Construction Soil and Water Quality Sub-Plan

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Details of Revision Amendments

Document Control

The Project Director is responsible for ensuring that this Sub Plan is reviewed and approved. The Support Services Director is responsible for updating this Sub Plan to reflect changes to the Project, legal and other requirements, as required.

Amendments

Any revisions or amendments must be approved by the Project Director before being distributed or implemented.

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1. Introduction

1.1 Context

The New M5 Project is the Stage 2 component of the WestConnex scheme, a NSW Government initiative to connect Sydney's west and south-west with the Sydney Airport and the Port Botany precinct. It is being delivered by the Sydney Motorway Corporation (SMC), formerly the WestConnex Delivery Authority (WDA).

The CPB Contractors Dragados Samsung Joint Venture (CDS-JV) will deliver the design and construction of WestConnex Stage 2 referred to as the New M5 (the Project). The Project will run from the existing M5 East corridor at Beverly Hills via tunnel to St Peters, providing improved access to the airport, south Sydney and Port Botany precincts. The Project will substantially improve the east - west corridor access between the Sydney CBD, Port Botany and Sydney Airport precincts and the South West growth areas.

The Project will deliver approximately nine kilometres of two-lane twin tunnels with capacity to operate three lanes in the future, motorway to motorway connections to the King Georges Road Interchange Upgrade at Beverly Hills, and a new interchange at St Peters. Infrastructure Approval was granted for the project on 20 April 2016. Major works are expected to commence in mid-2016 and the New M5 tunnel is scheduled to open to traffic in late 2019.

Section 2.3 of the Construction Environmental Management Plan provides further background and detailed description of the New M5 Project.

This Construction Soil and Water Quality Sub Plan (CSWQSP) forms part of the Construction Environmental Management Plan (CEMP) developed for the construction of the Project. The CSWQSP describes how CDS-JV will manage and mitigate and/or minimise soil and water quality impacts during construction of the Project.

This CSWQSP has been prepared with consideration of project requirements, and to address the mitigation measures listed in the New M5 Environmental Impact Statement (EIS), the revised environmental management measures (REMMs) listed in the Submissions and Preferred Infrastructure Report (SPIR) and applicable legislation.

1.2 Objectives and Targets

The objectives for soil and water management are to ensure that the potential impacts to soil and water quality are minimised and comply with the conditions set out within the Project requirements.

To achieve this, CDS-JV will:

- Ensure appropriate controls and procedures are implemented during construction activities to avoid or minimise erosion and sedimentation impacts and potential impacts to water quality in rivers, creeks and groundwater along the Project corridor;
- Ensure appropriate measures are implemented to address the relevant CoA, REMMs and EPL conditions (detailed in this Plan); and
- Comply with the Project's Environment Protection Licence (EPL).

Table 1: Project targets associated with the management of soil and water quality

Metric / measure	Target	Timeframe	Accountability	Documentation / reporting
Any soil identified as exceeding the ASS soil trigger values that is disturbed is treated in accordance with the requirements of the Acid Sulfate Soil Manual	100% of all disturbed ASS and leachate is controlled or treated	At all times	Project Managers	EPL reports Compliance Tracking Program (CTP)
Number of non-compliant monitoring results at authorised discharge points and external compliance points	Zero	At all times	Project Managers	EPL reports Surface water monitoring reports Compliance Tracking Program (CTP)
Number of enforcement notices / penalties issued by regulators and/or client	Zero	At all times	Project Managers	By exception CTP
Number of un-authorised discharges	Zero	At all times	Design/Project Managers	By exception CTP
Water use monitored	100% of water use activities metered	At all times	Design/Project Managers	Sustainability report

1.3 Interface with Other Plans

This CSWQSP is part of an integrated set of Sub-plans to the CEMP (Table 2). Associated and supporting documents to this Plan are described in further detail below:

- The Design Plan describes the design process of all permanent and temporary works, implemented and maintained on the Project. This includes all drainage designs and structures, including sediment basins, outlets and pavements;
- The Quality Plan describes the Quality Management System which will be established, implemented and maintained for the Project and relates to the testing and commissioning of drainage, erosion and sedimentation controls;
- The Community Communication Strategy describes how the Project will communicate with sensitive receivers and asset owners that may be impacted by works;
- The Sustainability Plan sets out the sustainability targets and management framework including a water balance assessment and water conservation and water reuse strategy;
- The site-specific Erosion and Sedimentation Control Plans will be developed in accordance with this CSWQSP and the Ancillary Facilities Management Plan to address erosion and sediment control issues specific to work stages and locations;
- Management of waste will be in accordance with the Construction Waste and Resource Management Plan;
- The Spoil Management Plan sets out the spoil reuse strategy;
- Management of minor spills will be in accordance with the Spill Management Procedure and the management of environmental incidents where material harm to the environment is caused or threatened will be managed in accordance with the Incident Response Plan (includes the Pollution Incident Response Management Plan required under the Environment Protection Licence);

- Management of asbestos and other hazardous materials will be in accordance with the Manage Work with Asbestos and Manage Hazardous Substances Procedure;
- Flood modelling which will be undertaken in developing the design of the temporary and permanent works will be documented in the Flood Mitigation Strategy;
- The Geotechnical Model will represent geological and groundwater conditions and identify geological structures and groundwater features. This model will be used to assess the predicted settlement, ground movement, stress redistribution and horizontal strain profiles caused by excavation and tunnelling on adjacent property and infrastructure;
- The Groundwater and Soil Salinity Report will detail the outcomes of geotechnical investigations to determine the presence, extent and severity of soil salinity within the Project area;
- The Groundwater Modelling report will present the model to be used to predict groundwater drawdown, tunnel inflows, and saline water migration. This model will be used to assess the impacts of predicted groundwater drawdown;
- The Instrumentation and Monitoring Plan has been developed and details the locations, durations and frequency for monitoring programs for settlement, convergence & groundwater levels. The related Acceptable Effects Report contains trigger values and management responses for these monitoring programs; and

Table 2: New M5 CEMP Framework

	Sub-Plans to CEMP	Sub-Plan attachments	Standalone Documentation (linked to CEMP)
Construction Environmental Management Plan	Construction Air Quality Sub-Plan	• NA	• Sustainability Plan • Ancillary Facilities Management Plan
	Construction Noise and Vibration Sub-Plan	• Out of Hours Works Protocol • Blast Management Strategy	• Land Use Survey • Sustainability Plan • Ancillary Facilities Management Plan • Temporary Noise Barrier Strategy
	Construction Traffic & Access Sub-Plan	• NA	• Traffic Management Plans • Ancillary Facilities Management Plan • Local Road Dilapidation Report • Road Safety Audit • Construction Parking and Access Strategy
	Construction Soil & Water Quality Sub-Plan	• Acid Sulfate Soils Sub-Plan	• Flood Mitigation Strategy • Groundwater Modelling Report • Groundwater and Soil Salinity Report • Sustainability Plan • Geotechnical Model • Ancillary Facilities Management Plan • Water Quality Plan and Monitoring Program • Construction Contaminated Land Management Plan • Acid Sulfate Soil Management Procedure • Asbestos Guideline
	Construction Heritage Sub-Plan	• Historical Archaeological Research Design & Excavation Methodology • Unexpected Heritage Finds	• Sustainability Plan • Geotechnical Model • Ancillary Facilities Management Plan
	Construction Flora & Fauna Sub-Plan	• Pathogen and Weed Management Strategy • Nest Box Plan	• Sustainability Plan • Ancillary Facilities Management Plan • Urban Design and Landscape Management Plan • Green and Golden Bell Frog Plan of Management • Biodiversity Offsets Package • Tree Reports
	Waste and Resource Sub-Plan	• NA	• Water Reuse Strategy • Spoil Management Plan • Sustainability Plan
	Energy and Greenhouse Gas Emissions Sub Plan	• NA	• Sustainability Plan

1.4 Training

All personnel, including employees, contractors and sub-contractors, are required to complete a Project induction containing relevant environmental information before they are authorised to work on the Project. Soil and water management-specific information will be covered in the Project induction.

Relevant personnel including Leading Hands, Supervisors, Superintendents, Environmental Coordinators and Engineers will receive training and ongoing toolbox talks on:

- Installation and maintenance of erosion and sediment controls;
- Spill management;
- Handling and storage of hazardous substances; and
- General environmental responsibilities (e.g. protected vegetation).

This will include training by the Project's Soil Conservationist on erosion and sediment control including legislative requirements, the application of best-practice (i.e. Blue Book Volumes 1 and 2D) and correct use & maintenance of various control techniques.

Training requirements are detailed within the CEMP, Part B Element 7.

2. Legal and Other Requirements

This section provides the relevant legislation and Project requirements that apply to soil and water quality aspects of construction.

2.1 Legislation

Legislation relevant to soil and water management for the Project includes:

- *Contaminated Land Management Act 1997;*
- *Dangerous Goods Act 1975;*
- *Environmental Planning and Assessment Act 1979 (*EP&A Act);
- *Fisheries Management Act 1994;*
- *Protection of the Environment Operations Act, 1997 (*POEO Act);
- *Protection of the Environment Operations (General) Regulation 2009;*
- *Water Management Act 2000;* and
- *Water Management (General) Regulation 2011.*

Relevant provisions of the above legislation are explained in the register of legal and other requirements included in Annexure E – Environmental obligations register of the CEMP.

2.2 Minister's Conditions of Approval

Conditions of Approval (CoA) that specifically address the management of soil and water are identified in Table 3. A cross-reference is included to indicate where each condition is addressed in this CSWQSP or other project management document.

Table 3: Conditions of Approval that address management of soils and water

Reference	Requirement	Where addressed
B20	Except as may be provided by an EPL, the SSI must be constructed and operated to comply with section 120 of the *Protection of the Environment Operations Act 1997*, which prohibits the pollution of waters.	This Plan
B21	All activities taking place in, on or under waterfront land, as defined in the *Water Management Act 2000* should be conducted generally in accordance with the *Guidelines for Controlled Activities on Waterfront Land (DPI, 2012).*	Section 5.7 Section 7.1 G2, W1-W4, V3

Reference	Requirement	Where addressed
B22	Watercourse crossings, including temporary work platforms, waterway crossings and/or coffer dams, where feasible and reasonable, must be consistent with the *NSW Guidelines for Controlled Activities Watercourse Crossings (*DPI, 2012), *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witherbridge, 2003), *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW Fisheries February, 2004), and *Policy and Guidelines for Fish Habitat Conservation and Management* (DPI Fisheries, 2013). Where multiple cell culverts are proposed for crossings of fish habitat streams, at least one cell must be provided for fish passage, with an invert or bed level that mimics watercourse flows.	Section 5.7 Section 7.1 G2, W1-W4
B23	A Flood Mitigation Strategy must be prepared and implemented in respect of the flood prone land and overland flow paths for the waterways and catchments in the vicinity of the SSI. The Flood Mitigation Strategy must be designed to ensure that the SSI, where feasible and reasonable, does not worsen existing flooding characteristics in the vicinity of the SSI during construction and operation. The Flood Mitigation Strategy must include but not be limited to: (a) the identification of flood risks to the SSI and adjoining areas, including further modelling and the consideration of local drainage catchment assessments, and climate change implications on rainfall and drainage characteristics. This must consider blockages of waterway structures from floating debris in its flood level modelling; (b) a floor level survey to verify whether inundation would be above the floor levels of residential, commercial and/or industrial buildings; (c) the identification of design and mitigation measures that would be implemented to protect proposed operations; (d) not worsen existing flooding characteristics within and in the vicinity of the SSI boundary during construction and operation, including soil erosion and scouring; (e) consideration of limiting flooding characteristics to the following levels – (i) a maximum increase in inundation time of one hour in a 1 in 100 year ARI rainfall event, (ii) a maximum increase of 10 mm in inundation at properties where floor levels are currently exceeded in a I in 100 year ARI rainfall event, (iii) a maximum increase of 50 mm in inundation at properties where floor levels would not be exceeded in a 1 in 100 year ARI rainfall event, and (iv) no inundation of floor levels which are currently not inundated in a 1 in 100 year ARI rainfall event, or else provide alternative flood mitigation solutions consistent with the intent of these limits; (f) the processes and actions committed to in the mitigation measures referred to in conditions A2(b) and A2(c); (g) the identification of measures to be implemented to minimise scour and dissipate energy at locations where flood velocities are predicted to increase as a result of the SSI and cause localised soil erosion or scour; (h) reconsideration of the proposed flood storage along Marsh Street with the intent of incorporating the flood storage requirements of the SSI into the proposed flood storage for the Cooks Cove development;	Section 7.1 F1 - F8 Flood Mitigation Strategy (Refer compliance table within the document.)

Reference	Requirement	Where addressed
	(i) identification of drainage system upgrades including those upgrades considered as mitigation measures and identified during the processes outlined in condition 829; and (j) identification of the timing and maintenance responsibility of any necessary works. The Flood Mitigation Strategy must be prepared by a suitably qualified and experienced person in consultation with directly affected landowners, Sydney Water, OEH, and relevant councils. The Flood Mitigation Strategy must be independently peer reviewed and confirmed as meeting the requirements of this condition by a suitably qualified and experienced independent hydrological engineer. The Flood Mitigation Strategy and details of the peer review must be submitted to the Secretary and the relevant council(s) prior to the commencement of works which have been identified in the documents listed in condition A2(b) and A2(c) as potentially increasing flood levels, or as otherwise agreed by the Secretary.	
B26	The Proponent must take all feasible and reasonable measures to limit operational groundwater inflows into each tunnel to no greater than one litre per second across any given kilometre.	Section 7.1 B3 Underground Grouting Plan (M5N-AJV-TER-150-500-TU-01646)
B27	The Proponent must undertake further modelling of groundwater drawdown, tunnel inflows and saline water migration prior to finalising the design of the tunnel and undertaking any works that would impact on groundwater flows or levels. The modelling must be undertaken in consultation with DPI (Water) and include the results of at least 12 months of current baseline groundwater monitoring data. The results of the modelling must be documented in a **Groundwater Modelling Report**. The Groundwater Modelling Report must be finalised in accordance with the *Australian Groundwater Modelling Guidelines* (National Water Commission, 2012) and prepared in consultation with DPI (Water). The Groundwater Modelling Report must include, but not be limited to: (a) justification for layer choice; (b) specification of matrix hydraulic and storage parameters for each layer; (c) statistical evaluation of the model's calibration; (d) details of the groundwater monitoring data inputs (levels and quality); (e) details of the proposed groundwater model update and validation as additional data is collected; (f) assessment of impacts of groundwater drawdown, taking into consideration the NSW Aquifer Interference Policy (DPI, 2012), including potential impacts on licensed bores and groundwater dependent ecosystems; (g) a comparison of the results with the modelling results detailed in the document referred to in condition A2(b); and (h) documentation of any additional measures that would be implemented to manage and/or mitigate groundwater impacts not previously identified or identified but at a smaller scale. A copy of the Groundwater Modelling Report must be submitted to the Secretary prior to finalising the tunnel design. The Groundwater Modelling Report must include details of consultation with DPI (Water). The groundwater model must be updated once 24 months of groundwater monitoring data are available and the results of the	Groundwater Modelling Report (Hydrogeological Design Report M5N-GOL-DRT-100-200-GT-1525) to be submitted to the Secretary prior to finalising the tunnel design. (Refer compliance table within the document.)

Reference	Requirement	Where addressed
	modelling provided to the Secretary and DPI (Water) in an updated Groundwater Modelling Report.	
B28	A Water Quality Plan and Monitoring Program must be prepared and implemented to monitor and avoid or mitigate impacts on surface and groundwater quality and resources, during construction and operation. The Water Quality Plan and Monitoring Program must be developed in consultation with DPI (Water), Sydney Water and relevant councils, and must include, but not be limited to: (a) identification of works and activities during construction and operation of the SSI, including tunnel discharge, runoff, emergencies and spill events, that have the potential to impact on groundwater quality, levels or potentiometric pressure (in confined aquifers), and surface water quality of potentially affected watercourses and riparian land; (b) a risk management framework for evaluation of the risks to groundwater and surface water resources and dependent ecosystems as a result of groundwater inflows to the tunnels or discharges to surface water receiving environments, including definition of trigger values for contingency and ameliorative measures; (c) the identification of environmental management measures that would be implemented to manage impacts to surface waters and groundwater during construction and operation, including water treatment, erosion and sediment control and stormwater management measures consistent with Water Sensitive Urban Design measures, where relevant, and consistent with the measures detailed in the documents listed in conditions A2(b) and A2(c); (d) details of construction water treatment plants and the operational water treatment plants, including treatment processes, discharge water quality criteria (taking into consideration any water uses and proposed rehabilitation measures downstream of the discharge locations), discharge locations and rates (and justification for their location), treatment capacity, and any proposed on-site storage of flows; (e) commitment to designing discharge points into watercourses affected by the SSI to emulate a natural stream system, where feasible and reasonable, or where emulation cannot be achieved, adequate scour protection measures are to be implemented; (f) consideration of any naturalisation or rehabilitation programs occurring upstream or downstream of waterways or drainage lines intersected by the SSI, including the Wolli Creek Riparian Corridor Management Plan; (g) the presentation of water quality objectives, standards, environmental values and parameters against which any changes to water quality will be assessed, based on the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Agriculture and Resource Management Council of Australia and New Zealand and the Australian and New Zealand Environment and Conservation Council, 2000). Where alternate guidelines are used to establish water quality objectives (including the levels for protection of aquatic ecosystems in receiving waters), justification for this must be provided. In particular, justification must be provided for the classification of waterways as 'highly disturbed' versus 'slightly to moderately disturbed' receiving environments; (h) details on the current water quality, including at least 12 months of representative background monitoring data (including but not limited to representative data collected by the relevant councils, agencies and organisations where	Section 7.6 Water Quality Plan and Monitoring Program (M5N-ES-PLN-PWD-0027) (Refer compliance table within the document.)

Reference	Requirement	Where addressed
	readily available) for surface and groundwater quality, levels and potentiometric pressures (in confined aquifers), to establish baseline water conditions prior to the commencement of construction; (i) monitoring of the quality of discharges from construction and operational water treatment plants;	
	(j) identification of construction and operational phase surface water and groundwater monitoring locations including watercourses and waterbodies which are representative of the potential extent of impacts from the SSI, including the relevant analytes and frequency of monitoring; (k) groundwater monitoring must be able to demonstrate that groundwater discharge quality is consistent with supporting the water quality objectives defined in accordance with B28(g) and include, but not be limited to - (¡) sites in the vicinity of Bardwell Park (to confirm groundwater quality), (ii) inside and outside the cut-off wall at the Alexandria Landfill, (iii) monitoring of groundwater levels at Stotts Reserve, southern bank of Wolli Creek behind the Wolli Creek station and forested areas along Bardwell Creek to ascertain potential impacts on groundwater dependent ecosystems, and (iv) monitoring of drawdown along the alignment of the tunnels; (l) details on the condition and status of licensed bores likely to be impacted by the SSI; (m) commitment to a minimum monitoring period of three years following the completion of construction or until the affected waterways and/or groundwater resources are certified by a suitably qualified and experienced independent expert as being rehabilitated to an acceptable condition, unless otherwise approved or directed by the Secretary. The monitoring must also confirm the establishment of operational water control measures (such as sedimentation basins and vegetation swales); (n) details of how the potential impact of discharges on receiving waters would be avoided or minimised, including design and operational measures incorporated into the SSI to protect water quality and, where feasible and reasonable, enhance water quality over time; (o) contingency and ameliorative measures in the event that adverse impacts to water quality or groundwater flows, levels or potentiometric pressures (in confined aquifers) are identified, with reference to the impact triggers defined in accordance with 828(b); (p) identification of and commitment to 'make good' provisions for groundwater users to be implemented in the event of a decline in water supply levels, quality and quantity from existing bores associated with groundwater changes from either construction and/or ongoing operational dewatering caused by the SSI; (q) procedures for monitoring of streambed fracturing; (r) procedures for monitoring and annual reporting of extracted groundwater volumes to DPI (Water) for a minimum monitoring period of three years following completion of construction, unless otherwise approved or directed by the Secretary; and (s) procedures for annual reporting of the monitoring results to the Secretary, DPI (Water), and the relevant councils.	Water Quality Plan and Monitoring Program (M5N-ES-PLN-PWD-0027) (Refer compliance table within the document.)

Reference	Requirement	Where addressed
	The Water Quality Plan and Monitoring Program must be submitted to the Secretary for approval prior to the commencement of construction of the SSI, unless otherwise agreed by the Secretary. A copy of the Water Quality Plan and Monitoring Program must be submitted to the DPI (Water), Sydney Water and relevant councils prior to its implementation. Nothing in this condition prevents the Proponent from preparing separate Water Quality and Monitoring Programs for the construction and operational stages of the SSI. Where a separate Water Quality and Monitoring Program is prepared for the operation of the SSI, this must be submitted to the Secretary for approval at least six months prior to the commencement of operation of the SSI.	
B29	The Proponent must undertake further hydrological and hydraulic modelling based on the detailed design of the SSI to determine the ability of the receiving drainage systems to effectively convey pavement drainage from the SSI once operational. The modelling must be undertaken in consultation with the relevant council(s) and the outcomes documented in a Stormwater Drainage Report. The Stormwater Drainage Report must: (a) confirm the location, size and capacity of all drainage basin structures associated with the operation of the SSI; (b) assess the potential impacts of pavement drainage discharges from the SSI drainage systems on the receiving environment including the hydrology (water quality and quantity) of receiving waterways, riparian vegetation, aquatic ecology and property; (c) identify all feasible and reasonable mitigation measures to be implemented where pavement drainage from the SSI drainage systems is predicted to adversely impact on the receiving environment; (d) where pavement drainage from the SSI flows to a council stormwater drainage system, confirm the location of the cross drainage point and, where available, use drainage information obtained from the relevant council, to - (i) confirm the capacity of the council's drainage system and its ability to receive and convey the flows, (ii) identify any consequent upstream and downstream impacts on cross drainage infrastructure capacity, (iii) assess the impacts on the receiving environment at the final outflow point resulting from any additional flow volume (including, but not limited to, scour, flooding, water quality impacts, and impacts on riparian vegetation, aquatic ecology and property), and (iv) identify all feasible and reasonable mitigation measures to be implemented where increased flows through cross drainage systems adversely impact on council drainage infrastructure and the receiving environment; and (e) set out a clear time frame for the implementation of mitigation measures. The Stormwater Drainage Report must be submitted to the Secretary prior to the commencement of any new operational drainage works, modifications to existing stormwater drainage works, or construction of hard surfaces associated with the operation of the SSI that would result in runoff to existing or new stormwater drainage systems, unless otherwise agreed by the Secretary.	Stormwater Drainage Report to be submitted prior to the commencement of the relevant new or modified operational drainage works. (Refer compliance table within the document.)
B30	The Proponent must prepare a Water Reuse Strategy which sets out feasible and reasonable options for the reuse of collected stormwater and groundwater during construction and operation of	Section 7.1 G11, S4, B4 Water Reuse Strategy – To be submitted to the Secretary

Reference	Requirement	Where addressed
	the SSI. The Water Reuse Strategy must include, but not be limited to: (a) evaluation of all feasible and reasonable reuse options; (b) details on the preferred reuse option(s), including volumes of water to be reuse, proposed reuse locations and/or activities, proposed treatment (if required), and any additional licences or approvals that may be required; and (c) a time frame for the implementation of the preferred reuse option(s). Justification must be provided in the event that it is concluded that no feasible or reasonable reuse options prevail. A copy of the Water Reuse Strategy must be submitted to the Secretary for approval prior to commencement of tunnelling works. Nothing in this condition prevents the Proponent from preparing separate Water Reuse Strategies for the construction and operational phases of the SSI. Where a separate Strategy is prepared for the operation of the SSI, this must be submitted to the Secretary for approval at least six months prior to the commencement of operation of the SSI.	for approval prior to commencement of tunnelling works (Refer compliance table within the document.)
B31	Prior to the commencement of any activities that would result in the disturbance of land and/or soil. or as otherwise agreed by the Secretary, in areas identified as having a moderate to high risk of contamination, a **Soil Contamination Report** must be prepared by a suitably qualified person(s) in accordance with the requirements of the *Contaminated Land Management Act 1997* and associated guidelines, detailing the outcomes of Phase 2 contamination investigations within these areas. The Soil Contamination Report must detail, where relevant, whether the land is suitable (for the intended land use) or can be made suitable through remediation and/or outline the potential contamination risks from the SSI to human health and receiving waterways. For land to be disturbed by the SSI, where the investigations identify that the site is suitable for the intended operations and that there is no need for a specific remediation strategy, measures to identify, handle and manage potential contaminated soils, materials and groundwater must be identified in the Soil Contamination Report and incorporated into the Construction Environmental Management Plan. Should a remediation strategy be required, the Soil Contamination Report must include a **Remediation Action Plan** for addressing the disturbed area, and how the environmental and human health risks will be managed during the disturbance, remediation and/or removal of contaminated soil or groundwater. If remediation is required, the Soil Contamination Report must be accompanied by a **Site Audit Statement**(s), prepared by an accredited Site Auditor under the *Contaminated Land Management Act 1997*, verifying that the disturbed area has been or can be remediated to a standard consistent with the intended land use. Where land is remediated, a final Site Audit Statement(s) must be prepared by an accredited Site Auditor, certifying that the contaminated disturbed areas have been remediated to a standard consistent with the intended land use. The final Site Audit Statement must be submitted to the Secretary and relevant councils prior to operation of the SSI, unless otherwise agreed to by the Secretary.	Section 5.4 Construction Contaminated Land Management Plan (M5N-ES-PLN-PWD-0033)
B32	The Proponent must submit a copy of the final Landfíll Closure Management Plan to the Secretary prior to the commencement of any closure or construction works at Lot 2 DP 1168612, 10-16 Albert Street, St Peters (the Alexandria Landfill). The Plan must	St Peters Interchange - Landfill Closure Management Plan (M5N-GOL-TER-900-116-0012)

Reference	Requirement	Where addressed
	be accompanied by a statement which sets out where the following have been addressed in the Landfill Closure Management Plan: (a) the environmental and monitoring framework to be implemented following the cessation of waste disposal and material recycling activities at the Alexandria Landfill and associated waste recycling and transfer facility; (b) existing operational consents and approvals for use of the site as a waste storage and recycling facility; (c) the proposed future use of the site; (d) the closure and stabilisation of the site including details of final capping designs and future landform; (e) a groundwater monitoring bore network, to monitor the movement of groundwater within and immediately outside the cutoff wall; (f) material tracking; (g) occupational health and safety requirements; (h) community engagement processes; (i) specific measures for the management, monitoring and reporting of - (i) dust and odour, (ii) asbestos, (iii) leachate and gases, (iv) stormwater, and (j) any outstanding clean-up notices; and (k) evidence that the EPA has reviewed the Landfill Closure Management Plan and has no outstanding concerns. Where any of the above details have not been included in the final Landfill Closure Management Plan, then the Proponent must provide the details in the statement accompanying the plan required by this condition.	
D3	Soil and water management measures consistent with *Managing Urban Stormwater - Soils and Construction Vols 1 and 2, 4th Edition* (Landcom, 2004) must be employed during the construction of the SSI to minimise soil erosion and the discharge of sediment and other pollutants to land and/or waters. Where available and practicable, and of appropriate chemical and biological quality, stormwater, recycled water or other water sources must be used in preference to potable water for construction activities, including dust control.	Section 7.1 G1 And more broadly Section 7 Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035) Erosion and Sediment Control Plan Flowchart page 7, 4th box down.
D4	The Proponent must ensure any siphonic-based water management system implemented during construction is removed and, where applicable, replaced with an adequate permanent drainage system.	Section 7.1 S1
D5	The Proponent must immediately notify DPI (Water) of any groundwater bores removed or damaged during construction and operation of the SSI. In the event that a groundwater bore is removed or damaged, the Proponent must repair or replace the bore (unless otherwise advised by DPI (Water)), as applicable within a timeframe agreed to by DPI (Water).	Section 7.1 B5

Reference	Requirement	Where addressed
D6	A geotechnical model of representative geological and groundwater conditions must be prepared prior to excavation and tunnelling in subject area(s) to identify geological structures and groundwater features. This model must include details of proposed excavations and tunnels, construction staging, and identify surface and sub-surface structures and infrastructure which may be impacted by the SSI, including the specific attributes of those structures. The Proponent must use this model to assess the predicted settlement, ground movement, stress redistribution and horizontal strain profiles caused by excavation and tunnelling on adjacent property and infrastructure	Geotechnical model
D54	The Proponent must prepare and implement a Construction Contamination Management Plan to manage potential contamination impacts during construction of the SSI (excluding contamination covered by the Landfill Closure Management Plan for the Alexandria Landfill site). The Construction Contamination Management Plan must be developed in consultation with the EPA and relevant councils, and include, but not be limited to: (a) details of construction activities and their locations which have the potential to expose areas known to contain, or potentially contain, contaminated soils and/or materials; (b) details of management measures to minimise bed sediment mobilisation in Alexandra Canal. All measures must comply with the actions required of Remediation Order HO1833, 230041 Area #3151 issued by the EPA on 10 May 2004; (c) measures for the handling, treatment and management of hazardous and contaminated soils, materials and groundwater including measures to manage and/or minimise public health and safety concerns with regards to exposure to contamination; (d) an Unexpected Finds Procedure detailing procedures and management measures to be implemented in the event that contaminated material is uncovered in any area not identified in the documents referred to in conditions A2(b), A2(c) and A2(e); (e) a description of how the effectiveness of the actions and measures for managing contamination impacts would be monitored during the proposed works, clearly indicating how often this monitoring would be undertaken, the locations where monitoring would take place, and how the results of the monitoring would be recorded and reported; and (f) mechanisms for the monitoring, review and amendment of this Construction Contamination Management Plan. The Construction Contamination Management Plan must be submitted to the Secretary prior to undertaking any works which may result in the disturbance of contaminated soil, land or materials. Nothing in this condition prevents the Proponent from preparing separate Construction Contamination Management Plans for specific areas of work, rather than a plan which addresses the entire SSI.	Construction Contaminated Land Management Plan (M5N-ES-PLN-PWD-0033) (Refer compliance table within the document.)

Reference	Requirement	Where addressed
D55	Dangerous goods, as defined by the Australian Dangerous Goods Code, must be stored and handled strictly in accordance with: (a) all relevant Australian Standards; (b) for liquids, a minimum bund volume requirement of 110% of the volume of the largest single stored volume within the bund; and (c) the Environment Protection Manual for Authorised Officers: Bunding and Spill Management, technical bulletin (EPA, 1997). In the event of an inconsistency between the requirements listed from (a) to (c) above, the most stringent requirement must prevail to the extent of the inconsistency.	(a)-(c) Section 7.1 C3 And more broadly Section 7.1 C1 - C17
D67	(e) details of how environmental performance would be managed and monitored to meet acceptable outcomes, including what actions will be taken to address identified potential adverse environmental impacts (including any impacts arising from the staging of the construction of the SSI). In particular, the following environmental performance issues must be addressed in the CEMP -	CEMP (M5N-ES-PLN-PWD-0001) (Refer to CEMP Compliance Table) This Plan - Sections 1.2, 4, 5, 6, 7, 8
	ii. measures for the handling, treatment and management of hazardous and contaminated materials (including asbestos),	Soil Contamination Report Manage Acid Sulfate Soils Procedure (M5N-ES-PRC-PWD-0038) Manage Contaminated Land Procedure (M5N-ES-PRC-PWD-0036) Manage Work with Asbestos (M5N-ES-GUI-PWD-0001) Manage Hazardous Substances Procedure (M5N-ES-PRC-PWD-0041)
	iii. measures to monitor and manage waste generated during construction including but not limited to	Construction Waste and Resource Sub-Plan (M5N-ES-PLN-PWD-0008) – Section 1.2, 4, 5, 6, 7, 8 Manage Waste Procedure (M5N-ES-PRC-PWD-0044)
	general procedures for waste classification, handling, reuse, and disposal,	Construction Waste and Resource Sub-Plan (M5N-ES-PLN-PWD-0008) – Section 5 Manage Waste Procedure (M5N-ES-PRC-PWD-0044)
	use of secondary waste material in construction wherever feasible and reasonable,	Construction Waste and Resource Sub-Plan (M5N-ES-PLN-PWD-0008) – Section 5.2 Section 6 RW11, RW12

Reference	Requirement	Where addressed
	procedures or dealing with green waste including timber and mulch from clearing activities and	Construction Waste and Resource Sub-Plan (M5N-ES-PLN-PWD-0008) – Section 5.5 Section 6 RW9 Manage Waste Procedure (M5N-ES-PRC-PWD-0044)
	measures for reducing demand on water resources (including potential for reuse of treated water from sediment control basins),	This Plan Section 7.1 G9 - G11, S4, B4, and Section 7.5
	vi the sub-plans identified in condition D68.	This Plan - Sections 1.2, 4, 5, 6, 7, 8
	Nothing in this condition prevents the Proponent from preparing a Stockpile Management Protocol as part of the CEMP.	
D68	(f) a **Construction Soil and Water Management Plan** to manage surface and groundwater impacts during construction of the SSI. The Construction Soil and Water Management Plan must be developed in consultation with DPI (Water), and the relevant councils, and include, but not be limited to -	This Plan
	(i) details of construction activities and their locations, which have the potential to impact on water courses and riparian land, storage facilities, stormwater flows, and groundwater, including identification of all pollutants that may be introduced into the water cycle,	Section 6
	(ii) processes to ensure that Water Quality Pond No.2 at Arncliffe is not decommissioned until replacement water quality devices are operational,	Note this is located in Kingsgrove. Section 7.7
	(iii) potential impacts on watercourse bank stability and the development of appropriate mitigation measures as required,	Section 5.7, 6 and 7.1 G2, D2, W1, W3, W4, A1, A2, A5, A6, V3, F4
	(iv) measures to manage and/or minimise sediment and erosion, groundwater impacts and surface water quality impacts (including stormwater runoff and groundwater treatment),	Section 7 Water Quality Plan and Monitoring Program (M5N-ES-PLN-PWD-0027) – Section 7 Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)
	(v) where acid sulfate soils are known to occur or potentially occur, an **Acid Sulfate Soils Management Plan**, including measures for the management, handling, treatment and disposal of acid sulfate soils, including monitoring of water quality at acid sulfate soils treatment areas, should the project impact on acid sulfate soils,	Section 5.3, 7.1 P9, X2 Appendix A: Acid Sulfate Soils Sub-Plan (M5N-ES-PLN-PWD-00031) Manage Acid Sulfate Soils Procedure (M5N-ES-PRC-PWD-0038)
	(vi) a description of how the effectiveness of the actions and measures for managing soil and water impacts would be monitored during the proposed works, clearly indicating how often this monitoring would be undertaken, the locations where monitoring would take place, how the results of the monitoring would be recorded and reported, and, if any	Water Quality Plan and Monitoring Program (M5N-ES-PLN-PWD-0027) – Section 6 – 8

Reference	Requirement	Where addressed
	exceedance of the criteria is detected how any non-compliance can be rectified, and	Section 7.1 E6, I1, F2 Section 7.6, 8 and 9
	(vii) mechanisms for the monitoring, review and amendment of this Construction Soil and Water Management Plan.	Section 10

2.3 Revised Environmental Management Measures

The revised environmental mitigation measures (REMMs) included in the Submissions Report relating to the management of soil and water quality are included in Table 4.

Table 4: Revised environmental mitigation measures from New M5 Submissions Report relevant to the management of soil and water quality

Reference	Requirement	Where addressed
Water quality		
REMM SW01.	The control and mitigation of potential surface water quality impacts during construction would be defined in a Soil and Water Management Plan prepared as part of the overall CEMP.	This Plan
REMM SW02.	The Soil and Water Management Plan would be developed to incorporate 'best practice' controls and measures in accordance with The Blue Book. The Plan would be continually updated to suit the changing needs as the Project works progress. The Plan would be developed in consultation with the Environment Protection Authority and DPI - Water and document the types of measures that would be put in place to minimise the risk of soil erosion or polluted discharges reaching the receiving environments.	This Plan
REMM SW03.	An Erosion and Sedimentation Management Plan would be prepared as outlined in Erosion and Sedimentation Risk Assessment Procedure (RTA, 2004).	This Plan
REMM SW04.	The Soil and Water Management Plan would include:	
	• Construction traffic restricted to access tracks, fenced before the start of construction and maintained until construction complete;	Section 7.1 E1 to E7 Construction Area Work Plans
	• Appropriate sediment and erosion controls to be implemented prior to soil disturbance ;	Section 7.1 A1 - A6
	• Stormwater management to avoid flow over exposed soils which may result in erosion and impacts to water quality;	Section 7.1 G3, S1, D1, D2, R1 - R3
	• Stockpiles located outside the 20 year ARI flood extent where feasible. Otherwise, appropriate management control measures such as bunding would be implemented;	Section 7.1 P1
	• Staging of surface works to minimise area of exposed surfaces, with re-vegetation and / or stabilisation of disturbed areas to occur as soon as feasible;	Section 7.1 W1 - W4, A1 - A6, V1 - V7 Construction Management Plan (M5N-CN-PLN-PWD-0001)

Reference	Requirement	Where addressed
	• Site compounds sealed or hard stand to minimise erosion where possible;	Section 7.1 E3
	• Wheel wash or rumble grid systems installed at exit points to minimise dirt on roads;	Section 7.1 E2
	• A soil conservation specialist would be contracted to supervise construction in high risk areas in accordance with the Erosion and Sedimentation Management Procedure (RTA, 2008c);	Section 7.1 T2
	• All water generated during construction would be captured, tested (and treated if required) prior to reuse or discharge under a site specific arrangement, depending on the quality of water generated. This would target compliance with the Water Quality Reference Criteria. At the St Peters interchange site this would include transfer of some water to the leachate treatment Plant as outlined below. Varying levels of groundwater quality would also require a variation to treatment approaches;	Section 7.1 S4, B1,B2, B4, AL1 Water Quality Plan and Monitoring Program (M5N-ES-PLN-PWD-0027)
	• Contaminated sediments and potential acid sulfate soils would be segregated and disposed of (with or without prior treatment) at a licensed facility or treated onsite; and	Section 3.1, Section 7.1 X1, X2 Construction Contaminated Land Management Plan (M5N-ES-PLN-PWD-0033) Acid Sulfate Soils Sub-Plan(M5N-ES-PLN-PWD-00031)
	• Stockpiles would be located outside of riparian corridors.	Section 7.1 P1
REMM SW05.	The water quality and outflow velocities of the water treatment Plants at the following compounds would be in accordance with the Project's Water Quality Reference Criteria and the Project's Environment Protection Licence: Kingsgrove North construction compound (C1), Commercial Road construction compound (C3), Bexley Road South construction compound (C5), Arncliffe construction compound (C7), Canal Road construction compound (C8).	Section 2.4, 8 Water Quality Plan and Monitoring Program (M5N-ES-PLN-PWD-0027)
REMM SW06.	The Project specific water quality monitoring program would continue to collect to at least 12 months of data or to the commencement of construction (whichever is sooner) to represent pre-construction conditions for the Project. Monitoring would continue during construction of the Project as identified in Appendix A of the Technical working paper: Surface water (Appendix N). The details of this monitoring program would be contained in the Soil and Water Management Plan, and would include the following: • Sampling locations to include upstream (control) and downstream measurement locations; and • Samples taken twice a month, once in dry conditions and once in wet conditions where possible. In-situ monitoring of: • pH; • Reduction Oxidation Potential; • Dissolved Oxygen; • Temperature; • Conductivity; • Turbidity;	Water Quality Plan and Monitoring Program (M5N-ES-PLN-PWD-0027)

Reference	Requirement	Where addressed
	• Colour; and • Odour. Analytical sampling of the following potential constituents of concern: • Total Recoverable Hydrocarbons; • Benzene, Toluene, Ethylbenzene, Xylene and Naphthalene; • Nutrients including: Total Nitrogen, Total Kjeldahl Nitrogen, Nitrogen Oxide, Nitrite, Nitrate; Total Phosphorous and Reactive Phosphorous; • Heavy metals (Arsenic, Cadmium, Copper, Chromium, Lead, Mercury, Nickel, Zinc); • Manganese; and • Ferrous Iron and Total Iron.	
REMM SW07.	Water quality monitoring of the breeding ponds for Green and Golden Bell Frog near Marsh Street, Arncliffe would occur during construction by a suitably qualified scientist as part of the Green and Golden Bell Frog Plan of Management.	Green and Golden Bell Frog Plan of Management – Arncliffe
Water reuse		
REMM SW08.	Opportunities for reuse of treated water generated at the Arncliffe motorway operations complex would be considered during detailed design.	Sustainability Plan (M5N-ES-PLN-PWD-0020) Sustainability Initiatives Register and appraisal procedure
Acid Sulfate Soils		
REMM SW09.	An Acid Sulfate Soil Management Plan would be prepared as a sub-Plan to the Construction Environment Management Plan to outline the requirements for the management of potential acid sulfate soils.	Appendix A: Acid Sulfate Soils Sub-Plan (M5N-ES-PLN-PWD-00031) Manage Acid Sulfate Soils Procedure (M5N-ES-PRC-PWD-0038)
REMM SW10.	Further contamination investigation would be conducted in areas with medium or high acid sulfate soils potential during the detailed design stage as part of early works. Management of acid sulphate soils during the Project would be undertaken as per the management measures outlined in Section 17.4. of the EIS	Sections 5.3, 7.1 X1, X2 Soil Contamination Report Construction Contaminated Land Management Plan (M5N-ES-PLN-PWD-0033) Acid Sulfate Soils Sub-Plan (M5N-ES-PLN-PWD-00031) Manage Acid Sulfate Soils Procedure (M5N-ES-PRC-PWD-0038) Manage Contaminated Land Procedure (M5N-ES-PRC-PWD-0036)
Contamination		
REMM SW11.	During landfill closure activities, surface water management measures would be implemented in accordance with The Blue Book to isolate and capture potentially contaminated water. Any such water would be transferred to the leachate treatment Plant for treatment prior to discharge to sewer under a trade waste agreement with Sydney Water.	St Peters Interchange - Landfill Closure Management Plan (M5N-GOL-TER-900-116-0012)

Reference	Requirement	Where addressed
Contaminated runoff and spills		
REMM SW12.	The following measures would be in place to manage spills of contaminated fluids: • Areas would be allocated for the storage of fuels, chemicals and other hazardous materials; • Facilities would be secured and bunded to levels dictated by Environment Protection Authority guidelines; • Spills or contaminated runoff would be captured and disposed of at a licensed facility; • With the exception of Arncliffe construction compound, Re-fuelling would occur in bunded areas or in areas beyond 40 metres from waterways. Where refuelling occurs outside bunded areas, specific refuelling procedures would be in place and operators would be trained in these procedures. Spill kits would be readily available to manage re-fuelling outside bunded areas. At Arncliffe construction compound, a bunded area would be provided where all refuelling would occur. • Wash down and preparation of construction materials would be undertaken in bunded areas to mitigate risks in relation to spills or leaks of fuels / oils or other hazardous onsite construction material; • The application of good practice in the storage and handling of dangerous and hazardous goods would provide appropriate practical responses to manage impacts on occupational health and safety and minimise the risk of a spill occurring; • Potential discharges from construction sites would be managed through the installation of basins (primarily designed for sediment capture but with capacity to contain the nominated spill volume) constructed in accordance with The Blue Book; • Captured contaminants resulting from spills or leaks would be treated and disposed of at a licensed facility; and • Any soil which has been contaminated with fuel, oils or other chemicals would be disposed as contaminated soil by a waste subcontractor.	Section 7.1 T1, C1-C17 Ancillary Facilities Management Plan (M5N-ES-PLN-PWD-0026) Construction Waste and Resource Sub-Plan (M5N-ES-PLN-PWD-0008)
Geomorphology		
REMM SW13.	Construction work activities within and / or adjacent to waterways would be minimised as much as feasibly possible to minimise disturbance to those waterways and waterfront land.	Section 7.1 A5
REMM SW14.	Alignment of drainage and discharge outlet infrastructure would direct flows downstream to minimise alterations and erosion of the channel beds and banks.	Design Plan (M5N-DS-PLN-PWD-0001)
REMM SW15.	Drainage and discharge outlet infrastructure would include energy dissipation and erosion scour protection as appropriate.	Section 7.1 D2 Design Plan (M5N-DS-PLN-PWD-0001)
REMM SW16.	Disturbed floodplain environments adjacent to watercourses (including waterfront land) and / or along overland drainage lines would be stabilised and vegetation managed in accordance with the Guidelines for Controlled Activities on Waterfront Land (DPI, 2012a).	Section 7.1 G2, W1-W4, V1, V2, V3
Contamination		

Reference	Requirement	Where addressed
REMM CM03.	Potentially contaminated areas directly affected by the Project would be investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the CLM Act. This includes further investigations in areas of potential contamination identified in the construction footprint.	Sections 5.4, 7.1 X1, X2 Soil Contamination Report Construction Contaminated Land Management Plan (M5N-ES-PLN-PWD-0033) Manage Contaminated Land Procedure (M5N-ES-PRC-PWD-0036)
REMM CM04.	An unexpected finds and hazardous materials procedure would be implemented to manage any potentially contaminated materials that may be encountered during site preparation and / or construction works.	Manage Contaminated Land Procedure (M5N-ES-PRC-PWD-0036)
REMM CM05.	Waste management plans, as part of the CEMP, would include procedures for handling and storing potentially contaminated spoil and, should off-site disposal be required, undertaking waste assessment and classification for off-site disposal to appropriately licenced waste facilities. See Chapter 24 (Resource use and waste minimisation) of the EIS for more information.	Construction Waste and Resource Sub-Plan (M5N-ES-PLN-PWD-0008) Manage Waste Procedure (M5N-ES-PRC-PWD-0044) Manage Contaminated Land Procedure (M5N-ES-PRC-PWD-0036) Spoil Management Plan (M5N-PM-PLN-PWD-0002)
REMM CM06.	Site specific asbestos management plans will be developed where relevant. Refer to Chapter 24 (Resource use and waste minimisation) of the EIS for further information on asbestos management.	Manage Work with Asbestos (M5N-ES-GUI-PWD-0001)
REMM CM07.	A hazardous materials assessments would be carried out prior to and during the demolition of buildings. Demolition works would be undertaken in accordance with the relevant Australian Standards and relevant NSW WorkCover Codes of Practice, including under the *Work Health and Safety Regulation 2011*.	Project WHS Management Plan (M5N-HS-PLN-PWD-0001) Manage Work with Asbestos (M5N-ES-GUI-PWD-0001)
REMM CM08.	A dangerous goods search of the SafeWork NSW records for licenced dangerous good would be undertaken prior to construction.	Construction Contaminated Land Management Plan (M5N-ES-PLN-PWD-0033)
REMM CM09.	An explosive ordnance due diligence assessment would be completed at the identified former ammunition site (Project area 3), located between Flatrock Road, Bexley Road and Wolli Creek.	Construction Contaminated Land Management Plan (M5N-ES-PLN-PWD-0033)
REMM CM10.	In the event of encountering unexpected finds of contamination (i.e. the observation of offensive odours, soil discoloration, buried waste or potential asbestos containing materials) during construction, work in the area would cease until an appropriately qualified environmental consultant can advise on the need for further assessment, remediation or other action, as deemed appropriate. Further assessment and management of contamination, if required, would be undertaken in accordance with the requirements of guidance endorsed under section 105 of the CLM Act.	Manage Contaminated Land Procedure (M5N-ES-PRC-PWD-0036)

Reference	Requirement	Where addressed
REMM CM11.	Appropriate mitigation measures to minimise sediment mobilisation as a result of construction activities at the location of the new stormwater infrastructure at Alexandra Canal would be detailed in the CEMP in accordance with the requirements of the Remediation Order in consultation with NSW EPA and Sydney Water. Measures would be detailed in a Alexandra Canal Contamination Management Plan.	Section 3.1 Construction Contaminated Land Management Plan (M5N-ES-PLN-PWD-0033)
REMM CM12.	Appropriate mitigation measures including stockpiling and management of potentially contaminated material would be undertaken at construction compounds to prevent movement of material into receiving waters.	Remediation Action Plans
REMM CM13.	Plant, equipment and supplies would be managed to prevent spills and leaks. See Chapter 26 (Hazard and risk) of the EIS for more information.	Section 7 C1 - C17 Manage Hazardous Substances Procedure (M5N-ES-PRC-PWD-0041)
REMM CM14.	Tunnel washing water and waste would be appropriately contained, treated and disposed of. Refer to Chapter 24 (Resource use and waste minimisation) of the EIS for more information	Section 7 B1 - B4 Construction Waste and Resource Sub-Plan (M5N-ES-PLN-PWD-0008)
REMM CM15.	Further in situ testing of soils in areas of known potential contamination to determine waste classification.	Construction Contaminated Land Management Plan (M5N-ES-PLN-PWD-0033) Construction Waste and Resource Sub-Plan (M5N-ES-PLN-PWD-0008)
Flooding and drainage		
REMM FD13.	Detailed flood modelling to understand the effects of likely rainfall events would be undertaken. Construction layouts would be finalised accordingly.	Design Flood Report
REMM FD14.	Tunnel dive shafts would be protected against flooding either through locating openings outside of flood prone areas or constructing temporary bunding and / or appropriate temporary drainage. Stockpiles would be located outside the 20 year ARI flood extent where possible. Where construction compounds are located in the 20 year ARI flood extent, a contingency Plan to manage flooding would be prepared and implemented.	Section 7.1 F1 - F3, F5 - F8 Design Flood Report

Reference	Requirement	Where addressed
REMM FD15.	Further detailed assessment of flooding impacts for proposed construction compounds and relevant management measures would be undertaken during detailed design. Contingency Plans to manage flooding would be prepared and implemented for high risk temporary facilities proposed including fuel storages, water treatment Plants and substations, as well as for the following construction compounds (located either wholly or partially within the 20 year ARI flood extent): • Kingsgrove South construction compound (C2); • Commercial Road construction compound (C3); • Bexley Road North construction compound (C4); • Bexley Road South construction compound (C5); • Arncliffe construction compound (C7); • Alexandra Canal bridge construction compound (C12); and • Gardeners Road bridge construction compound (C13). For these sites, suitable procedures for flood warning, emergency management, site evacuation and Planning would be developed.	Design Flood Report Risk Management Plan (M5N-RM-PLN-PWD-0001) Incident Response Plan (M5N-HS-PLN-PWD-0002) Construction Management Plan (M5N-CN-PLN-PWD-0001)
REMM FD16.	The following measures would be implemented to manage flooding risks on construction sites: • Temporary bunding around parts of the site that would be adversely affected by floodwaters; • Temporary drains / detention areas within the site; • Use of car parks to provide detention; • Elevation of site buildings where necessary to get floor levels above expected flood levels; and • Use of erosion and sediment fences around noise barriers to provide bunding to some parts of the sites while directing overland flows through less sensitive parts of sites, particularly at Kingsgrove and Arncliffe.	Section 7.1 F1 - F8 Temporary Facility Design Reports and Drawings Erosion and Sediment Control Plans
Groundwater		
REMM GW01.	An Acid Sulfate Soil Management Plan (ASSMP) would be prepared including the measures and monitoring to be undertaken where potential acid sulfate soils are expected. The Plan would outline the type of treatment required for acid sulfate soils, bunding and requirement for treatment ponds.	Appendix A: Acid Sulfate Soils Sub-Plan (M5N-ES-PLN-PWD-00031) Manage Acid Sulfate Soils Procedure (M5N-ES-PRC-PWD-0038)
REMM GW02.	A groundwater and soil salinity report would be prepared prior to the commencement of earthworks to assess the potential impacts to the local hydrogeological regime.	Groundwater and Soil Salinity Report
REMM GW03.	Contingency measures to address leachate management at the Alexandria Landfill during construction and prior to the commissioning of the new leachate treatment plant would be explored during detailed design. Identified measures would be detailed in the CEMP and implemented during construction.	Leachate Treatment Plant Design Report
REMM GW04.	The tunnel construction program would be constructed in accordance with an overarching CEMP for the Project which would include measures to manage contaminated groundwater issues. This may include removal of the source of the contamination by excavation and remediation of shallow impacted soils or engineering a solution to prevent the migration of contaminated groundwater into the tunnels.	Construction Management Plan (M5N-CN-PLN-PWD-0001)

Reference	Requirement	Where addressed
REMM GW05.	Intersected shallow contaminated groundwater would be directed to the construction water treatment plant prior to discharge. Elsewhere, collection and treatment options would be considered and releases made under relevant discharge criteria.	Section 7.1 B2 Construction Management Plan (M5N-CN-PLN-PWD-0001) Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)
REMM GW06.	The intersection of shallow groundwater at the Arncliffe construction compound (C7) would be managed under CEMP(s) for the Project. In the event that contaminated groundwater is intersected, the approach would be to either remove the source of the contamination by excavation and remediation of shallow impacted soils or engineering a solution to prevent the migration of contaminated groundwater into the Project tunnels.	Design Plan (M5N-DS-PLN-PWD-0001) Construction Management Plan (M5N-CN-PLN-PWD-0001)
REMM GW07.	Treated waste water would be stored and re-used for Project purposes wherever possible. Groundwater reuse would be in accordance with the policies of sustainable water use of the NSW Office of Water, such as dust suppression and earthworks.	Section 7.1 G11, B4 Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)
REMM GW08.	Where saturated faults and fractures are intersected additional rock support would be installed in order to ensure tunnel stability. Appropriate waterproofing measure to reduce the inflow to an acceptable quantity will be applied as required. Measures can range from a spray- on membrane to grouting or installation of a sheet membrane.	Design Plan (M5N-DS-PLN-PWD-0001) Construction Management Plan (M5N-CN-PLN-PWD-0001)
REMM GW09.	Where higher than expected inflows are experienced as beneath the Cooks River and under other major surface water features, appropriate waterproofing measure to permanently reduce the inflow to an acceptable quantity will be applied as required. Measures can range from a spray- on membrane to grouting or installation of a sheet membrane depending on the inflow volume.	Design Plan (M5N-DS-PLN-PWD-0001) Construction Management Plan (M5N-CN-PLN-PWD-0001)
REMM GW10.	Building materials that are resistant to aggressive groundwater conditions would be selected.	Design Plan (M5N-DS-PLN-PWD-0001) Design reports
REMM GW11.	The Project works would be undertaken in accordance with a CEMP(s) for the Project which would include the following management measures:	
	• Stockpiles of fuels, hazardous liquids and chemicals would be stored in an impervious bunded area in accordance with Australian Standards and EPA guidelines;	Section 7.1 C1 - C3
	• The storage of fuels and chemicals would be limited to locations more than 40 metres from any water course;	Section 7.1 C16
	• With the exception of Arncliffe construction compound, re-fuelling would occur in bunded areas or in areas beyond 40 metres from waterways. Where refuelling occurs outside bunded areas, specific refuelling procedures would be in place and operators would be trained in these procedures. Spill kits would be readily available to manage re-fuelling outside bunded areas. At Arncliffe construction compound, a bunded area would be provided where all refuelling would occur.	Section 7.1 T1, C7 - C12

Reference	Requirement	Where addressed
	• Vehicles would be properly maintained to minimise the risk of fuel/oil leaks and routine inspections of construction equipment would be undertaken to identify any fuel/oil leaks;	Section 7.1 C17
	• Emergency spill kits would be kept onsite and Project personnel would be aware of the location of spill kits and trained in their use;	Section 7.1 T1, C9 and C10
	• Hazardous materials handling procedures would be documented and implemented;	Section 7.1 C5
	• In the event of an incident resulting in impacts to human health, workplace safety or the environment, works would cease immediately and the EPA would be notified (if required); and	Section 7.1 C11
	• Erosion and sediment control measures would be regularly inspected, particularly following rainfall events. The controls would remain in place until construction works are completed and areas are stabilised.	Section 7.1 G1-G5, S3, I1 - I3, V6 Section 8
REMM GW12.	A tunnelling procedure that details a methodology to determine when and what type of waterproofing is required to be installed during construction would be implemented during construction. Pre-excavation pressure grouting may also be used in locations identified that could produce substantial inflows to reduce groundwater inflows to an acceptable level. Post grouting may also be required to further reduce groundwater inflows.	Tunnelling Wide Waterproofing Details - Design
REMM GW13.	A groundwater monitoring program would be prepared and implemented to monitor groundwater impacts during construction. This would include the monitoring of groundwater inflow into the tunnels. The program would be developed in consultation with the EPA, DPI (Fisheries), NSW DPI Water and relevant councils.	Water Quality Plan and Monitoring Program (M5N-ES-PLN-PWD-0025)
REMM GW14.	Where the Project alignment passes close to watercourses and inflows are elevated, appropriate waterproofing measures to permanently reduce the inflow to an acceptable quantity would be applied as required.	Design Plan (M5N-DS-PLN-PWD-0001)
REMM GW15.	In the event that the drawdown in a licensed water supply bore or irrigation bore exceeds two metres (in accordance with the Aquifer Interference Policy) or that impacts to groundwater quality after the beneficial use of the water, measures would be taken to 'make good' the impact by restoring the water supply to pre-development levels. The measures taken would be dependent upon the location of the impacted bore and would be determined in consultation with the affected licence holder but could include, deepening the bore, providing a new bore or providing an alternative water supply.	Water Quality Plan and Monitoring Program (M5N-ES-PLN-PWD-0025)
Ground settlement		
REMM GW16.	A Settlement Monitoring Plan would be prepared that would provide details on: • Location of monitoring points; • Duration of monitoring; • Data collection and review; • Roles and responsibilities for review of data; and • Triggers and actions for corrective actions.	Instrumentation and Monitoring Plan (M5N-GOL-DRT-100-200-GT-1530)

Reference	Requirement	Where addressed
REMM GW17.	Building conditions surveys would be undertaken in the zone of influence of the tunnel settlement where the settlement is expected to have a potential impact. In the unlikely event that any damage occurs to a property, appropriate rectifications would be carried out.	Instrumentation and Monitoring Plan (M5N-GOL-DRT-100-200-GT-1530)
REMM GW18.	Services in locations where differential/ angular settlement is anticipated would be identified. A monitoring Plan, triggers and actions would be agreed with the relevant utility owner prior to potential impacts occurring.	Instrumentation and Monitoring Plan (M5N-GOL-DRT-100-200-GT-1530)
REMM GW19.	A monitoring program, undertaken as part of the Settlement Management Plan, would be carried out prior to excavation until all relevant settlement has stabilised. Monitoring would be for a period of not less than six months after settlement has stabilised.	Instrumentation and Monitoring Plan (M5N-GOL-DRT-100-200-GT-1530)
Air Quality		
REMM AQ17.	Stockpiles would be located outside overland flow paths, and where left exposed and undisturbed for longer than 28 days, would be finished and contoured to minimise loss of material in flood or rainfall events. Materials which require stockpiling for longer than 28 days would be stabilised by compaction, covering with anchored fabrics, or seeded with sterile grass where appropriate.	Section 7.1 P4
Biodiversity		
REMM B11.	Measures to mitigate potential water quality impacts during construction are outlined in Section 16.4 and Section 18.4 of the EIS	Section 2.3 REMM SW01 - REMM SW16 Flood Mitigation Strategy Design Flood Report Design Drainage Report
REMM B12.	Works within or near aquatic habitats and riparian areas will be managed in accordance with *Roads and Maritime's Guide 10 – Aquatic habitats and riparian zones* and *Guidelines for Controlled Activities on Waterfront Land (DPI, 2012a).*	Section 5.7 Section 7.1 G2, W1-W4, A1-A6, V1, V2, V3 P1
REMM B13.	Works within aquatic habitats or riparian zones would be undertaken to limit impacts on aquatic flora and fauna, and their habitats, and impacts on riparian areas. This would be undertaken in accordance *with Guide 10 of the Biodiversity Guidelines* and *Guidelines for Controlled Activities on Waterfront Land (DPI, 2012a).*	Section 5.7 Section 7.1 G2, W1-W4, A1-A6, V1, V2, V3, P1
REMM B14.	Where possible, construction activities would minimise disturbance to waterways and riparian land	Section 7.1 A5
REMM B15.	Stockpiles would be located outside riparian corridors.	Section 7.1 W1, P1
Hazards and Risks		
REMM HR02.	Storage of dangerous goods and hazardous materials would occur in accordance with suppliers' instructions and relevant Australian Standards and may include bulk storage tanks, chemical storage cabinets / containers or impervious bunds.	Section 7.1 C1, C3

Reference	Requirement	Where addressed
REMM HR03.	Storage, handling and use of dangerous goods and hazardous substances would be in accordance with the *Work Health and Safety Act 2011* and the Storage and Handling of Dangerous Goods Code of Practice (WorkCover NSW, 2005).	Section 7.1 C1 - C3, C14
REMM HR04.	Secure, bunded areas would be provided around storage areas for oils, fuels and other hazardous liquids.	Section 7.1 C3
REMM HR05.	Bunds would be provided around activities such as vehicle refuelling, servicing, maintenance or wash-down, where there is a potential for spills and contamination.	Section 7.1 C12
REMM HR06.	Material Safety Data Sheets would be obtained for dangerous goods and hazardous substances stored onsite prior to their arrival.	Section 7.1 C13
REMM HR07.	Transport of dangerous goods and hazardous substances would be conducted in accordance with relevant legislation and codes including the Dangerous Goods (Road and Rail Transport) Regulation 2014 and the Australian Code for the Transport of Dangerous Goods by Road and Rail (National Transport Commission, 2008).	Section 7.1 C15
Management of waste		
REMM WM11.	Asbestos handling and management would be undertaken in accordance with the Asbestos Management Plan and relevant legislation, policies and standards: • *Work Health and Safety Act 2011;* • Code of Practice for the Safe Removal of Asbestos 2nd Edition (NOHSC, 2005a); • Code of Practice for the Management and Control of Asbestos in Workplaces (NOHSC, 2005b); • *Protection of the Environment Operations (Waste) Regulation 2014 – Part 7 Transportation and management of asbestos waste*; and • AS2601:1991 Demolition of Structures.	Demolition Plan Manage Work with Asbestos (M5N-ES-GUI-PWD-0001) Manage Contaminated Land Procedure (M5N-ES-PRC-PWD-0036)
REMM WM12.	Measures would be implemented to manage stockpiles such as potentially locating stockpiles outside of overland flowpaths, riparian corridors and finished and contoured so as to minimise loss of material in flood or rainfall events. Stockpiles left exposed and undisturbed for longer than 28 days would be stabilised by compaction then either sprayed with suitable tackifier, covered with anchored fabrics, or seeded with sterile grass.	Section 7.1 P1, P4
Wastewater		
REMM WM16.	Feasible and reasonable opportunities for wastewater reuse on-site or for construction purposes would be pursued (such as dust suppression both in the tunnels and for surface works).	Section 7.1 G11, S4, B4
REMM WM17.	Wastewater not used on-site would be discharged into the local stormwater system in accordance with the requirements of an environment protection licence issued for the Project.	Sections 2.4, 8 Section 7.1 S4, B4 Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)

Reference	Requirement	Where addressed
REMM WM18.	An Unexpected Finds Protocol would be implemented in the event of encountering previously unidentified area(s) or types of contaminated material. Where this happens, all relevant work would cease in the vicinity of the discovery in accordance with a unsuitable spoil management contingency procedure which would be included as part of the Spoil Management Strategy for the Project. Relevant works would not recommence until the need for and scope of remedial action(s), if required, is identified in accordance with the requirements of the *Contaminated Land Management Act 1997*.	Section 7.1 X1 Manage Contaminated Land Procedure (M5N-ES-PRC-PWD-0036)

2.4 EPL Conditions

The Project's construction activities will be regulated by Environment Protection Licences (EPL No. 20772 and EPL No. 4627) issued by the NSW Environment Protection Authority (EPA). EPL No. 20772 is for road construction of the project generally and EPL No. 4627 is for road construction works at the St Peters Interchange site. Conditions relevant to Soil and Water management, including discharge are the same for both licences, however references are differ slightly. Therefore, the relevant condition references for the primary licence EPL No. 20772 are provided in Table 5. The relevant additional condition references of EPL No. 4627 are included in Table 5.

Table 5: EPL conditions relevant to the management of soils and water quality

<table>
<tr><th>Reference</th><th>Requirement</th><th>Where addressed</th></tr>
<tr><td colspan="3">EPL 20772</td></tr>
<tr><td>P1</td><td colspan="2">Location of monitoring/discharge points and areas</td></tr>
<tr><td>P1.1</td><td>The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.</td><td>Refer to Temporary Sediment Basin and Construction Water Treatment Plants Discharge Point Schedule</td></tr>
<tr><td>P1.2</td><td>The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.
<table>
<tr><th colspan="4">Water and land</th></tr>
<tr><th>EPA identification no</th><th>Type of Monitoring point</th><th>Type of Discharge point</th><th>Location description</th></tr>
<tr><td>1</td><td>Surface Water discharge</td><td>Surface Water discharge</td><td>the outlet to sediment basins capturing surface water only, referred to in condition P1.3</td></tr>
<tr><td>2</td><td></td><td>Construction Water Treatment Discharge</td><td>the discharge of construction water associated with tunnelling works during construction at the Kingsgrove North, Commercial Road, Bexley Road North, Arncliffe, Canal Road sites</td></tr>
</table></td><td>Refer to Temporary Sediment Basin and Construction Water Treatment Plants Discharge Point Schedule</td></tr>
<tr><td>P1.3</td><td>The discharge point referred to in condition P1.2 are active water discharge points from sediment basins and Construction Water Treatment Plants identified in the spreadsheet titled Temporary Sediment Basin and Construction Water Treatment Plants Discharge Point Schedule and maintained on electronic file EF16/3654.</td><td>Refer to Temporary Sediment Basin and Construction Water Treatment Plants Discharge Point Schedule</td></tr>
<tr><td>P1.4</td><td>The licensee must notify the EPA in writing, at least 48 hours prior to a basin or water treatment plant discharge point becoming active or inactive. The notification must include an updated Temporary Sediment Basin and Construction Water Treatment Plant Discharge Point Schedule. (Sediment basins are only considered active whilst accepting water directly from active construction areas).</td><td>Refer to Temporary Sediment Basin and Construction Water Treatment Plants</td></tr>
</table>

<table>
<tr><th>Reference</th><th>Requirement</th><th>Where addressed</th></tr>
<tr><td></td><td></td><td>Discharge Point Schedule</td></tr>
<tr><td>L1</td><td colspan="2">Pollution of waters</td></tr>
<tr><td>L1.1</td><td>Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.</td><td>Project CEMP including this Plan</td></tr>
<tr><td>L2</td><td colspan="2">Concentration limits</td></tr>
<tr><td>L2.1</td><td>For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.</td><td>Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)</td></tr>
<tr><td>L2.2</td><td>Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.</td><td>Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)</td></tr>
<tr><td>L2.3</td><td>To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.</td><td>Noted</td></tr>
<tr><td>L2.4</td><td>Water and/or Land Concentration Limits
<table>
<tr><th colspan="6">Point 1</th></tr>
<tr><th>Pollutant</th><th>Units of measure</th><th>50 percentile concentration limit</th><th>90 Percentile concentration limit</th><th>3DGM concentration limit</th><th>100 percentile concentration limit</th></tr>
<tr><td>Oil and grease</td><td>Visible</td><td></td><td></td><td></td><td>Not visible</td></tr>
<tr><td>pH</td><td>pH</td><td></td><td></td><td></td><td>6.5-8.5</td></tr>
<tr><td>Total suspended solids</td><td>milligrams per litre</td><td></td><td></td><td></td><td>50</td></tr>
</table>
<table>
<tr><th colspan="6">Point 2</th></tr>
<tr><th>Pollutant</th><th>Units of measure</th><th>50 percentile concentration limit</th><th>90 Percentile concentration limit</th><th>3DGM concentration limit</th><th>100 percentile concentration limit</th></tr>
<tr><td>pH</td><td>pH</td><td></td><td></td><td></td><td>6.5-8.5</td></tr>
<tr><td>Total suspended solids</td><td>milligrams per litre</td><td></td><td></td><td></td><td>50</td></tr>
</table></td><td>Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)</td></tr>
<tr><td>L2.5</td><td>Exceeding the limits specified in the previous condition of this licence for pH and total suspended solids (TSS) for discharges from the sediment basins, referred to as EPA identification no. 1, identified by Conditions P1.1 and P1.2 is only permitted when the discharge occurs solely as a result of rainfall measured at the premises. The rainfall must exceed rainfall depth value for the corresponding discharge point as described in condition P1.3</td><td>Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)</td></tr>
</table>

Reference	Requirement	Where addressed
L2.6	If the licensee uses turbidity (NTU) in place of TSS to determine compliance with Condition L2.4, the licensee must develop a statistical correlation which identifies the relationship between NTU and TSS for water quality in the sediment basin/s in order to determine the NTU equivalent of 50 mg/L TSS before its use.	Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)
L2.7	The EPA may make a written request for a copy of the statistical correlation assessment and methodology to determine compliance with condition L2.4 if required.	Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)
O4	**Processes and management**	
O4.1	The licensee must maximise the diversion of run-on waters from lands upslope and around the site whilst land disturbance activities are being undertaken.	This Plan Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)
O4.2	The drainage from all areas that will mobilise suspended solids when stormwater runs over these areas must be controlled and diverted through appropriate erosion and sediment control measures.	This Plan Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)
O4.3	The licensee must minimise the area of the site that is able to generate suspended material when water runs over it.	This Plan Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)
O4.4	Erosion and sediment controls must be designed (stability, location, type and size), constructed, operated and maintained in accordance with the guideline "Managing Urban Stormwater – Soils and Construction, Volume 2D, Main road construction" DECC 2008, to be read and used in conjunction with volume 1 "Managing urban stormwater: soils and construction" Landcom 2004.	This Plan Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)
O4.5	The licensee must ensure the design storage capacity of any sediment basin installed on the premises is reinstated within 5 days of the cessation of a rainfall event that causes runoff to occur on or from the premises.	Section 7.1 S2, 7.2, 7.5 Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)
O4.6	The licensee must ensure that sampling point(s) for water discharged from the sediment basin(s) are provided and maintained in an appropriate condition to permit: a) a the clear identification of each sediment basin and discharge point; b) the collection of representative samples of the water discharged from the sediment basin(s); and	Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)

Reference	Requirement	Where addressed
	c) access to the sampling point(s) at all times by an authorised officer of the EPA.	
O4.7	The licensee must endeavour to maximise the reuse of captured stormwater on the premises.	This Plan Construction Air Quality Sub-Plan (M5N-ES-PLN-PWD-0002) Water Reuse Strategy – To be submitted to the Secretary for approval prior to commencement of tunnelling works
O4.8	Where sediment basins are necessary, all sediment basins and associated drainage must be installed and commissioned prior to the commencement of any clearing or grubbing works within the catchment area of the sediment basin that may cause sediment to leave the site. *Note: This condition does not apply to those works associated with the actual installation of sediment basins or associated drainage.*	Section 7.1 G1, G3, G6, T2, R3 Section 7.2, 8
O4.9	The licensee must inspect the operation of all erosion and sediment controls installed on the premises and undertake any works required to repair and/or maintain these controls: a) at least weekly during normal construction hours outlined in condition L4.1; b) daily during periods of rainfall that causes runoff to occur ; and c) prior to any site closure of greater than 24 hours.	Section 7.1 G5, R1 - R3, I1, Section 8
O4.10	The licensee must record all such inspections, including observations and works undertaken to repair and/or maintain soil and water management works.	Section 7.1 G5, I1, Section 8
M1	**Monitoring records**	
M1.1	The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.	Section 8
M1.2	All records required to be kept by this licence must be: a) in a legible form, or in a form that can readily be reduced to a legible form; b) kept for at least 4 years after the monitoring or event to which they relate took place; and c) produced in a legible form to any authorised officer of the EPA who asks to see them.	Section 8
M1.3	The following records must be kept in respect of any samples required to be collected for the purposes of this licence: a) the date(s) on which the sample was taken; b) the time(s) at which the sample was collected; c) the point at which the sample was taken; and	Section 8

<table>
<tr><th>Reference</th><th>Requirement</th><th>Where addressed</th></tr>
<tr><td></td><td>d) the name of the person who collected the sample.</td><td></td></tr>
<tr><td>M2</td><td colspan="2">Requirement to monitor concentration of pollutants discharged</td></tr>
<tr><td>M2.1</td><td>For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:</td><td>Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)</td></tr>
<tr><td>M2.2</td><td>Water and/ or Land Monitoring Requirements
<table>
<tr><th colspan="4">Point 1</th></tr>
<tr><th>Pollutant</th><th>Units of measure</th><th>Frequency</th><th>Sampling method</th></tr>
<tr><td>Oil and grease</td><td>Visible</td><td>Special Frequency 1</td><td>Visual Inspection</td></tr>
<tr><td>pH</td><td>pH</td><td>Special Frequency 1</td><td>Probe</td></tr>
<tr><td>Total suspended solids</td><td>milligrams per litre</td><td>Special Frequency 1</td><td>Grab sample</td></tr>
</table>
<table>
<tr><th colspan="4">Point 2</th></tr>
<tr><th>Pollutant</th><th>Units of measure</th><th>Frequency</th><th>Sampling method</th></tr>
<tr><td>pH</td><td>pH</td><td>Daily during any discharge</td><td>Probe</td></tr>
<tr><td>Total suspended solids</td><td>milligrams per litre</td><td>Daily during any discharge</td><td>Grab sample</td></tr>
</table></td><td>Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)</td></tr>
<tr><td>M2.3</td><td>For the purposes of condition M2.2 and the Table thereto ‘Special Frequency 1’ means:
(a) less than 24 hours prior to a controlled discharge and daily for any continued controlled discharge; and
(b) when rainfall causes a discharge from a basin which has not been emptied within 5 days of the cessation of a rainfall event.</td><td>Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)</td></tr>
<tr><td>M3</td><td colspan="2">Testing methods - concentration limits</td></tr>
<tr><td>M3.1</td><td>Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.</td><td>Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)</td></tr>
<tr><td>M5</td><td colspan="2">Weather monitoring</td></tr>
<tr><td>M5.1</td><td>Rainfall at the premises must be measured and recorded in millimetres per 24 hour period at the same time each day from the time that the site office associated with the activities permitted by this licence is established.</td><td>Section 8</td></tr>
<tr><td colspan="3">EPL No. 4627</td></tr>
<tr><td>P1</td><td colspan="2">Location of monitoring/discharge points and areas</td></tr>
</table>

<table>
<tr><th>Reference</th><th>Requirement</th><th>Where addressed</th></tr>
<tr><td>P1.1</td><td>The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.</td><td>Refer to the map titled "WestConnex Motorway Alexandria Landfill EPL 4627: Environmental Monitoring Locations" dated 1 March 2016</td></tr>
<tr><td>P1.2</td><td>The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.
<table>
<tr><th colspan="4">Water and land</th></tr>
<tr><th>EPA identification no</th><th>Type of Monitoring point</th><th>Type of Discharge point</th><th>Location description</th></tr>
<tr><td>2</td><td>Groundwater Quality Monitoring</td><td></td><td>Groundwater monitoring point labelled as "MW1" on map titled "WestConnex Motorway Alexandria Landfill EPL 4627: Environmental Monitoring Locations" dated 1 March 2016.</td></tr>
<tr><td>3</td><td>Groundwater Quality</td><td></td><td>Groundwater monitoring point labelled as "MW2s" on map titled "WestConnex Motorway Alexandria Landfill EPL 4627: Environmental Monitoring Locations" dated 1 March 2016.</td></tr>
<tr><td>4</td><td>Monitoring</td><td></td><td>Groundwater monitoring point labelled as "MW2d" on map titled "WestConnex Motorway Alexandria Landfill EPL 4627: Environmental Monitoring Locations" dated 1 March 2016.</td></tr>
<tr><td>5</td><td>Groundwater Quality</td><td></td><td>Groundwater monitoring point labelled as "MW3" on map titled "WestConnex Motorway Alexandria Landfill EPL 4627: Environmental Monitoring Locations" dated 1 March 2016.</td></tr>
<tr><td>6</td><td>Monitoring</td><td></td><td>Groundwater monitoring point labelled as "MW4b" on map titled "WestConnex Motorway Alexandria Landfill EPL 4627: Environmental Monitoring Locations" dated 1 March 2016.</td></tr>
</table></td><td>Refer to the map titled "WestConnex Motorway Alexandria Landfill EPL 4627: Environmental Monitoring Locations" dated 1 March 2016</td></tr>
</table>

<table>
<tr><th>Reference</th><th>Requirement</th><th>Where addressed</th></tr>
<tr><td></td><td>
<table>
<tr><td>7</td><td>Leachate Quality Monitoring</td><td></td><td>Leachate monitoring point labelled as "LP1" on map titled "WestConnex Motorway Alexandria Landfill EPL 4627: Environmental Monitoring Locations" dated 1 March 2016.</td></tr>
<tr><td>14</td><td>Surface Water Discharge</td><td>Surface Water Discharge</td><td>The outlet of sediment basins capturing surface water only, referred to in condition P1.5</td></tr>
<tr><td>15</td><td>Construction Water Treatment Discharge</td><td>Construction Water Treatment Discharge</td><td>The discharge of construction water associated with tunnelling works during construction at the St Peters Interchange site.</td></tr>
</table>
</td><td></td></tr>
<tr><td>P1.5</td><td>The discharge points 14 and 15 referred to in condition P1.2 are active water discharge points from sediment basins and Construction Water Treatment Plants identified in the spreadsheet titled Temporary Sediment Basin and Construction Water Treatment Plants Discharge Point Schedule and maintained on electronic file SF16/21394</td><td>Refer to the Temporary Sediment Basin and Construction Water Treatment Plants Discharge Point Schedule</td></tr>
<tr><td>P1.6</td><td>The licensee must notify the EPA in writing, at least 48 hours prior to a basin or water treatment plant discharge point becoming active or inactive. The notification must include an updated Temporary Sediment Basin and Construction Water Treatment Plant Discharge Point Schedule. (Sediment basins are only considered active whilst accepting water directly from active construction areas).</td><td>Refer to the Temporary Sediment Basin and Construction Water Treatment Plants Discharge Point Schedule</td></tr>
<tr><td>L2</td><td>Concentration limits</td><td></td></tr>
<tr><td>L2.4</td><td>Water and/or Land Concentration Limits
<table>
<tr><th colspan="6">POINT 14</th></tr>
<tr><th>Pollutant</th><th>Units of measure</th><th>50 percentile concentration limit</th><th>90 Percentile concentration limit</th><th>3DGM concentration limit</th><th>100 percentile concentration limit</th></tr>
<tr><td>Oil and grease</td><td>Visible</td><td></td><td></td><td></td><td>Not visible</td></tr>
<tr><td>pH</td><td>pH</td><td></td><td></td><td></td><td>6.5-8.5</td></tr>
<tr><td>Total suspended solids</td><td>milligrams per litre</td><td></td><td></td><td></td><td>50</td></tr>
</table>
</td><td>Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)</td></tr>
</table>

<table>
<tr><th>Reference</th><th>Requirement</th><th>Where addressed</th></tr>
<tr><td></td><td>
<table>
<tr><th colspan="6">POINT 15</th></tr>
<tr><th>Pollutant</th><th>Units of measure</th><th>50 percentile concentration limit</th><th>90 Percentile concentration limit</th><th>3DGM concentration limit</th><th>100 percentile concentration limit</th></tr>
<tr><td>pH</td><td>pH</td><td></td><td></td><td></td><td>6.5-8.5</td></tr>
<tr><td>Total suspended solids</td><td>milligrams per litre</td><td></td><td></td><td></td><td>50</td></tr>
</table>
</td><td></td></tr>
<tr><td>L2.5</td><td>Exceeding the limits specified in the previous condition of this licence for pH and total suspended solids (TSS) for discharges from the sediment basins, referred to as EPA identification no. 14, identified by Conditions P1.1 and P1.2 is only permitted when the discharge occurs solely as a result of rainfall measured at the premises. The rainfall must exceed rainfall depth value for the corresponding discharge point as described in condition P1.2</td><td>Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)</td></tr>
<tr><td>O5</td><td>Processes and management</td><td></td></tr>
<tr><td>O5.1</td><td>The licensee must take all practicable steps to control entry to the premises.</td><td>This Plan

Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)</td></tr>
<tr><td>O5.2</td><td>The premises must be maintained in a condition which prevents the pollutants entering the stormwater system.</td><td>St Peters Interchange Site Environment Plan (M5N-ES-PLN-SPI-001)

Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)</td></tr>
<tr><td>O6</td><td>Waste management</td><td></td></tr>
<tr><td>O6.1</td><td>There must be no incineration or burning of any waste at the premises.</td><td>Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)</td></tr>
<tr><td>O6.2</td><td>The "Waste Covering Management Plan" referenced M5N-ES-PLN-PWD-0030 dated 30 March 2016 must be implemented in areas where waste is uncovered and or exhumed.</td><td>Waste Covering Management Plan (M5N-ES-PLN-PWD-0030)

Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)</td></tr>
</table>

Reference	Requirement	Where addressed
O6.3	Leachate must only be disposed of by pumping to sewer, or removed from the premises by tanker and disposed of lawfully off-site.	Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)
O6.4	All water contained within any areas where waste is uncovered or exhumed must be managed as leachate.	Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)
O6.5	Leachate must not be used in the truck wash facility at the premises.	Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)
O6.6	Leachate must not be irrigated and/or used for dust control at the premises.	Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)
O6.7	Definition: “Leachate” is water which has come into contact with: a) waste (other than inert waste); and/or b) the area where waste is exhumed or exhumed waste is stored; and/or c) the greenwaste processing/storage areas. “Leachate” is also liquid removed from the leachate collection system “Leachate” is a reference to treated or untreated leachate. “Treated leachate” is leachate that has been treated in the leachate pre-treatment facility required under the Sydney Water Trade Waste Agreement. All other leachate on the premises is untreated leachate.	Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)
	Landfill Closure	
O6.8	The former landfill must be closed substantially in accordance with the document “Technical Report: St Peters Interchange – Landfill Closure Management Plan LCMP, Golders Associates, 11 May 16, Document: M5N-MNP-900-300-WT-9400-DE (the LCMP) and Annexures.” This includes capping layers comprising from bottom to top a : a. 300 mm thick seal bearing layer b. 600mm thick clay layer with a maximum permeability of 10-9 meters per second or a geosynthetic clay liner and a 200 mm thick clay layer with a maximum permeability of 10-9 meters per second, c. 400mm thick subsoil layer, and d. 100 mm thick topsoil layer.	Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)
O6.9	A floor liner and leachate collection system must be installed below the waste mound. The system must be substantially in accordance with 3.8.3 of the LCMP and comprise leachate feeder drains, a 200mm thick bearing layer, a	Landfill Closure Management Plan (M5N-

Reference	Requirement	Where addressed
	500 mm thick layer of clay rich material, leachate drainage aggregate and leachate collection drains.	GOL-MNP-900-300-WT-9400)
O6.10	The licensee must install the vertical barrier wall substantially in accordance with the document "St Peters Interchange – Barrier Wall Final Design (100%) Golders Associates, March 16, Document: M5N-GOL-DPK 900-302-WT-9420-E and Annexures."	Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)
O6.11	Leachate management must be substantially in accordance with section 3.8 of the LCMP. Leachate must be collected and conveyed to the leachate treatment plant and discharged to sewer.	Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)
O6.12	Any subsequent detailed leachate management design reports must be submitted to the EPA.	Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)
O6.13	Landfill gas management comprising passive, shallow gas collection and venting, and active gas extraction via deep wells and flaring must be installed substantially in accordance with section 3.7 of the LCMP.	Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)
O6.14	The licensee must install approximately 40 gas monitoring wells as proposed in section 3.7.4 of the LCMP.	Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)
O6.15	The licensee must install approximately eleven groundwater monitoring wells and the leachate collection sump/s proposed in 5.4.1.3 of the LCMP.	Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)
O6.16	Within three (3) months of practical completion of the closure works the licensee must submit the following reports to the EPA: 1. a Construction Quality Assurance Report in accordance with section 3.10 of the LCMP and section 11.2 NSW Environmental Guidelines Solid Waste Landfills second edition 2016, and 2. plans at a suitable scale of the installed barrier wall, leachate collection and conveyance systems, landfill gas management systems, and groundwater and gas monitoring wells including bore logs.	Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)
M2	**Requirement to monitor concentration of pollutants discharged**	
M2.1	For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:	Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)
M2.3	Water and/ or Land Monitoring Requirements	Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)

POINT 2,3,4,5,6			
Pollutant	**Units of measure**	**Frequency**	**Sampling method**
Alkalinity (as calcium carbonate)	milligrams per litre	Quarterly	Grab sample
Aluminium	milligrams per litre	Yearly	Grab sample
Arsenic	milligrams per litre	Yearly	Grab sample
Barium	milligrams per litre	Yearly	Grab sample
Benzene	milligrams per litre	Yearly	Grab sample
Bicarbonate	milligrams per litre	Quarterly	Grab sample
Cadmium	milligrams per litre	Yearly	Grab sample
Calcium	milligrams per litre	Quarterly	Grab sample
Chloride	milligrams per litre	Quarterly	Grab sample
Chromium (hexavalent)	milligrams per litre	Yearly	Grab sample
Chromium (total)	milligrams per litre	Yearly	Grab sample
Cobalt	milligrams per litre	Yearly	Grab sample
Copper	milligrams per litre	Yearly	Grab sample
Ethyl benzene	milligrams per litre	Yearly	Grab sample
Fluoride	milligrams per litre	Yearly	Grab sample
Lead	milligrams per litre	Yearly	Grab sample
Magnesium	milligrams per litre	Quarterly	Grab sample
Manganese	milligrams per litre	Yearly	Grab sample
Mercury	milligrams per litre	Yearly	Grab sample
Nitrate	milligrams per litre	Yearly	Grab sample
Nitrite	milligrams per litre	Yearly	Grab sample
Nitrogen (ammonia)	milligrams per litre	Quarterly	Grab sample
Organochlorine pesticides	milligrams per litre	Yearly	Grab sample
Organophosphate pesticides	milligrams per litre	Yearly	Grab sample
pH	pH	Quarterly	Probe
Polycyclic aromatic hydrocarbons	milligrams per litre	Yearly	Grab sample
Potassium	milligrams per litre	Quarterly	Grab sample
Sodium	milligrams per litre	Quarterly	Grab sample
Standing Water Level	metres	Quarterly	In situ
Sulfate	milligrams per litre	Quarterly	Grab sample
Toluene	milligrams per litre	Yearly	Grab sample
Total dissolved solids	milligrams per litre	Quarterly	Grab sample

Reference	Requirement				Where addressed
	Total organic carbon	milligrams per litre	Yearly	Grab sample	
	Total petroleum hydrocarbons	milligrams per litre	Yearly	Grab sample	
	Total Phenolics	milligrams per litre	Yearly	Grab sample	
	Xylene	milligrams per litre	Yearly	Grab sample	
	Zinc	milligrams per litre	Yearly	Grab sample	
	POINT 7				Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)
	Pollutant	**Units of measure**	**Frequency**	**Sampling method**	
	Alkalinity (as calcium carbonate)	milligrams per litre	Quarterly	Grab sample	
	Aluminium	milligrams per litre	Quarterly	Grab sample	
	Arsenic	milligrams per litre	Quarterly	Grab sample	
	Barium	milligrams per litre	Quarterly	Grab sample	
	Benzene	milligrams per litre	Quarterly	Grab sample	
	Bicarbonate	milligrams per litre	Quarterly	Grab sample	
	Cadmium	milligrams per litre	Quarterly	Grab sample	
	Calcium	milligrams per litre	Quarterly	Grab sample	
	Chloride	milligrams per litre	Quarterly	Grab sample	
	Chromium (hexavalent)	milligrams per litre	Quarterly	Grab sample	
	Chromium (total)	milligrams per litre	Quarterly	Grab sample	
	Cobalt	milligrams per litre	Quarterly	Grab sample	
	Copper	milligrams per litre	Quarterly	Grab sample	
	Ethyl benzene	milligrams per litre	Quarterly	Grab sample	
	Fluoride	milligrams per litre	Quarterly	Grab sample	
	Lead	milligrams per litre	Quarterly	Grab sample	
	Magnesium	milligrams per litre	Quarterly	Grab sample	
	Manganese	milligrams per litre	Quarterly	Grab sample	
	Mercury	milligrams per litre	Quarterly	Grab sample	
	Nitrate	milligrams per litre	Quarterly	Grab sample	
	Nitrite	milligrams per litre	Quarterly	Grab sample	
	Nitrogen (ammonia)	milligrams per litre	Quarterly	Grab sample	
	Organochlorine pesticides	milligrams per litre	Quarterly	Grab sample	

Reference	Requirement				Where addressed
	Organophosphate pesticides	milligrams per litre	Quarterly	Grab sample	
	pH	pH	Quarterly	Probe	
	Polycyclic aromatic hydrocarbons	milligrams per litre	Quarterly	Grab sample	
	Potassium	milligrams per litre	Quarterly	Grab sample	
	Sodium	milligrams per litre	Quarterly	Grab sample	
	Standing Water Level	metres	Quarterly	In situ	
	Sulfate	milligrams per litre	Quarterly	Grab sample	
	Toluene	milligrams per litre	Quarterly	Grab sample	
	Total dissolved solids	milligrams per litre	Quarterly	Grab sample	
	Total organic carbon	milligrams per litre	Quarterly	Grab sample	
	Total petroleum hydrocarbons	milligrams per litre	Quarterly	Grab sample	
	Total Phenolics	milligrams per litre	Quarterly	Grab sample	
	Xylene	milligrams per litre	Quarterly	Grab sample	
	Zinc	milligrams per litre	Quarterly	Grab sample	
	POINT 14				Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)
	Pollutant	**Units of measure**	**Frequency**	**Sampling method**	
	Oil and grease	Visible	Special Frequency 1	Visual Inspection	
	pH	pH	Special Frequency 1	Probe	
	Total suspended solids	milligrams per litre	Special Frequency 1	Grab sample	
	POINT 15				
	Pollutant	**Units of measure**	**Frequency**	**Sampling method**	
	pH	pH	Daily during any discharge	Probe	
	Total suspended solids	milligrams per litre	Daily during any discharge	Grab sample	
M2.4	For the purposes of condition M2.3 and the Table there to 'Special Frequency 1' means: (a) less than 24 hours prior to a controlled discharge and daily for any continued controlled discharge; and (b) when rainfall causes a discharge from a basin which has not been emptied within 5 days of the cessation of a rainfall event.				Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400)

<table>
<tr><th>Reference</th><th>Requirement</th><th>Where addressed</th></tr>
<tr><td>M3</td><td colspan="2">Testing methods - concentration limits</td></tr>
<tr><td>M3.1</td><td>Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

Note: The Protection of the Environment Operations (Clean Air) Regulation 2010 requires testing for certain purposes to be conducted in accordance with test methods contained in the publication "Approved Methods for the Sampling and Analysis of Air Pollutants in NSW".</td><td>Landfill Closure Management Plan (M5N-GOL-MNP-900-300-WT-9400

Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035)</td></tr>
<tr><td>M5</td><td colspan="2">Weather monitoring</td></tr>
<tr><td>M5.1</td><td>At the point(s) identified below, the licensee must monitor (by sampling and obtaining results by analysis) the parameters specified in Column 1 of the table below, using the corresponding sampling method, units of measure, averaging period and sampling frequency, specified opposite in the Columns 2, 3, 4 and 5 respectively.

<table>
<tr><th colspan="5">POINT 13</th></tr>
<tr><th>Parameter</th><th>Sampling method</th><th>Units of measure</th><th>Averaging period</th><th>Frequency</th></tr>
<tr><td>Rainfall</td><td>AM-4</td><td>millimetres</td><td>-</td><td>Daily</td></tr>
<tr><td>Wind speed</td><td>AM-2 & AM-4</td><td>metres per second</td><td>1.5 hours</td><td>Continuous</td></tr>
<tr><td>Wind Direction at 10 metres</td><td>AM-2 & AM-4</td><td>-</td><td>1.5 hours</td><td>Continuous</td></tr>
<tr><td>Temperature at
10 metres</td><td>AM-4</td><td>degrees Celsius</td><td>1.5 hours</td><td>Continuous</td></tr>
</table></td><td>Refer Construction Air Quality Sub-Plan (M5N-ES-PLN-PWD-0002)</td></tr>
<tr><td>M5.2</td><td>Rainfall at the premises must be measured and recorded in millimetres per 24 hour period at the same time each day from the time that the site office associated with the activities permitted by this licence is established.</td><td>Refer Construction Air Quality Sub-Plan (M5N-ES-PLN-PWD-0002)</td></tr>
</table>

2.5 Sustainability Requirements

In accordance with the Sustainability Plan, CDS-JV will target to achieve IS credits in ISCA IS Rating Tool:

- For land management including land contamination assessments; and
- For water management including minimising water consumption and water recycling and reuse.

CDS-JV will conduct regular monitoring in accordance with Section 7 of this Plan.

2.6 Guidelines and Relevant Documents

The main guidelines, specification and policy documents relevant to this CSWQSP include:

- AS 1940-2004: The Storage and Handling of Flammable and Combustible Liquids (Standards Australia 2004);
- AS 4452-1997: The Storage and Handling of Toxic Substances (Standards Australia 1997);
- Acid Sulfate Soil Manual (Acid Sulfate Soil Management Advisory Committee 1998);
- Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC 2004);
- Code of Practice: Storage and Handling of Dangerous Goods (WorkCover NSW, 2005);
- Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites (OEH 2011)
- Environmental Best Management Practice Guideline for Concreting Contractors (DEC 2004);
- Environment Protection Manual for Authorised Officers: Bunding and Spill Management (EPA), online version http://www.epa.nsw.gov.au/mao/bundingspill.htm;
- Environmental Protection (Participants Manual): Storing and Handling Liquids (DECC 2007);
- Guidance material: Notifications for Schedule 11 hazardous chemicals and abandoned tanks (WorkCover NSW, 2011);
- Identification and Investigation of Acid Sulphate Soils Guideline (Draft), WA Dept. of Environment, 2006;
- Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom, 4th Edition March 2004) and Volume 2D Main Roads Construction (DECC 2008) - the “Blue Book”;
- NSW Aquifer Interference Policy (DPI, 2012)
- NSW Fisheries, Fishnote – Policy and Guidelines for Fish Friendly Waterway Crossings, 2003 (Ref: NSWF – 1181);
- NSW Fisheries, Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings, Fairfull, S. and Witheridge, G, 2003;
- NSW Fisheries, Policy and Guidelines for Fish Habitat Conservation and Management (DPI Fisheries 2013);
- NSW Guidelines for Controlled Activities Watercourse Crossings (DPI Water);
- NSW Guidelines for Controlled Activities on Waterfront Land (DPI Water);
  - Guidelines for riparian corridors on waterfront land
  - Guidelines for vegetation management plans on waterfront land
  - Guidelines for watercourse crossings on waterfront land
  - Guidelines for instream works on waterfront land
  - Guidelines for outlet structures on waterfront land
  - Guidelines for laying pipes and cables in watercourses on waterfront land
- National Environment Protection (Assessment of Site Contamination) Measure 1999;
- National Water Quality Management Strategy Paper No 4, Australian and New Zealand Guidelines for Fresh and Marine Water Quality: Volume 1 The Guidelines (ANZECC and ARMCANZ, 2000);
- Western Sydney Salinity Code of Practice (Western Sydney Salinity Working Party, Western Sydney Regional Organisation of Councils Ltd March 2003, amended January 2004);
- Roads and Salinity Guideline (DIPNR, 2003);
- Roads and Maritime Roads Water Policy (RTA, n.d.);
- Roads and Maritime Services Specification D&C G36 – Environmental Protection (06 August 2014);
- Roads and Maritime Services Specification D&C G38 Soil and Water Management (04 June 2014);
- Roads and Maritime Services Specification D&C G40 Clearing and Grubbing (04 July 2011);
- Code of Practice for Water Management – Road Development and Management (Roads and Traffic Authority, 1999);
- Environmental Direction 19: Use of Reclaimed Water (Roads and Traffic Authority, 2006);

- Environmental Direction 25: Management of Tannins from Vegetation Mulch (Roads and Maritime Services, 2012);
- Erosion and Sediment Management Procedure (Roads and Traffic Authority, 2009);
- Guide 10 – Aquatic habitats and riparian zones in Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (Roads and Traffic Authority, 2011);
- Guideline for Construction Water Quality Monitoring (Roads and Traffic Authority, 2003);
- Guideline for the Management of Contamination, (Roads and Maritime Services, 2013);
- Draft Management of Wastes on Roads and Maritime Services Land (Roads and Maritime Services);
- Road Design Guideline: Section 8 Erosion and Sedimentation (Roads and Traffic Authority, 2003);
- Technical Guideline EMS-TG-010: Stockpile Site Management Guideline (Roads and Maritime Services, 2011);
- Technical Guideline EMS-TG-011: Environmental Management of Construction Site Dewatering (Roads and Traffic Authority, 2011);
- Technical Guideline: Guidelines for the Management of Acid Sulfate Materials: Acid Sulfate Soils, Acid Sulfate Rock and Monosulfidic Black Ooze (Roads and Traffic Authority, 2005); and
- Technical Guideline: Temporary stormwater drainage for road construction (Roads and Maritime Services, 2011).

3. Consultation

This plan has been provided to DPI Water and all relevant councils for review and comment. No comments were received on this CSWQSP. Comments were received on this CSWQSP from DPI Water and the Inner West Council. Comments have been incorporated where required and responses are provided in the Consultation Comment and Response Register.

Ongoing consultation with DPI (Water), relevant councils and other stakeholders will be undertaken as required for particular issues pertaining to the project's impacts on soil and water.

Refer to the consultation requirements in Section 3.2 of the CEMP for further details regarding consultation requirements for the CEMP and sub-plans.

3.1 Consultation of Stormwater Infrastructure Alexandra Canal

The EPA ordered a Remediation Order (HO1833, 230041 Area #3151 issued by the EPA on 10 May 2004) on Sydney Water declaring the bed sediments of the Alexandra Canal between Huntley Street, Alexandria and the junction of Alexandra Canal with the Cooks River at Mascot, being Lot 1 DP 532493, Lot 1 DP749404 and Lot 3 DP878489 ("the site") as a remediation site.

Accordingly, and prior to disturbance of the bed sediments, the NSW EPA and Sydney Water will be consulted over appropriate mitigation measures to minimise sediment mobilisation that may arise as a result of construction activities at the location of the new stormwater infrastructure at Alexandra Canal. These measures would be detailed in appropriate construction documents such as site environment plan, construction drawings, work pack and an erosion and sediment control plan.

4. Roles and responsibilities

4.1 Key CDS-JV Personnel

The roles and responsibilities of key CDS-JV Personnel with respect to soil and water are detailed in Table 6.

Table 6: CDS-JV Personnel and Environmental Responsibilities

Person	Responsibilities
Project Director	• Managing the delivery of the New M5 Works including ultimate responsibility for the implementation of soil, water and groundwater management; and • Contractor's Principal Representative.
Environment and Sustainability Manager	• Oversee the implementation of all soil, water and groundwater management strategies; • Environmental reporting and monitoring (EPL); • NSW EPA liaison; and • Track and report soil and water elements against sustainability targets.
Engineering and Design Director	• Ensure relevant soil, water and groundwater management requirements are addressed in design development.
Commercial Director	• Ensure that relevant soil, water and groundwater management requirements are considered in procuring materials and services.
Construction Director(s)	• Manage the delivery of the construction process in relation to soil, water and groundwater management across all sites in conjunction with the Environment Manager.
Construction Supervisors and Foremen	• On-ground implementation and adherence with soil and water quality management requirements.
Environment Advisors	• Manage the on-ground application of soil and water management measures during construction (e.g. erosion and sediment control, water treatment and monitoring); and • Monitor and report on soil and water management during construction.
Project and Site Engineers	• Implement soil and water management activities during construction works.

Further details on roles and responsibilities are provided in the CEMP.

4.2 Project Soil Conservationist

A Project Soil Conservationist will be engaged to provide expert advice during the design, planning and construction phases to ensure that impacts can be avoided, minimised or appropriately mitigated including:

- Providing input into design of erosion and sediment controls;
- Reviewing Plans for erosion and sediment controls, advising on the proposed strategy for erosion and sediment control and use of new technologies (where appropriate) regarding construction-phase soil and water management;
- Conducting regular site inspection with environmental and construction personnel to review performance and recommend improvements/enhancements; and
- Providing training to all key staff regarding erosion and sediment control. This will include legislative requirements, the application of best-practice (i.e. Blue Book Volumes 1 and 2D), correct use, maintenance and installation of erosion and sediment control techniques.

5. Existing Environment

5.1 Topography

The topography of the corridor is undulating and comprises a series of elevated ridges and relatively low lying broad valleys with gently inclined slopes.

The western portion of the Project corridor is relatively flat, low lying, with gentle undulating hills ranging between 30 metres Australian height datum (AHD) and 40 metres AHD. The central portion of the Project corridor, through the Bexley North and Bardwell Park areas, is at elevations of between 40 metres AHD to 50 metres AHD. This plateau is higher in elevation by approximately 20 to 30 metres than other parts of the Sydney basin.

The topography of the Project corridor near the confluence of Wolli Creek and the Cooks River is relatively flat and low-lying, around five metres AHD to 10 metres AHD, and gradually declining towards Botany Bay. The eastern portion of the Project corridor would include the St Peters interchange, which would be located on the former Alexandria Landfill site.

Land within and adjoining the Project corridor has been substantially modified over time and includes land reclamation activities. Land use surrounding the Project footprint is 100% urban, including major utilities infrastructure, Sydney airport, Sydney Port of Botany, Botany Industrial Park, other industrial, commercial, roads, railways, residential and open space.

The various ridgelines control the alignment of drainage features such as Wolli Creak and Alexandra Canal (former Shea's Creek).

5.2 Soils and Geology

The geology along the Project corridor is dominated by the Wianamatta Group rocks and the Hawkesbury Sandstone Formation. The expected bedrock comprises units of the Ashfield Shale over Hawkesbury Sandstone with a thin layer of Mittagong Formation rocks separating the two formations.

The Ashfield Shale layer typically extends to a depth of three to 10 metres (ridgelines around Kingsgrove, and from Sydenham to St Peters), although has extended to depths in excess of 40 metres in the area of St Peter's. Hawkesbury Sandstone is found near the surface in Bardwell Valley, and is present at depth all the way along the Project alignment.

The Project corridor is underlain by seven soil landscapes. The Gymea soil landscape covers the majority of the Project corridor in the west, with smaller areas of the Hawkesbury, Blacktown, Birrong, Warriewood and Oxford Falls soil landscapes. The eastern extent of the Project corridor is largely covered by land identified as being disturbed terrains, associated with Alexandra Canal and industrial land uses. Soil landscapes within the Project alignment are shown in Figure **1** and detailed in Table 7.

Table 7 also presents an estimate of the approximate percentage of each soil landscape within the tunnel, surface works and construction footprint alignment. The estimate is based on 'Figure 16-4 Soil landscapes' as presented in Chapter 16 Soil and Water Quality of the EIS.

Table 7: Soils and geology across the Project footprint

Soil Landscape Name	Approximate Percentage of the Alignment	Description
Residual Blacktown	16%	Occurs on gently undulating rises on Wianamatta Group Shales. Poorly drained, moderately reactive soil. No appreciable erosion occurs on this unit as most of the surface is covered by tiles, concrete, bitumen or turf. If surface cover is disturbed there is potential for pockets of erodible dispersible soils.

Soil Landscape Name	Approximate Percentage of the Alignment	Description
Alluvial Birrong	12%	Occurs on level to gently undulating alluvial flood Plan draining the Wianamatta Group Shales. Saline soils, seasonal waterlogging and localised flooding. Soil landscapes exhibit a high soil erosion hazard. However, most drainage lines have been artificially lined with concrete to prevent ongoing erosion. Minor streambank erosion has occurred along remaining natural drainage lines.
Erosional Gymea	27%	Occurs on undulating to rolling rises and low hills on Hawkesbury Sandstone. Localised steep slopes. High soil erosion hazard. Severe sheet erosion occurs when the stabilising vegetative ground cover is removed. Minor gully erosion occurs under concentrated flow conditions.
Colluvial Hawkesbury	3%	Occurs on rugged, rolling to very steep hills on Hawkesbury Sandstone. Extreme soil erosion and mass movement hazard. Severe sheet erosions often occur during storms and after ground cover is removed. Minor gully erosion can occur under concentrated flow conditions.
Transferral Oxford Falls	2%	Occurs in hanging valleys on Hawkesbury Sandstone, with occasional broad benches and scarps. Very high soil erosion hazard, potential for perched water tables and swamps, highly permeable soil.
Swamp Warriewood	1%	Occurs on level to gently undulating swales, depressions and infilled lagoons in Quaternary sands. High water tables and localised flooding, highly permeable soils, compressible soils. No appreciable erosion occurs where slopes are low and a vigorous ground cover is maintained. Subject to wind erosion when ground cover is removed.
Disturbed Terrain	39%	Terrain extensively disturbed by human activity, including complete disturbance, removal or burial of soil. Soil characteristics vary widely. Variable relief and slopes. Erosion hazard varies markedly according to site characteristics including slope, aspect and exposure. In general, severe sheet and rill erosion often occur at quarries, gravel pits and places where unconsolidated or disturbed material remains without a protective cover of vegetation, asphalt or concrete. Risk of contamination, depending on past land use.

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Figure 1 Soil landscapes within Project alignment

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5.3 Acid Sulfate Soils

There is generally a low to extremely low probability of occurrence of acid sulfate soils for the majority of the Project corridor. There is a high probability for occurrence of potential acid sulfate soils, however adjacent to watercourses that have the presence of alluvial deposits, namely Wolli Creek and the Cooks River. A high potential exists for acid sulfate soils in the sediments in and around the Alexandra Canal.

Based on historical quarrying records at Alexandria Landfill, potential acid sulfate soils are most likely present in the southern and eastern areas of the site - outside the areas that have been subject to quarrying.

The construction of bridge footings or dewatering at Alexandra Canal during road construction works has a high probability for excavation of potential acidic conditions. There is a high potential for acid sulfate soils at the Arncliffe compound (C3) and around the Arncliffe surface works. Areas showing the high and low probability of occurrence of acid sulfate soils are presented on Figure **2**.

Further investigation will be conducted in areas with medium or high acid sulfate soils potential during the detailed design stage as part of contamination investigations. An Acid Sulfate Soils Sub-Plan (M5N-ES-PLN-PWD-00031), refer Appendix A, has been developed for the management, handling, treatment and disposal of Acid Sulfate Soils. The Manage Acid Sulfate Soils Procedure (M5N-ES-PRC-PWD-0038) has been developed to ensure human and environmental safety are appropriately managed should acid sulfate soils be unearthed.

5.4 Contamination

A Phase 1 Environmental Site Assessment for contamination of soils was undertaken as part of the Project's EIS. The assessment targeted surface disturbance areas - associated with tunnel entry and exit points, ventilation facility locations, construction compounds and potential disturbance areas within the Alexandra Canal.

The EIS also assessed the potential contamination risk to the Project tunnels and caverns and identified that this would be associated with the migration of contaminated groundwater plumes towards the tunnels. Determining that the risk of intercepting contaminated groundwater is low as the majority of the tunnels would be constructed within the Hawkesbury Sandstone at depths greater than 20 metres at the western and eastern ends and up to 80 metres beneath Bardwell Park.

A summary of potential and known locations of contamination in the vicinity of the tunnel as identified in the EIS is presented on Figure 3. For further information, refer to the Construction Contaminated Land Management Plan (M5N-ES-PLN-PWD-0033).

Phase 2 Environmental Site Assessments (ESA) will be undertaken where identified as necessary in Phase 1 ESA. Phase 2 ESA will identify if a remediation action plan is required. Soil or land shall not be disturbed until the Phase 2 ESA reports work can commence or a remediation action plan has been developed and accompanied by a site audit statement prepared by an accredited contaminated lands auditor.

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Figure 2 Acid Sulfate Soil risk areas within the study area

Figure 3 Potential known areas of contamination

4 pages Figure to be inserted

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5.5 Soil Salinity

The EIS (AECOM 2015) notes that soil salinity is possible within the landscape affected by the Project footprint. Salinity has been recognised as a problem in some Sydney regions with groundwater levels close to ground surface (e.g. water logged areas), soils derived from Wianamatta shales, low permeable alluvial deposits and saline groundwater. In these areas the Project activities may contribute to salinity problems in the following ways:

- By exposing sodic or saline sub-soils;
- By increasing the level of regional groundwater and encouraging the development of perched water tables;
- By changing soil groundwater flow and creating areas of impeded drainage or forced discharge; and
- By developing or disturbing areas sensitive to salinity.

A groundwater and soil salinity assessment that is consistent with approaches contained in the Western Sydney Salinity Code of Practice (Nicolson 2003) and that determine the presence, extent and severity of soil salinity within the Project corridor is presented in the Groundwater and Soil Salinity Assessment Report. As part of this assessment a soil salinity baseline map of the Project corridor was developed using Geographical Information System (GIS) modelling.

5.6 Climate

Table 8 presents climate data statistics for two Bureau of Meteorology (BoM) sites that bound the Project corridor located at Sydney Airport AWS (site number 066037) and the Canterbury Racecourse AWS (site number 066194). Monthly averages of maximum and minimum temperatures are presented as well as rainfall data consisting of mean monthly rainfall and the average number of rain days per month and average windspeeds measured at 9am and 3pm.

Data presented show that temperatures are warm to hot in summer, with mild winters. Rainfall occurs throughout the year with a slight summer dominance. Mean annual rainfall is 1083.6mm/yr at Sydney Airport and 921.9mm/yr at Canterbury racecourse.

Average afternoon wind speeds are sufficient to contribute to potential dust rise, particularly during hot and/or dry conditions.

Table 8: Climate averages for Sydney Airport and Canterbury Racecourse AWS

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Sydney Airport (AWS) - Latitude: 33.95°S; Longitude: 151.17°E													
Mean max temp (°C)	26.5	26.4	25.3	22.9	20.0	17.6	17.0	18.4	20.6	22.6	24.1	25.8	22.3
Mean min temp (°C)	18.9	19.1	17.6	14.2	11.0	8.7	7.2	8.2	10.5	13.2	15.4	17.5	13.5
Mean rainfall (mm)	94.0	111.9	115.4	109.3	98.6	122.5	69.6	76.8	60.3	70.3	81.5	74.1	1083.6
Mean no of days of rain ≥ 1mm rain	8.0	8.6	9.2	8.6	8.5	8.8	6.7	6.8	6.8	7.8	8.4	7.8	96.0
Mean 9am wind speed (km/hr)	14.4	13.8	12.9	12.9	12.6	13.4	13.3	14.4	15.5	16.3	16.0	14.8	14.2
Mean 3pm wind speed (km/hr)	24.1	23.0	21.0	19.3	17.1	17.8	18.2	20.8	23.1	24.6	25.3	25.2	21.6
Canterbury Racecourse (AWS) - Latitude: 33.91°S; Longitude: 151.11°E													
Mean max temp (°C)	27.6	27.2	25.9	23.3	20.5	18.1	17.4	19.0	22.0	23.4	24.6	26.3	22.9
Mean min temp (°C)	18.3	18.3	16.4	12.7	9.3	7.1	5.7	6.5	9.4	12.0	14.8	16.8	12.3
Mean rainfall (mm)	76.0	103.6	73.3	113.4	84.9	98.8	57.6	63.2	46.1	60.8	81.4	64.7	921.9
Mean no of days of rain ≥ 1mm rain	7.6	7.8	7.5	7.8	7.1	8.9	6.6	5.1	5.0	6.2	8.6	6.8	85.0
Mean 9am wind speed (km/hr)	11.4	10.9	9.8	10.4	10.6	9.9	10.2	12.0	12.8	12.6	13.0	12.2	11.3
Mean 3pm wind	22.3	20.7	19.2	17.3	15.1	13.7	15.0	17.8	19.8	21.1	22.0	22.2	18.8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
speed (km/hr)													

Data statistics were sourced from the BoM website on 11 November 2015 and the BoM record period for Sydney Airport AWS was years 1929 - 2015 and for Canterbury Racecourse AWS was years 1995 - 2015.

5.7 Surface Water

The Project alignment is located wholly within the Cooks River catchment area. Several tributaries and channels cross the alignment or are in close proximity (Figure **4**). These are:

- Wolli Creek (and tributary Bardwell Creek);
- Alexandra Canal (formerly known as Shea's Creek); and
- Eastern Channel.

CDS-JV works include two waterway crossings over the concrete-lined Alexandra Canal. The works for piers and any bridge abutments would occur on heavily modified ground. Other CDS-JV works will occur within 40m of concrete lined sections of waterways on heavily modified ground. As such no natural or naturalised riparian habitats will be directly impacted by CDS-JV works. Further detail on surface water and the project environment is presented in the Water Quality Plan and Monitoring Program.

Table 9 details the condition of each of the surface water catchments and the potential Project interaction with each waterway.

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Figure 4 Watercourses along the Project

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Table 9: Watercourses associated with the Project

Watercourse	Condition	Construction location / compound site	Project interaction	Potential impacts on watercourse bank stability	Development of appropriate mitigation measures for bank stability
Wolli Creek From upstream of the Project boundary, near King Georges Road, to its confluence with the Cooks River.	The upper section of Wolli Creek, from Beverly Hills to Bexley Road, is generally concrete-lined channel owned and managed by Sydney Water as part of its trunk drainage system. *Tidal Limit* Tidal to vicinity of Bardwell Creek, 600m upstream from weir (Easting 327499 Northing 6243865 approx. 15.5km from ocean}.	Kingsgrove South (C2) & Commercial Rd (C3) Construction Compounds	Works at the construction compounds will be adjacent to the creek. Wolli Creek is the receiving watercourse for discharge from temporary WTP at the Kingsgrove North (C1) and Commercial Road (C3). Water Quality Pond No.2 will be decommissioned once replacement water quality devices are operational.	No impact to bank stability has been identified. There is no proposed modification to the banks of the creek. Construction work adjacent to the creek is not identified as having an impact on the stability of the concrete lining. Temporary treated water discharge to the creek is not predicted to impact the stability of the concrete lining of the creek banks.	As there are no plans to modify or impact on the bank no potential impacts to the stability of the bank have been identified in relation to Project activities. No mitigation measures are required at this time as no impacts are predicted.
		Bexley Rd South (C5) and Bexley Rd East (C6) Construction Compounds	Works at the construction compounds will be adjacent to the creek. Wolli Creek is the receiving watercourse for discharge from a temporary WTP Bexley South (C5) construction compound.	No impact to bank stability has been identified. There is no proposed modification to the banks of the creek. Construction work adjacent to the creek is not identified as having an impact on the stability of the concrete lining. Temporary treated water discharge to the creek is not predicted to impact the stability of the concrete lining of the creek banks.	As there are no plans to modify or impact on the bank no potential impacts to the stability of the bank have been identified in relation to Project activities. No mitigation measures are required at this time as no impacts are predicted.

Watercourse	Condition	Construction location / compound site	Project interaction	Potential impacts on watercourse bank stability	Development of appropriate mitigation measures for bank stability
Alexandra Canal	Alexandra Canal is a constructed canal, originally a stretch of natural watercourse named Sheas Creek. The canal is owned and operated by Sydney Water as are the major trunk drainage lines discharging into it. *Tidal Limit* Alexandra Canal is tidally dominated through its connection to the Cooks River. Due to its size in relation to its inflows as well as tidal action, the canal accumulates sediment. (Sheas Creek is tidal to a point ~100m downstream from Huntley Road bridge Easting 332829 Northing 6246365 approx. 15.8km from ocean).	Campbell St Bridge Gardeners Rd Bridge	Surface works will occur in the vicinity of Alexandra Canal associated with construction of the St Peters Interchange. Bridge construction works to span over Alexandra Canal would occur at Campbell Road and Gardeners Road, although no piers would be installed within the canal. Local road upgrades include the extension of Campbell Road from Burrows Road, across Alexandra Canal to Bourke Road. Is receiving watercourse for discharge from temporary WTP at the Canal Road (C8) construction compound.	No impact to bank stability has been identified. There are no bridge supports within Alexandra Canal or within the curtilage of the embankments. The footings for the bridge are set back from the banks of the canal and will not impact on the stability of the canal banks.	As there are no plans to modify or impact on the bank no potential impacts to the stability of the bank have been identified in relation to Project activities. No mitigation measures are required at this time as no impacts are predicted.
		Canal Rd storm water outlet		A storm water outlet is proposed to be constructed in the bank of the canal. The stone canal bank will be modified to incorporate the outlet (including reuse of the embankment stone). Potential impacts include localized erosion and sedimentation issues during construction. During construction these will be managed via a ERSED plan.	A construction erosion and sediment control plan will be developed in consultation with the Project Soil Conservationist. The bank is currently stone lined. The modification to the bank will also be stone and concrete lined to maintain stability of the bank. During installation of the storm water outlet engineered temporary shutters will be placed to

Watercourse	Condition	Construction location / compound site	Project interaction	Potential impacts on watercourse bank stability	Development of appropriate mitigation measures for bank stability
					maintain bank stability. Potential for scour once the outlet is operational will be assessed during design using TUFLOW hydraulic model. Output of the model will inform design of required scour protection.
Eastern Channel	The Eastern Channel is a concrete-lined open channel (SWC 66) runs along the Sydenham to Tempe railway line, discharging into the Cooks River. *Tidal Limit* Part of the channel is tidal due to its connectivity with the Cooks River.	Local Road upgrades	Portion of the local Road upgrade the minor surface works at Camdenville Park will occur in the vicinity of Eastern Channel.	No potential impacts to the stability of the bank have been identified in relation to Project activities.	As there are no plans to modify or impact on the bank no potential impacts to the stability of the bank have been identified in relation to Project activities. No mitigation measures are required at this time as no impacts are predicted.
Cooks River	From the Bayview Avenue Bridge, Tempe to Botany Bay. *Tidal Limit* Tidal to within ~200m of Punchbowl Road bridge	Arncliffe construction compound (C7), the closest point of the works are 220m from the Cooks River.	Mainline tunnels run under the Cook's River, no impact is likely from tunnelling. The Cooks river is the eventual receiving watercourse for discharge from temporary WTP at the Arncliffe construction compound (C7) and is also the eventual receiving watercourse for flows discharged into Wolli Creek and Alexandra Canal.	No works are planned at or near to the banks of the Cooks River. Construction water from the Arncliffe Site will be discharged to the existing stormwater network.	As there are no plans to modify or impact on the bank no potential impacts to the stability of the bank have been identified in relation to Project activities.

Watercourse	Condition	Construction location / compound site	Project interaction	Potential impacts on watercourse bank stability	Development of appropriate mitigation measures for bank stability
	(Easting 323389, Northing 6247165), approx. 21.9km from ocean).			No potential impacts to the stability of the bank have been identified in relation to Project activities.	No mitigation measures are required at this time as no impacts are predicted.

5.7.1 Surface Water Quality

The Cooks River catchment is an urban catchment and water quality in this catchment has been historically affected by stormwater pollution, industrial and domestic wastewater discharge, rubbish dumping and modification of watercourses.

Prior studies of water quality in the Cooks River catchment have provided the following remarks about various contaminants:

- Nutrients, phosphorus and nitrogen were found in high levels in the Cooks River. Sources include pets and birds, fertilisers, detergents, sewage discharges and golf courses;
- Faecal Coliforms – High levels found in the Cooks River, exceeding those of recreational guidelines;
- Dissolved oxygen – Depleted levels found in the lower reaches of Cooks River;
- Toxicants – Elevated levels of toxicants such as organics and heavy metals have been found in high concentrations in the Cooks River. Fish kills have also been attributed to pesticide use;
- Suspended solids and turbidity – Results for all Cooks River catchments in the past have indicated results well above the ANZECC/ARMCANZ Water Quality Guidelines (ANZECC/ARMCANZ, 2000); and
- pH – Results within the Cooks River have tended to indicate compliance guidelines.

The EIS reports that the Cooks River catchment is one of the most polluted urban catchments in Australia, and its surface water quality is considered to be poor. The Alexandra Canal in particular is a heavily polluted waterway.

Further information on water quality of surface waters can be found in the Water Quality Plan and Monitoring Program (M5N-ES-PLN-PWD-0027).

5.8 Flooding

The EIS notes that a number of the construction activities or facilities could be affected by flooding during storms, though minor in impact, and that the application of standard mitigation measures and refinements during detailed design and construction would be sufficient to mitigate potential flooding impacts. A range of potential measures which would reduce the impact of construction activities on flooding behaviour are proposed and these have been incorporated into this Plan (Section 7).

A number of construction ancillary facilities were identified to be affected by flooding during events more frequent than a five year ARI event. A Flood Mitigation Strategy describing the flood and stormwater-related issues specific to each construction site will be developed. The strategy will include details and procedures aimed at reducing risks to human safety and damage to infrastructure during the construction period.

5.9 Groundwater

The majority of the Project tunnels is in Hawkesbury sandstone and Ashfield Shale. Groundwater within Hawkesbury Sandstone is typically of low salinity and sometimes potable quality whereas groundwater in the Ashfield Shale is typically of poor quality and has elevated salinity. Groundwater quality within the alluvium associated with the rivers is variable but typically of low salinity in the upper reaches and becoming brackish in the lower reaches due to tidal influences and mixing.

In the eastern end of the Project and above the Hawkesbury sandstone lies the Botany Sands aquifer extending from Botany Bay to the west of Alexandra Canal. Parts of the project at Arncliffe and Alexandria Landfill would intrude into the Upper Quaternary Botany Sands - a shallow, unconfined to semi-confined aquifer, susceptible to contamination. Consequently, the Botany area has been divided into four management zones based on what the NSW Government knows about contamination in the area and the way groundwater moves underground. The Orica groundwater contamination exclusion area is in Zone 1 and east of the project. The project corridor runs through Zone 2 where domestic groundwater use is banned, and is outside and away from Zone 1.The proposed cut-off wall (and aided by the proposed landfill capping) for the closure of Alexandria Landfill will act as a barrier to groundwater flow in both directions - to minimise inflow of groundwater from the Botany Sands Aquifer into the Landfill and to minimise Landfil leachate migration to Alexandra Canal and the Botany Sands Aquifer. The Alexandra Currently pumps water from the Botany Sands Aquifer adjacent to the landfill pit to reduce groundwater flow into the pit. Project

works are intended to eliminate the need to continue pumping water from the Botany Sands Aquifer as the proposed cut off wall will reduce Botany Sands Aquifer water draining into the landfill. This will enable the decommissioning of pit and pumping equipment that currently drain the Botany Sands Aquifer on the Alexandria Landfill Site and have a positive outcome of reducing anthropogenic impacts on this dynamic aquifer .

Groundwater use across most of the Project corridor is low as bore yields are low, in certain locations the groundwater is contaminated, and the area has access to reticulated water. (Refer section 5.4 for known areas of potential groundwater contamination.)

The EIS reports the presence of 61 registered bores within 1 km of the Project alignment. Eleven bores intersect at depth sandstone (8) or shale (3). The other 50 bores are shallow (< 10 metres) and extract groundwater from sand (either Botany sands or alluvium geological units. Twenty one bores are used as monitoring wells, 31 bores for water supply purposes, and the remaining 10 bores used for other purposes such as exploration test bores.

The geographical distribution of the boreholes falls within three general groupings:

- West of Arncliffe along existing M5 East Motorway (three boreholes);
- At and near the Kogarah Golf Course at Arncliffe (15 boreholes); and
- At Tempe, St Peters and Alexandria (43 boreholes).

The Project is likely to lead to some localised lowering of groundwater tables due to inflows into the tunnels. Groundwater modelling predicts that eleven bores are close enough to Project works that they may potentially be affected during construction, shown in Figure **5** and Table 10. Of these wells only four are used for water supply – domestic (two) and industrial (two) purposes. The remaining seven wells are classified as either monitoring wells, test bore or other.

Further information on groundwater inflows, groundwater levels and drawdown, and water quality is to be found in the Groundwater Modeling Report and the Water Quality Plan and Monitoring Program (M5N-ES-PLN-PWD-0027).

Table 10: Groundwater bores that may potentially be affected by tunnelling

Bore ID	Lithology	Depth (m)	Water table depth metres below ground level	Purpose
GW023191	Sand	4.9	3.3	Water supply - domestic
GW023194	Sand	2.1	2.1	Water supply - domestic
GW027664	Sand	6.1	0.7	Industrial
GW107993	Sandstone	13.6	1.95	Monitoring
GW108406	Sand	8	Not available	Monitoring
GW108588	Sand	8	Not available	Test bore
GW109191	Sandstone	186	93	Industrial
GW109963	Sand	8	Not available	Other
GW109964	Sand	8	Not available	Monitoring
GW109965	Sand	8	Not available	Monitoring
GW109966	Sand	3	Not available	Monitoring

5.10 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDEs) are defined as ecosystems whose current species composition, structure and function are reliant on a supply of groundwater as opposed to surface

water supplies from overland flow paths. GDEs within the potential extent influence of groundwater drawdown are:

- Cooks River Castlereagh Ironbark Forest within Beverly Grove Park;
- Hinterland Sandstone Gully Forest with a moderate to high potential to be dependent on groundwater within Bardwell Valley Parkland and Broadford Street Reserve;
- Coastal Sandstone Ridgetop Woodland within Stotts Reserve;
- Estuarine Fringe Forest between the southern bank of Wolli Creek and the rail line behind Wolli Creek Station; and
- The Cooks River is likely to be an inflow dependent GDE.

5.11 Receiving Environment

As noted in the EIS, Wolli Creek and Alexandra Canal feed into the Cooks River estuary which in turn leads into Botany Bay. Water quality within the Cooks River estuary is generally considered to be poor.

Urbanisation and surrounding industrial land uses have led to elevated levels of nutrients, gross pollutants and sediment contamination. There has also been extensive alteration to the estuarine foreshore and limited tidal flushing in some areas. Sensitive receiving environments in the vicinity of the Project footprint include:

- The Green and Golden Bell Frog habitat on Kogarah Golf Course in Arncliffe;
- Eve Street Wetland, Marsh Street Wetland & Landling Lights Wetlands (Arncliffe);
- Wolli Creek and Wolli Creek Regional Park;
- Cooks River;
- Saltmarsh and other wetlands around Sydney Airport; and
- Botany Bay.

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Figure 5 Location of groundwater bores that may potentially be affected by tunnelling

6. Construction Aspects and Environmental Impacts

Construction activities that have the potential to impact on soil and water quality are listed in Table 11. These potential impacts have been taken into account in developing the strategy described in Section 7 of this CSWQSP.

Table 11: Environmental aspects and impacts relevant to the management of soil and water quality

• Key activity and location[1]	Potential Impacts														
	Acid Sulfate Soils	Contamination	Erosion and sedimentation	Groundwater quality impacts	Groundwater Drawdown	Groundwater Treatment	Ground Movement	Impacts to Creeks and Waterways	Water table, water supply and water balance	Flooding	Increased BOD in surface water	Changes to pH in surface water	Increased turbidity in surface water	Increased runoff	Tannin generation
Western surface works including M5 East Motorway integration works		✓	✓					✓	✓	✓	✓	✓	✓	✓	✓
Vegetation clearing and grubbing		✓	✓					✓			✓	✓	✓	✓	✓
Earthworks and excavation		✓	✓					✓					✓	✓	
Spoil stockpiling and removal		✓	✓					✓					✓	✓	
Construction of Western Tunnel Access		✓	✓					✓				✓	✓	✓	
Construction Kindilan underpass extension		✓	✓					✓				✓	✓	✓	
Construction retaining walls		✓	✓					✓				✓	✓	✓	

• Key activity and location[1]	Potential Impacts														
	Acid Sulfate Soils	Contamination	Erosion and sedimentation	Groundwater quality impacts	Groundwater Drawdown	Groundwater Treatment	Ground Movement	Impacts to Creeks and Waterways	Water table, water supply and water balance	Flooding	Increased BOD in surface water	Changes to pH in surface water	Increased turbidity in surface water	Increased runoff	Tannin generation
Installation of the drainage and utility infrastructure such as transverse pits and pipes, culvert extensions, water quality basins		✓	✓					✓		✓		✓	✓		
Paving		✓	✓					✓		✓	✓	✓		✓	
Sign installation and street lighting		✓	✓					✓					✓		
Line-marking, traffic switches to tie in with existing road network.		✓	✓					✓	✓				✓		
Landscaping.								✓	✓						
Alexandria Landfill Closure works		✓	✓					✓	✓		✓	✓	✓	✓	
Construction of access roads, site entry and exit points and enabling works		✓	✓												
Foundation preparatory works		✓	✓					✓					✓	✓	
Bulk earthworks (St Peters interchange cut to fill)		✓	✓					✓	✓				✓	✓	

• Key activity and location[1]	Potential Impacts														
	Acid Sulfate Soils	Contamination	Erosion and sedimentation	Groundwater quality impacts	Groundwater Drawdown	Groundwater Treatment	Ground Movement	Impacts to Creeks and Waterways	Water table, water supply and water balance	Flooding	Increased BOD in surface water	Changes to pH in surface water	Increased turbidity in surface water	Increased runoff	Tannin generation
Bulk earthworks (imported fill and engineered fill)		✓	✓					✓	✓				✓	✓	
Cut foundation treatment		✓	✓					✓					✓	✓	
Capping installation		✓	✓					✓	✓				✓	✓	
Establishment of leachate collection, treatment pumping station		✓	✓					✓				✓	✓	✓	
Construction and establishment of groundwater seepage cut-off		✓	✓					✓				✓	✓	✓	
Operation of leachate collection, treatment pumping station		✓						✓			✓	✓	✓	✓	
Landscaping								✓	✓						
St Peters Interchange		✓	✓					✓	✓	✓	✓	✓	✓	✓	✓
Vegetation clearing and grubbing		✓	✓					✓			✓	✓	✓	✓	✓
Bulk excavation and material disposal		✓	✓					✓	✓		✓		✓	✓	

• Key activity and location[1]	Potential Impacts														
	Acid Sulfate Soils	Contamination	Erosion and sedimentation	Groundwater quality impacts	Groundwater Drawdown	Groundwater Treatment	Ground Movement	Impacts to Creeks and Waterways	Water table, water supply and water balance	Flooding	Increased BOD in surface water	Changes to pH in surface water	Increased turbidity in surface water	Increased runoff	Tannin generation
Foundation works to pavements including piling		✓	✓					✓			✓	✓	✓	✓	
Structural and flexible pavement construction to St Peters interchange		✓	✓					✓		✓		✓	✓	✓	
Construction of Eastern Tunnel Access		✓	✓					✓				✓	✓	✓	
Construction of the St Peters interchange bridges		✓	✓					✓				✓	✓	✓	
Construction of the Campbell Road pedestrian and cycle bridge		✓	✓					✓				✓	✓	✓	
Construction of bridges over Alexandra Canal		✓	✓					✓				✓	✓	✓	
Construction of retaining walls		✓	✓					✓	✓			✓	✓	✓	
Sign installation and street lighting		✓	✓					✓					✓		
Line-marking, traffic switches to tie in with existing road network.		✓	✓					✓	✓				✓		
Landscaping.								✓	✓						

• Key activity and location[1]	Potential Impacts														
	Acid Sulfate Soils	Contamination	Erosion and sedimentation	Groundwater quality impacts	Groundwater Drawdown	Groundwater Treatment	Ground Movement	Impacts to Creeks and Waterways	Water table, water supply and water balance	Flooding	Increased BOD in surface water	Changes to pH in surface water	Increased turbidity in surface water	Increased runoff	Tannin generation
Eastern Surface Works including local road works		✓	✓					✓	✓	✓	✓	✓	✓	✓	✓
Vegetation clearing and grubbing		✓	✓					✓			✓	✓	✓	✓	✓
Removal of existing road pavements, as required		✓	✓					✓				✓	✓	✓	
Earthworks and excavation		✓	✓					✓					✓	✓	
Spoil stockpiling and removal		✓	✓					✓					✓	✓	
Installation of the drainage and utility infrastructure		✓	✓					✓		✓		✓	✓		
Installation of road base, kerb and guttering, verges, medians, and new jersey barriers		✓	✓					✓		✓		✓	✓		
Installation of final asphalting layer		✓	✓					✓		✓	✓	✓		✓	
Sign installation and street lighting		✓	✓					✓					✓		
Line-marking, traffic switches to tie in with existing road network, landscaping.		✓	✓					✓	✓				✓		

• Key activity and location[1]	Potential Impacts														
	Acid Sulfate Soils	Contamination	Erosion and sedimentation	Groundwater quality impacts	Groundwater Drawdown	Groundwater Treatment	Ground Movement	Impacts to Creeks and Waterways	Water table, water supply and water balance	Flooding	Increased BOD in surface water	Changes to pH in surface water	Increased turbidity in surface water	Increased runoff	Tannin generation
Establishment of Tunnel and Civil Support Compounds (C1, C3, C4, C5, C7, C8)	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓
Vegetation clearing and grubbing	✓	✓	✓					✓			✓	✓	✓	✓	✓
Demolition of buildings and/or structures		✓	✓					✓				✓	✓	✓	
Earthworks	✓	✓	✓					✓	✓				✓	✓	
Construction of access roads, site entry and exit points, service connections, enabling works	✓	✓	✓					✓					✓	✓	
Paving and sealing of surfaces		✓	✓					✓	✓	✓	✓	✓		✓	
Establishment stockpile / laydown		✓	✓					✓					✓	✓	
Establishment fuel, chemical and hazardous material storage		✓	✓					✓				✓	✓	✓	

• Key activity and location[1]	Potential Impacts														
	Acid Sulfate Soils	Contamination	Erosion and sedimentation	Groundwater quality impacts	Groundwater Drawdown	Groundwater Treatment	Ground Movement	Impacts to Creeks and Waterways	Water table, water supply and water balance	Flooding	Increased BOD in surface water	Changes to pH in surface water	Increased turbidity in surface water	Increased runoff	Tannin generation
Establishment of the acoustic sheds, water treatment plant, workshop, staff amenities and other structures		✓	✓					✓				✓	✓	✓	
Operation of Tunnel and Civil Support compounds (C1, C3, C4, C5, C7, C8)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Site Access		✓	✓										✓		
Deliveries		✓													
Car Parking		✓						✓						✓	
Staff amenities									✓					✓	
Operation of the Water Treatment Plants		✓	✓			✓		✓	✓	✓	✓	✓	✓		
Stockpile/laydown		✓	✓					✓			✓	✓	✓	✓	✓
Removal of spoil		✓	✓					✓					✓		

• Key activity and location[1]	Potential Impacts														
	Acid Sulfate Soils	Contamination	Erosion and sedimentation	Groundwater quality impacts	Groundwater Drawdown	Groundwater Treatment	Ground Movement	Impacts to Creeks and Waterways	Water table, water supply and water balance	Flooding	Increased BOD in surface water	Changes to pH in surface water	Increased turbidity in surface water	Increased runoff	Tannin generation
Fuel storage, chemical and hazardous material storage		✓						✓			✓	✓			
24 hour tunnelling site – shafts and declines		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	
Construction Bexley Road South motorway operations complex (MOC2)		✓	✓					✓		✓		✓	✓	✓	
Construction Arncliffe motorway operations complex (MOC3)		✓	✓					✓		✓		✓	✓	✓	
Construction of St Peters motorway operations complex (MOC4)		✓	✓					✓		✓		✓	✓	✓	
Establishment of Civil Construction Compounds (C2, C9, C10, C11, C12, C13, C14)		✓	✓					✓	✓	✓	✓	✓	✓	✓	✓
Vegetation clearing and grubbing		✓	✓					✓			✓	✓	✓	✓	✓
Demolition of buildings and/or structures		✓	✓					✓				✓	✓	✓	
Earthworks		✓	✓					✓	✓				✓	✓	

• Key activity and location[1]	Potential Impacts														
	Acid Sulfate Soils	Contamination	Erosion and sedimentation	Groundwater quality impacts	Groundwater Drawdown	Groundwater Treatment	Ground Movement	Impacts to Creeks and Waterways	Water table, water supply and water balance	Flooding	Increased BOD in surface water	Changes to pH in surface water	Increased turbidity in surface water	Increased runoff	Tannin generation
Construction of access roads, site entry and exit points, service connections,		✓	✓					✓					✓	✓	
Paving and sealing of surfaces		✓	✓					✓		✓	✓	✓		✓	
Establishment stockpile / laydown		✓	✓					✓					✓	✓	
Establishment fuel, chemical and hazardous material storage		✓	✓					✓				✓	✓	✓	
Establishment of sheds, staff amenities, workshop and other structures		✓	✓					✓				✓	✓	✓	
Operation of Civil Construction Compounds (C2, C9, C10, C11, C12, C13, C14)		✓	✓					✓	✓	✓	✓	✓	✓	✓	✓
Site Access		✓	✓										✓		
Deliveries		✓													

• Key activity and location[1]	Potential Impacts														
	Acid Sulfate Soils	Contamination	Erosion and sedimentation	Groundwater quality impacts	Groundwater Drawdown	Groundwater Treatment	Ground Movement	Impacts to Creeks and Waterways	Water table, water supply and water balance	Flooding	Increased BOD in surface water	Changes to pH in surface water	Increased turbidity in surface water	Increased runoff	Tannin generation
Car Parking		✓						✓		✓				✓	
Staff amenities									✓	✓				✓	
Stockpile/laydown		✓	✓					✓		✓	✓	✓	✓	✓	✓
Removal of spoil		✓	✓					✓					✓		
Construction of Kingsgrove motorway operations complex (MOC1)		✓	✓					✓		✓		✓	✓	✓	
Establishment of Support Compounds (C6)		✓	✓					✓	✓	✓	✓	✓	✓	✓	✓
Vegetation clearing and grubbing		✓	✓					✓			✓	✓	✓	✓	✓
Demolition of buildings and/or structures		✓	✓					✓				✓	✓	✓	
Earthworks		✓	✓					✓	✓				✓	✓	

• Key activity and location[1]	Potential Impacts														
	Acid Sulfate Soils	Contamination	Erosion and sedimentation	Groundwater quality impacts	Groundwater Drawdown	Groundwater Treatment	Ground Movement	Impacts to Creeks and Waterways	Water table, water supply and water balance	Flooding	Increased BOD in surface water	Changes to pH in surface water	Increased turbidity in surface water	Increased runoff	Tannin generation
Construction of access roads, site entry and exit points, service connections, enabling works		✓	✓					✓					✓	✓	
Paving and sealing of surfaces		✓	✓					✓		✓	✓	✓		✓	
Establishment laydown		✓	✓					✓					✓	✓	
Establishment fuel, chemical and hazardous material storage		✓	✓					✓				✓	✓	✓	
Establishment of sheds, staff amenities, workshop and other structures		✓	✓					✓				✓	✓	✓	
Operation of Support Compound (C6)		✓	✓					✓	✓	✓	✓	✓	✓	✓	✓
Site Access		✓	✓										✓		
Car Parking		✓						✓		✓				✓	
Staff amenities									✓	✓				✓	

• Key activity and location[1]	Potential Impacts														
	Acid Sulfate Soils	Contamination	Erosion and sedimentation	Groundwater quality impacts	Groundwater Drawdown	Groundwater Treatment	Ground Movement	Impacts to Creeks and Waterways	Water table, water supply and water balance	Flooding	Increased BOD in surface water	Changes to pH in surface water	Increased turbidity in surface water	Increased runoff	Tannin generation
Laydown		✓	✓					✓		✓	✓	✓	✓	✓	✓
Construction of Burrows Road motorway operations complex (MOC5)		✓	✓					✓		✓		✓	✓	✓	
General project wide construction works		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Tunnelling works across entire project including future M4-M5 Link stub tunnels		✓		✓	✓	✓	✓	✓	✓						
Mechanical and electrical systems fit-out		✓		✓		✓		✓							
Other earthworks and concrete works such as for establishment of air quality monitoring stations		✓	✓					✓	✓			✓	✓	✓	
Installation of permanent operational infrastructure across entire project such as ITS, tolling facilitie, lighting and roadside furniture		✓	✓												

• Key activity and location[1]	Potential Impacts														
	Acid Sulfate Soils	Contamination	Erosion and sedimentation	Groundwater quality impacts	Groundwater Drawdown	Groundwater Treatment	Ground Movement	Impacts to Creeks and Waterways	Water table, water supply and water balance	Flooding	Increased BOD in surface water	Changes to pH in surface water	Increased turbidity in surface water	Increased runoff	Tannin generation
Weed Treatment including herbicide spraying		✓						✓			✓	✓			
Onsite use of fuels and chemicals		✓						✓				✓			
Testing and commissioning – such as permanent water treatment plant and fire fighting systems		✓	✓					✓	✓	✓	✓	✓	✓		
Finishing work (including landscaping, asphalting, line marking and signage installation) and demobilisation.		✓	✓					✓	✓	✓					

Notes:

1 Refer earlier Section 5 for information on environmental matters such as soils, PASS/ASS, GDEs, and watercourses.

7. Mitigation and Management Actions

7.1 Summary

Measures to manage soil impacts and reduce the risk of impact to water quality are implemented prior to and during works. Elimination of the hazard is the first preference of control, followed by engineering, then administrative controls. Controls and actions to manage and mitigate environmental impacts for this project and will be implemented are identified in Table 12. These controls include the relevant conditions of approval and revised environmental management measures identified SPIR.

Mitigation measures that require consultation will align with the outcomes of that consultation unless otherwise agreed by the Secretary.

Table 12: Project controls associated with management of soil and water quality

Reference	Control / Action	Timing	Responsibility	Source
General				
G1	Erosion and Sediment Control Plans (ESCPs) will be prepared in accordance with the Blue Book Volumes 1 and 2D (Landcom, 2004 and DECC, 2008) for each specific stage or parcel of work prior to commencing construction in consultation with construction staff. These will be updated as required. ESCPs will be signed off by the Environment Advisor and Site Supervisor (or their representatives).	Pre-construction Construction	EM, SS, PE	CoA D3 EPL O4.8 REMM GW11 REMM SW03
G2	Works in watercourses and creeks will be planned in consultation with relevant Government Agencies and will be consistent with relevant guidelines. Environmental work method statements (EWMS) will be prepared before construction commences.	Design Pre-construction Construction	EM	CoA D3 CoA B21 CoA B22 REMM SW16 REMM B12 REMM B13
G3	Erosion and sediment controls will be installed in accordance with the Blue Book at all sites associated with construction activities. Where sediment basins cannot be reasonably constructed to Blue Book standards, alternative solutions will be employed with an enhanced focus on erosion control.	Design Pre-construction Construction	DM, EM, SS, PM	CoA D3 EPL O4.8 REMM SW03
G4	The Environment Manager or their representative will monitor weather conditions and forecasts (including rainfall prediction maps) daily and communicate relevant information to the construction teams to allow for adequate Planning for significant rain events. Resulting actions are the implementation of project controls such as R1, R2, R3.	Pre-construction Construction	EM	CoA D3
G5	Relevant documentation and systems for recording erosion and sediment control activities will be implemented including: • Environmental Inspection Checklist;	Pre-construction Construction	EM	CoA D3 EPL O4.9, O4.10 REMM GW11

Reference	Control / Action	Timing	Responsibility	Source
	• ESCP updates and amendments; • Site notes distributed between environmental and construction personnel; and • Water-quality monitoring results (e.g. sediment basins, receiving waters).			REMM SW03
G6	Key management structures such as sediment traps and clean water diversions will be installed as early works to assist in effective site management. (I.e. prior to clearing and stripping) wherever practicable.	Pre-construction Construction	EM, PM	CoA D3 EPL O4.8
G7	Sufficient supplies of erosion and sediment control materials/products (e.g. sediment fence, gravel bags, geofabric) will be stored on site at all times. Storage locations will be provided in suitable location/s within the site compound(s).	Pre-construction Construction	EM, PE, SS	CoA D3 REMM SW03
G8	Each major construction worksite (where required) will be connected to mains sewer. During establishment temporary arrangements will use portable effluent tanks or temporary ablution facilities.	Pre-construction Construction	EM, PM	Good practice
G9	Water-efficient (AAA-rated minimum) fixtures will be used in kitchens and ablutions facilities.	Pre-construction Construction	EM, PM	Good practice
G10	Wherever feasible, rainwater tanks will be used to harvest water for onsite reuse.	Pre-construction Construction	EM, PM	Good practice
G11	CDS-JV will liaise with Councils to determine if they would like to receive treated discharges from sediment basins and construction water treatment plants for non-potable uses such as irrigation and supplementary water at adjacent lands (e.g. Sydney Park, Tempe Recreational Reserve, parks along the Cooks River, and Spring Street wetlands). This will subsequently reduce their demand for potable water.	Pre-construction	EM, PM	CoA B30 CoA D3 REMM GW07 REMM WM16
Training and Resources				
T1	Environmental issues and aspects will be included in the site induction process for this Project. This will include (although is not limited to): • The Project's Environmental policy • Objectives of the CEMP including the SWQSP; • Understanding of obligations under NSW legislation, plus specific Project approval and licensing requirements; • Identification of site-specific environmental constraints and sensitive areas (and Site Environment Plans); • Incident reporting and management procedures;	Pre-construction Construction	EM, PM	REMM SW12 REMM GW11

Reference	Control / Action	Timing	Responsibility	Source
	• Details of environmental procedures (e.g. de-watering, clearing. refueling etc); • Understanding of environmental controls to minimise impacts (including sediment/mud tracking onto roads); and • Requirement to maintain environmental controls and repair damaged controls.			
T2	An erosion and sediment control specialist (the project soil conservationist) will be engaged and retained for the Project duration to provide advice on erosion and sediment control and undertake regular inspections.	Pre-construction Construction	EM	EPL O4.8 REMM SW04
T3	Erosion and sediment control training will be provided to Project and Site Engineers, Environmental staff and Foremen, including the correct use and installation of mitigation measures, legislative requirements and responsibilities.	Pre-construction Construction	EM	Good practice
Sediment Control				
S1	Turbid construction runoff will be directed into surface control structures (sediment basins, and sumps, and temporary controls including sediment fences and other sediment traps). Where levels and construction conditions allow, syphons or similar gravity systems will be used to discharge sediment basins instead of using pumps. Any such system will be either removed or replaced with an adequate permanent drainage system at the completion of construction.	Construction	EM, SS	CoA D3 CoA D4 REMM SW04
S2	Sediment controls will be checked and maintained as necessary and after rain. Sediment basins will be de-watered within 5 days following the cessation of runoff into the basin and desilted when necessary.	Construction	EM, SS	CoA D3 EPL O4.5
S3	Sediment controls will only be removed after appropriate stabilisation of the upslope catchment is achieved. This will be detailed on ESCPs.	Construction	EM, PM, SS	CoA D3 REMM GW11
S4	De-watering and reuse of water will only occur in accordance with the Project Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035 – therein Water Discharge Flowchart (M5N-ES-FLC-PWD-0008))	Construction	EM, SS	CoA B30 CoA D3 CoA D67 REMM SW04 REMM WM16 REMM WM17
S5	Mulch bunds will not be used in concentrated flow areas or if they have the potential to result in tannin leachate into waterways.	Construction	EM, SS	CoA D3

Reference	Control / Action	Timing	Responsibility	Source
S6	Any bales (e.g. straw) used onsite for sediment and erosion control are to be weed-free.	Construction	EM, SS	CoA D3
S7	Control the tracking of mud and soil material onto local roads using shakers, rumble pads and/or wheel-washes.	Construction	EM, SS	CoA D3
Access Gates and Sediment Tracking Onto Roads				
E1	All vehicles leaving site will be required to ensure tyres, guards and drawbars are clear of excess sediment. Brushes and hoses will be provided at site gates, along with appropriate signage.	Construction	EM, SS	CoA D3
E2	Use wheel washes or sprays (where significant outloading of spoil will occur) and/or stabilised access points.	Construction	EM, PM	CoA D3 REMM SW04
E3	Wherever possible, stabilise truck loading circuits to minimise the amount of sediment picked up on tyres.	Construction	EM, PM	CoA D3 REMM SW04
E4	Use berms or other structures/devices at gates to keep separate ‘clean’ and ‘dirty’ water.	Construction	EM, PM	CoA D3
E5	Clean hardstands and roads as required using street sweepers and broom trucks.	Construction	EM, SS	CoA D3
E6	Conduct regular monitoring of vehicle egress points (daily inspection).	Construction	EM, SS	CoA D3
E7	Cover loads prior to exiting site.	Construction	PM, SS	CoA D3
Drainage Control				
D1	As much as possible, isolate ‘clean’ (offsite) run-on water from onsite construction area runoff (clean water diversion).	Construction	EM, SS	CoA D3 REMM SW04
D2	Outlets of culverts/pipes are to include appropriate energy dissipation structures (e.g. scour rock).	Construction	EM, PE	CoA D3 REMM SW04 REMM SW15

Reference	Control / Action	Timing	Responsibility	Source
Works in Watercourses or on Live Stormwater Lines				
W1	ESCPs are to dictate the specific controls to be used in and around works on watercourses or on live stormwater lines. Typical measures include: • Timing works for lower-risk periods wherever practicable; • Monitoring weather forecasts and taking appropriate action prior; • Minimising the extent of work and the amount of time of disturbance where possible; • Isolating work areas from natural flows where possible using steel plates, clean rock and other materials; • Stockpilies to be located outside of the riparian area and away from stormwater inlets; • Concrete washout, refueling and chemical storage at least 40m from waterways and 20m from stormwater pit inlets wherever possible; • Use of temporary ground covers in areas of concentrated flow to minimise erosion of exposed soils during rainfall; and • Completing and stabilising works as quickly as possible after works are completed.	Pre-construction Construction	EM, PM, SS, PE	CoA B21 CoA B22 REMM B12 REMM B13 REMM B14 REMM B15 REMM SW03 REMM SW04 REMM SW16
W2	Any temporary crossing points at waterways (if used) will be stabilised to minimise the risk of scour and will be constructed of clean rock or similar.	Construction	EM, SS	CoA B21 CoA B22 REMM B12 REMM B13 REMM SW04 REMM SW16
W3	Clean materials will be used in waterways as required to form dissipaters, piling platforms, create crossing points or line channels.	Construction	EM, SS, PEs	CoA B21 CoA B22 REMM B12 REMM B13 REMM SW04 REMM SW16

Reference	Control / Action	Timing	Responsibility	Source
W4	Stabilisation of waterways including their beds and banks is to be commenced as soon as possible following the completion of any works within these areas.	Construction	EM, PM, SS	CoA B21 CoA B22 REMM B12 REMM B13 REMM SW04 REMM SW16
Stockpiling				
P1	Stockpiles will be sited in low-hazard areas: – at least 20m clear of watercourses – not under the dripline of any retained trees – outside of the 20 year ARI flood extent if feasible Otherwise appropriate management controls such as bunding would be implemented and listed on a ESCP.	Construction	EM, SS	CoA D3 REMM WM12 REMM SW04 REMM B12 REMM B13 REMM B14 REMM B15
P2	Separate mulch, topsoil and subsoil, and stockpile them separately unless limited by site constraints. To protect it from degradation, erosion or mixing with fill or waste. With the intention that topsoil retains its productivity and is beneficially re-used on or nearby to the project or asset.	Construction	EM, SS	CoA D3
P3	Stockpiles will be positioned within the Project boundary and away from protected areas (e.g. native vegetation) wherever possible.	Construction	EM, SS	CoA D3
P4	Stockpiles would be located outside overland flow paths, and where left exposed and undisturbed for longer than 28 days, would be finished and contoured to minimise loss of material in flood or rainfall events. Materials which require stockpiling for longer than 28 days would be stabilised by compaction, covering with anchored fabrics, or seeded with sterile grass where appropriate.	Construction	EM, SS	CoA D3 REMM AQ17 REMM WM12
P5	Topsoil and mulch stockpiles will be constructed to no more than 3m in height where possible.	Construction	EM, SS	CoA D3
P6	Stockpiles will be battered down to no steeper than 2:1 (H:V) where space permits.	Construction	EM, SS	CoA D3

Reference	Control / Action	Timing	Responsibility	Source
P7	Dust suppression will be undertaken on stockpiles as required.	Construction	EM, SS	CoA D3
P8	Weeds within natural soils (such as topsoils) will be managed (e.g. sprayed) prior to stockpiling and as they appear in stockpiles.	Construction	EM, SS, PE	CoA D3
P9	Potential acid sulfate soil material will be managed as per the Acid Sulfate Soils Sub-Plan.	Construction	EM, PM	CoA D3
P10	Mulch stockpiles will be limited to 2.5 metres in height and 10 metres in any horizontal direction to reduce the likelihood of combustion or smoking.	Construction	EM, SS	REMM SW04
Clearing and Stripping Limitations				
A1	Relevant erosion and sediment control measures (e.g. sediment fences, haybales) will be implemented for each particular section of works prior to the commencement of any clearing, stripping or earthworks. These will be installed as per the relevant ESCP.	Construction	EM, SS	CoA D3 REMM B12 REMM B13 REMM SW04
A2	Clearing limits and work boundaries will be established and clearly defined prior to any construction, clearing or stripping works commencing.	Construction	EM, SS	REMM B12 REMM B13 REMM SW04
A3	All vegetation that is to be retained will be clearly delineated (e.g. marking tape).	Construction	EM, SS	REMM B12 REMM B13 REMM SW04
A4	Where practicable, land clearing of will occur progressively and will be limited to only that which is required and the areas associated with the current section/stage of works.	Construction	EM, SS	REMM B12 REMM B13 REMM SW04
A5	Watercourses and adjacent (riparian) areas will be left undisturbed as much as possible. Where watercourses and adjacent (riparian) areas are to be disturbed implement project controls such as G2.	Construction	EM, SS	REMM B12 REMM B13 REMM B14 REMM SW04

Reference	Control / Action	Timing	Responsibility	Source
				REMM SW13
A6	Grasses and understorey species will be left undisturbed during tree removal works wherever possible (especially in and around watercourses).	Construction	EM, SS	REMM B12 REMM B13 REMM SW04
Other Erosion Controls				
O1	Slope lengths will be maintained at appropriate lengths to slow flows down and minimise erosion.	Construction	EM, SS	CoA D3
O2	Temporary diversions will be implemented during construction to divert 'clean' offsite run-on so it doesn't come into contact with disturbed soils or sediment.	Construction	EM, SS	CoA D3
O3	Geotextile linings, soil binders, tarps or similar will be used to provide temporary surface protection where appropriate (e.g. batter drains, fills, cut faces).	Construction	EM, SS	CoA D3
O4	Use geotextile linings, black plastic, organic fibre matting, rock or similar to provide temporary surface protection in areas of concentrated flows (e.g. batter drains, piling platforms etc) or in areas where sediment basins are required or are desirable to meet water quality objectives but cannot be provided due to space restrictions / current activities. Alternative erosion control measures should be selected consistent with Managing Urban Stormwater – Soils and Construction Vols 1 and 2, 4th Edition (Landcom, 2004) and advice from the Project Soil Conservationist.	Construction	EM, SS, PE	CoA D3
O5	The extent and time of soil exposure will be minimised as much as possible.	Construction	EM, SS	CoA D3
Prior to Rainfall				
R1	Prior to forecast rainfall events 20mm, end-of-day controls will be implemented throughout the worksite to help reduce erosion and control sediment. These will be listed on the ESCP and may include one or more of the following: • Check dams • Slope breaks; • Batter chutes; • Fill windrows; and • Temporary ground covers.	Construction	EM, SS, PE	EPL O4.9 REMM SW04
R2	Prior to forecast heavy rainfall (>20mm), the site will be inspected to identify any areas requiring additional management measures, such as; ○ Dewatering sediment basins and/or water holding tanks to lower water level	Construction	EM	EPL O4.9 REMM SW04

Reference	Control / Action	Timing	Responsibility	Source
	○ Place additional line of sediment fencing, gravel bags/coir logs, sand bags, sediment traps ○ Construct additional clean stormwater catch drains, soup drains, slope breaks, diversions			
R3	Sediment basins will be installed and maintained in accordance with the blue book.	Construction	EM, SS, PE	CoA D3 EPL O4.8, O4.9 REMM SW04
Site Inspection and Maintenance of Controls				
I1	The EM (or their representative) will inspect all environmental control measures across the site at least weekly, prior to forecast rainfall of 20mm and within 24 hours of rainfall causing runoff (if safe to do so), and prior to any site shut-down/closure greater than 24 hours. Records of these inspections will be kept and appropriate action taken to repair any damage, maintain (clean out) controls and/or install additional controls as required.	Construction	EM	EPL O4.9, O4.10 REMM GW11
I2	Repair any damage to erosion and sediment controls as soon as possible.	Construction	EM, SS	CoA D3 REMM GW11
I3	Sediment controls will be cleaned out as required after rainfall. Sediment will be visually inspected for contaminants; if clean returned to the source location and secured from erosion, if contaminated disposed of to a suitably licensed facility. Contaminants that may be visually identified include oil, grease and hydraulic fluid.	Construction	EM, SS	CoA D3 REMM GW11
I4	Concrete wash out points; • are not to be used once full • usage is to be supervised by foreman/leading hands • will be regularly inspected by environment team • must be regularly cleaned out (and handled in accordance with the POEO Waste Regulation.	Construction	EM, SS	Good practice
Site Stabilisation and Rehabilitation				
V1	Undertake progressive stabilisation of ground surfaces.	Construction	EM, SS, PE	CoA D3 REMM B12 REMM B13 REMM SW04
V2	Progressively revegetate disturbed areas utilising appropriate species in those areas to be revegetated.	Construction	EM	CoA D3

Reference	Control / Action	Timing	Responsibility	Source
				REMM B12 REMM B13 REMM SW04
V3	Stabilisation of waterways including their beds and banks is to be commenced as soon as possible after the completion of any works within these areas and will be in accordance with the relevant guidelines.	Construction	EM, SS, PE	CoA D3 CoA B21 REMM B12 REMM B13 REMM SW04 REMM SW16
V4	Re-spread topsoil over completed areas prior to revegetating. Ensure topsoil is properly keyed with subsoil, especially on slopes, to avoid slippage/slumping.	Construction	EM, SS, PE	CoA D3 REMM SW04
V5	Temporary ground covers such as hydraulic soil stabilisers (e.g. Vital Bon-Matt Stonewall or Gluon) or geotextile fabric will be used where feasible to stabilise batters, stockpiles and large surface areas.	Construction	EM, SS, PE	CoA D3 REMM SW04
V6	Sediment controls such as basins are to remain in place until their upslope catchment is stabilised as per the Blue Book (Landcom, 2004).	Construction	EM, SS, PE	CoA D3 REMM SW04 REMM GW11
V7	Revegetated areas will be maintained as required.	Construction	EM, SS, PE	CoA D3 REMM SW04
Chemicals, Fuels, Hazardous Materials and Concrete Use				
C1	Hazardous substances will be stored onsite in their original labelled receptacles only.	Construction	EM, SS	CoA D55 CoA D67 REMM SW12 REMM HR02 REMM HR03 REMM GW11

Reference	Control / Action	Timing	Responsibility	Source
				REMM CM13
C2	All hazardous substances will be clearly labelled and will have Safety Data Sheets affixed or available nearby.	Construction	EM, SS	CoA D55 CoA D67 REMM SW12 REMM GW11 REMM CM13 REMM HR03
C3	All hazardous substances, including any dangerous goods as defined by the Australian Dangerous Goods Code, must be stored and handled in accordance with: • Work Health and Safety Act 2011 (NSW) • All relevant Australian Standards including AS 1940-1993 – The Storage and Handling of Flammable and Combustible Liquids. • Storage and handling of Dangerous Goods Code of Practice (WorkCover NSW 2005) • For liquids, a bund sized to 110% of the largest stored receptacle will be established around any storage area for hazardous substances. • OEH and EPA guidelines for bunding and spill management including the Environment Protection Manual for Authorised Officers: Bunding and Spill Management, and Storing and Handling Liquids: Environmental Protection, Participants Manual (DECC 2007) • Suppliers instructions. In the event of inconsistency of any of the above, the most stringent requirement is to prevail.	Construction	EM, SS, PM	CoA D55 CoA D67 REMM SW12 REMM GW11 REMM CM13 REMM HR02 REMM HR03 REMM HR04
C4	An up-to-date register of hazardous substances will be kept onsite at all times.	Construction	EM, SS	CoA D55 CoA D67 REMM SW12 REMM CM13
C5	Hazardous substances will only be used onsite as required, in accordance with the manufacturer/supplier instructions.	Construction	EM, PM	CoA D67 REMM SW12 REMM GW11

Reference	Control / Action	Timing	Responsibility	Source
C6	Any hazardous substances with the potential to impact water quality will be assessed by the Environment Team to determine what environmental safeguards or procedures are required for that substance to minimise the risk of environmental harm.	Construction	EM, PM	CoA D67 REMM SW12 REMM CM13
C7	The use of any hazardous substance that could result in a spill will be undertaken away from drainage or stormwater lines and, wherever possible, within defined bunds.	Construction	SS	CoA D55 CoA D67 REMM SW12 REMM CM13
C8	Any refuelling or concrete washout undertaken on site shall be undertaken at least 40m from waterways and 20m from stormwater pit inlets wherever possible.	Construction	EM, SS	CoA D55 CoA D67 REMM SW12 REMM GW11 REMM CM13
C9	All spills or leakages will be immediately contained and absorbed.	Construction	EM, SS	CoA D55 CoA D67 REMM SW12 REMM GW11 REMM CM13
C10	In the event of a spill the Spill Management Procedure will be implemented. Emergency spill kits will be kept onsite and Project personnel would be aware of the location of spill kits and trained in their use.	Construction	EM, SS, PM	CoA D55 CoA D67 REMM SW12 REMM GW11 REMM CM13
C11	Environmental incidents where material harm to the environment is caused or threatened will be managed in accordance with the Project Incident Response Plan (including the Pollution Incident Response management Plan).	Construction	EM, PM	POEO Act CoA D55 CoA D67 REMM SW05 REMM SW12

Reference	Control / Action	Timing	Responsibility	Source
				REMM GW11 REMM CM13
C12	Bunds shall be provided around activities such as vehicle refuelling, servicing, maintenance or wash-down, where there is a potential for spills and contamination. Where refuelling occurs outside bunded areas, specific refuelling procedures would be in place and operators would be trained in these procedures. Spill kits would be readily available to manage re-fuelling outside bunded areas.	Construction	PM, PE, SS	CoA D55 CoA D67 REMM SW12 REMM GW11 REMM HR05 REMM CM13
C13	Material Safety Data Sheets will be obtained for dangerous goods and hazardous substances stored onsite prior to their arrival.	Construction	PE, SS	CoA D55 CoA D67 REMM SW12 REMM HR06 REMM CM13
C14	Notify SafeWork NSW of hazardous chemicals that are used, handled or stored, in quantities greater than the manifest level, as detailed in Schedule 11 of the WHS Regulation.	Pre-construction Construction	PM, PE	WHS Regulation CoA D55 CoA D67 REMM SW12 REMM HR03 REMM CM13
C15	Transport of dangerous goods and hazardous substances will be conducted in accordance with relevant legislation and codes including the Dangerous Goods (Road and Rail Transport) Regulation 2014 and the Australian Code for the Transport of Dangerous Goods by Road and Rail (National Transport Commission, 2008).	Construction	PM, PE	CoA D55 CoA D67 REMM SW12 REMM HR07 REMM CM13
C16	The storage of fuels and chemicals would be limited to locations more than 40 metres from any water course.	Construction	PE, SS	CoA D55 CoA D67

Reference	Control / Action	Timing	Responsibility	Source
				REMM SW12 REMM GW11 REMM CM13
C17	Vehicles would be properly maintained to minimise the risk of fuel/oil leaks and routine inspections of construction equipment would be undertaken to identify any fuel/oil leaks and repairs made as necessary.	Construction	Plant Manager	CoA D55 CoA D67 REMM SW12 REMM GW11 REMM CM13
Flood Management				
F1	Bunds, diversions or similar will be used at tunnel portals to limit the potential for floodwaters to enter tunnels.	Construction	PM	REMM FD14 REMM FD16
F2	The rainfall forecast will be monitored to identify and communicate the risk of potentially flooding rains.	Construction	EM, PM	REMM FD14 REMM FD16
F3	In areas affected by overland flows, Plan, implement and maintain measures to intercept concentrated flows and divert them in a controlled manner through or around construction facilities. Ensuring that the diversion does not worsen existing flooding characteristics within and in the vicinity of the SSI boundary during construction and operation.	Construction	EM, SS, PE	CoA B23 REMM FD14 REMM FD16
F4	Stage temporary work over Alexandra Canal to minimise the duration of construction activities and remove temporary facilities as soon as practicable.	Construction	PM	Good practice
F5	Locate spoil sites away from frequently inundated, flood-prone or riparian areas.	Construction	PM	REMM FD14 REMM FD16
F6	Minimise the time of stockpiling and footprint in areas subject to potential flooding or overland flow.	Construction	PM, SS	REMM FD14 REMM FD16
F7	Ensure construction equipment and materials are removed from flood-prone areas when works are completed or when there is significant potential for flooding.	Construction	EM, PM, SS	REMM FD14 REMM FD16

Reference	Control / Action	Timing	Responsibility	Source
F8	Plan for floor levels to be above known flood heights.	Design Pre-construction Construction	DM, PM, PE	REMM FD14 REMM FD16
Groundwater Inflows				
B1	Groundwater will be tested for a range of parameters including pH, organic compounds, hydrocarbons and dissolved metals.	Construction	EM	CoA D68 REMM SW04 REMM CM13
B2	Groundwater captured in the tunnel will be pumped to and treated by a Water Treatment Plant prior to release. Construction Water Treatment Plants are to be located at: • Commercial Road Compound (C3); • Bexley Road North Compound (C4); • Arncliffe Compound (C7); and • Canal Road Compound (C8).	Construction	EM	CoA D68 REMM SW04 REMM CM13 REMM GW05
B3	Tunnels will be managed in a manner to reduce the impact of groundwater inflows and limit inflows as much as possible.	Construction	PM, PE	CoA B26 CoA D68 REMM SW04 REMM CM13
B4	Reuse or discharge of water will be in accordance with the Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035). Water from the water treatment plants can potentially be reused: • Onsite for dust suppression and irrigation; • Reused in tunnel if acceptable biological and chemical quality; • Other reuse if suitable, such as washwater or mix water for concrete; and • In event of emergency for fire suppression either on premises and/or off premises.	Construction	EM, PM	CoA B30 CoA D3 CoA D67 CoA D68 REMM SW04 REMM CM13 REMM GW07 REMM WM16 REMM WM17
B5	DPI (Water) to be notified immediately of any groundwater bores removed or damaged by the project. Unless otherwise advised by DPI (Water), any groundwater bores lost or damaged due to construction will be repaired or replaced.	Construction	PM, PE	CoA D5 CoA D68
Alexandria Landfill – leachate water treatment plant				

Reference	Control / Action	Timing	Responsibility	Source
AL1	Leachate and other contaminated water collected by the Alexandria landfill leachate collection system would be directed to the existing and/or new leachate treatment plant. Discharge will be to trade waste sewer in accordance with Sydney Water trade waste agreement.	Construction	EM, SS, PE	CoA D68 REMM SW04
Contamination				
X1	Unexpected find of potential contamination will be managed in accordance with the Manage Contaminated Land Procedure (M5N-ES-PRC-PWD-0036).	Pre-construction Construction	EM, SS, PE	CoA D67 CoA D68 CoA D54 REMM SW04 REMM WM18
X2	Unexpected finds of Acid Sulfate Soils encountered during works will be managed in accordance with the Manage Acid Sulfate Soils Procedure (M5N-ES-PRC-PWD-0038).	Pre-construction Construction	EM, SS, PE	CoA D67 CoA D68 CoA D54 REMM SW04 REMM SW10

CRM Community Relations Manager; DM – Design Manager; EA – Environmental Advisor; EM – Environmental Manager; PE – Project Engineer; PM – Project Manager; SS – Site Supervisor

7.2 Sediment Basins

The requirement for sediment basins will be assessed for each site depending on:

- Area of disturbance;
- Erosion risk;
- Slope and topography; and
- Available space.

These basins will be designed and operated consistent with *Managing Urban Stormwater – Soils and Construction Vols 1 and 2, 4th Edition* (Landcom, 2004). Where sediment basins are required or are desirable to meet water quality objectives but cannot be provided (or cannot be provided to the required size) due to space restrictions or activities at the location, alternative sediment control measures will be developed in consultation with the Soil Conservationist and will be used along with a suite of compensatory erosion and drainage control measures. Measures to be considered include those detailed in *Managing Urban Stormwater – Soils and Construction Vols 1 and 2, 4th Edition* (Landcom, 2004) such as:

- Geotextile lining, black plastic, organic fibre matting, rock or similar to provide temporary surface protection in areas of concentrated flows;
- grass swales, sediment traps;
- low point sumps, sedimentation tanks; and
- clean water diversions eg catch drains.

For sediment basins, when rainfall received within a 5 day period exceeds the design storm event for that basin, it is expected that sediment basins may discharge by over-topping an emergency discharge point. In the event of an overflow during a storm event exceeding the sedimentation pond design capacity the pond and other sediment controls will reduce the volume of sediment in discharge which would be entering waterways at high flow.

7.3 Groundwater Management

Groundwater inflows into tunnels and excavations will be managed via a water treatment Plant and reused or discharged to the receiving environment. As part of this process:

- Groundwater will be tested for a range of parameters including pH, organic compounds, hydrocarbons and dissolved metals;
- Groundwater captured in the tunnel will be pumped to and, as required, treated via a Water Treatment Plant prior to release;
- Groundwater quality monitoring, reuse and discharge criteria are described in the Water Quality Plan and Monitoring Program; and
- Groundwater chemical and elevation triggers and their associated responses are listed in the Water Quality Plan and Monitoring Program.

7.4 Alexandria Landfill Leachate Water Treatment Plant

Contaminated stormwater and/or landfill leachate will be directed to the Leachate Treatment Plant (LTP). Discharge will be in accordance with a Trade Waste Agreement with Sydney Water to sewer.

Contingency measures to address leachate management at the Alexandria Landfill during construction are listed in the St Peters Interchange - Landfill Closure Management Plan (M5N-GOL-TER-900-116-0012). Works at the St Peter's Landfill site also include the construction of a cut-off wall that will reduce groundwater flows toward this site (refer to the St Peters Interchange - Landfill Closure Management Plan).

7.5 Surface Water Reuse and Discharge

Water will be discharged from the Project premises to ensure that sufficient storage capacity is available in sediment basins/traps or where water has been detained after wet weather. Where practicable, such water will be reused onsite (e.g. dust suppression, watering retained vegetation, cooling).

Testing and, where necessary, treatment of any construction water will be undertaken in accordance with Section 5.1 of the Water Quality Plan and Monitoring Program (M5N-ES-PLN-PWD-0027, Temporary Sediment Basins water quality discharge criteria) and will be carried out prior to discharge. Refer also to the Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035) which contains both a template for the Permit to Dewater (M5N-ES-PER-PWD-0001) and the Water Discharge Flowchart (M5N-ES-FLC-PWD-0008).

Water quality monitoring prior to discharge will be undertaken in accordance with the EPL conditions associated with the licensed discharge points and the Manage Soil and Water Procedure (M5N-ES-PRC-PWD-0035).

Testing and treatment can occur within sediment basins, an excavation or in a sealed container(s). Prior to any discharge offsite or reuse onsite the Environment Team is to sign off that the water is suitable for the proposed reuse or discharge on the Permit to Dewater (M5N-ES-PER-PWD-0001).

In accordance with the EPLs, laboratory testing will be undertaken in conjunction with field testing initially to establish a correlation between TSS and turbidity (NTU). Multiple correlations may be developed depending on the discharge locations. Once the correlation is established, NTU measurements will be undertaken to demonstrate that TSS is below the site discharge criteria.

Discharges from the site will be pumped (or where the geographic conditions allow, syphoned) to the receiving waters (i.e. to adjacent waterways or stormwater systems) unless a suitable alternative receiver can be identified**.**

7.6 Water Quality Monitoring

The Water Quality Plan and Monitoring Program (WQP&MP; M5N-ES-PLN-PWD-0027) details the water quality monitoring to be implemented during the construction of the project to monitor potential impacts to downstream receiving waters. The WQP&MP describes water quality triggers for both surface water and ground water and gives appropriate management responses should one or more of those triggers be activated.

The Water Quality Plan and Monitoring Program (WQP&MP; M5N-ES-PLN-PWD-0027) will be used to monitor the effectiveness of the action and measures for managing soil and water impacts. The WQP&MP details how often this monitoring would be undertaken, the locations where monitoring will take place, how the results of the monitoring would be recorded and reported, and the process by which, if any, non-conformance will be addressed.

The specific mitigations measures identified in Table 12 of this CSWQSP will be monitored and reported on as per Table 14 of this CSWQSP. Any changes to the mitigation measures will be in accordance with Section 10 of this CSWQSP and may also be as a result of monthly reporting findings.

7.7 Water Quality Pond No. 2

It is noted that the Water Quality Pond No.2 is located with the Wolli Creek catchment at Kingsgrove and not at Arncliffe.

The Water Quality Pond No.2 at Kingsgrove requires decommissioning due to conflicts with the cut and cover tunnel alignment at the Motorway Operations Complex at this site. Replacement water quality devices will be installed and operational prior to decommissioning.

CDS-JV has established and is implementing the following process:

- The scope of the Early Works Design package has been prepared and includes a design item for replacement devices or solutions and the associated commissioning;
- Develop the detailed design for the Early Works Design package; and
- Construction (implementation) of the Early Works Design package.

Following this process will ensure that the replacement devices are operational prior to decommissioning of the existing pond. This will also be tracked through the compliance tracking program and documented in the quarterly construction compliance report.

8. Monitoring

Inspections, observations, and monitoring requirements relevant to the management of soils and water quality are identified in Table 13.

Table 13: Monitoring requirements relevant to management of soil and water quality

Item	Frequency	Standards	Reporting	Responsibility
Inspections				
Pre-work inspection	Prior to ground disturbing activities in new worksite to be exposed	Appropriate controls are installed in accordance with the ESCP.	Environment Inspection Checklist Land Disturbance Permit	Environmental Advisor
Site inspection	Daily	No mud tracking off-site; check main exit/entry points and material on public roads Haul road integrity to be maintained	Site Supervisors Daily Diary	Site Supervisor
Site inspection	Prior to Project-wide shut down of greater than 96 hours	Installed erosion and sediment controls are effective	Environment Inspection Checklist	Environmental Advisor
Site inspection	Weekly	Compliance with the requirements of this Plan and RMS G38	Environment Inspection Checklist	Environmental Advisor
Observations by Management (CEMP Expectation 3.4)	Monthly	Compliance with the requirements of this Plan	Management Inspection Checklist	Project Manager
Event based inspections	To be conducted after receiving >20mm over a 24hr period at active exposed work sites	Installed erosion and sediment controls are effective	Environment Inspection Checklist	Site Supervisor Environmental Advisor
Monitoring				
Weather monitoring	Daily	Rainfall	Environment Advisor to report to Site Supervisor	Environmental Advisor

Item	Frequency	Standards	Reporting	Responsibility
Prevailing wind and rainfall conditions and weather forecast from Bureau of Meteorology to be reviewed.	Daily	Extreme weather: Winds >25 km/hr Rain >20mm over a 24hr period	Environment Advisor to report to Site Supervisor	Environmental Advisor
Construction sediment basin water quality prior to offsite discharge	Prior to Planned discharge	Tested, treated, discharged, recorded and reported to meet the requirements of Project EPLs.	Permit to discharge	Environmental Advisor
Construction Water Treatment Plant water quality prior to offsite discharge	Prior to Planned discharge	Tested, treated, discharged, recorded and reported to meet the requirements of the Project EPLs.	Permit to discharge	Environmental Advisor

9. Reporting

Reporting requirements relevant to the management of soils and water quality are identified in Table 14.

Table 14: Reporting requirements relevant to management of soil and water quality

Item	Frequency	Standards	Reporting	Responsibility
Surface and groundwater water quality monitoring at nominated locations.	Biannually	Monitoring will be conducted, recorded and reported in accordance with Section 8 of the Water Quality Plan and Monitoring Program (M5N-ES-PLN-PWD-0027)	Secretary of DP&E, EPA, OEH, DPI Water, DPI (Fisheries) and the relevant Council;	Environmental and Sustainability Manager
Project monthly reports	Monthly	As per reporting requirements and responsibilities documented in the CEMP. Reporting on Soil and Water targets and compliance with this Plan and the relevant legislative requirements and CoA;	RMS/SMC	Environmental and Sustainability Manager

For incident management and emergency management process refer to Element 9 Incident Management, Element 10 Emergency Planning and response of the CEMP.

10. Review and Improvement

10.1 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 Element 12 of the CEMP.

10.2 Record management

All documents and records referred to within and required to implement the CEMP (including the plan and relevant sub-plan) will be controlled and maintained according to the project's Records Management Plan.

Environmental documents may include, but are not limited to:

- CEMP and sub-plans;
- Procedures and protocols; and
- Checklists, forms and templates.

Environmental records relevant to the CSWQSP may include, but are not limited to:

- All monitoring, inspection and compliance reports / records. For samples required to be collected for the purposes of the EPL, the following records will be maintained:
  - the date(s) on which the sample was taken;
  - the time(s) at which the sample was collected;
  - the point at which the sample was taken; and
  - the name of the person who collected the sample;
- Reports on environmental incidents, other environmental non-conformances, complaints and follow-up action;
- Minutes of the CEMP and construction environmental management system review meetings and any resulting actions;
- Results of internal and external audits.

All records required to be kept by the EPL licence will be:

- in a legible form, or in a form that can readily be reduced to a legible form;
- kept for at least 4 years after the monitoring or event to which they relate took place; and
- produced in a legible form to any authorised officer of the EPA who asks to see them.

The minimum document retention periods beyond practical completion for environmental documents and records are described in Records Management Plan and will consider the EPL monitoring requirements M1.

10.3 Non-conformance management, corrective and preventative action

Environmental inspection, observation and monitoring results are interpreted to identify actual and potential non-conformances and events that may result in nuisance, environmental harm and unacceptable loss of amenity or community complaints. The Environmental Representative, WCX M5 AT Representative and/or a public authority may also raise a non-conformance or improvement notice.

Where non-conformances are identified during regular inspections, corrective actions are raised, tracked and closed out through the inspection records if the actions can be closed out without 72 hours. All other nonconformances are recorded and reported as incidents in Synergy.

Following the identification of a non-conformance, corrective and/or preventative actions will be identified and assigned to the appropriate person with set timeframes. Timeframes will be set to ensure any damage incurred is rectified and any chance of recurrence is eliminated as soon as practicable. Synergy will be used to assign, track and close out corrective actions (except for those actions identified, tracked and closed out within 72 hours through inspection records). All corrective

actions will include reference to the relevant incident record for ease of tracking. Refer to Element 3 and Element 9 of the CEMP.

10.4 Complaints

Complaints will be recorded in accordance with the Construction Complaints Management System. Information to be recorded will include location of complaint, time(s) of occurrence of alleged air quality impacts and perceived source. Resident complaints will be responded to in a timely manner and action taken recorded in accordance with the Construction Complaints Management System.

10.5 Revision of this plan

Continual improvement is achieved through constant measurement and evaluation, audit and review of the effectiveness of the plan, and adjustment and improvement of the Construction Environmental Management Plan, project environmental outcomes and CDS-JV Environmental Management System. Monthly reviews undertaken by the Environmental Representative and six-monthly management reviews provide specific opportunities to identify improvements in the environmental management system and/or this CSWQSP.

This plan will be updated as required:

- As a result of any investigations into any exceedances or non-conformances that determine changes to this plan are required to prevent reoccurrences;
- To take into account changes to the Environment or generally accepted environmental management practices, new risks to the Environment, any Hazardous Substances, Contamination or changes in Law;
- Where requested or required by the NSW Department of Planning and Environment or any other Authority; or
- In response to internal or external audits or quarterly management reviews.

The updated plan must be endorsed by the Environment and Sustainability Manager and approved internally by the Project Director. Minor changes may be approved by the Environmental Representative. Minor changes would typically include those that:

- Are editorial in nature (e.g. staff and agency/authority name changes);
- Do not increase the magnitude of impacts on the environment when considered individually or cumulatively;
- Are in response to audit findings or periodic reviews; or
- Do not comprise the ability of the project to meet approval or legislative requirements.

Where the Environmental Representative deems it necessary, the CSWQSP will be provided to relevant stakeholders for review and comment if required and forwarded to the Secretary of DP&E for approval. Revisions to the plan will be provided to the Project Company for review upon request by the Project Company prior to submission to stakeholders or the NSW Department of Planning and Environment.

Where approval of the Secretary of DP&E is not required, a copy of the updated plan will be provided to the Secretary for information.

Appendices

Appendix A: Acid Sulfate Soils Sub Plan

Acid Sulfate Soils Sub-Plan

Project Name: WestConnex New M5

Project number:	15.7020.2597
Document number:	M5N-ES-PLN-PWD-0031
Revision date:	10/06/2016
Revision:	02

Document Approval

Rev.	Date	Prepared by	Reviewed by	Recommended by	Approved by	Remarks
00	29/04/16	CDS-JV				
01	25/05/16	CDS-JV				
02	10/06/16	CDS-JV				
Signature:						

Details of Revision Amendments

Document Control

The Project Director is responsible for ensuring that this Plan is reviewed and approved. The Support Services Director (SSD) is responsible for updating this Plan to reflect changes to the Project, legal and other requirements, as required.

Amendments

Any revisions or amendments must be approved by the Project Director before being distributed or implemented.

Revision Details

Revision	Details
00	Prepared for internal review
01	Issued for DP&E Approval
02	Revised to address DP&E comment

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1. Purpose and Scope

The purpose of this Acid Sulfate Soils Sub-Plan (ASSSP) is to outline the management measures for handling, treatment and disposal of Acid Sulfate Soils (ASS). This Sub-Plan will act in accordance with the:

- Construction Contaminated Land Management Plan (M5N-ES-PLN-PWD-0033);
- Construction Soil and Water Management Sub-Plan (M5N-ES-PLN-PWD-0005);
- CDS-JV Manage ASS Procedure (M5N-ES-PRC-PWD-0035); and
- CDS-JV Manage Contaminated Land Procedure (M5N-ES-PRC-PWD-0036).

1.1 Acid Sulfate Materials

The following sections provide an overview of types of Acid Sulfate Materials (ASMs).

1.1.1 Acid Sulfate Soils (ASS)

Acid sulfate soils (ASS) are naturally occurring sediments that are deposited under estuarine conditions.

They contain iron sulfides and when they are exposed to oxygen via dewatering or removal from beneath the water table they are prone to releasing poor quality water that contains significant loadings of acidity, sulfate salinity and metals.

ASS are widespread along the NSW coast. ASS are generally found in estuaries, mangrove flats, salt marshes tea-tree swamps and beneath low lying coastal floodplains, including farmland and urban areas. As such, ASS areas are usually less than 5 metres Australian Height Datum (m AHD).

1.1.2 Monosulphidic Black Ooze (MBO)

Monosulphidic Black Ooze is black coloured mud rich in the amorphous iron mono-sulfide FeS. MBO is often formed in ASS environments or coastal stormwater drainage systems, canals and water ways where conditions favour anaerobic bacteria and there is a significant influx of sulfate rich tidal water, dissolved iron and nutrients. FeS reacts with oxygen very rapidly and thus exposure of MBO to oxygen rich water can result in significant anoxia, acidification and release of elevated concentrations of metals and metalloids

1.1.3 Acid Sulfate Rock (ASR)

Acid sulfate rock (ASR) is rock material that contains a range of metal sulfide minerals. Elevated concentrations are generally associated with metalliferous ore deposits and coal units but can also occur in other forms such as uplifted marine sedimentary rocks and wind driven sediments containing pyrite. When fresh pyrite containing rock is disturbed and exposed to air and water its can produce significant loadings of acidity, sulfate salinity and metals and metalloids. The finer the particle size distribution of the rock, the greater the rate and severity of sulfide oxidation.

1.2 Objectives and targets

The key objective of the ASSSP is to ensure appropriate management measures are implemented to manage acid sulfate soils and water quality impacts during construction of the project. To achieve this objective, the targets in the Construction Soil and Water Management Sub-Plan (M5N-ES-PLN-PWD-0005) have been established.

1.3 Training

All personnel, including employees, contractors and sub-contractors, are required to complete a Project induction containing relevant environmental information before they are authorised to work on the Project. Soil and Water Management specific information will be covered in the Project induction.

Relevant personnel including Leading Hands, Supervisors, Superintendents, Environmental Coordinators and Engineers will receive training and ongoing toolbox talks on:

- Project obligations including requirements to assess and manage acid sulfate soils on site;
- Responsibilities pertaining to the management of acid sulfate soils under the Contaminated Land Management Act 1997 and the Protection of the Environment Operations Act 1997; and
- Responsibilities under the Acid Sulfate Soils Manual (ASSMAC, 1998).

Training requirements are detailed within the CEMP, Part B Element 7.

2. Legal and Other Requirements

This section provides the relevant legislation and Project requirements that apply to acid sulfate soils aspects of construction.

2.1 Legislation

Legislation relevant to acid sulfate soils for the project includes:

- *Contaminated Land Management Act 1997*; and
- *Protection of the Environment Operations Act 1997*.

2.2 Ministers Conditions of Approval

Project approval has been granted and issued with Conditions of Approval (CoA).

Conditions of Approval that specifically address the management of acid sulfate soils are identified in Table 1.

Table 1: Conditions of Approval that address management of acid sulfate soils

Reference	Requirement	Where addressed
D68	(f) a **Construction Soil and Water Management Plan** to manage surface and groundwater impacts during construction of the SSI. The Construction Soil and Water Management Plan must be developed in consultation with DPI (Water), and the relevant councils, and include, but not be limited to -	Construction Soil and Water Quality Sub-plan (M5N-ES-PLN-PWD-0005)
	(v) where acid sulfate soils are known to occur or potentially occur, an **Acid Sulfate Soils Management Plan**, including measures for the management, handling, treatment and disposal of acid sulfate soils, including monitoring of water quality at acid sulfate soils treatment areas, should the project impact on acid sulfate soils,	This Plan Manage Acid Sulfate Soils Procedure (M5N-ES-PRC-PWD-0038)

2.3 Revised Environmental Management Measures

The revised environmental management measures (REMMs) included in the EIS and SPIR relating to the management of acid sulfate soils are included in Table 2.

Table 2: Revised environmental management measures from New M5 EIS and SPIR relevant to the management of acid sulfate soils

Reference	Requirement	Where addressed
Water quality		
REMM SW04.	The Soil and Water Management Plan would include:	
	• Contaminated sediments and potential acid sulfate soils would be segregated and disposed of (with or without prior treatment) at a licensed facility or treated onsite; and	This Plan Construction Waste and Resource Sub-Plan (M5N-ES-PLN-PWD-0008)
Acid Sulfate Soils		
REMM SW09.	An Acid Sulfate Soil Management Plan would be prepared as a sub-Plan to the Construction Environment Management Plan to outline the requirements for the management of potential acid sulfate soils.	This Plan Manage Acid Sulfate Soils Procedure (M5N-ES-PRC-PWD-0038)

Reference	Requirement	Where addressed
REMM SW10.	Further contamination investigation would be conducted in areas with medium or high acid sulfate soils potential during the detailed design stage as part of early works. Management of acid sulphate soils during the project would be undertaken as per the management measures outlined in Section 17.4. of the EIS	Construction Soil and Water Quality Management Plan (CSWQSP, M5N-ES-PLN-PWD-0005) Soil Contamination Report Construction Contaminated Land Management Plan (M5N-ES-PLN-PWD-0033) Manage Acid Sulfate Soils Procedure (M5N-ES-PRC-PWD-0038) Manage Contaminated Land Procedure (M5N-ES-PRC-PWD-0036)
Groundwater		
REMM GW01.	An Acid Sulfate Soil Management Plan (ASSMP) would be prepared including the measures and monitoring to be undertaken where potential acid sulfate soils are expected. The Plan would outline the type of treatment required for acid sulfate soils, bunding and requirement for treatment ponds.	This Plan Manage Acid Sulfate Soils Procedure (M5N-ES-PRC-PWD-0038)

2.4 EPL Conditions

The Project's construction activities will be regulated by an Environment Protection Licence (EPL) issued by the NSW Environment Protection Authority. There are no EPL conditions which are specifically related to the management of acid sulfate soils.

2.5 Sustainability Requirements

In accordance with the Sustainability Plan, CDS-JV will target to achieve IS credits in ISCA IS Rating Tool as identified in the Construction Soil and Water Management Sub-Plan (M5N-ES-PLN-PWD-0005).

2.6 Guidelines and Relevant Documents

The main guidelines, specification and policy documents relevant to this ASSSMP include:

- Acid Sulfate Soil Manual (Acid Sulfate Soil Management Advisory Committee 1998);
- Technical Guideline: Guidelines for the Management of Acid Sulfate Materials: Acid Sulfate Soils, Acid Sulfate Rock and Monosulfidic Black Ooze (Roads and Traffic Authority, 2005);
- Waste Classification Guidelines (EPA, 2014); and
- WestConnex Sustainability Strategy (WDA, 2015).

3. Existing Environment

3.1 Location of Potential ASMs

Table 3 identifies potential ASMs that may be encountered along the construction corridor. It has been based upon review of the Environmental Impact Statement for the Project (AECOM 2015).

Table 3: Potential ASMs that maybe encountered at construction areas for the Project

Construction Area		Activity	ASMs Potentially Present	Lines of Evidence
Western surface works	M5 East Motorway integration works	Surface Works and Spoil Management	Nil	- Low probability of ASS or MBO as higher ground, well away from estuarine environment; and - Although groundwater quality in the vicinity of the site suggests the Hawkesbury Sandstone and Ashfield Shale units may contain sulfide mineralisation (AECOM 2015), excavation activities for surface works will be will be above the water table and thus significant amounts of unoxidized sulfide are not likely to be present.
	C1 Kingsgrove North	Surface Works and Spoil Management	Nil	
		Tunnel Spoil Management	[1]ASR (relatively small volumes)	- Surface lithology and geological profile information (AECOM 2015) suggests tunnelling will require extraction of small volumes of Hawkesbury Sandstone beneath the water table which may contain unoxidised sulfides; and - Surface lithology and geological profile information (AECOM 2015) suggests tunnel spoil will be predominated by Quarternary Alluvium which is not likely to contain any sulfide mineralization.
	C2 Kingsgrove South	Surface Works and Spoil Management	Nil	- Low probability of ASS or MBO as higher ground, well away from estuarine environment; and - Although groundwater quality in the vicinity of the site suggests the Hawkesbury Sandstone and Ashfield Shale units may contain sulfide mineralisation (AECOM 2015), excavation activities for surface works will be will be above the water table and thus significant amounts of unoxidized sulfide are not likely to be present.
	C3 Commercial Road	Tunnel Spoil Management	[1]ASR (relatively small volumes)	- Surface lithology and geological profile information (AECOM 2015) suggests tunnelling will require extraction of small volumes of Hawkesbury Sandstone beneath the water table which may contain unoxidised sulfides; and - Surface lithology and geological profile information (AECOM 2015) suggests tunnel spoil will be predominated by Quarternary Alluvium which is not likely to contain any sulfide mineralization.
Bexley Road surface works	C4 Bexley Road North	Tunnel Spoil Management	[1]ASR (relatively small volumes)	- Surface lithology and geological profile information (AECOM 2015) suggests tunnelling will require extraction of small volumes of Hawkesbury Sandstone beneath the water table which may contain unoxidised sulfides; and - Surface lithology and geological profile information (AECOM 2015) suggests tunnel spoil will be predominated by Quarternary Alluvium which is not likely to contain any sulfide mineralization.
	C5 Bexley Road South	Tunnel Spoil Management		
	C6 Bexley Road East	Tunnel Spoil Management		
Arncliffe Surface works	C7 Arncliffe	Surface Works and Spoil Management	ASS (significant volume)	- High probability of occurrence of ASS according to acid sulfate soil risk map information (AECOM 2015); - Surface works maybe below the water table and thus significant amounts of currently water saturated ASS may be exposed to oxygen via excavation or dewatering activities;

Construction Area		Activity	ASMs Potentially Present	Lines of Evidence
				- MBO not likely to be present as not in the vicinity of any major stormwater canals or water ways; and - ASR not likely to Hawkesbury Sandstone or Ashfield Shale not likely to be encountered.
		Tunnel Spoil Management	Nil	- Surface lithology and geological profile information (AECOM 2015) suggests tunnel spoil will be predominated by Quarternary Alluvium which is not likely to contain any sulfide mineralization.
St Peters interchange and local road upgrade surface works	St Peters interchange	Surface Works and Spoil Management	ASS and MBO	- Surface lithology information (AECOM 2015) suggests surface works in these areas are likely to intersect peat, sandy peat and muds (AECOM 2015), commonly known as the Botany Bay Sands. Such lithology suggests water logged conditions and a highly reduced environment amenable to the formation of sulfides in the soils; and - There is a high probability of occurrence of ASS in the immediate vicinity of the Alexandra Canal according to acid sulfate soil risk map information (AECOM 2015). This canal represents a means for significant tidal inputs of sulfate and storm water inputs of anaerobic bacteria nutrients (carbon and nitrogen) in the area.
	C8 Canal Road			
		Tunnel Spoil Management	[1]ASR (moderate volumes)	- Surface lithology and geological profile information (AECOM 2015) suggests spoil will comprise a small volume of Hawkesbury Sandstone and a moderate volume of Ashfield Shale extracted from beneath the water table, both of which may contain sulfide mineralisation (AECOM 2015).
	C9 Campbell Road	Surface Works and Spoil Management	ASS and MBO	- Surface lithology information (AECOM 2015) suggests surface works in these areas are likely to intersect peat, sandy peat and muds (AECOM 2015), commonly known as the Botany Bay Sands. Such lithology suggests water logged conditions and a highly reduced environment amenable to the formation of sulfides in the soils; and - There is a high probability of occurrence of ASS in the immediate vicinity of the Alexandra Canal according to acid sulfate soil risk map information (AECOM 2015). This canal represents a means for significant tidal inputs of sulfate and storm water inputs of anaerobic bacteria nutrients (carbon and nitrogen) in the area.
	C10 Landfill Closure Compound			
	C11 Burrows Road			
	C12 Campbell Road Bridge			
	C13 Gardeners Road bridge			
	C14 Sydney Park			
	Local road upgrade works	Surface Works and Spoil Management	Nil	- Excavation activities for surface works will be shallow and above the water table and thus significant amounts of unoxidized sulfide are not likely to be present.

[1]ASR volume comments are based upon geological profile information (AECOM 2015)

4. Construction Aspects and Environmental Impacts

Aspects and impacts associated with the ASMs are shown in Table 4.

Table 4: Aspects and Impacts

ASM	Project Activity	Impacts
ASS	- Excavation beneath the water table; - Dewatering excavations; - Stockpile storage exposed to rainfall; and - Geotechnical settlement of materials.	- Detrimental effects upon surrounding fresh water and marine ecosystems; - Degradation of water resource quality; - Detrimental effects upon terrestrial fauna and flora within the flood plain of disturbed ASM materials; - Corrosion of concrete, roads, steel structures such as rail lines and geotechnical piles; - Differential settlement as a result of oxidation of the crystalline sulfide content of the material; and - Loss of visual amenity as a result of staining of ground surfaces in the vicinity of disturbed ASM materials.
MBO	- Dredging / excavation; - Diverting rainfall run-off into anoxic water bodies that contain MBO; and - Geotechnical settlement of materials.	
ASR	- Blasting; - Dewatering; - Blasting; - Stockpile storage exposed to rainfall; and - Geotechnical settlement of materials.	

5. Mitigation and Management Measures

5.1 General Principals

The following general principals should be adopted in relation to all ASM materials:

- Investigate and monitor expected areas of ASM as per process provided in Section 5.2;
- Identify the ASM as per the process provided in Section 6;
- Avoid the disturbance beneath the water table where practicable;
- Avoid dewatering / dredging of ASM containing water bodies where practicable;
- Minimise the depth of excavation where practicable;
- Minimise the period and depth of dewatering where practicable;
- Minimise the depth of drainage channels;
- Avoid directing significant volumes of stormwater into areas that are suspected to contain ASM;
- All surface water that has contacted ASM materials will require capture and water treatment prior to discharge;
- Keep material wet at all times during excavation and subsequent handling;
- Treat confirmed ASM materials as per process in Section 7.2
- Treated ASM solids maybe re-used as backfill or other reuse provided they are emplaced beneath a water shedding cover layer and or are below the water table;
- If not treated insitu, ASM materials can be immediately re-used at the same works area or transported to another works area for treatment provided the following conditions are met (refer to Section 7.3):
    - The pH of the material is greater than 6;
    - The pH of the material has not yet dropped by more than 1 pH unit since excavation; and
    - The material is kept wet; and
    - The material is transported within a limed water proof trailer for movement to a different works area for treatment.
- Off-site disposal to an EPA licensed waste facility requires protocols specified in Section 7.3.

5.2 Investigate and monitor areas where ASM is expected

The presence of ASS has and will be investigated during Phase 1 and 2 soil contamination investigations which included laboratory testing. Remedial Action Plans (RAP) and/or where a RAP is not deemed necessary, a Contamination Management Summary (CLMS) may be prepared for specific locations and detail the remediation requirements for contamination, including acid sulfate soils. These documents include detailed information regarding the laboratory testing requirements in order to 'validate' soils.

Regular monitoring of areas where ASM is expected will be undertaken to identify signs of sulfide oxidation. Visual and olfactory cues are:

- Yellow / Orange / Red staining on upper sediments and surrounding surfaces;
- Rust coloured deposits on plants and on the banks of drains, water bodies and watercourses indicating iron precipitates;
- Water logged soils with a hydrogen sulfide, 'rotten egg' smell;
- Area of black ooze (potentially indicating monosulfidic black oozes) typically in drains and low lying areas;
- Unexplained scalding, degradation or death of surrounding vegetation;
- Unexplained death or disease in aquatic organisms;
- Areas of green-blue water or extremely clear water indicating high concentrations of aluminium;
- Black to very dark coloured waters indicating de-oxygenation.

5.3 Permanent Drain Construction

The following strategies for permanent drain construction are recommended:

- Minimise the design depth of permanent drainage channels by constructing wide, shallow drains where possible;

- Installation of in-drain water control structures, such as drop-boards (to maximise water coverage of ASM materials); and
- The base and sides of permanent drains or basins in ASS areas should have one or more of the following implemented:
  - Installation of a impervious water shedding cover upon the exposed walls and base; and/or
  - Use of limed sand bags upon the exposed walls and base.

6. Identification of ASMs

6.1 Procedure for Identifying ASMs

The procedure for the identification of ASM materials and treatment options are provided in Figure 1 and Figure 2 and Table 5, Table 6 and Table 7.

Figure 1: Process for Identifying ASS and MBO

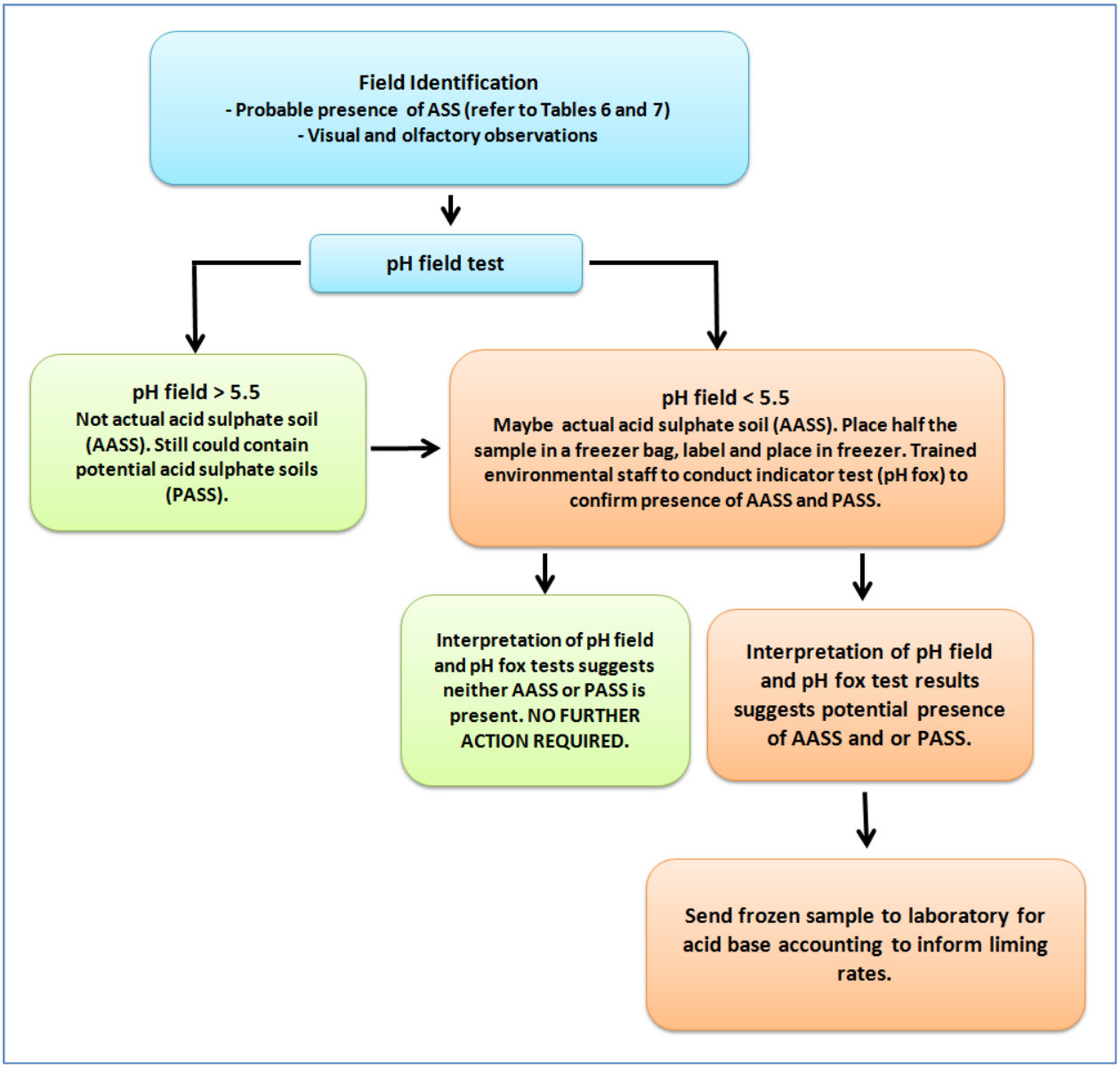


Figure 2: Process for Identifying ASR

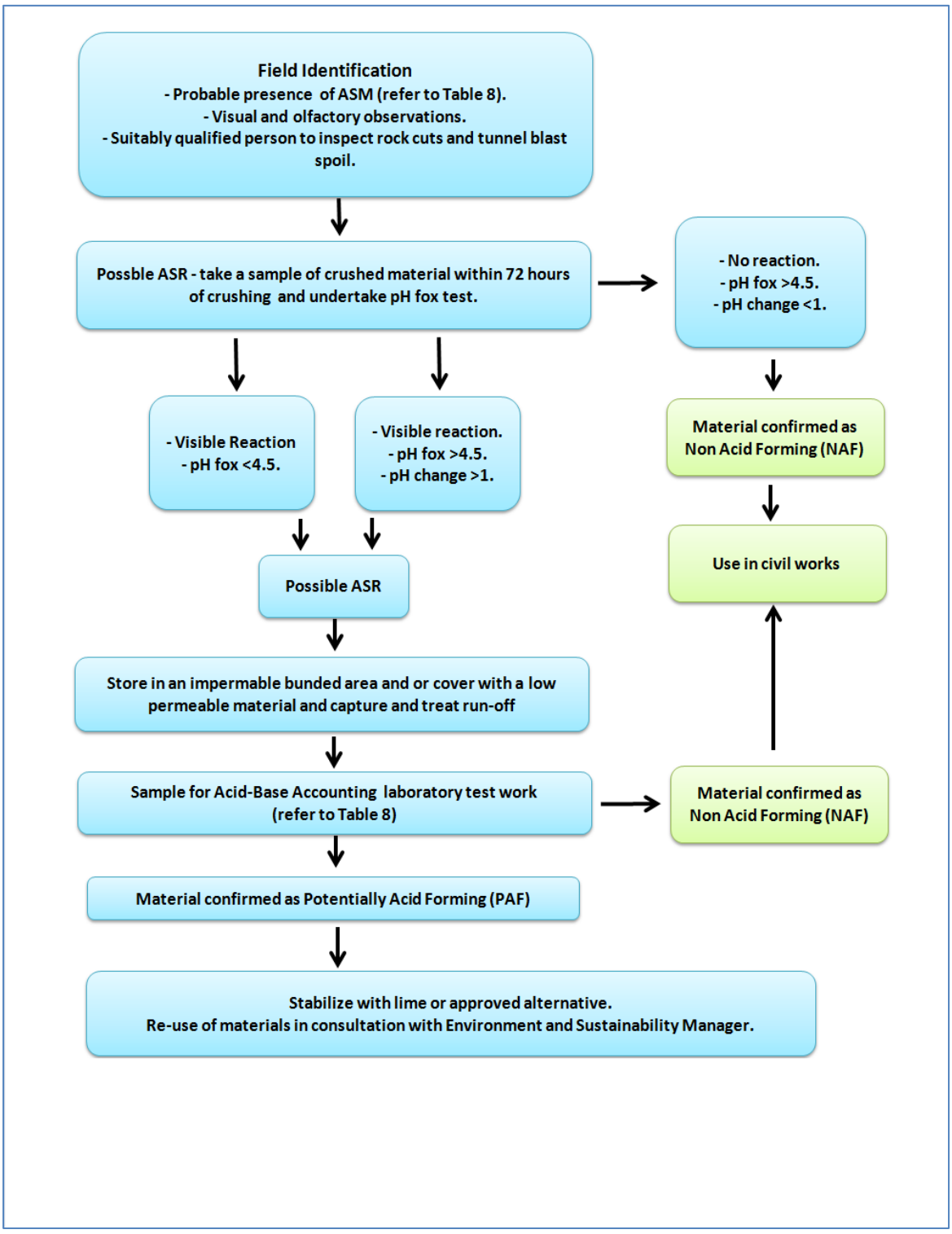


Table 5: Methods for Identifying ASS

<table>
<tr><th colspan="6">ASS Identification Methods</th></tr>
<tr><td>Image Examples</td><td colspan="5">  </td></tr>
<tr><td></td><td>A – Yellow / Orange stained upper sediments</td><td>B – Orange / brown residue in surface water</td><td>C- Orange / brown staining of surfaces.</td><td>D- Exposed ASS material in excavation</td><td>E – Orange stained upper layer (oxic zone) and grey / black lower layer (reduced zone)</td></tr>
<tr><td>Visual and Olfactory Observations</td><td colspan="5">– Yellow / Orange / Red stained upper sediments and surrounding surfaces;
– Water logged soils with a hydrogen sulfide, ‘rotten egg’ smell;
– Distinct colour change with depth, where lower water logged soils become blue-green / grey / black;
– Orange / brown residue forming within excavations and surface water run-off areas; and
– Orange / brown staining of surfaces.</td></tr>
<tr><td>Field Methods to Screen Potential AASS and PASS</td><td colspan="5">pH_{field} and pH_{fox} test as prescribed by the Acid Sulfate Soil Manual (ASSMAC 1998). A pH_{field} value below 5.5 is the screening criteria for probable presence of AASS (Actual Acid Sulfate Soils). A pH_{fox} value below 4.5 and or a difference between pH_{field} and pH_{fox} greater than 1 is the screening criteria for probable presence of PASS (Potential Acid Sulfate Soils). It should be noted this should be used as a preliminary screening tool to identify materials that require laboratory test work (i.e. not to be solely relied upon to inform management or treatment options). Sampling and tests should be undertaken by an appropriately qualified person. The pH meter must be calibrated.</td></tr>
<tr><td>Laboratory Test Methods to Confirm as ASS</td><td colspan="5">Full acid-base accounting methods [Potential Acidity (TPA or S_{CR}), Actual Acidity (s-TAA) and Acid Neutralizing Capacity (ANC)] as prescribed by the Acid Sulfate Soil Manual (ASSMAC 1998). Sampling should be undertaken by an appropriately qualified person. Laboratory test work should be undertaken by a NATA accredited laboratory.</td></tr>
<tr><td>Action Criteria (i.e. a management strategy or treatment is required)</td><td colspan="5">
<table>
<tr><th colspan="2" rowspan="2">Type of Material</th><th colspan="2">Action Criteria if 1 to 1000 tonnes of material is disturbed</th><th colspan="2">Action Criteria if more than 1000 tonnes of material is disturbed</th></tr>
<tr><th colspan="2">Existing + Potential Acidity</th><th colspan="2">Existing + Potential Acidity</th></tr>
<tr><td>Texture range (McDonald et al. 1990)</td><td>Approx clay content (%)</td><td>Equivalent sulphur (%S) (oven-dry basis)</td><td>Equivalent acidity (mol H^+/tonne) (oven-dry basis)</td><td>Equivalent sulphur (%S) (oven-dry basis)</td><td>Equivalent acidity (mol H^+/tonne) (oven-dry basis)</td></tr>
<tr><td>Coarse texture
Sands to loamy sands</td><td>= 5</td><td>0.03</td><td>18</td><td>0.03</td><td>18</td></tr>
<tr><td>Medium texture
Sandy loams to light clays</td><td>5 – 40</td><td>0.06</td><td>36</td><td>0.03</td><td>18</td></tr>
<tr><td>Fine texture
Medium to heavy clays and silty clays</td><td>= 40</td><td>0.1</td><td>62</td><td>0.03</td><td>18</td></tr>
</table>
Reference: Technical Guideline: Guidelines for the Management of Acid Sulfate Materials: Acid Sulfate Soils, Acid Sulfate Rock and Monosulfidic Black Ooze (Roads Traffic Authority, April 2005).
</td></tr>
</table>

Table 6: Methods for Identifying MBO

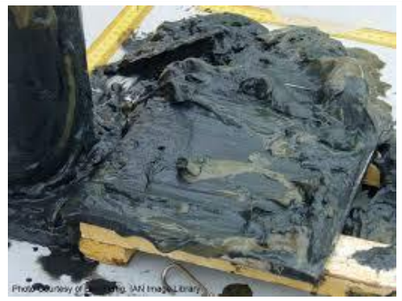
<table>
<tr><th colspan="6">MBO Identification Methods</th></tr>
<tr><td>Image Examples</td><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td></td><td>A – MBO in highly saturated sediment.</td><td>B – MBO covered drainage ditch</td><td>C- MBO in wetland environment.</td><td>D- Equipment covered in fresh MBO.</td><td>E – Shell covered in fresh MBO.</td></tr>
<tr><td>Visual and Olfactory Observations</td><td colspan="5">– Black viscous appearance;
– Strong ‘rotten egg’ smell; and
– Found in highly water logged sediments / wetland areas / open canals and drainage culverts.</td></tr>
<tr><td>Field Methods to Screen Potential AASS and PASS</td><td colspan="5">pH_{field} and pH_{fox} test as prescribed by the Acid Sulfate Soil Manual (ASSMAC 1998). A pH_{field} value below 5.5 is the screening criteria for probable presence of AASS (Actual Acid Sulfate Soils). A pH_{fox} value below 4.5 and or a difference between pH_{field} and pH_{fox} greater than 1 is the screening criteria for probable presence of PASS (Potential Acid Sulfate Soils). It should be noted this should be used as a preliminary screening tool to identify materials that require laboratory test work (i.e. not to be solely relied upon to inform management or treatment options). Sampling and tests should be undertaken by an appropriately qualified person. The pH meter must be calibrated.</td></tr>
<tr><td>Laboratory Test Methods to Confirm as ASS</td><td colspan="5">Full acid-base accounting methods [Potential Acidity (TPA or S_{CR}), Actual Acidity (s-TAA) and Acid Neutralizing Capacity (ANC)] as prescribed by the Acid Sulfate Soil Manual (ASSMAC 1998). Sampling should be undertaken by an appropriately qualified person. Laboratory test work should be undertaken by a NATA accredited laboratory.</td></tr>
<tr><td>Action Criteria (i.e. a management strategy or treatment is required)</td><td colspan="5">
<table>
<tr><th colspan="2">Type of Material</th><th colspan="2">Action Criteria if 1 to 1000 tonnes of material is disturbed</th><th colspan="2">Action Criteria if more than 1000 tonnes of material is disturbed</th></tr>
<tr><th colspan="2"></th><th colspan="2">Existing + Potential Acidity</th><th colspan="2">Existing + Potential Acidity</th></tr>
<tr><td>Texture range (McDonald et al. 1990)</td><td>Approx clay content (%)</td><td>Equivalent sulphur (%S) (oven-dry basis)</td><td>Equivalent acidity (mol H^+/tonne) (oven-dry basis)</td><td>Equivalent sulphur (%S) (oven-dry basis)</td><td>Equivalent acidity (mol $H^{+/}$tonne) (oven-dry basis)</td></tr>
<tr><td>Coarse texture Sands to loamy sands</td><td>= 5</td><td>0.03</td><td>18</td><td>0.03</td><td>18</td></tr>
<tr><td>Medium texture Sandy loams to light clays</td><td>5 – 40</td><td>0.06</td><td>36</td><td>0.03</td><td>18</td></tr>
<tr><td>Fine texture Medium to heavy clays and silty clays</td><td>= 40</td><td>0.1</td><td>62</td><td>0.03</td><td>18</td></tr>
</table>
Reference: Technical Guideline: Guidelines for the Management of Acid Sulfate Materials: Acid Sulfate Soils, Acid Sulfate Rock and Monosulfidic Black Ooze (Roads Traffic Authority, April 2005).
</td></tr>
</table>

Table 7: Methods for Identifying ASR

<table>
<tr><th colspan="6">ASR Identification Methods</th></tr>
<tr><td>Image Examples</td><td>  </td><td>  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td></td><td>A – Red / brown staining of metamorphic rock as a result of pyrite oxidation</td><td>B – Yellow / orange staining of a quartz vein as a result of pyrite oxidation</td><td>C- Red / brown staining of Ashfield Shale as a result of pyrite oxidation.</td><td>D- Red / brown staining of a rock cut of Hawkesbury Sandstone as a result of pyrite oxidation</td><td>E – Pyrite crystals within quartz vein of igneous rock.</td></tr>
<tr><td>Visual and Olfactory Observations</td><td colspan="5">– Yellow / Orange / Red / brown stained rock;
– Presence of quartz veins together with yellow crystals and or Yellow / Orange / Red / brown stained rock surfaces; and
– Orange / brown residue forming within excavations and surface water run-off areas.</td></tr>
<tr><td>Field Methods to Screen Potential AASS and PASS</td><td colspan="5">– pH of drainage water or a 1:5 (crushed rock : distilled water) < 5.5 (AASS);
– pH_{fox} upon crushed sample <4.5 and difference between pH_{field} and pH_{fox} >1 (PASS);
– It should be noted this should be used as a preliminary screening tool to identify materials that may require laboratory test work. Field measurements should be undertaken by an appropriately qualified person. The pH meter must be calibrated.</td></tr>
<tr><td>Laboratory Test Methods to Confirm as ASS</td><td colspan="5">– Full acid-base accounting methods (Total sulphur by Leco method, Non-sulfide sulphur by acid leach, Acid Neutralization Capacity by Modified-Sobek, Total Inorganic Carbon and paste pH) and Net Acid Generation (NAG) Test (for pH and Electrical Conductivity) as prescribed by the ARD Test Handbook: Project 387A Prediction and Kinetic Control of Acid Mine Drainage (AMIRA 2002). Sampling should be undertaken by an appropriately qualified person. Laboratory test work should be undertaken by a NATA accredited laboratory.</td></tr>
<tr><td>Action Criteria (i.e. a management strategy or treatment is required)</td><td colspan="5">
Victorian EPA Criteria for Acid Sulfate Rock
(EPA Victoria 1999)
<table>
<tr><th>Final Net Acid Generation</th><th>Net Acid Generation Value (kg H_2 $S0_4$/tonne)</th><th>Net Acid Producing Potential (kg H_2 $S0_4$/tonne)</th></tr>
<tr><td><4.5</td><td>>5</td><td>positive</td></tr>
</table>
Environment Australia Criteria for Acid Sulfate Rock
(EA 1997)
<table>
<tr><th>Classification</th><th>NAPP</th><th>Final NAG pH</th><th>Saturated Paste pH</th><th>Electrical conductivity (dS/m)</th></tr>
<tr><td>Potentially acid forming</td><td>Positive</td><td>4 or lower</td><td><4</td><td></td></tr>
<tr><td>Non acid forming</td><td>Zero or negative</td><td>>4</td><td></td><td></td></tr>
<tr><td>High level of soluble constituents (indicative of oxidation)</td><td></td><td></td><td></td><td>>2</td></tr>
</table>
Reference: RTA 2005.
</td></tr>
</table>

6.2 Field tests for Identifying Probable AASS and PASS

6.2.1 pH Field Test

This test comprises the following:

- Preparation of a 1 volumetric part soil: 5 volumetric parts distilled water solution in a glass or plastic vial;
- Allow approximately 10 minutes for solution to equilibrate; and
- Measure pH using a pH meter that has been calibrated as per the manufacturer's instructions.

A pH of 5.5 approximates the pH of pure water in equilibrium with atmospheric concentrations of carbon dioxide and represents a pH where laboratory derived 'total actual acidity' is zero. On that basis and as specified in Tables 6, 7 and 8 it is used as a screening criteria for AASS. It should be noted that this is a preliminary screening criteria and pH value below 5.5 may be also as a result of one or more of the following:

- Naturally acidic soils (e.g. those dominated by various aluminium and iron sulfate minerals such as alunite and jarosite); and
- Organic rich sediments that often have significant concentrations of various organic acids (e,g. humic acid).

6.2.2 pH_{fox} Test

This test comprises the following:

- Preparation of a 1 volumetric part soil: 5 volumetric parts 30% hydrogen peroxide (H_2O_2) solution in a glass or plastic vial. The hydrogen peroxide solution should be pre-prepared using laboratory grade hydrogen peroxide solution and adjusted to pH 5.5 with sodium hydroxide prior to use (refer to associated Safety Data Sheets (SDS) in terms of safe handling and personal protective equipment to be worn).
- Allow approximately 10 minutes for solution to react; and
- Measure pH using a pH meter that has been calibrated as per the manufacturer's instructions.

This test is based upon the premise that the pH_{fox} value is as a result of the oxidation of sulfides by H_2O_2 within the plastic or glass vial. The screening criteria for the presence of PASS specified in Tables 6, 7 and 8 (pH_{fox} value below 4.5 and or a difference between pH_{field} and pH_{fox} greater than 1) is based upon the following:

- A pH of 4.5 is the threshold at which the buffering capacity of a material has been overcome by the initial stages of acidity release associated with sulfide oxidation (INAP 2014);
- A difference between pH_{field} and pH_{fox} greater than 1 has been adopted as a conservative indicator of the initial stages of acidity release associated with sulfide oxidation.

It should be noted that these are preliminary screening criteria and a pH_{fox} value below 4.5 and or a difference between pH_{field} and pH_{fox} greater than 1 maybe as a result of the oxidation of the organic content of a sample by H_2O_2 (e.g. presence of peat and or organic rich soils).

7. Treatment Approaches

7.1 Dewatering of excavation in ASM

The following strategies for dewatering are recommended:

- Background groundwater pH should be confirmed prior to the commencement of dewatering where practicable;
- pH should be measured within the excavation after neutralization. Appropriate pH should be within 1 pH unit below and above background surface / groundwater pH. Where no background pH data exists, use target range: 6.5 to 8.5;
- pH monitoring of extracted water should be undertaken over the duration of the dewatering period;
- Collection of extracted groundwater for temporary storage and treatment as necessary prior to appropriate disposal / release; and
- Dose the base of the excavation at a rate of approximately 1 kg/m^2 of agricultural lime in order to counteract the generation of acidic leachate following groundwater recovery.

7.2 Onsite Treatment and Reuse of ASM

The ASM Treatment Area should be established prior to works that are likely to encounter ASM.

Generally the treatment area will be located:

- As close as possible to the source of the material or at construction compound; and
- Away from identified sensitive receivers.

Treated ASM that meet technical engineering specifications will be reused onsite. Treated ASM that do not meet engineering specifications will be made avaiable for reuse offsite and/or disposed of at an approporiate facility.

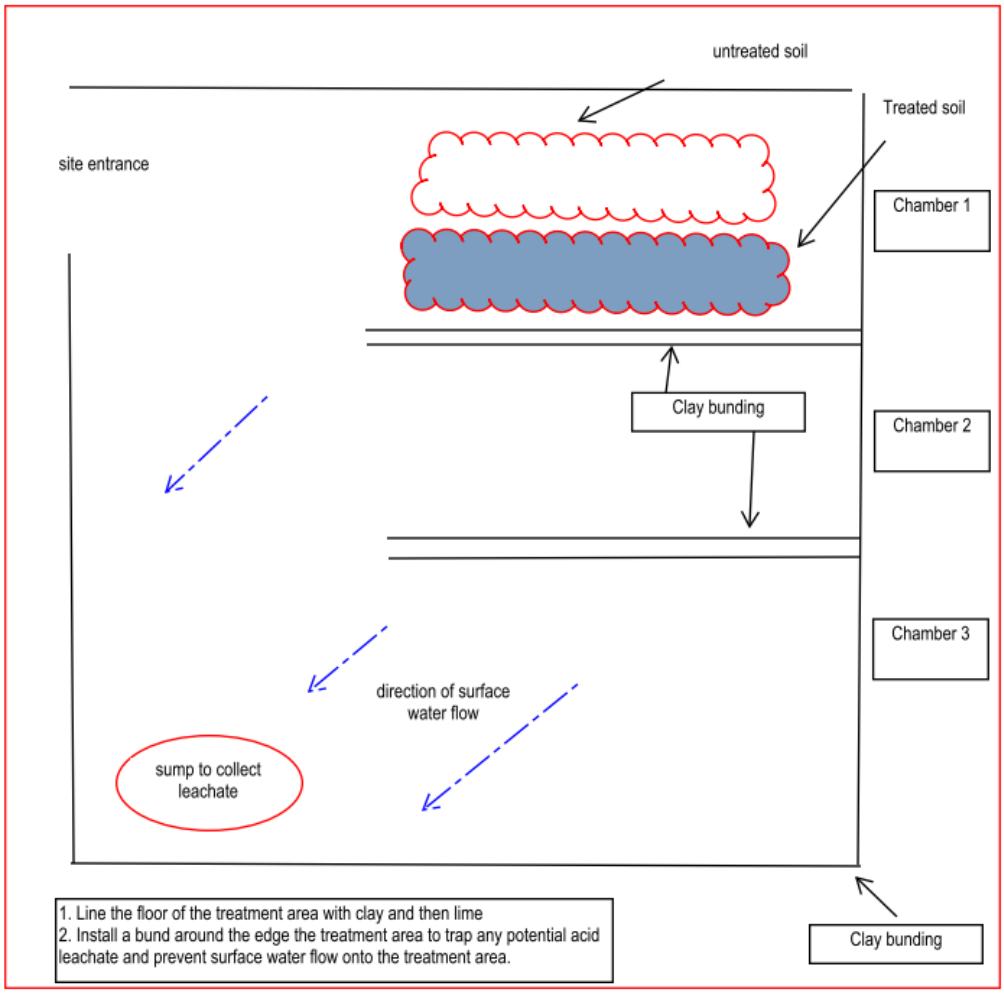
7.2.1 Containment

Containment areas shall meet the following requirements:

- All ASM solids should be contained within a bunded area with an impermeable base and appropriately neutralized;
- Any leachate produced in the bunded area should be captured and sent to disposal and/or water treatment prior to discharge;
- Where practicable the bunded area should be located at least 50 metres from waterways and above the 1 in a 20 year ARI flood levels; and
- The leachate sump should be designed to store enough water for a 1 in 10 year (1 hour) storm event.

A schematic of bunded containment is shown in Figure 3.

Figure 4: Schematic of Bunded Containment



7.2.2 Neutralisation of ASM Solids

Suitable neutralization agents include: natural alkaline materials such as agricultural lime ($CaCO_3$) and dolomite; and more concentrated synthetic alkaline agents such as calcined magnesia (MgO or $Mg(OH)_2$) and slaked lime ($Ca(OH)_2$). Natural alkaline materials are generally cheaper and less hazardous than synthetic alkaline agents, however use of natural alkaline materials will represent greater off-site disposal tonnages as a result of significantly greater amounts required to achieve neutralization.

Determination of the dosing rate required for neutralization should be determined by a jar test performed on site by an appropriately qualified person.

However, for the purpose of ball parking probable dosage rates, the following equation can be used:

Alkaline Agent Required (kg) per unit volume of soil (m^3)

= [(%S x 623.7)/19.98] x [100/ENV(%)] x D x FOS

Where: %S = net acidity equivalent;

D = Bulk Density (t/m^3);

FOS = Factor of safety (usually 1.5);

[1]ENV = Effective Neutralization Capacity (e.g. 80% for agricultural lime).

[1]The ENV is a calculated value based upon relative molar neutralization capacity of the reactive agent, particle size distribution and purity of the material.

The following protocols are recommended for when neutralizing materials:

- A soil pH targeted to be in the range: 6.5 to 8.5;
- Thoroughly mixing and aeration using, for example, an agricultural lime spreader and excavator. The soil should be treated in layers up to 300 mm thick to encourage aeration; and
- Periodic monitoring of soil pH and adjustment of the liming rate to ensure target pH is reached prior to off-site disposal.

7.2.3 Neutralisation of ASM Leachate

Treated water target pH should be within 1 pH unit below and above background surface / groundwater pH. Where no background pH data exists, use target range: 6.5 to 8.5.

Calcined magnesia (magnesium hydroxide, burnt magnesite, or magnesia) is the recommended neutralising agent as it produces a two-step reaction, which proceeds rapidly at acidic pH and slows down as higher pH is approached, and hence reduces the potential for over-neutralisation.

It should be added to the leachate as a slurry and mixing achieved via use of an agitator.

For the purpose of ball parking probable alkaline reagent dosage rates, the following equation can be used:

Alkaline Agent Required (kg) = $[(M_{ALKALI} \times 10^{-pH\ initial})/(2 \times 10^3)] \times V$

Where: pH initial = initial pH of the leachate;

V = volume of leachate (litres)

M_{ALKALI} = molecular weight of the alkaline agent

7.2.4 Neutralisation Monitoring

The following inspection and monitoring procedures are recommended:

- Daily inspection of liming operations by an appropriately qualified person during excavation;
- Daily visual monitoring of stockpiles for signs of ASS affected seepage (e.g. red/yellow/orange staining);
- Daily pH testing of any seepage from stockpiles by an appropriately qualified person. Appropriate pH should be between 6.5 and 8.5; and
- Sampling and testing after lime treatment by an appropriately qualified person (i.e. measurements of soil pH in distilled water), undertaken initially at a frequency of at least one sample per 100 m^3 excavated soil, or daily, (whichever is greater) to verify the neutralisation treatment. Appropriate pH should be between 6.5 and 8.5.

7.2.5 Contingency Measures

The following contingency measures are recommended:

- Monitoring during treatment indicates pH too low – additional lime should be added and continue to monitor;
- Monitoring during treatment indicates pH is too high – mix additional ASM or gypsum into batch and continue to monitor;
- Volume of ASM exceeds capacity of treatment area – adjust excavation or dewatering schedule where practicable;
- Captured leachate pH too low - additional lime should be added and continue to monitor;
- Captured leachate pH too high - gypsum should be added at the rate of 5 kg/m^2; and
- Treatment area leachate water quality indicates low pH and high electrical conductivity (greater than 2 dS/m) - additional lime should be added and continue to monitor.

7.3 Non-Treated Reuse and Transport of ASM

Non-treated reuse applies when there is a requirement for excavation of PASS and immediate re-use of the PASS material within a short time frame at the same site (e.g. trenching and backfilling within a day).

The following conditions must be met:

- The pH of the material is greater than 6;
- The pH of the material has not yet dropped by more than 1 pH unit since excavation; and
- The material has been kept wet.

It is recommended that lime application occur prior to backfilling as a precautionary measure.

Note: the majority of situations are not conducive for immediate reuse and as such the decision for immediate reuse can ONLY be made by the Environment and Sustainability Manager.

Where PASS material requires treatment at another works area this material should be transported in a water proof trailer and the forementioned conditions should be met prior to transportation. Similarly, the water proof trailer should be limed prior to transportation and the Environment and Sustainability Manager should be made aware of this activity prior to commencement.

7.4 Offsite Disposal of ASM

The following protocols must be followed in relation to off-site disposal of ASM to an EPA licensed landfill:

- Landfills shall be licensed;
- Consult the EPA's Environment Line in terms of facilities able to accept this waste: phone: 131 555;
- Conventional disposal of treated ASM to landfill (i.e. above the water table) requires classification of the material as per Part 1 of the Waste Classification Guidelines (EPA 2014) prior to haulage via an appropriately qualified person;
- Untreated ASM may be disposed in a landfill below the permanent water table, provided the conditions of EPA Part 4 Waste Classification Guidelines (EPA 2014a) are adhered to, with particular note to the following:
  - The landfill is licensed to do so;
  - Disposal occurs within 24 hours of excavation;
  - Material is kept wet at all times during excavation and subsequent handling and transport;
  - Material has been classified as 'virgin excavated natural material' (VENM) under the Protection of the *Environment Operations Act 1997* by an appropriately qualified person;
  - Documentation must be provided to the landfill for each truckload of material received, indicating that the soil's excavation, transport and handling have been in accordance with the Acid Sulfate Soil Manual (ASSMAC 1998) in terms of preventive significant sulfide oxidation; and
  - The occupier of the disposal site must also test the pH of each load of soil received immediately prior to its placement under water. These details, together with the pH of the soil recorded at the time of its extraction, must be retained by the occupier of the landfill site. pH measurement must be as per the Acid Sulfate Soil Manual (ASSMAC 1998).

8. Monitoring

Inspections, observations, and monitoring requirements relevant to the management of ASM are identified in Table 8.

Table 8: Monitoring requirements relevant to management of ASM

Item	Frequency	Standards	Reporting	Responsibility
Inspections				
Site inspection	Daily	Visual/olfactory cues of ASM	Site Supervisors Daily Diary	Site Supervisor
Site inspection	Weekly	Visual/olfactory cues of ASM	Environment Inspection Checklist	Environmental Advisor
Observations by Management (CEMP Expectation 3.4)	Monthly	Compliance with the requirements of this Plan	Management Inspection Checklist	Project Manager
Monitoring				
Monitoring of disturbed soils/excavation that are in PASS or ASS	Daily	Visual until backfilled	Site Supervisors Daily Diary	Site Supervisor
Monitoring of ASM Treatment Area	Daily	Visual Daily pH testing until results show ASM or leachate has been neutralised.	Site Supervisors Daily Diary	Site Supervisor
Dewatering excavation in PASS/ASS	Prior to Planned discharge	Tested, treated, discharged, recorded and reported to meet the requirements of the Project EPLs.	Permit to discharge	Environmental Advisor

9. Reporting

A record of treatment of acid generating materials and leachate will be kept and would include the following details:

- Location of monitoring site.
- Time of excavation, reuse or disposal of material.
- Neutralisation and treatment processes used.
- Lime application rates.
- Monitoring results for soil, leachate and groundwater, to be conducted by Environmental Advisor.
- Destination of treated material (i.e. offsite or onsite disposal).

If treated or untreated material is to be disposed of offsite, material tracking would be undertaken in accordance with the POEO Act 1997. Transport and disposal will be undertaken in accordance with the Protection of the Environment Operations (Waste) Regulation 2005 (POEO Waste Regulation) and the Waste Classification Guidelines (EPA, 2014). All contractors transporting waste from site must be licenced to transport the classification of waste and must only dispose of the waste at a facility that is licenced to accept the waste classification. For further information regarding material tracking, reuse and disposal refer to the Construction Waste and Resource Sub-Plan (M5N-ES-PLN-PWD-0008).

A record of dewatering 'in ASM excavations' activities would also be recorded and will include the following:

- pH at commencement of dewatering and prior to discharge to confirm adequate neutralisation.

For incident management and emergency management process refer to Element 9 Incident Management, Element 10 Emergency Planning and response of the CEMP.

10. Review and Improvement

Refer to the continuous improvement requirements in Section 3.3 and Element 12 of the CEMP.

11. References

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Appendix A – Glossary of Terms

Term / abbreviation	Definition
CAQSP	Construction Air Quality Sub-Plan
ASM	Acid Sulfate Materials
ASS	Acid Sulfate Soils
ASSSP	Acid Sulfate Soils Sub-Plan
ASR	Acid Sulfate Rock
CCS	Community Communication Strategy
CEMP	Construction Environmental Management Plan
CLM Act	*Contaminated Lands Management Act 1997*
CoA	Minister's Condition of Approval (to be obtained with Infrastructure Approval)
Construction Area	A separable portion of work that is identified early in construction Planning to help drive early definition of construction methodology and alignment of design activities. Work Areas should be listed in the overall construction methodology. The Planning document for a work area is called a Construction Area Plan.
Construction Area Plan (CAP)	The main document prepared during the construction Planning for that work area. Includes construction methodology, risk assessment, constructability reviews and Work Pack listing.
D&C	Design and Construction
Deed	As appropriate to the defined scope of the WestConnex New M5 Main Works D&C Deed
EIS	Environmental Impact Statement
EMM	Environmental management measures (proposed in the Environmental Impact Assessment)
EMS	Environmental Management System
Environmental aspect	Element of an organisation's activities, products or services that can interact with the environment
Environmental impact	Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services.
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ER	Environmental Representative
ESCP	Erosion and Sediment Control Plan
EWMS	Environmental Work Method Statement – a component of the environmental management system that addresses environmental management issues relevant to a specific site and/or activity.
IC	Independent Certifier

Term / abbreviation	Definition
Infrastructure Approval	Approval under the Environmental Planning & Assessment Act 1979 for SSI 6788 signed by the Minister for Planning on 20 April 2016
CDS-JV	CPB Contractors Dragados Samsung Joint Venture (Contractor)
MBO	Monosulphidic Black Ooze
OEH	Office of Environment and Heritage
PASS	Potential Acid Sulfate Soils
POEO Act	*Protection of the Environment Operations Act 1997*
Project	WestConnex New M5 Project
Project Company	WCX M5 AT
REMM	Revised Environmental Management Measure (from the SPIR)
RMS, Roads and Maritime	Roads and Maritime Services
SAP	Sensitive Area Plan – consolidation of environmental and socially sensitive areas, sites or places shown on a series of map-based sheets that extend the length of the site, used to assist with the Planning and management of Work Under the deed.
SMC	Sydney Motorway Corporation
SPIR	Submission [and Preferred Infrastructure] Report
CSWQSP	Construction Soil and Water Quality Sub-Plan
SWTC	As appropriate to the defined scope of the Scope of Works & Technical Criteria defined under the New M5 Main Works D&C Deed.
CWRSP	Construction Waste and Resource Sub-Plan
WCX	WestConnex
WDA	WestConnex Delivery Authority, now Sydney Motorway Corporation (SMC)
Work Pack	Assembly of documents that contain relevant information for the field delivery team to undertake a specific package of works. Inputs include safety, environment, design, temporary works, Project control, approvals/permits and community notices.
Work Procedure	A document that provides a detailed step-by-step description for how work activities will be carried out. May document Risks & Controls associated with each step.
WQP&MP	Water Quality Plan and Monitoring Program

Appendix B: Glossary of Terms

Term / abbreviation	Definition
CAQSP	Construction Air Quality Sub-Plan
ASS	Acid Sulfate Soils
CCS	Community Communication Strategy
CEMP	Construction Environmental Management Plan
CLM Act	*Contaminated Lands Management Act 1997*
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Term / abbreviation	Definition
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RMS, Roads and Maritime	Roads and Maritime Services
SAP	Sensitive Area Plan – consolidation of environmental and socially sensitive areas, sites or places shown on a series of map-based sheets that extend the length of the site, used to assist with the Planning and management of Work Under the deed.
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