Appendix B4

Soil and Water and Management Sub Plan

Western Harbour Tunnel and Warringah Freeway Upgrade Early and Enabling Works - Cammeray Golf Course Adjustment Works

June 2022

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Contents

Document control

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Glossary/ Abbreviations

Abbreviations	Expanded text
AEP	Annual Exceedance Probability
ASS	Acid Sulfate Soil
CEMP	Construction Environmental Management Plan
CGC	Cammeray Golf Course
CoA	Minister's Conditions of Approval
CLMP	Contaminated Land Management Plan
DPE	NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries
EA	Environmental Assessment
ESCP	Erosion and Sediment Control Plan
EEC	Endangered Ecological Community
EHG	Environment and Heritage Group (part of the Department of Planning and Environment)
EIS	Environment Impact Statement
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
EWMS	Environmental Work Method Statements
OEH	Office of Environment and Heritage
P-ESCP	Primary Erosion and Sediment Control Plan
PESCP	Progressive Erosion and Sediment Control Plan
PIRMP	Pollution Incident Response Management Plan
PMF	Probable Maximum Flood
POEO Act	*Protection of the Environment Operations Act 1997*
REMM	Revised Environment Management Measures

Abbreviations	Expanded text
Roads and Maritime	Roads and Maritime Services
RUSLE	Revised Universal Soil Loss Equation
SWMP	Soil and Water Management Sub Plan
TSC Act	*Threatened Species Conservation Act 1995*

1 Introduction

1.1 Context

This Soil and Water Management Sub Plan (SWMP or Plan) forms part of the Construction Environmental Management Plan (CEMP) for the Stage 1B – Cammeray Golf Course adjustments works (refer to herein as “the Cammeray Golf Course works’ or ‘CGC’) which will support the delivery program of the Early Works of the Western Harbour Tunnel and Warringah Freeway Upgrade (the Project). Sydney Program Alliance (SPA) has been appointed by Transport for New South Wales (TfNSW) to deliver the WHTWFU CGC works.

This SWMP has been prepared to address the requirements of the Minister’s Conditions of Approval (CoA), Western Harbour Tunnel and Warringah Freeway Upgrade Environmental Impact Statement (EIS), the revised environmental management measures (REMMs) listed in the Western Harbour Tunnel and Warringah Freeway Upgrade Response to Submissions Report (RtS) and all applicable legislation.

1.2 Background and project description

As part of the EIS development, a detailed assessment of contamination and groundwater of the construction and operational impacts associated with acid sulfate soils, salinity, erosion and sedimentation, groundwater inflow and drawdown were developed. The assessment was included in the EIS, within Chapter 16, Technical Paper Contamination (Appendix M of the EIS), Groundwater Technical Paper (Appendix N of the EIS), and Chapter 17, Surface Water and Hydrology (Appendix O of the EIS) and Flooding (Appendix R of the EIS).

The project description is outlined in Sections 1.1 to 1.3 of the CEMP. Figure 1-1 includes an overview of the CGC works scope.

Figure 1-1: Location of Cammeray Golf Course works scope

1.3 Environmental management systems overview

The environmental management system overview is described in Section 1.6 of the CEMP. This sub-plan forms part of a suite of sub-plans and procedures which sit under the CEMP.

2 Purpose and objectives

2.1 Purpose

The purpose of this Plan is to describe how the SPA proposes to minimise and manage potential soil and water quality during construction of the Project.

2.2 Objectives

The key objective of this Plan is to ensure all CoA, environmental management measures and licence/permit requirements, relevant to soil and water are described, scheduled and assigned responsibility as outlined in:

- The combined Environmental Impact Statement (EIS)
- Minister's Conditions of Approval
- Revised Environment Management Measures (REMMs)
- TfNSW specifications G36, G38 and G40
- Relevant legislation and other requirements described in Section 3.1 of this Plan.

2.3 Targets

The following targets have been established for the management of soil and water impacts during the project:

- Ensure full compliance with the relevant legislative requirements and/or guidelines, CoA and REMMs.
- Manage downstream water quality impacts attributable to the project (i.e. maintain water waterway health by avoiding the introduction of nutrients, sediment and chemicals outside of that permitted by the environmental protection licence and/or ANZECC guidelines).
- Ensure training on best practice soil and water management is provided to all construction personnel through site inductions.

2.4 Environmental Performance Outcomes

The environmental performance outcomes listed below are outlined in Chapter 28.6 of the EIS. Only the environmental performance outcomes specific to this SWMP have been presented in Table 2-1 below.

Table 2-1 Environmental performance outcomes relevant to the SWMP.

Desired performance outcome (early and enabling works)	How performance outcomes would be achieved	Measurement tool
Water – Hydrology and Quality Long term impacts on surface water are minimised.	Establish water quality discharge criteria with consideration of NSW Water Quality Objectives Effectively treat water to meet water quality discharge criteria	Management of soil and surface water will be undertaken throughout the delivery of the project in accordance with this plan. Further detail is provided in Section 6 of this SWMP in

The environmental values of nearby, connected and affected water sources are maintained (where values are achieved) or improved and maintained (where values are not achieved). Sustainable use of water resources. The project is designed and constructed to protect the NSW Water Quality Objectives where they are currently being achieved and contribute towards achievement of the Water Quality Objectives over time where they are currently not being achieved, including downstream of the project to the extent of the project impact including estuarine and marine waters (if applicable).	Maximise reuse of treated water during construction.	regard to *environmental mitigation and management measures*; Section 7.2 *inspections*; and Section 7.3 *monitoring*.
Soils The environmental values of land, including soils, subsoils and landforms, are protected. Risks arising from the disturbance and excavation of land and disposal of soil are minimised, including disturbance to acid sulfate soils (ASS) and site contamination	Erosion and sediment controls will be implemented in accordance with Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom 2004) and Volume 2D (DECCW 2008), commonly referred to as the 'Blue Book' Manage ASS in accordance with good practice measures Manage contamination to protect environmental values and human health	Construction activities will be managed in accordance with this plan to meet the project's soils performance outcomes. Further detail is provided in Section 6 of this SWMP in regards to *environmental mitigation and management measures*; Section 7.2 *inspections*; and Section 7.3 *monitoring*.

3 Environmental requirements

3.1 Relevant legislation and guidelines

3.1.1 Legislation

All legislation relevant to this SWMP is included in Appendix A3 of the CEMP.

3.1.2 Guidelines and standards

The main guidelines, specifications and policy documents relevant to this plan include:

- Acid Sulfate Soil Manual (ASSMAC 1998)
- Acid Sulfate Soil and Rock – Victorian EPA Publication 655.1 – July 2009
- Water Quality Guidelines, ANZG 2018
- Department of Environment and Conservation (DEC): Bunding & Spill Management. Insert to the Environment Protection Manual for Authorised Officers - Technical section "Bu" November 1997
- Managing Urban Stormwater: Soils and Construction. Landcom, (4th Edition) March 2004 (reprinted 2006) (the “Blue Book”). Volume 1 and Volume 2
- Volume 2A Installation of Services (DECCW 2008)
- Volume 2C Unsealed Roads (DECCW 2008)
- Volume 2D Main Roads Construction (DECCW 2008)
- DIPNR Roads and Salinity Guideline, 2003
- DLWC, 1998. Constructed Wetlands Manual
- Fairfull, S. and Witheridge, G. (2003) Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings. NSW Fisheries, Cronulla, 16 pp.
- *NSW Fisheries, November 2003. Fishnote – Policy and Guidelines for Fish Friendly* Waterway Crossings (Ref: NSWF – 1181)
- Road and Maritime Dewatering Guideline
- Roads and Maritime Management of Wastes on Roads and Maritime Services Land (Roads and Maritime 2014)
- RTA’s Code of Practice for Water Management – Road Development and Management (1999)
- Approved Methods for the Sampling and Analysis of Water Pollutants in NSW – March 2004
- Guidelines for the Management of Acid Sulphate materials: Acid Sulphate Soils, Acid Sulphate Rock and Monosulphidic Black Ooze (RTA 2005)
- Environment Direction Management of Tannins from Vegetation Mulch (Roads and Maritime)
- Stockpile Site Management Guideline (Roads and Maritime 2011)
- Environmental Best Management Practice Guideline for Concreting Contractors, DEC, 2004
- *NSW Water Quality Objectives*
- Guidelines for controlled activities on waterfront land Riparian corridors, NSW Department of Industry, 2018
- Guideline for the management of contamination (Roads and Maritime, 2013)

3.2 Minister's Conditions of Approval

The CoA relevant to this Plan are listed in Table 3-1 below. A cross reference is also included to indicate where the condition is addressed in this Plan or other Project management documents.

Table 3-1 Conditions of Approval relevant to the SWMP

CoA No.	Condition Requirements	How addressed
C4	The following CEMP Sub-plans must be prepared in consultation with the relevant government agencies identified for each CEMP Sub-plan. Details of all information requested by an agency during consultation must be provided to the Planning Secretary as part of any submission of the relevant CEMP Sub-plan, including copies of all correspondence from those agencies as required by Condition A5. (e) Soil and Surface Water	Section 3.4
C5	The CEMP Sub-plans must state how: (a) the environmental performance outcomes identified in the documents listed in Condition A1 will be achieved; (b) the mitigation measures identified in the documents listed in Condition A1 will be implemented; (c) the relevant terms of this approval will be complied with; and (d) issues requiring management during construction (including cumulative impacts), as identified through ongoing environmental risk analysis, will be managed through SMART principles.	CEMP Appendix A1 Section 3.2 Section 5 Section 6
C9	The CEMP Sub-plans must be submitted to the Planning Secretary for approval along with, or subsequent to, the submission of the CEMP but in any event, no later than one month before construction.	CEMP Section 2
C10	Construction must not commence until the CEMP and all CEMP Sub-plans have been approved, unless otherwise agreed by the Planning Secretary. The CEMP and CEMP Sub-plans, as approved by	CEMP Section 1.5

	the Planning Secretary, including any minor amendments approved by the ER must be implemented for the duration of construction. Where construction of the CSSI is staged, construction of a stage must not commence until the CEMP and sub-plans for that stage have been endorsed by the ER and approved by the Planning Secretary.	
C11	The following Construction Monitoring Programs must be prepared in consultation with the relevant government agencies identified for each to compare actual performance of construction of the CSSI against the performance predicted in the documents listed in Condition A1 or in the CEMP: (c) Surface water monitoring program	Section 3.4
C12	Each Construction Monitoring Program must provide: (a) details of baseline data available; (b) details of baseline data to be obtained and when; (c) details of all monitoring of the project to be undertaken; (d) the parameters of the project to be monitored; (e) the frequency of monitoring to be undertaken; (f) the location of monitoring; (g) the reporting of monitoring results and analysis results against relevant criteria; (h) details of the methods that will be used to analyse the monitoring data; (i) procedures to identify and implement additional mitigation measures where the results of the monitoring indicate unacceptable project impacts; (j) a consideration of SMART principles; (k) any consultation to be undertaken in relation to the monitoring programs; and (l) any specific requirements as required by Conditions C13 to C16.	Section 4.2 Section 7.3 Section 7.5
C17	The Construction Monitoring Programs must be developed in consultation with relevant government agencies as	Section 6.2

	identified in Condition C11. Details of all information requested by an agency during consultation must be provided to the Planning Secretary as part of any submission of the relevant Construction Monitoring Programs, including copies of all correspondence from those agencies as required by Condition A5.	
C18	The Construction Monitoring Programs must be endorsed by the ER and then submitted to the Planning Secretary for approval at least one month before the commencement of construction.	Section 6.2
C19	Unless otherwise agreed with the Planning Secretary, construction must not commence until all of the relevant Construction Monitoring Programs have been approved by the Planning Secretary, and all relevant baseline data for the specific construction activity has been collected.	Section 4
C20	The Construction Monitoring Programs, as approved by the Planning Secretary including any minor amendments approved by the ER must be implemented for the duration of construction and for any longer period set out in the monitoring program or specified by the Planning Secretary, whichever is the greater.	Section 7.5
C21	The results of the Construction Monitoring Programs must be submitted to the Planning Secretary, and relevant regulatory agencies, for information in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program. Note: Where a relevant CEMP Sub-plan exists, the relevant Construction Monitoring Program may be incorporated into that CEMP Sub-plan.	Section 3.4, Section 6.2 and CEMP Section 3.9.4
E114	Prior to the commencement of any work, erosion and sediment controls must be	Section 6.1

	installed and maintained, as a minimum, in accordance with the publication Managing Urban Stormwater: Soils & Construction (4th edition, Landcom 2004) commonly referred to as the 'Blue Book'.	
E115	Prior to the commencement of any work that would result in the disturbance of moderate to high risk contaminated sites as identified in the documented listed in **Condition A1**, a **Detailed Site Investigations** must be undertaken by a Contaminated Land Consultant certified under either the Environment Institute of Australia or New Zealand's "Certified Environmental Practitioner" (Site Contamination) scheme (CEnvP(SC)) or the Soil Science Australia "Certified Professional Soil Scientist Contaminated Site Assessment and Management (CPSS CSAM) scheme.	Section 4.1.4
E116	A **Detailed Site Investigation Report** must be prepared and submitted to the Planning Secretary for information following the completion of **Detailed Site Investigations** required by **Condition E115.** The report must be prepared in accordance with relevant guidelines made or approved by the EPA under section 105 of the *Contaminated Land Management Act 1997* (NSW) and prepared by a Contaminated Land Consultant certified under either the Environment Institute of Australia or New Zealand's "Certified Environmental Practitioner" (Site Contamination) scheme (CEnvP(SC)) or the Soil Science Australia "Certified Professional Soil Scientist Contaminated Site Assessment and Management (CPSS CSAM) scheme. Nothing in this condition prevents the Proponent from preparing individual Site Contamination Reports for separate sites.	Section 4.1.4

E117	The **Detailed Site Investigation Report** must provide details on: (a) primary sources of contamination, for example potentially contaminating activities, infrastructure (such as underground storage tanks, fuel line, sumps or sewer lines) or site practices; (b) contaminant dispersal in air, hazardous ground gases, surface water, groundwater, soil vapour, separate phase contaminants, sediments, infrastructure (e.g. concrete), biota, soil and dust; (c) contaminant characterisation and behaviour (volatility, leachability, speciation, degradation products and physical and chemical conditions on-site which may affect how contaminants behave); (d) potential effects of contaminants on human health, including the health of occupants of built structures (for example arising from risks to service lines from hydrocarbons in groundwater, or risks to concrete from acid sulphate soils) and the environment; (e) potential and actual contaminant migration routes including potential preferential pathways; (f) the adequacy and completeness of all information available for use in the assessment of risk and for making decisions on management requirements, including an assessment of uncertainty; (g) the review and update of the conceptual site model from the preliminary and detailed site investigations; (h) nature and extent of any existing remediation (such as impervious surface cappings); and/or; (i) whether the land is suitable (for the intended final land use) or can be made suitable through remediation.	Section 4.1.4
E124	An **Unexpected Finds Procedure for Contamination** must be prepared before the commencement of work and must be	Appendix D

	followed should unexpected contamination or asbestos (or suspected contamination) be excavated or otherwise discovered. The procedure must include details of who will be responsible for implementing the unexpected finds procedure and the roles and responsibilities of all parties involved. The procedure must be submitted to the Planning Secretary for information.	
E206	The CSSI must be designed, constructed and operated so as to maintain the NSW Water Quality Objectives where they are being achieved as at the date of this approval, and contribute towards achievement of the NSW Water Quality Objectives over time where they are not being achieved as at the date of this approval, unless an EPL in force in respect of the CSSI contains different requirements in relation to the NSW Water Quality Objectives, in which case those requirements must be complied with.	Section 6.2
E207	The Proponent must consider the Guidelines for controlled activities on waterfront land Riparian corridors (Department of Industry 2018) when carrying out work within 40 metres of a watercourse, including its bed.	Section 2.3 Section 3.1.2 Section 4.2 Section 7.5
E209	A replacement stormwater harvesting storage facility / dam must be provided within the boundaries of Cammeray Golf Course in consultation with North Sydney Council and Cammeray Golf Club (at no cost to either party). Should the new stormwater harvesting storage facility not be operational prior to the dewatering of the existing dam, the Proponent must pay all water usage costs (associated with the use of the harvesting storage facility / dam) incurred by Council or the golf club until the replacement facility is operational. ***Note: Condition C6(f)*** *provides requirements for relocating native fauna*	Dewatering and decommissioning of the existing Dam is beyond the scope of works of this SWMP and will be completed by the Stage 2 Main Works contractor. The scope of this SWMP is related to the construction and commissioning of a new stormwater harvesting storage facility / dam within the boundaries of Cammeray Golf Course only. TfNSW have consulted directly with NSC and Cammeray Golf Club (at no cost to either) in relation to the replacement dam. Further to this, where the new stormwater harvesting storage facility will not be operational prior to the dewatering of the existing dam, TfNSW will pay for water

	species within and around the stormwater harvesting storage facility / dam.	usage costs (associated with the use of the harvesting storage facility / dam) incurred by NSC or the golf club until the replacement facility is operational.
E210	If construction stage stormwater discharges are proposed, a water pollution impact assessment will be required to inform licensing consistent with section 45 of the POEO Act. Any such assessment must be prepared in consultation with the EPA and be consistent with the National Water Quality Guidelines, with a level of detail commensurate with the potential water pollution risk.	The EPA have confirmed in email correspondence with SPA (discussed in the WFU Stage 1B SWMP A5 Consultation Report) that it is supportive of SPA's proposal (inclusive of concentration limits related to pH, total suspended solids and hydrocarbons) to establish, operate and maintain a construction sediment basin at CGC, inclusive of construction stage stormwater discharges. Section 7.5 of the SWMP contains detail around SPA's consultation with the EPA on this matter. Following variation of SPA's EPL licence to implement a Blue Book compliant construction sediment basin, this would represent SPA's compliance with condition E210, as approved by the EPA.

3.3 Revised Environmental Management Measures

Revised Environmental Management Measures (REMMs) relevant to this plan are listed in table 3-2 below. This includes reference to required outcomes, the timing of when the commitment applies, relevant documents or sections of the environmental assessment influencing the outcome and implementation.

Table 3-2 – Revised Environmental Management measures relevant to this SWMP

REMM No.	Commitment	Where Addressed
SG5	Erosion and Sediment measures will be implemented at all work sites in accordance with the principles and requirements in 'Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom, 2004) and Volume 2D (NSW Department of Environment, Climate Change, 2008), commonly referred to as the 'Blue Book'.	Section 6.1
SG6	Potentially contaminated areas directly affected by the project will be WHT/WFU investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the Contaminated Land Management Act 2008. This includes, but is not limited to, further investigations in potential areas of environment interest in the project footprint, including: • Easton Park • Birchgrove peninsula (including Yurulbin Park) • Balls Head peninsula • Waverton Park • Warringah Freeway (from North Sydney to Cammeray). Subject to the outcomes of the investigations, a Remediation Action Plan will be implemented in the event that site remediation is warranted prior to construction. The Remediation Action Plan will be prepared and implemented in accordance with Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land (Department of Urban Affairs and Planning and EPA, 1998). An independent NSW EPA Accredited site Auditor will be engaged	Appendix D

	where contamination is complex to review applicable all contamination reports and evaluate the suitability of sites for a specified use as part of the project.	
SG7	Any soil / fill materials surplus to construction will be classified in accordance with the NSW EPA (2014a) Waste Classification Guidelines.	Appendix D –Unexpected Contaminated Land and Asbestos Finds Procedure
SG8	Asbestos handling and management will be carried out in accordance with relevant legislation, codes of practice and Australian standards.	Appendix D –Unexpected Contaminated Land and Asbestos Finds Procedure
SG11	The discovery of previously unidentified contaminated material will be managed in accordance with an unexpected contaminated lands discovery procedure, as outlined in the Guideline for the Management of Contamination (Roads and Maritime, 2013).	Appendix D –Unexpected Contaminated Land and Asbestos Finds Procedure
SG23	Emergency Spill measures procedures will be developed to avoid and manage accidental spillages of fuels, chemicals, and fluids to minimise the risk of human health impacts and contamination of groundwater.	Appendix B – Spill Response Procedure
WQ1	Erosion and sediment measures will be implemented at all work sites and surface road upgrades in accordance with the principles and requirements in Managing Urban Stormwater – Soils and construction, Volume 1 (Landcom, 2004), Managing Urban Stormwater: Volume 2D Main Road Construction (NSW department of Environment, Climate Change and Water, 2008) and relevant guidelines, procedures and specifications of Transport for NSW. A soil conservation specialist will be engaged by both Transport for NSW and the Contractor for the duration of construction of the project to provide advice regarding erosion and sediment control including review of Erosion and Sediment Control Plans (ESCPs).	Section 6.1

WQ2	Emergency spill procedures will be developed to avoid and manage accidental spillages of fuels, chemicals or fluids during construction.	Appendix C – Spill Response Procedure
WQ8	Subject to a timely agreement with Cammeray Golf Club and NSC regarding a suitable alternate location, TfNSW will install a new permanent replacement storage dam (and associated infrastructure) within the golf course prior to decommissioning of the existing dam, in order to maintain ongoing operational functionality of the water harvesting scheme. If a suitable location cannot be agreed prior to the commencement of construction, TfNSW will come to an interim arrangement with Cammeray Golf Club and NSC regarding compensation for additional water usage, for the period until the replacement dam is operational.	Dewatering and decommissioning of the existing Dam is beyond the scope of works of this SWMP and will be completed by the Stage 2 Main Works contractor. The scope of this SWMP is related to the construction and commissioning of a new stormwater harvesting storage facility / dam within the boundaries of Cammeray Golf Course only. TfNSW have consulted directly with NSC and Cammeray Golf Club (at no cost to either) in relation to the replacement dam. Further to this, where the new stormwater harvesting storage facility will not be operational prior to the dewatering of the existing dam, TfNSW will pay for water usage costs (associated with the use of the harvesting storage facility / dam) incurred by NSC or the golf club until the replacement facility is operational.
WQ13	If sediment basins are required a discharge impact assessment, commensurate with the potential risk and consistent with the National Water Quality Guidelines (ANZG (2018)) and Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom, 2014) will be prepared to inform the discharge criteria.	The EPA have confirmed in email correspondence with SPA (discussed in the WFU Stage 1B SWMP A5 Consultation Report) that it is supportive of SPA's proposal (inclusive of concentration limits related to pH, total suspended solids and hydrocarbons) to establish, operate and maintain a construction sediment basin at CGC, inclusive of construction stage stormwater discharges. Section 7.5 of the SWMP contains detail around SPA's consultation with the EPA on this matter. Following variation of SPA's EPL licence to implement a Blue Book compliant construction sediment basin, this would represent SPA's compliance with condition E210, as approved by the EPA.

F5	Spoil stockpiles will be located in areas which are not subject to frequent inundation by floodwater, ideally outside the 10% AEP flood extent. The exact level of flood risk accepted at stockpile sites will depend on the duration of stockpiling operations, the type of material stored, the nature of the receiving drainage lines and also the extent to which that would impact flooding conditions in adjacent development.	Section 6.3 Appendix E
F6	Site facilities will be located outside high flood hazard areas based on a 1% AEP flood.	Section 4.6

3.4 Consultation

This Sub Plan has been provided to the following agencies for consultation in accordance with CoA C4, with their outcomes summarised below:

- DPE Water – No comments.
- EHG – Comments relating to the completeness of the SWMP have been addressed in the relevant sections of this plan.
- Sydney Water – No comments.
- Councils (North Sydney) – No comments.
- EPA - Comments relating to the completeness of the SWMP have been addressed in the relevant sections of this plan and followed up in subsequent correspondence with the EPA regarding john Holland's application to vary EPL 21528.

This Plan incorporates comments received from the consultation. Note: as of April 2022, consultation with EPA is ongoing, and any additional requirements from the EPA will be incorporated into this plan, in line with the EPL and relevant TfNSW guidelines. Refer to Section 2 and Section 3 of the CEMP for consultation requirements relating to the CEMP and all Sub-plans.

4 Existing Environment

The following sections summarise what is known about factors influencing soils and water within and adjacent to the Project corridor.

4.1 Topography and soil characteristics

The Project site is located in a landscape that features residential, recreation and transport related developments. The Sydney 1:100,000 Geological Series Sheet 9130 (NSW Department of Mineral Resources, 1983) indicates Wianamatta Hawkesbury Sandstone (Rh) underlies the project site with a major fault zone (the Luna Park Fault Zone) running in parallel to the site.

4.1.1 Soil Types

Based on EIS Chapter 16. Geology, soils and groundwater, soil landscapes within the Project site predominantly consist of Disturbed terrain and mixed Gymea/Lambert groups. The key characteristics of these soil landscapes are listed in Table 4-1.

Table 4-1 Soil landscapes

Soil Landscape	Characteristics	Limitations/Erosion potential
Disturbed	The original soil has been removed, greatly disturbed or buried. Most of these areas have been levelled to slopes of less than five per cent. Landfill includes soil, rock, building and waste material. The original vegetation has been completely cleared	The soils are dependent on the nature of fill material, with subsidence resulting in a mass movement hazard. Soil impermeability may lead to poor drainage and low fertility. Care must be taken when these sites are developed.
Gymea (gy)	shallow to moderately deep yellow earths and earthy sands on crests and on the inside of benches.	Gymea soils have a high soil erosion potential. Soils are shallow, highly permeable with very low fertility.
Lambert (la)	soils are generally shallow (less than 50 centimetres) discontinuous earthy sands and yellow earths on crests and the insides of benches; shallow (less than 20 centimetres) siliceous sands/lithosols on leading edges; shallow to moderately deep (less than 150 centimetres) leached sands; grey earths and gleyed podzolic soils in poorly drained areas; and localised yellow podzolic soils associated with shale lenses.	Soils have a very high soil erosion potential, with seasonally perched water tables. The soil is generally shallow, highly permeable and has very low soil fertility.

4.1.2 Soil salinity

With reference to the Salinity Potential in Western Sydney map sheet (Department of Infrastructure, Planning and Natural Resources (DIPNR)) (2002), higher salinity risk in western Sydney is generally associated with residual soils overlying Wianamatta Group Bringelly Shales. None of the soil landscapes within the project site document salinity as a limitation to the landscape type. As such, naturally occurring soil salinity is not expected to be encountered within the project site.

4.1.3 Acid sulfate soils

Acid sulfate soil risk maps from the Australian Soil Resource Information System (ASRIS) database were reviewed to determine the probability of acid sulfate soil being present across the project site. The generalised acid sulfate soil probability across the project site has been assessed as being extremely low probability/very low confidence.

4.1.4 Contaminated land

Based on data contained in the EIS Chapter 16. Geology, soils and groundwater, several sources were referenced and investigations were carried out to determine the potential for land contamination within and adjacent to the project, including, Historic and current aerial photographs, NSW EPA Contaminated Sites Register and Record of Notices, Yellow Pages business directory search and Contaminated site investigations. A summary for each reference source is provided below:

- Historic and current aerial photographs - Historical aerial photographs from several years between 1930 to 2005 were reviewed with a focus on the key surface disturbance areas and construction support sites. Potential contamination issues at surface disturbance areas at the project site were:
    - Demolition – Inappropriate handling and disposal of building materials during demolition of buildings for construction of Warringah Freeway
    - Particulate matter deposition from vehicles using the Warringah Freeway
    - Chemical use and storage at the golf course.
- NSW EPA Contaminated Sites Register and Record of Notices - An online search of the NSW EPA Contaminated Sites Record of Notices (NSW EPA, 2019) was conducted and identified 2 key regulated/notified sites within 500 metres of the project:
    - Notified (Section 60) Service station at 16–38 Military Road, Neutral Bay whose regulation is being finalised and is within 200 metres of the CGC site
    - Notified (Section 60) Service station at 200–204 Ben Boyd Road, Neutral Bay whose Regulation is not required under the CLM Act and is within 500 metres of the CGC site
- Yellow Pages business directory search – A Yellow Pages business directory search did not identify sites 500 metres within or adjacent to the study area whose activities may cause contamination.
- Contaminated site investigations - Soil samples were analysed for common contaminant compounds and compared against guidelines for the protection of ecological and human (investigation and screening levels) receptors under open space and commercial/industrial land usage. The contamination investigations indicated that:
    - Unsealed areas next to Warringah Freeway within footprint of the CGC site had surface level (potentially 0- 0.1 m) sources of contamination from vehicle particulate matter deposition. The contaminants were heavy metals, hydrocarbons (mainly polycyclic aromatic hydrocarbons - PAH) and asbestos.
    - PAH exceedances of the human health guidelines were reported within the CGC site and surrounds. Left undisturbed this contamination is expected to have negligible impact on the proposed temporary construction use of the site as part of the Early Works program. However, where excavation of subsurface soils is required, any excavated material should be managed appropriately to minimise exposure to humans and the environment
- A DSI conducted in November 2021 at Cammeray Golf Course had the following outcomes:
    - Concentrations of benzo(a)pyrene TEQ, total PAHs and lead were reported above the adopted human health screening criteria in several soil samples, however following additional statistical analysis remained below the adopted assessment criteria, with the exception of benzo(a)pyrene TEQ;
    - Elevated concentrations of benzo(a)pyrene TEQ indicated the potential for a human health risk associated with the fill materials across the site, however following leachate analysis concentrations were reported below the laboratory limit of

reporting, and are considered to be associated with non-volatile and non-leachable PAH within observed asphalt, and no source-receptor pathways are likely to exist, the risk to future receptors is considered to be low

- During construction, potential impacts to human health and ecological risks associated with air, soil (including asbestos), water and waste can be managed by the CEMP and relevant Sub Plans
- The CGC site considered suitable for the proposed future recreational / public open space land use including a pedestrian footpath with surrounding golf course facilities

4.2 Surface water

The Project site is mainly located within the Sydney Harbour and Parramatta River regional catchment, located within Port Jackson. Port Jackson is comprised of three harbours: North Harbour, Middle Harbour and Sydney Harbour (the main branch of the estuary). The regional catchment covers Sydney Harbour, Parramatta River, Lane Cove River and Middle Harbour.

The Sydney Harbour catchment is a highly-urbanised catchment (86 per cent) which results in rapid runoff during high rainfall events. The waterways in the study area are highly modified, predominantly concrete-lined trenches, and although containing little ecosystem value, they provide good stability during stormwater overflows.

4.2.1 Willoughby Creek

The main waterway within the footprint of the CGC site is Willoughby Creek, a small modified concrete and rock channel which drains the suburbs of Neutral Bay and Cammeray directly into Willoughby Bay at Cremorne. Figure 4-1 shows Willoughby Creek in relation to the Cammeray Golf Course works site.

The water quality of Willoughby Creek is influenced by several factors including:

- Current and former polluting land uses within the catchments
- Stormwater and sewage overflows and leachate from contaminated and/or reclaimed land
- Urbanisation of the catchments and subsequent reduction in permeable area, increasing run-off and pollutant loads entering waterways.

Historic water quality data for Willoughby Creek included samples collected for the Warringah Freeway Upgrade (WFU) project between December 2020 and August 2021 (WFU, 2020 – 2021), site location WFU 2b.

The available data has been analysed and compared to ANZG (2018) Water Quality Guidelines Default Guideline Values (DGVs), as detailed in Table 4-2. Table 4-2 provides results of the water quality analysis for location WFU 2b. Results outside the applicable ANZG (2018) Water Quality Guidelines DGVs and NHMRC (2018) Guidelines for recreational water quality are shown in bold.

The water quality data collected in Willoughby Creek indicates that the creek is of variable quality. Whilst turbidity is low and pH and dissolved oxygen are within the recommended guideline limits, the creek exhibits elevated nutrient concentrations and elevated concentrations of copper and zinc. Total nitrogen concentrations are more than eight times the recommended ANZG (2018) limit and total phosphorus more than four times whilst copper and zinc are generally double the recommended limits. Bacteriological indicators were also recorded in high numbers. Overall, the water quality of Willoughby Creek appears notably poorer than the CGC Stormwater Dam.

***Table 4-2** Median water quality data for Willoughby Creek (Source: Warringah Freeway Upgrade (2020 – 2021), SPA (2021))*

Parameter	Unit	DGV for 90% species protection (ANZG, 2018)	Willoughby Creek
			WFU (2b)
pH		6.5 – 8.5[1]	8.32
Turbidity	NTU	<50[1]	11.4
Total Suspended Solids (TSS)	mg/L	-	2.5
Total Dissolved Solids (TDS)	mg/L	-	298
Dissolved Oxygen (DO)	% saturation	85-110[1]	–
	mg/L	-	7.1
Electrical conductivity (EC)	µS/cm	125-2200[1]	437.9
Total Nitrogen (TN)	mg/L	0.35[1]	**2.9**
Total Phosphorus (TP)	mg/L	0.025[1]	**0.105**
Oxidised Nitrogen (NO_x)	mg/L	0.040[1]	
Ammonia (NH_3)	mg/L	0.020[1]	
Filterable Reactive Phosphorus	mg/L	0.020[1]	
Biochemical Oxygen Demand (BOD)	mg/L	–	1
Chemical Oxygen Demand (COD)	mg/L	–	13.5
Chlorophyll-a (Chl-a)	µg/L	3[1]	Not detected
Enterococci	CFU/100mL	<40[2]	–
E. coli	CFU/100mL	–	–
Arsenic (As)	mg/L	0.094	0.0005
Cadmium (Cd)	mg/L	0.0004	0.00005*
Chromium (Cr)	mg/L	0.006	0.0005
Copper (Cu)	mg/L	0.0018	**0.0055**
Iron (Fe)	mg/L	-	0.295
Lead (Pb)	mg/L	0.0056	0.0015
Mercury (Hg)	mg/L	0.0006[3]	Not detected
Nickel (Ni)	mg/L	0.013	0.00005*
Zinc (Zn)	mg/L	0.015	**0.0505**
Manganese (Mn)	mg/L	2.5	

Note:
1 - ANZG (2018) South-east Australia lowland river

2 - NHMRC (2008) recreational water quality guidelines

3 - ANZG (2018) to account for bioaccumulating nature of this toxicant, the 99% species protection limit DGV has been applied.

Figure 4-1: Willoughby Creek historical water quality sampling locations

4.3 Groundwater

Aquifers

The project area is contained within the Hawkesbury Sandstone aquifer. Hawkesbury Sandstone has a highly variable hydraulic conductivity. It ranges from unconfined to semi confined and locally

confined, with the degree of confinement resulting from stratification (bedding layers), which generally increases with depth. The highly stratified nature of the sandstone and the presence of interbedded shales also results in multiple aquifer zones within the sandstone. The primary porosity of Hawkesbury Sandstone strata is generally low, leading to very low hydraulic conductivities (low water flow) within the sandstone where there is minimal fracturing. However, the flow of groundwater is usually dominated by secondary porosity and, as such, is highly variable and dependant on the distribution of structural defects including fractures, joints and bedding planes.

Groundwater quality within the Hawkesbury Sandstone is generally slightly acidic but of low salinity. The salinity of the upper part of the aquifer, however, can be elevated due to leakage from the Ashfield Shale. Elevated concentrations of dissolved iron and manganese naturally occur within the Hawkesbury Sandstone. In tunnels, groundwater ingress becomes oxidised, causing the dissolved iron and manganese to form sludge in drainage lines. Groundwater within the Hawkesbury Sandstone is expected to be fresh to brackish with neutral to slightly acidic pH and slightly elevated levels of iron and manganese. The concentration of dissolved metals and nutrients in the Hawkesbury Sandstone, including residual soils, is expected to be naturally very low.

Groundwater Dependent Ecosystems

There are no Groundwater Dependent Ecosystems that would be impacted by the excavation and construction activities at Cammeray Golf Course. There was only one area identified in the EIS located at Flat rock creek to the North of the Work area. Willoughby Creek does not drain into Flat Rock Creek. Therefore, the work will not impact any Groundwater Dependent Ecosystems

Groundwater Bores

Hawkesbury sandstone has been historically used as a water supply in the Sydney area with useful yields when fractures or joints are intersected. Details of groundwater bores sourced from the DPI Water Pinneena database and the Bureau of Meteorology Groundwater Explorer are identified one irrigation bore within 1km of the CGC site. GW023150.1.1 is located in Cremorne and is about 750 metres from the alignment. GW023150.1.1 is recorded as being only 1.8 metres deep, which may be erroneous, and is recorded as being used for irrigation. There were no Water Access Licence (WAL) users within 2.5 kilometres of the project.

Based on the EIS, existing Environment Management System overview in Section 1.7, and Environmental Risk Assessment Workshop overview, as detailed in Section 3.2.1 of the CEMP, a Groundwater monitoring program is not required for the Cammeray Golf Course works.

4.4 Rainfall

Rainfall data has been obtained from the EIS Technical Working Paper: Surface water quality and hydrology (Appendix O) closest BOM weather stations at Sydney Botanic Gardens (BOM Station 66006), Observatory Hill (BOM Station 66062), and Mosman Council (BOM Station 66184).

Most rainfall occurs in the first half of the year, peaking in June. There is then an abrupt seasonal change with the lowest rainfalls occurring in September. Average annual rainfall is of the order of 1215 to 1230 millimetres per annum across the three stations

Table 4-4 Average rainfall (mm)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
066006	103.6	113.2	134.5	123.1	120.8	135.4	98.2	86.4	68.6	75.2	85.2	82.2	1230.7
066062	102.2	117.6	130.9	128.5	118.6	133.2	97.1	81.1	68.4	76.4	83.8	77.6	1215.7
066184	110.3	139.4	95.7	147.6	123.3	122.8	77.4	76.1	63.0	79.6	111.0	91.8	1231.5

Table 4-5 Temperature and evapotranspiration - Observatory Hill (BOM Station 66062)

Record	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Max Temp (°C)	26.0	25.8	24.8	22.5	19.5	17.0	16.4	17.9	20.1	22.2	23.7	25.2	21.8
Mean Min Temp (°C)	8.7	18.8	17.6	14.7	11.6	9.3	8.1	9.0	11.1	13.6	15.7	17.5	13.8
ET (mm)	4.3	3.6	2.8	1.9	1.1	0.7	0.8	1.4	2.3	3.3	4.0	4.5	2.6

4.5 Rainfall erosivity factor

The rainfall erosivity factor is a measure of the ability of rainfall to cause erosion (referred as “R” in the Revised Universal Soil Loss Equitation RUSLE). The rainfall erosivity factor is used to determine the soil loss in tonnes per hectare over one year, and is used in calculations when sizing construction sediment basins.

The Project Rainfall Erosivity Factor SI to be provided by the contractor during ESCP development if a sediment basin is determined to be required (refer to Section 6.1).

4.6 Flooding

The CGC site is located mainly in the Willoughby Creek Catchment, a sub-catchment of the larger Sydney Harbour Catchment. The Willoughby Creek catchment drains in a north-easterly direction, extending from the Pacific Highway in North Sydney and has a total catchment area of about 1.5 square kilometres (150 hectares) at Grafton Street. A series of drainage systems comprising pipe and box culvert sections control runoff from the catchment upstream of the Warringah Freeway and converge at ANZAC Park where they discharge into twin 2000 millimetre wide by 1500 millimetre high box culvert where it crosses under the Warringah Freeway. A series of piped drainage systems that control runoff from the Warringah Freeway discharge directly into the box

culvert. This drainage line continues downstream through Cammeray Golf Course as a 2500 millimetre wide by 1500 millimetre high box culvert. At Grafton Street the box culvert outlets into a steep gully in the north-east corner of Primrose Park where it runs along the northern side of the park as a grassed channel before ultimately discharging into Middle Harbour.

The Cammeray Golf Course works site would be subject to very shallow sheet flow during heavy rainfall events, principally due to runoff generated from within its extent (Note that it is assumed that the existing golf course dam would be filled as part of the construction of the Western Harbour Tunnel and Warringah Freeway Upgrade components).

AEP

During a 10% AEP event, flow would surcharge the trunk drainage system that forms the main arm of Willoughby Creek and overtop the sag in Ernest Street to the east of Lytton Street to a maximum depth of about 0.5 metres, increasing to 0.7 metres during a 1% AEP. Existing residential development located on the southern side of Ernest Street is also affected by flooding due to surcharge of the trunk drainage system. The main flow path which runs between St Leonards Park and ANZAC Park principally operates as a low hazard floodway, although high hazard areas are located in the vicinity of ANZAC Park, principally due to the depth of ponding that occurs in this area.

Flow that surcharges the tributary branch of Willoughby Creek that runs between Miller Street and Anzac Avenue along the northern boundary of Anzac Park Public School would overtop Anzac Avenue to a maximum depth of about 0.2 metres during a 10% AEP event, increasing to 0.5 metres during a 1% AEP event.

Overland flow from Ernest Street and Anzac Avenue would collect at the low point in ANZAC Park before entering the trunk drainage system that runs under the Warringah Freeway. The depth of ponding in ANZAC Park would occur to a maximum of 2.1 metres and 3.5 metres during a 10% and 1% AEP event, respectively, which is sufficient to result in hazardous flooding conditions to persons and property.

Floodwaters that collect in ANZAC Park would pond against the noise wall that runs along the western side of the Warringah Freeway to a maximum depth of about three metres during a 1% AEP event. If the noise wall were to fail under this weight of water then floodwater would inundate the Miller Street off-ramp to a maximum depth of about two metres and would also extend across the northbound carriageways of the freeway

During a 1% AEP storm event, a low and high hazard floodway would form to the north (downstream) of the road corridor near Cammeray Golf Course. The floodway area also extends east into an existing residential development located along Fall Street and Grafton Street. Additional detail regarding the 10% AEP event for the project, including the road corridor near Cammeray Golf Course, is explored in Figure 4.2 (Sheet 6 of 7) *Flooding Patterns Under Present Day Conditions* of Appendix R of the EIS and includes an indicative depth of inundation would occur in the north-east corner of the site to a maximum of 0.7 metres.

PMF

Floodwaters that collect in ANZAC Park would build up to a level that overtops the noise wall that runs along the western side of the Warringah Freeway, where it would pond across the full width of the freeway before surcharging across its eastern side and into Cammeray Golf Course. During a PMF event, floodwater would surcharge the Warringah Freeway where it would discharge through the Cammeray Golf Course works site at depths exceeding 0.5 metres.

Potential impacts during construction

If appropriate connections to existing trunk drainage system are not incorporated into the design of the project, then the provision of hard stand areas within the confines of the Cammeray Golf Course works site would have the potential to exacerbate flooding conditions in existing residential

development that is located along Warringa Road, Falls Street, Cammeray Road and Grafton Street.

Construction activities within the confines of the Cammeray Golf Course construction support site would have the potential to obstruct flow which surcharges the Warringah Freeway during a PMF, thereby exacerbating flooding conditions in existing development that is located on the western side of the freeway.

The greatest potential for adverse impacts on flood behaviour in adjacent development is associated with construction support site (ancillary facility). There is also the potential for all construction activities to impact local catchment runoff, which would require appropriate local stormwater management controls to be implemented during the construction phase of the project.

Site facilities will be located outside high flood hazard areas based on a 1% AEP flood.

5 Environmental aspects and impacts

5.1 Construction activities

Key aspects of the Project that could result in adverse impacts to soils and water include:

- Vegetation clearing[1] and topsoil rotating (via rotary method).
- Bulk earthworks.
- Site access including drainage works.
- Site water dewatering
- Material stockpiles
- Compounds operation including fuel and chemical storage, refuelling and chemical handling.
- Noxious weed treatment including herbicide spraying.

Refer also to the Aspects and Impacts Register included in Appendix A4 of the CEMP.

5.2 Impacts

The potential for impacts on soil and water will depend on a number of factors. Primarily impacts will be dependent on the nature, extent and magnitude of construction activities and their interaction with the natural environment. Potential impacts attributable to construction might include:

- Exposure, handling and treatment of Acid Sulphate Soils
- Disturbance of contaminated materials during earthworks, piling, dewatering
- Contamination of soils and water from spills and chemical usage
- Treatment, handling and disposal of contaminated water, increasing the potential for migration of contaminants via leaching, overland flow or subsurface flow
- Mobilisation of contaminants in runoff containing sediment from disturbed areas entering local watercourses
- Potential for flooding of adjacent areas as a result of the Project
- Potential cumulative impacts associated with other Stages, including 1A-1B and 2.

Some impacts on soil and water attributable to the Project are anticipated. Relevant aspects and the potential for related impacts have been considered in a risk assessment at Section Appendix A4 of the CEMP. Chapter 6 provides a suite of mitigation measures that will be implemented to avoid or minimise those impacts.

[1] Current scope of vegetation clearing does not include works in the riparian corridor/vegetated riparian zone (including discharge from stormwater runoff). If the scope of works changes to impact upon these areas, the *Guidelines for Controlled Activities on Waterfront Land* applies.

6 Environmental mitigation and management measures

6.1 Erosion and sediment control

An Environmental Protection Licence (EPL) is currently in place for the CGC works for which John Holland Pty Ltd is the licensee. To meet EPL 21528 – condition O4.2, the project is required to ensure erosion and sediment controls are designed (stability, location, type and size), constructed, operated and maintained in accordance with Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom, 2004) and Managing Urban Stormwater: Soils and Construction Volume 2 (Department of Climate Change, 2008) (herein referred to as the Blue Book). To demonstrate compliance a site-specific Erosion and Sediment Control Plan (ESCP) has been developed for the project by a Certified Professional in Erosion and Sediment Control (CPESC).

A ESCP will be developed for each work site prior to the commencement of ground disturbance, and as site conditions change. The ESCP will outline appropriate erosion and sediment controls to minimise water pollution and maintain existing water quality of surrounding surface watercourses. The ESCP will detail:

- Required erosion and sediment control measures for the site, including establishing, operating and maintaining a Blue Book compliant construction sediment basin regulated under the Project's EPL.
- Staging of works to minimise disturbed catchment footprints
- Overview of construction activities and their locations if they have the potential to impact on stormwater flows and groundwater
- Stormwater management controls & site water capture points
- Details of temporary stockpiles, location and management.

The Environmental Staff (or delegated representative) will undertake site inspections, including a review of erosion and sediment controls on-site, ensuring all controls are undamaged, functional, adequate and installed as per the ESCP. A soil conservation specialist will be engaged by both TfNSW and the Contractor for the duration of construction of the project to provide advice regarding erosion and sediment control including review of ESCPs.

The ESCP will be updated to reflect the current site conditions as required, and for new work areas not previously addressed by an ESCP, as per G38 Section 3.1.1 Hold Point. All reviews and amendments will be conducted by the Environmental Manager in consultation with the Site Supervisor.

See **Appendix A** – Erosion and Sediment Control Procedure for a detailed flowchart of all soil and water management and mitigation measures to be implemented.

6.2 Water quality

Visual water quality monitoring will be undertaken during the construction phase. For instances where water quality is visually observed as reduced or impacted, a review will be undertaken immediately of relevant ESCP management and mitigation measures, to determine the significance of the possible causes. If the impact is determined to be attributable to project works, the event will be treated as an environmental incident and managed in accordance with the requirements of Section 3.7 of the CEMP. Further corrective and preventative actions will be identified and implemented as part of this process, and the ESCPs updated to capture these actions. Refer to Section 7.3 for further detail on monitoring and inspections.

6.3 Stockpile management

Stockpiles will be managed in accordance with the stockpile management protocols in Appendix E - Stockpile Management Protocol..

6.4 Tannin management

Tannin will be managed in accordance with **Appendix C** – Tannin Management Procedure[2].

6.5 Water extraction and Construction site dewatering

Water extraction are not required as part of CGC scope of works.

Construction site dewatering will not be undertaken. Surface water will be captured on site through erosion and sediment retention controls (e.g. berm structures), and preferentially used for dust suppression on site, or removed from site via vacuum truck and disposed of to a licensed waste facility.

As the detailed design and associated construction methodology and sequencing continues to be further refined, SPA will continue to investigate the potential implementation of a construction sediment basin as an avenue to assist the project team with managing construction site dewatering.

Note: as of April 2022, consultation with EPA is ongoing with regards to dewatering, and any additional requirements from the EPA will be incorporated into this plan where appropriate, in line with the EPL and relevant TfNSW guidelines.

Table 6-1 and Section 7.3 details the soil and water management and mitigation measures under the relevant CoA/REMMs.

Table 6-1: Soil and Water management and mitigation measures

ID	Measure/Requirement	When to implement	Responsibility	Reference
SWM1	Any previously unidentified contaminated material encountered during the works will be managed in accordance with an unexpected contaminated finds procedure, as outlined in the Guideline for the Management of Contamination (Roads and Maritime, 2013b)	Construction	Environment Manager	Appendix D – Unexpected Contaminated Land and Asbestos Finds Procedure

[2] Note - In the first instance rather than mulch native trees (that are approved for removal) these are to be salvaged and reused by either the project and/or by local community restoration/rehabilitation groups, Landcare groups, relevant public authorities etc. for habitat enhancement and rehabilitation work, in accordance with Condition E48 of the approval for this SSI.

ID	Measure/Requirement	When to implement	Responsibility	Reference
SWM2	Vehicle washdowns and/or concrete truck washouts will be undertaken within a designated area or undertaken at a suitable location off site. These areas will be detailed on the EWMS and ESCPs.	Construction	Environment Manager	Appendix A – Erosion and Sediment Control Procedure
SWM3	Erosion and Sediment Control Plans (ESCPs) will be developed throughout the works to ensure that adequate controls are in place to manage surface water runoff and erosion potential. These plans will be developed in consultation with the Soil Conservationist.	Construction	Environment Manager, Soil Conservationist	Appendix A – Erosion and Sediment Control Procedure

ID	Measure/Requirement	When to implement	Responsibility	Reference
SWM4	Awareness training for all personnel involved in construction will be conducted covering: • Environmental impacts; • Relevant legislation; • Principles of erosion and sediment control; • Techniques of erosion and sediment control. The program will be conducted in detail with: • Personnel with special responsibilities. • Including training in flocculation and water quality • management of sediment basins or preparation of Progressive Erosion and Sediment Control Plans	Preconstruction, construction	Environment Manager, Soil Conservationist	Appendix A – Erosion and Sediment Control Procedure, Section 7.2 and Section 3.5 of the CEMP
SWM5	Clearing will be staged, where possible, to reduce the potential for erosion and runoff in non-active work areas Where clearing, including of weeds, is required ahead of works commencing, appropriate erosion and sediment controls will be implemented in accordance with the ESCP.	Construction	Environment Manager, Site Supervisor	Appendix A – Erosion and Sediment Control Procedure

ID	Measure/Requirement	When to implement	Responsibility	Reference
SWM6	Use of geotextile, polymer sprays or similar linings to provide temporary surface protection against water and wind erosion.	Construction	Environment Manager, Site Supervisor	Appendix A – Erosion and Sediment Control Procedure
SWM17	Stockpiles of soil material will be located in low-hazard areas clear of watercourses (ie at least 50 metres). Additional protection to be afforded with temporary vegetation, upslope diversion banks and downslope sediment control measures as required.	Construction	Environment Manager, Site Supervisor	Section 6.3, Appendix A – Erosion and Sediment Control Procedure & CEMP Appendix A10 Stockpile Management Protocol
SWM18	Stockpile topsoil separately for potential reuse in landscaping and rehabilitation works. Protect stockpiles to prevent erosion during rainfall.	Construction	Environment Manager, Site Supervisor	Section 6.3, Appendix A – Erosion and Sediment Control Procedure & CEMP Appendix A10 Stockpile Management Protocol

ID	Measure/Requirement	When to implement	Responsibility	Reference
SWM20	Water is not to be discharged from site prior to achieving acceptable water quality standards.	Construction	Environment Manager, Site Supervisor	Section 6.5, Section 7.3
SWM21	Where feasible utilise water for site uses prior to discharge or removal from site (eg dust suppression, filtering techniques, flocculation with approved chemical flocculant, pumping for treatment into a water treatment plant). A water movement permit system and EWMS/methodology will be implemented for site dewatering to ensure volumes moved, treated, reused and disposed of are tracked.	Construction	Environment Manager, Site Supervisor	Section 6.5, Section 7.3 & Appendix A – Erosion and Sediment Control Procedure
SWM23	Arranging regular inspections by the Project Soil Conservationist and construction personnel to review and update control measures. Additional inspections will be conducted: • During significant rainfall events exceeding 10mm within 24hrs and during prolonged rainfall to monitor the functioning of controls. Consider safe access etc. • Within 24 hours of cessation of a rainfall event causing runoff to occur on or from the Project	Construction	Environment Manager	Section 7.3, Appendix A – Erosion and Sediment Control Procedure

ID	Measure/Requirement	When to implement	Responsibility	Reference
SWM24	Leave temporary erosion and sediment controls in place until the disturbed catchments have over 70% vegetation cover	Construction	Environment Manager, Site Supervisor	Appendix A – Erosion and Sediment Control Plan

Both contractors for Stage 1A-B and Stage 2 works will works collaboratively to ensure that each stage are consistent with the objectives, targets and environmental performance outcomes identified in Section 2 of the SWMP and the implementation of the soil and water management and mitigation measures set out in Table 6-1 of the SWMP.

7 Compliance management

7.1 Roles and responsibilities

The SPA Project Team's organisational structure and overall roles and responsibilities are outlined in Section 3.3 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Section 6 of this Plan.

7.2 Training

All employees, contractors and utility staff working on site will undergo site induction training relating to soil and water management issues. The induction training will address elements related to soil and water management including:

- Erosion and Sediment control
- Contamination
- Surface water management
- Stockpiling
- Acid Sulfate Soils

Targeted training in the form of toolbox talks or specific training will also be provided to personnel with a key role in soil and water management.

Further details regarding staff induction and training are outlined in Section 3.5 of the CEMP.

7.3 Inspections

In the event of forecast inclement weather (Sydney Botanic Gardens (BOM Station 66006), Observatory Hill (BOM Station 66062), and Mosman Council (BOM Station 66184) >80% forecast of 10mm or more in a 24hr period) and before planned site shutdowns of more than 72 hours, a review of all controls will be undertaken to ensure the controls are adequate for the expected conditions (as much as reasonably practical).This includes visual surface water inspections, as detailed below.

SPA will routinely visually inspect stormwater pits immediately adjacent to and / or within our work area and also visually inspect at the receiving location, east of Grafton Street, Cammeray NSW, including:

- Willoughby Falls,
- the remainder of Willoughby Creek (concrete drainage line), and
- the entry point into Sydney Harbour.

SPA will undertake visual inspection of these locations, under the following circumstances:

- pre-rainfall - 80% likelihood of greater then 10mm or more of rain in a 24-hour period

  mid-rainfall daily until the cessation of rain

Visual inspections will check for visible oil and grease and turbidity. If results indicate unacceptable project-related impacts (e.g. visible turbidity and/or oily sheen), SPA will review construction activities on site, and re-evaluate existing ESCPs and mitigation measures. Unacceptable project impacts are further explored in Table 7-1 below.

Table 7-1 Inspection parameters and limits to be considered for project-related impacts.

Location	Parameter	Limit
Stormwater pits immediately adjacent to or within our work area	Oil & Grease	None visible
	Turbidity	Visibly turbid water entering stormwater pits immediately adjacent to or within our work area that is a direct result of SPA activities
Receiving locations, including: • Willoughby Falls • Remainder of Willoughby Creek (concrete drainage line) • Entry point into Sydney Harbour	Oil & Grease	None visible
	Turbidity	Visibly turbid water entering stormwater pits immediately adjacent to or within our work area that is a direct result of SPA activities and visibly turbid water is identified at the receiving locations.

Both of the locations discussed in Table 7-1 will be inspected each time the criterion for forecast inclement weather is triggered on the Project. The inspection and monitoring requirements explored in Section 7 of this SWMP summarise the minimum requirements to be undertaken daily, through daily observations. Inspection and monitoring requirements that will be undertaken in relation to the construction sediment basin to be established, operated, and maintained by SPA at Cammeray Golf Course site is detailed in the Primary Erosion and Sediment Control Plan (P-ESCP) approved by the EPA as part of the EPL variation.

Reporting requirements related to such matters will be done in accordance with Section 7.7 of this plan.

As per SWM23, SPA will arrange regular inspections by the Project Soil Conservationist and construction personnel to review and update control measures. A post rainfall visual inspection will also be completed and inspection records maintained on Sharepoint.

Note: as of April 2022, consultation with EPA is ongoing with regards to monitoring program requirements, and any additional requirements from the EPA will be incorporated into this plan where appropriate, in line with the EPL and relevant TfNSW guidelines.

7.4 Licences and permits

The following licences and permits, relevant to soil and water management, will be in place for construction of the Project:

Licence/Permit	Issuing Authority	Description
21528	Environment Protection Authority (EPA)	The licence authorises the carrying out of the scheduled development work listed below at the premises listed in A2: Early works stages of the Western Harbour Tunnel/Warringah Freeway Upgrade (WHTWFU) and associated utility relocation and adjustments in preparation for the main road works (tunnelling, civil road construction).

7.5 Monitoring (including weather)

Rainfall will be taken from the Sydney Botanic Gardens (BOM Station 66006), Observatory Hill (BOM Station 66062), and Mosman Council (BOM Station 66184). Daily data is available from this location for all relevant parameters. This information will be downloaded on approximately a monthly basis and records maintained on SharePoint.

SPA will continually monitor weather conditions, and if there is an 80% likelihood of greater then 10mm or more of rain in a 24-hour period, the monitoring and inspection methods in Section 7.3 apply.

Consideration of potential updates to monitoring requirements related to construction surface water will be undertaken as a site-specific erosion and sediment control plan (ESCP) is developed prior to the commencement of works. The ESCP will be Blue Book compliant as discussed in Section 6.1 of this plan, progressive and reviewed and endorsed by the project and TfNSW CPESCs. Preliminary discussions have been had between SPA and the NSW EPA in relation to a proposed erosion and sediment control strategy for the Stage 1B CGC adjustment works, commencing with a workshop discussion involving SPA and TfNSW representative and the EPA on Monday 14 March 2022 via a Microsoft Teams Meeting. To summarise this discussion, a follow-up written memo was provided to the EPA on Thursday 24 March 2022. Key elements of this workshop discussion and follow-up memo included:

- Project background, including the contribution of other tributaries and receiving environments (i.e., stormwater drainage network, concrete-lined drainage channels and nearby waterway Willoughby Bay)
- SPA's scope of work, including the nature of the work (i.e. utilities adjustment); scale and duration of disturbance; and the proposed staging, sequencing, and methodology
- Utilising what will be permanent infrastructure (i.e. stormwater harvesting dam for golf course irrigation) for the purpose of temporary construction surface water management, in the form of a construction sediment basin.
- Concentration limits were also proposed for the EPA's consideration, including pH, total suspended solids and hydrocarbons.

Following consideration of SPA's proposed erosion and sediment control strategy for the Stage 1B CGC adjustment works, the EPA has since advised SPA via email (dated Tuesday 5 April 2022) that they are generally supportive of the proposal to install a Blue Book compliant sediment basin for the work. Additional supporting information will be required to be supplied by SPA as part of the EPL licence variation application. Any relevant changes required to be made as a result of the

licence variation process, including changes related to the construction surface water monitoring program, will be made accordingly.

Monitoring requirements associated with this SWMP, as approved by the Planning Secretary including any minor amendments approved by the ER must be implemented for the duration of construction and for any longer period set out in the monitoring program or specified by the Planning Secretary, whichever is the greater.

Monitoring requirements associated with this SWMP, including the Primary ESCP, as approved by the EPA under EPL 21528 must be implemented until the licence is surrendered by John Holland (the licence holder) or until it is suspended or revoked by the EPA or Minister. A licence may only be surrendered with the written approval of the EPA.

7.6 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this sub plan, CoA and other relevant approvals, licenses and guidelines. Audit requirements are detailed in Section 3.9.3 of the CEMP.

7.7 Reporting

Reporting will be undertaken in accordance with Section 3.9.4 of the CEMP, and Section 5 of the EPL 21528 dated 24 May 2021.

8 Review and improvement

8.1 Continuous improvement

Continuous improvement of this Plan will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

The continuous improvement process will be designed to:

- Identify areas of opportunity for improvement of environmental management and performance
- Determine the cause or causes of non-conformances and deficiencies
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies
- Verify the effectiveness of the corrective and preventative actions
- Document any changes in procedures resulting from process improvement
- Make comparisons with objectives and targets.

8.2 SWMP update and amendment

The processes described in Section 3.9 to Section 3.13 of the CEMP may result in the need to update or revise this Plan. This will occur as needed.

Only the Environment Manager, or delegate, has the authority to change any of the environmental management documentation.

A copy of the updated plan and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure – refer to Section 3.10.2 of the CEMP.

Appendix A – Erosion and Sediment Control Procedure

Progressive ESCPs will be developed for the work site prior to the commencement of ground disturbance. The progressive ESCPs will outline appropriate erosion and sediment controls to minimise water pollution and maintain existing water quality of surrounding surface watercourses. The ESCP will be developed in accordance with *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004) and *Managing Urban Stormwater: Soils and Construction Volume 2* (Department of Environment and Climate Change, 2008). The ESCP will detail:

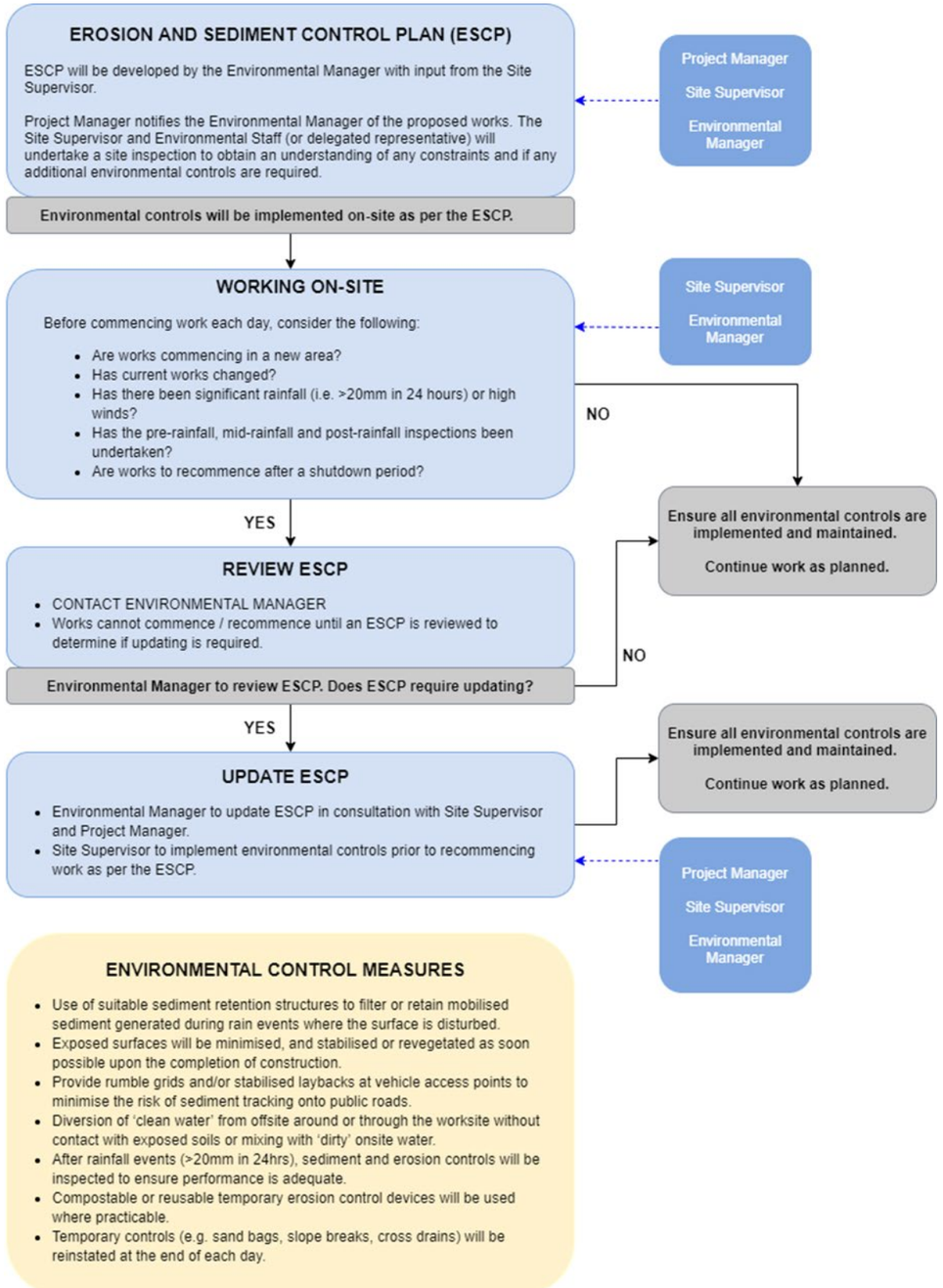
- Required erosion and sediment control measures for the site
- Overview of construction activities and their locations if they have the potential to impact on stormwater flows and groundwater
- Location of surface water capture points (for reuse in dust suppression or removal from site via tanker)
- Details of temporary stockpiles, location and management.

The SPA Environmental Manager (or delegated representative) will undertake site inspections on a weekly basis, during, and prior to and following rainfall events including a review of erosion and sediment controls on-site, ensuring all controls are undamaged, functional, adequate and installed as per the ESCPs. A soil conservation specialist will be engaged by both a TfNSW delegate and the Contractor for the duration of construction of the project to provide advice regarding erosion and sediment control including review of ESCPs. A G38 Hold Point will be released by the SPA Environment Manager prior to any ground disturbance and significant change in an existing area.

The ESCP will be updated to reflect the current site conditions as required. All reviews and amendments will be conducted by the Environmental Manager in consultation with the Site Supervisor.

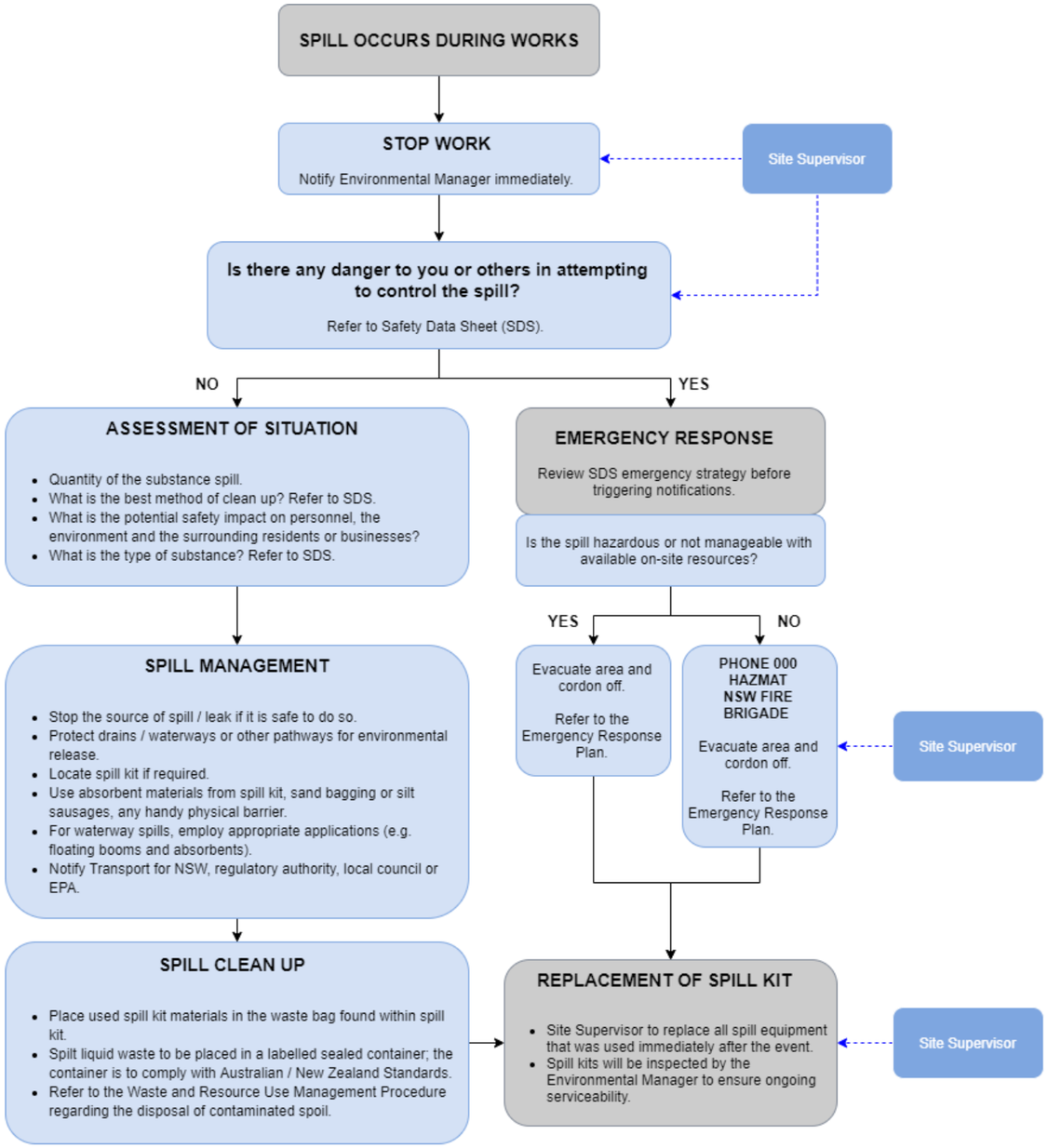
Minimising Water Use

- Where feasible and reasonable, construction water will be sourced from non-potable sources
- Water efficient controls, fixtures and fittings will be in place for temporary facilities
- Where possible, use water efficient construction methods and equipment.



Appendix B – Spill Response Procedure

Spill Response Flowchart



Spill Prevention & Spill Response Procedure

- In the event of a spill, this Spill Response Procedure will be implemented
- Appropriate security measures will be implemented to prevent unauthorised access by the public to the work site
- Fuel, chemical storage and handling areas will be clearly identified with signage
- Fuel, chemical storage and handling areas will be regularly checked for signs of spills and ensure the capacity of secondary containment is maintained
- Bunds must have 110% capacity of the total volume of liquids stored (Australian Standard AS 1940-2004: The storage and handling of flammable and combustible liquids)
- Hazardous substances will be stored onsite in lockable containers, in their original receptacles only
- All hazardous substances will be clearly labelled and have Safety Data Sheets available nearby
- All hazardous substances will be stored and managed in accordance with *the Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005) and Hazardous and Offensive Development Application Guidelines
- An up-to-date register of hazardous substances will be kept onsite at all times
- Hazardous substance use that could result in a spill will not be carried out near drainage or stormwater lines and, wherever possible, will be conducted within defined bunds. Where practical, small bunds will be provided on site to provide temporary storage for small containers at the point of use.
- Spill kit and fire response equipment will be located where chemicals are stored and where refuelled plant are operated or maintained. If refuelling is undertaken on site it will be in a designated area away from drainage lines. All refuelling activities will be supervised.
- All spills or leakages will be immediately contained and cleaned up, ensuring waste material is appropriately disposed
- Used packages (drums and containers) and containers storing waste liquids must be sealed and disposed of in accordance with the Waste and Resource Use Management Procedure
- Plan and execute the works so as to minimise the possibility of pollution of the site and adjoining areas by chemicals, dangerous goods and other potential contaminants.

Incident Management

- Incidents are managed in accordance with Section 3.7 of the CEMP. The investigation will include a review of events leading up to the incident and implement improved practices as required, with findings reported to TfNSW.
- Corrective actions may include monitoring groundwater and/ or nearby surface waters for possible contamination if required and spills are considered to be substantial.

In accordance with Part 5.7 the *Protection of the Environment Operations Act 1997*, should the incident be deemed to have resulted in or potential for material environmental harm, or the associated clean-up costs exceed $10,000, the Environmental Manager or Project Director will notify the relevant authorities.

Appendix C – Tannin Management Procedure

ENVIRONMENTAL DIRECTION

Management of Tannins from Vegetation Mulch

JANUARY 2012

ABOUT THIS RELEASE

Environmental Direction number	25
Environmental Direction title	Management of Tannins from Vegetation Mulch
Author	Environment Branch (Environmental Policy)

Issue	Date	Revision description
1	December 2011	Final draft
2	January 2012	Final

CONTENTS

1 PURPOSE

The purpose of this environmental direction is to set RMS's minimum management measures to minimise the generation and discharge of tannins from vegetation mulch on Roads and Maritime Services (RMS) construction projects. Additional background information on tannins and the use of mulch on construction sites is included in section 3 of this direction.

2 MANAGEMENT MEASURES

The primary focus must be to minimise tannin generation on construction sites.

2.1 General mulch management measures

These general mulch management measures are to be followed for all RMS construction projects.

2.1.1 Planning and works staging

The first step in planning and works staging is to identify the amount of mulch to be generated. With this information, a strategy can be prepared to manage mulch on site. Staging of chipping, tub grinding and/or mulching activities should be planned to reduce the volume of mulch to be managed at any one time. The volume of excess mulch can then be assessed and plans made to dispose of this off site.

Other general considerations at the planning and works staging phase are as follows:

- Mulch stockpile sites should be established with appropriate controls in place before the main site clearing activities commence. Limited clearing may be required earlier for establishment of stockpile areas and access.
- Stage the mulching of cleared vegetation to ensure that mulch can be progressively moved to elevated, or otherwise suitable, stockpile locations. It is preferred that mulch should be transferred to a stockpile or reused on the day of mulching.
- Plan to efficiently reuse mulch in progressive works to reduce the time that mulch is concentrated in stockpile locations.
- Excess mulch can be managed by community giveaway. This takes considerable time and mulch needs to be suitably located and managed as this occurs. The conditions for community giveaway of mulch are included as Appendix 3.
- Any other form of bulk offsite mulch disposal (eg to Council parkland or a development site) must be assessed to ensure waste management provisions are adhered to for off site disposal.

2.1.2 Stockpile location and management

- Mulch stockpile sites should be established on elevated ground where possible.
- Stockpile sites with a duration of not more than 1 month should be constructed not less than 20 metres from a watercourse, including floodplains.
- Stockpile sites with a duration of more than 1 month should be constructed not less than 50 metres from a watercourse, including floodplains.
- Mulch stockpiles should be designed and constructed to divert upgradient water to prevent it from entering the stockpile site.

2.1.3 Management measures for the use of mulch on site

- Do not use mulch for surface cover or sedimentation controls in any low lying areas of the site that remain consistently wet. Alternative controls such as geofabric (for surface protection) or sediment fence will be required in these areas.
- Do not spread surface mulch in thicker than 100mm layers. Mixing mulch with topsoil is encouraged for batters to prevent loss of topsoil during initial stabilisation. It should be noted that mulch will generally cause nitrogen draw down which may inhibit plant growth, unless mulch has been composted first.
- Care is to be taken to ensure that excessive mulch is not applied for sedimentation controls such as perimeter bunds or catch dams.

2.1.4 Monitoring and response

- Monitor the site for generation of tannins. Tannin impacts can be readily identified visually as dark coloured ponded water. Site staff should be trained to identify and report potential impacts to the site project management or environment staff.
- Review management practices where required to prevent the generation of tannins in identified problem areas.

2.2 Mulch management methods for high risk sites

2.2.1 High risk sites

High risk sites, where additional management measures may be required, include:

- where large quantities of mulch will be generated and stockpiled.
- where high tannin generating vegetation types are to be mulched (see 3.1).
- where the receiving environment is identified as sensitive (eg Marine Park, threatened aquatic species habitat).
- where tannins have been observed to be generated or discharged from an operating site with standard management controls.

2.2.2 Stockpile management measures for high risk sites

- Mulch stockpiles for high tannin generating vegetation types should incorporate an impermeable bund to capture stockpile leachate or tannin impacted water. Impervious bunds must be a minimum of 300 mm high, preferably higher to capture tannin impacted water. All bunded stockpiles that are in place for a period longer than one month must include a lined discharge point for overflow in extreme rainfall events.
- Stockpiles established on sloping sites must be designed to provide temporary stormwater containment equivalent to a 300 mm minimum height bund on a flat site.
- Tannin impacted water should be pumped out of bunded stockpiles within 5 days of the end of a rainfall event to maintain the storage capacity. This water should be used for on site purposes including dust suppression and landscape watering. These activities must be managed to prevent any pooling or runoff of tannin impacted water.
- Bunded stockpiles must be inspected within 24 hours of cessation of any rainfall event greater than 10mm to ensure tannin impacted water does not overflow.

2.3 Site management procedures

Site management procedures must be prepared for all sites where tannins are identified as a potential issue. Site management procedures should be based on the management measures provided in this Environmental Direction.

3 BACKGROUND

3.1 Tannin generation from vegetation mulch

See Plates 1 – 3 in Appendix 1.

Tannins are naturally occurring plant compounds. Tannin generation from vegetation mulch is likely to be highest from low-lying coastal floodplain areas. The species of vegetation (eg *Melaleuca*) will have a major impact on the likelihood of tannin generation.

Tannin generation is generally highest from mulched vegetation that is stockpiled in areas that are subject to inundation. Placement in wet areas will result in accelerated leaching of tannins into water, concentration of tannins in pooled water, and greater impacts on water quality.

3.2 Tannin impacts on water quality

See Plates 4 – 5 in Appendix 1.

The main concern with the discharge of water that is high in tannins is that it may increase the biological oxygen demand (BOD) of the receiving environment. Increases in BOD may result in a decrease in available dissolved oxygen. A lack of dissolved oxygen is identified as the main cause of about 80 percent of fish kills in NSW rivers and estuaries.

Tannin impacts may result in dark coloured water discharge from construction sites. This impact can be obvious and may raise the concern of the community and other stakeholders including regulatory authorities. Once discharged to the environment, tannins may reduce visibility and light penetration and change the pH of receiving waters. These impacts may affect aquatic ecosystems in receiving environments.

Tannins cannot be readily treated with standard construction site water quality controls. Once water on site is impacted with tannins it is not possible to treat effectively with currently approved flocculants. Minimisation of tannin generation in the first place is the management strategy that must be applied.

3.3 Use of mulch on construction sites

See Plates 10 – 16 in Appendix 2.

The RMS Biodiversity Guidelines provide guidance on the benefits of reusing various sizes of vegetation for different purposes. Mulch is a readily available and cheap source of material for temporary site stabilisation and sedimentation control. The re-use of mulch reduces the need to transport this material off-site and reduces handling and disposal costs for construction contracts.

Unprotected mulch sedimentation controls should not be placed in concentrated flow lines where mulch may be washed away. Mulch may be protected by wrapping it with geofabric or other materials to provide a stable control. All temporary catch dams constructed from mulch must have a stable outlet to minimise the washing away of mulch in high rainfall events, and the possible failure of the control.

4 ADDITIONAL RESOURCES

- RTA Biodiversity Guidelines- Protecting and Managing Biodiversity on RTA Projects, 2011
- Pacific Highway Mulch Protocol 2011

5 APPENDICES

Appendix 1: Plates showing tannin generation & water quality impacts

Plate 1: Melaleuca vegetation community – mulch from this vegetation type will generally produce high amounts of tannins.

Plate 2: Vegetation mulching activity – mulch should be progressively moved into prepared stockpile areas.

Plate 3: Tannin generation from recently felled and partially mulched vegetation in an area subject to localised inundation. Mulched vegetation should be progressively moved to prepared stockpiles to manage tannin impacted water.

Plate 4: Tannin impact in stormwater at the discharge point from a road construction site. The discharge of impacted water may be obvious to community and other stakeholders.

Plate 5: Tannins in a drainage line generated from very thickly applied mulch on the batter above. Note that the sedimentation fence is not effective in treating the tannins.

Appendix 2: Plates showing the use of mulch for erosion & sedimentation controls

Plate 6: Mulched vegetation stockpiled in a low-lying area subject to inundation. This is not an appropriate stockpile location and may increase the generation of tannins from stockpiled mulch.

Plate 7: Mulch being placed as batter erosion control. Mulch should not be applied in layers more than 100 mm thick for surface stabilisation.

Plate 8: Site showing recent application of a mulch/topsoil mix on batters (40% mulch to 60% topsoil). Mulch mixes are used to provide temporary stabilisation to prevent the loss of topsoil from batters in heavy rainfall events. Mulch use is also shown as a mounded sedimentation control to prevent sediment entering the median drain.

Plate 9: A mulch/topsoil mix used to provide temporary batter stabilisation and to assist cover crop establishment.

Plate 10: Successful establishment of cover crops on batters where mulch has been used with topsoil to assist temporary stabilisation.

Plate 11: Geofabric wrapped mulch bunds used for sedimentation control

Plate 12: Mulch used as a bund for a temporary sedimentation catch dam. Mulch is effective as it can provide both containment and filtering of site water. Mulch should not be used as a control in areas of concentrated flow where it may be washed away. Any mulch containment control should have a defined and lined outlet that allows discharge from the control without washing mulch away. Note that this control does not have a defined discharge outlet which should be installed to prevent failure of the control in heavy rainfall events.

Appendix 3: Minimum requirements for community mulch giveaways

The purpose of community mulch giveaways is to provide mulch for residential landscaping purposes.

The activities of a community mulch giveaway are permissible under the *Protection of the Environment Operations (Waste) Regulation 2005 – General Exemption Under Part 6, Clause 51 and 51A* (the Raw Mulch Exemption 2008). However, the activities remain subject to other relevant environmental regulations within the Act and Regulations. The Raw Mulch Exemption 2008 is subject to the following conditions:

- The raw mulch can only be applied to land for the purposes of filtration or as a soil amendment material or used either singularly or in any combination as input material(s) to a composting process.
- The consumer must land apply the raw mulch within a reasonable period of time.

Further information can be found at: www.environment.nsw.gov.au/resources/waste/ex08mulch.pdf

It is the mulch generators responsibility to ensure that the mulch is reused in an environmentally responsible manner.

A safe work method statement (SWMS) must be prepared that identifies potential OHS risks and all prevention and mitigation measures. The SWMS must apply to both the community and site workers involved in the mulch giveaway.

Each member of the community who participates in the mulch giveaway must read and understand a site specific information sheet. A template information sheet is attached as Appendix 4.

The site occupier must maintain written records for each load of mulch that is taken away and to ensure that each community participant understands the conditions of the community mulch giveaway information sheet. A suggested template to record this information is attached as Appendix 5.

Appendix 4: Community mulch giveaway information sheet

The following community mulch giveaway information sheet must be populated with site specific information.

Community Mulch Giveaway
Information Sheet

Details of Mulch Supply	
Site Occupier	<insert name of contractor / alliance etc>
Project Name	<insert project name>
Location	<insert location of mulch stockpile>
Mulch stockpile access directions	<insert adequate directions for community members to find the stockpile location>

Background

- This information sheet supports the non-commercial giveaway of mulch for local residents.
- The product is raw vegetation mulch from <insert project location / name>.

Conditions

- Any one individual may only take a maximum of 5 trailer loads from this project.
- The mulch may only be used for residential landscaping purposes.
- Mulch must not be placed in or immediately adjacent to waterways.
- The raw mulch can only be applied to land for the purposes of filtration or as a soil amendment material or used either singularly or in any combination as input material(s) to a composting process.
- The consumer must apply the raw mulch to land within a reasonable period of time.

Community Safety Requirements

- <add in any safety requirements or mitigation measures from the SWMS that apply to the community>
- <add in any safety requirements or mitigation measures from the SWMS that apply to the community>
- <add in any safety requirements or mitigation measures from the SWMS that apply to the community>
- <add in any safety requirements or mitigation measures from the SWMS that apply to the community>

Appendix 5: Records template for community mulch giveaway

The records in the following suggested template must be kept as a minimum.

Community Mulch Giveaway Record Sheet				
Date	**Car Registration**	**I have read and understand the 'Community Mulch Giveaway Information Sheet'**	**Name**	**Signature**
		❑ Yes		
		❑ Yes		
		❑ Yes		
		❑ Yes		
		❑ Yes		
		❑ Yes		
		❑ Yes		
		❑ Yes		
		❑ Yes		
		❑ Yes		
		❑ Yes		

Appendix D – Unexpected Contaminated Land and Asbestos Finds Procedure

Western Harbour Tunnel and Warringah Freeway Upgrade

Stage 1B Early and Enabling Works – Cammeray Golf Course Adjustment Works

June 2022

List of emergency and key contacts

Position	Name	Phone
EPA pollution hotline		131 555
Fire and Rescue NSW		000 (for pollution incidents that present an immediate threat to human health or property) 1300 729 579 (for pollution incidents that do not present an immediate threat to human health or property)
The Ministry of Health		(02) 9391 9000
SafeWork NSW		131 050
North Sydney Council		(02) 9936 8100
24 hour community information line		1800 931 189
SPA Environmental Manager	Alyce Harrington	0409 633 908
SPA Community Manager	Amanda Muir	0499 542 816
SPA Project Manager	Jason Nisbet	0418 693 964
SPA Superintendent	John Cosgrave	0419 717 529
Environmental Representative	Maurice Pignatelli	0407 493 176
Transport for NSW Representative (Greater Sydney Project Office)	Richard Peterson	0429 227 775
Transport for NSW Environmental Representative (Motorways)	Rob Owens	0435 578 294
Suitably qualified Contaminated Land Consultant	Ryan Jacka (EDP)	TBC

Roles and responsibilities

SPA Site supervisor

- Ensure this Unexpected Contaminated Land and Asbestos Finds Procedure is implemented throughout construction
- Stop work immediately upon becoming aware of a suspected unexpected contamination find
- Inform Environment Manager of unexpected find
- Assist Environment Manager in recording details of unexpected finds
- Work with Environment Manager to develop a plan for managing and/or remediating the unexpected find
- In coordination with the Environment Manager, implement the plan for the management and/or remediation of the unexpected find
- Ensure asbestos removalist (if required) are appropriately licenced
- If required, treat ASS on site to neutralise potential impact to environment
- Recommence work following approval from the Environment Manager
- Prior to any waste being removed from site ensure the waste been classified in accordance with the NSW EPA Waste Classification requirements

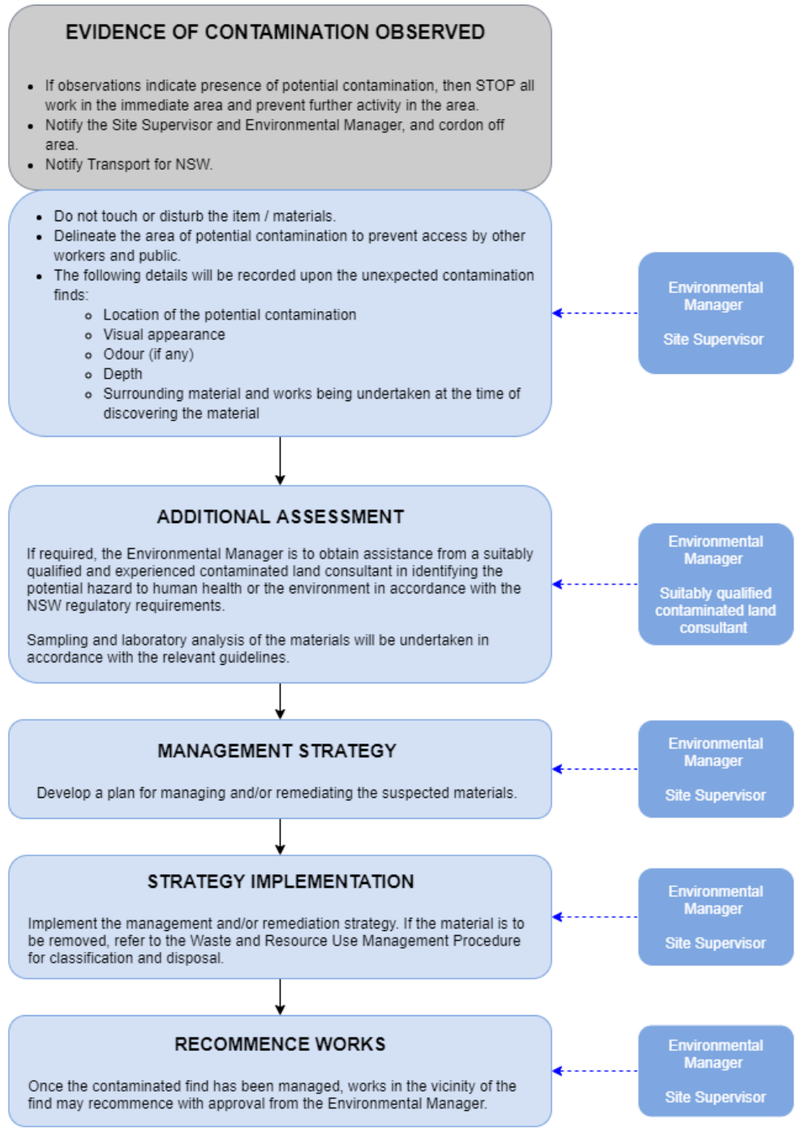
SPA Environment Manager

- Ensure this Unexpected Contaminated Land and Asbestos Finds Procedure is implemented throughout construction
- Record details of unexpected find
- Engage suitably qualified contaminated land consultant following unexpected find
- Assist suitably qualified contaminated land consultant in the investigation and assessment of unexpected find
- Work with Site Supervisor to develop a plan for managing and/or remediating the unexpected find
- Advise Site Supervisor of appropriate ASS treatment method to neutralise any potential threat to the environment
- In coordination with the Site Supervisor, implement the plan for the management and/or remediation of the unexpected find
- Engage licenced asbestos removalist if required
- Following successful management of the unexpected finds, issue the Site Supervisor with approval to recommence work.

Suitably Qualified Contaminated Land Consultant

- Identify the potential hazard to human health and/or the environment in accordance with applicable legislative requirements
- Undertake sampling of unexpected finds for laboratory analysis
- Undertake waste classification of any waste to be removed from site in accordance with the NSW EPA Waste Classification requirements
- Issue asbestos clearance certification (if required)

Unexpected Finds Procedure



The Unexpected Finds Procedure for Contamination must be followed should unexpected contamination or asbestos (or suspected contamination) be excavated or otherwise discovered. Any contamination or asbestos encountered during works must be managed in accordance with the requirements of section 105 of the *Contaminated Land Management Act 2008.*

Asbestos handling and management will be carried out in accordance with relevant legislation, codes of practice and Australian standards.

Likelihood of contamination

The following indicates the presence of potentially contaminated material; where material is uncovered which displays some or all of these characteristics, stop works and notify the Environment Manager:

- Unusual odour from soils that are not detected in other similar areas
- Discolouration or staining of soil or rock
- Seepage of unusual liquids from soil or rock
- Unusual odours, sheen or colour on groundwater and/or surface water
- Unusual metal objects
- Unexpected underground storage tanks, buried drums or machinery etc.
- Presence of waste or rubbish above or below ground
- Potential asbestos containing material

Where these factors are identified, the material is considered to be possibly contaminated and the flowchart is to be followed.

Asbestos

An unexpected asbestos find occurs when asbestos containing materials (ACM), not identified in the Asbestos Register, are found on site. In the event of an unexpected asbestos find, the below steps are to be followed along with the flowchart:

1. The area is to be demarcated, works in the area to cease and workers warned
2. Notify the Environmental Manager and Site Supervisor.
3. The storage of the soil and potential asbestos should be undertaken to ensure the material remains damp with dust suppression or covered where water cannot be accessed.
4. Arrange for testing of the suspected ACM and monitoring of the area (if required)
5. An asbestos removalist is to be engaged to provide recommendations to treat the area, as required
6. A clearance certificate is required from the asbestos removalist to confirm that the area has been made safe.

Acid Sulfate Soils

The EIS indicated that there is high probability of ASS occurrence within Sydney Harbour and Rozelle Bay. The critical utility works are unlikely to be undertaken within these known areas of ASS.

If detailed investigations determine high-risk ASS, then it will be identified on relevant Sensitive Area Plans and should works require impacts to ASS, the works will be undertaken in accordance with this procedure.

If ASS is encountered, possible management strategies include:

- Modifying the work to avoid the area of ASS.
- Delineation and removal of material to a suitably licenced facility.
- Onsite treatment to neutralise the ASS, which could include the application of lime. The storage of this material should ensure that potential contamination cannot leave site or cross contaminate other materials on site.

  The management of ASS includes appropriate erosion and sediment controls to minimise the potential for pollution to waters.

  Any material to be removed off-site will be classified in accordance with the NSW EPA Waste Classification requirements. Should any potentially contaminated material be required to be stockpiled on site it will be in accordance with the Stockpile Management Protocol.

Waste Generation and Disposal

Any soils / fill materials surplus to construction will be classified in accordance with the NSW EPA (2014a) Waste Classification Guidelines. Additional project-specific information related to waste generation and disposal is provided for in the WFU Stage 1B CGC Waste and Resource Use Management Procedure (Appendix B7 of the WFU Stage 1B CGC CEMP).

Appendix E – Stockpile Management Protocol

Stockpile Management Protocol

Western Harbour Tunnel and Warringah Freeway Upgrade

Stage 1B Early and Enabling Works - Cammeray Golf Course Adjustment Works

Transport for NSW

NSW GOVERNMENT

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Stockpile Management Protocol

Western Harbour Tunnel and Warringah Freeway Upgrade

Stage 1B Early and Enabling Works - Cammeray Golf Course Adjustment Works

January 2022

Contents

Appendices

Document control

Approval

Title	Stage 1B Early and Enabling Works - Cammeray Golf Course Adjustment Works Stockpile Management Protocol
Document No/Ref	SPAWP12-JHG-PAP-ENV-0-0009

Version control

The below document status table is for tracking the revisions of this Protocol, while the project is in construction. The version control table is to be used to track revisions, including those incorporating changes following agency comments.

It may be modified where necessary to fit with requirements of the individual project.

Revision	Date	Description	Approval
0	16/11/2021	First inclusion in CEMP for TfNSW & ER review	DL
1	09/02/2022	Updated following TfNSW & ER review	DL

Glossary / abbreviations

Abbreviation	Expanded text
CoA	Condition of Approval
CUT	Critical utilities installation, relocation and protection
DPIE	Department of Planning, Industry and Environment
EEC	Ecological Endangered Community
EIS	Environmental Impact Statement
ESCP	Erosion and Sediment Control Plan
Project, the	Western Harbour Tunnel Warringah Freeway Upgrade
Protocol, this	Stockpile Management Protocol
SPA	Sydney Program Alliance
TfNSW	Transport for NSW
WFU	Warringah Freeway Upgrade
WFUEW	Warringah Freeway Upgrade Early Works
WFUMW	Warringah Freeway Upgrade Main Works
WHT	Western Harbour Tunnel
WHTBL	Western Harbour Tunnel Beaches Link
WHTWFU	Western Harbour Tunnel Warringah Freeway Upgrade

1 Purpose

This Stockpile Management Protocol has been prepared to comply with the Conditions of Approval (CoA) for the Project. The definitions of Ancillary Facilities within the Infrastructure Approval includes the statement:

“Where an approved CEMP contains a stockpile management protocol, a material stockpile area located within the construction boundary is not considered to be ancillary facilities”

This Protocol will ensure that stockpiles are managed using appropriate mitigation measures and will be used to gain approval for all stockpiles that are not already approved within the Construction Environmental Management Plan (CEMP). This Protocol has been prepared with consideration of the Transport for NSW (TfNSW) Stockpile Site Management Guideline (May 2011).

2 Induction/Training

Personnel involved in planning or managing stockpiles will be trained in the requirements of this Procedure. Training will also include inductions, toolbox talks, pre-starts and targeted training as required.

3 Stockpile location criteria

Stockpiles sites on the Project shall be assessed against the following criteria:

- Located 5 metres away from areas of concentrated water flow;
- Located at least 10m away from a watercourse
- Have ready access to project or road network
- Located on relatively level land
- Located to minimize the need for heavy vehicles to travel on local streets and / or through residential areas
- Not unreasonably affect the land use of adjacent properties
- Located so that the appropriate erosion and sediment control measures can be installed and will operate effectively
- Located on land above the AEP 10% flood level unless a contingency plan to manage flooding is prepared and implemented
- On land that does not require the removal of threatened species (beyond those already impacted by the project)
- On land that does not require the removal of Endangered Ecological Communities (EEC) (beyond those already impacted by the project) or within the tree protection zone (in accordance with AS 4970) of EEC
- On land that does not require the removal of roosting habitat for listed threatened fauna species (beyond those already impacted by the project)
- Provides sufficient area for the storage of raw materials to minimize, to the greatest extent practical, the number of deliveries required outside of construction hours
- Positioned in areas were minimal visual and light spill impacts anticipated at the nearest residence.
- Positioned in areas were minimal noise and vibration impacts anticipated at the nearest residence
- Located in areas that will not impact on heritage sites (beyond those already impacted by the project)
- Located within the approved Project boundary.

Prior to use, proposed stockpiles will be assessed under the Stockpile Location Permit (Appendix A). The Stockpile Location Permit determines who is to provide approval and considers if a Minor Consistency Review is be undertaken.

Stockpiles that are within the construction footprint and are in place for less than 30 days do not require approval under the Stockpile Location Protocol and Permit.

Approved stockpile locations are to be marked-up on Erosion and Sediment Control Plans (ESCP) or relevant site plans and recorded in the project Stockpile Register (example located in Appendix B).

4 Protocol

Prior to the establishment of any stockpile on site as part of the project, ensure that:

1. The location of the stockpile is to be considered against the site selection criteria contained in Section 5 and requires prior approval via a Stockpile Location Permit (Appendix A). The Stockpile Location Permit determines who is to approve the stockpile and if a Minor Consistency Review is to be undertaken.
2. Site-specific mitigation measures, where they are necessary to further reduced impacts, are identified and detailed in the 'Stockpile Location Permit'.
3. Mitigation measures for each stockpile site include as a minimum:
    - Materials will not be stockpiled within the tree protection zone (in accordance with AS 4970) of trees or native vegetation to be retained, and never pushed up around the base of trees. Trees are not to be flooded or soils caused to be waterlogged as a result of stockpile development
    - An ESCP will be prepared and implemented in advance of stockpiling. ESCPs will be updated
    - The ESCP will detail soil and water management measures consistent with Managing Urban Stormwater - Soils and Construction Vols 1 and 2, 4th Edition (Landcom, 2004) to minimise soil erosion and the discharge of sediment and other pollutants to land and/or waters. This may include:
        - Erosion and sedimentation controls will be erected between the site and any drainage lines or down-slope areas
        - A diversion bund will be installed on the uphill side of the stockpile to divert water around the site, unless run on water is 'dirty' construction water. Where this occurs 'dirty' run on water shall be diverted to erosion and sediment controls
        - Erosion and sediment control structures shall remain installed and maintained until sufficient stabilisation is achieved as per the Blue Book
        - Separating 'clean' run-on water from 'dirty' construction area run-off
        - Maximising the diversion of turbid construction runoff into detention/sediment basins.
        - Controlling run-off during the construction of stockpiles
        - Diverting stockpile run-off through sediment traps and into pits and the stormwater drainage system as soon as practical to reduce surface flow lengths and velocities.
    - Controls will be installed around all stockpiles that are in place for more than 10 days in order to prevent wind and water erosion. These controls will be in accordance with the ESCP
    - Stockpile areas will be monitored for odours on a regular basis during inspections. If nuisance odours are generated and are impacting sensitive receivers, odour control measures will be implemented, in accordance with the CEMP
    - Weed management measure will be undertaken progressively including weed spraying or covering the stockpile to prevent growth as appropriate. Topsoil that is not contaminated by weeds will be located separately to other stockpiles.
    - Dust management measures (including for vehicle movements associated with stockpiling activities) will be implemented in accordance with the requirements of the CEMP
    - Stockpile heights will be generally no greater than 2 meters with slopes no steeper than 2:1

- Mulch stockpiles must be monitored and turned over as required to avoid spontaneous combustion
- Mulch stockpiles in high tannin generating vegetation should be:
    - Located 50m from water ways for mulch stockpiles that will be in place for duration of more than 1 month
    - Located 20m from water ways for mulch stockpiles that will be in place for duration of less than 1 month
    - Located on elevated ground where possible
    - Be fully bunded to ensure up-gradient water is prevented from entering the stockpile site, and to capture tannin impacted water. Bunds are to be impervious and 300mm high at a minimum. All bunded stockpiles that are in place for a period longer than one month must include a lined discharge point for overflow in extreme rainfall events
    - Managed in accordance with all other requirements specified in the Environmental Direction: Management of Tannins from Vegetation Mulch
- Other relevant mitigation measures that are specified within the CEMP
- Other mitigations measures that are required by an approved Stockpile Location Permit.

4. Topsoil stockpiles must:
    - be free from subsoil, other excavated materials, contaminated materials, refuse, clay lumps and stones, timber or other rubbish
    - be trimmed to a regular shape to facilitate measuring and batter slopes not steeper than 2H:1V
    - have their batters stabilised
5. Following completion of work, carry out restoration of the stockpile sites as follows:
6. Stockpile that are within the construction footprint and are in place for less than 30 days do not require approval under the Stockpile Location Permit
7. The Stockpile Management Protocol is not required for stockpiles that are approved within the CEMP.

5 Compliance

Compliance with this Protocol will be tracked through weekly environmental inspections.

Identified non-compliances will be reported to the SPA Environmental Manager and the appropriate management measures will be put in place to ensure ongoing compliance.

Appendix A – Stockpile location assessment and permit

Stockpile Location permit					
Date:		Location:			
#	Location based criteria	Yes	No	Permit approval requirement	Comments
1	Is the site located within the Approved Construction Footprint?			*Yes* = SPA EM. *No* = Consistency Assessment to be first approved by TNSW.	
2	Is the site on land that does not require the removal of threatened species (beyond those already impacted by the project)?			*Yes* = SPA EM. *No* = Consistency Assessment to be first approved by TNSW.	
3	Is the site on land that does not require the removal of EECs (beyond those already impacted by the project) or within the tree protection zone (in accordance with AS 4970) of EEC?			*Yes* = SPA EM. *No* = Consistency Assessment to be first approved by TNSW.	
4	Is the site on land that does not require the removal of roosting habitat for listed threatened fauna species (beyond those already impacted by the project);			*Yes* = SPA EM. *No* = Consistency Assessment to be first approved by TNSW.	
5	Are minimal noise and vibration impacts anticipated at the nearest residence?			*Yes* = SPA EM. *No* = Consistency Assessment to be first approved by TNSW.	
6	Are minimal visual and light spill impacts anticipated at the nearest residence?			*Yes* = SPA EM. *No* = Consistency Assessment to be first approved by TNSW.	
7	Is the site located in an area that does not impact on heritage sites beyond those already impacted by the project?			*Yes* = SPA EM. *No* = Consistency Assessment to be first approved by TNSW.	
8	Is the site located so that appropriate erosion and sediment control measures can be installed and will operate effectively?			*Yes* = SPA EM *No* = Amend proposal to facilitate controls.	
9	Is the site located so it does not unreasonably affect the land use of adjacent properties?			*Yes* = SPA EM. *No* = Amend proposal.	
10	Is the site located 5 metres away from areas of concentrated water flow?			*Yes* = SPA EM *No* = SPA EM to approve only if an approved ERSED plan is approved.	
11	Is the site located at least 10 metres from a watercourse?			*Yes* = SPA EM *No* = SPA EM to approve only if an approved ERSED plan is approved.	
12	Does the site have ready access to project or road network?			*Yes* = SPA EM *No* = Amend proposal	

Stockpile Location permit					
13	Is the site located to minimize the need for heavy vehicles to travel on local streets and / or through residential areas?			*Yes* = SPA EM *No* = Amend proposal	
14	Is the site located on relatively level land?			*Yes* = SPA EM *No* = SPA EM to approve only if an approved ERSED plan is approved.	
15	Is the site located on land above the 10% AEP flood level?			*Yes* = SPA EM. *No* = SPA EM to approve only if a contingency plan to manage flooding is prepared.	
16	Does the site provides sufficient area for the storage of raw materials to minimize, to the greatest extent practical, the number of deliveries required outside of construction hours?			*Yes* = SPA EM. *No* = Amend approval	
Compliant Stockpile Locations: If the proposed stockpile site is deemed compliant with the location based criteria (or the relevant approval requirements have been obtained), this form is to be approved prior to establishment of the stockpile site.					
Once approved, the stockpile location must be recorded in the project stockpile register.					
Prepared by:			Date:		
SPA Environmental Manager approval:			Date:		
ER approval (if required):			Date:		

Appendix B – Example stockpile site register

Approved stockpile site register					
Stockpile Number					
Location					
Date Stockpile Approved					
Comment: additional mitigation measures etc.					


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