699 e: mail@costinroe.com.au
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CRC
COSTIN ROE CONSULTING
CIVIL & STRUCTURAL ENGINEERS

DRAWING TITLE
BULK EARTHWORKS PLAN - SHEET 1
DRAWING No. C09916.06-SSDA301
ISSUE F

BREAKLINE - REFER TO DRAWING SSDA301 FOR CONTINUATION



PROPOSED STILLING POND. _____
REFER TO DRAWINGS SSDA901 TO
SSDA950 FOR DETAILS

PROPOSED STILLING POND. —
REFER TO DRAWINGS SSDA901 TO
SSDA950 FOR DETAILS

PROPOSED PAD 3A
BEL RL1.60±1000mm

PROPOSED PAD 3B
BEL RL1.60±1000mm

PROPOSED TRUNK DRAINAGE CULVERTS -
7x2100mmx600mm RCBC
REFER TO DRAWINGS SSDA901 TO SSDA905
FOR DETAILS

PROPOSED STILLING POND.
REFER TO DRAWINGS SSDA
SSDA950 FOR DETAILS

PROPOSED STILLING POND. —
REFER TO DRAWINGS SSDA901 TO
SSDA950 FOR DETAILS

PROPOSED STILLING POND. ———
REFER TO DRAWINGS SSDA901 TO
SSDA950 FOR DETAILS

PROPOSED STILLING POND. ———
REFER TO DRAWINGS SSDA901 TO
SSDA950 FOR DETAILS

EARTHWORK ESTIMATES

REFER TO DRAWING SSDA301 FOR EARTHWORKS ESTIMATES

SITE PREPARATION NOTES:

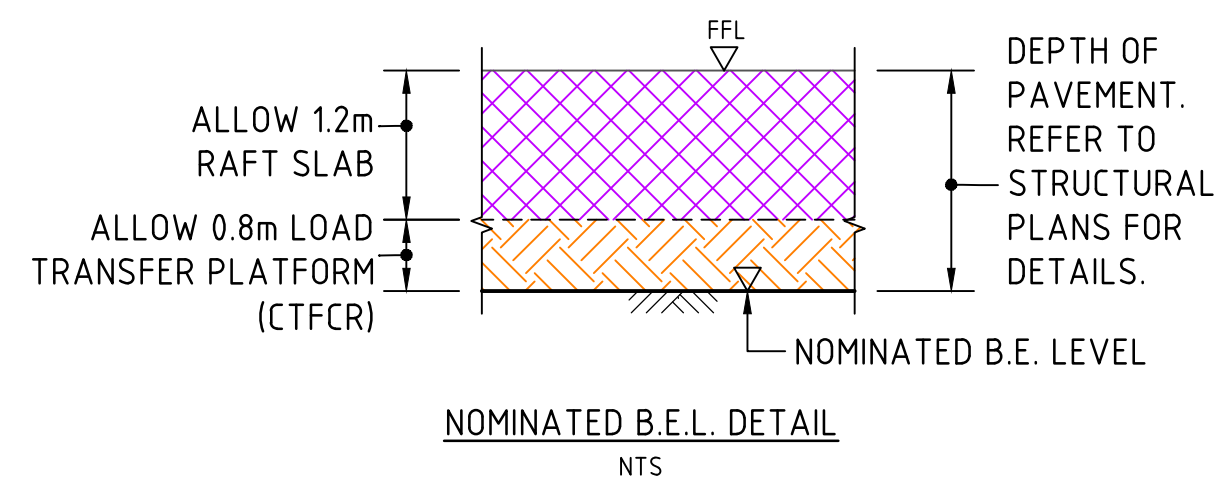
REFER TO DRAWING SSDA301 FOR SITE PREPARATION NOTES

LEGEND:

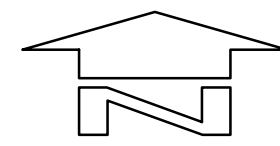
LEVELS DATUM IS AHD.

EXISTING CONTOURS ARE BASED ON SURVEY INFORMATION BY 'RPS
AAP CONSULTING PTY LTD' DATED 10/10/2025.

-
- 50.00 — - EXISTING CONTOUR (0.5m INTERVAL)
 - 50.00 — - B.E.L. CONTOUR (MAJOR 1.0m)
 - 50.25 — - B.E.L. CONTOUR (MINOR 0.25m)
 - ★ 50.00 - B.E.L. SPOT LEVEL
 - W — - DENOTES EXISTING WATER MAIN

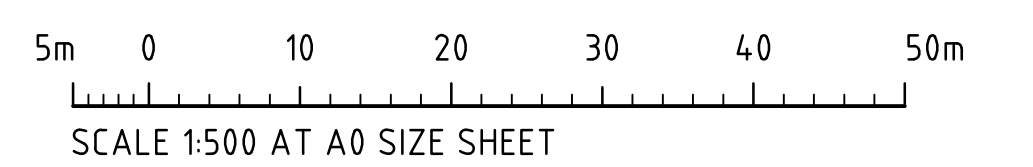


BREAKLINE - REFER TO DRAWING SSDA303 FOR CONTINUATION



BULK EARTHWORKS PLAN - SHEET 2
SCALE 1:500

FOR DEVELOPMENT APPLICATION

[illegible]

BREAKLINE - REFER TO DRAWING SSDA302 FOR CONTINUATION

PROPOSED STILLING POND.
REFER TO DRAWINGS SSDA901 TO
SSDA950 FOR DETAILS

PROPOSED STILLING POND.
REFER TO DRAWINGS SSDA901 TO
SSDA950 FOR DETAILS

PROPOSED STILLING POND.
REFER TO DRAWINGS SSDA901 TO
SSDA950 FOR DETAILS

PROPOSED STILLING POND.
REFER TO DRAWINGS SSDA901 TO
SSDA950 FOR DETAILS

PROPOSED STILLING POND.
REFER TO DRAWINGS SSDA901 TO
SSDA950 FOR DETAILS

PROPOSED STILLING POND.
REFER TO DRAWINGS SSDA901 TO
SSDA950 FOR DETAILS

PROPOSED PAD 3C
BEL RL1.60±1000mm

RETAINING WALL 3
WALL IN FILL
MAX HEIGHT = 3.0m

RETAINING WALL 4
WALL IN FILL
MAX HEIGHT = 2.0m

START RETAINING WALL 3

END RETAINING WALL 3

LEGEND:

LEVELS DATUM IS AHD.

EXISTING CONTOURS ARE BASED ON SURVEY INFORMATION BY 'RPS
AAP CONSULTING PTY LTD' DATED 10/10/2025.

— 50.00 — - EXISTING CONTOUR (0.5m INTERVAL)

— 50.00 — - B.E.L. CONTOUR (MAJOR 1.0m)

— 50.25 — - B.E.L. CONTOUR (MINOR 0.25m)

• 50.00 - B.E.L. SPOT LEVEL

— 50.00 — - DENOTES EXISTING WATER MAIN

DEPTH OF PAVEMENT.
REFER TO
STRUCTURAL
PLANS FOR
DETAILS.

ALLOW 1.2m
RAFT SLAB

ALLOW 0.8m LOAD
TRANSFER PLATFORM
(CTFCR)

NOMINATED B.E. LEVEL

No.	FROM DEPTH	TO DEPTH	COLOUR
1	-9.000	-8.000	Red
2	-8.000	-7.000	Red
3	-7.000	-6.000	Red
4	-6.000	-5.000	Red
5	-5.000	-4.000	Red
6	-4.000	-3.000	Red
7	-3.000	-2.000	Red
8	-2.000	-1.000	Red
9	-1.000	0.000	Red
10	0.000	1.000	Red
11	1.000	2.000	Red

NOTES:

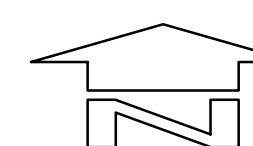
REFER TO DRAWING SSDA301 FOR EARTHWORKS ESTIMATES

REFER TO DRAWING SSDA301 FOR SITE PREPARATION NOTES

REFER TO DRAWING SSDA301 FOR SITE PREPARATION NOTES

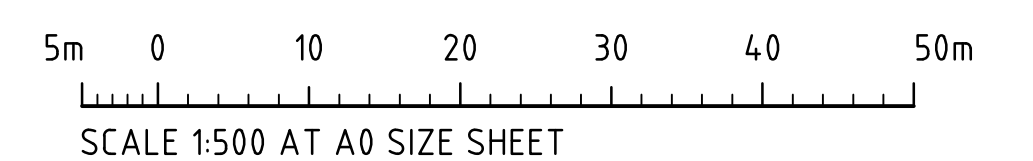
The diagram illustrates a cross-section of a pavement structure. At the top, a horizontal line with a wavy pattern is labeled '- DENOTES EXISTING WATER MAIN'. Below this, the structure consists of two main layers: a top layer labeled 'ALLOW 12m RAFT SLAB' and a bottom layer labeled 'ALLOW 0.8m LOAD TRANSFER SLAB (CTFCR)'. The top layer is filled with a purple cross-hatch pattern, and the bottom layer is filled with an orange diagonal-hatch pattern. A dashed line labeled 'F.F.L.' (Finished Floor Level) is shown within the top layer. To the right, a vertical dimension line indicates the 'DEPTH OF PAVEMENT. REFER TO STRUCTURAL PLANS FOR DETAILS.' At the bottom, a horizontal line is labeled 'NOMINATED B.E. LEVEL' (Nominated Base Level). The entire diagram is captioned 'NOMINATED B.E.L. DETAIL' and 'NTS' (Not To Scale).

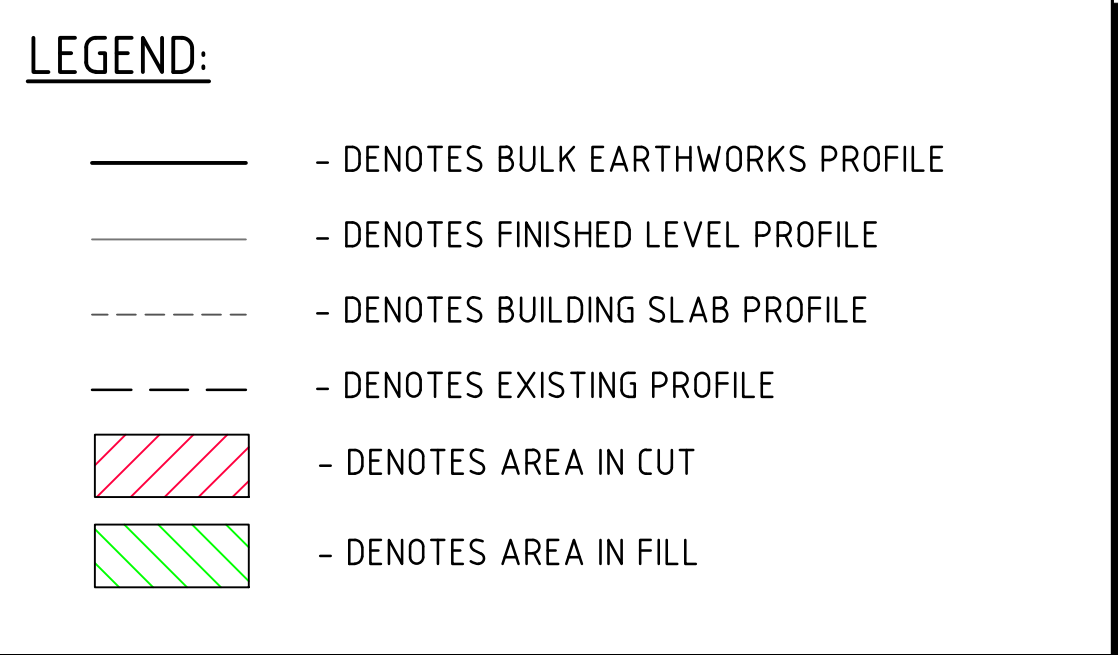
DEPTH RANGE			
No.	FROM DEPTH	TO DEPTH	COLOR
1	-9,000	-8,000	
2	-8,000	-7,000	
3	-7,000	-6,000	
4	-6,000	-5,000	
5	-5,000	-4,000	
6	-4,000	-3,000	
7	-3,000	-2,000	
8	-2,000	-1,000	
9	-1,000	0,000	
10	0,000	1,000	
11	1,000	2,000	
12	2,000	3,000	
13	3,000	4,000	



BULK EARTHWORKS PLAN - SHEET 3
SCALE 1:500

FOR DEVELOPMENT APPLICATION

[illegible]

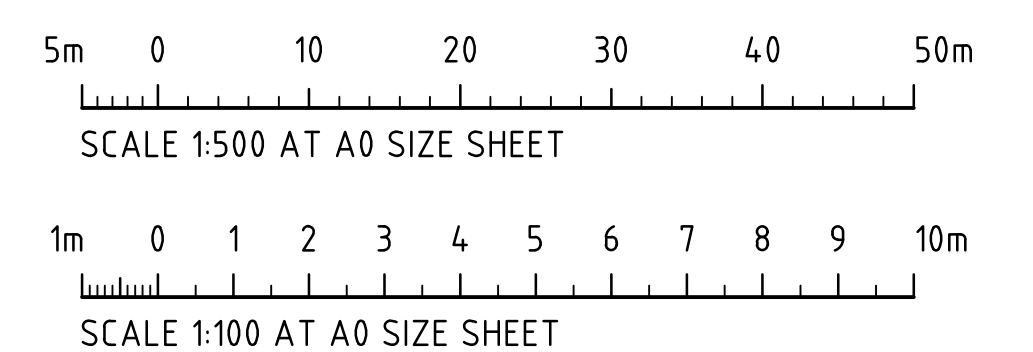


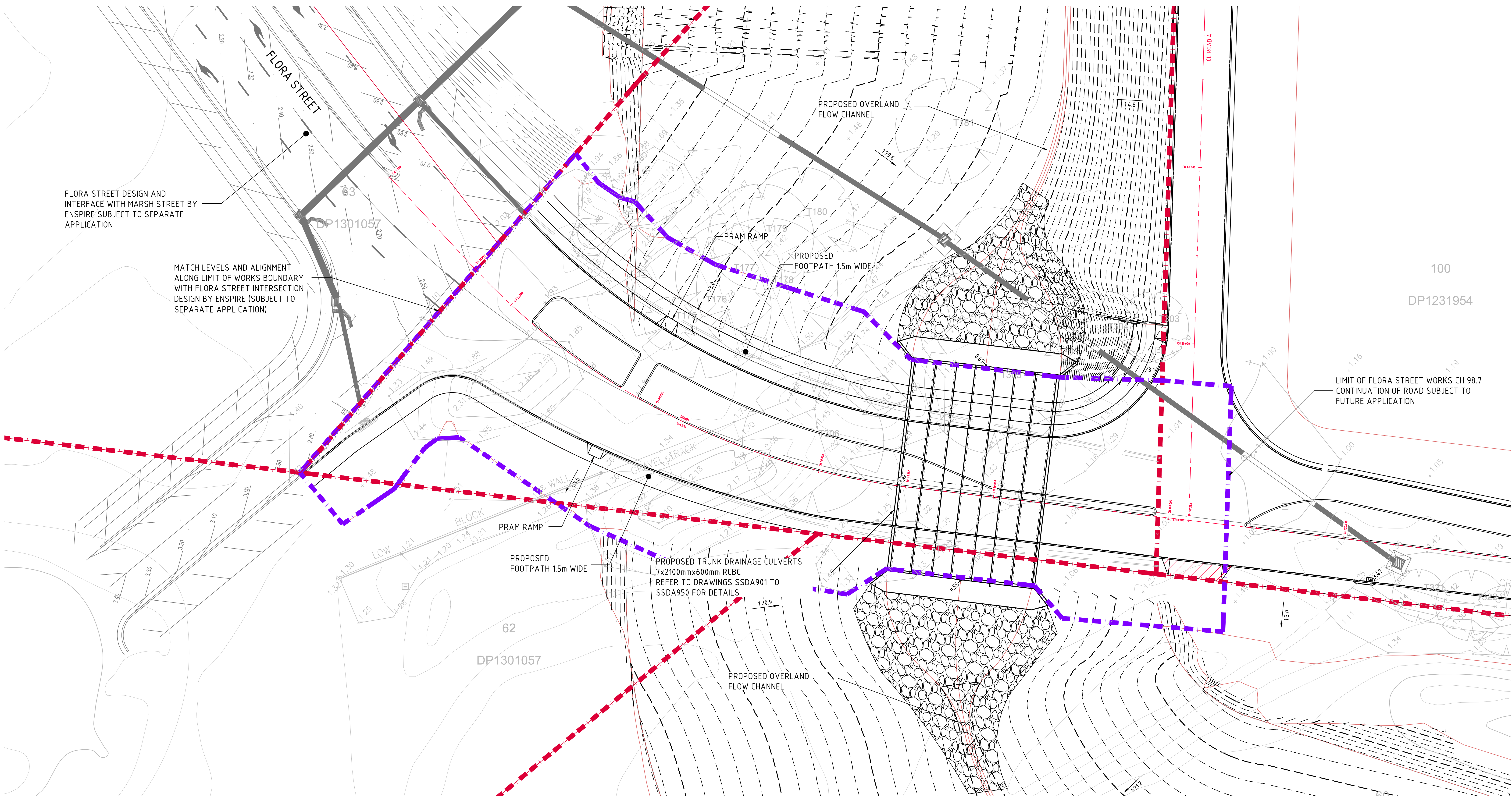
CHAINAGE	EXISTING SURFACE LEVEL	BULK EARTHWORKS LEVEL	CUT/FILL DEPTH
0+000	253		
10+000	1991	2284	0.793
20+000	1851	1814	-0.037
30+000	1710	1363	-0.367
40+000	1573	0872	-0.707
50+000	1530	0402	-1.048
60+000	1552	0390	-1.112
70+000	1551	3056	1556
80+000	14481	1796	0.315
90+000	1584	1600	0.017
100+000	1822	1600	-0.222
110+000	1998	1600	-0.388
120+000	2036	1600	-0.536
130+000	2004	1600	-0.524
140+000	1520	1600	0.100
150+000	1551	1600	0.099
160+000	1551	1600	0.100
170+000	1551	1600	0.099
180+000	1552	1600	0.098
190+000	1553	1600	0.097
200+000	1551	1600	0.099
210+000	1759	1600	-0.158
220+000	2044	1600	-0.443
230+000	1546	2442	0.895
240+000	1500		
250+000	1500		
260+000	2.96		
270+000			
280+000			

CUT/FILL DEPTH	BULK EARTHWORKS LEVEL	EXISTING SURFACE LEVEL	CHAINAGE
		2.95	0+00.000
	1.99	2.03	0+00.000
	0.929	1.652	0+00.000
	0.459	1.000	0+00.000
	0.221	1.000	0+00.000
	0.078	1.000	0+00.000
	1.134	1.884	0+00.000
	2.004	2.846	0+00.000
	2.714		0+00.000
	2.506		0+00.000
	1.908		0+00.000
	1.980		0+00.000
	2.002		0+00.000
	2.095		0+00.000
	2.004		0+00.000
	2.065		0+00.000
	3.106		0+00.000
	2.875		0+00.000
	3.159		0+00.000
	3.372		0+00.000
	3.071		0+00.000
	3.059		0+00.000
	2.887		0+00.000
	1.600		0+00.000
	1.600		0+00.000
	2.836		0+00.000
	2.766		0+00.000
			0+00.000
			0+00.000

CUT/FILL DEPTH	BULK EARTHWORKS LEVEL	EXISTING SURFACE LEVEL	CHAINAGE
2.296	2.344	0.788	0.000
1.710	2.659	0.899	100.000
0.985	1.600	14.5	150.000
0.957	1.600	14.3	160.000
0.900	1.600	15.00	170.000
0.900	1.600	15.00	180.000
0.999	1.600	15.01	190.000
0.131	1.600	14.69	200.000
0.982	1.600	14.8	210.000
0.231	1.600	13.69	220.000
0.301	1.600	12.9	230.000
0.373	1.600	12.27	240.000
0.451	1.600	11.9	250.000
0.534	1.600	10.66	260.000
0.510	1.600	10.30	270.000
0.418	1.600	11.22	280.000
0.340	1.600	12.4	290.000
0.267	1.600	13.33	300.000
0.445	1.600	14.55	310.000
0.698	1.600	15.3	320.000
0.192	1.600	14.68	330.000
0.149	1.600	14.51	340.000
0.691	1.600	15.09	350.000
0.900	1.600	15.00	360.000
0.101	1.600	15.00	370.000
0.100	1.600	15.00	380.000
-0.169	1.600	17.69	390.000
-0.357	1.600	19.57	400.000
-1.220	1.600	2.820	410.000
-0.107	1.600	17.77	420.000
0.534	2.555	19.21	430.000
		2.972	440.000

FOR DEVELOPMENT APPLICATION

[illegible]

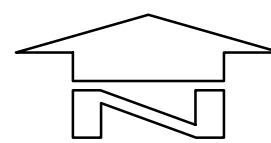


LEGEND:
LEVELS DATUM IS AHD.

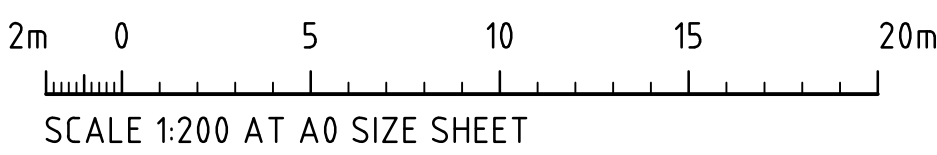
- SGGP, SINGLE GRATED GULLY PIT
- SJP, SEALED JUNCTION PIT
- KIP, KERB INLET PIT
- GD, GRATED DRAIN (300W x 225D UND)
- 50.00 - FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- 50.10 - FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
- DENOTES EXISTING WATER MAIN

NOTES:

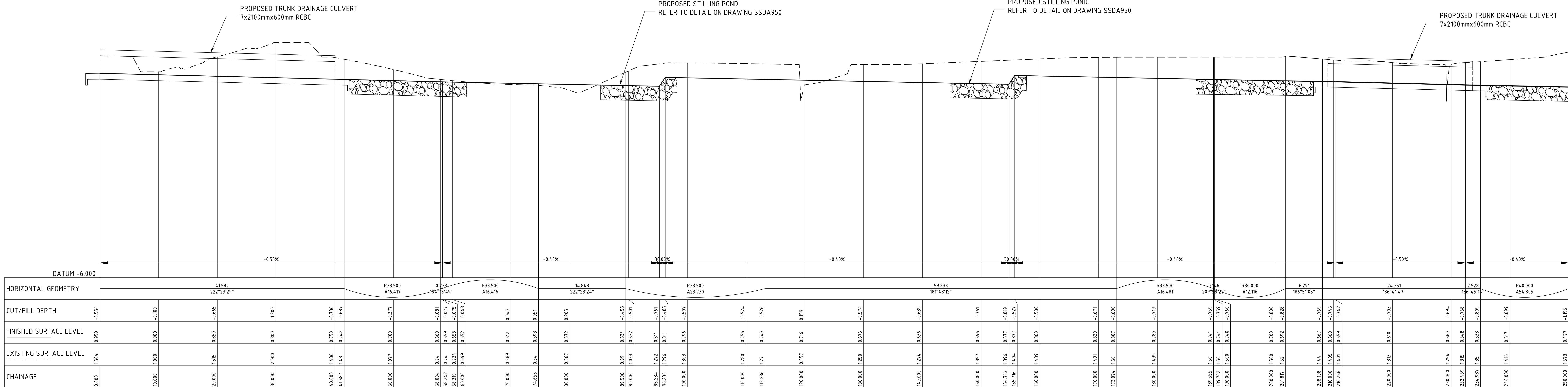
1. REFER TO DRAWING SSDA101 FOR FINISHED LEVELS PLAN NOTES.

 **CIVIL WORKS PLAN-FLORA STREET EAST**
SCALE 1:200

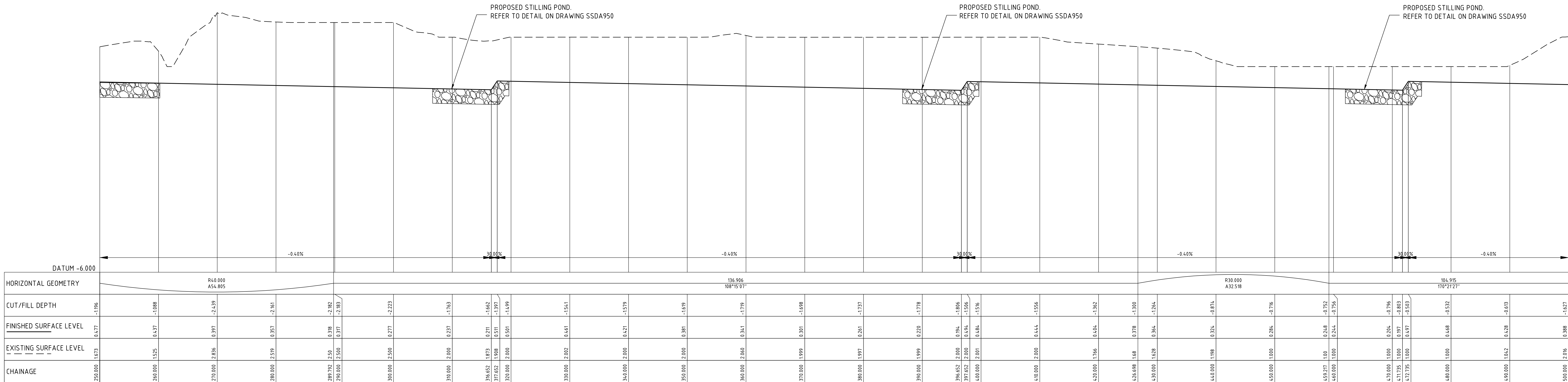
FOR DEVELOPMENT APPLICATION



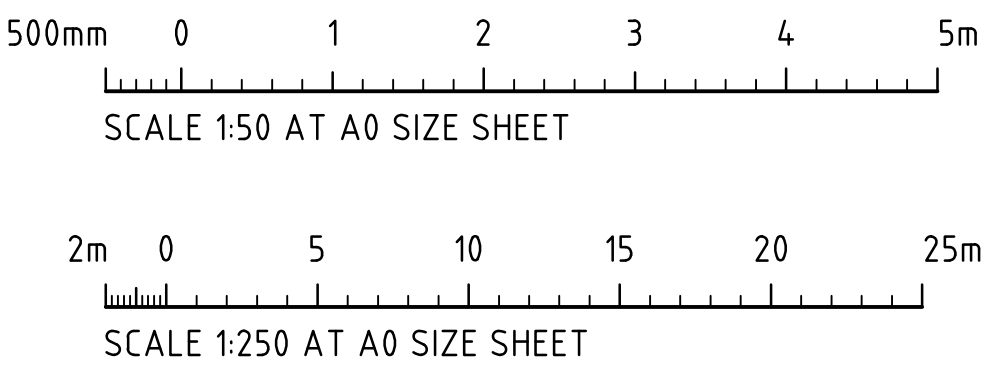
				ARCHITECT		CLIENT		PROJECT				CONSULT		DRAWING TITLE	
				GRIMSHAW		Stockland		KOGARAH GOLF CLUB DEVELOPMENT PROPOSED WAREHOUSE DISTRIBUTION & OFFICE MARSH STREET, ARNCLIFFE, NSW 2205				Costin Roe Consulting Pty Ltd. ABN 50 003 696 446 PO Box 2419 Sydney NSW 1220 Level 4 & 9 Woodmill Street, Millers Point NSW 2000 p: +61 2 9251 7699 e: mail@costinroe.com.au w: costinroe.com.au		CIVIL & STRUCTURAL ENGINEERS	
								DESIGNED: MC | DRAWN: MC | DATE: OCT 2025 | CHECKED: DS | SIZE: A0 | SCALE: AS SHOWN | CAD REF: C09916-06-SSDA500						DRAWING No: C09916-06-SSDA500	
														ISSUE B	



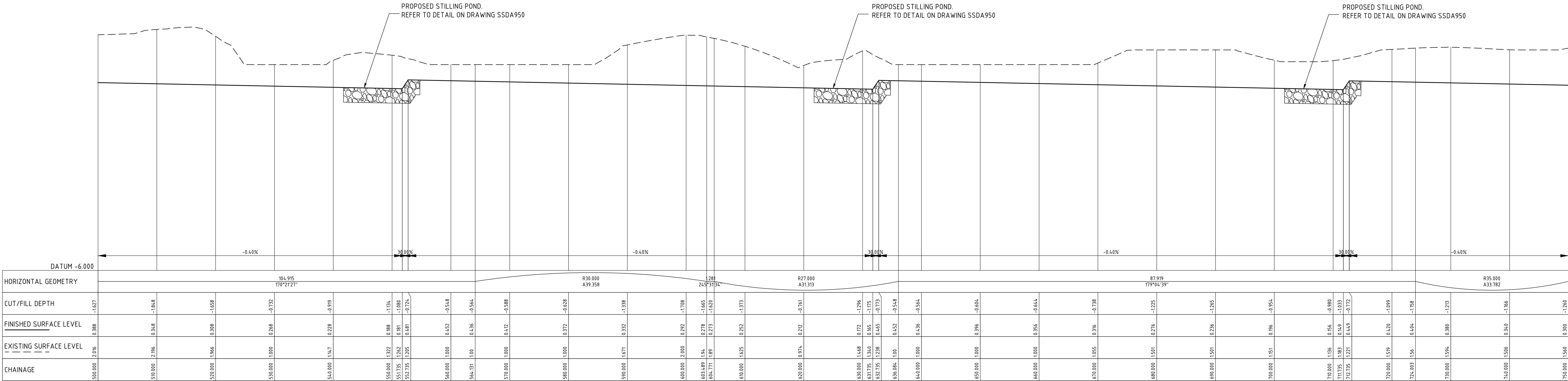
LONGITUDINAL SECTION - CL CHANNEL
HORIZONTAL SCALE 1:250
VERTICAL SCALE 1:50



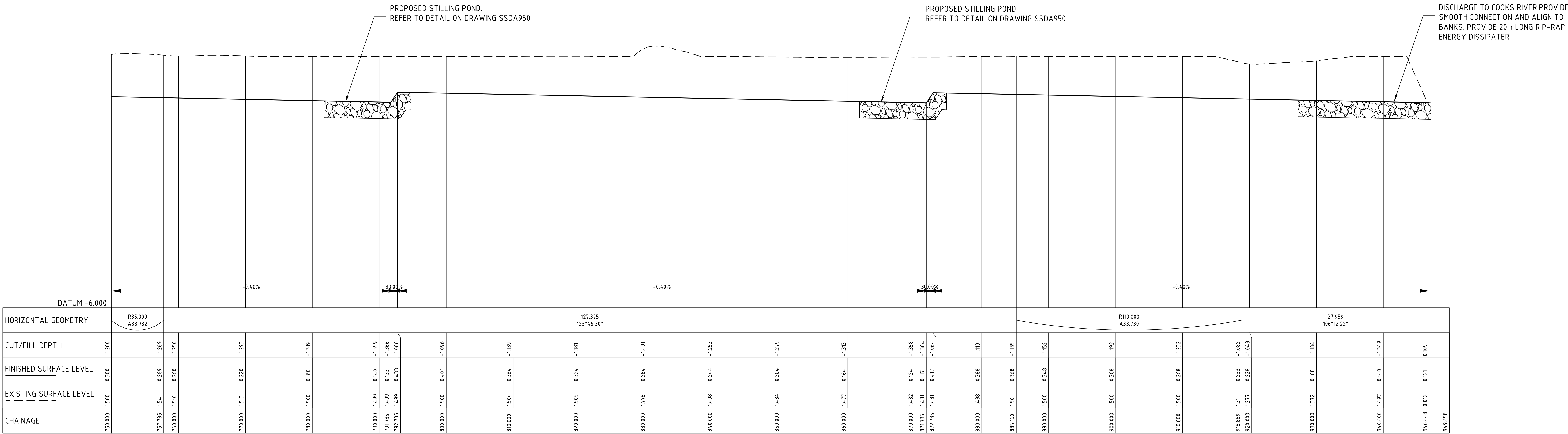
LONGITUDINAL SECTION - CL CHANNEL
HORIZONTAL SCALE 1:250
VERTICAL SCALE 1:50



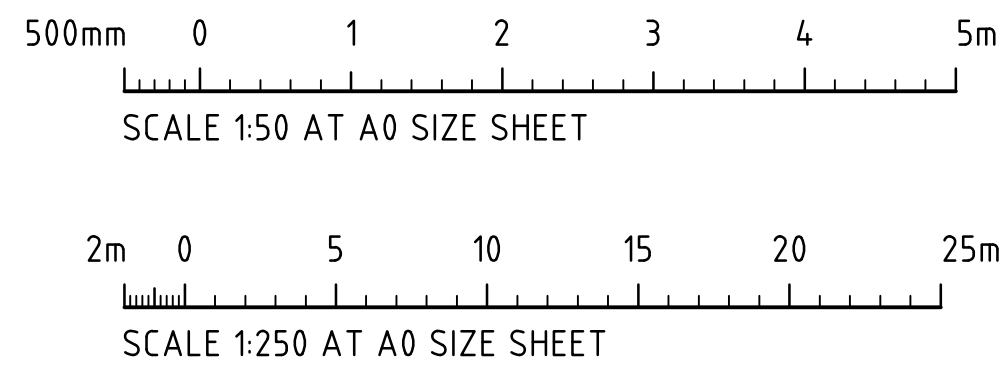
FOR DEVELOPMENT APPLICATION



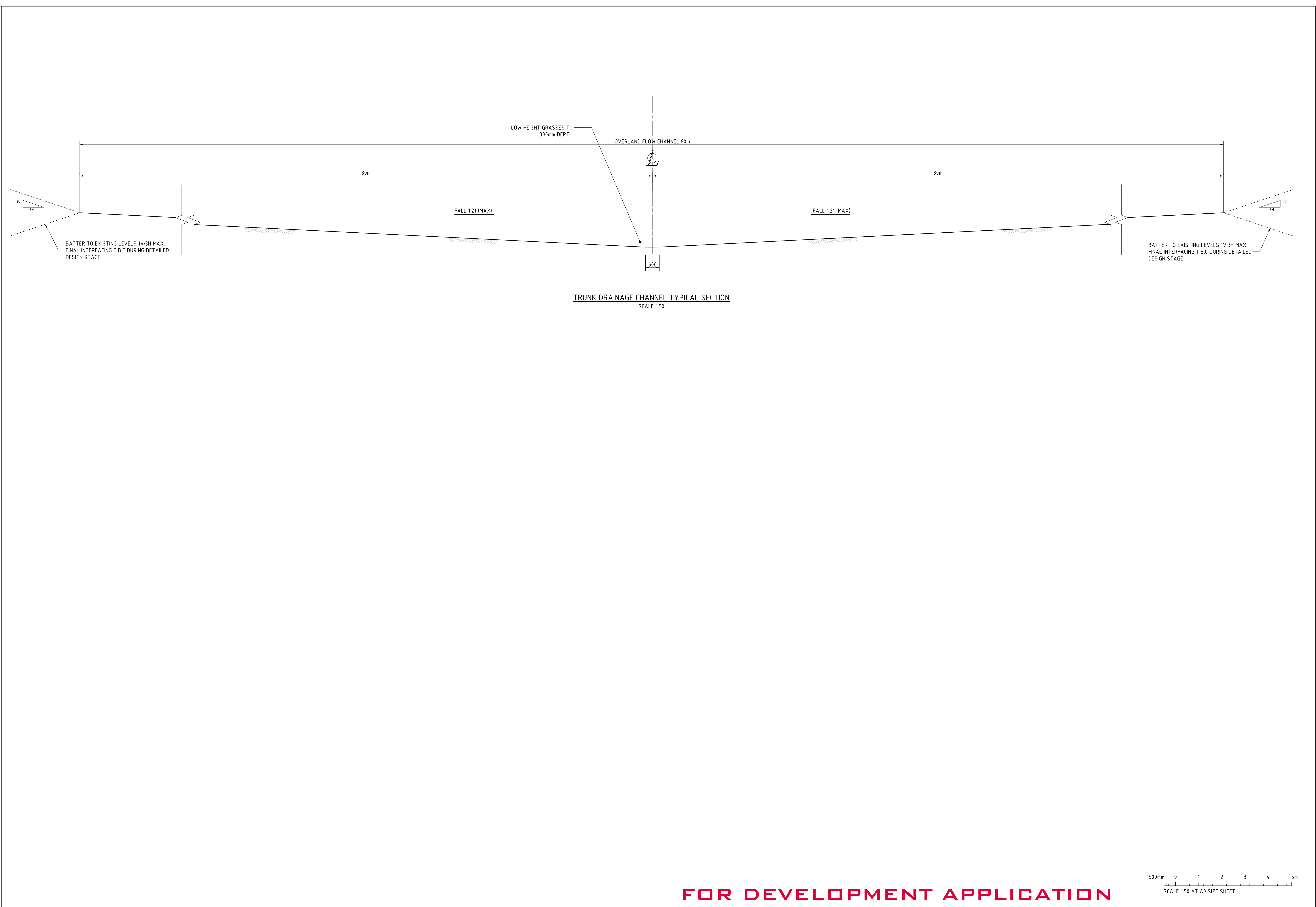
LONGITUDINAL SECTION - CL CHANNEL
HORIZONTAL SCALE 1:250
VERTICAL SCALE 1:50



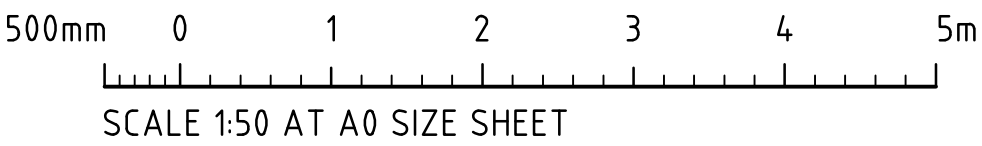
LONGITUDINAL SECTION - CL CHANNEL
HORIZONTAL SCALE 1:250
VERTICAL SCALE 1:50



FOR DEVELOPMENT APPLICATION



FOR DEVELOPMENT APPLICATION



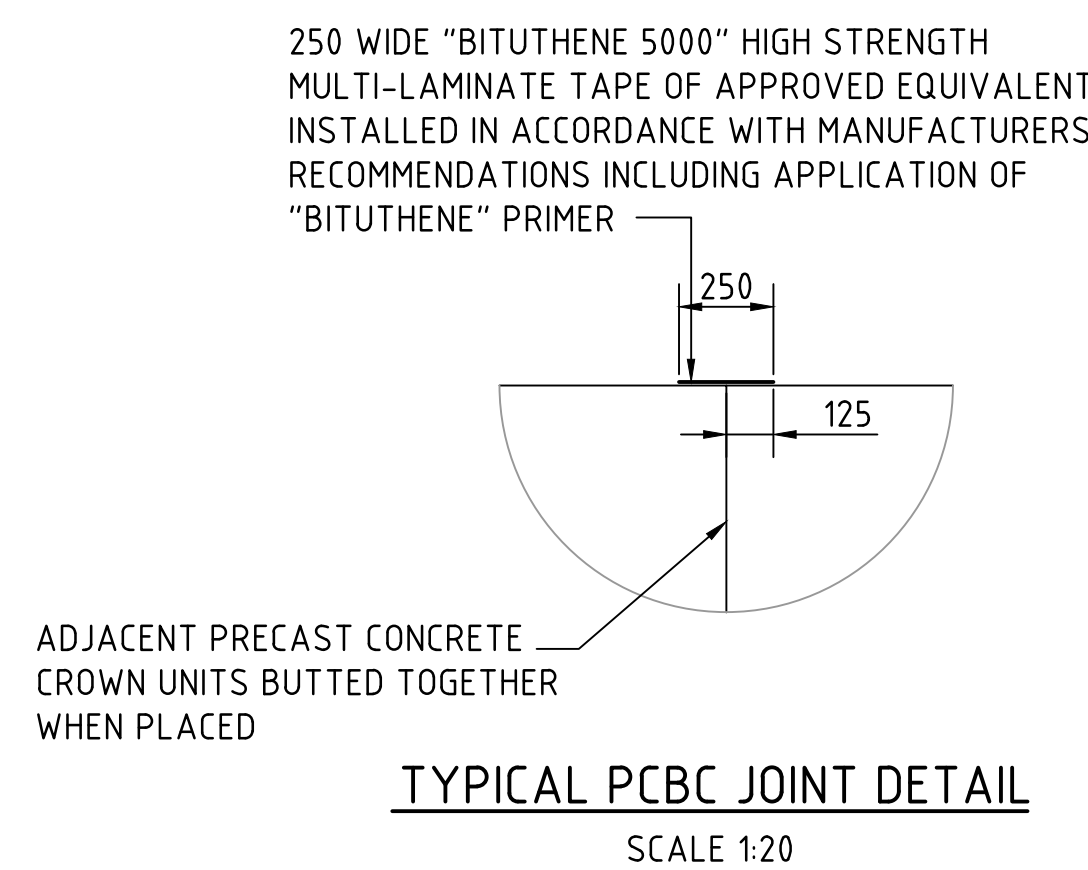
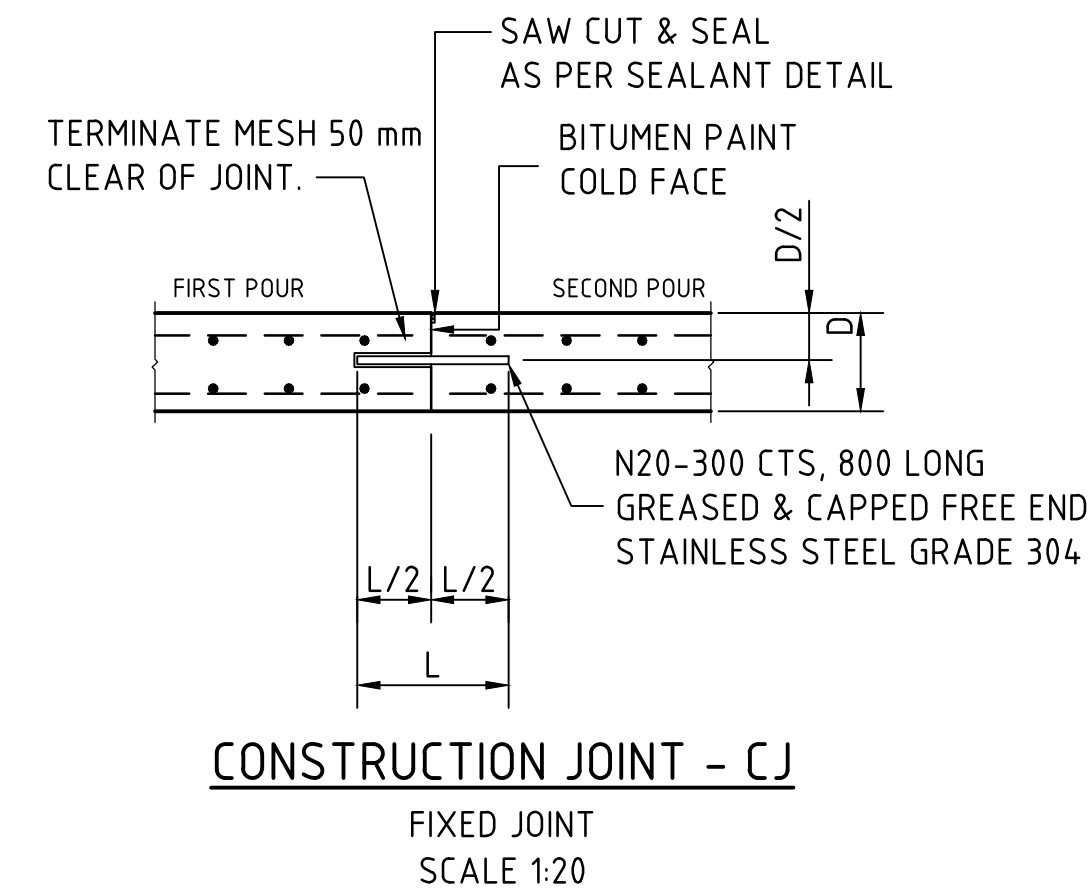
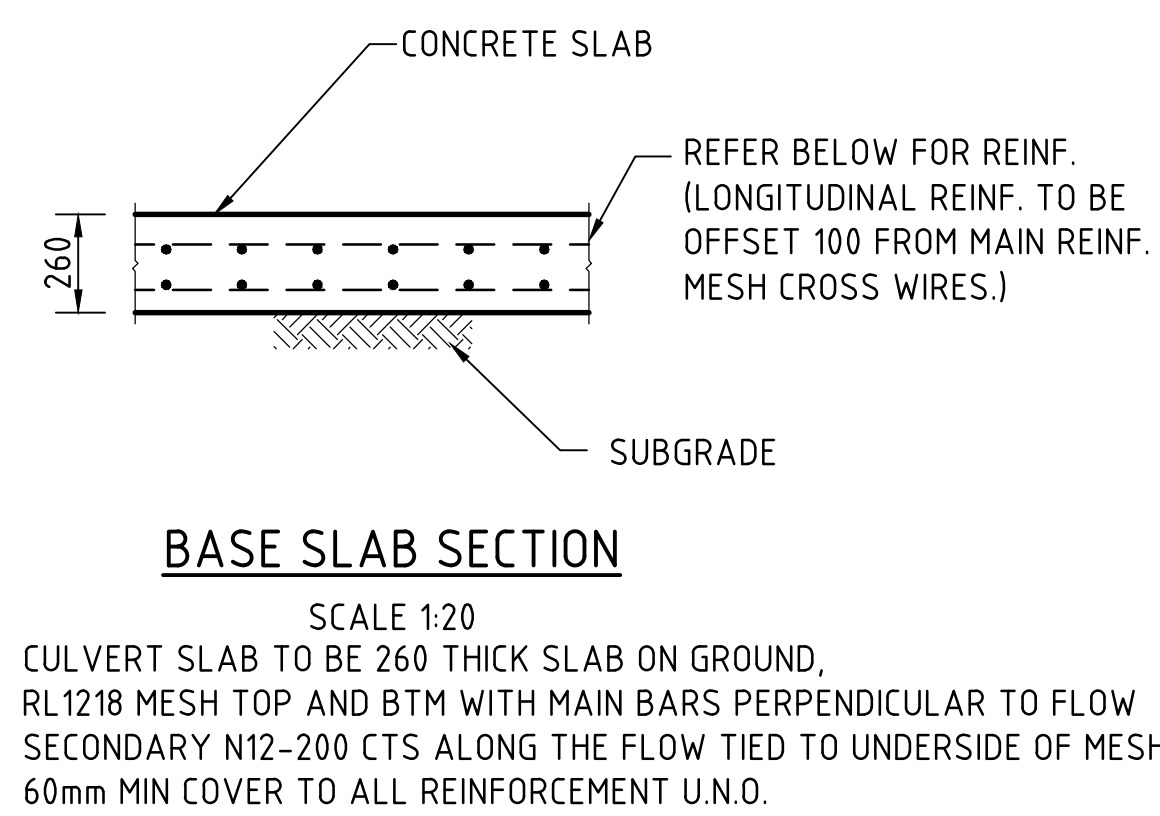
ISSUED FOR DEVELOPMENT APPLICATION										17.04.26		D												ARCHITECT		CLIENT		PROJECT										COSTIN ROE CONSULTING PTY LTD.		DRAWING TITLE															
ISSUED FOR DEVELOPMENT APPLICATION										10.04.26		C												GRIMSHAW		 Stockland		KOGARAH GOLF CLUB DEVELOPMENT PROPOSED WAREHOUSE DISTRIBUTION & OFFICE MARSH STREET, ARNCLIFFE, NSW 2205										 CONSULT AUSTRALIA		Costin Roe Consulting Pty Ltd. ABN 50 005 091 445		TRUNK DRAINAGE CHANNEL TYPICAL CROSS SECTION													
ISSUED FOR DEVELOPMENT APPLICATION										08.12.25		B																										PO Box 1419 Sydney NSW 1520 Level 4, 8 Woodmill Street, Millers Point NSW 2000 p: +61 2 9251 7699 e: mail@costinroe.com.au		CIVIL & STRUCTURAL ENGINEERS		DRAWING No													
ISSUED FOR INFORMATION										05.12.25		A																										p: +61 2 9241 3751 w: costinroe.com.au		C09916.06-SSDA903		ISSUE													
AMENDMENTS										DATE		ISSUE		AMENDMENTS										DATE		ISSUE		AMENDMENTS										DATE		ISSUE		AMENDMENTS										DATE		ISSUE	

1. ALIGN STRUCTURE EVENLY WITH BANK.
2. LOCATE STRUCTURE AT INVERT LEVEL OF STREAM AND POINT IN A DOWNSTREAM DIRECTION.
3. PIPE TO REST ON, AND BE PACKED IN, BY RIP-RAP (SIZE AS NOTED).
4. DISCHARGE INTO STREAM WHERE BEDROCK IS PRESENT, OTHERWISE SCOUR PROTECT AS REQUIRED.
5. SCOUR PROTECT THE OPPOSITE BANK AS REQUIRED. SCOUR PROTECTION TO BE PROVIDED WHERE OPPOSITE BANK IS WITHIN 12-14 TIMES THE PIPE DIAMETER.
6. RIP-RAP TO CONSIST OF ANGULAR RUN-OF-QUARRY ROCK (d50= 300mm MINIMUM) AS NOTED IN THE SCHEDULE. RIP-RAP TO BE MINIMUM THICKNESS OF RIP-RAP LAYER TO BE 16x AVERAGE ROCK SIZE (d50).
7. RIP-RAP IS TO BE PLACED OVER A 200mm LAYER OF 140mm COBBLES WHERE NEEDED TO BE GRAB ALL.
8. PLACE ROCK SO THAT IT FORMS A DENSE, WELL-GRADED MASS OF ROCK WITH A MINIMUM OF Voids. THE FINISHED RIP-RAP SURFACE SHOULD BE FREE OF POCKETS OF SMALL ROCK OR CLUSTERS OF LARGE ROCKS.
9. GAPS IN RIP-RAP TO BE HAND PACKED WITH TOPSOIL & PLANTED WITH NATIVE SEDGES & RUISHES TO PROVIDE. THE INTENT IS FOR THERE TO BE NO Voids BETWEEN RIP-RAP BOULDERS.
10. ENSURE THE FINISHED RIP-RAP SURFACE BLENDS WITH THE SURROUNDING GROUND LEVELS. NO OVERFALL OR PROTRUSION OF ROCK SHOULD BE APPARENT.
11. ENSURE THAT STORMWATER FROM SURROUNDING GROUND IS FREE TO ENTER THE STRUCTURE WITHOUT CAUSING UNDESIRABLE PONDING OR SCOUR.



500mm 0 1 2 3 4 5m
SCALE 1:50 AT A0 SIZE SHEET

										ARCHITECT		CLIENT		PROJECT		CONSULT AUSTRALIA		Costin Roe Consulting Pty Ltd. ABN 50 003 696 446		CIVIL & STRUCTURAL ENGINEERS		DRAWING TITLE TRUNK DRAINAGE CHANNEL DETAILS - SHEET 1			
										GRIMSHAW		Stockland		KOGARAH GOLF CLUB DEVELOPMENT PROPOSED WAREHOUSE DISTRIBUTION & OFFICE MARSH STREET, ARLCHFIELD, NSW 2205		PO Box N419 Sydney NSW 1220 Level 4, 8 Windmill Street, Millers Point NSW 2000 p: +61 2 9551 7699 f: +61 2 9541 3731 e: mail@costinroe.com.au w: costinroe.com.au		CRC COSTIN ROE CONSULTING		DRAWING NO C09916.06-SSDA951		ISSUE			
ISSUED FOR DEVELOPMENT APPLICATION										10.04.26		C													
ISSUED FOR DEVELOPMENT APPLICATION										18.12.25		B													
ISSUED FOR INFORMATION										05.12.25		A													
AMENDMENTS										DATE		ISSUE		AMENDMENTS		DATE		ISSUE		AMENDMENTS		DATE		ISSUE	



FOUNDATION NOTE:

UNSUITABLE MATERIALS BELOW THE FOUNDATION LEVEL OF THE CULVERT BASE SLAB MUST BE REMOVED AND REPLACED WITH SELECT FILL IN ACCORDANCE WITH PCC STANDARDS. FOUNDATION MATERIALS MUST BE VERIFIED BY SUITABLY QUALIFIED GEOTECHNICAL ENGINEER ON SITE TO CONFIRM THE DESIGN ASSUMPTIONS.

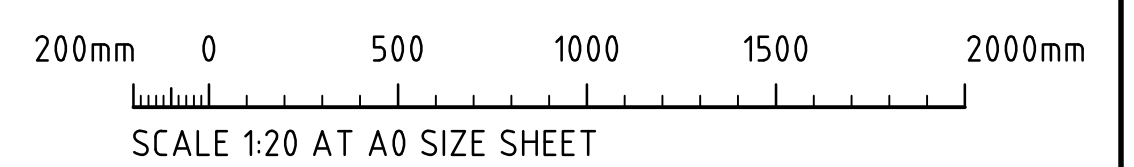
THE DESIGN BEARING CAPACITY SHALL BE DETERMINED USING A GEOTECHNICAL REDUCTION FACTOR (ϕ_g) OF 0.5 ON ACCORDANCE WITH TABLE 13.3.1(A) OF AS5100.3

MINIMUM ALLOWABLE BEARING PRESSURE OF CULVERT IS 150kPa					
CONCRETE QUALITY					
ELEMENT	SLUMP	AGGREGATE (MAX. SIZE)	CEMENT TYPE	AD MIXTURE	F'c (MPa)
BASE SLAB	80	20	SL	NIL	40

R1 ALL REINFORCEMENT BARS ARE TO BE D500N U.N.O.

R2 ALL REINFORCEMENT WELDED MESHES TO BE GRADE 500L U.N.O.

R3 WELDING OF REINFORCEMENT SHALL NOT BE PERMITTED
UNLESS SHOWN ON THE STRUCTURAL DRAWINGS OR
APPROVED BY THE ENGINEER.



FOR DEVELOPMENT APPLICATION

[illegible]

APPENDIX B
INDICATIVE STORMWATER LAYOUT DRAWINGS BY COSTIN ROE CONSULTING FOR
REFERENCE

BREAKLINE - REFER TO DRAWING SSDA402 FOR CONTINUATION

PROPOSED PAD 3C
FFL RL 3.60
+/- 500mm

PROPOSED STILLING POND
REFER TO DRAWINGS SSDA901 TO
SSDA950 FOR DETAILS

PROPOSED TRUNK DRAINAGE
CHANNEL REFER TO DRAWINGS
SSDA901 TO SSDA950 FOR DETAILS

PROPOSED STILLING POND
REFER TO DRAWINGS SSDA901 TO
SSDA950 FOR DETAILS

PROPOSED STILLING POND
REFER TO DRAWINGS SSDA901 TO
SSDA950 FOR DETAILS

PROVIDE 900mm CAPPED STUB FOR
WAREHOUSE 3C CATCHMENT (APPROX AREA
2.69HA) DRAINAGE CONNECTION

PROVIDE 450mm CAPPED STUB
FOR RETAIL CATCHMENT
(APPROX AREA 0.42HA)
DRAINAGE CONNECTION

STORMWATER QUALITY IMPROVEMENT DEVICE (SQID) SOUTH
50x0.6m PROTECT 690mm TALL NPSORB STORMFILTER
CARTRIDGES WITHIN DOUBLE VAULT - AREA 22.1m². INSTALL
OFFLINE WITH HIGH FLOW/LOW FLOW BYPASS AT PIT S9

DISCHARGE POINT SOUTH
DISCHARGE TO COOKS RIVER VIA EXISTING
1500mm OUTLET PIPE AND HEADWALL.
EXISTING PIPE IL -0.64m AHD. EXISTING
OUTLET TO BE MADE GOOD AS REQUIRED

DISCHARGE TO COOKS RIVER PROVIDE
SMOOTH CONNECTION AND ALIGN TO
BANKS. PROVIDE 20m LONG RIP-RAP
ENERGY DISSIPATER

NOTES:

- REFER TO DRAWING SSDA101 FOR STORMWATER DRAINAGE NOTES.

NOTES:

PIT LOCATIONS SHOWN NOMINALLY ONLY.
BUILDER TO ALLOW FOR PITS AT MAX 30m CENTRES THROUGHOUT.

MAIN DRAINAGE LINES SHOWN ONLY. CONTRACTOR TO ALLOW FOR
ALL CONNECTIONS TO SUSPENDED AND UPPER LEVEL DRAINAGE,
ANCILLARY LINES AND DRAINAGE, PLUS SUBSOIL LINES AS REQUIRED.

LEGEND:

LEVELS DATUM IS AHD.

EXISTING CONTOURS ARE BASED ON LIDAR
INFORMATION OBTAINED FROM NSW GOVERNMENT
SPATIAL SERVICES DATED MAY 2020.

- 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
- FINISHED PAVEMENT CONTOUR (MAJOR)
0.5m INTERVALS
- FINISHED PAVEMENT CONTOUR (MINOR)
0.1m INTERVALS
- DENOTES EXISTING WATER MAIN

CONCEPT STORMWATER DRAINAGE - SHEET 3
SCALE 1:500

KEY PLAN
SCALE: NTS

5m 0 10 20 30 40 50m
SCALE 1:500 AT A0 SIZE SHEET

FOR INFORMATION

1. REFER TO DRAWING SSDA101 FOR STORMWATER DRAINAGE NOTES.

PIT LOCATIONS SHOWN NOMINALLY ONLY.
BUILDER TO ALLOW FOR PITS AT MAX 30m CENTRES THROUGHOUT

MAIN DRAINAGE LINES SHOWN ONLY. CONTRACTOR TO ALLOW FOR ALL CONNECTIONS TO SUSPENDED AND UPPER LEVEL DRAINAGE, ANCILLARY LINES AND DRAINAGE, PLUS SUBSOIL LINES AS REQUIRED

LEVELS DATUM IS AHD

EXISTING CONTOURS ARE BASED ON LIDAR
INFORMATION OBTAINED FROM NSW GOVERNMENT
SPATIAL SERVICES DATED MAY 2020.

- | | |
|---|---|
|  | - 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 |
|  | - FINISHED PAVEMENT CONTOUR (MAJOR)
0.5m INTERVALS |
|  | - FINISHED PAVEMENT CONTOUR (MINOR)
0.1m INTERVALS |
|  | - DENOTES EXISTING WATER MAIN |

CONCEPT STORMWATER DRAINAGE - SHEET 3
SCALE 1:500

FOR INFORMATION

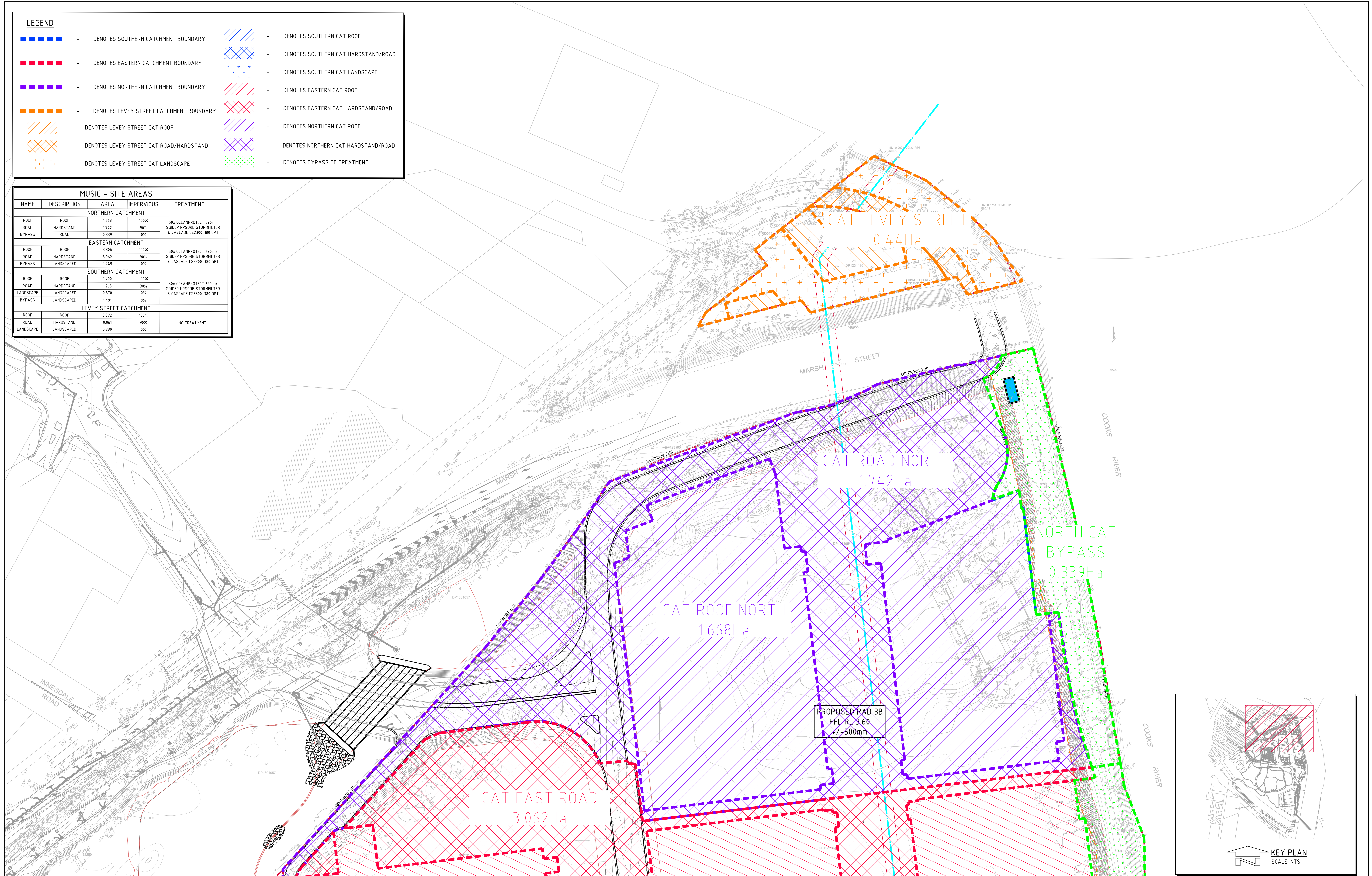
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SCALE 1:500 AT A0 SIZE SHEET

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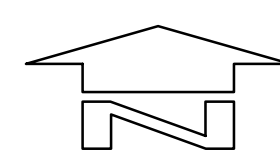
LEGEND

- | | | | | | |
|--|---|---|---|---|-------------------------------------|
|  | - | DENOTES SOUTHERN CATCHMENT BOUNDARY |  | - | DENOTES SOUTHERN CAT ROOF |
|  | - | DENOTES EASTERN CATCHMENT BOUNDARY |  | - | DENOTES SOUTHERN CAT HARDSTAND/ROAD |
|  | - | DENOTES NORTHERN CATCHMENT BOUNDARY |  | - | DENOTES SOUTHERN CAT LANDSCAPE |
|  | - | DENOTES LEVEY STREET CATCHMENT BOUNDARY |  | - | DENOTES EASTERN CAT ROOF |
|  | - | DENOTES LEVEY STREET CAT ROOF |  | - | DENOTES EASTERN CAT HARDSTAND/ROAD |
|  | - | DENOTES LEVEY STREET CAT ROAD/HARDSTAND |  | - | DENOTES NORTHERN CAT ROOF |
|  | - | DENOTES LEVEY STREET CAT LANDSCAPE |  | - | DENOTES NORTHERN CAT HARDSTAND/ROAD |
| | | |  | - | DENOTES BYPASS OF TREATMENT |

MUSIC - SITE AREAS				
NAME	DESCRIPTION	AREA	IMPERVIOUS	TREATMENT
NORTHERN CATCHMENT				
ROAD	ROAD	1.668	100%	50x OCEANPROTECT 690mm SODEP NP50RD STORMFILTER & CASCADE CS2300-180 GPT
ROAD	HARDSTAND	1.742	90%	
BYPASS	ROAD	0.339	0%	
EASTERN CATCHMENT				
ROAD	ROAD	3.806	100%	50x OCEANPROTECT 690mm SODEP NP50RD STORMFILTER & CASCADE CS3300-380 GPT
ROAD	HARDSTAND	3.062	90%	
BYPASS	LANDSCAPED	0.769	0%	
SOUTHERN CATCHMENT				
ROAD	ROAD	1.400	100%	50x OCEANPROTECT 690mm SODEP NP50RD STORMFILTER & CASCADE CS3300-380 GPT
ROAD	HARDSTAND	1.768	90%	
LANDSCAPE	LANDSCAPED	0.370	0%	
BYPASS	LANDSCAPED	1.491	0%	
LEVEY STREET CATCHMENT				
ROAD	ROAD	0.092	100%	NO TREATMENT
ROAD	HARDSTAND	0.061	90%	
LANDSCAPE	LANDSCAPED	0.290	0%	

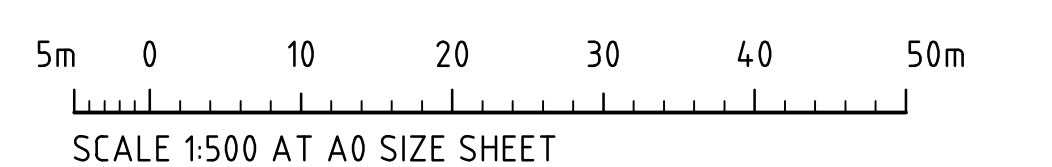


BREAKLINE - REFER TO DRAWING SSDA422 FOR CONTINUATION



STORMWATER QUALITY CATCHMENT PLAN - SHEET 1
SCALE 1:500

FOR INFORMATION

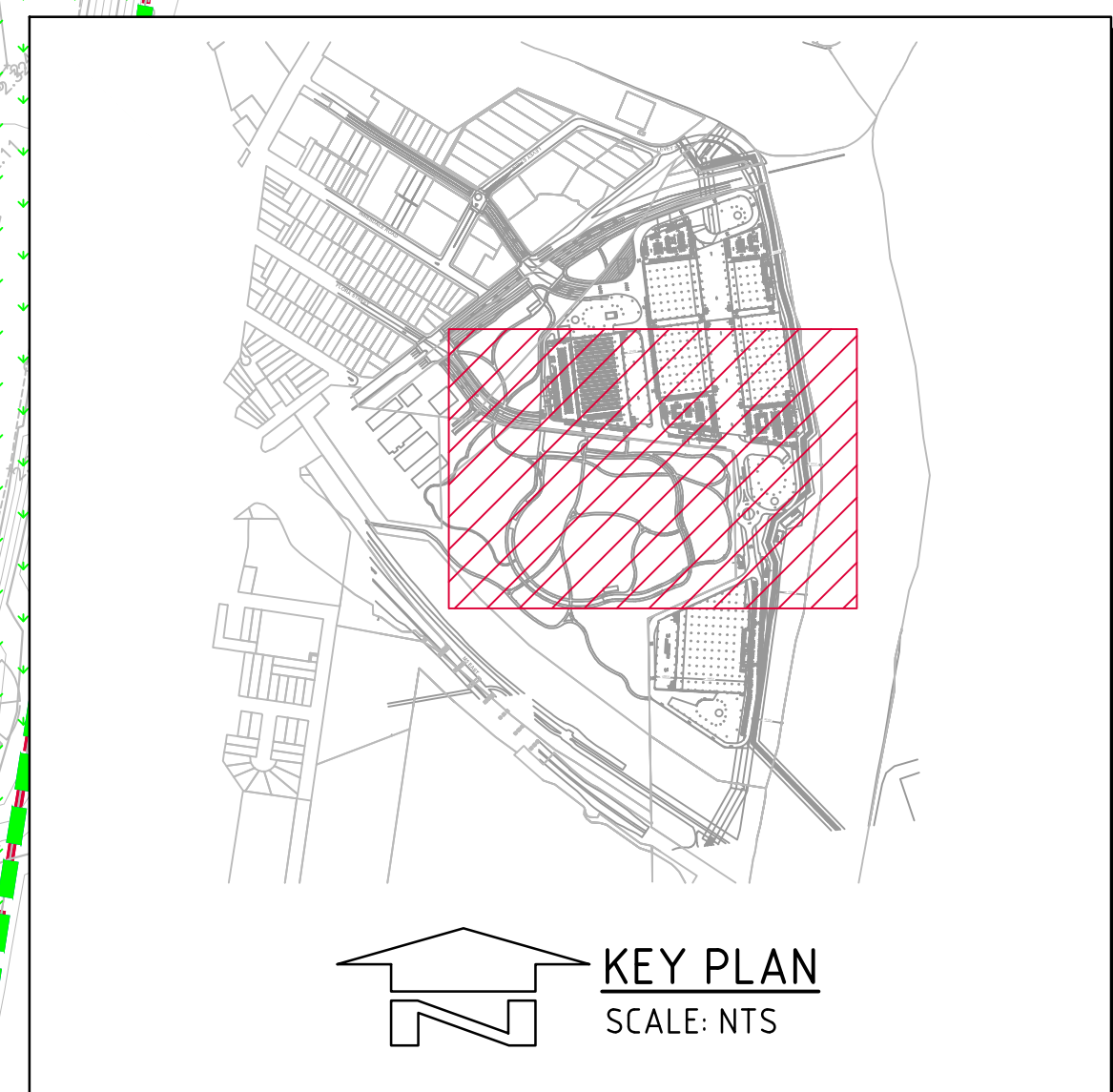


ISSUED FOR INFORMATION 10.04.26 C ISSUED FOR DEVELOPMENT APPLICATION 15.12.25 B ISSUED FOR DEVELOPMENT APPLICATION 08.12.25 A AMENDMENTS DATE ISSUE AMENDMENTS DATE ISSUE AMENDMENTS DATE ISSUE AMENDMENTS										ARCHITECT GRIMSHAW CLIENT Stockland PROJECT KOGARAH GOLF CLUB DEVELOPMENT PROPOSED WAREHOUSE DISTRIBUTION & OFFICE MARSH STREET, ARLIFFE, NSW 2205 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 9253 7699 f: +61 2 9241 3703 e: maa@costinroe.com.au w: crcostinroe.com.au CRC CIVIL & STRUCTURAL ENGINEERS DRAWING TITLE STORMWATER QUALITY CATCHMENT PLAN SHEET 1 DRAWING NO. C09916.06-SSDA421 ISSUE									
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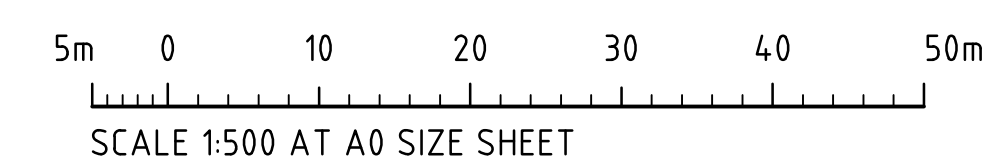


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|---|---|---|---|---|-------------------------------------|
|  | - | DENOTES SOUTHERN CATCHMENT BOUNDARY |  | - | DENOTES SOUTHERN CAT ROOF |
|  | - | DENOTES EASTERN CATCHMENT BOUNDARY |  | - | DENOTES SOUTHERN CAT HARDSTAND/ROAD |
|  | - | DENOTES NORTHERN CATCHMENT BOUNDARY |  | - | DENOTES SOUTHERN CAT LANDSCAPE |
|  | - | DENOTES LEVEY STREET CATCHMENT BOUNDARY |  | - | DENOTES EASTERN CAT ROOF |
|  | - | DENOTES LEVEY STREET CAT ROOF |  | - | DENOTES EASTERN CAT HARDSTAND/ROAD |
|  | - | DENOTES LEVEY STREET CAT ROAD/HARDSTAND |  | - | DENOTES NORTHERN CAT ROOF |
|  | - | DENOTES LEVEY STREET CAT LANDSCAPE |  | - | DENOTES NORTHERN CAT HARDSTAND/ROAD |
| | | |  | - | DENOTES BYPASS OF TREATMENT |

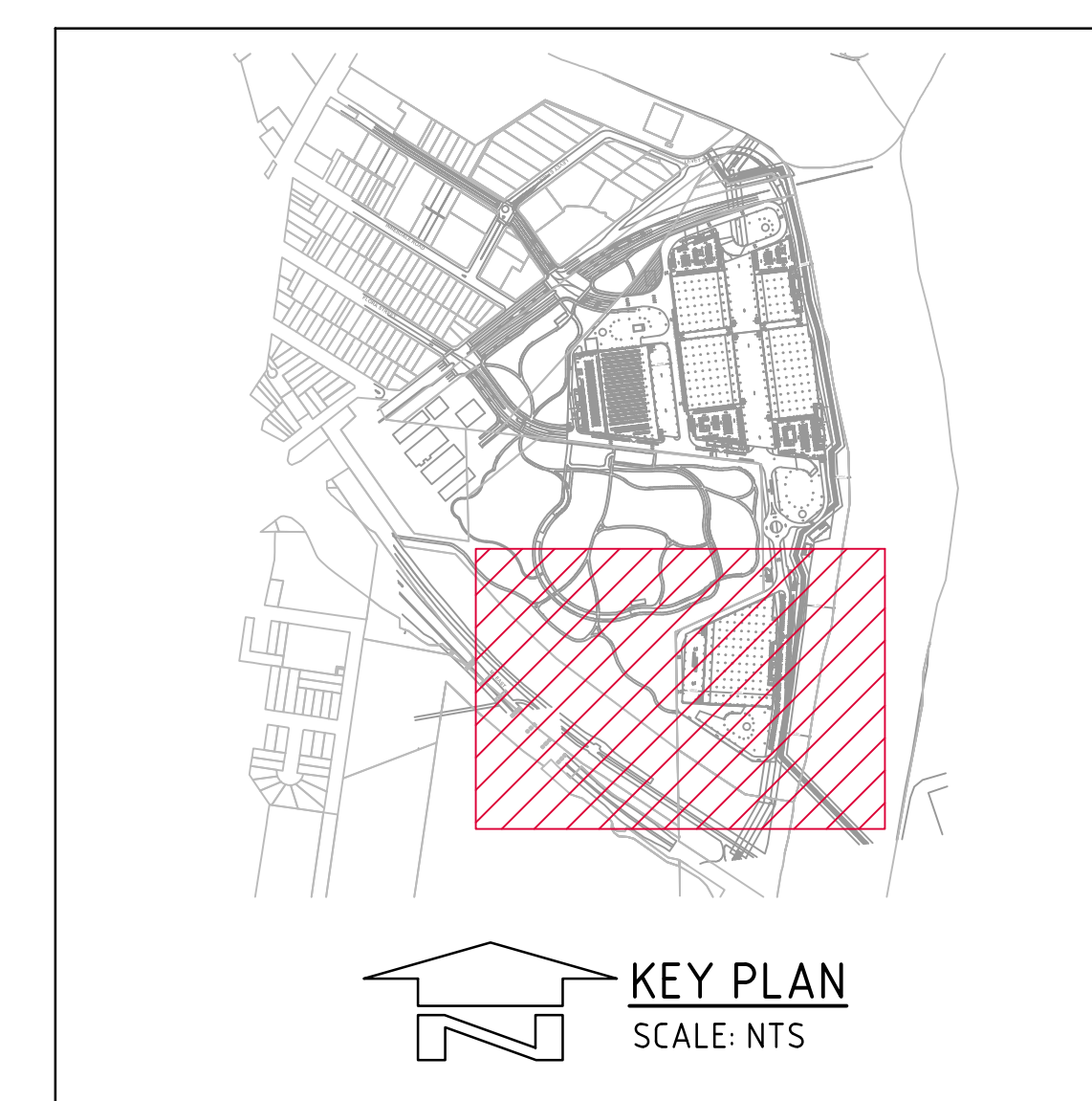


STORMWATER QUALITY CATCHMENT PLAN - SHEET 2
SCALE 1:500

FOR INFORMATION



																														ARCHITECT										CLIENT										PROJECT																				Costin Roe Consulting Pty Ltd. ABN 50 003 696 446										 CIVIL & STRUCTURAL ENGINEERS										DRAWING TITLE STORMWATER QUALITY CATCHMENT PLAN SHEET 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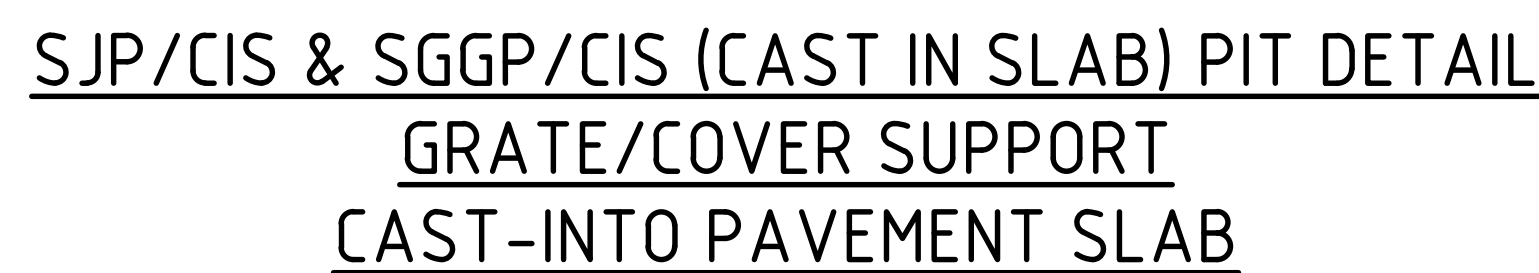


STORMWATER QUALITY ATTACHMENT PLAN - SHEET 3
SCALE 1:500

FOR INFORMATION

5m 0 10 20 30 40 50
SCALE 1:500 AT A0 SIZE SHEET

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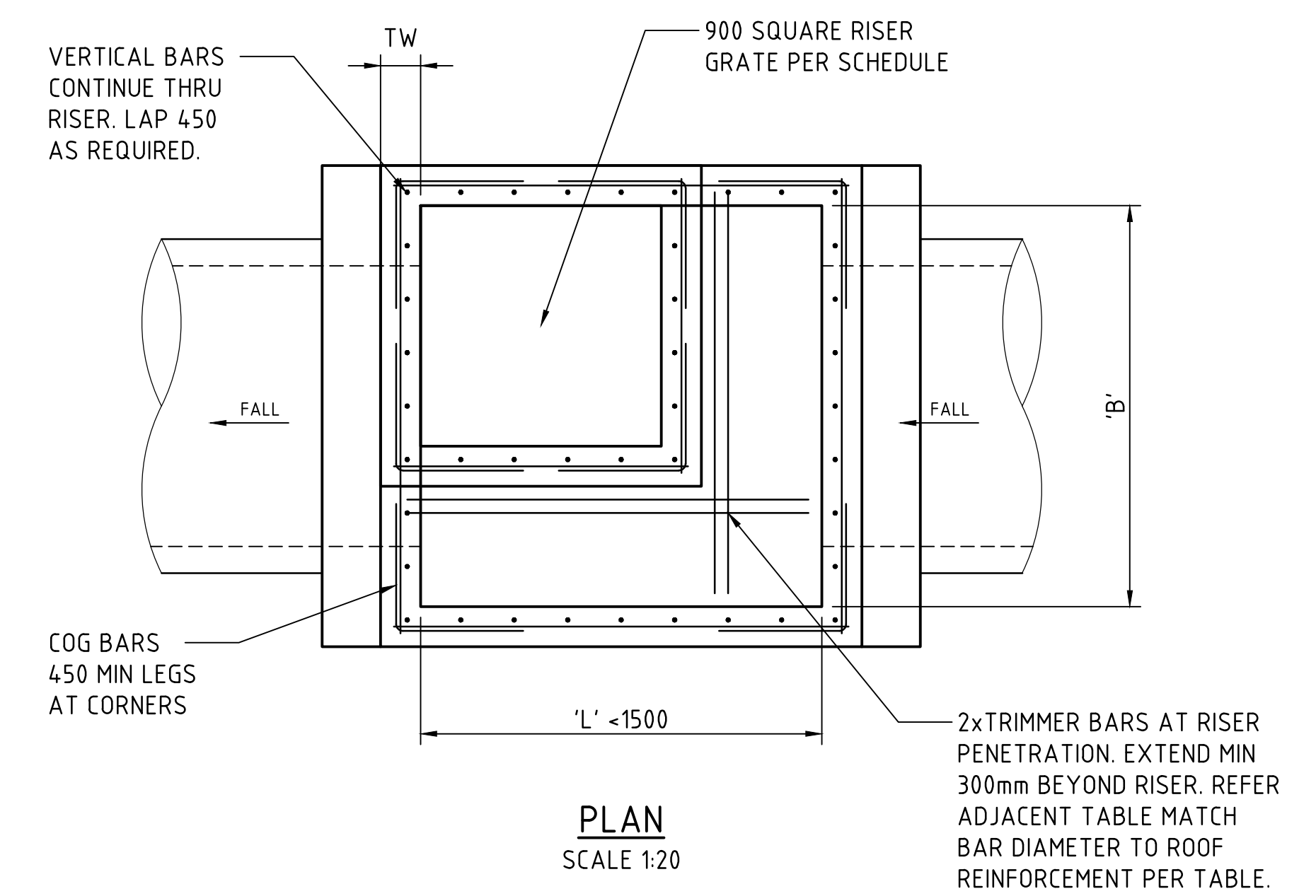
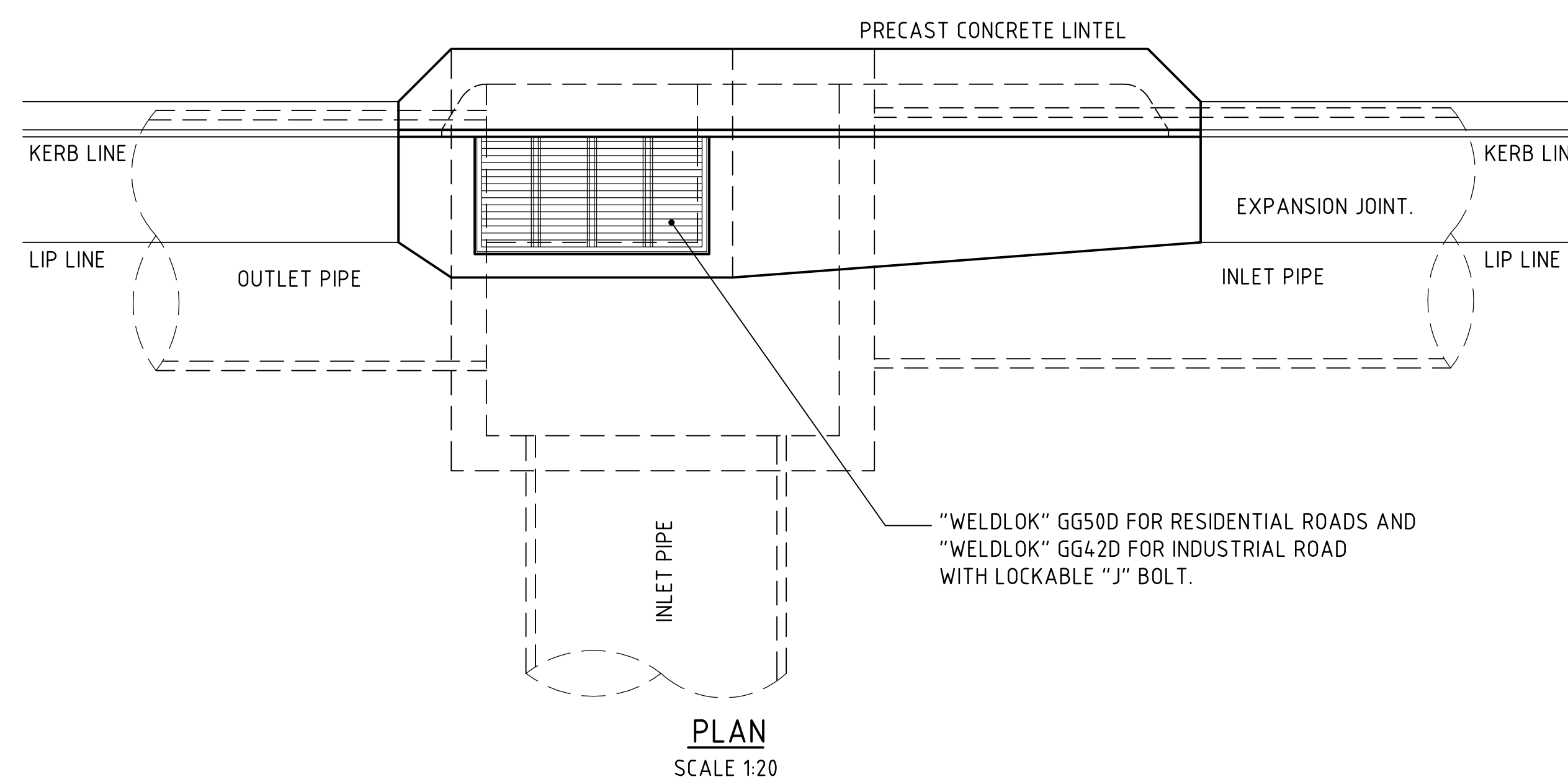
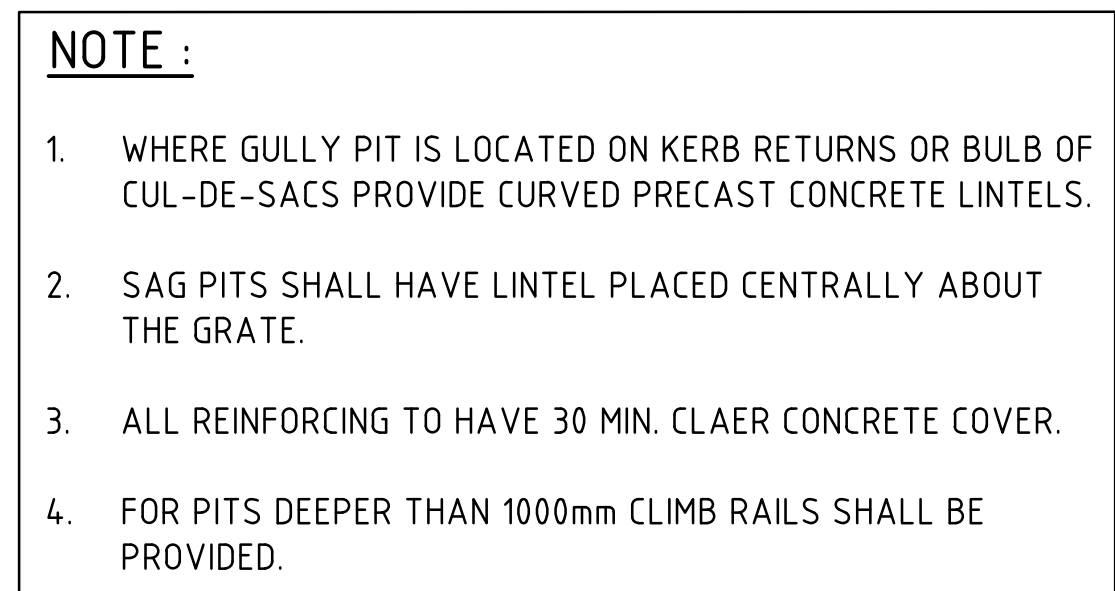
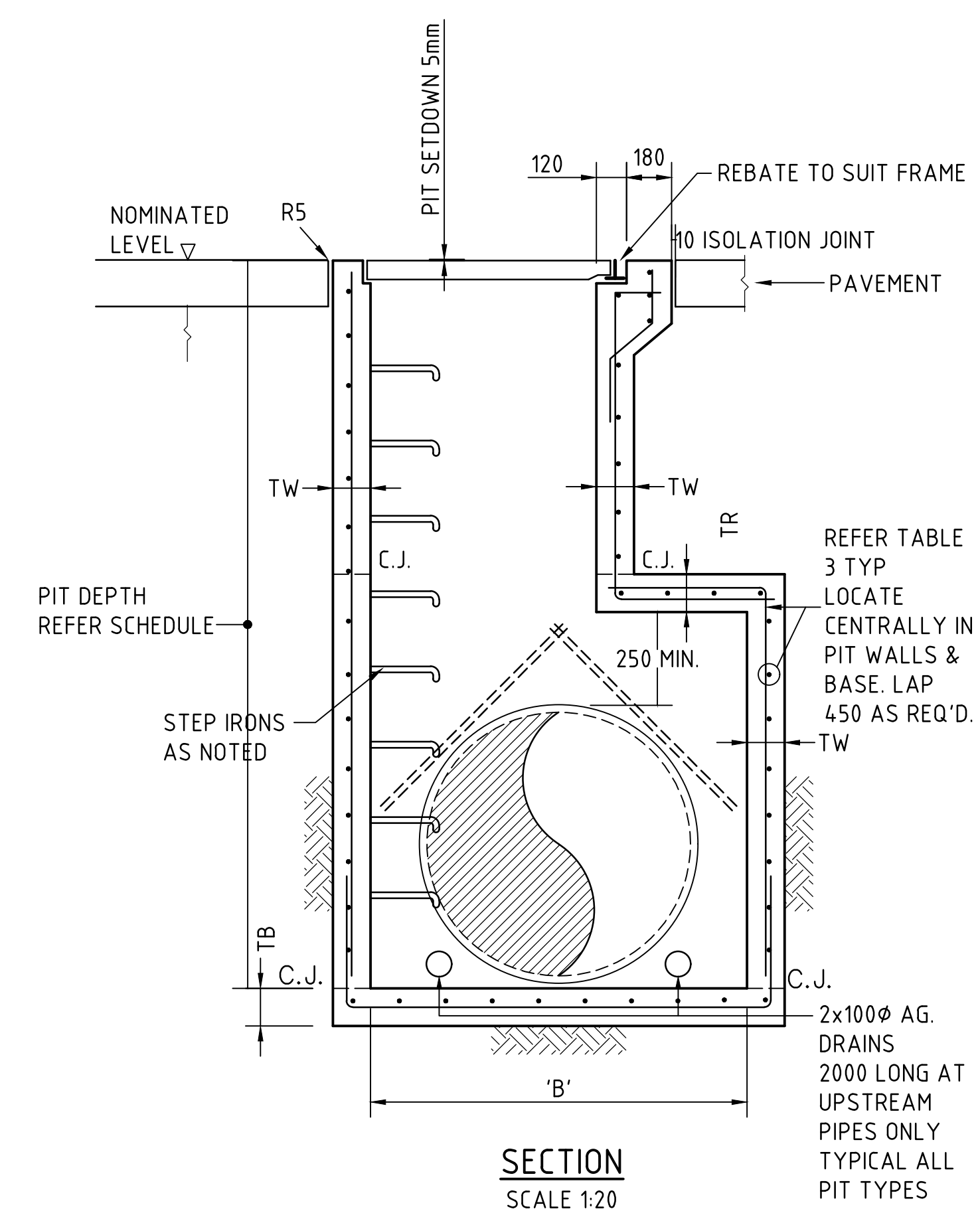
SIDE ZONE WIDTH	
PIPE SIZE (mm)	ℓ (mm)
≤ 900φ	150
1050φ	175
1200φ	200
1350φ	225
1500φ	250
1650φ	275
1800φ	300
ENGINEER TO SPECIFY TRENCH WIDTHS FOR PIPE SIZES GREATER THAN 1800φ	

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

SELECT FILL MATERIAL IN ACCORDANCE WITH
TABLE 1 AS 3725

200mm 0 500 1000 1500 2000mm
SCALE 1:20 AT A0 SIZE SHEET

FOR INFORMATION



DEPTH 'H'	WALL THICKNESS 'TW'	WALL REINFORCEMENT	ROOF THICKNESS 'TR'	ROOF REINFORCEMENT	BASE THICKNESS 'TB'	BASE REINFORCEMENT
<15m	150mm	N12-200 EACH WAY	150mm	N12-200 EACH WAY	150mm	N12-200 EACH WAY
15m-3.0m	200mm	N12-200 EACH WAY	200mm	N12-200 EACH WAY	200mm	N12-200 EACH WAY
3.0m-4.5m	200mm	N16-200 EACH WAY	200mm	N16-200 EACH WAY	200mm	N12-200 EACH WAY
4.5-6.0	250mm	N16-200 EACH WAY	250mm	N16-200 EACH WAY	250mm	N16-200 EACH WAY

APPENDIX C

FUTURE WATER CYCLE MANAGEMENT STRATEGY & DRAINAGE METHODOLOGY

C.1 Indicative Surface Water Drainage System

As per general engineering practice and the guidelines of Council, the indicative future 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 BC 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 is 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 stormwater trunk drains that traverse the site, consistent with existing conditions.

With reference to the drawings in **Appendix B**, the drainage system proposed can be described as follows:

- In-ground piped drainage system designed to the 5% AEP (1 in 20yr ARI);
- Site discharge to Cooks River.
- Treatment of stormwater via pit inserts and a proprietary treatment system;
- Conveyance of overland flow from the site through the hardstand and carparking areas to the Cooks River.

C.2 Hydrologic Modelling and Analysis

C.2.1 Minor/ Major System Design

In accordance with *Bayside Council DCP 2022* and generally accepted engineering practice, the piped stormwater drainage (minor) system has been designed to accommodate the 20-year ARI storm event (Q20). Overland flow paths (major)

which will convey all stormwater runoff up to and including the Q100 event have also been provided which will limit major property damage and any risk to the public in the event of a piped system failure for flows above the capacity of the piped system. Overland flow from the property will be directed to the Cooks River.

C.2.2 Rainfall Data

Rainfall Intensity–Frequency–Duration (IFD) data for the 2 to 100 Year Average Recurrence Interval (ARI) events were obtained from the Bureau of Meteorology 2016 IFD dataset (Australian Rainfall and Runoff 2019 Data Hub). Design rainfall depths and temporal patterns are consistent with the ARR 2019 methodology and the nearest Bureau gauging station (e.g. Sydney Airport).

C.2.3 Runoff Models

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

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

Table 11.1 - DRAINS Parameters

Model	Model for Design and analysis run	Rational method	
	Rational Method Procedure	ARR 2019	
	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	
	Inlet Pit Capacity		

C.3 Hydraulics

C.3.1 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.

C.3.2 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 300mm below the finished floor level of the building.

C.3.3 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.

C.3.4 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).

C.3.5 Overland Flow

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 estate road and associated drainage infrastructure.

C.3.6 Site Discharge

The final staged stormwater masterplan will be developed to establish new internal drainage catchments while maintaining discharge locations consistent with existing site conditions. Stormwater from the development will discharge directly to the Cooks River via three existing outlet locations, in accordance with the established catchment drainage pattern and independent of Council's drainage network.

- Discharge Point 1 – Located at the northeast of the site, discharging through a new $\varnothing 1200$ mm RCP to the Cooks River at IL 0.12 m AHD, with a maximum contributing catchment area of 5.26 ha.
- Discharge Point 2 – Located at the central eastern boundary, discharging through an upgraded $\varnothing 1200$ mm RCP to the Cooks River at IL -0.51 m AHD, with a maximum contributing catchment area of 6.80 ha.

- Discharge Point 3 – Located at the southeast of the site, discharging through an existing ø1500 mm RCP to the Cooks River at IL -0.61 m AHD, with a maximum contributing catchment area of 4.70 ha.

The proposed future discharge points are shown on drawings **CO9919.06-SSDA401** to **SSDA403**.

FUTURE WATER QUANTITY MANAGEMENT

C.4 General Design Principles

The Bayside Council “*Part 10 Stormwater Management Technical Guidelines*” (2021) establishes requirements for stormwater quantity management within the local government area.

In general, the guidelines require new developments to ensure that post-development runoff does not exceed pre-development discharge conditions and that all stormwater is appropriately managed on-site where feasible.

Section 6.1 of the *Guidelines* specifies that on-site detention (OSD) systems are required where increases in impervious area would otherwise result in higher downstream flows. However, the same section recognises that OSD may be omitted in specific hydraulic contexts, particularly in low-lying, tidally influenced catchments discharging directly to major waterways, such as the Cooks River.

The subject site lies within the Cooks River Estuary floodplain and discharges directly into the regional drainage system. The site's hydraulic behaviour is primarily influenced by tidal fluctuations and regional flood levels rather than by localised site discharges. Under these conditions, the introduction of OSD would not provide a measurable benefit and could, in fact, exacerbate flooding by delaying discharge and synchronising local runoff with regional flood peaks.

Accordingly, no on-site detention is proposed for this development. The stormwater management strategy focuses on generally preserving the existing catchment boundaries, maintaining natural drainage routes, and ensuring that pre- and post-development discharge characteristics remain consistent.

The key considerations supporting this approach are summarised below:

- No increase in runoff: With reference to Drawing **CO9919.06-SSDA400** to **SSDA404**, contained in **Appendix B** of this report, the site discharges directly to the Cooks River, a major receiving waterway with high conveyance capacity. The regional system, as represented in the Council's adopted flood model (originally developed by Arup Group), governs the downstream hydraulic performance.
- Floodplain interactions: The development area receives overland flows from upstream catchments along Marsh Street and is subject to potential backwater effects from the Cooks River. Detaining local runoff would alter hydrograph timing, increasing the risk of flood level coincidence within the regional floodplain.
- Compliance with Council Guidelines: In accordance with Section 6.1 of the Bayside Council Stormwater Management Technical Guidelines (2021), OSD is not required where detention would not reduce peak flows or would have adverse impacts on downstream hydraulics. The proposed strategy satisfies this exemption.
- Integration with Flood and Drainage Strategy: The proposed diversion channel and culvert system at Gertrude and Flora Streets preserve natural conveyance of both external and on-site flows, ensuring that Council's downstream trunk system continues to operate as intended.

C.5 Water Quantity Management Features

C.5.1 Existing

The existing site, a former golf course, currently conveys overland flow from Marsh Street through low-lying areas to the Cooks River. No on-site detention or formal quantity control measures are in place. The site's runoff is characterised by gradual sheet flow and shallow surface drainage typical of vegetated open space within a floodplain setting.

C.5.2 Proposed

No stormwater quantity measures are proposed as described in **Section C.4**.

Stormwater from the development will discharge directly to the Cooks River via three existing outlet locations, in accordance with the established catchment drainage pattern and independent of Council's drainage network, as noted in **Section C.3.6**.

Refer to drawings in **Appendix B** for discharge location and details.

FUTURE STORMWATER QUALITY, REUSE, AND MAINTENANCE

C.6 Regional Parameters

The stormwater quality management for the future developments has been designed in accordance with the principles of Water Sensitive Urban Design (WSUD), aiming to minimise the transport of pollutants to the receiving environment and to meet the objectives of Bayside Council.

Bayside Council specifies, in *Section 16 of Part 10 – Stormwater Management Technical Guidelines (2021)* of the *Botany Bay Development Control Plan (2013)*, that stormwater quality targets are to be assessed and achieved on a catchment-wide basis. These targets are derived from the *Botany Bay and Catchment Water Quality Improvement Plan (BBWQIP, 2011)* and are expressed as annual average percentage reductions in pollutants generated from developed catchments, as per the **Table 11.2** below:

Table 11.2 - Stormwater Quality Requirements

Pollutant	% Reduction
Gross Pollutants	90%
Total Suspended Solids (TSS)	85%
Total phosphorous (TP)	60%
Total Nitrogen (TN)	45%

The stormwater pollutant objectives are presented in terms of annual percentage pollutant reductions on a developed catchment.

C.7 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 one of the three Ocean Protect OceanSave GPT;
- Tertiary treatment of the development will be made by draining the area into one of the three Water Quality tanks with Ocean Protect StormFilter cartridges.
- A portion of the roof will also be treated via rainwater reuse and settlement within the rainwater tank.

C.8 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 C.6** 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 D**. **Figure 11.1** below shows the MUSIC model layout.

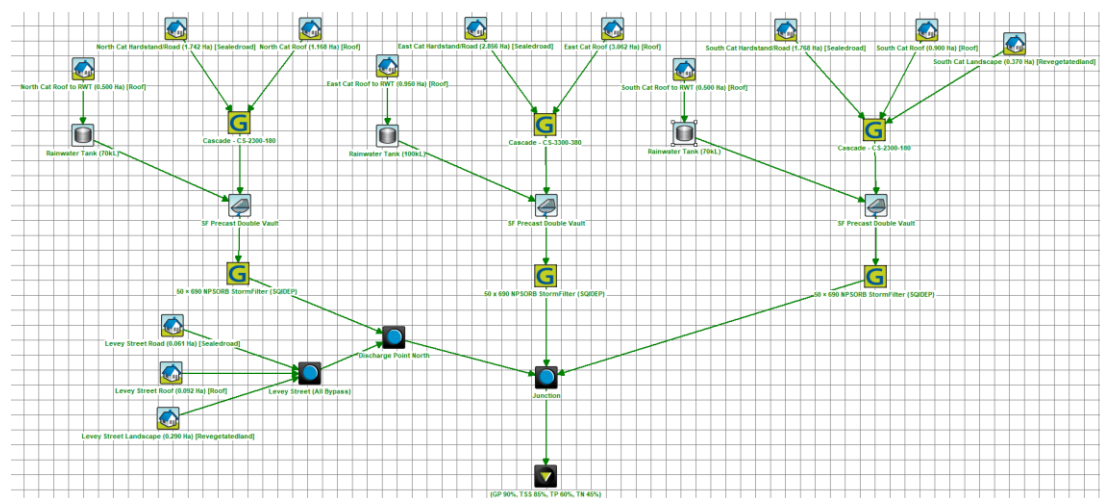


Figure 11.1 - MUSIC model layout

Table 11.3 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.

Table 11.3 - MUSIC analysis results - % reductions

	Source	Residual Load	% Reduction Achieved	% Reduction Targets
Total Suspended Solids (kg/yr)	27800	4100	85.2	Y (>85%)
Total Phosphorus (kg/yr)	56.6	17.9	68.3	Y (>60%)
Total Nitrogen (kg/yr)	373	170	54.4	Y (>45%)
Gross Pollutants (kg/yr)	3870	44.1	98.9	Y (>90%)

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

The MUSIC modelling has shown that the proposed treatment train of STM will provide stormwater treatment that will meet Council's reduction objective requirements effectively and economically.

C.9 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 non-potable water demand for the development by a minimum of 50% per the indicative outcomes for large storage projects Table 2.1 of the Stormwater Trust Department of Environment & Conservation NSW document "Managing Urban Stormwater – Harvesting and Reuse."

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.

Rainwater tanks have been designed, using MUSIC software to balance the supply and demand, based on the below base water demands to provide a 50% reduction in the non-potable water demands of the proposed development.

C.9.1 Internal Base Water Demand

Rainwater tank reuse demands have been calculated based on typical water demands of toilets and irrigation of landscaped areas. Water demands for toilets was calculated at 0.1 kL/day/toilet. Water demands for irrigation of landscaped areas was calculated using 0.3 kL/year/m².

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

Rainwater Tank	Number of Toilets	Irrigated Area (m2)	Demand (kL/Day)
RWT Northern Catchment	126	0	12.6

RWT Eastern Catchment	210	0	21.0
RWT Southern Catchment	84	3700	11.4

C.9.2 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 a dual high flow (225mm downpipe) and low flow (100mm downpipe) roofwater collection configuration, or a syphonic system with a high flow bypass manifold.

Table 11.4 - Rainwater Reuse Requirements

Roof Catchment (m2)	High Flow Bypass (m3/s)	Tank Size in MUSIC (kL)	Predicted Demand Reduction (%)	Provided Tank (kL)
RWT Northern Catchment	100	70	52.1	70
RWT Eastern Catchment	100	100	51.4	100
RWT Southern Catchment	100	70	52.5	70

The MUSIC model, results summarised in **Table 11.4**, predicts that the minimum 50% reduction in non-potable water demand outlined in Table 2.1 of the Stormwater Trust Department of Environment & Conservation NSW Document “Managing Urban Stormwater – Harvesting and Reuse,” will be met for the development with the provision of rainwater tanks sized as shown in the table above.

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

C.10 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 be made following large storm events.

APPENDIX D

MUSIC MODEL CONFIGURATION & PARAMETERS

D.1 Introduction

The MUSIC model 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 7.1.1 of Bayside Council's 2022 DCP 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 "9919.06 – Cooks Cove – rev3.sqz" was set up to examine the effectiveness of the water quality treatment train and to predict if BCC requirements have been achieved. The model was set up using parameters consistent with Bayside Council and the Botany Bay & Catchment Water Quality Improvement Plan (2011), and the layout of the MUSIC model is presented in Appendix B.

D.2 Rainfall Data

Six-minute pluviographic data 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	066062 Sydney Observatory
Rainfall Period	1 January 1982 – 31 December 1986 (4 Years)
Evapotranspiration	Sydney Monthly Areal PET
Model Timestep	6 minutes

D.3 Rainfall Runoff Parameters

Parameter	Value
Rainfall Threshold	1.50 (Roads) 0.30 (Roofs)
Soil Storage Capacity (mm)	170
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

D.4 Pollutant Concentrations & Source Nodes

Pollutant concentrations for source nodes are adopted as per the Table 11.5:

Table 11.5 - Pollutant Concentrations

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	1.10	0.17	-0.82	0.19	0.32	0.12
	Sealed Roads	1.20	0.17	-0.85	0.19	0.11	0.12
	Landscaping	1.2	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
	Landscaping	2.15	0.32	-0.6	0.25	0.30	0.19

The MUSIC model has been setup with a treatment train approach based on the pollutant concentrations in Table 11.5 above and the catchments shown on drawings **CO9919.06-SSDA421 to SSDA423**.

The relevant stormwater catchment sizes are listed in the following Table 6.2.

Table 11.6 – Water Quality Catchments

Catchment	Area (Ha)	Source Node	% Impervious	Stormwater Treatment
Northern Catchment				
Roof	1.168	Roof	0%	OceanProtect Cascade GPT + Stormfilter cartridges
Roof RWT	0.500	Roof	0%	Rainwater tank + Stormfilter cartridges
Road/Hardstand	1.742	Sealed Road	0%	OceanProtect Cascade GPT + Stormfilter cartridges
Eastern Catchment				
Roof	3.062	Roof	0%	OceanProtect Cascade GPT + Stormfilter cartridges
Roof RWT	0.950	Roof	0%	Rainwater tank + Stormfilter cartridges
Road/Hardstand	2.856	Sealed Road	0%	OceanProtect Cascade GPT + Stormfilter cartridges
Eastern Catchment				
Roof	0.900	Roof	0%	OceanProtect Cascade GPT + Stormfilter cartridges
Roof RWT	0.50	Roof	0%	Rainwater tank + Stormfilter cartridges
Road/Hardstand	1.768	Sealed Road	0%	OceanProtect Cascade GPT + Stormfilter cartridges
Landscape	0.370	Landscaping	100%	OceanProtect Cascade GPT + Stormfilter cartridges
Levey Street (Bypass)				
Roof	0.092	Roof	0%	N/A
Road	0.061	Sealed Road	0%	N/A
Landscape	0.290	Landscaping	100%	N/A

D.5 Treatment Nodes

Rainwater tanks nodes, Ocean Protect cascade nodes and Ocean Protect StormFilter nodes have been used in the modelling of the development.

Gross Pollutant Trap Cascade CS2100-180/CS3300-380

Parameter	Value
Treatable Flow	0.174/0.377 m ³ /s (Per GPT)

Pollutant Reductions

Per Ocean Protect Technical guidelines

Filtration Device (Ocean Protect NPSORB 690mm StormFilters)

Parameter	Value
Treatable Flow	0.0016 m ³ /s per filter cartridge

Pollutant Reductions

Per Ocean Protect Technical guidelines.

D.6 Results

Table 11.7 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 11.7. MUSIC analysis results

	Source	Residual Load	% Reduction Achieved	% Reduction Targets
Gross Pollutants (kg/yr)	27800	4100	85.2	Y (>85%)
Total Suspended Solids (kg/yr)	56.6	17.9	68.3	Y (>60%)
Total Phosphorus (kg/yr)	373	170	54.4	Y (>45%)
Total Nitrogen (kg/yr)	3870	44.1	98.9	Y (>90%)

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 from Council on an overall site basis.

D.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

and Sydney Water have been met. The MUSIC modelling has shown that the proposed treatment train of STM will provide stormwater treatment that will meet requirements in an effective and economical manner.

APPENDIX E DRAFT SOIL AND WATER MANAGEMENT PLAN

E.1 Introduction

An erosion and sediment control plan (ESCP) is shown on drawing **Co9919.06-SSDA200** with details on **SSDA250 & SSDA260**. 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.

E.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.

E.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 11.8**.

Table 11.8– Limitation to Access

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	
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E.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
1. All earthworks, including waterways/drains/spillways and their outlets, will be constructed to be stable in at least the design storm event.
2. 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.

E.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 tc 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.

E.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.

E.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 OFFICERDATE
 SIGNATURE

Legend: 4 OK 7 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 F

STORMWATER SYSTEM MAINTENANCE SCHEDULE

F.1 Introduction

It is important that each component of the water quantity measures, and water quality treatment train is properly operated and maintained. These need to be considered through the life cycle of the whole of the development. In order to achieve the design treatment objectives, a maintenance schedule has been prepared (refer to **Table 11.9** below).

Note that inspection frequency may vary depending on site specific attributes and rainfall patterns in the area. In addition to the maintenance requirements below it is also recommended that inspections are made following heavy rainfall or major storm events. Event heavy rain inspections should be carried out as soon as practicable following an intense period of rainfall, (i.e. greater than 100mm over 48 hours), as measured at Prospect Dam Weather Station No. 67019.

The maintenance requirements and schedule set out in this document are for the permanent drainage systems which will be required for the operational phase of the estate (i.e. after roads, buildings and final stormwater measures are constructed and occupied). The information in this appendix is provided subject to the provision of a future operational SMP for the whole of the development.

F.2 Types of Maintenance

Water Sensitive Urban Design (WSUD) assets require both proactive and reactive maintenance to ensure long term system health and performance.

Proactive maintenance refers to regular scheduled maintenance tasks, whereas reactive maintenance is required to address unscheduled maintenance issues. If an asset is not functioning as intended, then rectification may be required to restore the asset back to its intended functionality.

The preferred and recommended approach is for proactive maintenance.

F.2.1 Proactive Maintenance

Proactive maintenance is a set of scheduled tasks to ensure that the WSUD asset is operating as designed.

Proactive maintenance involves:

- Regular inspections of the WSUD asset;
- Scheduled maintenance tasks for issues that are known to require regular attention (e.g. litter removal, weed control); and
- Responsive maintenance tasks following inspections for issues which require irregular attention (e.g. sediment removal, mulching, and scour management).

Proactive maintenance in the first two years after the establishment period (construction and planting phases) are the most intensive and important to the long-term success of the treatment asset.

Proactive maintenance is a cost-effective means of reducing the long-term costs associated with operating stormwater treatment assets.

Maintenance activities specific to each WSUD asset type are detailed in the inspection and maintenance schedules and checklists provided in the report. The frequency of scheduled maintenance depends on the asset type and the issue being managed.

As a general guide, scheduled maintenance activities should be completed on a three to four-month cycle. The checklists provided should be used as a minimum guide to scheduled maintenance tasks and should be amended to suit site conditions and maintenance requirements.

Treatment assets should also be inspected at least once a year during or immediately after a significant rainfall event. This is important to confirm that the treatment system is functioning correctly under wet conditions.

A higher level of scheduled maintenance may be arranged for some treatment assets. This is often the case for treatment assets which are located in high profile locations (e.g. streetscapes and parklands), and where public amenity is considered to be a high priority. In these cases, a more frequent maintenance regime may be required to remove litter and weeds and to ensure vegetation health and cover is maintained to a high level.

F.2.2 Reactive Maintenance

Reactive maintenance is undertaken when a problem or fault is identified that is beyond the scope of proactive maintenance. Reactive maintenance may occur following a complaint about the WSUD asset (e.g. excessive odours or litter). Reactive maintenance often requires a swift response and may involve specialist equipment or skills.

F.2.3 Rectification

Rectification of a WSUD asset is undertaken when the system is not functioning as intended, and proactive and reactive maintenance activities are unable to return the asset to functional condition.

The lack of functional performance and therefore failure of a stormwater treatment asset may be related to many factors including inappropriate design, poor construction, and lack of regular maintenance or end of life cycle. In many cases, the design of assets has not included adequate consideration of the maintenance requirements, in terms of the system's ability to cope with catchment pollutant loads (i.e. sediments) and the frequency of maintenance required to maintain the system at a functional level.

Maintenance planning at the design phase is therefore crucial to both the long-term operating costs and the expected life cycle of the treatment system. In general, the expected lifecycle of a stormwater treatment asset (e.g. a bio-retention system) that has been well designed and constructed and is regularly maintained should be at least 15-20 years.

However, the lifecycle for each treatment system will be different and related to:

- whether the system has been designed, constructed and maintained according to best practice;

- catchment characteristics (influences the quality of the stormwater);
- the age and general health of the system; and
- the type of plants that have been used in the system.

Regular asset condition assessments should be undertaken to monitor the system condition and to inform where an asset is in terms of its expected lifecycle. Renewal of a system refers to replacing the main elements of the system including:

- infrastructure;
- removing deposited sediment, removing and replacing the topsoil (or filter media in the case of a bio-retention system) and profiling the topsoil level back to the design levels;
- re-planting; and
- pavement and sub-layers (in the case of permeable pavements).

A WSUD specialist may be required to assess whether a treatment system has reached the end of its life cycle and to provide advice on the renewal works.

Asset condition assessments can also identify assets that need to be rectified. The decision to continue with an increased maintenance regime or to rectify an asset, and over what timeframe, can be a difficult one to make. This is because certain maintenance items are more important to overall system function than others. For example, extended ponding on the surface of a bio-retention system or persistent scouring of a swale should be addressed more rapidly than recurrent weed problems.

F.3 Routine Inspections and Maintenance Schedule for General Stormwater System

Routine inspections are to be carried out to assess the need for maintenance and are primarily concerned with checking the functionality of the stormwater drainage facilities; items such as drains, drainage pits, box culverts, detention tanks and rainwater reuse tank systems. Maintenance of these items is vitally important for the ongoing drainage and treatment of stormwater.

Should the inspection reveal that maintenance of any item is required, this is to be reported to the building management for action.

Items that are to be subject to Routine Inspections for Maintenance may comprise, but not be limited to those listed in the table below. This table is to be read in conjunction with the Stormwater design drawings.

It is vitally important that each component of the stormwater system is properly operated and maintained. In order to achieve the modelled and design treatment outcomes, a maintenance schedule has been prepared (below) to assist in the effective operation and maintenance of the various drainage and water quality components.

Table 11.9. 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.

Rainwater Tanks			
Check for any clogging and blockage of the first flush device	Six 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
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.
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.
Proprietary Treatment Devices (Ocean Protect)			
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.

APPENDIX G
CRC FLOOD AND OVERLAND FLOW ASSESSMENT (CO9919.06-15.RPT)

APPENDIX H
SSD-84467726 SEAR'S DATED 17 JUNE 2025

Planning Secretary's Environmental Assessment Requirements

Kogarah Golf Course Redevelopment – Concept & Stage 1 Works



Application Number	SSD-84467726
Project Name	Kogarah Golf Course Redevelopment – Concept & Stage 1 Works
Development	Concept proposal and stage one development including: • Stage 1 works for demolition, clearing of vegetation, remediation, bulk earthworks, infrastructure delivery (including seawall), and roadworks • Concept proposal for the staged development of the site comprising five buildings to accommodate uses including warehousing, data centre, food and drink premises, hotel or motel accommodation, office premises, and trade-related enterprises.
Location	13-19A Marsh Street, Arncliffe in the Bayside LGA • Lot 100 DP1231954 • Lot 31 DP1231486 • Lot 14 DP213314 • Lots 62 & 63 DP1301057 • Lot 1 DP329283 • Lot 1 DP 108492
Applicant	The Trustee for Cook Cove Property Trust 2
Date of Issue	17 June 2025
General Requirements	The Environmental Impact Statement (EIS) for the development must: • comply with these assessment requirements • meet the form and content requirements in sections 190 and 192 of the Environmental Planning and Assessment Regulation 2021 (the Regulation) • have regard to the Department's <i>State Significant Development Guidelines (2021)</i>. In addition, the EIS must include: • a clear comprehensive description of the proposal for the site, including details of all activities and processes proposed to be carried out as part of the development • consideration of issues discussed in the public authority responses to request for key issues (see Attachment 2) • a detailed assessment of the key issues specified below, including: – a description of the existing environment, using sufficient baseline data – an assessment of the potential impacts of all stages, all proposed uses and activities that form part of the development, including any cumulative impacts, taking into consideration relevant guidelines, policies, plans and statutes – justification for the level of assessment carried out for each of the key issues as they relate to the Concept and Stage 1 development application – a description of the measures that would be implemented to avoid, minimise, mitigate and if necessary, offset the potential impacts of the development, including all proposed uses. The EIS must also be accompanied by: • an Estimated Development Cost (EDC) Report prepared in accordance with the relevant planning circular using the Standard Form of EDC Report • an estimate of the retained and new jobs that would be created during the construction and operational phases of the development, including details of the methodology to determine the figures provided • high quality files of maps and figures of the subject site and proposal • certification that the information provided is accurate at the date of preparation • a declaration from a Registered Environmental Assessment Practitioner that your EIS includes the information specified in the Department's <i>Registered Environmental Assessment Practitioner Guidelines</i>.
Key issues	The EIS must address the following specific matters:

- **Statutory and Strategic Context** – including:
 - justification for the proposal and the suitability of the site
 - detailed justification that the proposed land uses are permissible with consent
 - details of any proposed consolidation or subdivision of land
 - a detailed description of the history of the site, including the relationship between the proposed development and all development consents, infrastructure approvals and approved plans previously and/or currently applicable to the site
 - details of likely staging of the proposal, and a clear description of what items will be delivered as part of stage 1 works, and what will be delivered in the future stages
 - details of how the proposal will interact and align with works under any local voluntary planning agreement (LVPA), including details of the approval pathway sought for these works
 - a response to clause 6.18 of the Bayside Local Environmental Plan 2021, including consideration of any site-specific development control plan
 - demonstration the proposal is consistent with all relevant planning strategies, environmental planning instruments, adopted precinct plans, draft district plan(s) and adopted management plans and justification for any inconsistencies. This includes, but is not limited to:
 - State Environmental Planning Policy (Biodiversity and Conservation) 2021
 - State Environmental Planning Policy (Industry and Employment) 2021
 - State Environmental Planning Policy (Planning Systems) 2021
 - State Environmental Planning Policy (Primary Production) 2021
 - State Environmental Planning Policy (Resilience and Hazards) 2021
 - State Environmental Planning Policy (Sustainable Buildings) 2022
 - State Environmental Planning Policy (Transport and Infrastructure) 2021
 - State Environmental Planning Policy (Precincts—Eastern Harbour City) 2021
 - Greater Sydney Region Plan: A Metropolis of Three Cities
 - Eastern City District Plan
 - Future Transport Strategy 2056.
- **Suitability of the Site** – including:
 - a detailed justification for the proposal and that the site can accommodate the proposed development having regard to its potential environmental impacts, permissibility, strategic context and existing site constraints.
- **Community and Stakeholder Engagement** – a community and stakeholder engagement strategy consistent with the Department's *Undertaking Engagement Guidelines for State Significant Projects* for all stages of the development, including (but not limited to):
 - details of how issues raised, and feedback provided during engagement activities have been considered and responded to in the development
 - details of the proposed approach to future community and stakeholder engagement based on the results of consultation.
- **Traffic and Transport** – a quantitative transport impact assessment prepared in accordance with the Transport for NSW Guide to Transport Impact Assessment (GTIA) and Austroads guidelines, that includes:
 - consideration of all deliverables and actions for construction and operation of the development in Appendix E – Scoping checklist of the GTIA
 - an estimate of trip generation, and trip distribution likely to be generated by the development for all stages of operation and construction (including the fully developed site)
 - an assessment of cumulative traffic impact on road performance and safety implications at key intersections using an appropriate modelling framework (including the consideration of existing base case, future base case and project case scenarios)
 - plans demonstrating how all vehicles likely to be generated during construction
 - details and plans of any proposed internal road network, access points, on-site parking provisions, in accordance with the relevant Australian Standards and Austroads/TfNSW technical guidelines
 - detail of ownership of estate road infrastructure
 - description of how the proposal will interact with M6 Motorway works
 - swept path diagrams for the largest vehicles manoeuvring through site access points, internal roads, hardstand areas and nearby intersections (where necessary)

- details of road upgrades, traffic control measures, new roads or access points required for the development if necessary (including approval-in-principle from the relevant road authority, where relevant)
- details on how the proposal will interact with works under the Voluntary Planning Agreement SVPA2024-25, including the approval pathway for delivery of this road upgrade
- details of the likely trip generation, construction vehicle routes, access and parking arrangements during Stage 1 construction works and measures to mitigate any construction traffic and parking impacts, detailed in a draft Construction Traffic Management Plan.
- details of the adequacy of existing public transport or any future public transport infrastructure within the vicinity of the site, pedestrian and bicycle networks and associated infrastructure to meet the likely future demand for the proposed development
- measures to integrate the development with the existing/future public transport network.
- **Water Management** – an integrated water management strategy, including:
 - a detailed site water balance including a description of the likely water demands and breakdown of water supplies, measures to minimise water use and any water licensing requirements
 - an assessment of potential surface and groundwater impacts (both quality and quantity) associated with the development, including potential impacts on watercourses, riparian areas, groundwater, and groundwater-dependent communities nearby in accordance with relevant water quality guidelines and the Department of Climate Change, Energy, the Environment and Water - Water Group (DCCEEW-Water) Groundwater Toolkit
 - conceptual details of the proposed stormwater/wastewater drainage design including the capacity of onsite detention system(s), onsite sewage management and measures to treat, reuse or dispose of water
 - a surface water discharge assessment in accordance with relevant EPA guidelines, including an assessment of potential impacts on watercourses and riparian areas, and characterisation of water quality at the point of discharge against the relevant water quality criteria using a MUSIC water quality model
 - details of any surface or groundwater mitigation, management and monitoring activities and methodologies
 - identification of all works located on waterfront land and demonstration that the proposal meets the Guideline for Controlled Activities on Waterfront Land.
- **Flooding** – a flood impact risk assessment (FIRA) in accordance with the *Flood risk management guideline LU01 - Flood impact and risk assessment* (2023). The FIRA must:
 - align with the advice received in letters received from the NSW Department of Climate Change, Energy, the Environment and Water dated 12 June 2025 and Bayside Council dated 12 June 2025
 - identify any flood risk on-site (mainstream and overland) having regard to adopted flood studies, the potential effects of climate change, and any relevant provisions of the NSW Flood Risk Management Manual (2023)
 - 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
 - identify flood behaviour, flood constraints and risks on the site and adjoining areas including the potential impacts of climate change for the full range of events up to and including the probable maximum flood (PMF) event
 - include details of proposed management measures to minimise the impacts of flooding on the development and flood risk to the community
- **Contamination** – a site contamination assessment in accordance with the Managing Land Contamination Planning Guidelines: SEPP 55 – Remediation of Land (DUAP, 1998), including:
 - characterisation of the nature and extent of any contamination on the site and surrounding area
 - a Detailed Site Investigation (DSI) and a Remedial Action Plan, if the Preliminary Site Investigation indicates contamination is present and a DSI is required.
- **Soils** – an assessment of potential impacts on soil resources and riparian land on and near the site, including:

- impacts on soil erosion, salinity and acid sulfate soils
- details of earthworks, including cut and fill volumes
- description of the proposed erosion and sediment controls during construction.
- **Noise and Vibration** – a quantitative noise and vibration impact assessment undertaken by a suitably qualified acoustic consultant in accordance with the relevant Environment Protection Authority guidelines and Australian Standards which includes:
 - consideration of noise in a fully developed site, including all uses proposed
 - the identification of impacts associated with construction, site emission and traffic generation at noise affected sensitive receivers, including the provision of operational noise contours and a detailed sleep disturbance assessment
 - details of noise monitoring survey, background noise levels, noise source inventory and 'worst case' noise emission scenarios
 - consideration of annoying characteristics of noise and prevailing meteorological conditions in the study area
 - consideration of noise impacts internal to the site, including the impact industrial land uses may have on the proposed hotel component
 - consideration of aircraft noise impacts, including those under clause 6.8 of the Bayside Local Environment Plan 2021
 - details and analysis of the effectiveness of proposed management and mitigation measures to adequately manage identified impacts, including a clear identification of residual noise and vibration following application of these mitigation measures and details of any proposed compliance monitoring programs.
- **Air Quality and Odour** – an assessment of the potential air quality, dust and odour impacts of the development (construction and operation) on surrounding landowners, businesses and sensitive receptors, in accordance with relevant Environment Protection Authority guidelines.
- **Design Quality** – a design report which includes demonstration of the following:
 - how the development will achieve design excellence in accordance with any relevant EPI provisions
 - identifies design options considered during the iterative design process and demonstrates the proposed development has been optimised to provide an integrated landscape design and minimises amenity impacts by having regard to the relevant evaluation criteria in *Better Placed* (Government Architect NSW, 2017)
 - demonstrates that Aboriginal culture and heritage is considered and incorporated holistically in the design proposal consistent with the NSW Government's *Connecting with Country Framework*
 - demonstrates how the proposal will integrate with Pemulwuy Park
 - Where required by an EPI, the development has been subject to a competitive design process, and/or has been reviewed by the State Design Review Panel (SDRP) consistent with the NSW SDRP: Guidelines for Project Teams
 - that the recommendations of the Design Integrity Panel (where a competitive design process has been held) or the SDRP have been addressed.
- **Visual, including** - a visual impact assessment, including:
 - photomontages and perspectives of the proposed building form
 - details of staging, site coverage, setbacks, open space, landscaping, height, colour, scale
 - an assessment of the potential visual impacts of the development on the amenity of the surrounding area, including:
 - nearby public and private receivers
 - significant vantage points in the broader public domain
 - consideration of the layout and design of the development having regard to the surrounding vehicular, pedestrian and cycling networks
 - detailed plans showing suitable landscaping which incorporates endemic species as well as how it maximises opportunities for green infrastructure, consistent with *Greener Places* (Government Architect NSW, 2020) including clear details on what is being delivered as part of the Stage 1 works.
- **Hazards and Risk** – including:
 - a preliminary risk screening completed in accordance with *State Environmental Planning Policy (Resilience and Hazards) 2021* and Applying SEPP 33 (DoP, 2011), that includes a clear indication of class, storage and handling quantities and location of all dangerous goods and hazardous materials associated with the development
 - a Preliminary Hazard Analysis (PHA) prepared in accordance with *Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis* (DoP,

	2011) and <i>Multi-Level Risk Assessment</i> (DoP, 2011), should the preliminary risk screening indicate that the project is “potentially hazardous”. – a hazard analysis that reports on the consultation outcomes with the adjoining pipeline corridor and verifies that the scope of the proposal is consistent with the land uses, population limits, and remains compliant with the findings of the recent planning proposal’s pipeline risk analysis • Airport Safeguarding – details of how the proposal may impact on the operations of Sydney Airport, including potential intrusion into the obstacle limitation surface and consultation with Sydney Airport and the Australian Government Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts • Aboriginal Cultural Heritage – an Aboriginal Cultural Heritage Assessment Report (ACHAR) prepared in accordance with the Code of Practice for Archaeological Investigation in NSW (DECCW 2010), and guided by the Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales (OEH 2011). The ACHAR must: – identify, describe and assess impacts on the Aboriginal cultural heritage values that exist across the development site – provide evidence and details of consultation with Aboriginal people in accordance with the Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW 2010) – include results of a surface survey and any test excavations and an unexpected finds protocol. • Non-Aboriginal Cultural Heritage – a non-Aboriginal cultural heritage assessment (including both cultural and archaeological significance) which must detail potential impacts on heritage assets and any proposed management and mitigation measures. • Biodiversity – an assessment of the proposal’s biodiversity impacts in accordance with the <i>Biodiversity Conservation Act 2016</i>, including the preparation of a Biodiversity Development Assessment Report (BDAR) where required under the Act, except where a waiver for preparation of a BDAR has been granted. • Social – including a social impact assessment in accordance with the Department’s <i>Social Impact Assessment Guideline</i> • Infrastructure Requirements – an infrastructure delivery, management and staging plan that includes: – an assessment of impacts of the development on existing utility infrastructure and service provider assets surrounding the site – a detailed written and/or graphical description of infrastructure required on the site, including any electrical substation/s and on-site switch yard/s – details of the existing capacity of the site to service the proposed development and any extension or augmentation, property tenure or staging requirements for the provision of utilities, including arrangements for electrical network requirements, drinking water, wastewater and recycled water – details of interaction with Sydney Desalination Plant’s pipeline – a description of how any upgrades will be co-ordinated, funded and delivered on time and be maintained to facilitate the development – identification of any existing infrastructure or easements on or off the site which may be impacted by construction or operation of the development and details of measures to be implemented to address any impacts. • Ecologically Sustainable Development – including: – identification of how ESD principles (as defined in section 193 of the EP&A Regulation) are incorporated in the design and ongoing operation of the development – demonstration of how the development will meet or exceed the relevant industry recognised building sustainability and environmental performance standards • Planning Agreement/Development Contributions – including consideration of any applicable State and local development contributions, and details of any existing Planning Agreements.
Consultation	During the preparation of the EIS, you must consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners. In particular you must consult with: • Bayside Council

	• Department of Climate Change, Energy, the Environment and Water, specifically the: ◦ Water Group • Heritage NSW • Department of Planning, Housing and Infrastructure • NSW Department of Primary Industries and Regional Development, specifically the: ◦ NSW Fisheries • Transport for NSW • Fire & Rescue NSW • Sydney Water • Sydney Airport • Sydney Desalination Plant • Australian Government Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts • surrounding local landowners, businesses and stakeholders • local and regional community and environmental groups • Traditional Owners • La Perouse Local Aboriginal Land Council • any other public transport, utilities or community service providers.
SEARs Expiry	SEARs will expire two years after the date of issue (or the date they were last modified).
References	The assessment of the key issues listed above must take into account relevant guidelines, policies, and plans as identified. While not exhaustive, Attachment 1 contains a list of some of the guidelines, policies, and plans that may be relevant to the environmental assessment of this proposal.

ATTACHMENT 1

Technical and Policy Guidelines

The following guidelines may assist in the preparation of the environmental impact statement. This list is not exhaustive and not all of these guidelines may be relevant to your proposal.

Many of these documents can be found on the following websites:

<https://www.planningportal.nsw.gov.au/major-projects/assessment/policies-and-guidelines>

<http://www.australia.gov.au/publications>

<http://www.epa.nsw.gov.au/>

<http://www.environment.nsw.gov.au/>

<http://www.dpi.nsw.gov.au/>

Policies, Guidelines & Plans	
Aspect	Policy / Methodology
State Significant Development Guidelines	
	State Significant Assessment Guidelines (DPIE, 2021)
	Undertaking Engagement Guide – Guidance for State Significant Projects (DPIE, 2021)
	Cumulative Impact Assessment Guidelines for State Significant Projects (DPIE, 2021)
	Planning Circular PS24-002: Changes to how development costs are calculated for planning purposes
	Standard Form of Estimated Development Cost (State significant projects) – March 2024
Air Quality	
Air Quality	Protection of the Environment Operations (Clean Air) Regulation 2022
	Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (EPA, 2022)
	Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (EPA, 2022)
Odour	Assessment and Management of Odour from Stationary Sources in NSW (DEC 2006)
Greenhouse Gas	AGO Factors and Methods Workbook (AGO, 2018)
	Guidelines for Energy Savings Action Plans (DEUS, 2005)
	National Greenhouse and Energy Reporting Scheme Measurement, Technical Guidelines for the estimation of emissions by facilities in Australia (Department of the Environment and Energy (DoEE), 2017)
	National Greenhouse Accounts Factors (DoEE, 2019)
	NSW Guide for Large Emitters (EPA, 2025)
Biodiversity	
	<i>Biodiversity Conservation Act 2016</i>
	Biodiversity Assessment Method (EES, 2021)
	Guidelines for Controlled Activities on Waterfront Land (NRAR, 2018)
	Developments adjacent to National Parks and Wildlife Service lands (DPIE, 2020)
Bush Fire	
	Planning for Bush Fire Protection (RFS, 2019)
Climate Change	
	EPA Climate Change Policy (EPA, 2023)
	Net Zero Plan Stage 1: 2020-2030 (DPIE, 2020)
Design Quality	
	Greener Places (Government Architect NSW, 2020)

Policies, Guidelines & Plans	
Aspect	Policy / Methodology
	Better Placed (Government Architect NSW, 2017)
	NSW SDRP: Guidelines for Project Teams (GANSW Advisory Note, V3 2522/2020)
Fire Safety	
	Fire Safety Guidelines – Fire Safety in Waste Facilities (FRNSW, 2020)
	Fire Safety Guidelines – Access for fire brigade vehicles and firefighters
	Fire Safety Guidelines – Emergency services information package and tactical fire plans
Flooding	
	Flood Impact and Risk Assessment Flood Risk Management Guide (LU01) (DPE, 2022)
	Department of Planning and Environment Flood Risk Management Toolkit – https://www.environment.nsw.gov.au/topics/water/floodplains/floodplain-guidelines
	Shelter in place guideline for flash flooding (DPHI, 2024)
Hazards and Risk	
	State Environmental Planning Policy (Resilience and Hazards) 2021
	Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines (DoP, 2011)
	Assessment Guideline: Multi-level Risk Assessment (Planning and Infrastructure, 2011)
Heritage	
	<i>Heritage Act 1977</i>
Non-Aboriginal Heritage	NSW Heritage Manual (HO and DUAP, 1996)
	The Burra Charter (ICOMOS Australia, 2013)
	Statements of Heritage Impact (HO and DUAP, 2002)
Aboriginal Heritage	Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010)
	Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (DECCW, 2011)
	Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (DECCW, 2010)
Human Health Risk	
	Environmental Health Risk Assessment: Guidelines for assessing human health risks from environmental hazards (enHealth, 2012)
Noise and Vibration	
	Approved methods for measurement and analysis of environmental noise in NSW (EPA, 2022)
	Acoustics – Description and measurement of environmental noise (AS1055:2018)
	Noise Policy for Industry (EPA, 2017)
	NSW Road Noise Policy (DECCW, 2011)
	Noise Criteria Guideline (RMS, 2015)
	Noise Mitigation Guideline (RMS, 2015)
	Interim Construction Noise Guideline (DECC, 2009)
	Assessing Vibration: A Technical Guide (DEC, 2006)
	Noise Guide for Local Government (EPA, 2013)
Social	
	Social Impact Assessment Guideline for State Significant Projects (DPIE, 2021)

Policies, Guidelines & Plans	
Aspect	Policy / Methodology
Soils and Water	
Erosion and Sediment	Managing Urban Stormwater: Soils & Construction (Landcom, 2004)
	Soil and Landscape Issues in Environmental Impact Assessment (DLWC, 2000)
	Wind Erosion – 2 nd Edition (DIPNR, 2003)
Groundwater	Groundwater assessment toolbox for major projects in NSW - Overview document Technical guideline (DPE, 2022)
	Guidelines for Groundwater Documentation for SSD/SSI Projects Technical guideline (DPE, 2022)
	Minimum Groundwater Modelling Requirements for SSD/SSI Projects, Technical guideline (DPE, 2022)
	Cumulative Groundwater Impact Assessment Approaches Information paper (DPE, 2022)
	National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ/ANZECC, 2000)
	NSW State Groundwater Policy Framework Document (DLWC, 1997)
	NSW Aquifer Interference Policy (NOW, 2012)
	Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources (NOW, 2011)
Stormwater	Storing and Handling Liquids: Environmental Protection (DECC, 2007)
	Managing Urban Stormwater: Strategic Framework. Draft (EPA, 1996)
	Managing Urban Stormwater: Council Handbook. Draft (EPA, 1997)
	Managing Urban Stormwater: Treatment Techniques (DEC, 2006)
	Managing Urban Stormwater: Source Control. Draft (EPA, 1998)
Wastewater	Managing Urban Stormwater: Harvesting and Reuse (DEC, 2006)
	National Water Quality Management Strategy: Guidelines for Sewerage Systems – Effluent Management (ARMCANZ/ANZECC, 1997)
	National Water Quality Management Strategy: Guidelines for Sewerage Systems – Use of Reclaimed Water (ARMCANZ/ANZECC, 2000)
	National Water Quality Management Strategy – Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1) (EPHC, NRMMC & AHMC, 2006)
Contamination	National Water Quality Management Strategy – Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2) (EPHC, NRMMC & AHMC, 2009)
	State Environmental Planning Policy (Resilience and Hazards) 2021
	Managing Land Contamination Planning Guidelines, SEPP 55 – Remediation of Land (DUAP & EPA, 1998)
Traffic, Transport and Access	Consultants reporting on contaminated land: Contaminated Land Guidelines (EPA, 2020)
	<i>Roads Act 1993</i>
	State Environmental Planning Policy (Transport and Infrastructure) 2021
	Guide to Transport Impact Assessment (TfNSW, 2024)
	Road Design Guide (RMS, 2015-2017)
	Guide to Traffic Management – Pt 12: Traffic Impacts of Development (Austroads, 2016)
	Guidelines for Planning and Assessment of Road Freight Access in Industrial Areas (Austroads, 2014)
	Bicycle Parking Facilities: Guidelines for Design and Installation (AS 2890.3:2015)

Policies, Guidelines & Plans

Aspect	Policy / Methodology
	Integrated Public Transport Service Planning Guidelines: Sydney Metropolitan Area (TfNSW, 2013)
	Future Transport Strategy 2056 (TfNSW, 2018)
	Greater Sydney Services and Infrastructure Plan (TfNSW, 2018)
	NSW Freight & Ports Plan 2018-2023 (TfNSW, 2018)
Upper Canal and Warragamba Pipeline Corridors	
	Guidelines for Development Adjacent to the Upper Canal and Warragamba Pipelines (WaterNSW, 2018)
Visual	Control of Obtrusive Effects of Outdoor Lighting (AS 2482)
Waste	NSW Waste and Sustainable Material Strategy 2041 (EPA, 2021) NSW Plastics Action Plan (EPA, 2021) NSW Energy from Waste Policy Statement (EPA, 2021) NSW Energy from Waste Infrastructure Plan (2021) The National Waste Policy: Less Waste More Resources 2018 Waste Classification Guidelines (EPA, 2014) Environmental guidelines: Composting and Related Organics Processing Facilities (DEC, 2004) Environmental guidelines: Use and Disposal of Biosolid Products (EPA, 1997) Composts, soil conditioners and mulches (Standards Australia, AS 4454) Standards for Managing Construction Waste in NSW (EPA, 2018)
Waterways	Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning (OEH, 2017) Guidelines for controlled activity approvals - https://water.dpie.nsw.gov.au/our-work/licensing-and-trade/controlled-activity-approvals/guidelines

ATTACHMENT 2
Government Authority Advice

