WestConnex M4-M5 Link Mainline Tunnels

Operational Environmental Management Plan

Project:	M4-M5 Link Mainline Tunnels – Design and Construct
Contract Number:	TBC
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Document Approval

Rev	Date	Prepared by	Reviewed by	Remarks
00	13/12/21	ASBJV	DPIE	
01	4/02/22	ASBJV	DPIE	Response to DPIE comments

WestConnex

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Term/acronym	Definition
NRAR	Natural Resource Access Regulator (previously Department of Primary Industries – Water)
NSW	New South Wales
O&M Manual	Operation and Maintenance Manual
OAQMP	Operational Air Quality Management Plan
OEH	NSW Office of Environment and Heritage
OEMP	Operational Environmental Management Plan
ONVR	Operational Noise and Vibration Review
OTMS	Operational Traffic Management Strategy
OSWQP	Operational Surface Water Quality Plan
OSWQMP	Operational Surface Water Quality Monitoring Program
OGMP	Operational Groundwater Management Plan
OGWMP	Operational Groundwater Monitoring Program
POEO Act	*Protection of the Environment Operations Act 1997*
Project Company	M4-M5 Link Group in its capacity as trustee of the WCX M4-M5 Project Trust or its successor in title or assigns
PRVF	Parramatta Road Ventilation Facility
QSE	Quality, safety and environment
REMM	Revised environmental management measure (from the Submissions Report and Preferred Infrastructure Report)
Roads and Maritime, RMS	Roads and Maritime Services (now Transport for New South Wales)
SDS	Safety Data Sheets
Secretary, the	Secretary of the NSW Department of Planning & Environment
SOP	Standard Operating Procedure
SPIR	Submissions and Preferred Infrastructure Report
TfNSW	Transport for New South Wales, the Proponent for the M4-M5 Link Mainline Tunnels. TfNSW has engaged the Project Company to deliver the M4-M5 Link Mainline Tunnels.
WCX	WestConnex
WMCC	WestConnex Motorway Operations Centre

1 Introduction

This document forms the Operational Environmental Management Plan (OEMP) for the M4-M5 Link Mainline Tunnels between the M4 at Haberfield and the M8 at St Peters (SSI 7485, 'the Asset'). It has been prepared in accordance with:

- Conditions of Approval (CoA) D1 – D7;
- the *Guideline for the Preparation of Environmental Management Plans*, Department of Infrastructure, Planning and Natural Resources, 2004 (DIPNR, 2004) (refer Annexure A for compliance table);
- Environmental Management System Guidelines 3rd Edition (EMS Guidelines, NSW Government, 2013), which helps prepare and implement systematic practices to manage environmental performance and conformance;
- ISO 14001:2016 environmental management standards (Standards International, 2016), which provide a defined system for managing operations to minimise their environmental impacts, ensure legal compliance, and allow for continual improvement over time;
- Other relevant CoA relating to the operation of the WCX M4-M5 Link Mainline Tunnels project ('the approved project'), refer to Section 4.1.1.

This OEMP will be made available on the WestConnex project website (https://www.westconnex.com.au/) and provided to the public upon request.

1.1 Purpose

This OEMP identifies risks and legal obligations associated with the Asset's day-to-day operations by:

- identifying best environmental management practices for operating the Asset in the future;
- setting-out relevant operational environmental management commitments, safeguards and management measures;
- describing relevant legal and regulatory provisions;
- managing environmental risk.

The OEMP also:

- satisfies and executes relevant operational environmental obligations in the CoA (refer to Section 4.1.1) and revised environmental management measures (REMM) identified in the M4-M5 Link Submissions and Preferred Infrastructure Report (2018) (refer to Section 4.1.2);
- allows environmental performance to be easily reported, audited and monitored;
- allows management plans, standard operating procedures (SOPs) and environmental work method statements (EWMSs) to be developed and implemented.

1.2 Objectives

The OEMP's objectives are to:

- provide a reference document that defines and interprets operational environmental commitments;
- identify legislative and regulatory compliance requirements;
- identify the operational CoA and REMMs relevant to operation of the Asset (as detailed in Section 4.1);
- provide a program to facilitate training and awareness for all personnel to undertake activities in an environmentally responsible manner;

Glossary of terms

Term/acronym	Definition
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AQCCC	Air Quality Community Consultative Committee
Asset	M4-M5 Link Mainline Tunnels between the M4 at Haberfield and the M8 at St Peters.
Blue Book	Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom 2006)
CoA	Minister's Conditions of Approval
CRP	Community Relations Plan
CRVF	Campbell Road Ventilation Facility
CSSI	Critical State significant infrastructure
CTP	Compliance Tracking Program
D&C	Design and Construct
D&C Contractor	Acciona Samsung Bouygues Joint Venture (ASBJV), which was engaged to design and construct the M4-M5 Link Mainline Tunnels project.
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DECW	Department of Environment, Climate Change and Water
DEWHA	Department of the Environment, Water, Heritage and the Arts
DPIE	NSW Department of Planning, Industry & Environment
DPI	NSW Department of Primary Industries
DPI Fisheries	NSW Department of Primary Industries – Fisheries
DPI Water	NSW Department of Primary Industries – Water (formerly NSW Office of Water, NoW)
EIS	Environmental impact statement
EM	Environment Manager
EMP	Environmental Management Plan
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	NSW Environment Protection Authority
EPL	Environment protection licence
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
FRNSW	Fire & Rescue New South Wales
I&M	Incident and Maintenance
I&M Contractor	TBC
IIAP2	International Association for Public Participation
IRP	Incident response procedures (IRPs)
MOC	Motorway Operations Complex

- identify key risks and appropriate management measures relevant to the operation of the Asset with aim of preventing, or minimising, environmental harm;
- provide management measures, processes and procedures to help minimise road user disturbance and local community impacts during the operation of the Asset;
- provide key performance indications monitor the Asset's operational environmental impacts in accordance with this document;
- document the environmental monitoring to be undertaken to monitor potential impacts on the environment during the operation of the Asset;
- develop, implement and maintain effective management systems and plans to control and manage activities associated with the operation of the Asset that may have an adverse environmental impact;
- demonstrate environmental protection, pollution prevention control and continual improvement;
- maintain consistency with current ISO 14001 environmental management standards.

1.3 OEMP structure

The structure of the OEMP, displayed in Figure 1-1, consists of a main document with issue-specific sub-plans and issue-specific management strategies for key environmental concerns. The OEMP is the overarching document detailing governance and a structured approach to the management of environmental issues during operation and maintenance of the Asset.

Figure 1-1: OEMP structure

1.4 Management, update, and approval

This OEMP must remain a flexible document that provides continual feedback and improvement. Updates to this plan may be required to reflect:

- improvements, observations and non-conformances;
- improvements in mitigation, management and monitoring measures;
- changes in:
  - project implementation and operation;
  - environment resulting in new or amended risks;
  - maintenance methods;
  - organisational structure, roles and responsibilities;
  - legislation, regulation, policy and guidance;
- after the occurrence of an emergency situation or test;

- where requested or required by Department of Planning, Industry & Environment (DPIE) or any other relevant authority.

This OEMP must be submitted for the approval of the Secretary no later than one month prior to the commencement of operation, or as otherwise agreed by the Secretary. Operation must not commence until written approval of the OEMP has been received from the Secretary.

Updates to the plan in response to regular review of the OEMP (refer to Section 10.1) may be approved internally if they are considered minor. 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 necessary, the OEMP will be provided to relevant stakeholders for review and comment if required, and forwarded to the Secretary of DPIE for approval.

1.5 OEMP consultation

The OEMP and sub-plans must be prepared in consultation with relevant agencies in accordance with CoA D3 and D8. The stakeholders identified in Table 1-1 were consulted during the preparation of this plan as agreed with DPIE.

Table 1-1: OEMP consultation

	CoA	NRAR	EPA	OEH	AQCCC	Sydney Water	Relevant Council(s)	State Emergency Service	NSW Health
Operation Environmental Management Plan	D1		■				■	■	■
Operational Air Quality Management Plan					■				
Operational Surface Water Quality Plan & Monitoring Program	D8a)	■	■	■		■	■		
Operational Groundwater Plan & Monitoring Program	D3 D8b)	■	■			■	■		

NRAR: Natural Resource Access Regulator (previously Department of Primary Industries – Water); EPA: Environment Protection Authority; OEH: Office of Environment and Heritage; Relevant Councils including City of Sydney and Inner West; AQCCC: Air Quality Community Consultative Committee; TfNSW: Transport for New South (including TMC: Traffic Management Center)

A document titled 'Consultation for the M4-M5 Link Mainline Tunnels OEMP and sub-plans' (Annexure J) has been prepared separately to this plan to provide detail relating to the consultation received and where feedback has been covered or addressed in this OEMP. Subsequent feedback will be documented and used to inform revisions and updates of this OEMP (refer Section 10.1).

1.6 Interface with other Projects

The M4-M5 Link Mainline Tunnels is one component of the 33-kilometer WestConnex motorway providing underground connections to the M4 and M8 (as shown in Figure 2-1). Given this, the Asset will be operated in conjunction with the other WestConnex components as one integrated motorway.

Environmental risks and potential impacts will also need to be coordinated to ensure effective management across the entire WestConnex Motorway.

This OEMP should be read and implemented in conjunction with the following documents to ensure environmental risks are appropriately managed during the operation of the entire integrated WestConnex Motorway:

- WestConnex M4 OEMP (M4E-ES-PLN-PWD-06956)
- WestConnex M8 OEMP (M5N-ES-PLN-PWD-0047)
- Rozelle Interchange OEMP (once prepared)

2 Asset description

2.1 Location

Figure 2-1 shows the location and key features of the Asset.

2.2 Asset components

The Asset comprises the M4-M5 Link Mainline Tunnels between the M4 at Haberfield and the M8 at St Peters. A summary of the Asset components is included in Table 2-1. The key facilities are further described in the following sub-sections.

Table 2-1: Key Asset components

Asset	Location
Interchanges (including on and off ramp tunnels)	St Peters interchange: • Gardeners Road on-ramp to M4-M5 Link • Euston Road on-ramp to M4-M5 Link • Sydney Gateway on-ramp to M4-M5 Link • M4-M5 Link off ramp to Gardeners Road • M4-M5 Link off ramp to Euston Road • M4-M5 Link off ramp to Sydney Gateway Wattle Street Interchange: • Wattle Street on-ramp to M4-M5 Link • M4-M5 Link off ramp to Wattle Street
Local Road upgrade	• Minor physical integration works with the surface road network at the Wattle Street • Minor physical integration works with the surface road network at the St Peters interchange
Motorway Operations Complexes	• Campbell Road Motorways Operation Complex (MOC)
Mainline Tunnel	• Twin mainline motorway tunnels between the M4 at Haberfield and the M8 at St Peters. Each tunnel is around 7.5 kilometres long and sized to accommodate up to four lanes of traffic in each direction • A tunnel-to-tunnel connection that connects the mainline tunnels with the Rozelle Interchange and the Iron Cove Link
Tunnel ventilation system	• Campbell Road Ventilation Facility (CRVF) within the Campbell Road MOC • Parramatta Road Ventilation Facility (PRVF) at Haberfield
Tunnel support systems and services	• Electricity substations • Fire pump rooms and tanks • Water treatment facilities and pump station • Low point sump for detention of stormwater, groundwater inflows and/or spills in the tunnel • Fire and life safety systems including emergency evacuation infrastructure
Watercourse bridge	• Gardeners Road bridge (Alexandra Canal) • Campbell Road bridge (Alexandra Canal)

Asset	Location
Intelligent transport systems	• Tolling equipment • Gantries • Equipment shelters • Substations • Cameras • Cabling and conduits • Traffic control systems
Environmental and amenity controls	• Noise mitigation installations • Planting and landscape treatments • Water sensitive connections
Stormwater drainage	• Longitudinal drains (pits and pipes) • Cross drains (culverts) • Detention (storage) basins
Road furniture	• Lighting • Signage
Utilities	• Power • Communications • Cables and conduits

2.3 Motorway Operational Ancillary Infrastructure

The M4-M5 Mainline Link Tunnels includes the following operational ancillary infrastructure:

- Operational management control systems and incident and emergency response infrastructure
- Tunnel ventilation systems and facilities
- Drainage and water treatment facilities
- Noise attenuation measures
- Utilities
- Roadside furniture and lighting.

A ‘single operating entity’ would undertake day-to-day ‘coordinated operations’ for the widened M4 (M4 Widening project), M4, M8 and M4-M5 Link (the ‘WestConnex Motorway’) projects, as well as the existing M5 East, from a combined traffic control room located at the St Peters interchange WestConnex Motorway Control Centre (WMCC). This WMCC was built as part of the M8 project.

Most operational ancillary infrastructure for the M4-M5 Mainline Link Tunnels is established in the Campbell Road Motorway Operations Complex (MOC). As identified above, coordinated operations of the Asset will be undertaken from the WMCC – captured in the M8 OEMP as the Burrows Road MOC, however integrated day to day operations will also be linked with the St Peters MOC, M4 Motorway Control Centre (MCC) at Homebush Bay Drive and the Parramatta Road Ventilation Facility (PRVF), captured under the M8 and M4 OEMPs respectively. The Incident and Maintenance (I&M) Contractor will operate and maintain the MOCs.

2.3.1 Campbell Road Motorway Operations Complex

The Campbell Road MOC is located on the southern extent of the Project, at the St Peters Interchange northern portals.

This Complex includes the Campbell Road Ventilation Facility (CRVF), a water treatment plant that will treat the captured tunnel water and includes a maintenance facility to support maintenance of the Asset during operation.

The operational features of Campbell Road MOC are included in Table 2-2 and shown in Figure 2-2.

Table 2-2: Campbell Road MOC infrastructure and equipment

Aspect	Infrastructure / equipment
Buildings	• Distribution substation building • Ventilation building including two ventilation shafts with four exhaust fans arranged horizontally in a two-storey configuration • Workshop and office maintenance facility • Spare parts and equipment storage facility • Water Treatment Plant • Hardstand and site parking
Access	• Access road via Campbell Road • 24 hours per day • I&M Contractor vehicles • At all times a minimum of two people shall attend site. During maintenance activities up to 10 people shall attend the site.

2.3.2 Parramatta Road Ventilation Facility

The PRVF is located on the northern extent of the Project on the corner of Parramatta Road and Wattle Street in Haberfield and was constructed by the M4. Additional mechanical and electrical (M&E) fit out was completed during the construction of the Asset to ensure the required ventilation system performance during the operation of both the M4 and M4-M5 Link Mainline Tunnels.

The operational features of the PRVF are included in Table 2-3 and shown in Figure 2-3.

Table 2-3: PRVF infrastructure and equipment

Aspect	Infrastructure / equipment
Buildings	• Ventilation supply and exhaust stations • Air quality monitoring equipment on the outlet • Electrical distribution substation facilities • Fire pumps room • Fire water tanks (shared with the M4) • Ancillary facilities
Access	• General vehicle access is provided via Parramatta Road and emergency vehicle access is provided via Wattle Street • 24 hours per day • I&M Contractor vehicles • At all times a minimum of two people shall attend site. During maintenance activities up to 10 people shall attend the site.

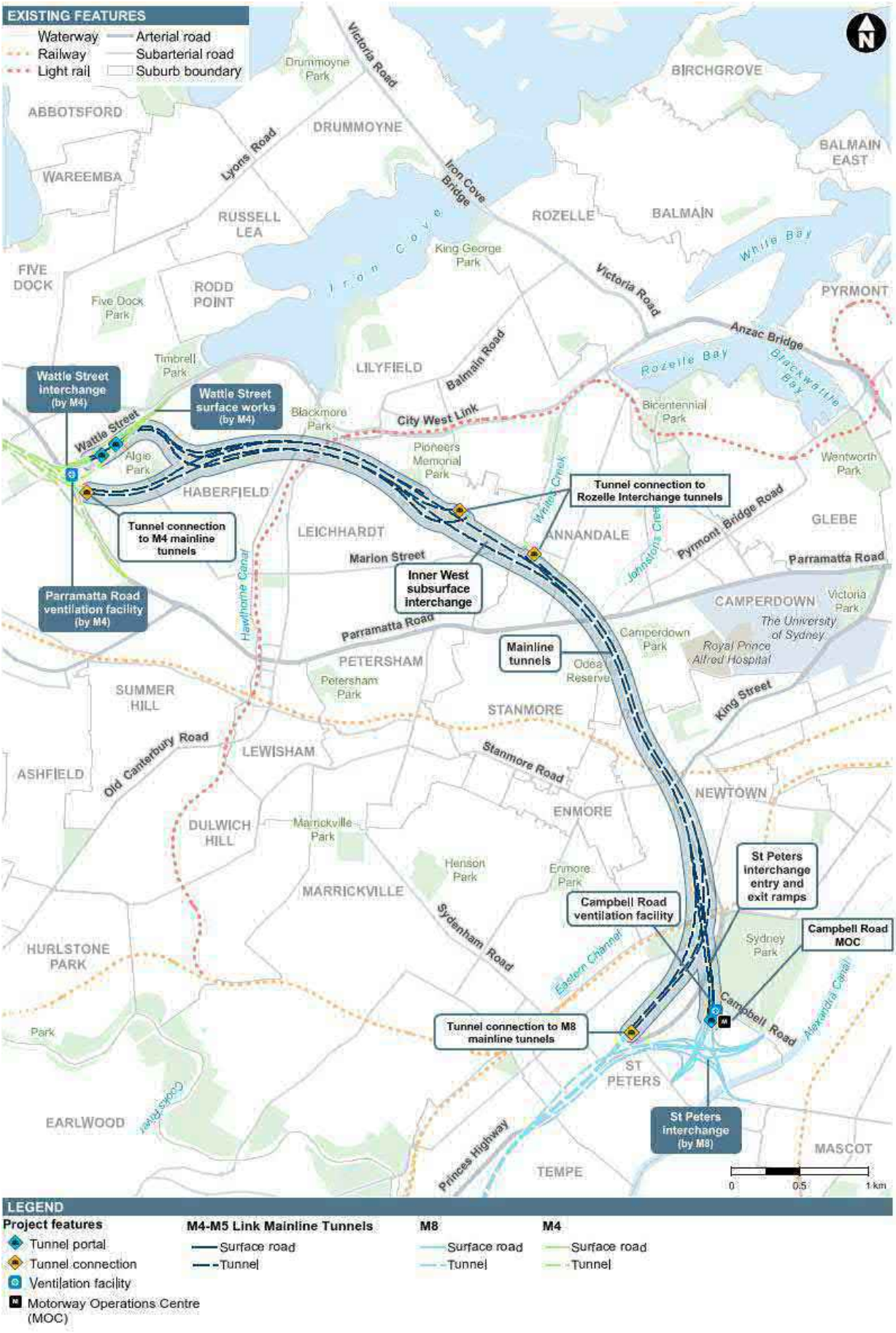


Figure 2-1: Key features of the Asset as upgraded under the approved project

WestConnex M4-M5 Link Mainline Tunnels

Figure 2-3: Parramatta Road Ventilation Facility

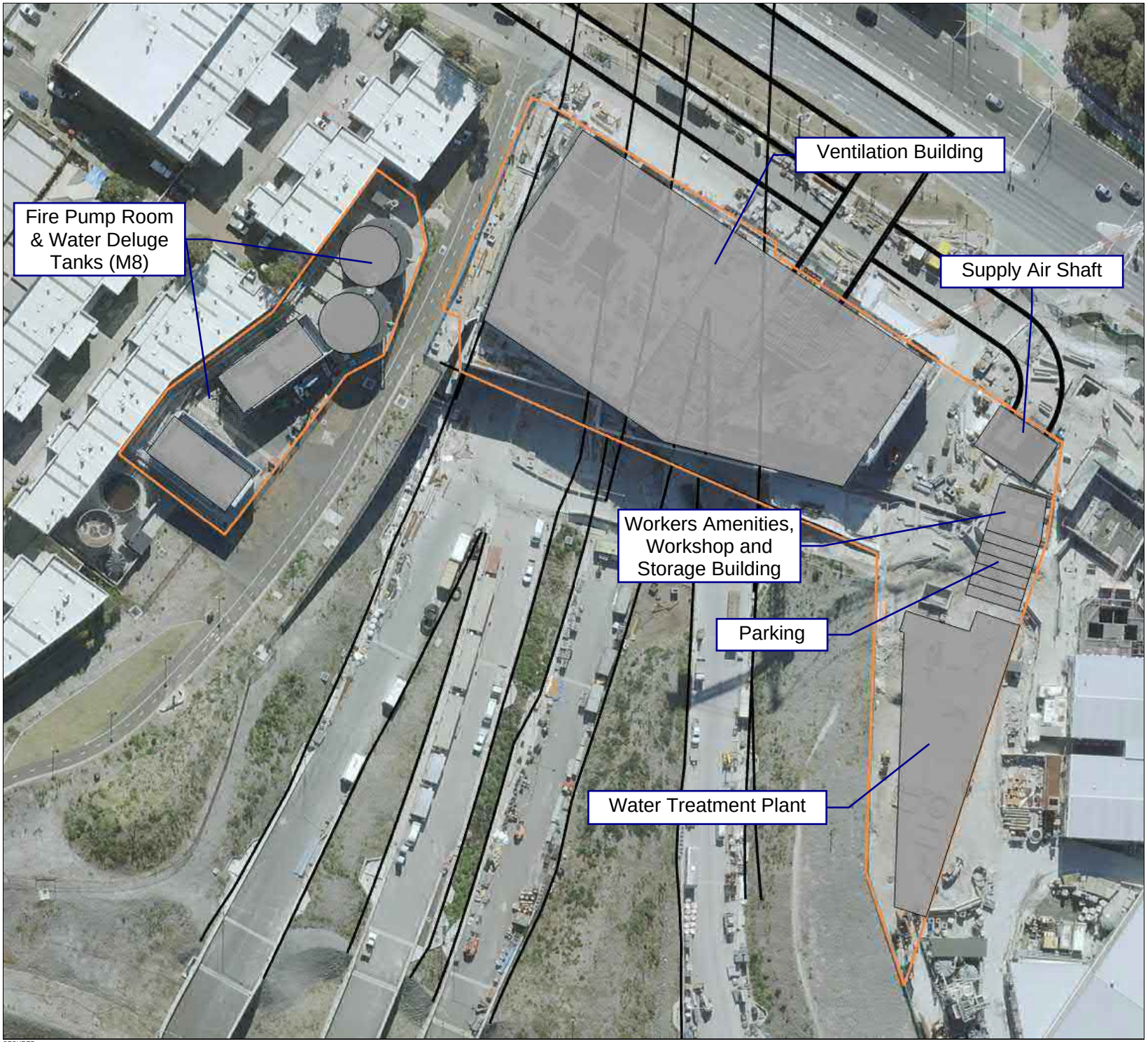
Legend

- Tunnel Alignment
- Ancillary Facility Boundary
- Operational Ancillary Infrastructure

0 25 50 m

WestConnex M4-M5 Link Tunnels

Figure 2-2: Campbell Road MOC



Legend

- Tunnel Alignment
- Ancillary Facility Boundary
- Operational Ancillary Infrastructure

0 25 50 m

3 Operation and maintenance activities

3.1 Operation and maintenance activities summary

Table 3-1 includes a list of activities to be undertaken during operation and maintenance of the Asset.

Table 3-1: Operational and maintenance services

Services	Facility/ Location	Number of personnel (indicative)	Activities	Considerations	Frequency	Access Hours
Operations services			All things necessary for the use, operation and control of the Motorway including:			
	Motorway	Refer below and to section 2.3	Traffic management including monitoring the operation of traffic signalling devices from the Motorway Control Centre (MCC)		Daily	24 hours / 7 days
	Tunnel		Operation and periodic testing of tunnel ventilation equipment and facilities to maintain acceptable air quality within and outside of tunnel		Daily	24 hours / 7 days
	Motorway		Equipment and systems management including monitoring the operation of tolling systems and tunnel ventilation system		Daily	24 hours / 7 days
	Motorway		Incident management including attending and clearing all breakdowns and other vehicle incidents (including spills) on the M4-M5 Link Mainline Tunnels Motorway		As required	24 hours / 7 days
	Campbell Road MOC		Storage of liquids and chemicals at the workshop and maintenance facilities		Daily	24 hours / 7 days
Maintenance Services	Campbell Road MOC / PRVF	At all times a minimum of two people shall attend site. During maintenance activities up to ten people shall attend the site.	Maintenance of ventilation plant, facilities and monitoring equipment: (e.g. fans, ventilation facilities, monitors) including: • Testing of the tunnel ventilation system • Inspect fan assemblies and airways into fans	Coordination of activities at the PRVF with M4 O&M Contractor.	Daily	Major activities generally occur during quarterly nightly closures; minor activities generally occur during day hours, providing

Services	Facility/ Location	Number of personnel (indicative)	Activities	Considerations	Frequency	Access Hours
			• Diagnosis for out of balance vibration and bearing condition • Measure and record operating current and voltage, and motor winding insulation resistance • Inspect protective coatings and tightness of bolts • Inspect impeller for abrasion, corrosion or dirt deposits • Check the fan, impeller, motor for corrosion and damage Inspect ventilation facility for structural integrity and soundness of fixtures and fittings			Motorway operations are unaffected and it is safe to do so
			Maintain external areas including: • Removing rubbish • Maintain visual appearance	Routine activities with repairs involving machinery as required	Weekly inspections and monthly routine tasks	Generally during daylight hours as required
			Maintaining landscaped areas including vegetation trimming, grass mowing and replanting using equipment such as tractor slashers, ride on mowers, hand mowers, brush cutters, blower/vacs, small skids steer, augers, water carts, etc.	Routine activities with access to adjacent areas	Weekly inspections and monthly routine tasks	Generally during daylight hours as required
			Cleaning out drains	Routine inspection; cleaning activities may require machinery, with appropriate controls and notification measures in place	Annually and as required	Generally during daylight hours as required
			Water treatment (through Water Treatment Plant) at Campbell Road MOC	Routine activity with dedicated machinery	Daily	Generally during daylight hours as required
			Delivery of chemicals to the WTP involving one chemical tanker	Routine activity with dedicated machinery	Weekly	Generally during daylight hours as required

Services	Facility/ Location	Number of personnel (indicative)	Activities	Considerations	Frequency	Access Hours
			Removal of sludge produced as a by-product of the treatment process utilising one skip bin truck	Routine activity with dedicated machinery	Weekly	Generally during daylight hours as required
			Graffiti removal from the facility using non-hazardous materials and a pressure cleaner after application of removal agent (graffiti treatment may also include re-painting)	Will be completed as identified after inspections or reported through any of the communication mediums. Activities may involve high pressure water machinery. These shall normally be conducted during day time shifts and appropriate control and notification measures in place.	Maintenance as required following weekly inspection	Generally during daylight hours as required
			Remove unauthorised posters from assets by appropriate means such that the strata from which the items are removed are not damaged and, where possible, minimal damage to the poster occurs. Record details of the poster, sign, location and, where practical, name and address the owner. Once removed, unauthorised posters (including supporting structures) must be stored for one month before disposing.		Maintenance as required following weekly inspection	Generally during daylight hours as required
	All external landscaped areas	At all times a minimum of two people shall attend site. During maintenance activities up to four people shall attend the site.	Maintaining landscaped areas including vegetation trimming, grass mowing and replanting using equipment such as tractor slashers, ride on mowers, hand mowers, brush cutters, blower/vacs, small skids steer, augers, water carts, etc.	Routine activities with access to adjacent areas	Weekly	Generally during daylight hours as required
	Motorway (includes all areas within the operational boundary of the project)	At all times a minimum of two people shall attend site. During maintenance activities up to four people shall attend the site.	Removing material deposited by motorists, such as non-biodegradable litter and food wastes from the Motorway verges using road sweeping equipment and maintenance crew members	As identified, sweeping conducted weekly	Maintenance as required following daily inspection	Generally during daylight hours as required
			Cleaning up any spills from motor vehicles using spill kits containing material to absorb spills, then shovelled/swept up and material disposed at approved waste facilities	As required as part of clean up after incidents	Maintenance as required following daily inspection	As required and safe to do so

Services	Facility/ Location	Number of personnel (indicative)	Activities	Considerations	Frequency	Access Hours
			Graffiti removal from road furnishings, retaining walls, bridges, etc. using non-hazardous materials and a pressure cleaner after application of removal agent (graffiti treatment may also include re-painting). Remove graffiti and clean the surface according to any requirements for anti-graffiti coatings. Remove unauthorised posters from assets by appropriate means such that the strata from which the items are removed are not damaged and, where possible, minimal damage to the poster occurs. Record details of the poster, sign, location and, where practical, name and address the owner. Once removed, unauthorised posters (including supporting structures) must be stored for one month before disposing.	Will be completed as identified after inspections or reported through any of the communication mediums. Activities may involve high pressure water machinery. These shall normally be conducted during day time shifts and appropriate control and notification measures in place.	Maintenance as required following daily inspection	As required and safe to do so
			Stormwater system maintenance and repair including: • Cleaning out drains (including detention and sedimentation basins) • Inspect Pits for structural integrity and flow obstructions (Note: flame trap pits fill with water) • Inspect pipes for structural integrity and flow obstructions • Inspect sub-surface drains	Routine inspection with CCTV equipment requiring access to inlet pits. Cleaning activities may require heavy machinery, these shall generally be conducted during day time shifts, with appropriate controls and notification measures in place.	Annually and as required	Night closures and during 24 hour operations as safe to do so.

Services	Facility/ Location	Number of personnel (indicative)	Activities	Considerations	Frequency	Access Hours
			Pavement maintenance and repair including: • Undertake inspection of assets following heavy rains and storms • Undertake asset inspection which is prompted by a public complaint • Undertake detailed Inspection • Test carriageway and ramps in minimum 100m lengths for roughness	Periodic repairs of degraded pavement will be conducted by onsite teams with minimal machinery. Significant pavement works as result of reaching end of effective life will require significant machinery and be undertaken as a major project.	Maintenance as required following daily inspections	During permitted night closures
			Maintenance of road furnishings (including noise barriers). Visual inspection for accident damage, vandalism or graffiti.	Routine activities with repairs involving machinery as required	Monthly	Night closures and during 24 hour operations as safe to do so.
			Maintenance of roadside and medians (including fences, retaining walls and landscaping) including removal of graffiti with issues identified through inspections of the structural integrity and stability and public complaint. Inspections will also include ensuring retaining walls are not sloping or falling.	Routine activities with repairs involving machinery as required	Monthly	Night closures and during 24 hour operations as safe to do so.
			Maintenance of mechanical and electrical systems (lighting, hydraulics, instrumentation) including replacement of light globes	Routine activities with repairs involving machine as required	Monthly	Night closures and during 24 hour operations as safe to do so.
			Line marking inspections, both scheduled (alternating day and night) and prompted by public complaints. Maintenance as required by the inspection. Maintenance and repair of intelligent transport systems (traffic lights, traffic signs, safety cameras)	Routine activities with repairs involving machine as required	Quarterly	During permitted night closures.

Services	Facility/ Location	Number of personnel (indicative)	Activities	Considerations	Frequency	Access Hours
	Tunnel	At all times a minimum of two people shall attend site. During maintenance activities up to ten people shall attend the site.	Tunnel washing	Routine activity with dedicated machinery under closed or controlled conditions	Quarterly	During permitted night closures.
			Tunnel operation systems including ventilation, fire and life safety, etc.	During scheduled closures operation and testing of systems in accordance with maintenance standards.	Quarterly	Night closures and during 24 hour operations as safe to do so.

3.2 Staging and scheduling of operation and maintenance activities

DPIE will be notified of the date of the commencement of the operation of the road in accordance with CoA A34(b), prior to the commencement of operation.

Table 3-2 includes a list of assets that are proposed to be staged as part of the operation of the CSSI.

Table 3-2: Staged Assets

Asset	Location	Timeframe
Bridge 5 and 6	• Twin bridges over the M8 connecting M4-M5 Link Mainline Tunnels to Sydney Gateway	Upon completion of Sydney Gateway Project (2024)
Leichhardt tunnel stubs	• Entry and exit portals connecting the M4-M5 Link Mainline Tunnels to the Rozelle Interchange and Iron Cove Link	Upon completion of the Rozelle Interchange Project (2023)

The Asset will be continuously operated and maintained 24-hours per day, 7-days a week, 365 days a year.

Programmed maintenance works will be undertaken where possible, during daylight hours (including off-motorway works, e.g. landscaping, litter removal, graffiti removal, gantry access etc.). However due to the strategic importance of the motorway, certain motorway, maintenance works will be required to occur during:

- hours of low traffic volumes to ensure maintenance works limits impacts on peak traffic flow
- scheduled maintenance shutdowns.

The Project Company Community & Stakeholder Manager will notify the public and other stakeholders before working at night or out of hours, using the methods described in section 7.3.1. Urgent unplanned maintenance will be undertaken in accordance with the Project Company's Community Relations Plan (refer to section 7.3.1).

4 Environmental obligations

4.1 Statutory obligations

This section describes the statutory and other obligations covering the operational Asset.

4.1.1 Conditions of Approval

Conditions of Approval (CoA) relevant to the operation of the Asset are included in Table 4-1. Those CoA that are specific to the air quality, surface water quality and groundwater management are contained in the relevant sub-plans and monitoring programs.

Table 4-1: Relevant operational conditions of approval

CoA	Relevant Requirement	Reference
A1	The CSSI must be carried out in accordance with the terms of this approval and generally in accordance with the description of the CSSI in the WestConnex M4-M5 Link Environmental Impact Statement – Volumes 1A-C and 2A-J (dated August 2017) (the EIS) as amended by: (a) the WestConnex M4-M5 Link Submissions and Preferred Infrastructure Report (dated January 2018) (the SPIR); (b) the WestConnex M4-M5 Link Mainline Tunnel Modification Report (dated September 2018) (Modification 1 Report) as amended by the WestConnex M4-M5 Link Mainline Tunnel Modification Response to Submissions (dated November 2018) (Modification 1 RtS); (c) the WestConnex M4-M5 Link Rozelle Interchange Iron Cove Ventilation Underground Modification Report (dated November 2019) as amended by the WestConnex M4-M5 Link Rozelle Interchange Iron Cove Ventilation Underground Modification Response to Submissions Report (dated March 2020); and (d) the WestConnex M4-M5 Link Rozelle Interchange Glebe Island Construction Ancillary Facility Modification Report (dated June 2020). (e) the WestConnex M4-M5 Link Rozelle Interchange The Crescent overpass and active transport links Modification report (dated August 2019) (Modification 2 Report) as amended by the (i) WestConnex M45-M5 Link Rozelle Interchange Modification The Crescent overpass and active transport links Design amendment report (dated April 2020) (Modification 2 Amendment Report), (ii) WestConnex M45-M5 Link Rozelle Interchange Modification The Crescent overpass and active transport links Response to Submissions Report (dated April 2020) (Modification 2 RtS), and (iii) WestConnex M45-M5 Link Rozelle Interchange Modification The Crescent overpass and active transport links Response to Submissions on the Design amendment report (dated June 2020) (Modification 2 Amendment RtS); and (f) the WestConnex M4-M5 Link Rozelle Interchange Modification Request Letter (dated October 2020).	This OEMP and subs plans have been developed in accordance with the requirements of CoA A1(a-f).
A9	Without limitation, all strategies, plans, programs, reviews, audits, report recommendations, protocols and the like required by the terms of this approval must be implemented by the Proponent in accordance with all requirements issued by the Secretary from time to time in respect of them.	The requirements of the Project approval have been incorporated into this OEMP.

CoA	Relevant Requirement	Reference
A11	The Proponent is responsible for any breaches of the conditions of this approval resulting from the actions of all persons that it invites onto any site, including contractors, sub-contractors and visitors.	Compliance, training and awareness (refer Section 6) for the operation of the Asset, including the compulsory site induction, will provide opportunities to inform I&M personnel of the requirements under the conditions of approval relevant to the operation of the Asset.
A12	The CSSI may be constructed and operated in stages. Where staged construction or operation is proposed, a Staging Report (for either or both construction and operation as the case requires) must be prepared, then endorsed by the ER and then submitted to the Secretary for information. The Staging Report must be submitted to the Secretary no later than one (1) month prior to the commencement of construction of the first of the proposed stages of construction (or if only staged operation is proposed, one (1) month prior to the commencement of operation of the first of the proposed stages of operation).	The operation of the M4-M5 Link Project will be staged. Refer to Section 3.2 of this OEMP.
A16	Where changes are proposed to the staging of construction or operation, a revised Staging Report must be prepared and submitted to the Secretary for information no later than one (1) month prior to the proposed change in the staging.	Where changes to the staging of operation are proposed, the Staging Report will be revised and submitted to the Secretary at least one (1) month prior to the proposed change. Refer to Section 9.7.
A27	A Compliance Tracking Program to monitor compliance with the terms of this approval must be prepared, taking into consideration any staging of the CSSI that is proposed in a Staging Report submitted in accordance with Conditions A12 and A13 of this approval.	The Compliance Tracking & Environmental Audit Program (CTEAP) was prepared to satisfy this condition. The CTEAP is discussed in Section 9.5.
A29	The Compliance Tracking Program in the form required under Condition A28 of this approval must be implemented for the duration of works and for a minimum of one (1) year following commencement of operation, or for a longer period as determined by the Secretary based on the outcomes of independent environmental audits, Environmental Representative Monthly Reports and regular compliance reviews submitted through Compliance Reports. If staged operation is proposed, or operation is commenced of part of the CSSI, the Compliance Tracking Program must be implemented for the relevant period for each stage or part of the CSSI.	The CTEAP was prepared to satisfy this condition and is discussed in Section 9.5.
A37	The Environmental Audit Program, as submitted to the Secretary, must be implemented and complied with for the duration of construction and operation.	This is a captured under the wider CTEAP. Discussed further in Section 9.3.
A38	All independent environmental audits of the CSSI must be conducted by a suitably qualified, experienced and independent team of experts in auditing and be documented in an Environmental Audit Report which: (a) assesses the environmental performance of the CSSI, and its effects on the surrounding environment; (b) assesses whether the project is complying with the terms of this approval; and (c) recommends measures or actions to improve the environmental performance of the CSSI.	This is a captured under the wider CTEAP. Discussed further in Section 9.3.
A39	The Proponent must submit a copy of the Environmental Audit Report to the Secretary for information, with a response to any recommendations contained in the audit report within six (6) weeks of completing the audit.	This is a captured under the wider CTEAP. Discussed further in Section 9.3.
A40	The Secretary must be notified as soon as possible and in any event within 24 hours of any incident.	Incident management, including notification of the Secretary, is summarised in Section 8.2 and 9.7.

CoA	Relevant Requirement	Reference
A41	Notification of an incident under Condition A40 of this approval must include the time and date of the incident, details of the incident and must identify any consequent non-compliance with this approval.	Incident management, including notification of the Secretary, is summarised in Section 8.2.
A42	All written requirements of the Secretary or relevant public authority, which may be given at any point in time, to address the cause or impact of an incident must be complied with, within any timeframe specified by the Secretary or relevant public authority.	Incident management, including notification of the Secretary, is summarised in Section 8.2.
A43	If statutory notification is given to the EPA as required under the POEO Act in relation to the CSSI, such notification must also be provided to the Secretary within 24 hours after the notification was given to the EPA.	Incident management, including notification of the Secretary, is summarised in Section 8.2.
B5	The Communication Strategy, as approved by the Secretary, must be implemented for the duration of the works and for 12 months following the completion of construction.	Noted. The approved CCS is being implemented to manage stakeholder communications, complaints and engagement throughout construction.
B8	A Complaints Management System must be prepared prior to the commencement of any works in respect of the CSSI and be implemented and maintained for the duration of construction and for a minimum for 12 months following completion of construction of the CSSI.	Project Company established the complaints management system to comply with this condition during the preparation of the Environmental Impact Statement for the Project, fulfilling the requirements of this condition. This same consultation manager system is being utilised during operation of the Asset to ensure consistency in reporting of enquiries and complaints. This will continue for up to 12 months following the completion of the construction of the SSI Complaints and enquiries are discussed in Section 7.3.2.
B9	The Complaints Management System must include a Complaints Register to be maintained recording information on all complaints received about the CSSI during the carrying out of any works associated with the CSSI and for a minimum of 12 months following the completion of construction of the CSSI. The Complaints Register must record the: (a) number of complaints received; (b) number of people affected in relation to a complaint; and (a) (c) nature of the complaint and means by which the complaint was addressed and whether resolution was reached, with or without mediation.	Complaints and enquiries are discussed in Section 7.3.2.
B17	A website providing information in relation to the CSSI must be established before commencement of works and maintained for the duration of works, and for a minimum of 24 months following the completion of construction of the CSSI. The following up-to-date information (excluding confidential, private and commercial information) must be published prior to works commencing and maintained on the website or dedicated pages: (a) information on the current implementation status of the CSSI; (b) a copy of the documents listed in Condition A1 of this approval, and any documentation relating to any modifications made to the CSSI or the terms of this approval; (c) a copy of this approval in its original form, a current consolidated copy of this approval (that is, including any approved modifications to its terms), and copies of any approval granted by the Minister to a modification of the terms of this approval; and	Where required by this approval, documents are uploaded on the project website (https://www.westconnex.com.au/) prior to the relevant work/activity being undertaken.

CoA	Relevant Requirement	Reference
	(d) a copy of each licence or permit required and obtained in relation to the CSSI. Where a condition(s) of this approval requires a document(s) be prepared prior to a work or construction or operational activity being undertaken, a current copy of the relevant document(s) must also be published on the website before the work / activity is undertaken.	
D1	An Operational Environmental Management Plan (OEMP) must be prepared in accordance with the Guideline for the Preparation of Environmental Management Plans (DIPNR, 2004) to detail how the performance outcomes, commitments and mitigation measures made and identified in the documents listed in Condition A1 will be implemented and achieved during operation. This condition (Condition D1) does not apply if Condition D2 of this approval applies.	This OEMP has been prepared to satisfy this condition. This plan has been developed in accordance with the Guideline for the Preparation of Environmental Management Plans (Department of Infrastructure, Planning and Natural Resources, 2004) as identified in Section 1. The plan has been developed in consultation with relevant stakeholders. Consultation on this plan is summarised in Section 1.5. A separate document 'Consultation for the M4-M5 Link Mainline Tunnels OEMP and sub-plans' has been prepared separately to this plan to describe the OEMP consultation activities to date and how comments received have been addressed or considered.
D3	Where an OEMP is required, the Proponent must include the following OEMP Sub-plans in the OEMP: (a) Groundwater management: DPI Water and Sydney Water	Refer to Annexure H
D6	The OEMP or EMS or equivalent as agreed with the Secretary, must be submitted to the Secretary for information no later than one (1) month prior the commencement of operation.	Noted.
D7	The OEMP or EMS or equivalent as agreed with the Secretary, as submitted to the Secretary and amended from time to time, must be implemented for the duration of operation and the OEMP or EMS must be made publicly available prior to the commencement of operation.	Noted.
D8	The following Operational Monitoring Programs must be prepared in consultation with the relevant authorities identified for each Operational Monitoring Program to compare actual operational performance against predicted performance. (a) Surface Water Quality Plan & Monitoring Program: EPA, DPI Water, Sydney Water, and relevant council(s) (b) Groundwater Monitoring Program: DPI Water, relevant council(s), EPA and Sydney Water	Refer to Annexure G & Annexure H
D18	Where a relevant OEMP Sub-plan exists, the relevant Operational Monitoring Program may be incorporated into that OEMP Sub-plan.	Refer to Annexure G & Annexure H
E1	In addition to the performance outcomes, commitments and mitigation measures specified in the documents listed in Condition A1, all reasonably practicable measures must be implemented to minimise the emission of dust and other air pollutants during the construction and operation of the CSSI.	Noted. Measures to minimise impacts on air quality impacts during operation are summarise in Section 5.4.
E2	Prior to finalising the detailed design of the CSSI and establishing the ambient air quality monitoring stations required under Condition E24, the Proponent must establish an Air Quality Community Consultative Committee (AQCCC) to provide advice prior to and during the operation of the CSSI. The AQCCC must:	Refer to Section 7.5 and Annexure F

CoA	Relevant Requirement	Reference
	(a) be comprised of – i. two representatives from the Proponent and tunnel operator, ii. one representative from each of the relevant councils, whose attendance is only required when considering matters relevant to their respective local government area, iii. three representatives from each local community adjacent to each ventilation facility whose attendance is only required when considering matters relevant to their respective local area, and whose appointment has been approved by an expression of interest process conducted by the Proponent in consultation with the Secretary, and iv. a Chair who is an independent from the design and construction of the CSSI put forward by the Proponent and approved by the Secretary; (b) meet at least four (4) times a year, or as otherwise agreed by the Chair and the Secretary; (c) review and provide advice on the location of the air quality monitoring stations required under Condition E24, operation environmental management plans and other operation stage documents, compliance tracking reporting, audit reports, or complaints as they relate to air quality; and (d) provide advice on the dissemination of monitoring results and other information on air quality issues. The AQCCC may comprise the same members of the AQCCC established under CSSI approvals for the WestConnex M4 East and New M5 projects (SSI 6307 and SSI 6788) in relation to the ventilation outlets located in Haberfield and St Peters. The AQCCC must operate for up to two (2) years after commencement of operation, or as otherwise approved or directed by the Secretary, in consultation with the Chair.	
E7	Conditions E2A, E3, E4, E5, and E6 do not apply in an emergency, as defined in the OEMP required by Condition D1.	Refer to Section 8.2.1
E8	The Proponent must, as soon as reasonably practicable, notify the Secretary and the EPA of any discharge during an emergency.	Refer to Annexure F
E9	The tunnel ventilation systems must be designed, constructed and operated so as to only release emissions from ventilation outlets and not from the portals or the tunnel support facilities as identified in the documents listed in Condition A1, except for emergency smoke management purposes in the event of a fire in a tunnel or periodic testing of the system as defined in the OEMP required by Condition D1.	Refer to Section 8.2.1 and Annexure F
E64	The Proponent must prepare an Operational Road Network Performance Review, within 12 months and five (5) years after the commencement of operation of the full CSSI (of the mainline tunnels and Rozelle Interchange). The Review must address road network performance and review the performance of the CSSI on the adjoining road network. The Review must confirm the adequacy of the mitigation measures identified in the Road Network Performance Plan required under Condition E63. The Review must be undertaken in consultation with Transport for NSW and relevant council(s) and be completed within six (6) months of the review timeframes. The Review must be provided to the Secretary within 60 days of its completion. Further mitigation measures, if required, must be included in the Review. The Proponent is responsible for the implementation of the identified measures.	Refer to Section 9.4 and 9.7

CoA	Relevant Requirement	Reference
	Note: Identified mitigation measures may need to be further assessed under the Environmental Planning and Assessment Act, 1979. Works will need to meet relevant design standards and to subject to independent road safety audits.	
E67	All noise and vibration assessment, management and mitigation required by this approval must consider the cumulative noise impacts of approved CSSI and SSI projects. This includes using ambient and background levels which do not include other WestConnex M4 East and New M5 (SSI 6307 and SSI 6788) projects. This condition applies to all works and operation.	The operational noise assessments contained in the Operational Noise and Vibration Review (ONVR) considered cumulative impacts of the other WestConnex stages and will be verified within 12 months from the commencement of operation. Refer to Section 9.2. Cumulative impacts will also be considered in noise assessments undertaken for I&M activities during operation. Refer to Section 5.4
E95	Within 12 months of the commencement of operation of the CSSI, the Proponent must undertake monitoring of operational noise to compare actual noise performance of the CSSI against the noise performance predicted in the review of noise mitigation measures required by Condition E92. The Proponent must prepare an Operational Noise Compliance Report to document this monitoring. The Report must include, but not necessarily be limited to: (a) noise monitoring to assess compliance with the operational noise levels predicted in the review of operational noise mitigation measures required under Condition E92; (b) a review of the operational noise levels in terms of criteria and noise goals established in the NSW Road Noise Policy 2011; (c) methodology, location and frequency of noise monitoring undertaken, including monitoring sites at which CSSI noise levels are ascertained, with specific reference to locations indicative of impacts on sensitive receivers; (d) details of any complaints and enquiries received in relation to operational noise generated by the CSSI between the date of commencement of operation and the date the report was prepared; (e) any required recalibrations of the noise model taking into consideration factors such as noise monitoring and actual traffic numbers and proportions; (f) an assessment of the performance and effectiveness of applied noise mitigation measures together with a review and if necessary, reassessment of mitigation measures; and (g) identification of additional measures to those identified in the review of noise mitigation measures required by Condition E92, that would be implemented with the objective of meeting the criteria outlined in the NSW Road Noise Policy (EPA, 2011) and Industrial Noise Policy (EPA, 2000), when these measures would be implemented and how their effectiveness would be measured and reported to the Secretary and the EPA. The Operational Noise Report must be submitted to the Secretary and the EPA within 60 days of completing the operational noise monitoring and made publicly available.	Operational performance monitoring is discussed in Section 9.2 and reporting requirements in Section 9.7. A standalone Operational Noise Compliance report will be prepared to satisfy this condition within 12 months of commencement of operation of the Asset.
E122	The Proponent must construct and operate the CSSI with the objective of minimising light spillage to residential properties. All lighting associated with the construction and operation of the CSSI must be consistent with the requirements of Australian Standard 4282-1997 Control of the obtrusive effects of outdoor lighting and relevant Australian Standards in the series AS/NZ 1158 – Lighting for Roads and Public Spaces. Notwithstanding,	The operation-phase lighting design is consistent with the Australian Standard 4282-1997. Light spill to adjacent properties will be minimise during operation through the use of directional lighting, light shields and avoidance of taller element lighting.

CoA	Relevant Requirement	Reference
	the Proponent must provide mitigation measures to manage any residual night lighting impacts to protect properties adjoining or adjacent to the CSSI, in consultation with affected landowners.	Refer to the UDLP.
E123	The Proponent must construct and operate the CSSI with the objective of avoiding adverse or distracting lighting configuration, spillage or intensity to aircraft operations. All lighting associated with the construction and operation of the CSSI must adhere to the Lighting in the Vicinity of Aerodromes: Advice to Lighting Designer (CASA, 1999) and National Airports Safeguarding Framework Guideline E: Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airports (DIRD, 2012). Notwithstanding, the Proponent must provide mitigation measures to manage any residual night lighting impacts to protect aircraft operations, in consultation with CASA and DIRD.	Given the proximity to Sydney Airport, lighting at the Campbell Road MOC was designed to minimise any adverse impacts to aircraft operations and adhere to the relevant CASA and DIRD guidelines. Consultation with CASA and DIRD was also completed during the detailed design process. Refer to the UDLP.
E137	The Urban Design and Landscape Plan(s), as approved by the Secretary, must be implemented during construction, as required, and operation.	The approved UDLP is being implemented with construction of the permanent built surface works commencing in August 2020.
E139	The ongoing maintenance and operation costs of urban design, open space, landscaping and recreational items and works implemented as part of this approval will remain the Proponent's responsibility until satisfactory arrangements have been put in place for the transfer of the asset to the relevant authority. Prior to the transfer of assets, the Proponent will maintain items and works to at least the design standards established in the Urban Design and Landscape Plan, and its sub-plans, required by Condition E133.	Noted.
E144	The Proponent must undertake annual Hazard Reviews of the project for the first five (5) years of operation. The Hazard Review must detail all hazardous incidents that have occurred during the preceding period, identify safety measures required to rectify those incidents, and address any ongoing issues. The first Hazard Review must be undertaken for the first three (3) months of operation after the opening of the project to traffic. Subsequent Hazard Reviews must be undertaken for the following nine (9) months and thereafter at 12 monthly intervals. FRNSW may also direct the Proponent to undertake a Hazard Review following any major incident in the tunnel.	Refer to Section 9.4
E145	A Hazard Review Report, outlining the results of the Hazard Review, and any proposed additional safety measure(s) to be implemented in response to the findings of the Hazard Review, must be submitted to FRNSW no later than one (1) month after the review period. The Proponent must respond in writing to any recommendation made by FRNSW in relation to the findings of a Hazard Review, within such time as may be agreed to by FRNSW.	Refer to Section 9.4 Results of these annual reviews will be documented in a Hazzard Review Report and provided to FRNSW for review with any feedback received responded to in writing.
E150	Maintenance testing of fire and life safety systems must be undertaken at least annually, or any other interval as required by the design engineer and in consultation of FRNSW. Results of maintenance testing must be made available to FRNSW for review, and the Proponent must respond in writing to any recommendations from FRNSW to ensure the reliability of the fire and life safety systems.	Refer to Section 9.4. Results of these annual reviews will be documented in a Maintenance Testing Report and provided to FRNSW within 1 month after the review with any feedback received responded to in writing.
E153	The Proponent must prepare a Flood Review Report(s) after the first defined flood event for any of the following flood magnitudes – the 5 year ARI event, 20 year ARI event, 100 year ARI event and probable maximum flood – to assess the actual flood impact against that predicted in the documents referred to in Condition A1. The Flood Review Report(s) must be prepared within three	Operational reviews and checks are discussed in Section 9.4 and reporting requirements in Section 9.7

CoA	Relevant Requirement	Reference
	(3) months of each flood event. The report(s) must prepared by an appropriately qualified person(s) and include: (a) identification of the properties and infrastructure affected by flooding during the reportable event; (b) a comparison of the actual extent, level, velocity and duration of the flooding event against the impacts predicted in the documents referred to in Condition A1 and the requirements specified in Condition E151; and (c) where the actual extent and level of flooding exceed the predicted level and / or the requirements specified in Condition E151, with the consequent effect of adversely impacting on property(s), structures and infrastructure, identification of the measures to be implemented to reduce future impacts of flooding related to the CSSI works, including the timing and responsibilities for implementation. Flood mitigation measures must be developed in consultation with the affected property / structure / infrastructure owners and the relevant council(s). A copy of the Flood Review Report(s) must be submitted to the Secretary and relevant council(s) within one (1) months of finalising the report(s).	
E204	All waste generated during construction and operation must be classified in accordance with the EPA's Waste Classification Guidelines, with appropriate records and disposal dockets retained for audit purposes.	Noted.

4.1.2 Mitigation and management commitments

Table 4-2 summarises the safeguards and mitigation measures included in the M4-M5 Link Tunnels Submissions and Preferred Infrastructure Report (SPIR) (Section 8 of the document referred to in CoA A1(a)) that relate to operation of the Asset.

Table 4-2: Operational environmental mitigation and management commitments

No.	Relevant requirement	Responsibility	OEMP reference
OpTT1	A review of operational network performance will be undertaken 12 months and five years from the opening of the project to confirm the operational impacts of the project on surrounding arterial roads and major intersections in proximity to the Wattle Street interchange, Rozelle interchange and St Peters interchange. The assessment will be based on updated traffic surveys at the time and the methodology used will be comparable with that used in this assessment. The results of the review will be considered in future operational network performance planning carried out by Roads and Maritime [now TfNSW].	TfNSW	The 12-month and 5-year Operational Road Network Performance Review required by CoA E64 will satisfy this REMM. Refer Section 9.4.
OpTT2	To manage potential performance constraints at the Wattle Street interchange, Roads and Maritime will investigate the implementation of the following in consultation with local councils: • Queuing and capacity monitoring and management on the Frederick Street/Milton Street corridor • Managing lane use and utilisation to improve the operation of the corridor.	TfNSW	Measures to manage performance constraints at Wattle Street Interchange will be reviewed as part of the 12-month Operational Road Network Performance Review required by CoA E64 and REMM OpTT1. Refer Section 9.4.
AQ29	Ambient air quality monitoring will be carried out in the vicinity of the ventilation outlets installed as part of the project. Monitoring will occur at key representative locations, identified in consultation with an independent air quality specialist and an Air Quality Community Consultative Committee (AQCCC) [CoA E2], to allow direct comparison of measured ambient air quality with dispersion model predictions. The monitoring will commence at least 12 months prior to and continue for at least two years following the commencement of operation. Monitoring results and a comparison of monitoring results against dispersion model predictions and relevant ambient air quality criteria will be made publicly available.	I&M Contractor	This is met via compliance with CoA E24 to E26. Refer to OAQMP (Annexure F)

No.	Relevant requirement	Responsibility	OEMP reference
NV14	Within 12 months of the commencement of the operation of the project, actual operational noise performance will be compared to predicted operational noise performance. The need for any additional management measures to address any identified operational performance issues and meet relevant operational noise criteria will be assessed and implemented where reasonable and feasible.	D&C Contractor	This will be met via compliance with CoA E95. Refer Section 9.2
FD17	A Flood Review Report will be prepared after the first defined flood event affecting the project works for any of the following flood magnitudes – the five year ARI event, 20 year ARI event and 100 year ARI event - to assess the actual flood impact against those predicted in the design reports or as otherwise altered by the FMS. The Flood Review Report(s) must be prepared by an appropriately qualified person(s) and include: • Identification of the properties and infrastructure affected by flooding during the reportable event • A comparison of the actual extent, level, velocity and duration of the flooding event against the impacts predicted in the design reports or as otherwise altered by the FMS • Where the actual extent and level of flooding exceeds the predicted level with the consequent effect of adversely impacting of property(ies), structures and infrastructure, identification of the measures to be implemented to reduce future impacts of flooding related to the M4-M5 Link project including the timing and responsibilities for implementation. Flood mitigation measures will be developed in consultation with the affected property, structure and/or infrastructure owners, OEH and the relevant council(s).	D&C Contractor / I&M Contractor	This will be met via compliance with CoA E153. Refer Section 9.4 and 9.7
OpRW2	Waste will be managed and disposed of in accordance with relevant NSW legislation and government policies and the mitigation measures described in this EIS.	I&M Contractor	Waste management will be undertaken in accordance with the relevant legislation and guidelines. Refer to Section 4.1.3 and 4.2.
OpHR12	Aviation hazard lighting (if required), building lighting and surface road lighting will be designed and operated in accordance with the requirements of CASA and the Sydney Airport Master Plan 2033.	D&C Contractor	This is met via compliance with CoA E123.

4.1.3 Performance Outcomes

Annexure K summarises the performance outcomes included in EIS (Section 5 of Appendix A) that are relevant to the operation of the Asset.

4.1.4 Legislation

The following legislation is relevant to the OEMP and its implementation.

Table 4-3: Relevant key environmental legislation

Legislation	Relevance
General	
Environmental Planning and Assessment Act 1979	Planning and development control
Local Government Act 1993	Pollution control, protection of Aboriginal heritage, and watercourse management
Protection of the Environment Operations Act 1997	Pollution and waste management
Work Health and Safety Act 2011	Worker safety
Noise and vibration	
Protection of the Environment Operations Act 1997	Noise and vibration management
Protection of the Environment (Noise Control) Regulation 2017 (as amended)	
Traffic and transport	
Roads Act 1993	Traffic management and working on public roads
Surface water quality and hydrology	
Protection of the Environment Operations Act 1997	Soil and water management
Soil Conservation Act 1938	Erosion and sediment control
Contaminated Land Management Act 1997	Contaminated land management
National Environmental Protection (Assessment of Site Contamination) Measure 1999 (amended 2013)	Stockpile management Spill management
Water Management Act 2000 *Water Management Amendment Act 2014*	Watercourse protection Water access and use Water use approval Water management work approval Activity approval (other than aquifer interference)
Sydney Water Act 1994	Requirement to obtain consent to discharge waste water to a sewer
Pesticides Act 1999	Safe use and application of pesticides Public notification requirements before applying pesticides
Dangerous Goods (Road and Rail Transport) Act 2008	Safe and licenced transportation of dangerous goods.
Biodiversity	

Legislation	Relevance
NSW Biosecurity Act 2015 *Fisheries Management Act 1994* *Biodiversity Conservation Act 2016*	Weed management and control Safe fish passage Protection of threatened (fish) species, populations and communities
Aboriginal heritage	
National Parks and Wildlife Act 1974	Aboriginal heritage protection Management of unexpected finds
Non-Aboriginal heritage	
Heritage Act 1977	Non-Aboriginal heritage protection Management of unexpected finds
Air quality	
Protection of the Environment Operations Act 1997 *Protection of the Environment (Clean Air) Regulation 2010*	Pollution management Prohibition of burning
Greenhouse gas	
National Greenhouse and Energy Reporting Act 2007	Minimisation of greenhouse gas generation
Waste and resource management	
Protection of the Environment Operations (Waste) Regulation 2014 *Protection of the Environment Operations Act 1997* *Waste Avoidance and Resource Recovery Act 2001*	Waste classification, management, storage, transportation and disposal Waste hierarchy: reduction, in preference to reuse and recycling Littering Reduction of resource consumption Minimisation of transport impacts
Dangerous and hazardous materials	
Work Health and Safety Act 2011 *Dangerous Goods (Road and Rail Transport) Act 2008* (NSW) *Dangerous Goods (Road and Rail Transport) Regulation 2014* (NSW)	Dangerous goods and hazardous materials

4.1.5 Licences, permits and approvals

The Asset does not routinely operate under any additional permits, licences and/or approvals. However, permissions and licences may be needed for maintenance activities as described in Table 4-4.

The need for any permit or licence would be determined by the Project Company Representative on a case-by-case basis depending on the nature of the proposed work.

Table 4-4: Licences, permits and approvals for operation of the Asset

Requirement	Comment
Environment Protection Licence (EPL) under Schedule 1 of the POEO Act	Due to elevated ammonia levels in local groundwaters due to historic landfilling, the operation (activity) of the Water Treatment Plant at Campbell Road (MOC5) is considered to be a scheduled activity (treatment of contaminated groundwater) identified in the *Protection of the Environment Operations Act 1997* (POEO Act). The Water Treatment Plant will operate under an EPL. A copy of the EPL will be available on the Project Website. Emissions from the ventilation outlet will also be regulated under an EPL.
Section 138: NSW *Roads Act 1993*: road occupancy	Required when operation of maintenance activities require the occupation of the road carriageway

Requirement	Comment
Aquifer interference approval may be required in accordance with section 91 of the *Water Management Act 2000*	Section 5.23 (previously 115ZG) of the EP&A Act states that a water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act 2000* are not required for SSIs.

4.2 Environmental guidelines and principles

The policies, guidelines and principles relevant to the OEMP and its implementation are identified in Table 4-5.

Table 4-5: Environmental policies, guidelines and principles

Policy / Guideline / principles	Relevance
General	
G36: Environmental Protection (Roads and Maritime, 2017)	Environmental protection
EIA-PO5-1 Environmental Assessment Procedure for Routine and Minor Works (Roads and Maritime, 2015).	Management of routine and minor work
• Interim Community Consultation Requirements for Applicants (Department of Environment and Conservation (DEC), 2005) • International Association for Public Participation (IAP2): Public Participation Spectrum (IAP2, 2014)	Community consultation
Air Quality	
• Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DEC, 2007) • Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA, 2016) • 9TP-SD-107/2.0 Air Quality Management Guideline (TfNSW, 2016) • Australian Standard: AS3580.8 Methods for sampling and analysis of ambient air (Standards Australia, 2008) • Australian Standard: AS/NZS3580.9 Methods for sampling and analysis of ambient air (Standards Australia, 2013)	Management of air quality and dust
Noise and vibration	
• Interim Construction Noise Guidelines (Department of Environment and Climate Change (DECC), 2009) • Construction Noise and Vibration Guidelines (Roads and Maritime, 2016) • Assessing vibration: a technical guideline (DEC, 2006)	Maintenance and repair noise management
• Environmental Noise Management Manual (Roads and Maritime, 2001) • Noise Mitigation Guideline (Roads and Maritime, 2015) • Noise Criteria Guideline (Roads and Maritime, 2015) • NSW Road Noise Policy (Department of Environment, Climate Change and Water (DECCW), 2011)	Operational road traffic noise
• Noise Policy for Industry (EPA, 2017)	Operational equipment noise
• Australian Standard: AS1055 Acoustics (Standards Australia, 1997)	Description and measurement of environmental noise
Traffic and Transport	
• Guide to Traffic Management (Austroads, 2014) • Guide to Traffic Generating Developments (Roads and Maritime, 2002) • Traffic Control at Work Sites (Roads and Maritime, Version 4, 2010)	Traffic management and working on public roads
• Sydney CBD to Parramatta Strategic Transport Plan (TfNSW, 2015)	Public transport management

Policy / Guideline / principles	Relevance
Climate change and energy use	
• Australian Standard: AS 5334 Climate Change Adaptation for Settlements and Infrastructure (Standards Australia, 2013) • Climate Change Impacts and Risk Management: A Guide for Business and Government (Department of the Environment and Heritage, Australian Greenhouse Office, 2006) • Environmental Sustainability Strategy 2015-2019 (Roads and Maritime, 2016).	Climate change adaptation
Visual amenity and landscaping	
• WestConnex M4-M5 Link Mainline Tunnels Urban Design and Landscaping Plan • RMS QA Specification M321 Landscape Maintenance (Roads and Maritime, 2008) • Bridge Aesthetic Design Guidelines (Roads and Maritime, 2012) • Noise Wall Design Guideline (Roads and Maritime, 2016) • Landscape Guideline (Roads and Maritime, 2008) • Beyond the Pavement (Roads and Maritime, 2014) • G40: Clearing and Grubbing (Roads and Maritime, 2012) • GreenWay Species List: Native plants of the Cooks River to Iron Cove GreenWay	Landscape, urban design and vegetation management
• Australian Standard: AS4282 Control of the obtrusive effects of outdoor lighting (Standards Australia, 1997)	Light spill
Groundwater	
• Australian Groundwater Modelling Guidelines (National Water Commission, 2012) • NSW Aquifer Interference Policy (Department of Primary Industries, (DPI), 2012)	Groundwater modelling
Surface water quality and hydrology	
• G38: Soil and Water Management (Roads and Maritime, 2015) • Code of Practice for Water Management: Road Development and Management (Roads and Maritime, 1999) • Guidelines for Controlled Activities on Waterfront land (DPI, 2012) • Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) and the Australian and New Zealand Environment and Conservation Council (ANZECC), 2000)	Soil and water quality management
• Bunding and Spill Management Guidelines (EPA, 2017) • Australian Standard: AS1940 The Storage and Handling of Flammables and Combustibles (Standards Australia, 1994) • Australian Standard: AS4452 The Storage and Handling of Toxic Substances (Standards Australia, 1997) • Storage and Handling Liquids: Environmental Protection: Participant's Manual (DECC, 2007)	Working with chemical substances near watercourses
• Code of Practice for Water Management: Road Development and Management (Roads and Maritime, 1999) • Guidelines for Treatment of Stormwater Runoff from the Road Infrastructure (AP- R232, Austroads, 2003) • Technical Guideline: Temporary Stormwater Drainage for Road Construction (Roads and Maritime, 2011) • Managing Urban Stormwater Soils and Construction: Volume 2D Main Road Construction (DECC, 2008) • The Blue Book: Managing Urban Stormwater: Soils and Construction, Volume 1 and 2 (Landcom, 2004)	Stormwater runoff management

Policy / Guideline / principles	Relevance
• Floodplain Risk Management Guideline: Practical Consideration of Climate Change (DECC, 2007) • Guidelines for watercourse crossing on waterfront land (DPI - Water, 2012)	Working in flood plains and over/close to watercourses
• Guidelines for Construction Water Monitoring (Roads and Maritime, undated) • Australian/New Zealand Standard: AS/NZS5667.1 Water Quality – Sampling, Guidelines on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples (Standards Australia, 1998) • Australian and New Zealand Guidelines for Fresh and Marine Water Quality: Volume 1 –The Guidelines ('the ANZECC guidelines', ANZECC, 2000) • The Blue Book: Managing Urban Stormwater: Soils and Construction, Volume 1 and Volume 2 (Landcom, 2004)	Water quality sampling
• Guidelines for the Assessment and Management of Groundwater Contamination (DEC, 2007) • Environmental Direction: Management of Tannins from Vegetation Mulch (Roads and Maritime, 2012) • Guideline for the Management of Contamination (Roads and Maritime, 2013) • Environmental Incident Classification and Reporting Procedure (Road and Maritime, 2017)	Contaminated waters and leachate management
• Best Practice Guidelines for Contaminated Water Retention and Treatment Systems (NSW Government, 1994)	Storage and treatment of firefighting water
Biodiversity	
• Biodiversity Guidelines – Protecting and managing biodiversity (Roads and Maritime, 2011) • Environmental Impact Assessment Practice Note: Biodiversity Assessment (EIA-N06, Roads and Maritime, 2016) • Matters of National Environmental Significance: Significant Impact Guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999 (Department of the Environment, Water, Heritage and the Arts (DEWHA), 2013) • Threatened Biodiversity Survey and Assessment: Guidelines for developments and activities (working draft, NSW DEC, 2004) • G40: Clearing and Grubbing (Roads and Maritime, 2016)	Threatened Species Management
• 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 Witheridge, 2003) • Policy and Guidelines for Fish Friendly Waterway Crossings (NSW Fisheries, 2004) • Guidelines for Fish Habitat Conservation and Management (DPI Fisheries, 2013)	Safe fish passage
Soils and Geology	
• G38: Soil and Water Management: Soil and Water Management Plan (Roads and Maritime, 2016)	Soil and water management
• Acid Sulfate Soils Assessment Guidelines (Acid Sulfate Soil Management Advisory Committee, 1998) • Acid Sulfate Soil Manual (Acid Sulfate Soil Management Advisory Committee, 1998) • Guidelines for the Management of Acid Sulphate materials: Acid Sulphate Soils, Acid Sulphate Rock and Monosulphidic Black Ooze (Roads and Maritime, 2005) • Waste Classification Guidelines Part 4: Acid Sulfate Soils (EPA. 2014)	Acid Sulfate soils

Policy / Guideline / principles	Relevance
Aboriginal Heritage	
• Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (Office of Environment and Heritage (OEH), 2011) • Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (DECCW, 2010) • Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (NSW DECCW, 2010) • Procedure for Aboriginal Heritage Consultation and Investigation (Roads and Maritime, 2011)	Investigating and managing Aboriginal heritage
• Standard Management Procedure – Unexpected Heritage Items (Roads and Maritime, 2015)	Management of unexpected finds
Non-Aboriginal Heritage	
• Statements of Heritage Impact (Heritage Office and Department of Urban Affairs and Planning, 2002) • NSW Heritage Manual (Heritage Office and Department of Urban Affairs and Planning, 1996) • Assessing Heritage Significance (Heritage Office, 2001) • Statements of Heritage Impact (Heritage Office and Department of Urban Affairs and Planning, 2002) • How to Prepare Archival Records of Heritage Items, (Heritage Office, 1998)	Investigating and managing non-Aboriginal heritage
• Standard Management Procedure – Unexpected Heritage Items (Roads and Maritime, 2015)	Management of unexpected finds
Greenhouse gas	
• The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard, Revised Edition (World Council for Sustainable Business Development and World Resources Institute, 2004) • Greenhouse Gas Assessment Workbook for Road projects (Transport Authorities Greenhouse Group, 2013) • National Greenhouse Accounts Factors (Department of Environment and Energy, 2017)	Minimisation of greenhouse gas generation
Waste and resource management	
• Environmental Compliance Report: Liquid Chemical Storage, Handling and Spill Management (NSW DEC, 2005) • Environmental Procedure: Management of Wastes on Roads and Maritime Services Land (Roads and Maritime, 2014) • The reclaimed asphalt pavement exemption 2014 (EPA, 2014) • The stormwater exemption 2014 (EPA, 2014) • Waste Classification Guidelines (EPA, 2014) • Excavated Natural Material Exemption 2014 (EPA, 2014) • Excavated Public Road Material Exemption 2014 (EPA, 2014) • Raw Mulch Exemption 2014 (EPA, 2014)	Materials handling and storage, and waste management
• Fact Sheet 1: Virgin Excavated Natural Material (Roads and Maritime, 2015) • Fact Sheet 2: Excavated Natural Material (Roads and Maritime, 2015) • Fact Sheet 3: Excavated Public Road Materials (Roads and Maritime, 2015) • Fact Sheet 4: Reclaimed Asphalt Pavements (Roads and Maritime, 2015) • Fact Sheet 5: Asbestos Waste (Roads and Maritime, 2015) • Fact Sheet 6: Waste Sampling (Roads and Maritime, 2015).	TfNSW waste factsheets
• Waste Avoidance and Resource Recovery Strategy (NSW EPA, 2014) • Sustainability Policy: Waste Reduction and Purchasing Policy (WRAPP) (OEH, 2011)	Waste hierarchy

Policy / Guideline / principles	Relevance
• Waste Reduction and Purchasing Plan (Roads and Maritime, 2010)	Reduction of resource consumption
Dangerous goods and hazardous materials	
• Storage and Handling of Dangerous Goods Code of Practice (WorkCover NSW 2005) • The Environment Protection Manual for Authorised Officers: Bunding and Spill Management, technical bulletin (EPA, 1997) • Australian Code for the Transport of Dangerous Goods by Road and Rail (National Transport Commission 2008).	Dangerous goods and hazardous materials

5 Implementation

This section describes how the OEMP will be implemented.

5.1 Environmental management system

The I&M Contractor will utilise an Integrated Management System for environmental management. The environmental management system (EMS) has been certified as complying with AS/NZS ISO 14001.

The EMS forms the context for this OEMP, which is summarised in Figure 5-1.

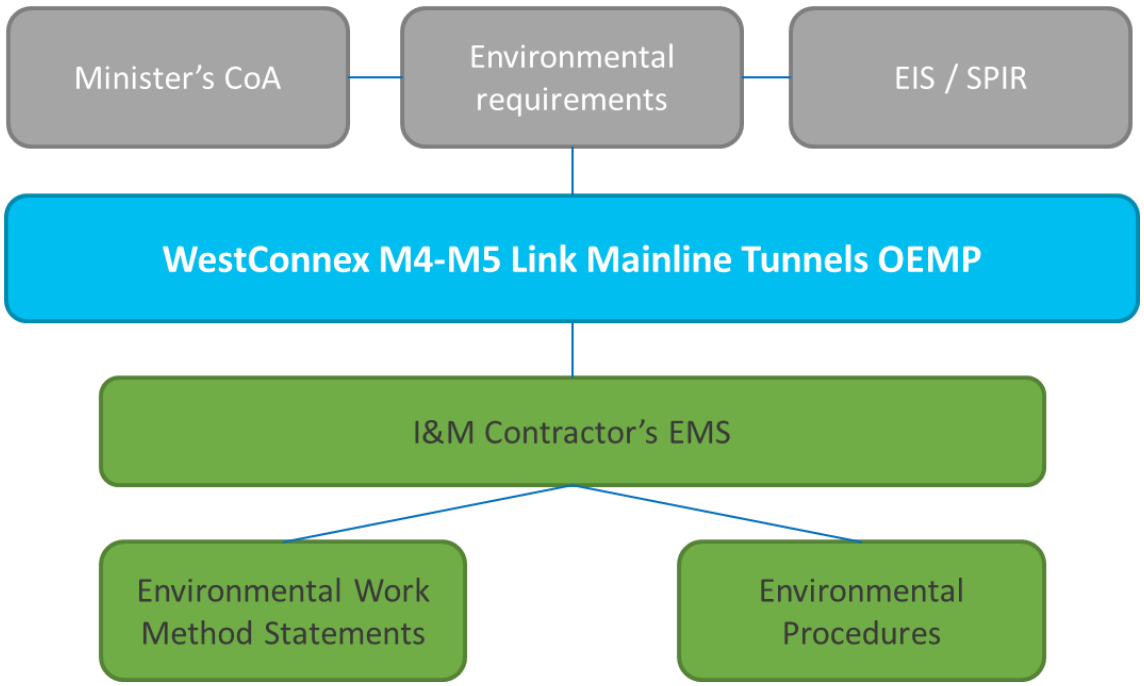


Figure 5-1: OEMP context

5.2 Environment policy

The environmental and sustainability performance of the Asset will be guided by the Project Company's Environment and Sustainability Policies (refer Annexure B). These policies will be displayed on the project website and displayed at relevant offices. The I&M Contractor's environment and sustainability policies will be consistent with the Project Company's policies.

5.3 Operation environmental management plan

This OEMP outlines the environmental management practices and procedures that are to be followed during the operation and maintenance of the Asset. It provides the overall frameworks for the systems and controls to minimise environmental impacts and meet legislative and other requirements.

5.4 Environmental management activities and controls

Site specific operational impacts have been identified and addressed through strategies and sub-plans (refer to Annexure F through I). Each strategy or sub-plan outlines management activities and controls which will be implemented to mitigate potential adverse impacts and assigns responsibility for these control measures.

The following table provides a summary of the environmental aspects which have a moderate to high risk of site-specific impacts, and the mitigation measures which have been identified to lower the risk. Aspects that have low risks have not been included in Table 5-1.

Table 5-1: Impact and mitigation measure summary

Aspect	Mitigation
Noise and vibration	Measures will be implemented to minimise the risk of noise and vibration. These measures may include: • Inform residents of planned maintenance works • Implement a complaints hotline and handling procedure • Undertake regular maintenance of equipment to ensure noise emissions do not increase over time • Schedule maintenance works during normal construction hours (if possible) • Consider cumulative noise impacts of other approved CSSI and SSI during noise assessments for I&M activities • Where maintenance works involve vibration generating activities, safe working distances would be complied with where feasible and reasonable to minimise the potential for vibration-induced building damage to nearby properties and heritage items. • Undertake consultation with affected sensitive receivers during maintenance planning • Analyse complaints and report to Project Trustee with recommendations to minimise impact
Surface water	Measures will be implemented to minimise the risk of adverse surface water quality. These measures may include: • Program regular landscape maintenance activities • Routine surface water quality monitoring • Maintenance of drainage and sump pump in tunnels • Manage vegetation stockpiles • All maintenance and incident response vehicles to contain a spill kit • Provision of 24/7 hotline for motorists to advise of any major dumping and or spill • All refuelling to be undertaken out of the Maintenance site at normal approved filling station • Promptly report all spills to the QSE Manager Refer to the Operational Surface Water Management Plan for further mitigation measures.
Groundwater	Measures will be implemented to minimise the risk of adverse groundwater quality. These measures may include: • Maintenance of drainage and sump pump in tunnels • Contain spills in the spill containment chamber of tunnel sump and/or cap outfall points to prevent offsite discharge of polluted water if required and feasible • Ensure that all groundwater monitoring is undertaken in accordance with the Monitoring Program, including if an exceedance is recorded. Refer to the Operational Groundwater Management for further mitigation measures.
Erosion and sediment	Measures will be implemented to minimise the risk of erosion and sedimentation. These measures may include: • Undertake routine post-construction monitoring to ensure successful establishment of landscaping and vegetation • Undertake remedial planting in locations where vegetation cover has not been established • Use mulch bunds or straw bales as alternatives to sediment fencing where appropriate Refer to the Operational Surface Water Management Plan for further mitigation measures.

Aspect	Mitigation
Contamination	Measures will be implemented to minimise the risk of contamination. These measures may include: • Develop a remedial action plan or ASSMP if contamination or acid sulfate soils are found to pose unacceptable risks • Engage reputable subcontractor to remove and dispose of sludge • Undertake storage and transport of liquid and dry chemicals in bunded areas and according to relevant Australian standards • Keep liquid chemicals and fuels in bunded storage areas or sheds that have capacity to contain spills from leaky containers or from an incident • Advise all personnel of the following: - Location of bunded storage areas, liquid absorbent materials and other spill containment materials and kits - Storage of large quantities of fuel for I&M vehicles and plant is not permitted - All drums and decanted containers must be labelled and stored within bunded areas whenever not in use Refer to the Operational Surface Water Management Plan for further mitigation measures.
Flora and fauna	Measures will be implemented to minimise the risk of adverse effects towards flora and fauna. These measures may include: • Maintain landscaping in accordance with the UDLP to ensure local native species are used to stabilise the soil and enhance the area • If EEC/ threatened species is identified, incorporate specific procedures to deal with that species is incorporated into the OEMP • Where fauna is encountered that requires handling or rescue, follow the Fauna Handling Rescue Procedure • Weed management controls will be undertaken in accordance with the Biodiversity Guidelines • Cleaning of maintenance vehicles and equipment regularly to avoid the spread of weeds
Air quality	Measures will be implemented to minimise the risk of air quality. These measures may include: • The tunnel ventilation system is to be automatically controlled using real-time traffic data • Tunnel ventilation is to be regularly tested • Regular Maintenance of ventilations stacks • Put exhaust fans into overdrive to further disperse emissions in the local environment • Cover any mulch stockpiles • Maintain vegetation to eliminate bare land • Only use equipment with appropriate filters • Modify or stop dust creating maintenance activities during periods of strong wind • Cover all loads that enter or leave the Maintenance Site Refer to the Operational Air Quality Management Plan for further mitigation measures.
Waste and resources	Measures will be implemented to minimise the risk of waste and resources. These measures may include: • Calculate precise estimate of materials prior to placing orders • Implement, where possible, agreements with suppliers to return excess packaging for future reuse • Encourage all staff to separate waste types • Purchase low energy equipment with ‘standby’ mode • Adopt and promote waste hierarchy • Comply with relevant legislation and guidelines as detailed in Table 4-3 and Table 4-5 • Establish a list of preferred suppliers for waste management services • Record all waste removed from Maintenance Site in the Waste Register • Monitor fuel consumption and investigate and implement minimisation measures were possible • Reuse waste material generated onsite where possible, particularly mulch

Aspect	Mitigation
Traffic and Transport	Measures will be implemented to minimise the risk of adverse effects to traffic and transport. These measures may include: • Prior to commencement of works, undertake consultation with Transport Management Centre, the Sydney Coordination Office, and/or relevant Council and where required, obtain Road Occupancy Licence (ROL) under section 138 of the NSW Roads Act 1993 and fulfil other required legislative requirements • Undertake works in accordance with Road Occupancy Licences (ROLs) • Develop a specific Traffic Control Plan (TCP) or Traffic Management Plan (TMP), as required, covering controls relevant to the location and I&M activity taking place • Notify road users and the local community two weeks prior to implementing traffic management controls for planned maintenance
Visual Amenity and Landscape	Measures will be implemented to minimise the risk of adverse effects towards visual amenity and landscaping. These measures may include: • Develop and implement relevant environmental procedures and EWMSs for vegetation and landscape management including the provisions and actions of the urban design and landscape plan • Inspect the rehabilitated and revegetated areas within the Campbell Road MOC site that provide screening and amenity and prevent erosion once every month for the first year of operation. If there is evidence of poor establishment (e.g. plants under stress and wilting) replace with suitable plant species. Continue inspections after one-year in locations where there is evidence of poor establishment in the first year until a point in time where the area is established • Maintain landscaping in accordance with the UDLP to ensure local native species are used to stabilise the soil and enhance the area Refer to the Urban Design and Landscape Plan for further mitigation measures.

5.5 Environmental control plans and maps

Environmental control plans and maps are planning documents that clearly show the site layout and location of project specific constraints, including but not limited to:

- environmentally sensitive areas;
- waterways;
- monitoring locations; and
- vegetation.

Refer to Annexure I for the site-specific environmental control maps.

5.6 Environmental schedules

The environmental schedules include documents such as site inspection checklists, environmental incident reports and waste registers. These are outlined in the appropriate sub-plans (refer to Annexure F through H).

5.7 Responsible parties for the OEMP

The key responsible parties for the OEMP are:

- Transport for NSW (TfNSW);
- Project Company;
- I&M Contractor;
- D&C Contractor.

Table 5-2: Roles and functions for key I&M responsible parties

Organisation	Roles and function
TfNSW: Proponent	• Act on behalf of the Government as the client and commissioning agency • Manage concession arrangements on behalf of the NSW Government • Is the proponent for the planning approval • Acquired the property needed to build and operate WestConnex • Maintain responsibility for tolling policy • Provide advice and leadership on environmental policy and regulation
Project Company: Delivery	• Project manage delivery of WestConnex • Assist with communication and stakeholder activities including Ministerial liaison during operation • Contractor management, performance monitoring and auditing.
I&M Contractor: Operation	Operation Services: • Procure and manage contracts for the operation and maintenance of WestConnex and any impacts that could result from this • Traffic management including monitoring the operation of traffic signalling devices from the WestConnex Motorway Control Centre (WMCC) • Equipment and systems management including monitoring the operation of tolling systems • Incident management, including attending and clearing all breakdowns and other vehicle incidents (including spills) on the M4-M5 Link Mainline Tunnels Motorway. Maintenance Services: • Routine and non-routine preventative maintenance activities required to maintain the safe and continuous operation of the M4-M5 Link Mainline Tunnels Motorway. • Corrective maintenance (activities required to repair an unexpected failure of, or defect or damage to the Asset, to restore it to full operational condition) • Condition monitoring and reporting (to provide objective assessment of the condition of the Asset) • Spare parts management (custody, use and management of spare parts).
D&C Contractor: Operation	Operational Noise Performance: • Undertake noise monitoring within 12 months following the commencement of operation to compare actual noise performance of the Asset against the noise levels predicted in the Operational Noise and Vibration Review (ONVR). • Prepare an Operational Noise Compliance Report for provision to the DPIE and EPA in accordance with CoA E95 Flood Review Reports: • Prepare a Flood Review Report(s) following the first defined flood event that occurs within five years following commencement of operation in accordance with CoA E153

5.8 Roles and responsibilities

This section describes the key environmental management roles and responsibilities that will operate for the Asset's lifetime. Figure 5-2 shows the organisational structure.

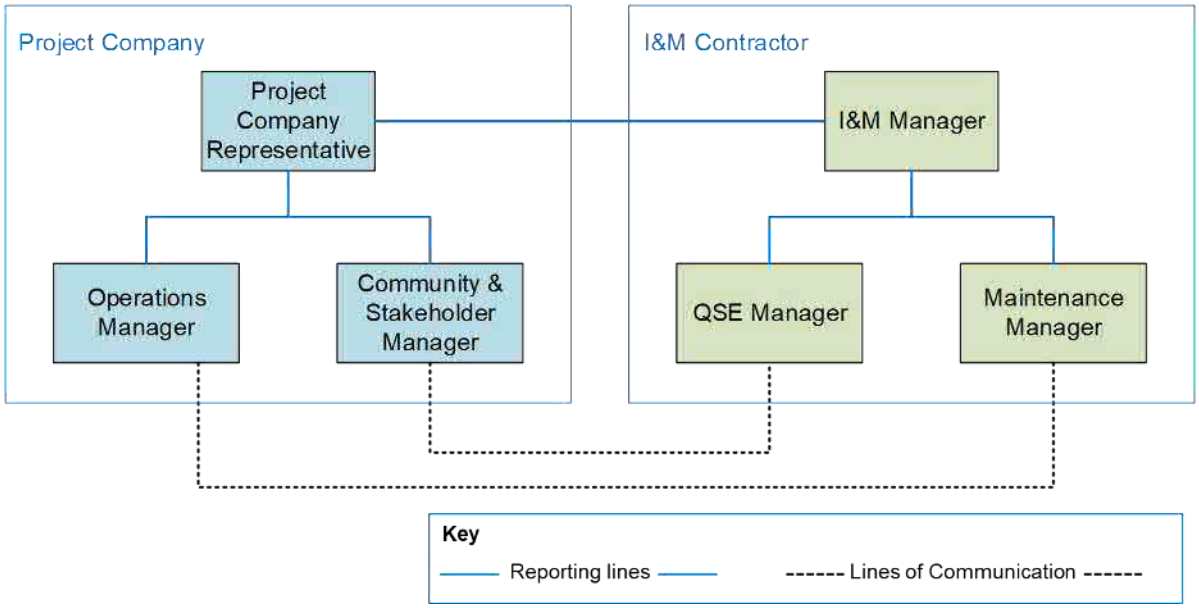


Figure 5-2: OEMP management structure

The environmental responsibilities of key I&M personnel are included in Table 5-3.

Table 5-3: Management responsibilities

Organisation and job title	Names and responsibilities
I&M Manager	• Ensure all I&M activities comply with relevant regulatory, TfNSW and Project Company requirements • Ensure the requirements of the OEMP are fully implemented, and in particular, that environmental requirements are not secondary to other I&M requirements • Implement the I&M Contractor's environmental policy • Liaise with Project Company and other Government authorities as required • Provide adequate resources (personnel, financial and technological) to ensure effective development, implementation and maintenance of the I&M Contractor's EMS • Ensure that all maintenance personnel receive appropriate induction training, including details of the environmental and community requirements • Ensure that complaints are investigated and issues raised resolved in accordance with the I&M Contractor's Community Relations Plan (CRP) • Direct work to stop immediately if there is likely to be an unacceptable environmental impact • Report back to the Project Company's Project Director • Confirm the need for any specific permissions and licences before work starts • Report, as required to Project Company
Operations Manager	• Plan operations and incident response services to avoids or minimises environmental impacts • Ensure the requirements of the OEMP are fully implemented • Ensure I&M Contractor personnel manage operations in accordance with statutory approval requirements

Organisation and job title	Names and responsibilities
	• Ensure environmental management procedures and protection measures are implemented • Ensure all I&M Contractor personnel attend an induction before starting work • Liaise with Project Company and other Government authorities as required • Direct work to stop immediately if there is likely to be an unacceptable environmental impact • Report, as required to the Project Company • Ensure adequate resources are provided to effectively respond to incidents on the motorway • Ensure that regular training is provided to all personnel participating in incident response
I&M Maintenance Manager	• Plan maintenance services in a manner that avoids or minimises impact to environment • Ensure the requirements of this OEMP are fully implemented • Ensure I&M Contractor personnel manage maintenance works in accordance with statutory and approval requirements • Ensure environmental management procedures and protection measures are implemented • Ensure all I&M Contractor personnel attend an induction prior to commencing works • Liaise with Project Company and other government authorities as required • Direct work to stop immediately if there is likely to be an unacceptable environmental impact • Report, as required to Project Company • Providing maintenance staff for incident response and manage rectification of damage following incidents
I&M Quality, Safety & Environment (QSE) Manager	• Manage environmental aspects of the O&M services • Report to I&M Manager and Project Company on the performance and implementation of the EMS and other environmental documentation • Ensure environmental risks are identified and appropriate mitigation is implemented • Identify where environmental measures are not meeting the set targets and where improvement can be achieved • Ensure environmental protocols are in place and managed • Ensure environmental compliance • Liaise with Project Company and approval authorities • Direct work to stop immediately if there is likely to be an unacceptable environmental impact or to prevent an environmental non-conformance and advise the I&M Manager, Operations Manager and I&M Maintenance Manager • Assist the Community & Stakeholder Manager to resolve environment-related complaints • Report to the Project Company as required • Responsible for all environmental records and information relating to this OEMP
Community & Stakeholder Manager	• Ensure all community consultation activities and notifications are carried out in accordance with the CoA • Report environmental issues raised by stakeholders or members of the community to the I&M QSE Manager • Communicate environment-related I&M services, performance, mitigation measures and issues to stakeholders and the community • Maintain the 24 hour complaints hotline
All I&M Contractor personnel	• Participate in the I&M services induction program • Implement activities in accordance with this OEMP • Work under the requirements of this OEMP, SOPs, EWMSs • Minimise the potential for environmental impacts • Feedback to the Operations Manager and I&M Contractor's QSE Manager on the effectiveness and practicality of maintenance methods and environmental controls

Organisation and job title	Names and responsibilities
	• Immediately report environmental incidents to the supervisor, or as soon as practicable if reasonable steps can be adopted to control the incident • Undertake remedial action as required to ensure environmental controls are maintained in good working order • Stop work immediately if there is likely to be an unacceptable environmental impact
Project Company Representative	• Receive a copy of this OEMP • Review documentation provided by the I&M Contractor, where required • Liaise with relevant stakeholders • Attend site inspections and relevant project meetings as required • Monitor I&M Contractor's environmental performance and compliance • Review and determine Consistency Assessments and Review of Environmental Factors, as required

5.9 Subcontractor environmental management

All I&M Contractor personnel are required to undertake work in accordance with this OEMP and sub-plans. Sub-contractors are required to provide their own environmental management system (EMS) relating to the activities they are contracted to perform. Sub-contractors' EMS must be consistent with this OEMP and sub-plans.

Sub-contractors to the I&M Contractor will be evaluated, selected and effectively monitored by the I&M Contractor to ensure their activities do not adversely affect the conforming deliverables. Additional detail is included in the I&M Contractor's Quality Plan.

6 Compliance, training and awareness

This section describes the processes and tools to inform the I&M personnel of their environmental obligations in undertaking their roles and responsibilities as discussed in Section 5.8. Relevant training and induction must be provided by the I&M Contractor to inform personnel of their environmental and compliance obligations under the conditions of approval.

Training requirements will be regularly reviewed and may form part of staff performance reviews, compliance tracking and ISO14001 audits. The I&M QSE Manager may also determine additional training requirements relevant to any I&M personnel's environmental responsibilities based on his/her education, training and/or experience.

6.1 Environmental induction

The I&M Contractor will implement a compulsory site induction that includes an environmental component for all I&M personnel attending the site.

I&M personnel must be aware of the requirements of this OEMP and be familiar with implementing the associated management measures. Visitors will be required to be accompanied by inducted personnel at all times.

The environmental component of the site induction will include, but not be limited to an overview of:

- relevant details of this OEMP;
- key environmental issues;
- conditions of environmental licences, permits and approvals;
- specific environmental management requirements and responsibilities;
- mitigation measures for the control of environmental issues;
- incident response and reporting requirements, including near misses;
- spills, leaks, emissions, and contamination treatment;
- emergency response procedures, communications and equipment;
- localised health, safety and environment meetings;
- site and job-specific environmental impacts and aspects;
- environmental management system obligations;
- the media protocol summarised in Section 7.4.4;
- information relating to the location of environmental constraints; and
- community awareness..

6.2 Toolbox talks

Toolbox talks will be one method of awareness training and educating for I&M personnel on issues related to all operational related aspects including environmental issues. The toolbox talks will be used to maintain environmental awareness throughout the Asset's lifetime. They will also be tailored to specific issues relevant to upcoming work, and include such as:

- environmental hazards and risks;
- SOPs, EWMSs and incident response procedures (IRPs);
- legislation changes;

- inspection findings;
- audit results;
- incident or near-miss investigations;
- I&M personnel and community suggestions for improvements; and
- community feedback and actions.

6.3 Environmental awareness training

Targeted environmental awareness training will be provided to I&M personnel with a specific authority or responsibility for environmental management or those undertaking an activity with a high risk of environmental impact.

Awareness notes will also be developed by the I&M Contractor and distributed to inform I&M personnel. These will typically take the form of a poster, booklet, or similar and will be distributed to those responsible for managing specific work locations or activities. Training may include:

- ISO 14000 awareness, obligations and requirements;
- Project Company's and I&M Contractor's environmental policies, procedures, standards and guidelines;
- SOPs and EWMSs;
- auditing (including spot and formal auditing) and workplace inspections;
- incident reporting and investigation;
- continuous improvement policies;
- environment protection and sustainability;
- spill, leaks, emissions and contamination management; and
- the waste hierarchy.

Awareness training may be delivered through:

- distance and online training in the form of memoranda and instructions; and
- training sessions prepared and delivered by the I&M QSE Manager.

6.4 Emergency response training

I&M personnel who are required to participate in an incident and/or emergency response will be trained under a program that focuses on implementing effective environmental management controls. The training will address:

- stop work procedures and follow-on actions;
- oil, fuel, chemical spill response;
- containment;
- clean up;
- waste management including removal, classification, storage, transport and disposal;
- liaison with Fire Brigade, NSW EPA and other emergency response services; and
- environmental management controls (e.g. water quality basins).

The I&M Contractor will be suitably trained in emergency response procedures identified in the Emergency Response Plan (refer Section 8.2.3), including initiating the correct and most-appropriate response and reporting incidents to the correct authority, as required.

7 Communication

This section covers the requirements to implement internal and external communication procedures in operating, maintaining and repairing the Asset.

7.1 Internal communication

The I&M QSE Manager, I&M Maintenance Manager and Operations Manager will meet regularly to discuss on-site environmental management, amendments to plans, changes to I&M activities, environmental monitoring results and other relevant aspects of the I&M Services.

Regular meetings may also be scheduled with Project Company Representative to communicate ongoing environmental performance and to discuss issues to be addressed.

The I&M QSE Manager will participate in toolbox talks (Section 6.2) and other environmental awareness training (Section 6.3) to communicate to I&M personnel on environmental performance including sensitive environmental matters for future work areas, and to receive feedback from on-site personnel.

7.2 External and Government consultation

The I&M QSE Manager will be the main point of contact regarding specific environmental issues for external and Government stakeholders.

Relevant Government agencies will be notified as required by this OEMP following an incident and/or emergency. Routine meetings will be used to discuss environmental performance, upcoming work, and high-risk activities. The meetings will include inspections of the Asset as needed.

7.3 Community communication

7.3.1 Community engagement strategy

The Project Company has developed a Community Relations Plan to provide an approach to stakeholder and community engagement. The Community and Stakeholder Manager will be responsible for engaging with the community members impacted by the operation and maintenance.

The Community Relations Plan identifies opportunities for providing information and consulting with the community and stakeholders throughout the Asset's life. The plan defines:

- engagement groups (e.g. community, other road stakeholders);
- key messages; and
- tools that will be used to interact with community and stakeholders. These tools are detailed below in Section 7.4.

Consultation with stakeholders (e.g. relevant Councils, local community, other road stakeholder groups) will be undertaken throughout I&M of the Asset in accordance with the Project Company's Community Relations Plan.

7.3.2 Complaints and enquiries procedure

A Complaints Management System, consistent with *AS/NZS 10002:2014 Guidelines for Compliant management in Organisations* will be implemented by the Project Company during the operational life of the Asset.

There are several pathways to make a complaint or enquiry. These include the following:

- 24 hour phone number (1800 660 248) answered by the Stakeholder and Community Manager or delegated on-site supervisor during out of hours works
- postal address (Locked Bag 3905 GPO Sydney NSW 2001)
- email address (info@westconnex.com.au).

Community members can access the above resources, as required, to address any complaints or enquires they have.

All enquiries, feedback and complaints received through the above pathways or received by personnel working on the project will be forwarded to the Stakeholder and Community Manager, and to the I&M Contractor's QSE Manager (where appropriate) for issues relating to management of the environment.

Information on all complaints received, including the means by which they were addressed, whether resolution was reached, and whether mediation was required, will be included in a Complaints Register by the Stakeholder and Community Manager. The information contained within the register will be made available to DPIE on request.

The Community Relations Plan provides the framework to manage and resolve complaints that arise from a number of communication methods, with this framework summarised in Table 7-1, Figure 7-1 and Figure 7-2.

All complaints should be closed off in the Complaints Register. The stakeholder(s) will also be kept informed of when they will receive a response.

The Stakeholder and Community Manager (and/or delegate) will manage, record and respond to all complaints. Complaints will be reported to Project Company through regular Asset reporting.

Table 7-1: Response processes for complaints, enquiries and feedback

Item	Response Process
Enquiries from Federal, State and local government representatives via email, telephone or written correspondence	• Stakeholder and Community Manager notifies the Project Company Representative immediately of all enquiries from Federal, State and local government representatives relating to the I&M Services. • Stakeholder and Community Manager acknowledges the correspondence / contact within 48 hours of its receipt. A draft response (if required) is provided to Project Company for approval within 5 working days of the correspondence/contact. • Any briefings for these representatives will be arranged by the Project Company Representative
Calls (complaints/enquiries/ feedback)	• All calls or enquiries will be responded to immediately or within two working hours. Calls will be answered by the Stakeholder and Community Manager or a delegated on-site supervisor at the WMCC during out of hours works. • When a complaint or enquiry cannot be responded to immediately a follow up verbal response on what action is proposed will be provided to the complainant / enquirer within 24 hours of the complaint or enquiry being received. • A written response to the complainant / enquirer will be made within 10 business days if the complaint or enquiry cannot be resolved by the initial or follow up verbal response. • A draft response will be provided to the Project Company (if required) before responding to the contact.
Written correspondence or representation	• Any representation is acknowledged within 5 business days of receipt by the Stakeholder and Community Manager. • Draft responses to be approved by Project Company. • The written response will be issued within 15 business days of receipt by Stakeholder and Community Manager.

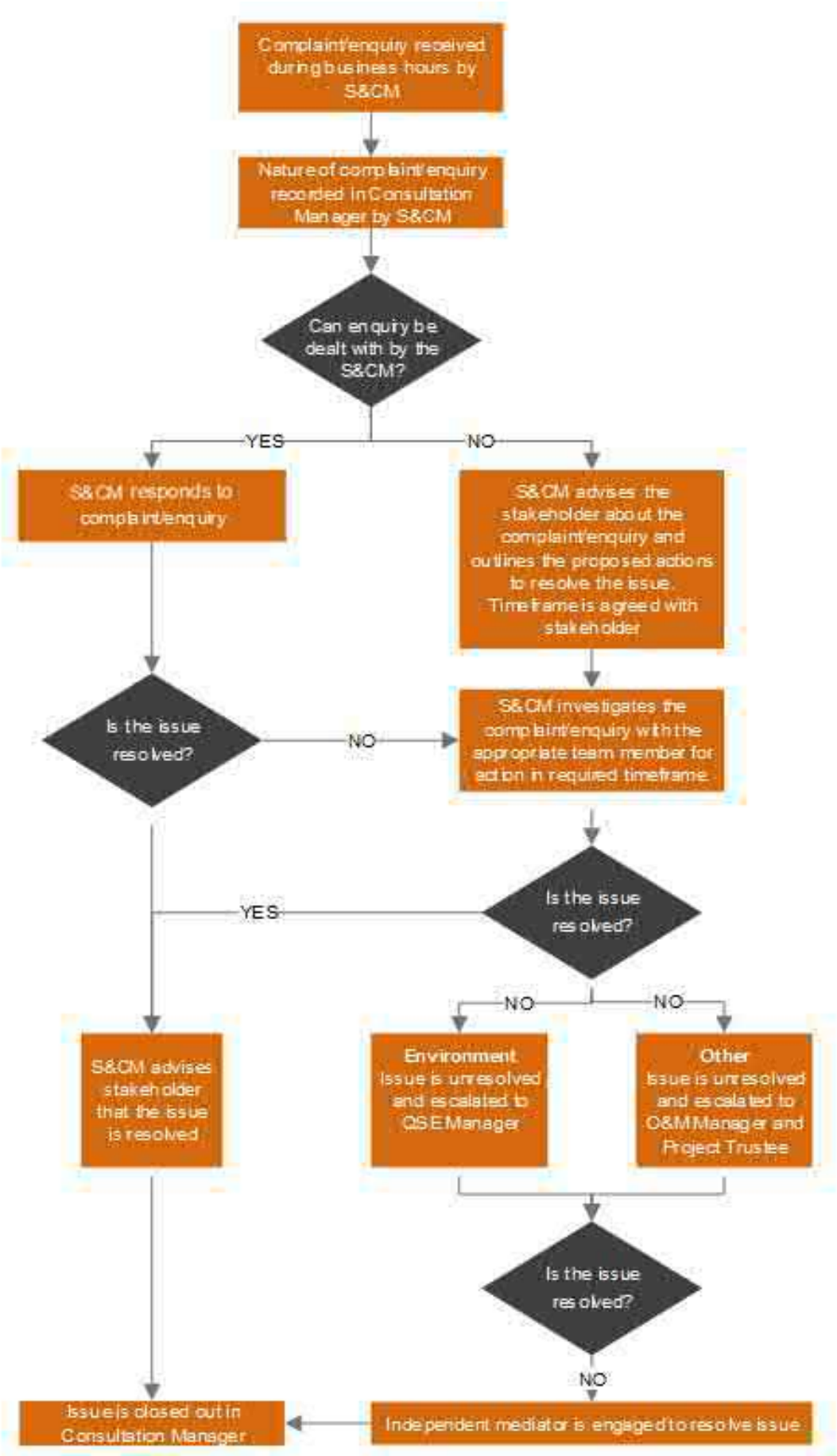


Figure 7-1: Process for enquiries and complaints recieved during business hours.

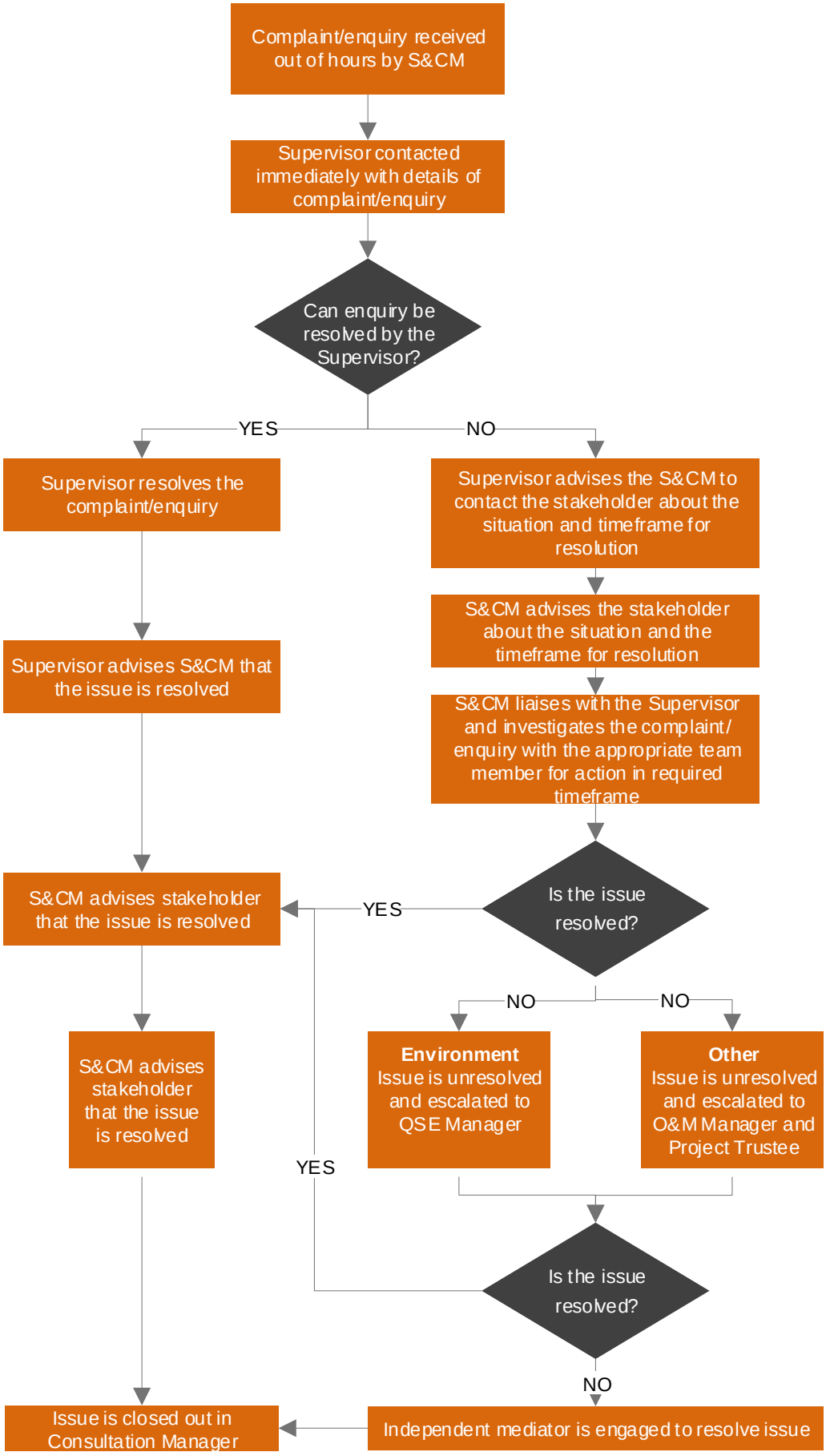


Figure 7-2: Process for enquiries and complaints received outside of business hours

7.4 Communication tools

Communication tools defined in the Community Relations Plan include:

- leaflets / letterbox notifications;
- advertisements;
- door knocking;
- signage;
- website updates;
- meetings; and
- 24-hour contact telephone number and email address.

7.4.1 Advertising routine operations and maintenance activities

Expected traffic delays and restrictions due to planned major operation and maintenance work will be publicly advertised through various media streams. The information to be advertised includes:

- the nature of the work;
- areas where the work is proposed;
- hours of work;
- contact information;
- changes to traffic and transport arrangements;
- how to register complaints;
- details of how to obtain further information.

The I&M Contractor must comply with the format of all written information and standard formats provided by the Project Company where appropriate.

Motorists will be informed of upcoming work and disruptions through:

- Variable message signs (VMS);
- WestConnex website;
- Livetraffic.com (http://www.livetraffic.com);
- Advertisements in newspapers and online; and / or
- Radio advertisements.

7.4.2 WestConnex website

Information relevant to the Asset is available to the public on the WestConnex website (https://www.westconnex.com.au/) including:

- information on the current implementation status of the SSI;
- the relevant approval documentation including the Project environmental impact statement (EIS), Submissions Report and modifications;
- the SSI 7485 approval;
- each relevant environmental approval, licence or permit required and obtained in relation to SSI 7485;

- each current report, plan or other document required under SSI 7485;
- outcomes of compliance tracking in accordance with CoA A27 & A28;
- details of contact point(s) to which community complaints and enquires may be directed, including a telephone number, a postal address and an email address; and
- how to receive important information in the common community languages of the area.

Further to this, air quality monitoring results will be made publicly available each month in hard copy format in an easy to interpret format in accordance with CoA E28. Further detail on air quality monitoring results, including the type of information available and where it can be obtained, is outlined in the OAQMP (refer to Annexure F).

7.4.3 Contact information

The relevant contact information for community complaints and enquiries is included in Table 7-2.

Table 7-2: Community contact information

Method	Information
24-hour telephone number	A permanent 24-hour contact number (1800 660 248) will be maintained, publicised and advertised on the WestConnex website, mail outs and in all publications.
Postal address	Locked Bag 3905 GPO Sydney NSW 2001
Email address	info@westconnex.com.au
Website	Project Company manages the Asset website (https://www.westconnex.com.au/). The website will be routinely and regularly updated to include: • The latest OEMP and sub-plans • EIS, SPIR and Modification reports • Information on the current implementation status • Environmental approval, licences or permits required • Conditions of Approval and any future modifications • Tolling queries • Scheduled operations and maintenance activities • The outcome of compliance tracking • Complaints handling details • Contact details • Traffic management and patronage • Other relevant community information

7.4.4 Media protocol

I&M personnel will adhere to the following media communication protocol:

- Media enquiries will be directed to the Project Company Representative;
- No I&M personnel will be authorised to make a public statement without consulting with the Project Company Representative;
- Media will not be permitted onsite without Project Company approval;
- All I&M personnel will be made aware the media protocol in their induction training.

7.5 Air Quality Community Consultative Committee

The Air Quality Community Consultative Committee (AQCCC) has been established in accordance with CoA E2. The AQCCC consists of representatives from TfNSW, the Project Company, relevant councils and the local community.

The AQCCC reviews and provides advice on the following, as they relate to air quality:

- Location of the air quality monitoring stations required under CoA E24, and the length of time during which monitoring is required;
- Operational sub-plans relevant to air quality;
- Other operation stage documents relevant to air quality;
- Compliance tracking reports relevant to air quality;
- The proposed air quality auditor(s) for the Asset, air quality audit reports; and
- Complaints received relating to air quality.

The AQCCC may also provide advice on the dissemination of monitoring results and other information on air quality issues. This OEMP will be updated, if required, in accordance with Section 1.3 of this plan to consider AQCCC advice on the availability of monitoring results or other air quality related information.

8 Risks, incidents and emergencies

This section covers the processes used to identify, monitor and manage risks, incidents and emergencies.

8.1 Environmental risk analysis

The typical inherent environmental risks associated with the Asset's operational key environmental performance issues are identified in Annexure C. The environmental risk analysis adopts the methods included in Australian Standard AS ISO 31000:2009 Risk Management, Principles and Guidelines (Standards Australia, 2009) and ISO 14001:2016 Environmental Management Systems. It includes:

- Routine operational risks;
- Non-routine operational risks.

The analysis then describes the measures that serve to manage these risks and consequently the residual outcome. The OEMP and supporting sub-plans serve to introduce risk mitigation controls to reduce:

- Likelihood, such as training and awareness, as well as the assignment of roles and responsibilities;
- Magnitude, such as water quality detention basin maintenance.

The potential consequence, likelihood and risk level were assessed using the ratings in Table 8-1, Table 8-2 and Table 8-3.

Table 8-1: Potential environmental consequence

	Insignificant	Minor	Significant	Major	Catastrophic
Environmental Consequence	No impact on or off site	On-site impact requiring routing internal remediation	Off-site impact requiring internal remediation OR on-site impact requiring substantial internal remediation	Impact on- or off-site requiring specialist external remediation	Impact on- or off-site with long term effect OR requiring immediate external response

Table 8-2: Potential environmental likelihood level

	Almost certain	Likely	Possible	Unlikely	Rare
Potential Likelihood Level	The potential consequence is expected to occur in most circumstances	The potential consequence will probably occur in most circumstances	The potential consequence is expected to occur at some time	The potential consequence could occur at some time	The potential consequence may occur in exceptional circumstances

Table 8-3: Environmental risk rating

		Potential Consequence level				
		Insignificant	**Minor**	**Significant**	**Major**	**Catastrophic**
Potential likelihood level	**Almost certain**	Medium 11	High 16	High 20	Extreme 23	Extreme 25
	Likely	Medium 7	Medium 12	High 17	High 21	Extreme 24
	Possible	Low 4	Medium 8	Medium 13	High 18	High 22
	Unlikely	Low 2	Low 5	Medium 9	Medium 14	High 19
	Rare	Low 1	Low 3	Low 6	Medium 10	Medium 15

8.1.1 Continual improvement

The environmental risk register will be reviewed, and upgraded if required following an incident, emergency, change in legislation, change in operating and maintenance procedures/activities, audit findings, non-compliance, continual improvement measures or otherwise annually. New, atypical, non-routine or major environmental risks will be included and assessed under environmental risk analysis.

Where additional key environmental impacts are identified through this process, an appropriately detailed assessment of key environmental impact will be undertaken.

The I&M Contractor's QSE Manager will be responsible for maintaining and reviewing the environmental risk analysis process and environmental risk register, with input from Project Company.

8.1.2 Risk identification

Environmental risks may be identified through:

- Site audits;
- Reporting checks and audits;
- On-the-job observations;
- Site meetings;
- Toolbox talks;
- Investigations into an actual or potential breaches of the CoA and/or this OEMP;
- Corrective actions;
- Regular reviews of the I&M Contractor's environmental management system;
- Continuous improvement measures.

8.2 Incident and emergency management

8.2.1 Definition of emergency

An ‘emergency’ is required to be defined in this OEMP as it applies to conditions B4, E22 and E44. Relevant conditions are listed in Table 8-4.

Table 8-4: CoA relevant to the definition of an ‘emergency’

CoA	Requirement
E7	Conditions E2A, E3, E4, E5, and E6 do not apply in an emergency, as defined in the OEMP required by Condition D1.
E9	The tunnel ventilation systems must be designed, constructed and operated so as to only release emissions from ventilation outlets and not from the portals or the tunnel support facilities as identified in the documents listed in Condition A1, except for emergency smoke management purposes in the event of a fire in a tunnel or periodic testing of the system as defined in the OEMP required by Condition D1.
E142	Prior to operation, the Proponent must prepare an Emergency Response Plan, in consultation with FRNSW and NSW Police Force. The Emergency Response Plan must include, but not be limited to: (a) protocols and procedures to be followed during emergency situations associated with the operation of the project (including fires, explosions and, for the purposes of this condition, vehicle collisions). The protocols and procedures are to take into account the needs of people with a disability or who may experience access problems in emergency situations; (b) details of traffic management measures to be implemented during emergencies, where appropriate, to minimise the potential for escalation of the emergency; (c) design and management measures for containment of contaminated fire-fighting water, fuel spills and gaseous combustion products; (d) details of a training and testing program to ensure that – (i) all operational staff familiar with the Emergency Response Plan, and (ii) coordination with FRNSW and NSW Police is regularly exercised; and (e) provision for a simulated emergency response exercise, including the Proponent, FRNSW and NSW Police, to be conducted in accordance with the approved Emergence Response Plan on at least one occasion prior to the opening of the tunnel to traffic. The time for the exercise is to be agreed by the participants.

The definition of an emergency for each of the above CoA is included in Table 8-5.

Table 8-5: Definition of ‘emergency’ by relevant CoA

CoA	Requirement
E7	An emergency discharge is an emission from the ventilation system that is caused by an incident or set of circumstances which does not ordinarily occur in the everyday use of the tunnel and is beyond: • Merely heavy traffic or congestion, or • The capacity of the tunnel operator to control or to have prevented by taking steps which a prudent, experience and competent operator would have taken. Conditions E2A, E3, E4, E5, and E6 do not apply in the event of this emergency.

CoA	Requirement

E9	An emergency smoke management purpose is what is reasonably necessary to manage smoke in response to a fire occurring in the tunnel, including in accordance with instructions given by NSW Emergency Services. An emergency smoke management purpose may also occur during a simulated emergency response exercise as referred to in the Emergency Response Plan required under condition E142 (e) of the approval.
	Periodic testing may include, but not be limited to testing during commissioning; replacement, repair and testing of faulty ventilation equipment; and routine testing and maintenance periods of:
	• tunnel ventilation equipment,
	  ○ where one or both carriageways are closed to traffic including maintenance of jet fans in the tunnel
	  ○ in the ventilation facilities including axial fans, dampers and sound attenuators, and within the internal outlet
	• tunnel ventilation support systems (e.g. substations)
	• fire and life safety systems.

E142	An emergency to which the Plan applies is an out-of-the-ordinary event, such as bushfires, flood and dust storms, or set of circumstances that causes or threatens to cause harm to the safety or well-being of the community, employees, or users of the Motorway or associated assets. It requires a coordinated response from NSW Emergency Services and the Tunnel Operator.

An emergency may require a coordinated response from relevant authorities, Emergency Services, I&M Contractor and Project Company.

Upon declaration of an emergency, the Operator will implement the relevant emergency or incident management plans and key I&M Contractor staff will form an emergency management team (EMT). The EMT will coordinate the I&M Contractor's response to best assist the Project Company's Crisis Management Team and Emergency Services in managing the event.

In relation to condition E9, all reasonable attempts have been made to avoid portal emissions during normal operations and during foreseeable incident conditions. The ventilation system has significant capacity to manage a broad range of Asset emergencies (as defined in Table 8-5), however, there may be emergency cases whereby portal emissions will be necessary to protect occupants inside of the tunnel. It is considered that based on the capacity of the ventilation system, that these emergency cases will be infrequent.

8.2.2 Directing and stopping work

All management roles in the organisation charts provided in Section 5.8 have the responsibility to stop works in instances where there is likely to be an unacceptable environmental impact. The Project Company Representative and I&M Contractor roles are the key contacts with full authority over the works.

The Project Company's Operation Manager will be available 24 hours a day, 7 days a week and has authority to stop or direct works.

8.2.3 Emergency Response Plan

An Emergency Response Plan has been prepared in consultation with Fire & Rescue NSW and NSW Police Force. The Emergency Response Plan consists of a number of I&M Contractor documents including an Incident Response Plan, safety plans, and emergency and evacuation plans.

These documents contain:

- protocols and procedures to be followed during emergency situations associated with the operation of the Asset (including fires, explosions and, for the purposes of this condition, vehicle collisions). The protocols and procedures are to take into account the needs of people with a disability or who may experience access problems in emergency situations;
- details of traffic management measures to be implemented during emergencies, where appropriate, to minimise the potential for escalation of the emergency;

- design and management measures to address the potential environmental impacts of an emergency situation, including measures for containment of contaminated fire-fighting water, fuel spills and gaseous combustion products;
- training and testing programs for all operational staff;
- details of simulated emergency response exercises including the I&M Contractor, Project Company, NSW Police and NSW Fire & Rescue.

In the event of a flooding emergency, which causes or is expected to cause major road closures which potentially impacting on the ability of Emergency Services to respond and to evacuate people, the project will notify the NSW State Emergency Service, along with our emergency services (refer to Annexure E for contact details).

8.2.4 Environmental incidents, notifications and reporting

The I&M Contractor operates under an environmental incident management procedure (refer to Annexure D) that will apply to the operational Asset. The I&M Contractor must include elements of this environmental incident procedure into its EMS.

Notification to EPA and other agencies

The Project Company Representative will notify the Environment Protection Authority (EPA) in relation to any pollution incident in accordance with the Protection of the Environment Operations Act 1997 (POEO Act). The Secretary shall be provided with a record of any such pollution incident notification within 24 hours in accordance with CoA A43.

Notification to the Secretary, DPIE

In accordance with CoA A40, the Project Company Representative, must notify the Secretary as soon as possible and in any event within 24 hours of any incident that causes, or threatens to cause, material harm (as defined by SSI 7485) to the environment, community or any member of the community, being actual or potential harm to the health or safety of human beings or to threatened species, endangered ecological communities or ecosystems that is not trivial. This notification will include the time and date of the incident, details of the incident and any non-compliances against the CoA that occur as a result of the incident in accordance with CoA A41.

Full written details of the incident will be provided to the Secretary by the Project Company Representative within seven days of the date on which the incident occurred.

Incident reporting

The Project Company and I&M Contractor will meet the requirements of the Secretary or relevant public authority (as determined by the Secretary), to address the cause of impact of any incident associated with the operation and maintenance of the Asset, in accordance with CoA A41.

9 Managing and monitoring performance

This section addresses ongoing inspection and monitoring requirements, reporting obligations, non-conformance reporting, subcontractor requirements and operational audits of the OEMP. Project Company will remain responsible for managing and monitoring performance against the OEMP. The I&M Contractor will implement monitoring activities including inspections and will provide feedback to Project Company.

9.1 Environmental inspections

Environmental inspections of the operational Asset will be conducted in accordance with the requirements of the I&M Contractor's EMS to evaluate the effectiveness of environmental controls. Inspections will be scheduled in the EMS and will consider high risk activities. Inspections may include:

- works in environmentally sensitive areas
- issues such as spills, graffiti, vandalism and dust generation
- waste management, including illegal dumping, litter, contamination of waste streams, system capacity
- plant and equipment operations
- evaluation of sub-contractor management controls.

9.2 Operational performance monitoring

Monitoring will be undertaken to validate and confirm the operational impact of the Asset on the environment. This monitoring will extend to the effectiveness of the installed environmental mitigation controls, such as the water quality basins.

Monitoring to be undertaken during operations of the Asset is identified in Table 9-1. Monitoring requirements are addressed within specific programs or plans as identified in the final column.

Table 9-1: Operational performance monitoring

CoA	Monitoring	Implementation	Where addressed
D8	Surface water and groundwater monitoring required at specific locations and frequency that are representative of the potential extent of impacts from the project.	Monitoring will occur for both surface water and groundwater.	Operational Surface Water Quality Plan and Monitoring Program (Annexure G) Operational Groundwater Plan and Monitoring Program (Annexure H)
E2A, E19A	Monitor pollutants from the ventilation outlets.	Pollutants from the ventilation outlets are measured at differing times such as continuous, quarterly and annual. This is dependent on the parameter being monitored.	Operational Air Quality Management Plan (Annexure F)
E3 – E5, E20	Monitor pollutants within the tunnel	In-tunnel monitoring will be continuous, with monitoring undertaken on CO, NO_2 and visibility.	Operational Air Quality Management Plan (Annexure F)
E6, E24	Monitor pollutants associated with ambient air quality.	Ambient air quality monitoring will be continuous. Monitoring will be undertaken for the following: • NO • NO_2 • NO_x • PM_{10}	Operational Air Quality Management Plan (Annexure F)

CoA	Monitoring	Implementation	Where addressed
		• $PM_{2.5}$ • CO • Wind speed @ 10m • Wind direction @ 10m • Sigma Theta @ 10m • Temperature @ 2m • Temperature @ 10m	
E95	Monitor operational noise to compare actual noise performance of the project against the noise performance predicted in the Operational Noise and Vibration Review.	Noise modelling to be undertaken to compare against predictions of the operational noise impacts. During operation, monitoring will occur at similar locations, where possible, to compare outputs. The need for additional management measures will also be assessed and implemented where reasonable and feasible.	Operational Noise Compliance Report
E134(x)	Monitoring and maintenance procedures for built elements, rehabilitated vegetation and landscaping	Periodic site inspections will be used to review environmental performance and determine the need for any maintenance.	Urban Design and Landscape Plan

9.3 Operational audits

9.3.1 Routine audit schedule

Environmental audits will be conducted at regular intervals during the operation of the Asset to evaluate compliance and identify opportunities for improvement. An audit schedule is included in Table 9-2.

Table 9-2: Audit schedule

Audit	Details	Timing	Responsibility	Recipient of the audit report
Internal audit	Compliance with approval and legal requirements, TfNSW specifications, OEMP	6 monthly, or in accordance with the EMS schedule	I&M Contractor: suitably qualified and experienced internal member not directly associated with the I&M Services	I&M Contractor Project Company
External audit	Compliance with EMS (ISO 14001) in accordance with environmental management system requirements	6 monthly, or in accordance with the EMS schedule*	I&M Contractor to engage independent external auditor	I&M Contractor Project Company
External Independent Audit	Independent environmental audit (CoA A36)	Annually	I&M Contractor to engage a suitably qualified, experienced and independent team of experts (including experts in air quality, biodiversity, noise and vibration, hydrology and any other fields nominated by the Secretary) whose appointment has been	Project Company, Secretary, relevant public authorities

Audit	Details	Timing	Responsibility	Recipient of the audit report
			approved by the Secretary	

* Independent environmental audit (CoA E51) may satisfy an external audit.

Additional audit requirements identified in the CoA are summarised in Table 9-3. The document in which the requirement is addressed is included in the final column.

Table 9-3: Additional audit requirements identified in the CoA

CoA	Audit details	Recipient of the audit report	Implementation
E22	All sampling points and visibility monitoring points must be audited prior to commencing monitoring, for compliance with the requirements set out in Conditions E3, E4, E5 and E20. Verification and compliance auditing is to be undertaken by an independent person(s) or organisation(s) whose appointment has been approved by the Secretary. The independent person(s) must be a Chartered Professional Engineer (either Mechanical, Chemical or Control Systems engineer).	DPIE	Operational Air Quality Management Plan (Annexure F)
E37	The Proponent must engage a person independent from the design and construction of the CSSI, to audit the air quality monitoring (in-tunnel and ambient) for the CSSI at six (6) monthly intervals following commencement of operation of the CSSI, or at any longer interval if approved by the Secretary.	DPIE	Operational Air Quality Management Plan (Annexure F)
E40	The Proponent must document the results of the audit and make available all audit data for inspection by the Secretary upon request. A copy of the audit report must also be issued to the Proponent and AQCCC.	DPIE	Air Quality Community Consultative Committee
E148	Prior to the opening of the project to traffic, a full audit of the fire and life safety system as defined by the Fire Engineering Study required by Condition E147 must be undertaken by an Accredited Fire Engineer. The objective of the audit must be to ensure that all design and operational measures outlined in the fire engineering study has been installed, are operational, and achieve the required design criteria. The results of the audit must be submitted to FRNSW prior to opening of the project to traffic. The Proponent must respond in writing to any recommendations resulting from the FRNSW review of the audit.	DPIE; Fire and Rescue NSW	Project Quality Plan

9.4 Operational reviews and checks

Operational reviews and other maintenance / checks or tests will be conducted as required during the operation of the Asset. Reviews identified in the CoA are summarised in Table 9-4. The document in which the requirement is addressed is included in the final column.

Table 9-4: Review requirements identified in the CoA

CoA	Audit details	Frequency / Timing	Recipient of the review report	Implementation
E64	An Operational Road Network Performance Review prepared in consultation with TfNSW and relevant councils to review road network performance and manage performance impacts of the Asset on the adjoining road	12 months and 5 years after the commencement of the full CSSI (this Asset and Rozelle Interchange).	Secretary	Operational Road Network Performance Review

CoA	Audit details	Frequency / Timing	Recipient of the review report	Implementation
	network. It will be based on updated traffic surveys and the assessment methodology consistent with the EIS. The Review will confirm the adequacy of the mitigation measures identified in the Road Network Performance Plan required by CoA E63, and whether additional measures are required. The results will also be considered in future operational network performance planning by TfNSW.	The Review will be completed within 6 months of the above timeframes.		
E144 E145	Hazard Reviews detailing all hazardous incidents that have occurred during the preceding review period, identify safety measures required to rectify those incidents, and address any ongoing issues.	For the first 5 years of operation: • first 3 months of operation • subsequent 9 months Thereafter 12-month intervals, or as directed by FRNSW	FRNSW	Operation and Maintenance (O&M) Manual Hazard Review Report(s)
E150	Annual maintenance testing of fire and life safety systems	Annual, or any other interval as required by the design engineer and to the satisfaction of FRNSW	FRNSW	O&M Manual Maintenance Testing Report(s)
E153	Flood Review Report(s) prepared to assess the actual flood impact against those predicted by the Project Flood Model and the need for additional flood mitigation measures. If required, additional mitigation measures will be developed in consultation with affected property, structure and/or infrastructure owners, OEH and the relevant council(s).	Within 3 months of the first defined flood event for any of the following flood magnitudes - 5 year ARI event, 20 year ARI event, 100 year ARI event and probable maximum flood	Secretary and relevant council(s)	Flood Review Report(s)

9.5 Periodic Testing

In accordance with CoA E9, the operation of the tunnel ventilation system is to avoid emissions of tunnel air from the portals and/ or the tunnel support facilities. Portal emissions are prohibited, except for the following circumstances:

- Emergency smoke management purposes in the event of a fire in the tunnel;
- Period testing.

Periodic testing may include, but not be limited to testing during commissioning; replacement, repair and testing of faulty ventilation equipment; and routine testing and maintenance periods. Further detail on periodic testing is outlined in the OAQMP (refer to Annexure F).

9.6 Compliance tracking

The Compliance Tracking and Environmental Audit Program (CTEAP) prepared to support design and construction was approved on 18 October 2018. It described how A27, A29, A36 and A37 of the Infrastructure Approval (SSI 7485) will be met. It also identifies the frequency for the compliance reporting and independent auditing. The Project Company will use this CTEAP during this Asset's operation. The CTEAP contains:

- Provisions for:
  - Notifying DPIE before the Asset is operational;
  - Periodic compliance reviews against the CoA and REMMs;
  - Periodic reporting to DPIE including a Pre-Operation Compliance Report;
  - All employees, contractors and sub-contractors to be aware and comply with the relevant CoA relating to their respective roles and responsibilities;
- An independent environmental auditing program;
- Procedures for rectifying any non-compliance identified during environmental auditing.

The CTEAP will be implemented for at least one year following the commencement of operation, unless otherwise determined by the Secretary.

9.7 Reporting to DPIE

Table 9-5 lists the DPIE reporting requirements relevant to the operation of the Asset and this OEMP.

Table 9-5: DPIE reporting requirements

Document (CoA ref)	Details / timing
Revised Staging Report (CoA A16)	One month prior to proposed change in the staging during operation.
Compliance tracking program (CoA A27/A28): notification	Notification to the Secretary prior to the commencement of operation and operate for a minimum of 12 months.
Independent environmental audit report (CoA A39): submission	Independent Environmental Audit report (and responses to recommendations) to be provided to the Secretary within six (6) weeks of completing the audit.
Incident notification (CoA A40): notification and submission	Notification as soon as possible and in any event within 24 hours of any incident, as detailed in Section 8.2.4.
EPA notification (CoA A43): notification	Following any EPA notification, provide DPIE with record of such notification within 24 hours.
OEMP (CoA D1): submission	The OEMP must be submitted to DPIE no later than one month prior to commencement of operation
Groundwater monitoring review (CoA D12)	At least one (1) month prior to the end of the five (5) year monitoring period. The Proponent must notify the Secretary within two (2) weeks of the review as to the outcomes of the review and any requirements for future monitoring.
Operational monitoring programs (CoA D14): submission	The Operational Monitoring Programs must be submitted to the Secretary for approval at least one (1) month prior to the commencement of operation
Operational monitoring programs (CoA D17): submission	Annual summary report of water monitoring data to be provided to DPIE, DPI (Water) and relevant councils.
Operational Road Network Performance Review (CoA E64): submission	At both 12 months and 5 years after commencement of operation the review must be completed within 6 months. Within 60 days of its completion, the plan must be submitted to the Secretary, Transport for NSW and to relevant councils, and made publicly available.
Operational Noise Compliance Report (CoA E95): submission	The Operational Noise Compliance Report will be submitted to the Secretary and the EPA within 60 days of completing the operational noise monitoring (undertaken within 12 months of commencement of operation). The report will be made publicly available on the Project website.
Flood Review Report(s) (CoA E151): submission	The Flood Review Report(s) will be submitted to the Secretary and the relevant council(s) within one (1) month of finalising the report(s).

9.8 Non-conformity, correction and preventative actions

A non-conformance is a failure to comply with a requirement, standard or procedure such as the Conditions of Approval, this OEMP or associated documents. Environmental non-conformances may be identified through regular inspections, monitoring, audits, complaints, observations or through incident management. They may be identified by the I&M Contractor, the Project Company and/or a public authority.

Environmental incident reports will be used to record non-conformances.

Following the identification of a non-conformance, corrective actions will be identified and determined by the relevant manager and will reflect the nature and scale of the incident and whether it presents and material risk to human health, the environment or property.

Corrective actions will be preventative-based, where possible. They will be implemented, monitored, checked and reviewed. The corrective action process is summarised as:

- I&M Contractor's QSE Manager to be made aware of the non-conformance;
- I&M Contractor's QSE Manager to prepare an environmental incident report and/or environmental improvement notice;
- I&M Contractor's QSE Manager (or relevant manager) to assign corrective actions and responsibility to specific I&M personnel(s) including timeframes, follow-up dates, and close-out expectations;
- Close-out the action, following monitoring, and follow-up observation that the non-conformance and associated risks have been removed or appropriately managed to limit the potential for material harm as far as is reasonably feasible and reasonable.

10 OEMP review and records management

10.1 OEMP review

The OEMP and sub plans will be checked, reviewed and updated annually or as required if there is a significant change in operations, maintenance, organisational structure, reporting lines or legislation. The review will ensure that identified issues and corrective actions are being appropriately managed and reported. The review will be conducted by the I&M QSE Manager and will include relevant personnel who may include:

- I&M Contractor's I&M Manager;
- I&M Contractor's Maintenance Manager;
- Project Company Representative;
- Project Company's Operations Manager;
- Project Company's Community & Stakeholder Manager.

As a minimum, the review will consider:

- Changes to the environment or generally accepted environmental management practices;
- Opportunities to improve environmental management processes and practices;
- Feedback, comments, actions and communications provided by Government agencies, regulators, and independent specialists;
- Audit findings;
- Environmental monitoring outcomes;
- Incidents and non-conformances;
- Environmental risks, including any new or additional (type or volume) of hazardous substances or contamination;
- Community feedback, including trends and persistent issues;
- Organisational structure changes;
- Role and responsibility changes;
- Operations and maintenance responsibility changes;
- Legislative and regulatory changes.

A summary of the OEMP management review will be provided to the Project Company. Any required updates to the OEMP will be undertaken in accordance with Section 1.3 of this OEMP. Changes to the OEMP will be communicated by the Project Company Representative using either management meetings for non-critical updates or through formal communication (e.g. email, other transmittal) for critical and essential updates.

10.2 Records management

The I&M Contractor's QSE Manager will be responsible for all environmental records and information relating to this OEMP, including the resources and training needed to maintain:

- The OEMP and sub plans
- Monitoring data, inspections and corrective actions
- Audit reports and corrective actions
- Environmental incident reports and notifications
- Internal and external communications
- Training and induction records
- Operations and maintenance activities

- Complaints Compliance tracking
- Subcontractor monitoring and performance
- Waste management records
- Greenhouse gas emissions
- Meeting minutes
- Monitoring environmental planning obligations
- Agency, regulatory, Governmental and TfNSW correspondence.
- Climate change and energy use records

All environmental management documents will be subject to ongoing review, revision and continual improvement. This includes changes to scheduled activities and legislative and licencing requirements.

Records will be held for 10 years. TfNSW, the DPIE and key Government agencies will have access to all records upon request. Records will be managed in accordance with Project Company's record management system.

10.3 Document control

OEMP and sub plan preparation, distribution and review will be led by the I&M Contractor's QSE Manager**.** During the Asset's operation, the environmental documentation will be stored in the I&M Contractor's integrated management system.

A document control procedure will manage the flow of information between internal and external parties in line with the communication requirements in Section 7. This procedure will identify measures to ensure that documents are:

- Developed, reviewed and approved before being issued;
- Issued for use;
- Controlled and stored for 10 years, or the current prevailing legal requirements;
- Removed when superseded or updated.

A distribution list will identify the current version of each document, report and/or data.

Annexure A Compliance table for DIPNR, 2004

Guidelines for the preparation of Environmental Management Plans (DIPNR, 2004)

EMP guideline section		Document reference
Background	Introduction Location Operation and maintenance activities Timing and schedule	Section 1 Section 2.1, Figure 2-1 Section 3.1 Section 3.2
	Project description	Section 2
	EMP context	Section 1.2, Section 5.1
	EMP objectives	Section 1.2
	Environmental Policy	Section 5.2, Annexure B
Environmental Management	Environmental management structure and responsibility	Sections 5.4 to 5.9
	Approval and licensing requirements	Section 4
	Reporting	Sections 9.2 to 0
	Environmental training	Section 6
	Emergency contacts and responses	Section 8.2; Annexure E
Implementation	Risk assessment	Section 8.1, Annexure C
	Environmental management activities and controls	Issue-specific strategies and sub-plans
	Environmental control plans or maps	Section 5.5, Annexure I
	Environmental schedules	Environmental schedules (e.g. site inspection checklists, environmental incident reports, waste register) will be included in issue-specific sub-plans, where appropriate, or will be retained on the project's document management system.
Monitor and review	Environmental monitoring	Section 9.2; issue-specific environmental strategies and sub-plans
	Environmental auditing	Section 9.3
	Corrective actions	Section 9.8
	EMP review	Section 10.1

Annexure B Environment and sustainability policy

Available upon request

Annexure C Environmental risk register

Available upon request

Annexure D Environmental incident procedure

Environmental Incident Classification and Reporting Procedure

Roads and Maritime Services | November 2018

Document No. | RMS 17.374 | Version 5.1

NSW GOVERNMENT

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About this release

Title	Environmental Incident Classification and Reporting Procedure

Approval		
Prepared by	Environment Manager Performance Improvement	Scott Machar
Reviewed by	Director Environment Operations	Sally Durham
Approved by	Director Environment	Michael Crowley

Document Control			
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Contents

Acronyms and definitions	
Acronym	**Definition**
DE	(Roads and Maritime Services) Director Environment
DES	(Roads and Maritime Services) Director Environment Sydney
DPE	Department of Planning and Environment
Environmental harm	Any act that degrades or pollutes the environment
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1997*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environment Protection Licence
POEO Act	*Protection of the Environment Operations Act 1997*
REF	Review of Environmental Factors
Roads and Maritime	NSW Roads and Maritime Services
SEQC	(Roads and Maritime Services) Safety Environment and Quality Co-ordinator
SEQO	(Roads and Maritime Services) Safety Environment and Quality Officer
WHS	Work Health and Safety

1. Introduction

1.1 Aim

The Environmental Incident Classification and Reporting Procedure (the Procedure) aims to ensure Roads and Maritime Services workers and contractors understand how to classify, respond to and report environmental incidents that occur as a result of Roads and Maritime managed activities.

1.2 Objectives

The objectives of the Procedure are to:

- Ensure all relevant Roads and Maritime workers, managers and contractors are made aware of environmental incidents promptly and can respond accordingly
- Ensure site workers understand the immediate environmental incident reporting requirements
- Ensure all workers understand reporting timeframes, including statutory requirements
- Ensure incidents are reported to enable monitoring, sharing of lessons learnt and response to emerging environmental incident trends
- Comply with statutory obligations to report certain environmental incidents to regulators and other relevant government agencies (see section 5.1).

1.3 Scope and coverage

This Procedure is applicable to all Roads and Maritime activities where environmental incidents may occur. This includes (but is not limited to):

- Temporary activities, such as preliminary investigations (e.g. geotechnical and environmental surveys) and the construction and maintenance of Roads and Maritime assets
- Activities at Roads and Maritime properties and facilities
- Vessels operated by Maritime division
- Activities undertaken by contractors on behalf of Roads and Maritime.

The requirements of this Procedure must be communicated to all Roads and Maritime workers and contractors (e.g. during inductions) who are undertaking activities where incidents may occur.

The Procedure is for internal reporting processes, except where incidents are identified that need to be notified to regulators, and other relevant authorities (see section 5.1).

The procedure does NOT cover environmental incidents caused by:

- Operational road and traffic activities of the general public (e.g. vehicle accidents, fires caused by discarded cigarette butts)
- Boating accidents (except those involving Roads and Maritime vessels)
- Dumping of materials by members of the public on Roads and Maritime roadsides or land (except where hazardous materials are unexpectedly found during road construction or maintenance activities). Illegal dumping should be reported to the NSW Environment Protection Authority (EPA)
- Marine oil and chemical spills covered by the National Plan for Maritime Environmental Emergencies (Australian Maritime Safety Authority, 2014).

2. Environmental incident classification

There are three categories of environmental incidents, as detailed in Table 2.

Table 2: Environmental incident classification

Category	Description	Examples	
Category 1	Potential breaches of legislation or failures of process that result in actual off-site environmental harm, or residual on-site environmental harm or Works undertaken outside approved areas, without required approval or without environmental assessment or Any Material Harm pollution incident as defined by Part 5.7 of the *Protection of the Environment Operations Act 1997* (POEO Act).	Pollution Incidents	Discharge of waters from site not in accordance with any approval requirements (e.g. discharge criteria in an Review of Environmental Factors (REF) safeguard or Environment Protection Licence (EPL) condition)
			Pollution, or potential pollution, of waters
			Unmanaged vehicle tracking of materials or emissions of dust, offensive odours or noise beyond the site boundary that are not managed in accordance with approval requirements and/or might impact on nearby land users
			Pollution incidents that threaten harm to the health or safety of people (e.g. uncontrolled releases of hazardous substances)
			Unauthorised or illegal disposal or transport of waste
			A spill or other incident that causes pollution to land
		Conservation Breaches	Unauthorised harm or damage to native flora and fauna (terrestrial or aquatic/marine)
			Unauthorised dredging or reclamation works within a watercourse
			A fire caused by Roads and Maritime activities that travels beyond the boundary causing or potentially causing harm to the environment or community
		Heritage Breaches	Unauthorised harm to Aboriginal objects and Aboriginal places
			Unauthorised damage to any State or locally significant relic or Heritage item, or item listed on the Roads and Maritime Section 170 register

Table 2: Environmental incident classification			
Category	**Description**	**Examples**	
		Planning and compliance breaches	Failure to comply with the requirements of: • The *Environmental Planning and Assessment Act 1997* (EP&A Act), including exempt activities, Part 5 determinations and Part 5.1 approvals • An *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) approval • An EPL • A CEMP or environmental work method statement • A permit from a regulator (e.g. under the *Fisheries Management Act 1994*)
Category 2	Failures of process or events that do not result in off-site environmental harm, or residual on-site environmental harm. These incidents may result in temporary on-site environmental harm that can be rectified to pre-existing conditions.	A procedural, administrative or technical breach of environmental requirements, including: • Failure to prepare or submit required documents, reports or other correspondence • Failure to comply with the requirements of: o The *Environmental Planning and Assessment Act 1997* (EP&A Act), including exempt activities, Part 5 determinations and Part 5.1 approvals o An *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) approval o An EPL o A CEMP or environmental work method statement o A permit from a regulator (e.g. under the *Fisheries Management Act 1994*).	
		Spills and discharges that do not leave a site boundary and are cleaned up without residual on-site environmental harm, and the area of temporary impact can be restored to pre-existing conditions	
		A fire that is contained on site and does not cause or potentially cause adverse impact to the environment or community	
Reportable Event	An event or unexpected find that occurs outside the scope of reasonable environmental controls and mitigation measures	Sediment or site water travelling beyond a site boundary, and where it can be demonstrated that: • Erosion and sediment controls were installed and maintained in accordance with an erosion and sediment control plan, and • The cause of the incident was reasonably unforeseen or the weather (rain, wind etc) event exceeded the design capacity of controls.	

Table 2: Environmental incident classification		
Category	**Description**	**Examples**
		Note these events are considered to have occurred (and the response should commence in accordance with Section 3) when sediment or site water first travels beyond the site boundary (e.g. when an appropriately sized and maintained sediment basin commences overtopping)
		An unexpected archaeological find that is being managed in accordance with the "Roads and Maritime Standard Management Procedure - Unexpected Archaeological Finds"
		An unexpected threatened species find that is being managed in accordance with the "Roads and Maritime Biodiversity Guidelines – unexpected threatened species finds procedure"
		An unexpected find of contaminated soils, asbestos or other potentially hazardous substances during construction or maintenance works. Note that once a particular contaminant is identified or found for the first time (either during project planning or construction phases) it is then reasonably expected to be found, so additional finds need not be reported in this category.
Regulatory Action	Formal regulatory action from an environmental regulator (that has not already been reported in conjunction with another incident)	Formal regulatory action from an environmental regulator includes, but is not limited to: • Penalty infringement notices (PINs) • Clean up notices • Prevention notices • Official cautions / warnings • EPA show cause notifications.

Note: For any incident where there is associated formal regulatory action from an environmental regulator, copies of this correspondence must be forwarded to envops@rms.nsw.gov.au in addition to the Environmental Incident Report (see section 4).

3. Environmental incident response

3.1 Considerations and steps for environmental incident response

The step-by-step response for Category 1 incidents, Category 2 incidents and Reportable Events is detailed in Table 3.1a (activities undertaken by contractors) and Table 3.1b (activities undertaken by Roads and Maritime Regional Maintenance). However, some key points apply throughout all stages of the response to any environmental incident:

- If in doubt, treat all incidents as Category 1 to ensure reporting timeframes can be met
- Project teams should also undertake the following notifications as appropriate:
    - Roads and Maritime Corporate Communications for any incidents that have potential for community or media attention (see section 4.4)
    - Roads and Maritime Work Health and Safety (WHS) Branch for any incidents that involve actual or potential risks to worker health and safety (see section 4.4).
- The person responsible for operational management of the site/activity shall assume responsibility for the response to the incident and direct actions as necessary and in accordance with this Procedure
- The Director Environment Sydney (DES) may reclassify the category of an incident where appropriate, in consultation with the relevant Roads and Maritime Environment Manager.

Any Regulatory Action received (that has not already been reported in conjunction with another incident) should be immediately forwarded to the envops@rms.nsw.gov.au mailbox, and followed by an immediate phone call to the relevant Roads and Maritime Environment Manager, who will immediately advise the DES. Consideration should then be given as to whether an environmental incident has occurred (see section 2) that should be reported in accordance with this section.

Table 3.1a: Environmental incident response – activities undertaken by contractors				
Step	**Action**	**Responsibility for completing action**	**Timeframe**	
			Category 1 Incidents	Category 2 Incidents / Reportable Events
1	Stop work in relevant area (if necessary) and take actions to prevent adverse impact to human health or the environment. Note human health and safety is the primary concern, and no action should be taken if it is not safe to do so - in these instances emergency services should be contacted (phone triple zero).	Person who identifies incident	Immediate	Immediate
2	Advise the contractor site management team (and Roads and Maritime Corporate Communications and/or WHS Branch as appropriate)	Person who identifies incident	Immediate	Immediate
3	Advise the Roads and Maritime project management team and the relevant Roads and Maritime Environment Manager.	Contractor	Immediate	Day of the incident
4	Consider if the incident is a pollution incident that constitutes Material Harm in accordance with Part 5.7 of the POEO Act. For Material Harm pollution incidents, notify relevant agencies (see section 5.2). Sites with an EPL should implement their Pollution Incident Response Management Plan.	Contractor	Immediate	Immediate
5	Advise DES by phone. The DES may request photographs and a brief summary of known information via email. The following Roads and Maritime managers should also be notified by phone as relevant: • Director Environment (Regions) • Director Environment (Motorways).	Roads and Maritime Environment Manager	Immediately following advice of the incident	N/A
6	Where relevant, notify incident to appropriate regulatory agency (see section 5.1). Note this does not refer to the requirement to notify Material Harm pollutions incidents (see Step 4).	Contractor	As required by legislation	As required by legislation
7	Complete the incident report form (see section 4.2), including sign-off from Roads and Maritime Project Manager, and submit to Roads and Maritime Environment Manager* (see sections 4.3 and 4.4).	Contractor	Within 3 business days of the incident	Within 3 business days of the incident
8	Sign and submit incident report form to envops@rms.nsw.gov.au.	Roads and Maritime Environment Manager	On the day of receipt of the form	On the day of receipt of the form
9	For Material Harm pollution incidents, provide a written report to each relevant authority (see section 5.2).	Contractor	Within 7 days of the incident	N/A
10	Undertake incident investigation (level of investigation to be appropriate to the severity of the incident) to determine root cause and any necessary corrective actions. Summarise findings in 'Incident Lessons Learnt' template and submit to Environment Manager for review.	Contractor	Within 1 month of incident	N/A
11	Submit final Incident Lessons Learnt to envops@rms.nsw.gov.au.	Roads and Maritime Environment Manager	Within 1 week of receipt	N/A
12	Consider the need for any required corrective actions to be addressed through a management system (e.g. corrective action request), and any required updates to a risk register.	Roads and Maritime Environment Manager and project team	As appropriate	As appropriate

*Alternate workflow / signatory arrangements may be required for projects where a third party is involved (e.g. a delivery authority). These arrangements can be confirmed with the relevant Roads and Maritime Environment Manager.

Table 3.1b: Environmental incident response – activities undertaken by Regional Maintenance (including contractors or RMCC on behalf of Regional Maintenance)				
Step	**Action**	**Responsibility for completing action**	**Timeframe**	
			Category 1 Incidents	Category 2 Incidents / Reportable Events
1	Stop work in relevant area (if necessary) and take actions to prevent adverse impact to human health or the environment. Note human health and safety is the primary concern, and no action should be taken if it is not safe to do so - in these instances emergency services should be contacted (phone triple zero).	Person who identifies incident	Immediate	Immediate
2	Advise the Roads and Maritime site management team and the relevant Roads and Maritime Environment Manager and Safety Environment Quality Officer (SEQO) / Safety Environment Quality Co-ordinator (SEQC) (and Corporate Communications and/or WHS Branch as appropriate)	Person who identifies incident	Immediate	Immediate
3	Advise DES by phone. The DES may request photographs and a brief summary of known information via email. The relevant Regional Maintenance Manager must also be notified.	Environment Manager	Immediate	N/A
4	Consider if the incident is a pollution incident that constitutes Material Harm in accordance with Part 5.7 of the POEO Act. For Material Harm pollution incidents, notify relevant agencies (see section 5.2). Sites with an EPL should implement their Pollution Incident Response Management Plan.	DES	Immediately following advice of the incident	N/A
5	Where relevant, notify incident to appropriate regulatory agency (see section 5.1). Note this does not refer to the requirement to notify Material Harm pollutions incidents (see Step 4).	Environment Manager	As required by legislation	As required by legislation
6	Complete the incident report form (see section 4.2), including sign-off from Roads and Maritime Project Manager, and submit to SEQC (see section 4.3).	Relevant Roads and Maritime site representative	Within 3 business days of the incident	Within 3 business days of the incident
7	SEQC to sign and submit incident report form to relevant Environment Manager (see section 4.4).	SEQC	On the day of receipt of the form	On the day of receipt of the form
8	Sign and submit incident report form to envops@rms.nsw.gov.au.	Environment Manager	On the day of receipt of the form	On the day of receipt of the form
9	For Material Harm pollution incidents, provide a written report to each relevant authority (see section 5.2).	DES	Within 7 days of the incident	N/A
10	Undertake incident investigation (level of investigation to be appropriate to the severity of the incident) to determine root cause and any necessary corrective actions. Summarise findings in 'Incident Lessons Learnt' template and submit both to Environment Manager for review. Consider the need for any required corrective actions to be addressed through a management system (e.g. corrective action request), , and any required updates to a risk register.	SEQC	Within 1 month of incident	N/A
11	Submit final Incident Lessons Learnt to envops@rms.nsw.gov.au.	Roads and Maritime Environment Manager	Within 1 week of receipt	N/A

Copies of formal regulatory action from an environmental regulator (that has not already been reported in conjunction with another incident) must be forwarded to the relevant Roads and Maritime Environment Manager (and SEQC/SEQO for Regional Maintenance projects) and envops@rms.nsw.gov.au immediately upon receipt.

3.2 Critical incidents

Some Category 1 incidents require escalation so relevant members of the Roads and Maritime Executive are aware of the incident and ready to respond as necessary. Category 1 incidents will be deemed 'Critical Incidents' for escalation to the Executive when they have the potential for:

- Regulatory action (e.g. EPA Penalty Infringement Notice) and/or
- Reputational damage (e.g. media coverage) and/or
- Significant environmental harm.

Guiding factors that will be considered when determining whether there has been 'significant' environmental harm include:

- When there has been actual or potential harm to the health or safety of people or to the environment that is not trivial
- Actions required to prevent, mitigate or make good the actual or potential environmental harm are likely to exceed $10,000

When a potential 'Critical Incident' is reported, the DES will immediately brief the Director Environment (DE) who will make a determination on whether it will be considered a 'Critical Incident'. The DE will then brief the Roads and Maritime Chief Executive and relevant Executive Director, as well as any other members of the Executive as appropriate. When the DE cannot be contacted, the DES will make the determination and make the relevant Executive briefings.

4. Environmental incident reporting

4.1 Environmental incident report form

The Environmental Incident Report Form should be completed for Category 1 incidents, Category 2 incidents and Reportable Events, and is available on the Roads and Maritime website.

4.2 Completing the incident report form

All parts of the Incident Report Form must be completed in accordance with this procedure and following the instructions within the form. The Form (and any subsequent reports) must only include factual information. Speculation about the causes and outcomes of incidents are not to be included.

The Form must be signed by the following:

Signatory	Reason
The person making the report	The person witnessed the incident or has the most knowledge of the incident, and can provide sufficient factual information.
The Roads and Maritime Project Manager	To ensure all relevant Roads and Maritime parties can be made aware of the incident, and appropriate resources can be allocated and/or approved to respond to the incident. This also ensures the project management team are aware of any environmental performance trends if multiple incidents occur.
Safety Environment and Quality Co-ordinator (Roads and Maritime Regional Maintenance only)	To ensure Regional Maintenance management system staff are aware of the incident, and any necessary management system changes can be made once corrective actions and lessons learnt are finalised.
The relevant Roads and Maritime Environment Manager	Concurrence that the incident is adequately described, and the immediate actions and corrective actions are appropriate.

As noted in Table 3.1a, alternate signatory arrangements may be required for projects where a third party is involved (e.g. a delivery authority). These arrangements can be confirmed with the relevant Roads and Maritime Environment Manager.

4.3 Submitting the incident report form

All Incident Report Forms must be populated, signed and submitted electronically (never printed / signed / scanned etc.) to enable Roads and Maritime to electronically capture the information entered in the form.

Completed Incident Report Forms should be submitted by the Roads and Maritime Environment Manager to the Environment Operations mailbox:

- envops@rms.nsw.gov.au

It is essential that a clear and consistent subject line convention is used to allow tracking of correspondence about each incident. All emails about an incident between all parties should structure the subject line as follows:

- Category X - project name / incident location - date
- For example, Category 1 – Main Road Upgrade – dd/mm/yy.

Where information cannot be gathered within the timeframes set out in this Procedure, the incident form should be submitted to the mailbox as a ‘draft’, whether or not the information contained is fully completed.

- For example, Category 1 – Main Road Upgrade – dd/mm/yy (DRAFT).

The Environment Manager should then request further information from the person making the report, and the final report should be submitted within the next 24 hours.

4.4 Roads and Maritime contacts

The relevant Environment Manager for each region and Project Office is the first point of contact for enquiries relating to environmental incidents. Current contacts for all Roads and Maritime Environment Managers can be found on the Roads and Maritime website.

Environment Managers can also provide contact details for other relevant contacts during an incident, such as Communications or Work, Health and Safety. Hazards and occurrences that occur during Roads and Maritime activities should be reported through the Roads and Maritime WHS reporting line on 1300 131 469.

The DES oversees the application of this Procedure, and can be contacted in the absence of the relevant Environment Manager for Category 1 incidents:

- Phone - (02) 0428 608 758

5. Regulatory agency notification

5.1 Notification of Material Harm pollution incidents

5.1.1 Definition of Material Harm pollution incidents

Under Part 5.7 of the POEO Act, there is a duty to immediately notify (i.e. promptly and without delay) each relevant authority (see section 5.1.3) of a pollution incident where material harm to the environment is caused or threatened.

The POEO Act states that a pollution incident should be considered Material Harm if:

> *"(i) it involves actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial, or*
>
> *(ii) it results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding $10,000"*

Material Harm only relates to pollution incidents. Other environmental incidents, such as conservation, heritage and planning breaches, are not included in the definition of a pollution incident.

5.1.2 Determining if an incident should be considered Material Harm

As soon as a person becomes aware of a pollution incident that has the potential to cause Material Harm, the Category 1 incident response should be followed (see Table 3.1a and Table 3.1b above). The determination on whether a pollution incident should be considered Material Harm should be made in accordance with Table 5.1.2.

Table 5.1.2: Determination of Material Harm pollution incidents

Project delivery	Material Harm determination
Activities undertaken by Regional Maintenance	The DES should make the determination (and any associated notifications) on whether a pollution incident should be considered Material Harm. If the DES is not available, the relevant Environment Manager should seek advice from other Roads and Maritime Environment Branch Directors, or make the material harm determination themselves. If no assistance can be obtained and it is suspected that a pollution incident should be considered Material Harm, the project should notify the relevant authorities in accordance with Table 5.1.3a or Table 5.1.3b (as relevant).
Activities undertaken by contractors	The contractor project team should make the determination (and any associated notifications) on whether a pollution incident should be considered Material Harm. The relevant Roads and Maritime Environment Manager or Environment Branch Director may contact the DES to assist in making an assessment of the incident, to aid the contractor in determining if the pollution incident should be considered Material Harm. Where Roads and Maritime believes a pollution incident should be considered Material Harm but the contractor disagrees, Roads and Maritime is required by law to notify EPA and other relevant authorities. In this instance the DES or DE would make a determination on whether the incident should be notified by Roads and Maritime as Material Harm. Roads and Maritime would provide details of any notifications made to the contractor.

Even if only limited information is available for a pollution incident being considered Material Harm, each relevant authority must be immediately notified with the information available and updates provided as soon as further relevant information becomes available.

In circumstances where there is doubt about the need to notify a pollution incident as Material Harm, Roads and Maritime and its contractors should always err on the side of notification.

When in doubt, communicate!

Note: Roads and Maritime is not responsible for notifying a Material Harm pollution incident caused by a traffic or vehicle accident where notification has already occurred by someone at the scene. However, if it is believed notification has not been undertaken, Roads and Maritime should undertake notification in accordance with section 5.1.3. Environment Branch can provide advice in this instance (see section 4.4).

5.1.3 Relevant authorities to notify

The relevant authorities that must be notified for a Material Harm pollution incident are listed in tables 5.1.3a and 5.1.3b below. It is important to note the order of notification and phone numbers to use can vary depending on the nature of the pollution incident, as detailed in the two tables.

All of the authorities listed (whether considered relevant or not) must be contacted for each Material Harm pollution incident to satisfy POEO Act requirements. Serious penalties apply to both individuals and corporations for failing to notify Material Harm pollution incidents:

- Maximum penalty for individuals - $500,000
- Maximum penalty for corporations - $2,000,000.

Table 5.1.3a: Authorities to notify for Material Harm pollution incidents that present an immediate threat to human health or property

Order	Authority	Contact Number
1	Fire and Rescue NSW	000
2	NSW EPA environment line	131 555
3	Ministry of Health (via the local Public Health Unit)*	Contact 1300 066 055 to be directed to the local Public Health Unit, or visit the NSW Health Website
4	SafeWork NSW	131 050
5	The Appropriate Regulatory Authority*, being either: • Local council • Western Lands Commissioner for the Western Division (except any part of the Western Division within the area of a local council).	Local council - contact Office of Local Government on 4428 4100, or visit the Office of Local Government website Western Lands Commissioner – phone 6883 5400

Table 5.1.3b: Authorities to notify for Material Harm pollution incidents that do NOT present an immediate threat to human health or property

Order	Authority	Contact Number
1	NSW EPA environment line	131 555
2	The Appropriate Regulatory Authority*, being either: • Local council • Western Lands Commissioner for the Western Division (except any part of the Western Division within the area of a local council).	Local council - contact Office of Local Government on 4428 4100, or visit the Office of Local Government website Western Lands Commissioner – phone 6883 5400

3	Ministry of Health (via the local Public Health Unit)*	Contact 1300 066 055 to be directed to the local Public Health Unit, or visit the NSW Health Website
4	SafeWork NSW	131 050
5	Fire and Rescue NSW	1300 729 579

* The appropriate contact for the Appropriate Regulatory Authority and Public Health Unit will vary according to the geographic location of the activity. These contact numbers should be found in advance and stored for immediate access (e.g. in a project's Construction Environmental Management Plan and/or on site notice boards) should a pollution incident need to be notified.

5.1.4 The relevant information to provide

It is important to avoid speculation on origin, causes or outcomes of a pollution incident in discussions with the authorities. Section 150 of the POEO Act provides the information that needs to be notified, being:

a) The time, date, nature, duration and location of the incident

b) The location of the place where pollution is occurring or is likely to occur, the nature, the estimated quantity or volume and the concentration of any pollutants involved, if known

c) The circumstances in which the incident occurred (including the cause of the incident, if known)

d) The action taken or proposed to be taken to deal with the incident and any resulting pollution or threatened pollution, if known

e) Other information prescribed by the regulations.

Only known information should be provided when notifying of a Material Harm pollution incident. If further information becomes known after the initial notification, that information must immediately be notified to all authorities in accordance with Section 150 (see above). The immediate verbal notification is to be followed by written notification to each relevant authority within seven days of the date on which the incident occurred.

Complying with these notification requirements does not remove the need to comply with any other legislative requirements for incident notification (e.g. requirements under EPL conditions or the Work Health and Safety Act 2011).

5.2 Summary of other regulatory agency notification requirements

Specific statutory requirements relating to the notification of environmental incidents to relevant regulatory agencies are summarised in Table 5.2. Additional requirements adopted by Roads and Maritime are indicated in *italics*. Any notification to regulatory agencies should be indicated in the Environmental Incident Report Form to confirm that any required notifications have been initiated.

Table 5.2: Regulatory agency notification requirements

Legislation / issue	Regulating authority	Section / requirement
Commonwealth Aboriginal and Torres Strait Islanders Heritage Protection Act 1984	Department of the Environment and Energy	Section 20 – requirement to notify the Minister of the discovery of Aboriginal remains.
Contaminated Land Management Act 1997	EPA	Section 60 – requirement to notify if Roads and Maritime activities have contaminated land or if Roads and Maritime owns land that has been contaminated.
Heritage Act 1977	Office of Environment and Heritage	Section 146 – requirement to notify the Heritage Council of the location of the relic once a relic has been discovered or located.
National Parks and Wildlife Act 1974	Office of Environment and Heritage	Section 89A – requirement to notify the location of an Aboriginal object that is the property of the Crown.

Protection of the Environment Operations Act 1997	EPA and other relevant authorities	Section 148 – requirement to immediately notify pollution incidents that cause or threaten Material Harm to the environment (see Section 5.1)
	EPA	*Pro-active reporting to the local EPA officer of offsite pollution incidents that occur as a result of Roads and Maritime activities is encouraged as soon as practicable after the pollution incident occurs.*
Rural Fires Act 1997	NSW Rural Fire Service	Section 64 – requirement to notify an appropriate fire officer of the inability to extinguish any fire burning during a bush fire danger period applicable to the land.
Breach of Conditions of Approval (projects approved under Part 5.1 of the EP&A Act)	Department of Planning and Environment (DPE)	DPE should be notified by the project proponent when there has been a breach of a Condition of Approval (CoA). There may also be other notification requirements included in the CoA.
Water supply catchment areas	*Local water supply authority*	*If an environmental incident has the potential for unapproved impacts on a drinking water supply, the relevant water supply authority must be advised.*

5.3 Requests for written reports from regulatory authorities (activities delivered internally by Roads and Maritime)

Should Roads and Maritime directly receive a request from a regulatory authority for a written report regarding an environmental incident, Environment Branch and Legal Branch must be immediately contacted for advice. No further correspondence (including email) about the incident should be distributed either internally or externally until advice is received. Environment Branch will coordinate with Legal Branch to:

- Assist in the investigation of the incident
- Provide legal advice to the project
- Co-ordinate the preparation of the written response to the regulatory authority.

Annexure E Environmental contacts

Emergency contacts will be available to be contacted by the EPA and Project Company on a 24 hour basis.

Title	Name	Phone number
I&M Contractor project representatives		
Maintenance Manager	To be provided prior to commencement of operation	To be provided prior to commencement of operation
QSE/ICMS Manager	To be provided prior to commencement of operation	To be provided prior to commencement of operation
Motorway Control Centre	Motorway Controller on duty	To be provided prior to commencement of operation
Project Company representatives		
Project Company Project Representative	TBC	
Operations Manager	TBC	
Community & Stakeholder Manager	TBC	
External parties		
Fire and Rescue NSW	N/A	000 (emergency) 1300 729 579 (non-emergency)
EPA	N/A	(02) 9995 5000 131 555
Ministry of Health / Camperdown Public Health Unit	N/A	Business hours: (02) 9515 9420 After hours: (02) 9515 6111 (ask for Public Health Officer on call)
SafeWork NSW	N/A	131 050
City of Sydney	N/A	(02) 9265 9333
Inner West Council	N/A	(02) 9392 5000
Transport Management Centre	Operations Controller	131 700
NSW State Emergency Services	N/A	132 500

Annexure F Operational Air Quality Management Plan

WestConnex M4-M5 Mainline Link Tunnels

Operational Air Quality Management Plan

Project:	M4-M5 Link Mainline Tunnels – Design and Construct
Contract Number:	TBC
Document Number:	M4M5-LSBJ-PRW-GEN-OP01-PLN-0004
Revision Date:	November 2022

Document Approval

Rev	Date	Prepared by	Reviewed by	Remarks
00	01/02/22	ASBJV	DPE	Submission to DPE for information
01	23/02/22	ASBJV	DPE	Response to DPE RFI
02	29/11/22	ASBJV	DPE	Response to follow up DPE RFI

WestConnex

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Glossary of terms

Term/acronym	Definition
AAQ NEPM	National Environment Protection Measure for Ambient Air Quality Guidelines
AM-1	Ambient monitoring – guide for the siting of sampling units
AM-2	Ambient monitoring – guide for measurement of horizontal wind for air quality applications
AM-4	Ambient monitoring – meteorological guidance for regulatory modelling applications
AM-6	Ambient monitoring – Carbon monoxide
AM-12	Ambient monitoring – Nitrogen oxides
AQCCC	Air Quality Community Consultative Committee
AS	Australian Standard
Asset	M4-M5 Link Mainline Tunnels between the M4 at Haberfield and the M8 at St Peters.
CEM-2	Continuous emissions monitoring method – Sulfur dioxide or nitrogen dioxide or nitric oxide
CEM-4	Continuous emissions monitoring method – Carbon monoxide
CEM-6	Continuous emissions monitoring method – Velocity or volumetric flow rate of stack gases
CEM-8	Continuous emissions monitoring method – Volatile organic compounds or methanol
CO	Carbon Monoxide
CoA	Minister's Conditions of Approval
CSSI	Critical State significant infrastructure
DEC	NSW Department of Environment and Conservation (which the EPA is part of)
DPE	NSW Department of Planning, Industry & Environment
EIS	Environmental impact statement
EPA	NSW Environment Protection Authority
EPL	Environment protection licence
FRNSW	Fire & Rescue New South Wales
GREP	Government Resource Efficiency Policy (NSW)
I&M	Incident and Management
I&M Contractor	Fulton Hogan Egis
KPI	Key performance indicator
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Councils
NEPM	National Environment Protection Measure
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NSW	New South Wales
O&M Manual	Operation and Maintenance Manual
OAQMP	Operational Air Quality Management Plan
OEH	NSW Office of Environment and Heritage
OEMP	Operation Environmental Management Plan
OMCS	Operations Maintenance and Controls System
OM-5	Other approved method – 'Fine' particulates (PM10)

Term/acronym	Definition
OM-6	Other approved method – Polycyclic aromatic hydrocarbons (PAHs)
PMCS	Plant Monitoring and Control System
$PM_{2.5}$	Particulate matter 2.5 micrometres or less in diameter
PM_{10}	Particulate matter 10 micrometres or less in diameter
Project Company	M4-M5 Link Group in its capacity as trustee of the WCX M4-M5 Project Trust or its successor in title or assigns
QA	Quality assurance
QC	Quality control
RATA	Relative Accuracy Test Audits
REMM	Revised environmental management measure (from the Submissions Report)
Secretary, the	Secretary of the NSW Department of Planning & Environment
SPIR	Submissions and Preferred Infrastructure Report
SSI	State significant infrastructure
TM-1	Test method – Selection of sampling positions
TM-2	Test method – Velocity or volumetric flow rate or temperature or pressure of stack gases
TM-15	Test method – Solid particles (Total)
TM-22	Test method – Moisture content in stack gases
TM-34	Test method – Volatile organic compounds
TMCS	Traffic Management Control System
VOC	Volatile organic compounds

1 Introduction

1.1 Context

This Operational Air Quality Management Plan (OAQMP) forms part of the Operation Environmental Management Plan (OEMP) for the M4-M5 Link Mainline Tunnels (the Asset).

This OAQMP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the WestConnex M4-M5 Link Environmental Impact Statement (EIS), the revised environmental management measures (REMM) listed in the Project Submissions and Preferred Infrastructure Report (SPIR), the WestConnex M4-M5 Link Mainline Tunnel Modification reports and all applicable legislation.

1.2 Asset background

The M4-M5 Link EIS (AECOM 2017) assessed the impacts of construction and operation of the Project on air quality, within Chapter 9 and Appendix I (Technical working paper: Air quality).

The EIS identified and assessed the potential air quality impacts during operation. The EIS concluded that these impacts would be managed by the air quality control measures described in this OAQMP. Potential impacts on air quality during operation are discussed in Section 4.

Please refer to Section 2 of OEMP for Asset description.

1.3 Scope of the Sub-plan

The scope of this OAQMP is specific to the operation of the Asset and outlines how the Incident and Management (I&M) Contractor will manage and protect air quality as described in the EIS. It applies to all operation and maintenance activities relating to the Asset.

This Plan also details the reporting procedure for potential exceedances of in-tunnel, ventilation outlet and ambient air quality limits that may occur during operation.

1.4 Implementation of the Sub-plan

The reporting system contained in Section 8.1 and Annexure A of this Plan must be approved by the Secretary and fully implemented prior to operation in accordance with CoA E27.

Operation must not commence until the OEMP, OEMP sub-plans, monitoring programs and reporting systems have been approved by the Secretary.

This OAQMP, and any future updates that occur time to time, must be implemented for the duration of operation or for the timeframe specified. For example, monitoring and reporting requirements associated with ambient air quality must be implemented for a minimum of two years following the commencement of operation until Secretary approval is received to close a monitoring station. As noted by CoA E35, the provision, operation and maintenance (including all auditing and validation of data) of all air quality monitoring and reporting must be funded by the Proponent. Where the CSSI is being staged, operation of that stage is not to commence until the relevant operational documents have been approved by the Secretary.

1.5 Environmental management system overview

The environmental management system overview is described in Section 5.1 of the OEMP.

2 Purpose and objectives

2.1 Purpose

The purpose of this Plan is to describe how the I&M Contractor would manage the Asset to ensure compliance with the in-tunnel, ventilation outlet and ambient air quality outcomes identified in the EIS and limits identified in the Minister's Conditions of Approval (CoA).

It also provides an overarching reporting system for in-tunnel, ventilation outlets and ambient air quality limits. This Plan should be read in conjunction with the OEMP.

2.2 Objectives

The key objective of the OAQMP is to ensure all CoA, REMM, and licence/permit requirements relevant to air quality are described, scheduled, and assigned responsibility as outlined in:

- The EIS prepared for WestConnex M4-M5 Link
- The SPIR prepared for WestConnex M4-M5 Link
- The Modification reports for WestConnex M4-M5 Link Mainline Tunnel
- CoA granted to the Project on 17 April 2018 and as altered by the Modification reports
- The Roads and Maritime Services (Roads and Maritime) specifications G36, G38 and G40
- The Project's Environment Protection Licence (EPL)
- All relevant legislation and other requirements described in Section 3.1 of this Plan.

2.3 Environmental performance outcomes and targets

The targets presented in Table 2-1 have been established for the management of air quality during operation of the Asset. Key performance indicators (KPIs) have been established for these targets.

Table 2-1: KPIs for air quality management during operation

Target / KPI number	Target	KPI	Records	Source
AQ1	Air quality management during the operation phase of the Project performed in accordance with the OAQMP	Compliance with OAQMP	Audit Reports	CoA
AQ2	Effective management of operational activities with respect to maintaining tunnel and ventilation outlet emissions within acceptable limits	No reoccurring or major exceedances of air quality emission limits and goals	Monitoring data and reports	CoA / EPL
AQ3	Notification and reporting of any exceedances performed in accordance with the OAQMP	Notification and reporting of exceedances within the required timeframes.	Above-Emission Limit Recording Notification and Report Tunnel Air Quality Notification and Tunnel Air Quality Management Systems Report Above-Goal Recording Notification and Report	CoA

3 Environmental obligations

3.1 Legislation

All legislation relevant to this OAQMP is described Section 4.1.3 of the OEMP.

3.2 Guidelines and relevant documents

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

- National Environment Protection Councils (NEPC) – National Environment Protection Measure (NEPM) for Ambient Air Quality Guidelines (AAQ NEPM)
- Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DEC 2007)
- Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA 2016)
- NSW Government Resource Efficiency Policy (OEH 2014) (GREP)

3.3 Conditions of approval

Conditions of Approval (CoA) relevant to air quality management during operational activities are included in Table 3-1. A cross-reference is included to indicate where the condition is addressed in this OAQMP or other project management documents.

Table 3-1: Relevant Conditions of Approval

CoA	Requirement	Reference
E2	Prior to finalising the detailed design of the CSSI and establishing the ambient air quality monitoring stations required under Condition E24, the Proponent must establish an Air Quality Community Consultative Committee (AQCCC) to provide advice prior to and during the operation of the CSSI. The AQCCC must: (a) be comprised of - (i) two representatives from the Proponent and tunnel operator, (ii) one representative from each of the relevant councils, whose attendance is only required when considering matters relevant to their respective local government area, (iii) three representatives from each local community adjacent to each ventilation facility whose attendance is only required when considering matters relevant to their respective local area, and whose appointment has been approved by an expression of interest process conducted by the Proponent in consultation with the Secretary, and (iv) a Chair who is an independent from the design and construction of the CSSI put forward by the Proponent and approved by the Secretary; (b) meet at least four (4) times a year, or as otherwise agreed by the Chair and the Secretary; (c) review and provide advice on the location of the air quality monitoring stations required under Condition E24, operation environmental management plans and other operation stage documents, compliance tracking reporting, audit reports, or complaints as they relate to air quality; and (d) provide advice on the dissemination of monitoring results and other information on air quality issues. The AQCCC may comprise the same members of the AQCCC established under CSSI approvals for the WestConnex M4 East and New M5 projects (SSI 6307 and SSI 6788) in relation to the ventilation outlets located in Haberfield and St Peters.	Section 7.5 of the OEMP, Section 7.4.1 of this Plan. Members of the AQCCC satisfies the requirements of this CoA with the exception of only five local community representatives. Appropriate efforts were made to find a sixth member from the St Peters area, however to no avail. Advertisements for a sixth member are still ongoing. The above approach was communicated to Secretary in March 2021.

CoA	Requirement	Reference
E2A	The concentration of a pollutant discharged from the ventilation outlets must not exceed the respective limits specified for that pollutant in Table 3A.	Section 5.1.2
E3	The tunnel ventilation system must be designed and operated so that the average concentrations of CO and NO2, calculated along the length of the tunnel, do not exceed the concentration limit specified for that pollutant in Table 4.	Section 5.1.1
E4	The concentration of CO as measured at any single point in the tunnel must not exceed the concentration limit specified for that pollutant in Table 5 under all traffic scenarios.	Section 5.1.1
E5	The tunnel ventilation system must be designed and operated so that the visibility in the tunnel does not exceed the level specified in Table 6.	Section 5.1.1
E6	Should ambient monitoring of air pollutants exceed the following goals, the provisions of Conditions E32, E33 and E34 will apply: (a) CO – 8 hour rolling average of 9.0 ppm (NEPM); (b) NO2 – One hour average of 0.12 ppm (245 µg/m3) (NEPM); (c) PM10 – 24 hour average of 50 µg/m3 (NEPM); (d) PM2.5 – 24 hour average of 25 µg/m3 (NEPM); (e) PM10 – annual average of 25 µg/m3 (NEPM); and (f) PM2.5 – annual average of 8 µg/m3 (NEPM). *Note: The notification and reporting obligations under conditions E32, E33 and E34 relating to ambient monitoring will begin at the commencement of operation of the CSSI. The first annual average concentrations for PM10 and PM2.5 must be calculated on the first day the project has been in operation for 12 months and on a rolling basis thereafter.*	Sections 5.1.3, 8.4
E7	Conditions E2A, E3, E4, E5, and E6 do not apply in an emergency, as defined in the OEMP required by Condition D1.	Section 0
E8	The Proponent must, as soon as reasonably practicable, notify the Secretary and the EPA of any discharge during an emergency.	Section 0
E9	The tunnel ventilation systems must be designed, constructed and operated so as to only release emissions from ventilation outlets and not from the portals or the tunnel support facilities as identified in the documents listed in Condition A1, except for emergency smoke management purposes in the event of a fire in a tunnel or periodic testing of the system as defined in the OEMP required by Condition D1.	Sections 5.2.3, 5.2.4
E16	The Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration Protocol, must be implemented for the duration of operation.	A standalone Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration will be prepared. Relevant information has been included in Sections 5.2.1, 5.2.2
E17	Prior to commencing operation, a person or organisation, who is independent from the design and construction of the CSSI, whose appointment has been approved by the Secretary, must review the in-tunnel ventilation and ventilation outlet design of the project and the Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration Protocol prepared in accordance with Condition E13 to verify that: (a) the final design achieves the in-tunnel and ventilation outlet limits for all traffic conditions including congestion (as described by the regulatory worst-case scenario in Chapter 9 of the EIS); (b) the predicted impacts of the final design are no greater than predicted in the documents listed in Condition A1 for the equivalent operating conditions; and (c) the ventilation system has been optimised to achieve effective and responsive treatment of in-tunnel air quality and efficient energy consumption.	Section 6.1

CoA	Requirement	Reference
	The operating scenarios used to model the final design should be the same as those used in the documents listed in Condition A1. Should the design review adopt a modelling program different to that used in the EIS, the EIS predictions shall be re-modelled using the model adopted for the design review, to establish the predicted outcomes under part (b). The information required in this condition must be made available to the Secretary on request.	
E18	Prior to operation, permanent signage must be installed at each surface tunnel entrance and variable messaging signage provided at regular intervals throughout the tunnel to instruct tunnel users to close windows and turn on recirculated air. Relevant information about this instruction is to be provided on a website, operated by the Proponent, which is maintained throughout operation of the CSSI.	Section 5.2.2
E19	Prior to operation, the Proponent must investigate, in consultation with the EPA, the measures for smoky vehicle enforcement in the tunnels. The effectiveness of the smoky vehicle enforcement measures must be documented in the Independent Environmental Audit required under Condition A36.	Section 6.7
E19A	The Proponent must install monitoring equipment to monitor pollutants from the ventilation outlets. Pollutant monitoring from the ventilation outlets (by sampling and obtaining results by analysis) must be in accordance with the methods and frequencies for the pollutant parameters specified in Table 6A and be undertaken at commencement of and throughout operation. The monitoring equipment must be verified by an independent auditor who is expert in tunnel ventilation outlet design prior to the commencement of monitoring for compliance with the requirements set out in Table 6A.	Sections 5.2.5, 6.1, 6.3
E20	The Proponent must continuously monitor (by sampling and obtaining results from analysis) the pollutants within the tunnel specified in Table 7, using the methods approved by the Secretary. Monitoring must commence on the first day of operation of the CSSI and continue throughout the operation of the CSSI.	Sections 5.2.5, 6.2
E21	The number and location of the monitoring stations inside the tunnel must be determined to permit an accurate calculation, per the requirements of Conditions E3, E4 and E5, and be independently verified in accordance with a methodology developed in consultation with the EPA and approved by the Secretary prior to the operation of the CSSI. As a minimum, monitoring stations must be installed near intakes to the ventilation outlets, at the entry portals and at tunnel and ramp junctions.	Section 6.1
E22	All sampling points and visibility monitoring points must be audited prior to commencing monitoring, for compliance with the requirements set out in Conditions E3, E4, E5 and E20. Verification and compliance auditing is to be undertaken by an independent person(s) or organisation(s) whose appointment has been approved by the Secretary. The independent person(s) must be a Chartered Professional Engineer (either Mechanical, Chemical or Control Systems engineer).	Section 6.1
E23	Air quality monitoring data is to be made available in as close to real time as possible, under the website reporting requirements of Condition E28.	Section 6.6
E24	The Proponent must monitor (by sampling and obtaining results by analysis) the pollutants and parameters specified in Table 8 using the sampling method, units of measure, and sampling frequency specified in the table. Monitoring must be undertaken at the following locations as a minimum: (a) two ground level receptors near the Rozelle ventilation outlet, at locations suitable for detecting any impact on air quality from the outlet; (b) two ground level receptors near the Victoria Road ventilation outlet, at locations suitable for detecting any impact on air quality from the outlet; (c) two ground level receptors near the Campbell Road ventilation outlet, at locations suitable for detecting any impact on air quality from the outlet with one in a location different to that established under SSI 6788; and (d) two ground level receptors near the Haberfield ventilation outlet, at location suitable for detecting any impact on air quality from the outlet (these may be the same as those established under SSI 6307).	Sections 5.2.5, 6.4

CoA	Requirement	Reference
E25	The monitoring locations must be selected with the objective of achieving like-to-like comparison of monitoring results with available pre-construction data. The locations must also allow for the review of the accuracy of predicted environmental outcomes discussed in the documents referred to in Condition A1 against monitored air quality as part of the environmental audit required under Condition A36. The location of the monitoring stations must be agreed to by the AQCCC and subject to landowner's and occupier's agreement. The establishment and operation of the monitoring stations is to be undertaken in accordance with recognised Australian standards and undertaken by an organisation accredited by NATA for this purpose and approved by the Secretary in consultation with the EPA and the AQCCC. The quality of the monitoring results must be assured through a NATA accredited process prior to the data being considered as a basis for compliance/auditing purposes.	Section 6.4
E26	The Proponent must commence monitoring for at least 12 continuous months prior to operation and continue monitoring for at least two (2) years following the commencement of operation. At the conclusion of the two (2) year operational monitoring period, the Proponent must review the need for the continued use of ambient monitoring stations in consultation with the AQCCC and EPA. Closure or discontinued use of an ambient monitoring station will require the approval of the Secretary.	Sections 6.4, 7.4
E27	The Proponent must develop and implement a reporting system for ventilation outlet, in-tunnel and ambient limits. The reporting system must be approved by the Secretary and fully implemented and operational prior to operation. Minimum analytical reporting requirements for air pollution monitoring stations must be as specified in the Approved Methods for the sampling and Analysis of Air Pollutants in NSW (EPA, 2007, or as updated).	Section 8.1 and Annexure A
E28	Results of hourly updated real-time monitoring and relevant meteorological data must be provided on a website in an easy to interpret format. This data must be preliminary until a quality assurance check has been undertaken by a person or organisation, who is accredited by NATA for this purpose.	Section 6.6
E29	The availability of monitoring data must be conveyed to the local community by way of newsletter (including translation into common community languages in the area) and newspaper advertisement at least one month prior to the commencement of operation.	Section 6.6
E29A	The Proponent must notify the Secretary, EPA and Ministry of Health of any recordings above the emission limits (Above-Emission Limit Recording) in Condition E2A as soon as possible and within 24 hours of the recording. This notification must provide details of the circumstances of the event, including: (a) the nature of the event; (b) the concentration levels that occurred; (c) the timing and duration of the event; and (d) the measures employed to minimise the concentration levels.	Section 8.3
E29B	Within one (1) month of any notification of Above-Emission Limit Recording, the Proponent must prepare and submit to the EPA for information a Report on Above-Emission Limit Recording that details the cause of the exceedance, the effectiveness of any action(s) taken in response to the exceedance and the options available to prevent recurrence. The Report on Above-Emission Limit Recording must include consideration of improvements to the tunnel air quality management system so as to achieve compliance with the ventilation outlet emission limits.	Section 8.3
E30	In addition to the general reporting requirements specified in Condition E27, the Proponent must notify the Secretary, EPA and Ministry of Health of any recordings above the limits specified in Conditions E3, E4 and E5 as early as possible and within 24 hours of the recorded event. This notification must provide details of the circumstances of the event, including: (a) the nature and location of the event, including details relating to the cause; (b) the timing and duration of the event;	Section 8.2

CoA	Requirement	Reference
	(c) the extent and severity of the event; (d) the measures employed to minimise the concentration levels, and measures to improve visibility levels in the event that visibility levels were above the specified limit; (e) the frequency of the event, including whether an event with the same or similar circumstances has occurred previously; and (f) the date when the Proponent will submit a Tunnel Air Quality Management Systems Effectiveness Report in accordance with Condition E31.	
E31	Within 20 working days of a request by the Secretary, the Proponent must prepare and submit to the Secretary for information a Tunnel Air Quality Management Systems Effectiveness Report on the overall system performance and cause and major contributor of any exceedances, including: (a) the overall performance and concentration levels in the tunnel for the preceding six (6) month period (or since commencement of operation, where the CSSI has operated for under six (6) months), including average and maximum levels and time periods; (b) details of any instances throughout the operation of the CSSI where pollutant concentration levels in the tunnel have exceeded the limits specified in Conditions E3, E4 and E5; and (c) consideration of improvements to the tunnel air quality management system. The Tunnel Air Quality Management Systems Effectiveness Report is to be prepared by the Proponent and reviewed by a suitably qualified and experienced independent specialist(s) whose appointment has been approved by the Secretary. The Proponent must comply with any requirements arising from the Secretary's review of the Tunnel Air Quality Management Systems Effectiveness Report.	Section 8.2
E32	The Proponent must prepare an Ambient Air Quality Goal Protocol for evaluating a potential measurement that exceeds the goals in Condition E6. The Ambient Air Quality Goal Protocol must be developed by the Proponent in consultation with the AQCCC and submitted to the Secretary for approval at least 12 months prior to the commencement of operation of the CSSI. The Ambient Air Quality Goal Protocol must include: (a) a process for notification of a recording above the ambient air quality goals in Condition E6, subject to Condition E33; (b) the template that would be used for the Report on Above-Goal Recording, required by Condition E34; and (c) a process for appointing an independent person/organisation to prepare the Report on Above-Goal Recording. The process must include - (i) approval of the independent person (independent of the environmental assessment, design and construction of the CSSI) by the Secretary prior to preparation of the report, and (ii) the appointment of the independent person/organisation at least one (1) month prior to the commencement of operation, or at some other time prior to preparation of the report with the agreement of the Secretary.	Annexure B
E33	In addition to the general reporting requirements specified in Condition E27, the Proponent must notify the Secretary, EPA and Ministry of Health of any recordings above the goals in Condition E6 as soon as possible and within 24 hours of the recording. This notification must provide details of the circumstances of the event, including: (a) the nature of the event; (b) the concentration levels that occurred; (c) the timing and duration of the event; (d) the measures employed to minimise the concentration levels; and (e) the date when the Proponent will submit a Report on Above-Goal Recording in accordance with Condition E34.	Section 8.4
E34	Within 20 working days of any Notification of Above-Goal Recording, the Proponent must prepare and submit to the Secretary for information a Report on Above-Goal Recording that details the cause and major contributor of the exceedance, the	Section 8.4

CoA	Requirement	Reference
	effectiveness of any action(s) taken in response to the exceedance and the options available to prevent recurrence. Where the operation of the tunnel is identified to be a significant contributor to the recorded above-goal reading, the Report on Above-Goal Recording must include consideration of improvements to the tunnel air quality management system so as to achieve compliance with the ambient air quality goals, including but not limited to installation of the additional ventilation management facilities allowed for under Condition E10.	
E35	The provision, operation and maintenance (including all auditing and validation of data) of all air quality monitoring and reporting must be funded by the Proponent.	Noted.
E36	All continuous emissions monitoring systems installed and operated as a requirement of Condition E21 must undergo relative accuracy test audits at an interval not exceeding 12 months, or within another timeframe agreed with the Secretary.	Section 7.3.2
E37	The Proponent must engage a person independent from the design and construction of the CSSI, to audit the air quality monitoring (in-tunnel and ambient) for the CSSI at six (6) monthly intervals following commencement of operation of the CSSI, or at any longer interval if approved by the Secretary.	Section 7.3.1
E38	The Proponent must consult with the EPA and AQCCC before nominating the proposed auditor to the Secretary. Operation of the CSSI must not commence until the auditor's appointment is approved by the Secretary.	Section 7.3.1
E39	The auditor must ensure that the operating procedures and equipment to acquire air monitoring, meteorological data and emission monitoring data and monitoring reporting comply with NATA (or equivalent) requirements and sound laboratory practice.	Section 7.3.1
E40	The Proponent must document the results of the audit and make available all audit data for inspection by the Secretary upon request. A copy of the audit report must also be issued to the Proponent and AQCCC.	Section 7.1
E41	The Proponent must undertake appropriate quality assurance (QA) and quality control (QC) measures for air quality and ventilation outlet emission monitoring data. This must include, but not be limited to: accreditation/quality systems; staff qualifications and training; auditing; monitoring procedure; service and maintenance; equipment or system malfunction; and records/reporting. The QA/QC measures must be approved by an expert independent from the design and construction of the CSSI. The independent expert must be approved by the Secretary prior to monitoring of air quality and ventilation outlet emissions, as appropriate.	Section 6.5

3.4 Revised environmental management measures

The revised environmental management measures (REMMs) included in the WestConnex M4-M5 Link Submissions and Preferred Infrastructure Report that are relevant to air quality management during the operations and maintenance of the Asset are included in Table 3-2.

Table 3-2: Relevant revised environmental management measures

No.	Relevant requirement	Reference
AQ27	An in-tunnel air quality monitoring system will be included in the detailed design. The system will monitor oxides of nitrogen, nitrogen dioxide, carbon monoxide and visibility (as a minimum) throughout the tunnel. Monitoring of each pollutant will be undertaken throughout the tunnel. The locations of monitoring equipment will generally be at the beginning and end of each ventilation section. This will include, for example, monitors at each entry ramp, exit ramp, merge point and ventilation exhaust and supply point. The location of monitors will be governed by the need to meet the in-tunnel air quality criteria for all possible journeys through the tunnel system, especially for nitrogen dioxide. This will require sufficient, appropriately placed monitors to calculate a journey average.	Sections 5.2.5, 6.2

No.	Relevant requirement	Reference
AQ29	Ambient air quality monitoring will be carried out in the vicinity of the ventilation outlets installed as part of the project. Monitoring will occur at key representative locations, identified in consultation with an independent air quality specialist and an Air Quality Community Consultative Committee (AQCCC) [CoA E2], to allow direct comparison of measured ambient air quality with dispersion model predictions. The monitoring will commence at least 12 months prior to and continue for at least two years following the commencement of operation. Monitoring results and a comparison of monitoring results against dispersion model predictions and relevant ambient air quality criteria will be made publicly available.	Sections 5.2.5, 6.2, 7.4

3.5 Environment protection licence

An Environment Protection Licence (EPL) issued by the NSW Environment Protection Authority (EPA) is required for the operation of the Asset. Road tunnel emissions from the ventilation outlets for the tunnels is defined as a scheduled activity (35A) under the Protection of the Environment Operations Act 1997.

3.6 Consultation

This Plan was provided to the Air Quality Community Consultative Committee (AQCCC) for review and comment in accordance with CoA E2.

Refer to Section 1.5 of the OEMP for consultation requirements relating to the OEMP, sub-plans and monitoring programs.

All community feedback, complaints and notification (including those relating to air quality) will be managed in accordance with Section 7.3 of the OEMP.

4 Environmental aspects and impacts

4.1 Operational activities

Key aspects of the operation of the Asset that could result in adverse impacts to air quality include

- Routine operation:
  - Traffic operations and monitoring
  - Equipment and systems management including operation of the ventilation system
  - Exhaust emissions from plant/equipment used in permanent operations (such as generators, pumps as required)
  - Exhaust emissions from use of I&M vehicles
- Routine maintenance and repair work:
  - Vegetation clearing and landscape management
  - Stockpile management
  - Transport of materials for routine maintenance / repair works
  - Road infrastructure maintenance and repair
  - Pavement renewal and resurfacing
- Non-routine operation:
  - Road traffic accidents and incidents
  - Emergency smoke extraction
  - Road maintenance plant and machinery
- Non-routine maintenance and repair:
  - Major spill including clean-up
  - Equipment failure leading to damage, spills or an uncontrolled outcome

Environmental risks including those related to air quality will be identified, monitored and managed in accordance with Section 8 of the OEMP. Refer to the Aspects and Impacts Register included in Annexure D of the OEMP.

4.2 Potential impacts

Potential impacts to air quality associated with the operation of the Asset include:

- In-tunnel emissions including NO2, CO, visibility, PM10 and PM2.5
- Exceedance of in-tunnel, ventilation outlet or ambient air quality criteria due to emergency situations (e.g. fire or system failure) or non-performance of ventilation system
- Transport or disturbance of dust and dirt by heavy vehicles from the Asset to the public road networks, where it may be deposited and then re-suspended by other vehicles using the network
- Exhaust emissions from transport-related operations (such as transportation of materials, movement of maintenance vehicles, employee travel and waste removal).

5 Air quality control measures

5.1 Goals and limits

The air quality criteria for various parameters as defined by the Infrastructure Approval for SSI 7485 are identified in the following sections. The caption of each table includes the applicable CoA reference.

5.1.1 In-tunnel

In-tunnel air quality criteria is identified in Table 5-1, Table 5-2 and Table 5-3.

Table 5-1: In-tunnel average limits along length of tunnel (CoA E3)

Pollutant	Concentration Limit	Units of measurement	Averaging period
CO	87	ppm	Rolling 15-minute
CO	50	ppm	Rolling 30-minute
NO_2	0.5	ppm	Rolling 15-minute

Table 5-2: In-tunnel single point exposure limits (CoA E4)

Pollutant	Concentration Limit	Units of measurement	Averaging period
CO	200	ppm	Rolling 3-minute

Table 5-3: In-tunnel visibility limits along length of tunnel (CoA E5)

Pollutant	Concentration Limit	Units of measurement	Averaging period
Visibility	0.005	m^{-1}	Rolling 15-minute

5.1.2 Ventilation Outlet

Ventilation outlet air quality criteria is identified in Table 5-4.

Table 5-4: Ventilation Outlet Mass Pollutant Concentrations (CoA E2A)

Pollutant	Concentration Limit	Units of measurement	Averaging period	Reference conditions
Solid Particles	1.1	mg/m^3	1 hour or the minimum sampling period specified in the relevant test method, whichever is the greater	Dry, 273K, 101.3kPa
NO_2 or NO or both, as NO_2 equivalent	20	mg/m^3	1 hour block	Dry, 273K, 101.3kPa
NO_2	2.0	mg/m^3	1 hour block	Dry, 273K, 101.3kPa
CO	40	mg/m^3	1 hour rolling	Dry, 273K, 101.3kPa
VOC (as propane)	4.0	mg/m^3	1 hour rolling	Dry, 273K, 101.3kPa

5.1.3 Ambient

Ambient air quality goals are identified in Table 5-5.Table 5-5: Ambient air quality goals (CoA E6)

Pollutant	Concentration Limit	Units of measurement	Averaging period	Source
CO	9	ppm	Rolling 8-hour	NEPM
NO_2	0.12 (245)	ppm (µg/m^3)	1 hour	NEPM
PM_{10}	50	µg/m^3	24 hour	NEPM
$PM_{2.5}$	25	µg/m^3	24 hour	NEPM
PM_{10}	25	µg/m^3	1 year	NEPM
$PM_{2.5}$	8	µg/m^3	1 year	NEPM

Should ambient monitoring of air pollutants exceed the goals listed in Table 5-5, the notification and reporting obligations as outlined in Annexure B and Section 8.4 apply. As noted in Annexure B, the first annual average concentrations for PM10 and PM2.5 must be calculated on the first day the project has been in operation for 12 months and on a rolling basis thereafter.

5.1.4 Emergency Discharge

The air quality criteria identified in Table 5-1 to Table 5-5 (CoA E2A, E3, E4, E5 and E6) do not apply in an emergency situation. An ‘emergency’ has been defined in Section 8.2 of the OEMP.

In the event of an emergency situation that results in discharge(s) that exceed the nominated criteria, the Secretary and the EPA would be notified as soon as reasonably practicable.

5.2 Control mechanisms

5.2.1 Ventilation overview

The tunnel ventilation system enables the tunnel to operate with acceptable air quality at all times. The tunnel ventilation system is part of the overall Plant Monitoring and Control System (PMCS) and consists of:

- Exhaust fans;
- Supply fans;
- Jet fans mounted throughout the tunnel and ramps;
- Shutoff and balancing dampers;
- Air-flow, pollution and thermal measurement equipment both within the tunnel and at the outlets;
- Plant control system;
- St Peters Ventilation Facility within the St Peters interchange at MOC4 – the facility provides supply to the mainline southbound tunnel and exhaust from the southbound mainline tunnel and St Peters interchange off-ramp; and
- Parramatta Road Ventilation Facility located near the Wattle Street (City West Link) and Parramatta Road interchanges at Haberfield – the facility provides supply to the mainline southbound tunnel and exhaust from the northbound mainline tunnel and Wattle Street off-ramp.

The operating conditions for the tunnel can be divided into the following categories:

- Normal operation with traffic speeds of 20km/h, 40km/h, 60km/h and 80km/h;
- Ramp metering scenario with traffic speeds of 5km/h in ramps and 60k/h in the main carriageway; and

- fire operations with a design fire size of 50 megawatts.

The tunnel must be operated so as not to exceed the pollutant limits in CoA E3, E4 and E5 (refer to Section 5.1.1), except in the event of an emergency as permitted under CoA E7 (refer to Section 8.2 of the OEMP).

The ventilation control system software module has the ability to control the required level of ventilation to be operated (including corresponding numbers of supply, exhaust and jet fans within the tunnel) depending on in-tunnel air quality results in order to comply with the air-quality limits under normal operation.

With the nominated ventilation system capacity, the ventilation system is capable of meeting foreseeable incident conditions. However, the I&M Contractor may manually adjust the operation of the ventilation system, in anticipation of a traffic impact on air quality. This adjustment would be associated with the incident and would be cleared when the incident is cleared by the Operator.

The Asset's ventilation control system forms part of the wider WestConnex tunnel ventilation control system which integrates with the M4 and M8 Motorway ventilation systems. An integrated ventilation control system will help ensure compatibility between the operation of motorways, coordinated fire response and energy efficient operation of the air exchanges.

5.2.2 Ventilation and traffic management integration

The traffic management control system (TMCS) monitors traffic speed and flow through the tunnel and activates the operation of traffic control and driver advisory devices in and around the Asset. The TMCS devices are designed to be operated manually and/or automatically and can be used as a means of limiting or stopping vehicles entering the tunnel (e.g. avoiding congestion) which, if required, could be used to control air quality.

The PMCS and TMCS are operated together to provide the best possible outcome in terms of air quality both during normal operations and incident operations.

The tunnel ventilation system operates together with the TMCS to ensure CoA E3, E4 and E5 requirements are met for all operating scenarios (except during an emergency, as identified in CoA E7). Maintaining these limits will, in turn, ensure the ventilation outlet and ambient air quality criteria identified in CoA E2A and E6 are not exceeded (except as permitted in an emergency).

The ventilation control system will utilise the following key inputs to automatically determine the most appropriate level of ventilation required at any given time and for any given traffic scenario:

- Time of day;
- Traffic level of service via input from the TMCS;
- Air quality and velocity sensors; and
- Fire control and monitoring.

The control system will be capable of utilising real-time traffic flow data to prompt the ventilation control system to anticipate increased ventilation requirements to avoid emission discharge to the portals and to avoid exceedance of the air quality limits.

Variable message signs at the entrance to and throughout the tunnel form part of the project traffic management control system and, during normal traffic conditions, will instruct tunnel users to close windows and turn on recirculated air in accordance with CoA E18. This information will also be provided on the WestConnex website (https://www.westconnex.com.au/), which will be maintained throughout operation of the Asset.

5.2.3 Ventilation intake and extraction

In accordance with CoA E9, the tunnel ventilation system will be operated to release emissions from the ventilation outlets only to avoid emissions from the portals, except for emergency smoke management

purposes in the event of fire (refer to Section 8.2 of the OEMP) and during periodic testing of the system (refer to Section 5.2.4).

5.2.4 Periodic testing

As detailed above, the tunnel ventilation system is required to be operated to avoid emissions of tunnel air from the portals. Portal emissions are not permitted, except in the following circumstances:

- Emergency smoke management purposes in the event of a fire in the tunnel;
- Maintenance activities; and
- Periodic testing.

Periodic testing may include, but not be limited to testing during commissioning; replacement, repair and testing of faulty ventilation equipment; and routine testing and maintenance periods of:

- tunnel ventilation equipment;
  - where one or both carriageways are closed to traffic including maintenance of jet fans in the tunnel
  - in the ventilation facilities including axial fans, dampers and sound attenuators, and within the internal outlet
- tunnel ventilation support systems (e.g. substations); and
- fire and life safety systems.

Relevant conditions, and how they relate to possible emissions from the portals and/or the tunnel support facility, are included in Table 5-6.

Table 5-6: Instances of periodic testing

CoA	Requirement	Potential for emissions
E143	Fire simulation and hot smoke testing must be undertaken as part of the simulated emergency response exercise to be staged prior to opening of the project to traffic as required in Condition E142(e). The Proponent must respond in writing to any recommendations made by FRNSW and NSW Police as a result of the exercise.	Emissions from the portal and/or the tunnel support facilities at St Peters Interchange and Haberfield are expected during the simulated emergency response exercise/s undertaken at least one prior to opening the tunnels to traffic in accordance with the Emergency Response Plan prepared to satisfy CoA E142. Emissions may also occur during any additional emergency response exercises undertaken during operation as required by the Emergency Response Plan.
E149	A detailed maintenance-testing program outlining the methods of testing the fire and life safety systems and schedule for implementation must be developed in consultation with FRNSW prior to opening of the project to traffic. The Proponent must respond in writing to any recommendations made by FRNSW.	The detailed maintenance-testing program will be included in the Operation and Maintenance (O&M) Manual. Maintenance-testing of the fire and life safety systems that may result in emissions from the portals / support facilities may include but not be limited to the deluge system, foam generation system, fire pumps, water tanks, hydrant systems, tunnel fire detection and indication systems, fire indicator panels, fire alarms warning devices, fire doors, fire hose reels and fire extinguishers.
E150	Maintenance testing of fire and life safety systems must be undertaken at least annually, or any other interval as required by the design engineer and in consultation of FRNSW. Results of maintenance testing must be made available to FRNSW for review, and the Proponent	Maintenance testing of the fire and life safety systems will be undertaken a least annually as identified in the maintenance-testing program (CoA E149) included in the O&M Manual.

CoA	Requirement	Potential for emissions
	must respond in writing to any recommendations from FRNSW to ensure the reliability of the fire and life safety systems	During these events, emissions from the portals and/or tunnel support facilities at St Peters Interchange and Haberfield may result.

5.2.5 Operational monitoring

Potential impacts on air quality will be monitored during the operation of the Asset within the tunnel, at the ventilation outlets at Haberfield and St Peters and in locations in the vicinity of those outlets to monitor broader ambient air quality. Monitoring data will be assessed against the limits and goals specified in Section 5.1, with a management response triggered following any exceedances of the relevant criteria.

Details of operational air quality monitoring are provided in Section 6.

5.2.6 Equipment maintenance

In-tunnel monitors and ventilation outlet monitors will be connected to the Operations Maintenance and Controls System (OMCS), which will result in an alarm if an instrument is not functioning correctly. Maintenance and any necessary repair or replacement of monitors will be addressed in the O&M Manual.

All monitoring equipment (including in-tunnel, ventilation outlet and ambient air monitors) will be calibrated or verified in accordance with the manufacturer's recommendations. Equipment will be used and maintained, as appropriate. Calibration and maintenance records will be maintained for all monitoring equipment.

6 Monitoring and measurement

6.1 Independent verification and optimisation

Verification of in-tunnel and ventilation outlet air quality monitoring was undertaken prior to commencement of monitoring. Required verifications and the relevant CoA are detailed in Table 6-1.

Table 6-1: Independent verifications of operational air quality design and monitoring systems

CoA	Verification to be undertaken	In-tunnel monitoring	Ventilation outlet monitoring
E17	Prior to commencing operation, a person or organisation, who is independent from the design and construction of the CSSI, whose appointment has been approved by the Secretary, must review the in-tunnel ventilation and ventilation outlet design of the project and the Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration Protocol prepared in accordance with Condition E13 to verify that: (a) the final design achieves the in-tunnel and ventilation outlet limits for all traffic conditions including congestion (as described by the regulatory worst-case scenario in Chapter 9 of the EIS); (b) the predicted impacts of the final design are no greater than predicted in the documents listed in Condition A1 for the equivalent operating conditions; and (c) the ventilation system has been optimised to achieve effective and responsive treatment of in-tunnel air quality and efficient energy consumption. The operating scenarios used to model the final design should be the same as those used in the documents listed in Condition A1. Should the design review adopt a modelling program different to that used in the EIS, the EIS predictions shall be re-modelled using the model adopted for the design review, to establish the predicted outcomes under part (b). The information required in this condition must be made available to the Secretary on request	■	■
E19A	The Proponent must install monitoring equipment to monitor pollutants from the ventilation outlets. Pollutant monitoring from the ventilation outlets (by sampling and obtaining results by analysis) must be in accordance with the methods and frequencies for the pollutant parameters specified in Table 6A and be undertaken at commencement of and throughout operation. The monitoring equipment must be verified by an independent auditor who is expert in tunnel ventilation outlet design prior to the commencement of monitoring for compliance with the requirements set out in Table 6A. **Table 6A: Ventilation Outlet Emission Monitoring Methodologies** *Notes:*		■

Pollutant	Units of measure	Frequency	Method[1]
Solid particles	mg/m^3	Continuous	Special Method 1[4]
Solid particles	mg/m^3	Quarterly	TM-15
PM_{10}	mg/m^3	Quarterly	OM-5
$PM_{2.5}$	mg/m^3	Quarterly	OM-5
NO_2 or NO or both, as NO_2 equivalent	mg/m^3	Continuous	CEM-2
NO_2	mg/m^3	Continuous	CEM-2
CO	mg/m^3	Continuous	CEM-4
VOC[2]	mg/m^3	Continuous	CEM-8
Speciated VOC	mg/m^3	Annual	TM-34
Speciated PAH[3]	$\mu g/m^3$	Annual	OM-6
Parameter	**Units of measure**	**Frequency**	**Method[1]**
Velocity	m/s	Continuous	CEM-6
Volumetric flow rate	m^3/s	Continuous	CEM-6
Moisture	%	Continuous	TM-22
Temperature	°C	Continuous	TM-2
Other	**Units of measure**	**Frequency**	**Method[1]**
Selection of sampling locations	N/A	N/A	TM-1

CoA	Verification to be undertaken	In-tunnel monitoring	Ventilation outlet monitoring
	1. Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (EPA 2007) or an alternative method approved by the Secretary in consultation with the EPA. *2. Must include, but not be limited to: Benzene, Toluene, Xylenes, 1,3-Butadiene, Formaldehyde and Acetaldehyde.* *3. Must include, but not limited to; 16 USEPA priority PAHs, namely; Naphthalene, Phenanthrene,Benz(a)anthracene, Benzo(a)pyrene, Acenapthylene, Anthracene, Chrysene, Indeno(1,2,3-cd)pyrene, Acenaphthene, Fluoranthene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Fluorene,Pyrene, Benzo(k)fluoranhtene, Benzo(g,h,i)perylene.* *4. Special Method 1 means a method approved by the Secretary in consultation with the EPA.*		
E21	The number and location of the monitoring stations inside the tunnel must be determined to permit an accurate calculation, per the requirements of Conditions E3, E4 and E5, and be independently verified in accordance with a methodology developed in consultation with the EPA and approved by the Secretary prior to the operation of the CSSI. As a minimum, monitoring stations must be installed near intakes to the ventilation outlets, at the entry portals and at tunnel and ramp junctions.	■	
E22	All sampling points and visibility monitoring points must be audited prior to commencing monitoring, for compliance with the requirements set out in Conditions E3, E4, E5 and E20. Verification and compliance auditing is to be undertaken by an independent person(s) or organisation(s) whose appointment has been approved by the Secretary. The independent person(s) must be a Chartered Professional Engineer (either Mechanical, Chemical or Control Systems engineer).	■	

6.2 In-tunnel monitoring

The I&M Contractor must monitor the pollutants within the tunnel, using the sampling method, units of measures and frequency specified in Table 6-2.

In accordance with CoA E20, in-tunnel monitoring will be undertaken at the commencement of and throughout operation.

Table 6-2: In-tunnel monitoring methodologies (CoA E20)

Pollutant / Parameter	Units of measurement	Frequency	Method[1]
CO	ppm	Continuous	Infrared absorption spectroscopy
NO_2	ppm	Continuous	Differential optical absorption spectroscopy
Visibility	m^{-1}	Continuous	Light transmission

Notes: [1]Methodolgies approved by the Secretary

A total of 39 air quality monitoring sensors will be installed within the mainline tunnels and ramps including near intakes to the ventilation outlets, at the entry portals and at tunnel and ramp junctions to the M4, M8 and Rozelle Interchange Motorways. These sensors will monitor the parameters in Table 6-2 to provide feedback to the tunnel ventilation control system and enable vehicle pollutant levels within the tunnel to be maintained below limits in Section 5.1.1.

The in-tunnel air quality sensors will be connected to the PMCS for monitoring, recording and input to the tunnel ventilation control system to ensure the in-tunnel concentrations remains below the limits outlined in Section 5.1.1. The PMCS will record and store a history of measurements from the in-tunnel air quality sensors for reporting purposes. These results are then made available for use as required by the Project on the reporting website as detailed in Section 6.6.

As detailed in Section 7.3, once established, the in-tunnel monitoring points will also be audited prior to the commencement of monitoring for compliance against the requirements identified in Section 5.1.1 and Table 6-2. The appointed independent auditor will be approved by DPE.

6.3 Ventilation outlet monitoring

The I&M Contractor must monitor pollutants within the ventilation outlets, using the sampling method, units of measures and frequency specified in Table 6-3. In accordance with CoA E19A, ventilation outlet emission monitoring will be undertaken at the commencement of and throughout operation.

Table 6-3: Ventilation outlet emission monitoring methodologies (CoA E19A)

Pollutant / Parameter	Units of measurement	Frequency	Method[1]
Solid Particles	mg/m^3	Continuous	Special Method 1[4]
Solid Particles	mg/m^3	Quarterly	TM-15
PM_{10}	mg/m^3	Quarterly	OM-5
$PM_{2.5}$	mg/m^3	Quarterly	OM-5
NO_2 or NO or both, as NO_2 equivalent	mg/m^3	Continuous	CEM-2
NO_2	mg/m^3	Continuous	CEM-2
CO	mg/m^3	Continuous	CEM-4
VOC[2]	mg/m^3	Continuous	CEM-8
Speciated VOC	mg/m^3	Annual	TM-34
Speciated PAH[3]	$\mu g/m^3$	Annual	OM-6
Velocity	m/s	Continuous	CEM-6
Volumetric flow rate	m^3/s	Continuous	CEM-6
Moisture	%	Continuous	TM-22
Temperature	°C	Continuous	TM-2
Selection of sampling locations	N/A	N/A	TM-1

Notes:

[1] *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (EPA 2007) or an alternative method approved by the Secretary in consultation with the EPA.

[2] Must include, but not be limited to: Benzene, Toluene, Xylenes, 1,3-Butadiene, Formaldehyde and Acetaldehyde.

[3] Must include, but not limited to; 16 USEPA priority PAHs, namely; Naphthalene, Phenanthrene,Benz(a)anthracene, Benzo(a)pyrene, Acenapthylene, Anthracene, Chrysene, Indeno(1,2,3-cd)pyrene, Acenaphthene, Fluoranthene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Fluorene,Pyrene, Benzo(k)fluoranhtene, Benzo(g,h,i)perylene.

[4] Special Method 1 means a method approved by the Secretary in consultation with the EPA.

Air quality monitoring equipment to enable the continuous monitoring of the pollutants and parameters listed in Table 6-3 are provided within the ventilation outlets at Haberfield and St Peters.

The system will monitor pollutants through probes installed through the walls of the ventilation outlets that will be connected back to gas analysing enclosures installed at accessible locations. The system will be self-calibrating through calibration gases provided in bottles stored at accessible locations and connected to the gas analysing enclosure. Access platforms are provided around each of the outlet stacks with ports provided to enable manual sampling of the emissions and verification of the monitoring results.

The outlet sensors are connected to the PMCS for monitoring, recording and input to the tunnel ventilation control system to ensure the ventilation outlet emissions remains below the limits outlined in Section 5.1.2. The PMCS records and stores a history of measurements from these sensors for reporting purposes. These results are then made available for use as required by the Project on the reporting website as detailed in Section 6.6.

The installation of the monitoring equipment will be verified by an independent auditor, who is an expert in tunnel ventilation outlet design, prior to the commencement of monitoring for compliance against the methodologies specified in Table 6-3.

6.4 Ambient air quality

The I&M Contractor must monitor the pollutants and parameters, using the sampling method, units of measures and frequency specified in Table 6-4. In accordance with CoA E26, ambient air quality monitoring commenced 12 months prior to operation and will continue for at least two years following the commencement of operation.

Table 6-4: Ambient air quality monitoring methodologies (CoA E24)

Pollutant / Parameter	Units of measurement	Averaging Period	Frequency	Method[1]
NO	pphm	1 hour	Continuous	AM-12
NO_2	pphm	1 hour	Continuous	AM-12
NO_x	pphm	1 hour	Continuous	AM-12
PM_{10}	µg/m^3	24 hour	Continuous	AS3580.9.8-2008[2]
$PM_{2.5}$[5]	µg/m^3	24 hour	Continuous	AS3580.9.12-2013[3]
CO	ppm	1 hour, 8 hour	Continuous	AM-6
Parameter[4]	**Units of measurement**	**Averaging Period**	**Frequency**	**Method[1]**
Wind speed @ 10 m	m/s	1 hour	Continuous	AM-2, AM-4
Wind direction @ 10 m	°	1 hour	Continuous	AM-2, AM-4
Sigma Theta @ 10 m	°	1 hour	Continuous	AM-2, AM-4
Temperature @ 2 m	K	1 hour	Continuous	AM-4
Temperature @ 10 m	K	1 hour	Continuous	AM-4
Other	**Units of measurement**	**Averaging Period**	**Frequency**	**Method[1]**
Siting	N/A	N/A	N/A	AM-1, AM-4

Notes:

[1] *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (EPA 2007) or as otherwise approved by EPA.

[2] AS3580.9.8-2008, *Methods for the Sampling and Analysis of Ambient Air – Determination of Suspended Particulate Matter – PM10 Continuous Direct Mass Method using Tapered Element Oscillating Microbalance Analyser* (Standards Australia, 2008).

[3] AS 3580.9.12-2013, *Methods for Sampling and Analysis of Ambient Air – Determination of Suspended Particulate Matter – PM2.5 Beta Attenuation Monitors* (Standards Australia, 2013). This alternate methodology was approved by the Secretary in consultation with the EPA.

[4] TBD - location for meteorological monitoring station(s) to be representative of weather conditions likely to occur in the vicinity of the Haberfield, Rozelle (including the Rozelle Rail Yards and Victoria Road) and Campbell Road ventilation outlets.

[5] Appropriately modified to include size selective inlet for $PM_{2.5}$ or as otherwise approved by the EPA.

During construction of the Asset, the locations of the ambient air quality monitoring stations were selected based on the requirements of CoA E24 and E25 in consultation with the AQCCC. Refer to Section 7.5 of the OEMP for additional information on the AQCCC.

The four ambient air quality monitoring locations for the Asset are described in Table 6-5, and shown in Figure 6-1 and Figure 6-2.

Table 6-5: Ambient air quality monitoring locations

No.	AQCCC	CoA 24 Criteria	Location	Landowner in agreement with installation of monitoring station
1	St Peters 1	c. near Campbell road ventilation outlet (established under SSI 6788)	Campbell Road, St Peters	TfNSW
2	St Peters 2	c. near Campbell road ventilation outlet	St Peters Interchange, St Peters	TfNSW
3	Haberfield 1	c. near Haberfield ventilation outlet (established under SSI 6307)	Ramsay Street, Haberfield	TfNSW
4	Haberfield 2	c. near Haberfield ventilation outlet	Wattle Street, Haberfield	TfNSW

The ambient air quality monitoring stations are operated by Ecotech Pty Ltd. Ecotech Pty Ltd were approved by the Secretary (after satisfactory consultation with the EPA and AQCCC) as being an organisation sufficiently skilled and accredited by the National Association of Testing Authorities (NATA) to supply and operate the air quality monitoring stations as required under CoA E24 and E25.

At the conclusion of the two (2) year operational monitoring period, the I&M Contractor must review the need for the continued use of ambient monitoring stations in consultation with the AQCCC and EPA. Closure or discontinued use of an ambient monitoring station will require the approval of the Secretary.

Figure 6-1: Ambient air quality monitoring stations near St Peters Ventilation outlet

Figure 6-2: Ambient air quality monitoring stations near Haberfield Ventilation outlet

6.5 Quality assurance / quality control

The air monitoring (and air sampling, if required) will be carried out by a qualified and NATA accredited technician. Air sampling analysis will be carried out in accordance with ISO17025 at a NATA accredited laboratory under the quality assurance and quality control (QA/QC) protocol requirements at the time of air monitoring (and sampling). The QA/QC measures for air quality and ventilation outlet emission monitoring data will be undertaken, including, but not limited to:

- Quality systems;
- Staff qualifications and training;
- Auditing;
- Up-to-date standard operating procedures;
- Calibration, service and maintenance of all monitoring instruments;
- Equipment or system malfunction; and
- Records and reporting.

The QA/QC measures to be implemented during the operation of the Asset will be approved by an independent expert, who is approved by the Secretary prior to monitoring of air quality and ventilation outlet emissions. EMM Consulting Pty Ltd was approved by the Secretary as the independent expert to satisfy CoA E41 on 2 November 2021.

6.6 Availability of monitoring data

Information regarding the air quality monitoring required during operation of the Asset will be made available on the WestConnex website. Information will include hourly updated real-time monitoring and relevant meteorological data in an easy to interpret format as required by CoA E28. All data will be preliminary until a quality assurance check has been undertaken by a person or organisation accredited by NATA.

At least one month prior to the operation of the Asset, the local community will be notified by way of newsletter and newspaper advertisement of the availability of this information on the WestConnex website (https://www.westconnex.com.au/). A hard copy of the monitoring results will be available on request.

6.7 Smoky vehicle emissions

Prior to operation, measures for smoky vehicle enforcement in the tunnels were investigated by TfNSW in consultation with the EPA in accordance with CoA E19.

In accordance with the above requirement, air quality monitoring and detection equipment has been installed in the tunnels to identify record smoky vehicles. Australian Design rules set a smoke emission requirement for vehicles with four or more wheels powered by a diesel engine and is based on a ’10 second smoke rule’. That is, smoky vehicles are those that are visually identified as emitting smoke continuously for a period of 10 seconds or more.

The equipment installed within the tunnel enables the operator to record vehicle details of smoky vehicles and provide the records to EPA for enforcement action as the appropriate regulatory authority under the POEO Act.

The effectiveness of the smoky vehicle emissions measures will be documented in the Independent Environmental Audit required under condition A36. Refer to Section 9.3 of the OEMP for the schedule of operational audits.

7 Auditing and review

7.1 Continuous improvement

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

The continuous improvement process will be designed to:

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

7.2 OAQMP update and amendment

The processes described in Sections 9 and 10 of the OEMP may result in the need to update this OAQMP and its associated reporting system. Plan updates will occur on an as needed basis.

Document updates to the plan in response to regular reviews (refer to Section 10.1 of the OEMP) will be approved internally. Where necessary, the OAQMP will be provided to relevant stakeholders including the AQCCC for review and comment if required and provided to the Secretary for information.

A copy of updated plans will be made public ally available on the WestConnex project website (https://www.westconnex.com.au/) and provided to the relevant stakeholders on request.

7.3 Auditing

7.3.1 Six-monthly audits

An external auditor will be appointed to conduct an audit of the air quality monitoring (in tunnel and ambient) at six-monthly intervals, or at any longer interval if approved by the Secretary. The auditor must be approved by the Secretary, in consultation with the EPA and the AQCCC. Audits will commence six months after the commencement of operation.

The audit will review the operating procedures and equipment to acquire air monitoring, meteorological data and emission monitoring data and monitoring reporting complies with NATA (or equivalent) requirements and sound laboratory practice. These audits will also review the accuracy of predicted environmental outcomes discussed in the EIS against the monitored ambient air quality in accordance with CoA E25.

The audit report will be issued directly to the Project Company and the AQCCC. All audit data will be made available to the Secretary upon request.

7.3.2 In-tunnel relative accuracy test audits

In accordance with CoA E36, all continuous emissions monitoring systems installed and operated as a requirement of CoA E21, must undergo relative accuracy test audits (RATA) at an interval not exceeding 12 months, or as otherwise agreed to by the Secretary.

7.4 Reviews

7.4.1 Quarterly AQCCC Meeting

As detailed in Section 7.5 of the OEMP, the AQCCC will consist of representatives from TfNSW, the Project Company, relevant councils and the local community in accordance with CoA E2, with the exception of only five local community representatives. Appropriate efforts were made to find a sixth member from the St Peters area, however to no avail. Advertisements for a sixth member are still ongoing. The above approach was communicated to Secretary in March 2021.

The AQCCC must meet at least four times a year for the first two years of operation or as otherwise directed by the Secretary in consultation with the Committee Chair.

During these meetings, the AQCCC;

- Reviewed and provided advice on the location of the air quality monitoring stations required under CoA E24, as described in Section 6.4;
- Will continue to review and provide advice on operation environmental management plans and other operation stage documents, compliance tracking reporting, audit reports, or complaints as they relate to air quality; and
- Provide advice on the dissemination of monitoring results and other information on air quality issues.

7.4.2 Ambient air quality monitoring review

After a period of two years from the commencement of operation (in accordance with CoA E26), the Project Company, in consultation with the AQCCC and EPA, must review the need for the continuation of the ambient monitoring stations. Any recommendations to close the stations or discontinue monitoring will require the approval of the Secretary.

In accordance with REMM AQ29, the results of this ambient air quality monitoring review will be made publicly available on the WestConnex website (https://www.westconnex.com.au/).

8 Notification and reporting

8.1 Air quality reporting system

In accordance with CoA E27, a reporting system for ventilation outlet, in-tunnel and ambient air quality limits will be developed. The air quality reporting system must be approved by the Secretary and fully implemented and operational prior to operation. Minimum analytical reporting requirements for air pollution monitoring stations must be as specified in the Approved Methods for the *Sampling and Analysis of Air Pollutants in NSW* (EPA 2007, or as updated).

The air quality notifications and reporting system is summarised in Annexure A.

8.2 In-tunnel

The I&M Contractor will immediately notify the Project Company of any in-tunnel air quality exceedances after they occur. The Project Company will then notify the Secretary, EPA and NSW Health of any recordings above the limits specified in CoA E3, E4 and E5, as early as possible and within 24 hours of the recorded event. The notification will include:

- Nature and location of the event;
- Timing and duration of the event;
- Extent and severity of the event;
- Measures employed to minimise the concentration levels and/or improve the visibility levels;
- Frequency of the event, including whether an event with the same or similar circumstances has occurred previously; and
- Date when the Project Company will submit a Tunnel Air Quality Management Systems Effectiveness Report required by CoA E31.

Upon notification, the Secretary will consider the circumstances of the event and may request a Tunnel Air Quality Management Systems Effectiveness Report to be prepared in accordance with CoA E31.

If requested, the I&M Contractor will prepare a Tunnel Air Quality Management Systems Effectiveness Report within 20 working days. The report will consider the overall system performance and cause and major contributor of any exceedance, detailing the following:

- The overall performance and concentration levels in the tunnel for the preceding six months (or since commencement of operation, where the CSSI has operated for under six months), including average and maximum levels and time periods;
- Details of any instances throughout the operation of the CSSI where pollutant concentration levels in the tunnel have exceeded the limits specified in conditions E3, E4 and E5; and
- Consideration of improvements to the tunnel air quality management system.

The report must be reviewed by a suitably qualified and experienced independent specialist(s) who has been approved by the Secretary.

Requirements resulting from the Secretary's review of the Tunnel Air Quality Management Systems Effectiveness Report will be complied with during operation of the Asset.

8.3 Ventilation outlet

The I&M Contractor will immediately notify the Project Company of any ventilation outlet emission exceedances after they occur. The Project Company will then notify the Secretary, EPA and NSW Health of any recordings above the limits specified in CoA E2A, as soon as possible and within 24 hours (in accordance with CoA E29A). The notification will include:

- Nature of the event;
- Concentration levels that occurred;
- Timing and duration of the event; and
- Measures employed to minimise the concentration levels.

Following any notification, the I&M Contractor will prepare and submit a Report on Above-Emission Limit Recording within one month to the EPA in accordance with CoA E29B. The report will detail the cause of any exceedance, the effectiveness of any action(s) taken in response to the exceedance and the options available to prevent reoccurrence. It must also include consideration of improvements to the tunnel air quality management system so as to achieve compliance with the ventilation outlet emission limits in CoA E2A.

8.4 Ambient air quality

An Ambient Air Quality Goal Protocol (Annexure B) has been prepared in accordance with CoA E32, in consultation with the AQCCC and approved by the Secretary. This Protocol outlines the process for evaluating potential exceedances of the ambient air quality goals which apply during the operation of the Asset.

The Project Company will notify the Secretary, EPA and Ministry of Health of any recordings above the goals in Section 5.1.3 (CoA E6) as soon as possible and within 24 hours of the recording in accordance with CoA E33. The notification will include:

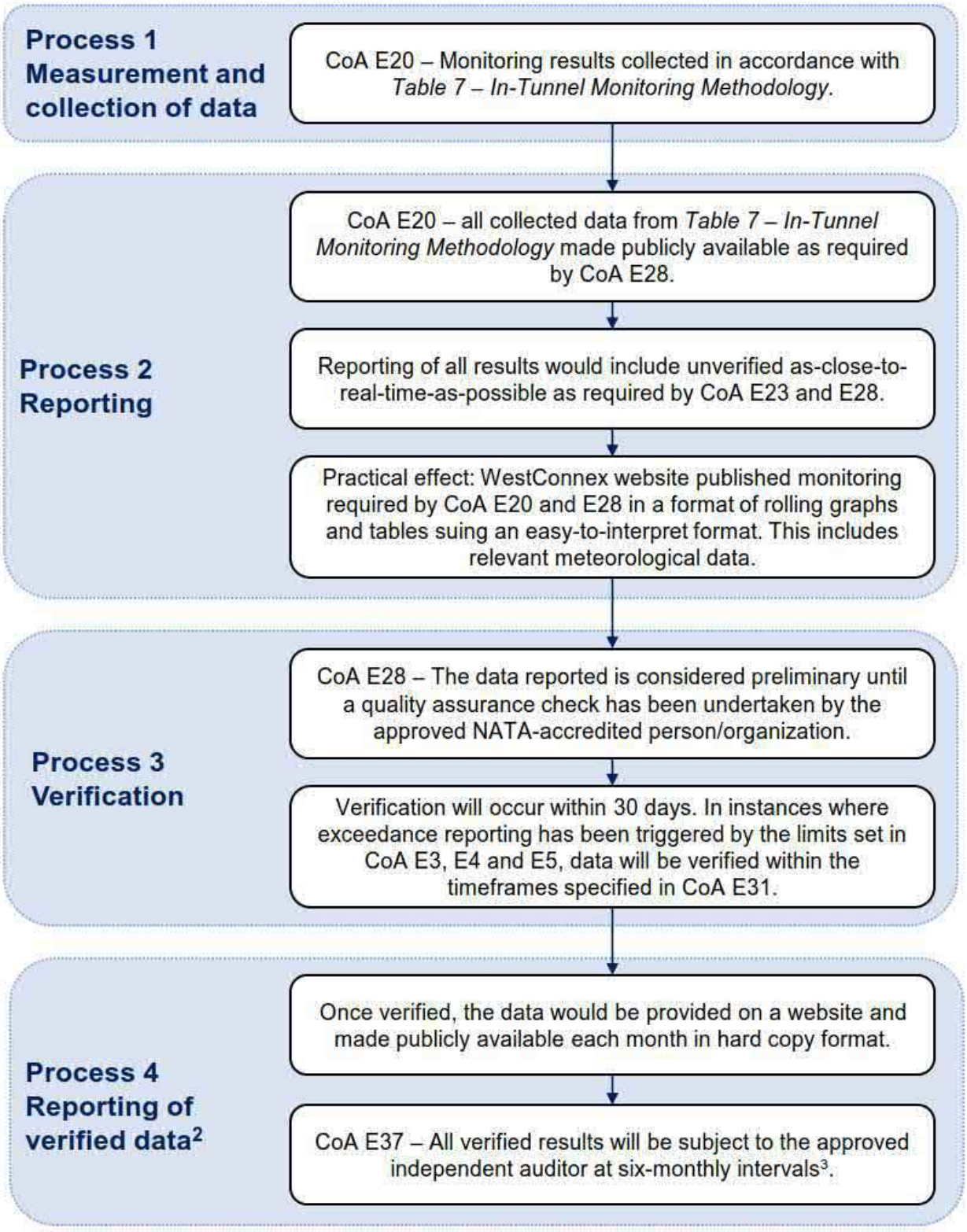
- Nature of the event;
- Concentration levels that occurred;
- Timing and duration of the event;
- Measures employed to minimise the concentration levels; and
- Date when the Project Company will submit a Report on Above-Goal *Reading* as required by CoA E34.

Within 20 working days of any Notification of Above-Goal Recording, Project Company will prepare and submit a Report on Above-Goal Reading to the Secretary in accordance with CoA E34. The report will detail the cause of any exceedance, the effectiveness of any action(s) taken in response to the exceedance and the options available to prevent reoccurrence.

Where the operation of the tunnel is identified to be a significant contributor to the recorded Above-Goal Reading, the Report on Above-Goal Reading must include consideration of improvements to the tunnel air quality management system so as to achieve compliance with the ambient air quality goals, including but not limited to installation of the additional ventilation management facilities allowed for under CoA B10.

Annexure A Air quality notification and reporting system

In-Tunnel Air Quality Reporting[1] Process



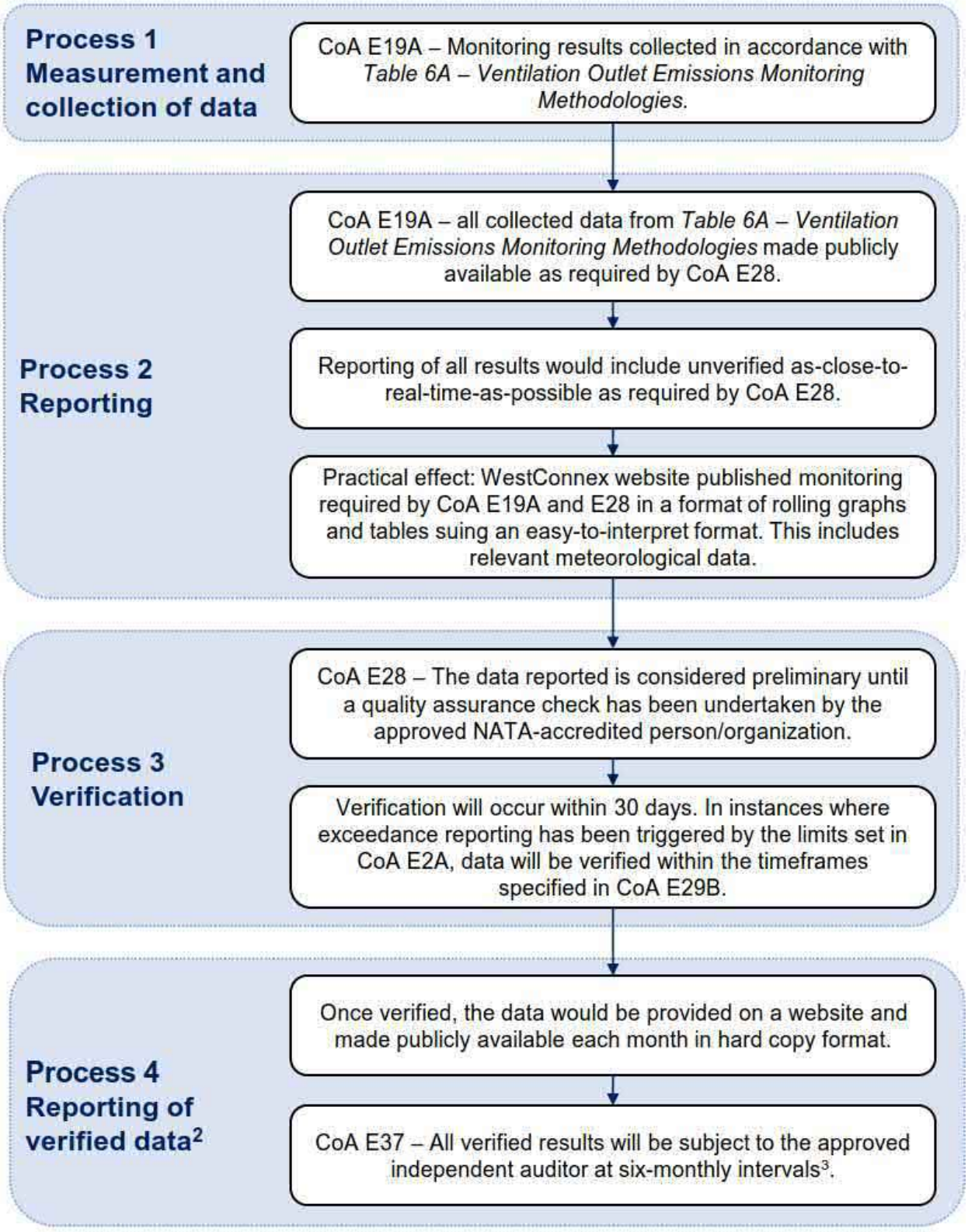
Notes:

1 All monitoring stations would include the minimum analytical reporting requirements specified in *Approved Methods for the Sampling and Analysis of Air Pollutants* for the parameters specified in CoA E20 and E28.

2 This is an important process used to determine whether there is a verified above limit reading substantiating the earlier triggering of CoA E30 and E31.

3 As specified in CoA E37, E39 and E40, all results will be subject to six monthly audits by the approved independent auditor. The audit report will be issued to the Project Company, AQCCC and Secretary (upon request)

Ventilation Outlet Emission Reporting[1] Process

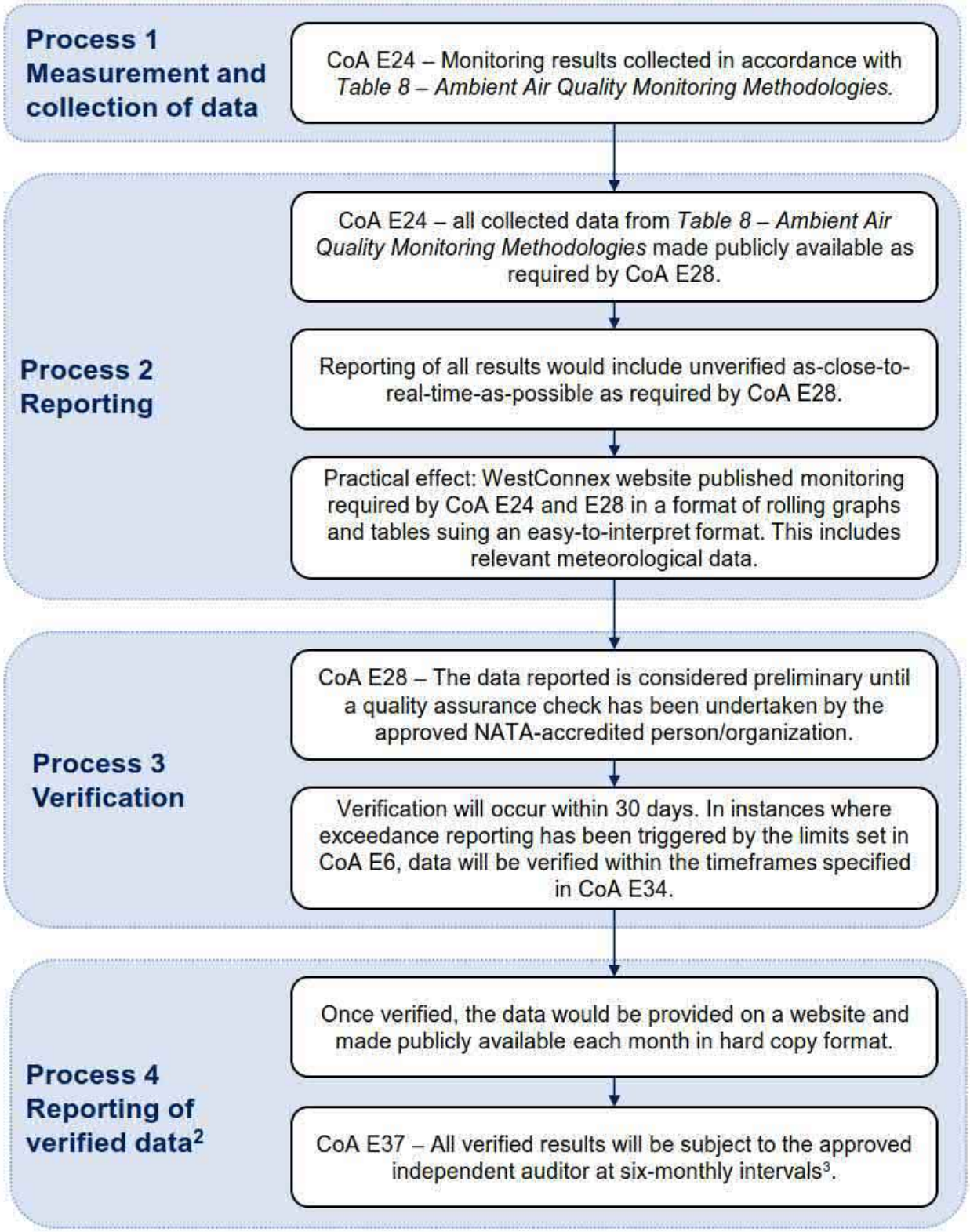


Notes:

1 All monitoring stations would include the minimum analytical reporting requirements specified in *Approved Methods for the Sampling and Analysis of Air Pollutants* for the parameters specified in CoA E19A.

2 This is an important process used to determine whether there is a verified above limit reading substantiating the earlier triggering of CoA E29A and E29B.

Ambient Air Quality Reporting[1] Process



Notes:

1 All monitoring stations would include the minimum analytical reporting requirements specified in *Approved Methods for the Sampling and Analysis of Air Pollutants* for the parameters specified in CoA E24.

2 This is an important process used to determine whether there is a verified above limit reading substantiating the earlier triggering of CoA E33 and E34.

3 As specified in CoA E37, E39 and E40, all results will be subject to six monthly audits by the approved independent auditor. The audit report will be issued to the Project Company, AQCCC and Secretary (upon request)

Annexure B Ambient Air Quality Protocol

WestConnex

WestConnex M4–M5 Link

Ambient Air Quality Goal Protocol

Condition E32

Revision	4
Date revised	6/12/21/21

Revision history

This document interfaces with the M4-M5 Link Operational Air Quality Management Plan, within the M4-M5 Link Operational Environmental Management Plan (OEMP), which together describe the proposed overall management system for the I&M Services.

The latest revision of this document is available on Contract Workspace. If any unsigned hard copies of this document are printed, they are valid only on the day of printing.

The revision number is included at the bottom of each page. When revisions occur, the entire document will be issued with the revision number updated accordingly.

Appendices to this plan may be revised independently of this plan.

Rev No	Revised by	Reviewed and Approved by:	Date	Description/Summary of Changes
0.1	K Hincks		27/7/21	Initial issue for internal review and approval
0.2	K Hincks		8/8/21	Initial issue for internal review and approval
0.3	K Hincks		30/9/21	Revised to incorporate AQCCC comments
0.4	K Hincks		6/12/21	Revised to incorporate DPIE comments
1				
2				
3				

Table of Contents

List of Tables

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Glossary

Term Used	Explanation
AM-1	Ambient monitoring – guide for the siting of sampling units
AM-2	Ambient monitoring – guide for measurement of horizontal wind for air quality applications
AM-4	Ambient monitoring – meteorological guidance for regulatory modelling applications
AM-6	Ambient monitoring – Carbon monoxide
AM-12	Ambient monitoring – Nitrogen oxides
AGR	Above-goal reading (ambient monitoring only)
AQCCC	Air Quality Community Consultative Committee
AQMS	Ambient air quality monitoring station
ASIC	Australian Securities and Investment Commission
Background levels	Existing concentrations of pollutants in the ambient air
CO	Carbon Monoxide
CoA	Minister's Conditions of Approval
DPIE	NSW Department of Planning, Industry and Environment
EMT	Emergency Management Team
EPA	NSW Environment Protection Authority
Minister, the	Minister for Planning
NATA	National Association of Testing Authorities, Australia
NEPM	National Environment Protection (Ambient Air Quality) Measure 2016
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
O&M	Operations and Maintenance
I&M Contractor	The contractor engaged to deliver the incident response and maintenance contract for the M4-M5 Link project.
OAQMP	Operational Air Quality Management Plan
OEMP	Operational Environmental Management Plan
PM_{10}	Particulate matter (10 micrometres or less in diameter)
$PM_{2.5}$	Particulate matter (2.5 micrometres or less in diameter)
Project Company	WestConnex Transurban The Project Company, WestConnex Transurban has been engaged by Transport for New South Wales to deliver the M4-M5 Link Tunnels project. WestConnex Transurban has in turn, engaged the Contractor, ASBJV to design and construct the project

Project, the	WestConnex M4-M5 Link Tunnels
Reasonable and Feasible	Consideration of best practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. Feasible relates to engineering considerations and what is practical to build. Reasonable relates to the application of judgement in arriving at a decision, taking into account mitigation benefits and cost of mitigation versus benefits provided, community expectations and nature and extent of potential improvements.
Relevant council(s)	Any or all as relevant, Inner West or City of Sydney
Secretary	Secretary of the Department of Planning, Industry and Environment
Secretary's approval	A written approval from the Secretary (or delegate)
SSI	State Significant Infrastructure
TfNSW	Transport for New South Wales

1 Introduction

1.1 Purpose and Overview

This Ambient Air Quality Goal Protocol has been developed to satisfy the requirements of condition E32 of the Conditions of Approval (CoA) for the WestConnex M4-M5 Link project (the project).

Condition E32 requires that an Ambient Air Quality Goal Protocol (Protocol) be prepared for the evaluation of a potential measurement that exceeds the ambient air quality goals. The Protocol is to include a form and process for notifying the measurement that exceeds the goal; the form and contents for reporting the measurement; and the process for appointing an independent person to prepare a Report on the Above-Goal Recording.

1.2 Environmental Management System

The Incident and Maintenance (I&M) Contractor will utilise an Integrated Management System for environmental management. The I&M Contractor's environmental management system (EMS) has been certified as complying with AS/NZS ISO 14001.

The EMS includes the Operational Environmental Management Plan (OEMP) which provides the detail of how the environmental aspects of the project will be managed during the operational phase. The OEMP provides the overall framework for the system and procedures to ensure environmental impacts are minimised and legislative and other requirements are fulfilled.

This Ambient Air Quality Goal Protocol forms part of the management system documents which are to be implemented on the WestConnex M4-M5 Link. It is to be read in conjunction with the other management system documents including the OEMP, the Operational Air Quality Management Plan and the reporting system for in-tunnel, ambient and ventilation outlet limits required by CoA E23 (website reporting).

1.3 Consultation

In accordance with CoA E32, the Ambient Air Quality Goal Protocol must be prepared in consultation with the M4-M5 Link Tunnels Air Quality Community Consultative Committee (AQCCC).

The AQCCC were consulted during the preparation of this document. The AQCCC were sent a draft of the protocol prior to the September 2021 meeting and was discussed at the meeting. Minor editorial changes were requested by members of the AQCCC, the protocol was revised following these comments.

2 Environmental Obligations

Legislative obligations relating to air quality, including ambient air quality, are detailed within the Operational Air Quality Management Plan.

2.1 Conditions of Approval

Conditions of the Infrastructure Approval for the project that are relevant to the Ambient Air Quality Goal Protocol (Protocol) are provided in the table following.

A cross-reference is included to indicate where each condition is addressed in this Protocol or other project management documents.

Table 2-1 Conditions of Approval

CoA Ref	Requirement	Reference
A40	The Secretary must be notified as soon as possible and in any event within 24 hours of any incident.	See Flowchart
E6	Should ambient monitoring of air pollutants exceed the following goals, the provisions of **Conditions E32, E33** and **E34** will apply: (a) CO – 8 hour rolling average of 9.0 ppm (NEPM); (b) NO_2 – One hour average of 0.12 ppm (245 µg/m^3) (NEPM); (c) PM_{10} – 24 hour average of 50 µg/m^3 (NEPM); (d) $PM_{2.5}$ – 24 hour average of 25 µg/m^3 (NEPM); (e) PM_{10} – annual average of 25 µg/m^3 (NEPM); (f) and $PM_{2.5}$ – annual average of 8 µg/m^3 (NEPM) Note: *The notification and reporting obligations under conditions E32, E33 and E34 relating to ambient monitoring will begin at the commencement of operation of the CSSI. The first annual average concentrations for PM_{10} and $PM_{2.5}$ must be calculated on the first day the project been in operation for 12 months and on a rolling basis thereafter.*	Section 3
E7	**Conditions E3, E4, E5**, and **E6** do not apply in an emergency, as defined in the OEMP required by **Condition D1.**	Section 3.1
E8	The Proponent must, as soon as reasonably practicable, notify the Secretary and the EPA of any discharge during an emergency.	Section 3.1
E10	All tunnels must be designed and constructed so as to allow for future modification of the ventilation system if required. The Proponent must submit a report to the Secretary demonstrating how this will be allowed for prior to finalising detailed design.	Section 5.3
E24	The Proponent must monitor (by sampling and obtaining results by analysis) the pollutants and parameters specified in **Table 8** using the sampling method, units of measure, and sampling frequency specified in the table. Monitoring must be undertaken at the following locations as a minimum: (a) two ground level receptors near the Rozelle ventilation outlet, at locations suitable for detecting any impact on air quality from the outlet; (b) two ground level receptors near the Victoria Road ventilation outlet, at locations suitable for detecting any impact on air quality from the outlet; (c) two ground level receptors near the Campbell Road ventilation outlet, at locations suitable for detecting any impact on air quality from the outlet with one in a location different to that established under SSI 6788; and (d) two ground level receptors near the Haberfield ventilation outlet, at location suitable for detecting any impact on air quality from the outlet (these may be the same as those established under SSI 6307).	Section 3

CoA Ref	Requirement	Reference

Table 8: Ambient Air Quality Monitoring Methodologies

Pollutant	Units of measurement	Averaging Period	Frequency	Method[1]
NO	pphm	1-hour	Continuous	AM-12
NO_2	pphm	1-hour	Continuous	AM-12
NO_x	pphm	1-hour	Continuous	AM-12
PM_{10}	µg/m³	24-hour	Continuous	AS3580.9.8-2008[2]
$PM_{2.5}$[5]	µg/m³	24-hour	Continuous	AS3580.9.13-2013[3] or as otherwise agreed by the Secretary in consultation with the EPA
CO	ppm	1-hour,8-hour	Continuous	AM-6
Parameter[4]	**Units of measurement**	**Averaging Period**	**Frequency**	**Method[1]**
Wind Speed @ 10 m	m/s	1-hour	Continuous	AM-2 & AM-4
Wind Direction @ 10 m	°	1-hour	Continuous	AM-2 & AM-4
Sigma Theta @ 10 m	°	1-hour	Continuous	AM-2 & AM-4
Temperature @ 2m	K	1-hour	Continuous	AM-4
Temperature @ 10 m	K	1-hour	Continuous	AM-4
Other	**Units of measurement**	**Averaging Period**	**Frequency**	**Method[1]**
Siting	NA	NA	NA	AM-1 & AM-4

Notes:

1. *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (EPA, 2007) or as otherwise agreed by EPA.*
2. *AS3580.9.8-2008, Methods for the Sampling and Analysis of Ambient Air – Determination of Suspended Particulate Matter – PM10 Continuous Direct Mass Method using Tapered Element Oscillating Microbalance Analyser (Standards Australia, 2008).*
3. *AS 3580.9.13-2013, Methods for the Sampling and Analysis of Ambient Air – Determination of Suspended Particulate Matter – PM2.5 Continuous Direct Mass Method using a Tapered Element Oscillating Microbalance Analyser (Standards Australia, 2013).*
4. *TBD - location for meteorological monitoring station(s) to be representative of weather conditions likely to occur in the vicinity of the Haberfield, Rozelle (including the Rozelle Rail Yards and Victoria Road) and Campbell Road ventilation outlets.*
5. *Appropriately modified to include size selective inlet for PM2.5 or as otherwise approved by the EPA.*

E27	The Proponent must develop and implement a reporting system for in-tunnel and ambient limits. The reporting system must be approved by the Secretary and fully implemented and operational prior to operation. Minimum analytical reporting requirements for air pollution monitoring stations must be as specified in the *Approved Methods of Modelling and Assessment of Air Pollutants in NSW* (EPA, 2007, or as updated).	A reporting system for in-tunnel, ventilation outlet and ambient air quality limits will be developed in consultation with EPA.

CoA Ref	Requirement	Reference
E32	The Proponent must prepare an **Ambient Air Quality Goal Protocol** for evaluating a potential measurement that exceeds the goals in **Condition E6**. The **Ambient Air Quality Goal Protocol** must be developed by the Proponent in consultation with the **AQCCC** and submitted to the Secretary for approval at least 12 months prior to the commencement of operation of the CSSI. The **Ambient Air Quality Goal Protocol** must include: (a) a process for notification of a recording above the ambient air quality goals in **Condition E6**, subject to **Condition E33**; (b) the template that would be used for the **Report on Above-Goal Recording**, required by **Condition E34**; and (c) a process for appointing an independent person/organisation to prepare the **Report on Above-Goal Recording**. The process must include – (i) approval of the independent person (independent of the environmental assessment, design and construction of the CSSI) by the Secretary prior to preparation of the report, and (ii) the appointment of the independent person/organisation at least one (1) month prior to the commencement of operation, or at some other time prior to preparation of the report with the agreement of the Secretary.	This document The evaluation occurs by Section 5.2 and 5.3 Section 5 and Appendix A1 Section 5 and Appendix A2 Section 6 Section 6 Section 6
E33	In addition to the general reporting requirements specified in **Condition E27**, the Proponent must notify the Secretary, EPA and Ministry of Health of any recordings above the goals in **Condition E6** as soon as possible and within 24 hours of the recording. This notification must provide details of the circumstances of the event, including: (a) the nature of the event; (b) the concentration levels that occurred; (c) the timing and duration of the event; (d) the measures employed to minimise the concentration levels; and (e) the date when the Proponent will submit a **Report on Above-Goal Recording** in accordance with **Condition E34**.	Section 5, Section 5.1.2 and Section 3
E34	Within 20 working days of any Notification of Above-Goal Recording, the Proponent must prepare and submit to the Secretary for information a **Report on Above-Goal Recording** that details the cause and major contributor of the exceedance, the effectiveness of any action(s) taken in response to the exceedance and the options available to prevent recurrence. Where the operation of the tunnel is identified to be a significant contributor to the recorded above-goal reading, the **Report on Above-Goal Recording** must include consideration of improvements to the tunnel air quality management system so as to achieve compliance with the ambient air quality goals, including but not limited to installation of the additional ventilation management facilities allowed for under **Condition E10**.	Section 5.3 Appendix A2

3 Ambient Air Quality Goals

The ambient air quality criteria for the M4-M5 Link are defined in CoA E6 and are provided below in the table following:

Table 3-1 Ambient air quality criteria (CoA E6)

Parameter	Concentration limit	Units of measure	Averaging period	Source
CO	9.0	ppm	Rolling 8-hour	NEPM
NO_2	0.12 (245 µg/m^3)	ppm	1 hour	NEPM
PM_{10}	50	µg/m^3	24 hour	NEPM
$PM_{2.5}$	25	µg/m^3	24 hour	NEPM
PM_{10}	25	µg/m^3	1 year	NEPM
$PM_{2.5}$	8	µg/m^3	1 year	NEPM

**Note: The notification and reporting obligations under conditions E32, E33 and E34 relating to ambient monitoring will begin at the commencement of operation of the CSSI. The first annual average concentrations for PM_{10} and $PM_{2.5}$ must be calculated on the first day the project has been in operation for 12 months and on a rolling basis thereafter.*

In accordance with CoA E6, should ambient monitoring of air pollutants exceed the goals listed in Table 3-1, CoAs E32, E33 and E34 apply and notification and reporting of the above-goal reading shall occur as required.

For the reporting of above-goal readings of the annual average (1-year averaging period), the first annual average result will not be available until at least 12 months following the commencement of operation. As the first annual average result will not be available until this time, any notifications or reports of above-goal readings of the annual average will also not be available until at least 12 months following the commencement of operation.

3.1 Emergency discharge

In accordance with CoA E7, the air quality criteria identified in Table 3-1 do not apply in an emergency situation (refer also CoA A40). An ‘emergency’ has been defined in the OEMP.

In the event of an emergency situation that results in discharge(s) that exceed the nominated criteria, the Secretary and the EPA would be notified in accordance with CoA E8.

4 Monitoring

4.1 Monitoring methodologies

The I&M Contractor will monitor the pollutants and parameters, using the sampling method, units of measures and frequency specified in the table following:

Table 4-1 - Ambient Air Monitoring Methodologies (CoA E24)

Pollutant	Units of Measurement	Averaging Period	Frequency	Method
NO	pphm	1-hour	Continuous	AM-12
NO2	pphm	1-hour	Continuous	AM-12
NOx	pphm	1-hour	Continuous	AM-12
PM_{10}	µg/m^3	24 hour	Continuous	AS 3580.9.8-2008[2]
$PM_{2.5}$[5]	µg/m^3	24 hour	Continuous	AS 3580.9.13-2013[3]
CO	ppm	1-hour, 8 hour	Continuous	AM-6
Parameter[4]	**Units of measure**	**Averaging period**	**Frequency**	**Method[1]**
Wind speed @10 m	m/s	1-hour	Continuous	AM-2 & AM-4
Wind direction @ 10 m	°	1-hour	Continuous	AM-2 & AM-4
Sigma Theta @ 10 m	°	1-hour	Continuous	AM-2 & AM-4
Temperature @ 2 m	K	1-hour	Continuous	AM-4
Temperature @ 10 m	K	1-hour	Continuous	AM-4
Other	**Units of measure**	**Averaging period**	**Frequency**	**Method[1]**
Siting	N/A	N/A	N/A	AM-1 & AM-4

TABLE NOTES

1. Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (EPA, 2007) or as otherwise agreed by EPA.
2. AS3580.9.8-2008, Methods for the Sampling and Analysis of Ambient Air – Determination of Suspended Particulate Matter – PM_{10} Continuous Direct Mass Method using Tapered Element Oscillating Microbalance Analyser (Standards Australia, 2008).
3. AS 3580.9.13-2013, Methods for the Sampling and Analysis of Ambient Air – Determination of Suspended Particulate Matter – PM2.5 Continuous Direct Mass Method using a Tapered Element Oscillating Microbalance Analyser (Standards Australia, 2013).
4. TBD - location for meteorological monitoring station(s) to be representative of weather conditions likely to occur in the vicinity of the Haberfield, Rozelle (including the Rozelle Rail Yards and Victoria Road) and Campbell Road ventilation outlets.
5. Appropriately modified to include size selective inlet for PM2.5 or as otherwise approved by the EPA

The ambient air quality monitoring stations were established and are operated by Ecotech Pty Ltd. Ecotech Pty Ltd were approved by the Secretary on 23 June 2021 (after satisfactory consultation with the EPA and AQCCC) as being an organisation sufficiently skilled and accredited by the National Association of Testing Authorities Australia to supply and operate the air quality monitoring stations as required under CoA E25.

Ambient monitoring of pollutants for the purposes of notification and reporting obligations under CoAs E32, E33 and E34 will begin at the commencement of operation. As such, the first annual average of pollutants will be available 12 months following the commencement of operations.

4.2 Monitoring Locations

Ambient air quality monitoring occurs at four monitoring locations. These are described in the table following and shown in Figure 1 to Figure 3.

Table 4-2 - Monitoring Locations and Standards

Figure	Reference	Location	Landowner
1	Site 1	Ramsay Street, near Martin Street, Haberfield	TfNSW
1	Site 2	Wattle Street, Near Ramsay Street, Haberfield	TfNSW
2	Site 3	Campbell Street, between Church Street and Princess Highway, St Peters	TfNSW
2	Site 4	St Peters Interchange, near Princess Highway	WestConnex

Figure 1 - Ambient Air Quality monitoring stations

Figure 2 - Ambient air quality monitoring stations

5 Notification and reporting of above-goal readings

The key steps in notification and reporting of above-goal readings are detailed within Figure 5-1 and include:

1. Notify the above-goal reading
2. Investigate the above-goal reading
3. Report the above-goal reading.

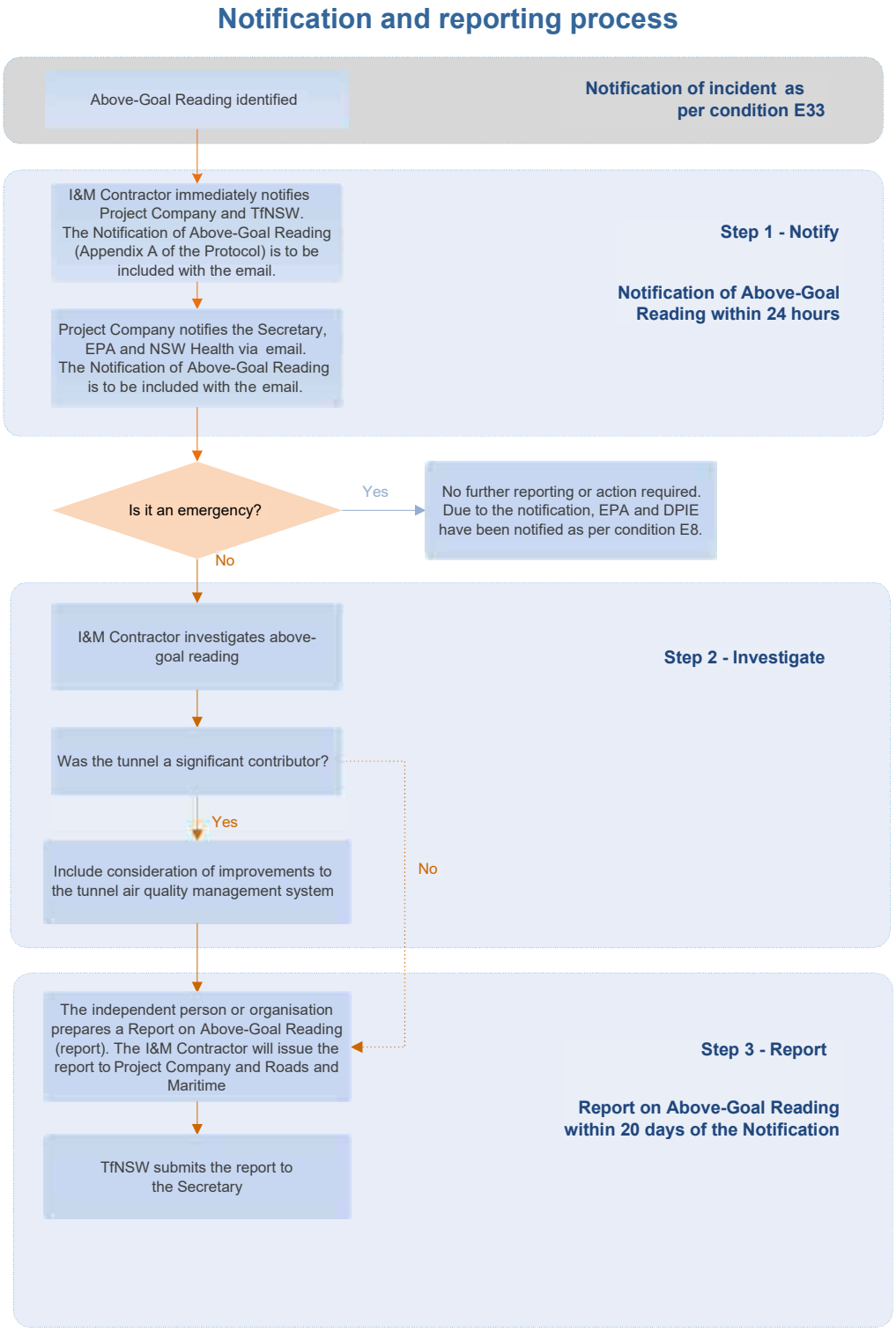

Figure 3 - Notification and reporting process for above goal readings

5.1 Notify the above-goal reading

When an exceedance of the air quality goals detailed within CoA E6 occurs, it will be reported as an 'incident' in accordance with the requirements of CoA E33 and then the steps within Section 5.1.1 and 5.1.2 will be followed.

5.1.1 Notifying Project Company and TfNSW

Upon identification of an above-goal reading, the I&M Contractor will immediately notify Project Company and TfNSW.

The email notification included in section 5.1.2 will be provided along with the completed form within Appendix A.

5.1.2 Notifying the Secretary, EPA and NSW Health

The Project Company will notify the Secretary, EPA and NSW Health. The notification is to be provided within 24 hours of the reading.

Form of Notification

As per CoA E33 the form of notification will be via the major projects portal for the Secretary and email for all other agencies with the Notification of Above-Goal Reading form (Appendix A) attached or included within the email. As required by CoA E33, the Notification of Above-Goal Reading form will provide details of:

(a) the nature of the event;
(b) the concentration levels that occurred;
(c) the duration of the event;
(d) measures employed to minimise the concentration levels;
(e) the date when the Proponent will submit a Report on Above-Goal Recording in accordance with Condition E34.

The sample content of the email is indicated in Figure 5.

Figure 4 - Sample content of the email notification

An example of an email which would be issued is provided below:

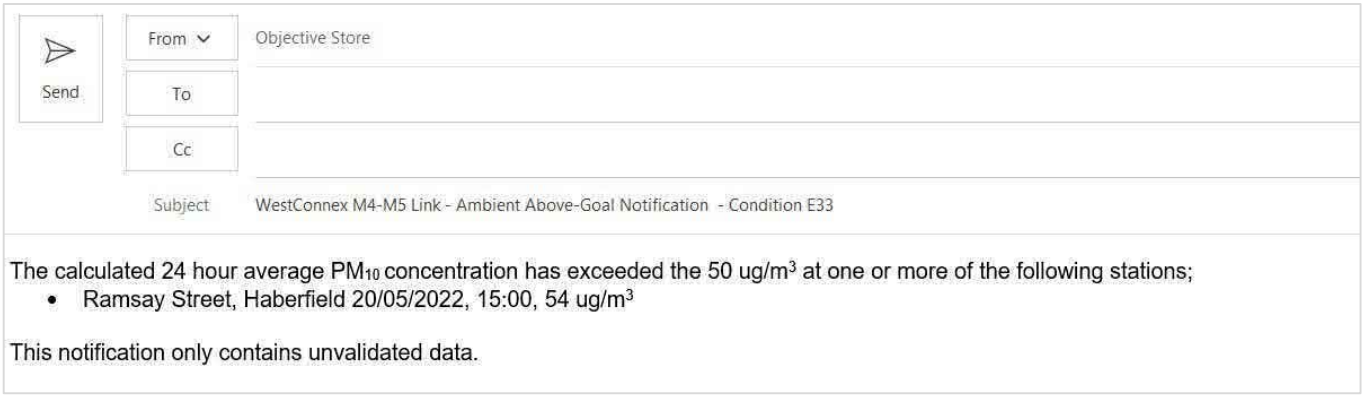

Figure 5 - An example of an email for issue. The completed form within Appendix A will be included.

The Notification of Above-Goal Reading form within Appendix A will be attached or included with the email notification.

5.1.3 Contact details for notification

The table below provides the contact details for those stakeholders that will be notified.

Table 5-1 - Contact details for stakeholders that are to be notified

Organisation	Contact Position	Telephone	Email
Department of Planning, Industry & Environment (DPIE)	Secretary of the Department Team Leader Compliance – Government Projects	NA	Submitted via the Major Projects Planning Portal compliance@planning.nsw.gov.au
EPA	Duty Officer	(02) 9995 5000 or 131 555	info@environment.nsw.gov.au
NSW Health	Director, Environmental Health	(02) 9424 5817	Moh-ehp@health.nsw.gov.au
TfNSW	TBA	TBA	TBA prior to commencement of operation
Project Company	TBA	TBA	TBA prior to commencement of operation

It is the responsibility of the organisations detailed above to contact the I&M Contractor, in writing to I&M Manager (MCC) (refer Appendix C), should their contact details change.

5.2 Investigate the above-goal reading

To determine whether an Above-Goal Reading is attributable to external phenomena or events or emissions from the M4-M5 Link Motorway tunnel outlets, the below investigations will be undertaken.

5.2.1 Validate Results

Within two days of the above-goal reading, the data will be quality validated.

If the data validity checks confirm that the recorded Above-Goal Reading was not valid and was due to an instrument fault or data error, the independent person will complete the Report for Above-Goal Reading (Appendix B) and will submit this document to Project Company and TfNSW. TfNSW will submit the report to DPIE.

A copy will also be placed on the WestConnex Linkt website.

If the data validity checks confirm that the recorded Above-Goal Reading was valid, the I&M Contractor will proceed to section 5.2.2.

5.2.2 Assess whether an emergency occurred

Should the investigation determine that an emergency occurred (as defined in Section 3.1), no further reporting shall occur.

It is considered that notification of the above-goal reading to DPIE and EPA has occurred in accordance with CoA E33through submission of the Notification of Above-Goal Reading.

A written record of the result of the investigation (ie that it is an emergency) is to be retained by the I&M Contractor and Project Company and TfNSW are to be advised of the finding.

5.2.3 Further investigation of valid results

If the investigation confirms that the data is valid, and an emergency does not appear to have occurred, further investigations will be undertaken, and the I&M Contractor will request the independent person/organisation prepare a Report on Above-Goal Reading.

Further investigations of the potential cause may include the below steps.

Sydney-wide events

Obtain data for other ambient air quality monitoring stations in the Sydney Basin from the EPA for concurrent monitoring periods to determine whether the exceedance is a Sydney-wide event. This would include information from other projects' AQM stations such as the M8..

If the monitored exceedance is widespread, it is likely that there was an external cause. In this instance, the I&M Contractor will contact relevant authorities such as the Bureau of Meteorology and State Emergency Services to determine if a regional event has occurred consistent with the recorded exceedance.

Locally specific events

If the exceedance is not widespread throughout the Sydney basin, a local cause is possible and supplementary investigations should be undertaken, such as consulting with relevant stakeholders such as (for example) EPA or relevant Councils, with the aim of establishing whether a specific localised source may have affected one or more monitoring stations. Localised activity (e.g. rubbish burning or unusually high emissions from an industrial premise (with unfavourable weather conditions)) may adversely affect the readings.

Monitoring equipment calibration

In the circumstance where the investigations are unable to identify a logical cause of the exceedance, further investigations may be undertaken to investigate whether the monitoring equipment is calibrated and functioning effectively.

Assessment of outlet emissions

A review of the ventilation outlet emissions data will be checked to determine whether emissions are higher or considerably different to emissions over previous periods, with similar traffic conditions within the tunnel.

Assessment of background data

An assessment against background data (or pre-operational data) may also occur.

5.3 Report on Above Goal Reading

If the investigation confirms that there was not an emergency, the I&M Contractor will request the independent person/organisation (once approved) to prepare a Report on Above-Goal Reading in accordance with CoA E34.

The Report on Above-Goal Reading (Report) (Appendix B) will detail the cause and major contributor of the exceedance and options available to prevent recurrence.

Where the operation of the tunnel is identified to be a significant contributor to the recorded above-goal reading, the Report on Above-Goal Recording must include consideration of improvements to the tunnel air quality management system so as to achieve compliance with the ambient air quality goals, including but not limited to installation of the additional ventilation management facilities allowed for under CoA E10.

The Report will be submitted within 20 working days of any Notification of Above-Goal Reading and the Proponent will comply with any requirements arising from the Secretary's review of the Report.

6 Process of Appointing Independent Person / Organisation

6.1 Definition of an independent person / organisation

The Australian Securities and Investment Commission (ASIC) *Regulatory Guide 112 Independence of Experts (March 2011)* states that an expert must not be associated with certain interested parties, and must disclose certain interests and relationships, when preparing reports[2].

Any disclosures should be contained within the report/s, relate to relationships or interests existing at the time of preparation of the report or existing in the previous two years and be timely, prominent, specific and meaningful.[3]

DPIE have developed a guideline on the appointment of independent experts titled ***Seeking approval from the Department for the appointment of independent experts.*** The requirements within the guide plus the ASIC literature will be used to determine the independent expert nominated by the project.

6.2 Definition of an Independent Person / Organisation

Whilst it does not define an independent *organisation* in itself, ASIC's RG 112.23 states that in identifying relationships and interests that may affect, or may be perceived to affect, the expert's ability to prepare an independent report, the expert should not only identify relationships with, and interests of, the expert but also of:

(a) the expert's associates;
(b) those directors and senior employees who are principally responsible for preparing and issuing the expert report; and
(c) the spouse, children and associates of the directors and senior employees who are principally responsible for preparing and issuing the expert report.

The I&M Contractor will adhere to ASIC's interpretation of independence, and whether or not an 'expert' is an individual or an organisation will largely depend on the nature, scale and complexity of the expert's business and the circumstances of the expert's engagement, as well as the requirements of the report.

Appropriately qualified independent persons/organisations will be identified prior to selection on the basis of meeting the requirements contained within the guide produced by DPIE, ***Seeking approval from the Department for the appointment of independent experts.***

6.3 Selection criteria

In selecting an appropriate independent expert, the following requirements set forth from DPIE will be adhered to;

1. The independent expert will be a member of a relevant professional body
2. not have a close relationship with the proponent/contractor
3. not have any pecuniary interest
4. not accept any inducement or benefit
5. exercise their own independent, professional judgement

other items to be considered include;

1. Whether the expert has adequate resources (which may include access to appropriate third-party specialists) to perform the necessary work
2. The qualifications of the expert and whether the expert has the requisite level of technical expertise (including whether the expert meets the requirements of any relevant industry codes)

3. The experience of the expert. For example, a commissioning party may ask what comparable transactions the expert has given an opinion on and whether that experience is relevant to the current transaction
4. Whether the expert can meet the timeframe required for the report to be produced, and
5. Whether there are any independence issues

6.4 Appointment process

The process for appointing an independent person/organisation to prepare a Report for Above-Goal Reading is as follows:

1. Identify appropriately qualified independent persons/organisations.

2. Select independent person/organisation on the basis of DPIE's guideline (refer above).

3. Ensure that any pre-engagement discussions do not compromise the expert's independence. For example, these discussions should not deal with how the expert proposes to evaluate the transaction or the merits of the transaction.[5]

4. Seek written approval from the Secretary ensuring all criteria set forth in the Departments guidelines are met. Nomination and consultation with Project Company and TfNSW.

5. Before commencing work, an expert should obtain written terms of engagement[6] from the commissioning party that:
    (a) set out the scope and purpose of the report
    (b) set out the facts of the proposal and relevant data
    (c) recognise the expert's right to refuse to give an opinion or report at all if it is not given the information and explanations it requires to prepare the report
    (d) give the expert the same access to the commissioning party's records as the auditor of the commissioning party; and
    (e) set out the fee.

6. Ensure appointment of the independent person/organisation is prior to commencement of operation, or at some time prior to preparation of the report with agreement of the Secretary.

The process for appointing an independent person/organisation to prepare the Report on Above-Goal Reading is as follows:

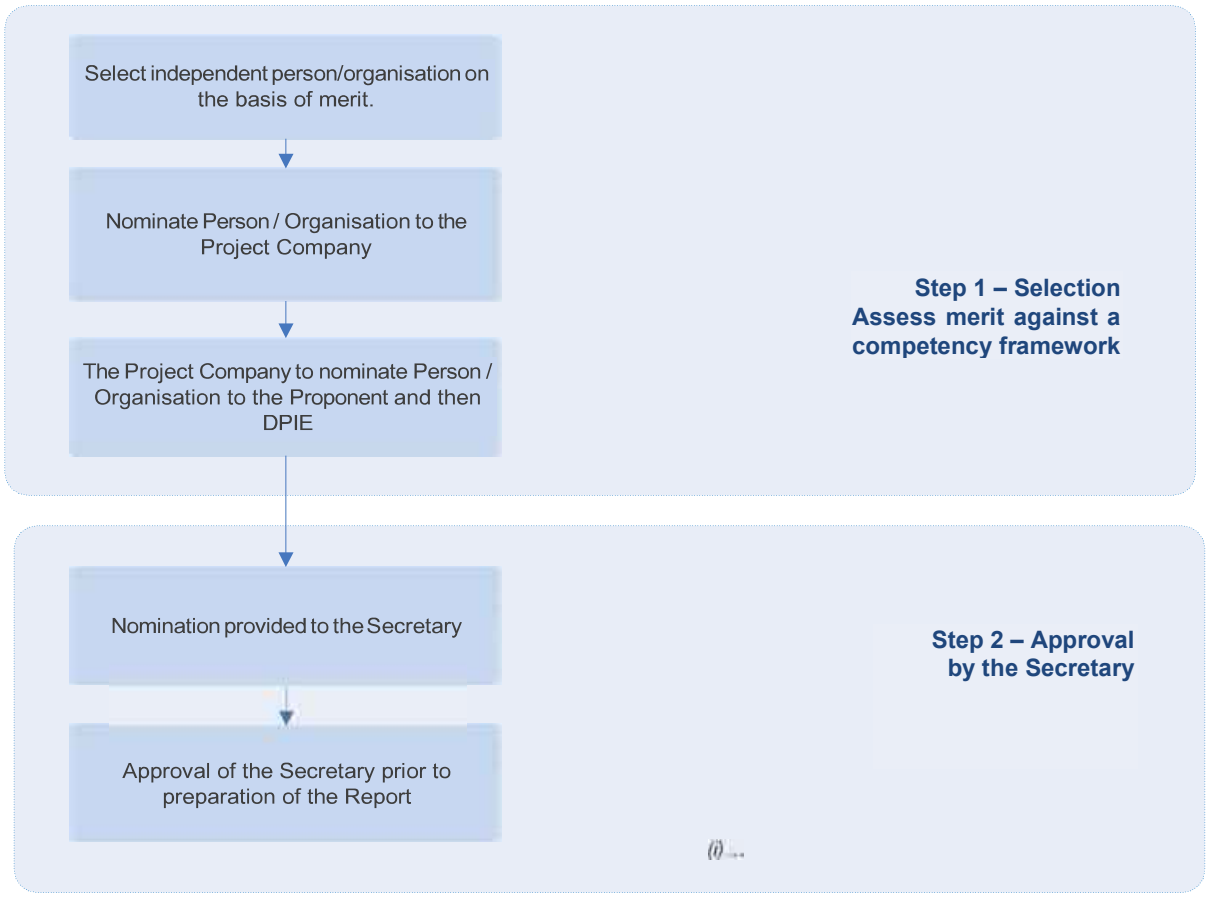

Figure 6 - Process of Appointment

The independent person or organisation shall not prepare a Report on Above-Goal Recording until approval has been received for their appointment by the Secretary.

It is noted where the Secretary's approval or agreement is required under a condition of this approval, the Secretary will endeavour to provide a response within one month of receiving an approval or agreement request. The Secretary may ask for additional information if the approval or agreement request is considered incomplete. When further information is requested, the time taken for the Proponent to respond in writing will be added to the one-month period. The Secretary may ask for additional information where a document is required to be submitted to the Secretary and the document is considered incomplete or not fully addressing the requirements of a condition.

It is unknown if or when the requirement to prepare a Notification of Above-Goal Recording and subsequent Report on Above-Goal Recording could be triggered once the project becomes operational. Given the timeframes involved to receive approval from the Secretary as outlined above, the independent person/organisation will be appointed prior to project operation. This will ensure the Report on Above-Goal Recording can be submitted to the Secretary within 20 working days of any Notification of Above-Goal Recording if ambient monitoring of air pollutants records an exceedance of the goals in CoA E6.

Once an appropriately qualified independent person/organisation has been approved by the Secretary, this independent person/organisation will prepare all Reports on Above-Goal Recordings. Should for any reason the project needs to appoint a new appropriately qualified independent person/organisation, then the appointment process outlined in this section shall be applied again.

2 RG 112.7 Regulatory Guide 112 Independence of Experts (March 2011) Part (a)
3 RG 112.31 – 112.35 Regulatory Guide 112 Independence of Experts (March 2011)
4 RG 112.40 Regulatory Guide 112 Independence of Experts (March 2011)
5 RG 112.41 Regulatory Guide 112 Independence of Experts (March 2011)
6 RG 112.42 Regulatory Guide 112 Independence of Experts (March 2011)

Appendix A - Notification of Above-Goal Reading

Notification of above-goal reading WestConnex M4-M5 Link To be notified immediately to Project Company and TfNSW. Project Company is to notify DPIE, EPA and NSW Health within 24 hours of the recording.		
Date		
Time (start and finish)		
Relevant location	☐ Ramsay Street, near Martin Street, Haberfield	☐ Wattle Street, Near Ramsay Street, Haberfield
	☐ Campbell Street, between Church Street and Princess Highway, St Peters	☐ St Peters Interchange, near Princess Highway
Relevant goal	☐ CO – 8 hour rolling average of 9.0 ppm (NEPM)	
	☐ NO_2 – One hour average of 0.12 ppm (245 µg/m^3) (NEPM)	
	☐ PM_{10} – 24 hour average of 50 µg/m^3 (NEPM)	
	☐ $PM_{2.5}$ – 24 hour average of 25 µg/m^3 (NEPM)	
	☐ PM_{10} – annual average of 25 µg/m^3 (NEPM)	
	☐ $PM_{2.5}$ – annual average of 8 µg/m^3 (NEPM)	
Above-goal reading Detail the above-goal reading that was received		
Duration Detail the duration of the above-goal reading or event		
Nature of event Detail nature of the event that contributed to the above-goal reading		
Was the data valid? If unknown at this stage, please indicate. Refer section 5.2.1 of this Protocol.		
Was there an emergency? Refer section 3.1 of this Protocol. If this is unknown at this stage, please indicate.		
Measures employed Detail measures employed to minimise the concentration levels		
Commitment to prepare and submit a Report on Above-Goal Reading A Report on Above-Goal Reading will be prepared for this notification. Please note that a Report is not required in the event of an emergency.		
Person responsible for notification	Name	
	Position	
	Organisation	

Appendix B - Report on Above-Goal Reading

Report on above-goal reading WestConnex M4-M5 Link To be submitted to DPIE within 20 days of the Report of Above-Goal Reading	
Details of the exceedance Attach relevant Notification of Above-Goal Reading	
Was the data valid? If invalid, include any details or justifications for the invalidity	
Comparison with long term monitoring trends and background air quality data This is not required to be completed, however if available and	
Cause or major contributor of the exceedance If the cause or major contributor are not able to be determined, then known facts of what was occurring at the time should be included (eg traffic information, ventilation outlet monitoring records etc)	
Options to prevent recurrence and effectiveness of actions taken This is to include consideration of improvements to the tunnel air quality management system so as to achieve compliance with the ambient air quality goals, including but not limited to installation of the additional ventilation management facilities allowed for under condition E10, and discussion of whether those improvements are feasible and reasonable. The effectiveness of any action(s) taken in response to the exceedance shall be documented below.	
Person responsible for report	Name
	Position
	Organisation
	Date

Appendix C - Contact list

Environmental contacts

Title	Name	Phone number
I&M Contractor project representatives		
Incident and Maintenance Manager	To be provided prior to commencement of operation	To be provided prior to commencement of operation
QSE Manager	To be provided prior to commencement of operation	To be provided prior to commencement of operation
Role TBC	To be provided prior to commencement of operation	To be provided prior to commencement of operation
Project Company representatives		
Project Company Project Representative	To be provided prior to commencement of operation	To be provided prior to commencement of operation
TfNSW		
TfNSW Project Representative	To be provided prior to commencement of operation	To be provided prior to commencement of operation
Stakeholders and relevant agencies		
DPIE	Secretary of the Department Team Leader Compliance – Government Projects	Submitted via the Major Projects Planning portal compliance@planning.nsw.gov.au
Fire and Rescue NSW		000 (emergency) 1300 729 579 (non-emergency)
EPA		(02) 9995 5000 131 555
Ministry of Health / Camperdown Public Health Unit		Business hours: (02) 9515 9420 After hours: (02) 9515 6111 (ask for Public Health Officer on call)
SafeWork NSW		Phone: 131 050
Transport Management Centre		Phone: (02) 8396 1400

Annexure G Operational Surface Water Quality Management Plan and Monitoring Program

WestConnex M4-M5 Link Mainline Tunnels

Operational Surface Water Quality Management Plan

Project:	M4-M5 Link Mainline Tunnels – Design and Construct
Contract Number:	TBC
Document Number:	M4M5-LSBJ-PRW-GEN-OP01-PLN-0002
Revision Date:	May 2022

Document Approval

Rev	Date	Prepared by	Reviewed by	Remarks
00	21 April 2022	ASBJV	WCX, TfNSW + External Stakeholders	Provision to DPE following external consultation
01	13 May 2022	ASBJV	DPE	Update in response to DPE RFI

WestConnex

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Glossary of terms

Term/acronym	Definition
the Asset	WestConnex M4-M5 Link Mainline Tunnels
BBWQIP	Botany Bay Water Quality Improvement Plan
Bti	Bacillus thuringiensis israeliensis
CDA	Chemical Delivery Area
CoA	Conditions of Approval
EC	Electrical Conductivity
EIS	Environmental Impact Statement
HF	High Flow
HMI	Human Machine Interface
I&M	Incident and Maintenance
LPS	Low point sumps
MF	Minor Flows
MOC	Motorway Operations Complex
OEMP	Operational Environmental Management Plan
OGMP	Operational Groundwater Management Plan
OMCS	Operations Management and Control System
OSWQP	Operational Surface Water Quality Management Plan
OSWQMP	Operational Surface Water Quality Monitoring Program
REMM	Revised Environmental Management Measures
Ops WTP	Operational Water Treatment Plant
PBR	Pyrmont Bridge Road
PREW	Parramatta Road East and West
RMS	Roads and Maritime Services
SPIR	Submissions and Preferred Infrastructure Report
SWQ	Surface Water Quality
TfNSW	Transport for New South Wales (formerly Roads and Maritime Services)
WCX	WestConnex

1 Introduction

1.1 Context

The Operational Surface Water Quality Management Plan (OSWQP) has been prepared for the operation and maintenance phase of the WestConnex M4-M5 Link Mainline Tunnels (the Asset). The Operational Surface Water Quality Monitoring Program (OSWQMP) forms part of this document and can be found in Annexure B. The OSWQP comes under the Operation Environmental Management Plan (OEMP) and should be read in conjunction.

This OSWQP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the WestConnex M4-M5 Link Environmental Impact Statement (EIS), the revised environmental management measures (REMM) listed in the Project Submissions and Preferred Infrastructure Report (SPIR), the WestConnex M4-M5 Link Mainline Tunnel Modification reports and all applicable legislation. The development of the monitoring program has been undertaken in consultation with the EPA; DPE Water; DPE Environment & Heritage (formerly OEH); Sydney Water and the local councils (refer to Section 1.5 of the OEMP).

1.2 Asset Background

An EIS (AECOM 2017) assessed the impacts of construction and operation of the Project on surface water, within Chapter 15 and Appendix Q (Technical working paper: Surface Water and flooding).

The surface water quality was identified within the EIS to be potentially impacted through discharges of poorly treated tunnel water, and through increased pollutant loads associated with surface runoff. However, it concluded these impacts would be managed through the Operational Water Treatment Plant (Ops WTP) and other treatment devices. Section 5 and 6 provides further exploration and explanation on these risks, and the mitigation and management measures that will be implemented as part of the operation of the Asset. Both risks and management measures are described in this OSWQP.

Please refer to Section 2 of the OEMP for Project description.

1.3 Scope of the Sub-plan

The scope of this OSWQP is to describe how the Incident and Maintenance (I&M) contractor will monitor and respond to potential impacts from the operation of the Asset to the local surface water quality. This includes mosquito management as well as the emergency response to hydrocarbon and chemical spills. As noted below in Section 2.1, this plan does not consider potential impact of the Rozelle Interchange on the local surface water quality.

1.4 Implementation of the Sub-plan

This OSWQP must be submitted to the Secretary for approval at least one (1) month prior to the commencement of operation.

Operation will not commence until the Secretary has approved all of the required Operational Monitoring Programs (including the OSWQMP), and all relevant baseline data has been collected.

This OSWQP, as approved by the Secretary, must be implemented for the duration identified in this document or as specified by the Secretary, whichever is greater.

1.5 Environmental Management System

The environmental management system overview is described in Section 5.1of the OEMP

2 Purpose and objectives

2.1 Purpose

The purpose of this OSWQP is to describe how the I&M contractor will manage and respond to potential impacts from the operation of the Asset to the local surface water quality. This includes mosquito management and the emergency response to hydrocarbon and chemical spills. This document should be read in conjunction with the OEMP.

This OSWQP will be implemented to monitor the effectiveness of mitigation measures applied during the operation phase of the Asset. Monitoring of the surface water will be undertaken to identify potential impacts and ensure a comprehensive management response can be implemented to address those impacts and protect local surface water quality.

This OSWQP is based on baseline studies developed for the WestConnex M4-M5 Link EIS (AECOM 2017), pre-construction baseline monitoring data and construction monitoring data.

Items that are not considered within this document, include:

- The potential impact of the Rozelle Interchange on the local surface water quality.

2.2 Objectives

The key objective(s) of the OSWQP are to:

- Manage all I&M activities during Asset operation to ensure they do not harm or impact the local surface water quality;
- Ensure the quality of the water discharged to the receiving environment meets statutory requirement and relevant objectives;
- Ensure the required CoAs, REMM, and licence/permit requirements are described, scheduled, and assigned responsibility;
- Monitor the effectiveness of the surface water quality controls of the Asset and outline the procedures in which the I&M Contractor is to follow if the results of the monitoring are unsatisfactory or a non-compliance is identified;
- Management wetlands that have been identified as being affected by the operation of the Asset as well as mosquito breeding;
- Ensure all notification and reporting requirements are complied with and achieved;

2.3 Consultation

This OSWQP was provided to the EPA; DPE Water; DPE Environment & Heritage (formerly OEH); Sydney Water; Inner West Council and the City of Sydney Council in accordance with CoA D8, for review and comment.

A document titled ‘Consultation for the M4-M5 Link Tunnels OEMP and sub-plans’ has been prepared separately to this plan to provide detail relating to the consultation received and where feedback has been covered or addressed in this plan. Subsequent feedback will be documented and used to inform revisions and updates of this plan (refer Section 10.1 of the OEMP).

Ongoing consultation with relevant councils and other stakeholders, including any unique local receivers, may be undertaken for particular issues pertaining to the operation and maintenance of the Asset on surface water quality. All community complaints, issues and notifications (this includes those relating to surface water quality) will be managed in accordance with section 7.3 of the OEMP.

3 Environmental obligations

3.1 Conditions of Approval

An OSWQP is required by CoA D8. A description of compliance with the requirements of this CoA, as well as other CoA identified to be relevant to the management of surface water quality during the I&M phase of the Asset is provided below in Table 3-1.

Table 3-1: CoA Compliance

CoA Reference	Requirement	Document Reference
A6	Where the terms of this approval require a document or monitoring program to be prepared or a review to be undertaken in consultation with identified parties, evidence of the consultation undertaken must be submitted to the Secretary with the document. The evidence must include: (a) Documentation of the engagement with the party(s) identified in the condition of approval that has occurred prior to submitting the document for approval; (b) Log of the points of engagement or attempted engagement with the identified party(s) and a summary of the issues raised by them; (c) Documentation of the follow-up with the identified party(s) where feedback has not been provided to confirm that they have none or have failed to provide feedback after repeated requests; (d) Outline of the issues raised by the identified party(s) and how they have been addressed; and (e) A description of the outstanding issues raised by the identified party(s) and the reasons why they have not been addressed.	Evidence of consultation with the relevant authorities outlined in CoA D8 was provided to the Secretary along with the monitoring program.
D2	An OEMP is not required for the CSSI if the Proponent has an Environmental Management Sydtem (EMS) or equivalent as agreed with the Secretary, and can demonstrate, to the written satisfaction of the Secretary, that through the EMS: (a) The performance outcomes, commitments and mitigation measures, detailed in the documents listed in Condition A1, and specified relevant terms of this approval, can be achieved; (b) Issues identified through ongoing risk analysis can be managed; and (c) Procedures are in place for rectifying any non-compliance with this approval identified during compliance auditing, incident management or any other time during operation.	This section, Section 3, outlines the operations commitments of the tunnel during the I&M phase; (a – b) Section 5.3 lists the identified potential risks and impact to the local surface water quality during the I&M phase of the Asset. Section 6 and Table 6-1 outlines the control mechanisms included within the permanent design of the Asset to address the risks identified in Section 5.3 and the management measures to be implemented by the I&M and Project Company. (c) Non-compliances identified during the management of an incident will be addressed in accordance with the OEMP Annexure D and Annexure B Section 4.2.2.2 .

<table>
<tr><th>CoA Reference</th><th>Requirement</th><th>Document Reference</th></tr>
<tr><td></td><td></td><td>Non-compliances identified during a compliance audit will be managed in accordance with Section 9 and 10 of the OEMP.</td></tr>
<tr><td>D4</td><td>Each of the OEMP Sub-plans must include the information set out in Condition D2 (a), (b) and (c).
The OEMP Sub-plans must be developed in consultation with relevant authoirities as identified in Condition D3.</td><td>Refer to D2 document reference(s).
CoA D3 outlines only those relevant authorities applicable for the Groundwater Management Subplan and therefore is not relevant to the OSWQP and the OSWQMP.</td></tr>
<tr><td>D8</td><td>The following Operational Monitoring Programs must be prepared in consultation with the relevant authorities identified for each Operational monitoring program to compare actual performance:
<table><tr><th></th><th>Required Operational Monitoring Programs</th><th>Relevant authority(s) and council(s) to be consulted for each Operational Monitoring Program.</th></tr><tr><td>(a)</td><td>Surface Water Quality Plan & Monitoring Program</td><td>EPA; DPI Water; OEH; Sydney Water; and relevant council(s)</td></tr><tr><td>(b)</td><td>Groundwater Monitoring Program</td><td>DPI Water, relevant council(s), EPA and Sydney Water</td></tr></table></td><td>This document. Note the OSWQMP can be found in Annexure B.
Evidence of consultation with the relevant authorities outlined in CoA D8 was provided to the Secretary along with the monitoring program.
The Operational Groundwater Monitoring Program is a separate document that forms part of the Operational Groundwater Management Plan. Document reference number: M4M5-LSBJ-PRW-GEN-OP01-PLN-0003.</td></tr>
<tr><td>D9</td><td>Each Operational Monitoring Program must include:
(a) Details of baseline data;
(b) Details of all monitoring of the project to be undertaken;
(c) The parameters of the project to be monitored;
(d) The frequency of monitoring to be undertaken;
(e) The location of monitoring;
(f) The reporting of monitoring and analysis results against relevant criteria;
(g) Details of the methods that will be employed to analyse the monitoring data;
(h) Procedures to identify and implement additional mitigation measures where results of monitoring are unsatisfactory; and
(i) Any consultation to be undertaken in relation to the monitoring programs.</td><td>(a – h) Refer to Table 6-1 and Annexure B Section 4.2 and 6.2

(i) Refer to Section 7.3 of the OEMP</td></tr>
<tr><td>D10</td><td>The Operational Surface Water Quality Plan and Monitoring Program must address wetland and mosquito management.</td><td>Wetland management and details of how the I&M will manage mosquito breeding and population is addressed in Section 6.2.</td></tr>
</table>

CoA Reference	Requirement	Document Reference
D13	The Operational Monitoring Program must be developed in consultation with relevant authorities outlined in CoA D8 of this approval.	Refer to CoA A6 and D8
D14	The Operational Monitoring Programs must be submitted to the Secretary for approval at least one (1) month prior to the commencement of operation.	Section 1.4.
D15	Operation must not commence until the Secretary has approved all of the required Operational Monitoring Programs, and all relevant baseline data has been collected.	Section 1.4.
D16	The Operational Monitoring Programs, as approved by the Secretary, must be implemented for the duration identified in the relevant Operational Monitoring Program or specified by the Secretary, whichever is the greater.	Unless specified by the Secretary, the duration at which surface water quality monitoring is to be undertaken by the I&M contractor is outlined in Section 4.2 of Annexure B
D17	The results of the Operational Monitoring Programs must be submitted to the Secretary, and the relevant regulatory authorities, for information in the form of the Operational Monitoring Report at the frequency identified in the Operational Monitoring Program.	The frequency of reporting the surface water quality monitoring results to the relevant authorities and Secretary are described in Table 7.1 and Section 4.2 of Annexure B.
D18	Where the relevant OEMP Sub-Plan exists, the relevant Operational Monitoring Program may be incorporated into that the OEMP Sub-plan.	The OSWQP (including OSWQMP) is a stand-alone document which will be incorporated into the OEMP.
E187	The CSSI operational water treatment plant discharge criteria must comply with the ANZECC (2000) 95 per cent species protection level and a 99 per cent protection level for contaminants that bioaccumulate unless other discharge criteria are agreed in consultation with relevant stakeholders including EPA, DPI Water and Sydney Water. Discharge criteria for iron during operation must comply with the ANZECC (2000) recreational water quality criteria.	The Operations Water Treatment Plant discharge criteria is outlined in Section 6.3 and the Operational Groundwater Management Plan (M4M5-LSBJ-PRW-GEN-OP01-PLN-0003).

3.2 Revised Environmental Mitigation Measures

Those REMMS which have been identified as applicable to the OSWQP are presented below in Table 3-2

Table 3-2: REMM Compliance

REMM Reference	Requirement	Document Reference
OSW12	Stormwater from the project during operation will be treated prior to discharge. Where space is available, bioretention systems or constructed wetlands will be installed. Where space is not available other smaller devices, such as proprietary stormwater treatment devices, will be installed. The final design of treatment will be supported by MUSIC modelling and water sensitive urban design principles.	A general overview of stormwater runoff management is provided in Section 6.1. Section 6.1.1.1 provides a summary of the MUSIC modelling that was undertaken comparing the surface water quality of the 9.SWB.02 Biofiltration Swale Basin against the Botany Bay Water Quality Improvement Plan

REMM Reference	Requirement	Document Reference
		and the incorporation of a HumeCeptorSTC23 GPT into the design.
OSW13	Maintenance requirements for all stormwater treatment systems and devices installed as part of the project will be identified and included in relevant operational maintenance schedules/systems.	Noted. Operation and Maintenance Manuals that detail the required operational maintenance requirements will be prepared for all stormwater treatment systems and devices including the WTP
OSW14	Spill containment will be provided on the motorway. Spill management and emergency response procedures will be documented in the OEMP and/or Emergency Response Plan	The I&M contractor will implement the procedures outlined in Annexure A for spill and leak response, as well as tunnel washing (Section 6.4 and 6.5).
OSW15	The constructed wetland at the Rozelle interchange will be appropriately designed considering Water Sensitive Urban Design Principles to cater for the continuous release flow of treated groundwater from the water treatment plant and onsite stormwater flows and lined to prevent potential interaction with groundwater.	As outlined in Section 2.1, this OSWQP and OSWQMP does not include the Rozelle Interchange. This REMM condition will be included in a separate Operational Surface Water Quality Plan and Monitoring Program.
OSW16	The operational water treatment facilities will be designed and managed such that effluent will be of suitable quality for discharge to the receiving environment. Discharge criteria will be in accordance with the ANZECC (2000) and relevant NSW WQOs, including the following discharge criteria: • 0.3 milligrams per litre for iron • 1.9 milligrams per litre for manganese The discharge criteria for the treatment facilities will be nominated during detailed design in consultation with relevant stakeholders and included in the OEMP.	The Operations Water Treatment Plant discharge criteria is outlined in Section 6.3 and the Operational Groundwater Management Plan (M4M5-LSBJ-PRW-GEN-OP01-PLN-0003).
OSW17	New discharge outlets will be designed with appropriate energy dissipation and scour protection measures as required to minimise the potential for sediment disturbance and resuspension in the receiving waters. Outlet design and energy dissipation/scour protection measures will be informed by drainage modelling.	Section 6.1.1.
OSW18	Existing drainage outlets that be subject to increased inflow from the project will be assessed. If necessary, energy dissipation or scour protection will be added to prevent sediment disturbance and resuspension in receiving waters.	Section 6.3
OpCM01	Procedures to address spill, leaks and tunnel washing will be developed as part of an OEMP and implemented during operation of the project.	Refer to REMMs OSW14.
CM08	Measures identified in Chapter 25 (Hazard and Risk) of the EIS will be implemented to store contaminated materials and materials with the potential to cause contamination due to spills and leaks.	Hazardous chemical storage is addressed in Section 6.4 and 6.5.

REMM Reference	Requirement	Document Reference
OpHR3	The transport of dangerous goods and hazardous substances will be prohibited through all tunnels associated with the project.	Section 6.6
OpHR6	Storage of dangerous goods and hazardous materials will occur in accordance with suppliers' instructions and relevant Australian Standards and legislation including the: – Work Health and Safety Act 2011 (NSW) – Storage and Handling of Dangerous Goods Code of Practice (WorkCover NSW 2005) – Environment Protection Manual for Authorised Officers: Bunding and Spill Management, technical bulletin (NSW EPA 1997). Storage methods may include bulk storage tanks, chemical storage cabinets/ containers or impervious bunds.	Section 6.6
OpHR7	Secure, bunded areas will be provided around storage areas for oils, fuels and other hazardous liquids. Impervious bunds will be of sufficient capacity to contain at least 110 per cent of the volume of the largest stored container.	Section 6.6
OpHR8	Management measures to reduce the potential for spills, reduce potential spill volumes and prevent any contamination will be developed and implemented for activities such as vehicle refuelling, servicing, maintenance or washdown, where there is a potential for spills and contamination.	Section 6.6
OpHR9	Material Safety Data Sheets for dangerous goods and hazardous substances will be stored on site prior to their arrival.	Section 6.6

3.3 Legislation

All legislation relevant to the OSWQP is described in Appendix A1 of the OEMP.

3.4 Guidelines and Standards

The environmental policies, guidelines and principles relevant to the management of surface water during operation and maintenance of the Asset are identified in Table 3-3.

Table 3-3: Environmental policies, guidelines and principles

Policy / Guideline / principles	Relevance
Surface water quality and hydrology	
• Stockpile Site Management Guidelines (Roads and Maritime, 2008) • Code of Practice for Water Management: Road Development and Management (Roads and Maritime, 1999) • Australian Standard: AS1940 The Storage and Handling of Flammables and Combustibles (Standards Australia, 1994) • Australian Standard: AS4452 The Storage and Handling of Toxic Substances (Standards Australia, 1997) • Storage and Handling Liquids: Environmental Protection: Participant's Manual (DECC, 2007) • 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) • Australian National Water Quality Management Strategy	Soil and water quality management
• Bunding and Spill Management Guidelines (NSW EPA, 2017) • Australian Standard: AS1940 The Storage and Handling of Flammables and Combustibles (Standards Australia, 1994) • Australian Standard: AS4452 The Storage and Handling of Toxic Substances (Standards Australia, 1997) • Storage and Handling Liquids: Environmental Protection: Participant's Manual (DECC, 2007)	Working with chemical substances near watercourses
• Code of Practice for Water Management: Road Development and Management (Roads and Maritime, 1999) • Guidelines for Treatment of Stormwater Runoff from the Road Infrastructure (AP- R232, Austroads, 2003) • Technical Guideline: Temporary Stormwater Drainage for Road Construction (Roads and Maritime, 2011) • Managing Urban Stormwater Soils and Construction: Volume 2D Main Road Construction (DECC, 2008) • The Blue Book: Managing Urban Stormwater: Soils and Construction, Volume 1 and 2 (Landcom, 2004)	Stormwater runoff management
• Australian/New Zealand Standard: AS/NZS5667.1 Water Quality – Sampling, Guidelines on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples (Standards Australia, 1998) • Australian and New Zealand Guidelines for Fresh and Marine Water Quality: Volume 1 –The Guidelines ('the ANZECC guidelines', ANZECC, 2000) • The Blue Book: Managing Urban Stormwater: Soils and Construction, Volume 1 and Volume 2 (Landcom, 2004)	Water quality sampling

Policy / Guideline / principles	Relevance
• Environmental Direction: Management of Tannins from Vegetation Mulch (Roads and Maritime, 2012) • Guideline for the Management of Contamination (Roads and Maritime, 2013) • Environmental Incident Classification and Reporting Procedure (Road and Maritime, 2017)	Contaminated waters and leachate management
• Best Practice Guidelines for Contaminated Water Retention and Treatment Systems (NSW Government, 1994)	Storage and treatment of firefighting water
Waste and resource management	
• Environmental Compliance Report: Liquid Chemical Storage, Handling and Spill Management (NSW DEC, 2005) • Storing and Handling Liquids, Environmental Protection: Participants Manual (NSW DECC, 2007) • Stormwater Exemption 2014 (NSW EPA, 2014) • Waste Classification Guidelines (NSW EPA, 2014)	Materials handling and storage, and waste management
Chemical Management	
• Australian Dangerous Goods Code • Environment Protection Manual for Authorised Officers: Bunding and Spill Management, technical bulletin (EPA, 1997) • Storage and Handling of Dangerous Goods Code of Practice (WorkCover NSW, 2005) • Relevant Australian Standards	Dangerous good storage and handling

3.5 Licences, permits and approvals

The Asset does not routinely operate under any additional permits, licences and/or approvals. However, permissions and licences may be needed for maintenance activities as described in Table 3-4.

The need for any permit or licence would be determined by the Project Company Representative on a case-by-case basis depending on the nature of the proposed work.

Table 3-4: Licences, permits and approvals for operation of the Asset

Requirement	Comment
Environment Protection Licence (EPL) under Schedule 1 of the POEO Act	The operation (activity) of the Water Treatment Plant at the St Peter's Ops WTP is considered to be a scheduled activity identified in the *Protection of the Environment Operations Act 1997* (POEO Act) - treatment of contaminated groundwater. The Ops WTP will operate under an EPL. Details regarding the specific monitoring locations and targets are included in section 4.2 of Annexure B.
Licence for Storage of Dangerous Goods Australian Standard: AS1940 The Storage and Handling of Flammables and Combustibles (Standards Australia, 1994) Australian Standard: AS4452 The Storage and Handling of Toxic Substances (Standards Australia, 1997)	The Asset must obtain a licence where the storage of dangerous goods for operations and maintenance is in licensable quantities.

4 Existing Environment

The following sections below summarise what is known about factors influencing the existing surface water quality within and adjacent to the Asset's corridor and are applicable to the I&M phase.

4.1 Surface Water

4.1.1 Catchments and Waterways

The Asset is predominantly located within the Sydney Harbour and Parramatta River catchment (Dobroyd Canal and Johnstons Creek). The southern portion of the tunnel's alignment and the Campbell Road Motorway Operations Complex (MOC 5) is located within the Cooks River catchment (Alexandra Canal), which discharges into Botany Bay (Mascot).

Alexandra Canal will receive treated water from the Asset during operation. Table 4-1 summarises its key features.

Table 4-1: Sub-catchments and Waterways applicable to the I&M phase of the Asset

Catchment	Waterway	Waterway Description	Applicable Asset Facilities
Cooks River catchment	Alexandra Canal	The Alexandra Canal catchment (including Sheas Creek) comprises of an area of around 23km^{2}and receives runoff from Alexandria, Rosebery, Erskineville, Beaconsfield, Zetland, Waterloo, Redfern, Newtown, Eveleigh, Surry Hills, and Moore Park. Near the Campbell Road MOC 5, Alexandra Canal is a 2nd order stream.	Campbell Road MOC 5 and Ops WTP. During the construction phase of the Asset, the Campbell Road construction WTP discharged into Alexandra Canal, as will the Ops WTP.

4.1.2 Geomorphology

The catchments and waterways within and surrounding the Asset are highly urbanised, disturbed environments. The waterways are all artificial, hard-lined (ie. concrete, piped, brick or underground concrete channel) stormwater channels, with the exception of Alexandra Canal, which has an unlined base and hard-lined banks.

The geomorphic characteristics of the watercourse reflect their urban and anthropogenic nature.

4.1.3 Surface Water Quality

The surface water quality within and surrounding the Asset is influenced by several factors including:

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

A review of the baseline water quality data, undertaken for the EIS (AECOM 2017) along with the inclusion of construction phase data, is detailed in Section 3 of the OSWQMP in Annexure B.

4.1.4 Sensitive receiving environments

A sensitive receiving environment is an environment that has high conservation or community value, or that supports an ecosystem or human uses of water, and that is particularly sensitive to pollution or degradation of water quality.

The receiving surface water environments associated with the Asset are characterised as highly urbanised, degraded and are typically concrete lined storm channels. The environments do not support ecosystems sensitive to operation of the Asset (AECOM 2017). Human uses for the watercourses are limited.

5 Incident Management and Maintenance of the Asset and Environmental Impacts

5.1 Transition from Construction to Operation Phase

5.1.1 Previous Ancillary Facilities

During the construction phase of the Asset, the WestConnex M4-M5 Link Mainline Tunnel project included four main ancillary facilities located at the Haberfield, Parramatta Road East and West (PREW); PBR, and Campbell Road. These facilities acted as both car parks for employees and subcontractors; equipment and material laydown and access into the on and off ramps at Wattle Street and the St Peters Interchange as well as the mainline and ventilation tunnels.

At completion of the Project three of the four ancillary facilities (Haberfield, PREW and PBR) were reinstated to level hardstand only and will be returned to WestConnex.

During the operation phase of the Asset the Campbell Road MOC 5, once known as the Campbell Road ancillary facility, will house the WestConnex M4-M5 Link mainline tunnel ventilation facility which contains the mechanical and electrical services required to exhaust the tunnel. The building occupies a footprint of 4,100m^2 and is the largest structure within the Campbell Road MOC 5 (refer to Figure 1). In addition to the ventilation facility, the Campbell Road MOC 5 also contains the Ops WTP; staff amenities; workshop and storage building; substation and ventilation fan crane pad; and staff car parking.

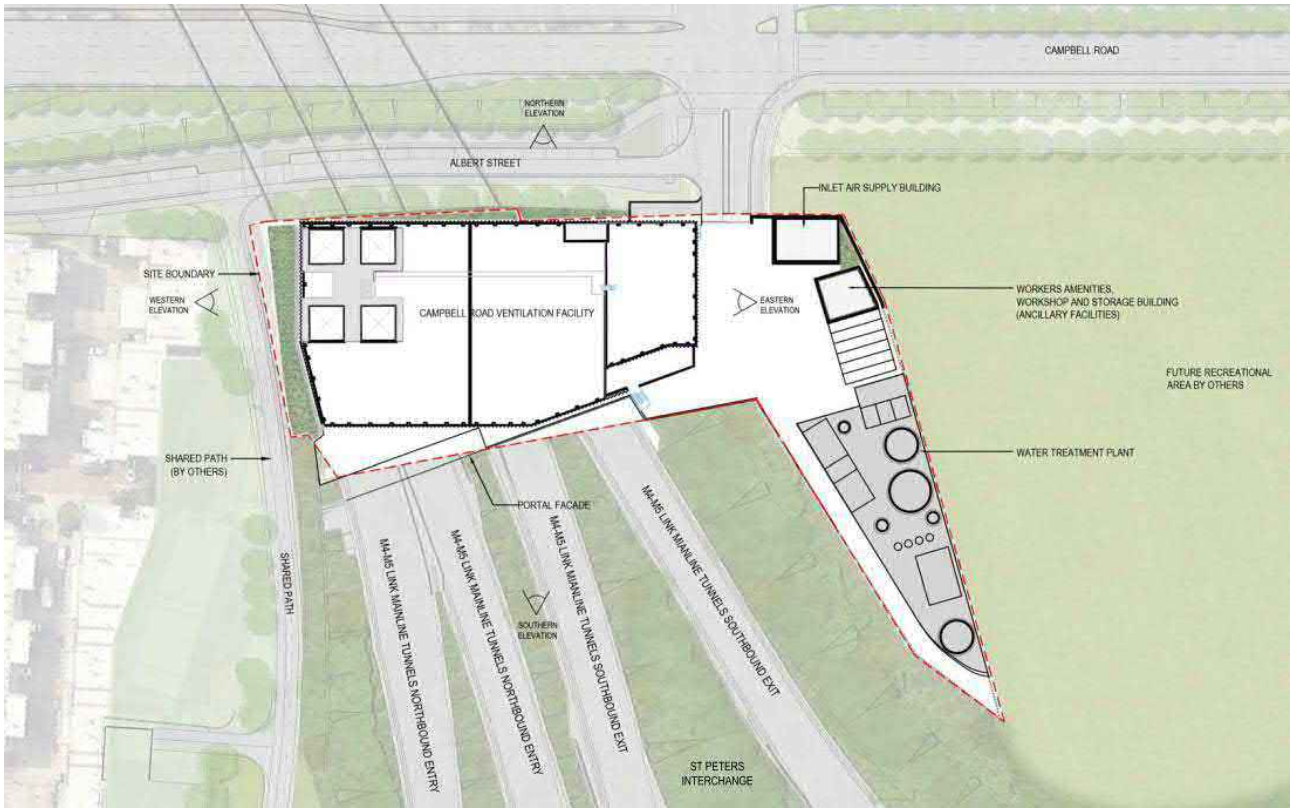


Figure 1: Overview of the Campbell Road MOC 5

5.2 Incident and Maintenance Activities

I&M activities undertaken throughout the operation phase of the Asset that are relevant to the management of surface water quality are outlined below in Table 5-1:

Table 5-1: I&M Activities relevant to surface water quality

O&M Activity	Description
Routine Operation	• Traffic operations and monitoring • Operation and monitoring of the Ops WTP and stormwater treatment devices
Routine Maintenance / Repair Work	• Vegetation clearing and landscape management • Road infrastructure maintenance and repair • Pavement renewal and resurfacing • General maintenance and repair work
Routine equipment maintenance	• Tolling equipment • Intelligent Transport Systems Sediment Basins • Gross Pollution Traps (e.g. Stormceptors) • WTP
Non-routine Operation	• Tunnel washing • Road traffic accidents and incidents • Vehicle washing • Road maintenance plant and machinery • I&M vehicles
Non-routine Maintenance and Repair	• Asset damage (e.g. Vehicle strike) • Major spills including clean-up • Equipment failure leading to damage, spill or an uncontrolled outcome

5.3 Potential Environmental Impacts

Potential risks and impacts to the local surface water quality associated with the operation of the Asset may include:

- Exposure and erosion of soils causing pollution of receiving waters and sedimentation of drains (REMM OSW17 and OSW18);
- Breeding habitat for mosquitoes in stormwater retention basins (CoA D10);
- Contamination of waterways associated with mobilisation of pollutants in stormwater runoff (eg. Fuel and chemical spills, seepage spills, washing contaminated water release, water discharge, firefighting activities) (REMM OSW14, OpCM01 and CM08);
- Reduction of water quality and degradation of natural habitats in sensitive receiving environments from the uncontrolled discharge of untreated tunnel wastewater. Tunnel wastewater not only can contain groundwater that has entered the tunnel drainage system, but also spills of fuel; oil; hazardous chemical spills; fire suppressant, and tunnel wash water (REMM OSW16 and OpCM01);
- Spills of hazardous chemicals stored and used within the Ops WTP into the surrounding environment (REMM OSW14, OpCM01 and CM08).

Control measures that will be implemented during the operation phase of the Asset to manage the risks and potential impacts outlined above, are included below in Section 6.

6 Control Mechanisms

6.1 Stormwater Runoff Design and Retention

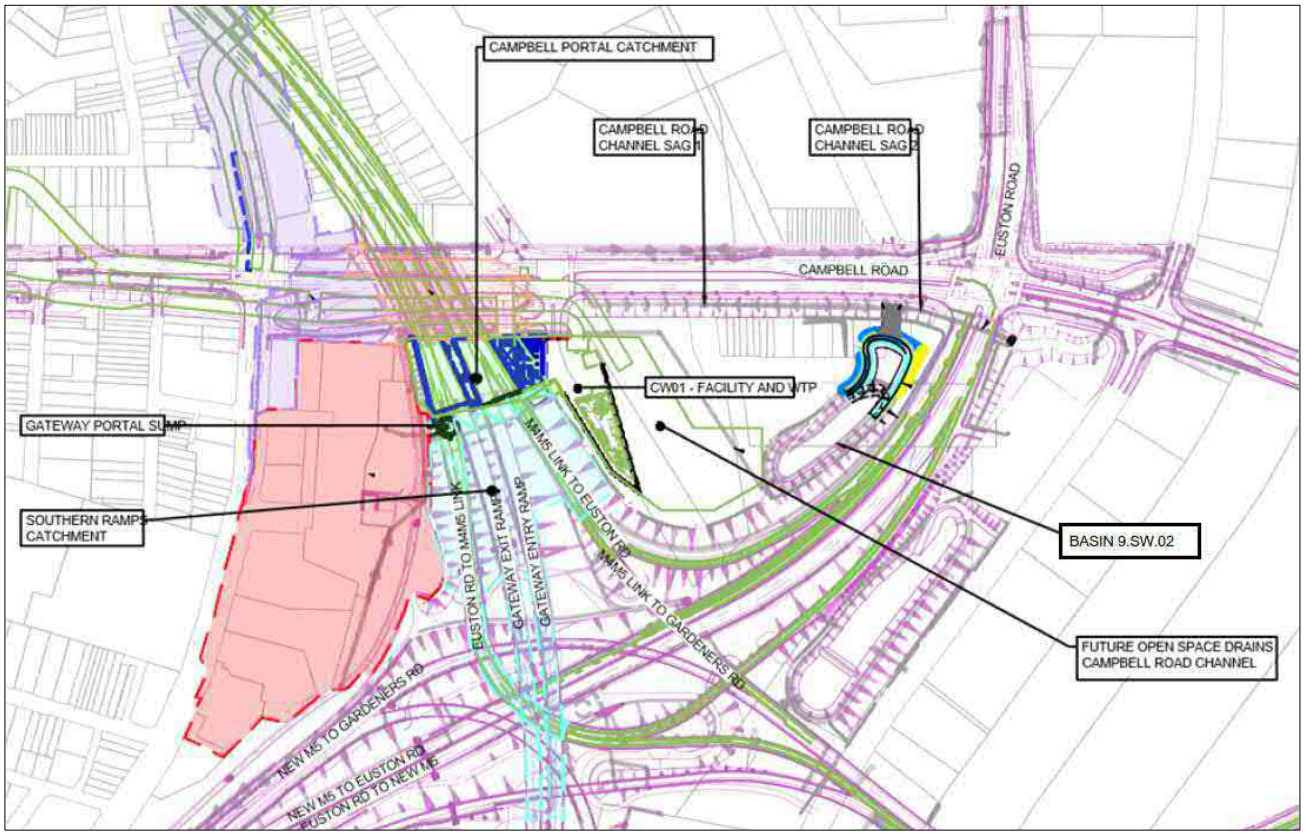


Figure 2: Overview of Campbell Road MOC 5 and Augmented Basin

REMM OSW12 requires stormwater from the project during operation will be treated prior to discharge, and where space is available bioretention systems or constructed wetlands will be installed. Where space is not available other smaller devices, such as proprietary stormwater treatment devices, will be installed. The Campbell Road MOC 5 is considerably constrained for area, includes a vast number of underground facilities and has been designed around the space requirements for the Ops WTP and for vehicles and plant undertaking operation and maintenance activities at the facility (ie. ventilation fan maintenance and transformer removal). Where the ground surface is not covered by either a building, concrete and asphalt (refer to Figure 1), the area will be landscaped with a layer of mulch and plantings of various ground covers; grass; small and large shrubs. Therefore, the potential for 'polluted' stormwater runoff is considered very low risk. A spill kit with spill response materials will be located is an easily accessible and visible location, close to the car park. Annexure A outlines how staff are required to response to hydrocarbon spill.

Stormwater runoff from the car park and workshop facility drains via a pit and pipe network into the existing drainage infrastructure as per part of the M8 (previously known as the NewM5) contract and flows into the operational biofiltration swale (9.SWB.02) (refer to Figure 2). By diverting the stormwater runoff to the swale, this reduces impact on the downstream stormwater systems. 9.SWB.02 was originally constructed by the M8 and was augmented during construction of the Asset. The rainwater collected from the ventilation building roof will also be connected to the same M8 drainage system. Drainage from the M8 ramps to the M180 and M190 On and Off Ramp portals will be connected to a collection sump and pump station which is located underneath the pavement. The collected water is pumped west via a dedicated rising main to a surface water drainage network before entering the 9.SWB.02.

Outside of the Campbell Road MOC 5 perimeter and along the western boundary of the Ops WTP is a clean water diversion drain which captures any rainfall runoff from the M8 landscaped batters and diverts the water into a single stormwater drain, preventing the runoff from entering the site.

The option to retain and reuse harvested rainfall for landscape irrigation and washdown of plant and equipment has been investigated in the Operational Water Reuse Strategy (M4M5-LSBJ-PRW-EN-MP01-PLN-0029). It was concluded not to be viable due to the constrained nature of site and the potential for the water to pose a human and environmental health risk if the water was left untreated prior to reuse. The vast number of underground facilities also prevents on-site detention such as small basin, from being a feasible option.

Operational surface water quality monitoring requirements are outlined in Table 6-1; Section 7 and the OSWQMP (Annexure B).

6.1.1 9.SWB.02 Biofiltration Swale

As part of the flood mitigation strategy, the storage capacity of 9.SWB.02 swale has been increased (1500m^3) to cater for the afflux levels on Burrows Road during the 100-yr ARI. The emergency spillway now also discharges at a maximum flowrate of 0.38m/s into the grassed Campbell Road channel. Should the capacity of the basin be exceeded, and water cannot be discharged out of the pit outlet fast enough, the emergency spillway has been constructed using rip-rap protection (Figure 3) which will attenuate flow velocities and prevent sediment disturbance and resuspension in receiving waters. Scour protection has also been provided in the downstream receiving channel, the design of which was informed by drainage modelling during the development of the flood mitigation strategy.

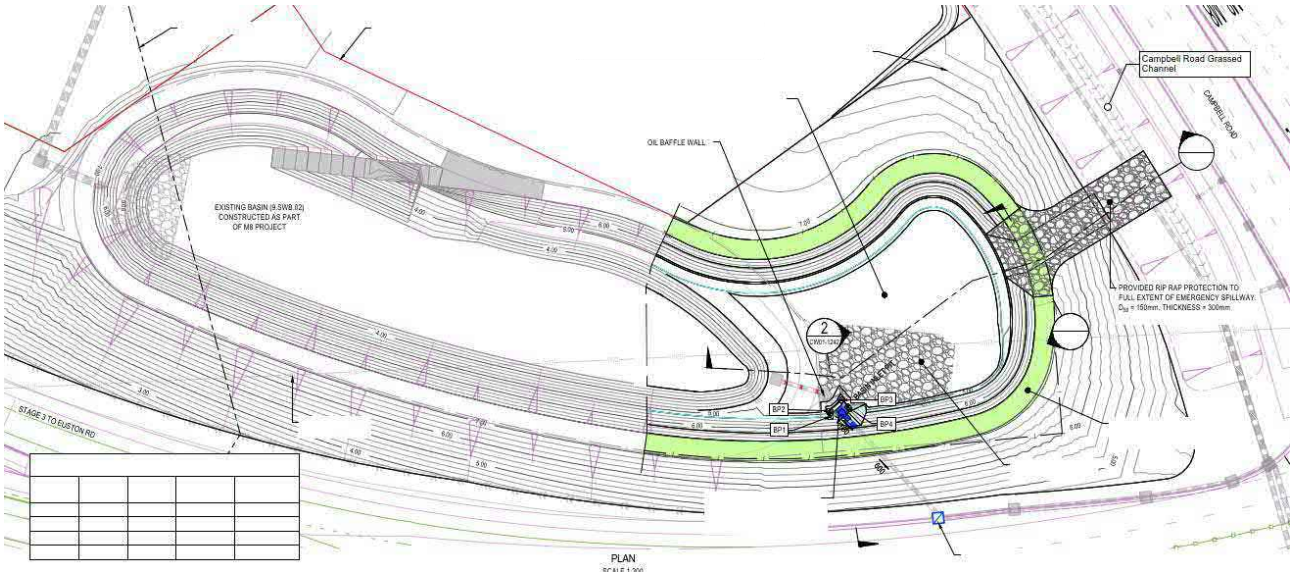


Figure 3: Emergency Spillway Rip Wrap Protection

6.1.1.1 9.SWB.02 Biofiltration Swale SWQ and BBWQIP

SWQ controls have been incorporated into the design of the Asset and Campbell Road MOC 5 to ensure and/or improve the water quality prior to it entering Alexandra Canal and meet the requirements of the Botany Bay Water Quality Improvement Plan (BBWQIP). These controls include: The Ops WTP; the first flush tank; 9.SWB.02 Swale; and the Campbell Road grassed channel.

A water quality assessment was undertaken using the MUSIC program (eWater 6.2) to identify residual pollutant loads discharged from the project works catchment areas into the 9.SWB.02 swale if stormwater

runoff from the ventilation building roof and carpark catchment discharged directly into the basin versus if the water first had to pass through a HumeCeptorSTC23 GPT. The results were also compared to the treatment effectiveness of the basin as constructed during M8 project phase (base case). The MUSIC modelling results demonstrated that the basin alone provides the necessary water quality target reduction without the need of the HumeCeptorSTC23 GPT, whilst also achieving the BBWQIP targets. Therefore because of these results and due to the Campbell Road MOC 5's area constraints, no GPT was incorporated into the final design.

6.2 Wetland and Mosquito Management

Wetland and mosquito management is required to be addressed within this document, as per CoA D10. The Asset is not located within or near a wetland or an existing mosquito breeding habitat. However, it has been identified that 9.SWB.02 basin could pose as a health risk to users of the future recreational park that surrounds the basin, during periods in which the water was to remain below the discharge outlet and stagnant.

The basin as previously stated above was originally constructed by the M8, however wetland and mosquito management was not included within the M8 CoAs, and therefore not within their Operation Water Management Plan (M5N-ES-PLN-PWD-0057) and Water Quality Monitoring Program (M5N-ES-PLN-PWD-0049).

Mosquito breeding times and treatment days are highly dependent on the inflow of water, rainfall and temperature. Most treatments are required to be applied at specific stages of the mosquito lifecycle to be effective, so treatment windows are generally very short. The inspection frequency of the 9.SWB.02 basin is specified in Table 6-1 and if mosquito larvae is identified the I&M operator will engage a qualified and licenced pest controller to ensure that the growth of the larvae is inhibited and prevented.

There are environmentally friendly products already used in Sydney which could be used for the control of mosquito breeding and larvae. Sydney Olympic Park Authority in collaboration with NSW Health pathology currently use the control product containing the bacterium *Bacillus thuringiensis israeliensis* (Bti). Bti is designed to kill mosquito larvae by targeting their gut wall and killing them prior to them becoming adults, without harming people, pets or the general environment.

6.3 Groundwater and Tunnel Wastewater Treatment

Similar to the construction phase of the Asset, groundwater is anticipated to make its way from the water table into the tunnel during the I&M phase and will be managed by the permanent design features such as strip drains; no-fines concrete; in ground drainage and the two low point sumps. Within the in-ground drainage system and low point sumps the groundwater will be mixed in with the tunnel wastewater. As per EIS section 5.10.3 water that is classified as wastewater includes stormwater that enters the tunnels via the on and off ramps portals; washdown water; water from the annual fire deluge testing and fire hydrant water. All these sources of potentially contaminated water have been accounted for into the design of the Ops WTP.

The Ops WTP will treat the groundwater and wastewater collected within the tunnel's two low point sumps (LPS), prior to discharge into the Campbell Road drainage network and ultimately into Alexandra Canal. For further information on groundwater inflow rates; anticipated quality and explanation of how the contaminated water from within the tunnel is transferred to the Ops WTP please refer to the Operational Groundwater Management Plan OGMP (M4M5-LSBJ-PRW-GEN-OP01-PLN-0003).

The Ops WTP discharge criteria must comply with the ANZECC (2000) 95 per cent species protection level and a 99 per cent protection level for contaminants that bioaccumulate unless other discharge criteria is agreed upon in consultation with relevant stakeholders. Discharge criteria for iron and manganese during operation must comply with the ANZECC (2000) recreation water quality criteria. The Asset will operate under an Environmental Protection Licence (EPL), please refer to the EPL discharge criteria for the Ops WTP.

To achieve the required discharge criteria, major components of the Ops WTP include the balance tank; dissolved air flotation unit; greensand media filtration; break point chlorination tank; activated carbon filters and an ion exchange feed tank and vessel and a screw press (refer to Figure 4 below).

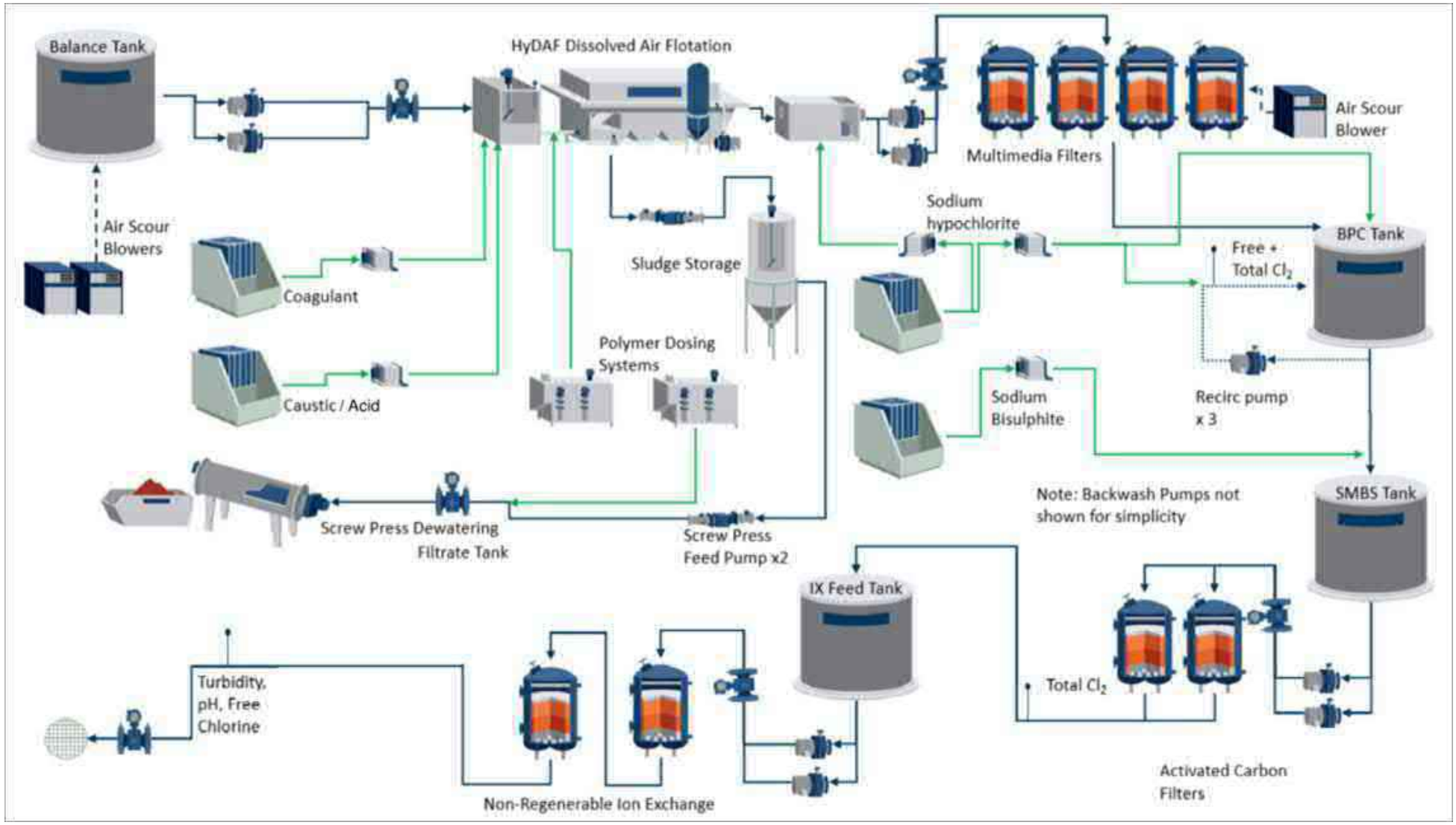


Figure 4: Ops WTP Process Flow Diagram

Under normal operation the maximum discharge rate from the Ops WTP into the Campbell Road surface drainage is 24L/s, however in general will be less. The discharge rate has been checked against the safety criteria for flow rates in channels (0.4) and confirmed that during a wet weather event (1 in 100-year ARI) the flow rate does not have to change. The Ops WTP can continue to discharge at 24L/s without causing an overload of water downstream.

In the event of incoming high flows, the Ops WTP may be bypassed and discharged to the stormwater network if the water quality meets the EPL criteria. Sensors installed in the system will monitor and communicate the water quality to the operator. The Ops WTP design also includes an emergency overflow / bypass in the event of a failure of the Op-WTP and when the sumps and balance tanks are at capacity, preventing potential impacts on tunnel operations.

REMMs OSW18 specifies that energy dissipation or scour protection be added if required to existing drainage outlets to prevent sediment disturbance and resuspension in receiving waters. Where the Campbell Road channel is assumed to receive a continuous baseflow of 24L/s from the Ops WTP, it was identified there was a risk of the channel softening at the discharge invert. To mitigate this risk, the invert of the existing channel has been lined with a narrow concrete channel to the downstream receiving pit. The lining provides uninterrupted flow path and helps prevent channel softening, whilst defining the channel invert during maintenance. Generally rock scour is not needed but has been installed as best practice.

6.4 Management of Tunnel Spills and Leaks, Tunnel Washing and Firefighting Water

As highlighted above in section 6.3 all water inflows to the tunnel will be mixed within the tunnel drainage system and captured at one of the two LPS. It is a mixture of groundwater ingress, tunnel wash-down, firefighting suppressant, tanker spills and stormwater runoff. Each LPS is separated into two compartments, the minor flows (MF) sump and the high flows (HF) sump connected by an under/over weir. The MF sump will continuously collect and pump MF (predominantly groundwater ingress). In the event of larger flows the water will first enter into the MF sump, and then will rise until it overtops into the HF sump through the under/over weir. The under/over weir system will trap hydrocarbons (including those from a major spill) in the MF sump. As a result, the hydrocarbon detection system and the foam suppression system are only required for this sump. The foam suppression system will trigger on detection of hydrocarbons in the sump to reduce combustion risks.

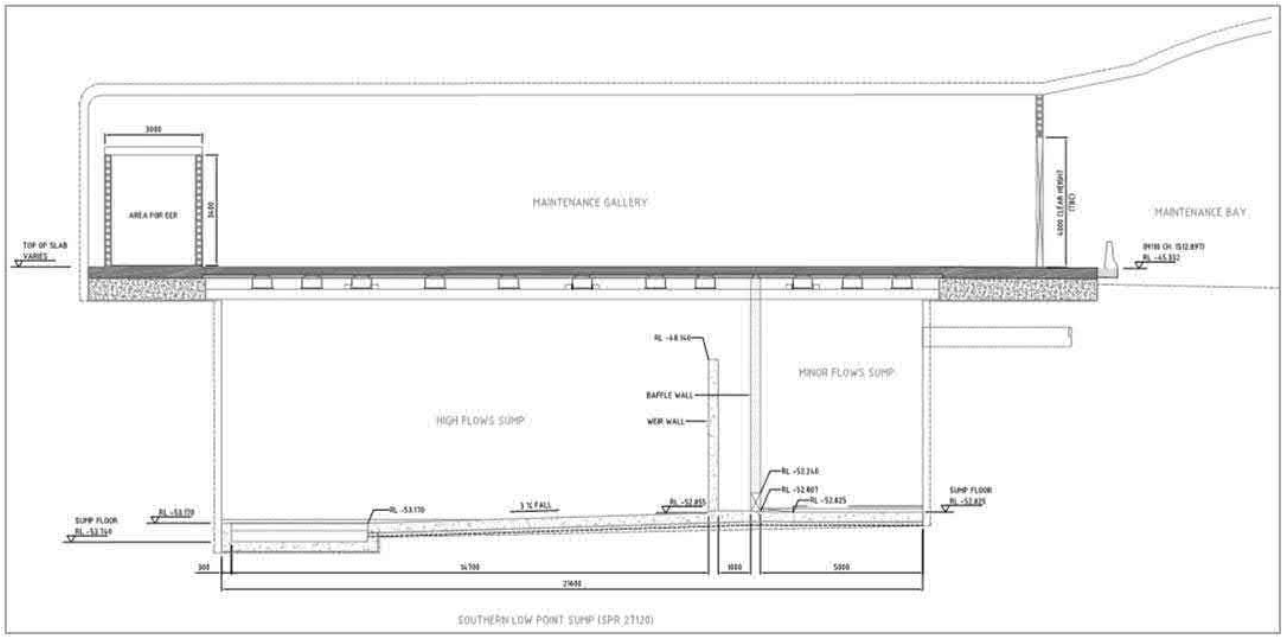


Figure 5: The Under/Over Weir System of the LPS

The MF sumps are sized to cater concurrently for the groundwater inflow, a 1-yar ARI rainfall event and a 50m^3 tanker spillage without overflowing into the HF sump.

If the water being transferred from the LPS are found to be heavily polluted and unable to be treated by the Ops WTP, the water will be removed by a tanker truck for disposal. A camlock is provided at the balance tank to prevent the accidental transfer of polluted water from the Balance Tank to the dissolved air flotation unit. Sensors have also been installed within the Asset's low point sump that monitor the water quality within and communicate the information to the I&M Operator.

6.5 Management of fuel and chemical spills within the Campbell Road MOC 5

Spill containment has been provided in the WTP around the chemical delivery area (CDA) in the form of a bunded bay. The bay provides access for a rigid delivery vehicle to pick up / deliver to the chemical stores and will contain approximately 9000L of spill. This is in accordance with the Sydney Water Guidelines Chemical Dosing Unit Standard Specification (ACP0002 29.102018). All chemical dosing lines onsite have double containment and leak detection. A stop valve has been provided downstream of the CDA to contain spills prior to entering the main line drainage. Any spill captured in the bunded area will be treated onsite or removed for off-site disposal.

In addition to the bunded CDA, a water quality tank has been incorporated into the design of the Ops WTP to capture the first flush runoff from within the Ops WTP and immediately adjacent surrounds (ARI 1-year, 36m3). The water held in this first flush tank is pumped into the WTP at approximately 5/ls for treatment prior to release.

As stated in section 5.1.1 a spill kit containing spill response materials will be stationed within an easily accessible and visible location in the event of a hydrocarbon spill. A second spill kit specific for hazardous chemicals will be located within CDA thus allowing the WTP operator to respond safely to a chemical spill and dispose of the contaminated/hazardous material in accordance with Annexure A . The procedure on how to respond to both a hydrocarbon and hazardous chemical spill is outlined within section Annexure A.

6.6 Management Measures

Steps that will be implemented to plan, manage, monitor and/or review environmental impacts are identified in Table 6-1.

Table 6-1: Environmental Controls

Surface Water Management Controls	Responsibility
Incident and Emergency Response: Road Traffic Incidents	
Follow the Emergency Response Plan (CoA E142 (or relevant associated documents as described in Section 8.2 of the OEMP) during emergency situations associated with the operation of the Asset (including fires, explosions and vehicle collisions). The Emergency Response Plan includes management measures to address the potential environmental impacts of an emergency situation, including measures for containment of contaminated fire-fighting water, fuel spills and gaseous combustion products.	I&M Contractor and Project Company
Shut down the stormwater system and stormwater / deluge pump in the tunnel LPS and stop discharging offsite as soon as it is safe and feasible to do so.	I&M Contractor and Project Company
I&M personnel will work with emergency authorities (when authorities have attended the incident) to clean-up spills and prevent them migrating to the stormwater drainage or reaching surface or groundwater. • The key steps will include: • The use of spill kit material once the area is made safe • Contain the spill within the pavement area if possible	I&M Contractor and Project Company

Surface Water Management Controls	Responsibility
• Install containment measures comprising sandbags and booms to prevent migration to the stormwater drainage • Contain spill in spill containment chamber of tunnel sump and/or cap outfall points to prevent offsite discharge of polluted water if required and feasible • Remove any polluted water using a licensed company • Skim oil sheens from the surface of collected water or water quality basins if required.	
Notify NSW EPA and relevant authorities in accordance with OEMP Section 8.2.4 and Annexure F (RMS Environmental Incident Classification and Reporting Procedure).	I&M Contractor and Project Company
Refer to Incident Response Flow Chart in Annexure A.	I&M Contractor and Project Company
In the event that post-event water quality monitoring identified any exceedances, implement the response action process in the section 4.2.2.2 of Annexure B.	I&M Contractor and Project Company
All I&M personnel are to be trained on how to response to both a small and large spill within the tunnel. Simulated emergency spill scenarios will be carried out on an annual basis and refresher training provided to all personnel.	I&M Contractor and Project Company
Spill prevention: general provisions	
Ensure all I&M personnel are trained in spill management, including the use of materials and their deployment.	I&M Contractor
Retain all necessary personal protective equipment (PPE) onsite.	I&M Contractor
Stocktake and check the use-by date of all spill containment kit and PPE once every quarter.	I&M Contractor
Prohibit the transport of dangerous goods and hazardous substances through all tunnels associated with the Asset	I&M Contractor
Spill prevention: material and chemical storage	
The use of any chemicals or fuels that could result in a spill will be undertaken away from drainage or stormwater lines and, wherever possible, within defined bunds.	I&M Contractor
Safety Data Sheets (SDS) for dangerous goods and hazardous substances will be stored on site prior to their arrival.	I&M Contractor
Retain SDS's onsite. Also ensure they are available via a 24-hour contact number.	I&M Contractor
Maintain access to spill kits onsite ensuring they are included at each storage area and at areas of the worksite where handling and use of dangerous goods occur, and in all I&M personnel site vehicles and within the maintenance workshop and WTP.	I&M Contractor
Protect all stormwater and surface drains before starting any site activities requiring the use of chemicals or fuels.	I&M Contractor
Ensure that all chemicals, fuels, dangerous goods and other potentially polluting materials are stored within nominated storage areas. This extends to storing all such materials on hardstand within an area that is bunded to 110 per cent of the volume of the largest single stored materials ie. the WTP CDA. Dangerous goods, as defined by the Australian Dangerous Good Code, must also be stored and handled in accordance with relevant Australian Standards and the Environment Protection Manual for Authorised Officers: Bunding and Spill Management, technical bulletin (EPA, 1997). Ensure that all drainage within chemical and fuel storage areas is self-contained to prevent any offsite migration ie. the first flush tank at the WTP.	I&M Contractor
Spill prevention: refuelling	
Ensure that as much as possible chemical and fuel transfer activities take place within a bunded and contained area.	I&M Contractor
Ensure that a person will be in attendance when vehicle refuelling takes place and that spill kit provisions are available at designated locations or within response vehicle.	I&M Contractor

Surface Water Management Controls	Responsibility
Spill prevention: vehicle and equipment servicing	
Use spill containment controls when vehicles are serviced.	I&M Contractor
As part of the daily plant and vehicle inspection checklist, leaks will be inspected for. If a leak is identified, the plant or vehicle is to be tagged out of service and organised to be fixed.	I&M Contractor
Spill prevention: vehicle washing	
Ensure that no vehicles will be washed to allow runoff to the stormwater system.	I&M Contractor
Spill management as part of the I&M Operations	
Following a minor or major spill: • Identify the type and volumes of spilled material where possible • Refer to SDS for PPE requirements • Assess containment needs • If containment is required use earth mounds and/or absorbent socks/spill kit • Use the relevant clean-up procedure in SDS • Dispose of material using a licensed contractor, and keep records of disposal onsite • Complete an incident reporting form and submit in accordance with Annexure D of the OEMP.	I&M Contractor
Manage major fuel or chemical spills through the incident response procedure (refer to Section 8 and Annexure D of the OEMP).	I&M Contractor
Clean up all spillages immediately, providing there is no risk to human health, to prevent its spread offsite or into the stormwater system, surface waters or groundwater sources.	I&M Contractor
Contract qualified and licensed personnel to manage and classify hazardous or special wastes in accordance with the requirements of the NSW Environmentally Hazardous Chemicals Act 1985 and the EPA Waste Classification Guidelines (NSW EPA, 2014).	I&M Contractor
All I&M personnel are to be trained on emergency spill response, and refresher training provided on an annual basis.	I&M Contractor
Erosion and sedimentation control, including post-construction monitoring of vegetation	
General provisions: applicable to relevant activities	
Erect and maintain effective sediment control barriers down gradient of all areas where soil disturbance will be undertaken.	I&M Contractor
Construct diversion banks upslope of activities where sediment loss may occur to manage surface water runoff away from the exposed areas, where appropriate.	I&M Contractor
Test and classify generated spoil and sediment in accordance with the NSW Assessment Classification and Management of Liquid and Non-Liquid Waste Guidelines (NSW DEC, 2004) and/or the NSW Waste Classification Guidelines (NSW EPA, 2014) before its disposal offsite.	I&M Contractor
Excavate and transport soil offsite for disposal at a licensed facility that is (suspected to be) contaminated as a result of fuel, oil, or chemical spills.	I&M Contractor
Sweep road surfaces as required to prevent the build-up of sediment and kept clear of debris including; vehicle waste, solid waste, sediment, sand, soil, clay or stones.	I&M Contractor
Road sweepings and collected sediment to be classified in accordance with the NSW Assessment, Classification and Management of Liquid and Non-Liquid Waste Guidelines (NSW DEC, 2004) and/or the NSW Waste Classification Guidelines (NSW EPA, 2014) before its disposal offsite.	I&M Contractor
Stabilise exposed areas and earthworks as soon as practicable.	I&M Contractor
Where necessary, protect stormwater drainage to prevent the discharge of sediment by using gravel bags, sand filters or other geotextile fabrics.	I&M Contractor

Surface Water Management Controls	Responsibility
Routinely replace sediment control devices and remove the old devices offsite for storage, waste classification and disposal. Remove sediment from control devices following a major rainfall event and/or when required.	
Batter Slopes and Embarkment Management	
Undertake visual inspections of the batter slopes and embankments especially after a rainfall event, and implement management actions if there is evidence of loose or unstable rock.	I&M Contractor
Stockpile Management	
Install erosion and sediment control measures at stockpile areas based on the provisions included in the Management of Urban Stormwater: Soils and Construction (Landcom, 2004). Install and manage all stockpiles in accordance with Stockpile Site Management Guidelines (Roads and Maritime, 2008).	I&M Contractor
Vegetation Establishment	
Inspect the areas of landscaping and vegetation cover which formed part of the WestConnex M4-M5 Link Tunnel Project to prevent soil erosion, once every month for the first year of operation. If there is evidence of erosion, consider additional remedial actions. Continue inspections after one-year in locations where there is evidence of erosion in the first year until a point in time where the area is established	I&M Contractor
Stormwater drainage system maintenance and repair, including water quality infrastructure, water sensitive urban design measures and outfall points	
General provisions: applicable to relevant activities	
Keep and maintain an Asset drawing of the stormwater system, its respective catchments, collection points, and discharge points.	I&M Contractor
Prepare, maintain, update and review a schedule of all operation and maintenance activities that involve work that could impact on stormwater drainage. This will principally include sediment-generating activities and activities involving the use of chemicals, fuels and other potentially polluting materials.	I&M Contractor
Routine and regular maintenance of the stormwater system including water quality features and water sensitive urban design	
Visually inspect drainage basins at least once a week for signs of debris, poor maintenance, weeds and plant replacement, chemical and oil sheens, notable odours, or other signs of pollution. Monitor, treat and discharge retained water as required. Herbicide and pesticide use should be avoided for weed and plant removal to reduce water pollution. The weekly visual inspection should also include identification of any potential mosquito or other pest larvae such as toads within 9.SWB.02 basin. A qualified and licensed pest controller is required to be engaged to prevent the growth of these pests as required.	I&M Contractor
Ensure that an inspection takes place immediately following an incident, spill or adverse heavy rainfall.	I&M Contractor
Remove sediment from control devices following a major rainfall event and/or when the device is 60 per cent full. Collect, test, classify and dispose of the sediment in accordance with the NSW Waste Classification Guidelines (NSW EPA, 2014).	I&M Contractor
If required, obtain consent from Sydney Water to discharge the collected water to the trunk sewer main.	I&M Contractor

Flood Protection and Maintenance	
Ensure the road drainage infrastructure is inspected quarterly, or more frequently if there is a period of prolonged heavy rainfall or accidental discharge, to ensure it operates within its design specifications to achieve the required flood immunity protection.	I&M Contractor

7 Monitoring, Notification and Reporting

Notification and reporting during operation of the Asset will be undertaken in accordance with Section 8 and 9 of the OEMP. Specific requirements relevant to the OSWQP and the OSWQMP are identified below.

7.1 Surface water quality monitoring

Surface water quality (SWQ) monitoring will be undertaken for duration of operation. This will enable the I&M Contractor to assess the performance of the Asset and identify potential impacts and the required management responses.

Operational monitoring requirements are detailed in the OSWQMP in Annexure B including the various monitoring locations, performance criteria and the triggers for management responses.

7.2 Reporting

As per CoA D17 the results from the Operational Monitoring Programs must be submitted to the Secretary, and the relevant regulatory authorities, for information in the form of the Operational Monitoring Report at the frequency identified in the Operational Monitoring Program. The reporting schedule is outlined in Annexure B and is summarised below in Table 7-1.

Table 7-1: SWQ Monitoring Program reporting schedule

Report Timing	Report requirements	Recipient
Operational Surface Water Quality Monitoring Reports (Six-monthly)	Raw SWQ data from the Ops WTP to be collected and tabulated. Performance criteria exceedances are to be highlighted and what response measures were activated/implemented to further investigate and address these exceedances. Report to confirm implementation and performance of required operational water control measures monitored through monthly visual inspections, including 9.SWB.02 Biofiltration swale, discharge points and chemical storage areas.	DPE, DPE Water (formerly DPI Water), DPE Environment & Heritage (formerly OEH), Sydney Water and relevant councils

8 Auditing and review

8.1 Continuous Improvement

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

The continuous improvement process will be designed to:

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

8.2 OSWQP update and amendment

The processes described in Sections 9 and 10 of the OEMP may result in the need to update this OSWQP and its associated monitoring program. Plan updates will occur on an as needed basis.

Document updates to the plan in response to regular reviews (refer to Section 10.1 of the OEMP) may be approved internally if they are considered minor. Where necessary, the OSWQP will be provided to relevant stakeholders for review and comment if required and provided to the Secretary for approval.

A copy of updated plans will be made public ally available on the WestConnex project website (https://www.westconnex.com.au/) and provided to the relevant stakeholders on request.

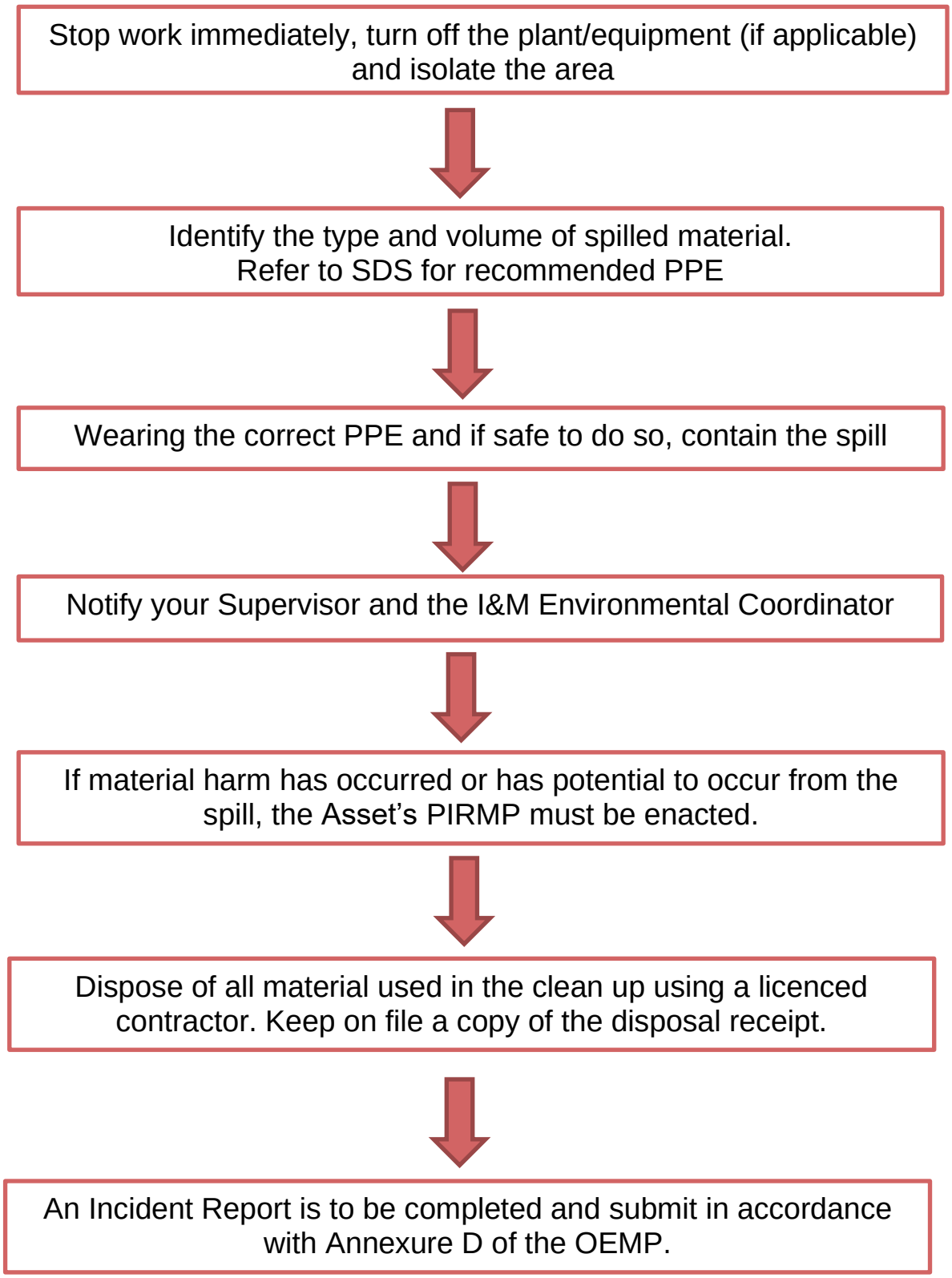
8.3 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this Plan, CoA and other relevant approvals, licenses, and guidelines.

Audit requirements are detailed in Section 9.3 of the OEMP.

Annexure A Spill Response Flow Chart

General I&M Operations



Annexure B Operational Surface Water Quality Monitoring Program

WestConnex M4-M5 Link Mainline Tunnels

Operational Surface Water Quality Monitoring Program

Project:	M4-M5 Link Tunnels – Design and Construct
Contract Number:	TBC
Revision Date:	May 2022

Document Approval

Rev	Date	Prepared by	Reviewed by	Remarks
00	21 April 2022	ASBJV	WCX, TfNSW + External Stakeholders	Provision to DPE following external consultation
01	13 May 2022	ASBJV	DPE	Update in response to DPE RFI

WestConnex

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Glossary of terms

Term/acronym	Definition
the Asset	WestConnex M4-M5 Link Mainline Tunnels
CoA	Conditions of Approval
EC	Electrical Conductivity
EIS	Environmental Impact Statement
EPL	Environment Protection Licence
I&M	Incident and Maintenance
MOC	Motorway Operations Complex
OEMP	Operational Environmental Management Plan
OGMP	Operational Groundwater Management Plan
OSWQMP	Operational Surface Water Quality Monitoring Program
OSWQP	Operational Surface Water Quality Plan
Ops WTP	Operational Water Treatment Plant
PREW	Parramatta Road East and West
REMM	Revised Environmental Management Measures
RMS	Roads and Maritime Services
the Asset	M4-M5 Link Mainline Tunnels
TfNSW	Transport for New South Wales
WCX	WestConnex

1 Introduction

1.1 Context

This Operational Surface Water Quality Monitoring Program (OSWQMP) has been prepared for the incident and maintenance (I&M) phase of the WestConnex M4-M5 Link Mainline Tunnels (the Asset). The document describes how the I&M Contractor will monitor the extent and nature of the potential impacts to SWQ, as well as the required response and management procedure in the event that the performance criteria is exceeded.

This OSWQMP will be implemented to monitor effectiveness of the mitigation measures implemented as part of the I&M phase of the Asset, as described within the main body of the Operational Surface Water Quality Management Plan (OSWQP). The Program has been developed in accordance with the Ministers Conditions of Approval (CoA), the Revised Environmental Management Measures (REMM); the WestConnex M4-M5 Link Mainline Tunnel Modification reports, and applicable legislation. It is based on baseline data and studies from the Asset's Environmental Impact Statement (EIS) (AECOM 2017); monitoring data recorded during the construction phase of the Asset as well as individual case studies which have received approval during construction phase.

This OSWQMP forms part of the SWQP and ultimately the Operational Environmental Management Plan (OEMP) and should be read in conjunction.

1.2 Objectives

The objective of the OSWQMP is to clearly outline the following information:

- Details of baseline data;
- Details of all monitoring of the project to be undertaken;
- The parameters of the project to be monitored;
- The frequency of monitoring to be undertaken;
- The location of monitoring;
- The reporting of monitoring and analysis results against relevant criteria;
- Details of the methods that will be employed to analyse the monitoring data;
- Procedures to identify and implement additional mitigation measures where results of monitoring are unsatisfactory; and
- Any consultation to be undertaken in relation to the monitoring programs.

1.3 Implementation

Operational Monitoring Programs must be submitted to the Secretary for approval at least one (1) month prior to commencement of operation of the Asset.

Operation will not commence until the Secretary has approved all of the required Operational Monitoring Programs relevant to that activity and all the relevant baseline data has been collected.

The Operational Monitoring Programs, as approved by the Secretary, must be implemented for the duration identified in the relevant Operational Monitoring Program or specified by the Secretary, whichever is the greater.

1.4 Consultation

This OSWQMP as part of the OSWQP was provided to the EPA; DPE Water; DPE Environment & Heritage (formerly OEH); Sydney Water; Inner West City Council and the City of Sydney Council in accordance with CoA D8, for review and comment.

A document titled 'Consultation for the M4-M5 Link Tunnels OEMP and sub-plans' has been prepared separately to this plan to provide detail relating to the consultation received and where feedback has been covered or addressed in this plan. Subsequent feedback will be documented and used to inform revisions and updates of this plan (refer Section 7.3 of the OEMP).

All community complaints, issues and notifications (this includes those relating to surface water quality) will be managed in accordance with section 7.3 of the OEMP.

2 Environmental obligations

Refer to section 3 of the OSWQP for those CoA; Revised Environmental Management Measures (REMMs); Guidelines and Standards, and RMS G38 requirements which are applicable to the SWQ Monitoring Program.

3 Baseline Surface Water Monitoring

A baseline surface water monitoring program was implemented in July 2016 and continued through to June 2018 to inform the Asset's EIS. The program was based on a desktop assessment which involved a review of the information obtained from geotechnical investigation and assessments carried out as part of the EIS; information and surface water quality monitoring data from the M4 East EIS and the New M5 EIS relevant to the Asset catchment area; and data relevant to the existing surface water conditions from the following sources: Inner West Council; City of Sydney Council; WestConnex (WCX) Transurban; Sydney Water and Transport for New South Wales (TfNSW), formerly known as Roads and Maritime Services (RMS).

The baseline surface water quality (SWQ) monitoring locations were located upstream and downstream of the Asset alignment, as well of the construction ancillary facilities (refer to Table 3-1 and Figure 1). These monitoring locations were chosen to provide general characterisation of the local waterways, and to include SWQ monitoring locations already established for the M4 and the M8 (formerly known as the New M5) Projects.

Table 3-1: Baseline Surface Water Monitoring Locations

Monitoring Location ID	Address	Ancillary Facility	Waterway
SW10	South side of Huntley Street, Alexandria	Campbell Road	Sheas Creek (upstream)
SW15	Euston Road, Alexandria	Campbell Road	Sheas Creek (Alexandra Canal) (downstream)

3.1 EIS Baseline Surface Water Quality

At each of the monitoring location the following baseline surface water quality analytes were measured on a monthly basis:

- Physio-chemical (field) parameters (pH, temperature, electrical conductivity (EC), oxidation / reduction potential, dissolved oxygen, and turbidity)
- Benzene, toluene, ethylbenzene, xylene, and naphthalene (BTEXN)
- Dissolved metals (arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel and zinc)
- Nutrients (nitrite as N, nitrate as N, reactive phosphorus and ammonia)
- Total recoverable hydrocarbons (TRHs) and Total petroleum hydrocarbons (TPHs)

A summary of the monthly baseline SWQ data can be found in Annexure A. The Asset's EIS provided an interpretation of these results which is summarised below in Table 3-2.

Table 3-2: Baseline Surface Water Result Summary

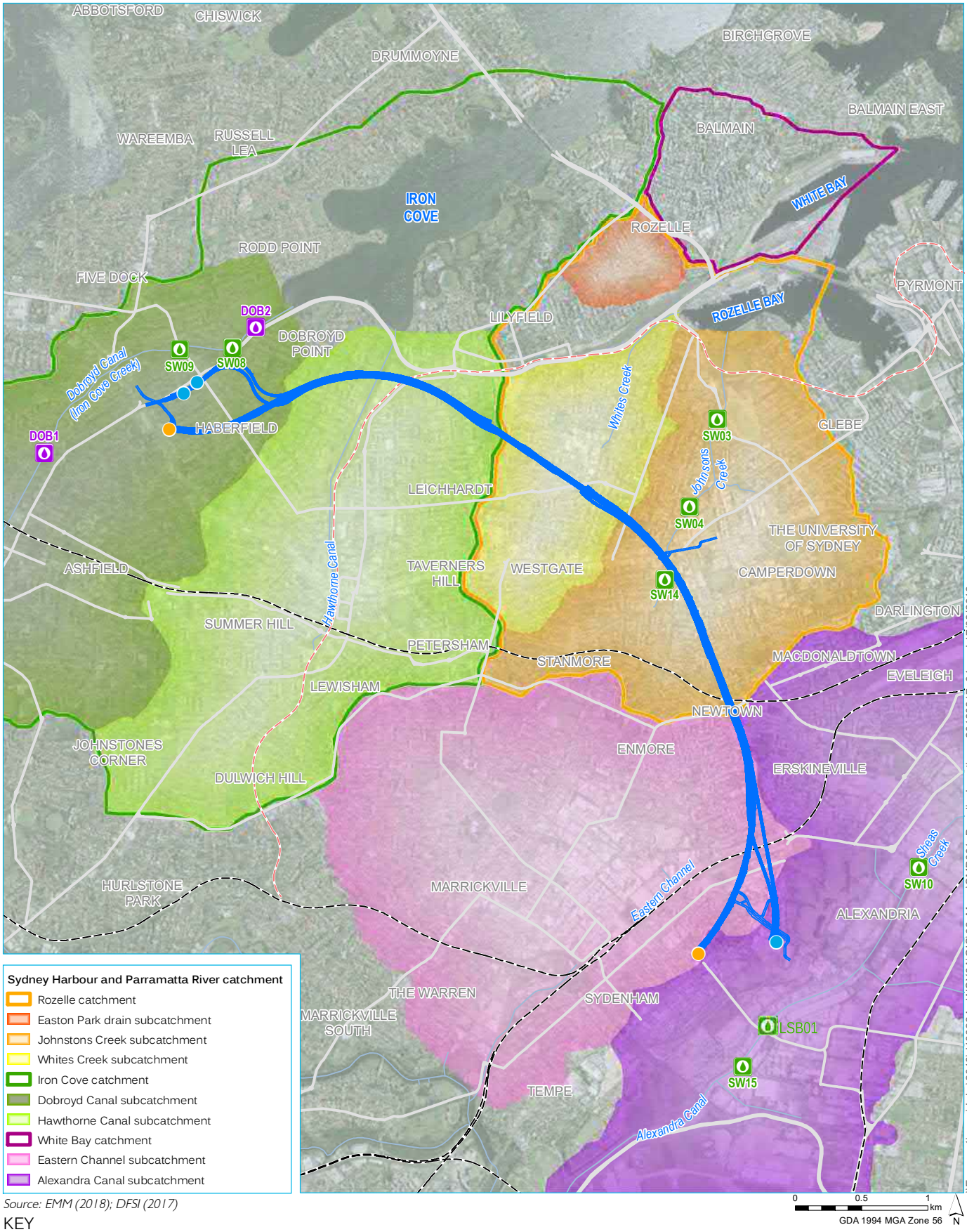
Waterway	Baseline Data Obtained	Description of SWQ
Alexandra Canal	SW10 and SW15	Elevated pH, concentrations of metals (copper, lead, chromium, nickel, manganese and zinc) and nutrients (nitrogen, nitrate and phosphorus) and turbidity The pH was also outside guideline levels on occasions.

[1] ANZECC (2000a)

3.2 Construction Phase SWQ Monitoring Data

In addition to the true baseline data collected prior to any potential impact having occurred, SWQ monitoring data was collected during the construction phase of the Asset to monitor potential construction phase water quality impacts (Annexure B).

During construction, an alternate downstream monitoring location (LSB01) was selected due to issues around safe and public access to the baseline downstream location (SW15). This alternate sampling location also reduced the distance between the control and impact sites resulting in fewer stormwater outlets and potential non-Project pollution sources within the sampling zone. As detailed in Section 4.2, surface watering monitoring will continue during operation at LSB01.



Source: EMM (2018); DFSI (2017)

KEY

Surface water monitoring points

- M4-M5 Link Tunnels
- M4 East

Existing features

- Light rail
- Rail line
- Arterial road
- Watercourse / drainage line

Project features

- Tunnel connection
- Tunnel portal
- Proposed M4 - M5 Link Mainline Tunnel alignment

Figure 3-1: EIS baseline and construction-phase monitoring locations

4 Operational Surface Water Quality monitoring

4.1 Potential Surface Water Impact and Controls

As discussed in section 5.3 of the OSWQP, during the I&M phase of the Asset the local SWQ may be impacted from the following risks:

- Exposure and erosion of soils causing pollution of receiving waters and sedimentation;
- Contamination of waterways associated with the mobilisation of pollutants in stormwater runoff;
- Reduction of water quality and degradation of natural habitats in sensitive receiving environments from uncontrolled discharge of untreated tunnel wastewater;
- Spills of hazardous chemicals and used within the Operation Water Treatment Plant (Ops WTP)

Controls measures which have been implemented to minimise the above risks have been discussed in detail in section 5 of the OSWQP and are summarised below in Table 4-1.

Table 4-1: Potential Impact and Control Measure Summary

Potential risks & impacts on the SWQ	Control Measures as per Section 6 of the SWQP
Exposure and erosion of soils causing pollution of receiving waters and sedimentation.	• 9.SWB.02 Biofiltration Swale emergency spillway has been constructed out of rip-rap protection. Scour protection also provided further downstream. • Landscaped areas will be stabilised with topsoil; mulch; ground covers; grasses and shrubs.
Contamination of waterways associated with the mobilisation of pollutants in stormwater runoff.	• Stormwater runoff from the Campbell Road Motorway Operations Complex (Campbell Road MOC 5) and from the M8 On and Off ramps will be pumped to the 9.SWB.02 Biofiltration Swale which contains an oil baffle wall.
Reduction of water quality and degradation of natural habitats in sensitive receiving environments from uncontrolled discharge of untreated tunnel wastewater.	• All groundwater ingress and tunnel wastewater collected within the two tunnel low point sumps (LPS) will be transferred to the Ops WTP.
Spills of hazardous chemicals and used within the Ops WTP.	• All chemicals for the Ops WTP will delivered and stored within a bunded bay which can contain approx. 9000L of chemical spillage. • All dosing lines have double containment and leak detection. • Stop valve downstream of the chemical delivery area.

The associated management measures that will be implemented by the I&M Operator to also reduce the risk of the above impacts, are outlined within Table 5-2 of the OSWQP.

4.2 Surface Water Quality Monitoring

4.2.1 Monitoring strategy

Table 4-1 identifies the risks and impacts to local surface water quality from the operation of the Asset and describes the control measures that will be implemented to manage the risks. Rather than monitoring the quality of downstream surface water that are subject to a broad range of impact sources, the M4-M5 Link surface water quality monitoring program has been developed to monitor the management measures developed to managed the risk presented by the asset itself.

Table 4-2: Surface Water Quality Monitoring

Potential impacts on the SWQ	Control Measures as per Section 6 of the SWQP	Monitoring type and frequency	Location	Duration
Exposure and erosion of soils causing pollution of receiving waters and sedimentation.	Basin 9.SWB.02 Biofiltration Swale emergency spillway has been constructed with rip-rap protection measures.	Monthly visual inspection of Basin 9.SWB.02 Biofiltration Swale stability.	-33.914012449055654, 151.18182027596671	3 years
	The Operational Water Treatment Plant discharges to Swale 7B.SW04, that has a 1m wide SO concrete lined base.	Monthly visual inspection of Swale 7B.SW04 (southern edge of Campbell Rd) stability and operational performance.	-33.91415686773497, 151.18203471398135	3 years
	Landscaped areas stabilised with topsoil; mulch; ground covers; grasses and shrubs.	Monthly visual inspection of all landscaped areas within the asset boundary to assess stability.	Various	3 years
Contamination of waterways associated with the mobilisation of pollutants in stormwater runoff.	Stormwater runoff from the Campbell Road Motorway Operations Complex (Campbell Road MOC 5) and from the M8 On and Off ramps will be pumped to Basin 9.SWB.02 Biofiltration Swale which contains an oil baffle wall.	Monthly visual inspection of Basin 9.SWB.02 Biofiltration Swale oil baffle performance.	-33.91524297625522, 151.18384613680107	3 years
Reduction of water quality and degradation of natural habitats in sensitive receiving environments from uncontrolled discharge of untreated tunnel wastewater.	All groundwater ingress and tunnel wastewater collected within the two tunnel low point sumps (LPS) will be transferred to the Ops WTP and treated in accordance with the Environment Protection Licence.	Monthly monitoring adopting the EPA approved methods of the Operational Water Treatment Plant outlet for compliance with Environment Protection Licence discharge limits.	-33.914405002 151.181050995	Duration of EPL

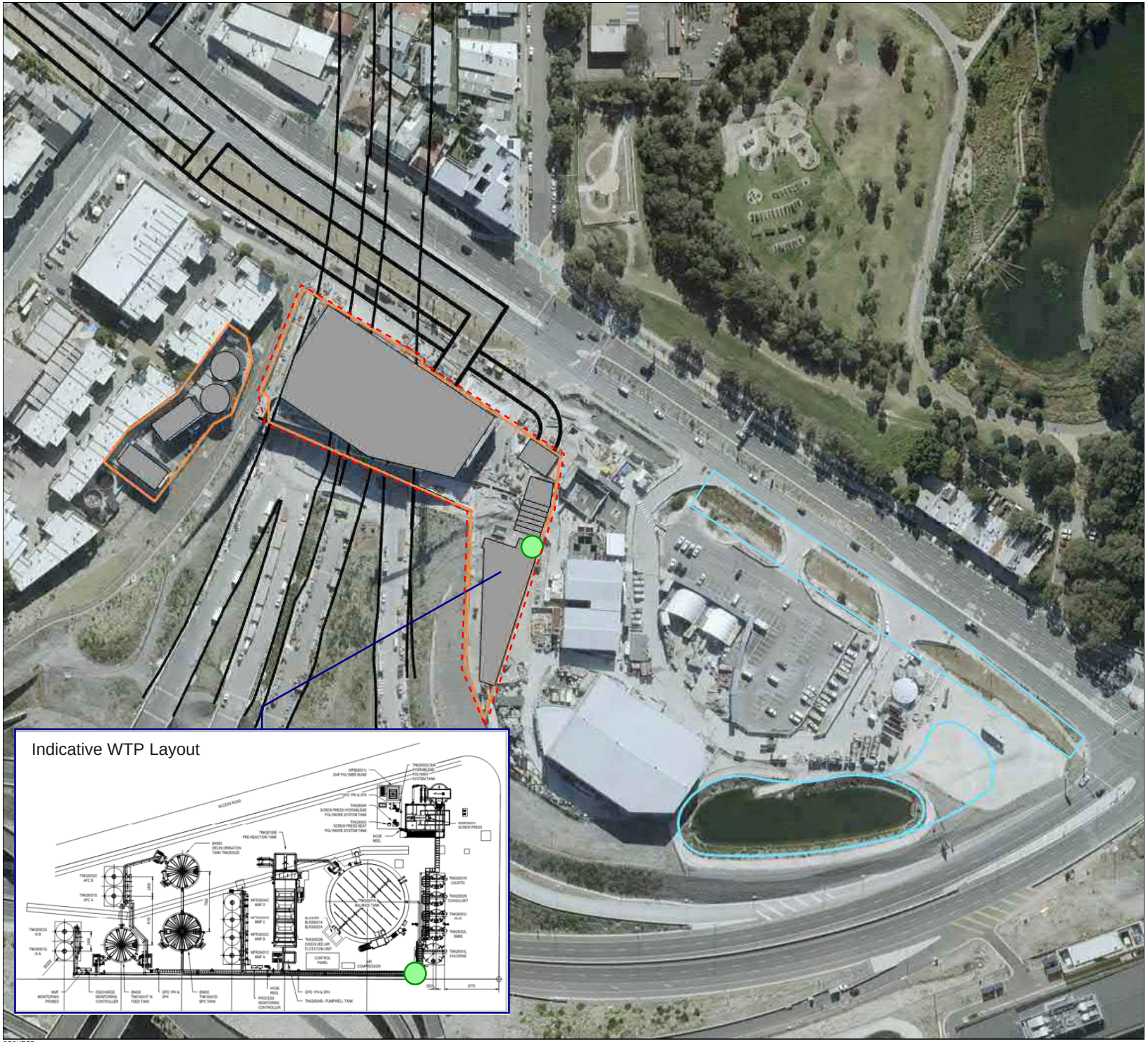
Potential impacts on the SWQ	Control Measures as per Section 6 of the SWQP	Monitoring type and frequency	Location	Duration
Spills of hazardous chemicals used within the Operational Water Treatment Plant.	All chemicals for the Ops WTP will delivered and stored within a bunded bay which can contain approx. 9000L of chemical spillage. All dosing lines have double containment and leak detection. Stop valve downstream of the chemical delivery area.	Monthly monitoring of chemical and fuel storage control measure compliance	-33.91421028923871, 151.18118713598753	Duration of WTP operation

WestConnex M4-M5 Link Mainline Tunnels

Figure 4-1: Operational monitoring locations

Legend

- Tunnel Alignment
- WTP Discharge Sampling Location
- Ancillary Facility Boundary
- Operational Ancillary Infrastructure
- 9.SWB.02 Swale Inspection Areas
- Landscaping and Chemical Storage Inspection Area



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4.2.1.1 Monitoring Parameters

Table 4-3: Surface Water Monitoring Parameters

Potential impacts on the SWQ	Monitoring type and frequency	Parameters
Exposure and erosion of soils causing pollution of receiving waters and sedimentation.	Monthly visual inspection of Basin 9.SWB.02 Biofiltration Swale stability. Monthly visual inspection of Swale 7B.SW04 (southern edge of Campbell Rd) stability and operational performance. Monthly visual inspection of all landscaped areas within the asset boundary to assess stability.	Exposed soils, instability or accumulated debris Presence of exposed soils along Swale 7 or instability Stability of landscaped areas
Contamination of waterways associated with the mobilisation of pollutants in stormwater runoff.	Monthly visual inspection of Basin 9.SWB.02 Biofiltration Swale oil baffle performance.	Performance of swale oil baffle
Reduction of water quality and degradation of natural habitats in sensitive receiving environments from uncontrolled discharge of untreated tunnel wastewater.	Monthly monitoring adopting the EPA approved methods of the Operational Water Treatment Plant outlet for compliance with Environment Protection Licence (EPL) discharge limits.	As defined by the Asset EPL.
Spills of hazardous chemicals used within the Operational Water Treatment Plant.	Monthly monitoring of chemical and fuel storage control measure compliance	Presence of spill containment measures, damage or visual signs of spills.

5 Monitoring Methodology

5.1 Personal Protective Equipment

When out in the field the staff will wear the following to avoid sunburn and infection:

- Sunscreen
- Sunglasses (UV protection grade)
- Wide brim hat
- Long sleeve shirt and pants
- Waterproof and disposable gloves

5.2 Visual Inspections

Weekly and monthly visual inspections of Basin 9, Swale 7, Water Treatment Plant storage areas and landscaped areas will be undertaken in accordance with Table 5.1 below.

Table 5-1: Visual inspection methodology

Monitoring area	Methodology
Basin 9.SWB.02 Biofiltration Swale stability.	Inspection of the basin outlet will be from Campbell Road. The rock rip-rap from the basin spill-over to the adjoining channel will be inspected, with a focus on the main flow channel path and compliance with the Code of Maintenance Standard and the Operational Maintenance Manual. If more than two concurrent inspections identify debris or instability, the frequency of monitoring and the swale design will be revisited, with maintenance of the swale to be scheduled as required. Refer to OSWQMP Table 6-1 for Management measures.
Monthly visual inspection of Basin 9.SWB.02 Biofiltration Swale oil baffle performance.	The swale oil baffle will be visually inspected from within the operational motorway area, with a focus on ensuring stability and compliance with the Code of Maintenance Standard and the Operational Maintenance Manual. If more than two concurrent inspections identify baffle performance matter, the frequency of monitoring and the baffle design will be revisited, with maintenance of the baffle to be scheduled as required. Refer to OSWQMP Table 6-1 for Management measures.
Swale 7B.SW04 (southern edge of Campbell Rd)	The Swale 7 inspection will be undertaken from the footpath on the southern edge of Campbell Road. The entire length of the swale will be walked and inspected for compliance with the Code of Maintenance Standard and the Operational Maintenance Manual. If more than two concurrent inspections identify swale stability matters, the frequency of monitoring and the swale design will be revisited, with maintenance of the swale to be scheduled as required. Refer to OSWQMP Table 6-1 for Management measures.
Monthly monitoring of Operational Water Treatment Plant chemical storage control measure compliance	The inspection of the Operational Water Treatment Plant chemical storage areas will be undertaken from within the motorway access area. The perimeter of the bund will be walked, evidence of spills identified and observations of any bund damage identified. If more than two concurrent inspections identify non-compliances with the chemical storage area, the frequency of monitoring and the operational training manual communication will be revisited.
	Areas within and adjoining St Peters Interchange and Habberfield landscaped by the M4-M5 Link project will be visually inspected from publicly accessible areas and operational motorway areas, with a focus on perimeter zone compliance with the Code of Maintenance Standard and the Operational Maintenance Manual. If more than two concurrent inspections identify landscape instability matters, the frequency of monitoring and the design of identified landscape areas will be revisited, with landscape maintenance to be scheduled as required. Refer to OSWQMP Table 6-1 for Management measures.

Monitoring area	Methodology
Landscaped areas within the asset boundary Basin 9.SWB.02 Biofiltration Swale and Swale 7B.SW04 (southern edge of Campbell Rd)	As outlined in OSWQMP Section 6.2 and Table 6-1, weekly visual inspections of potential mosquito breeding habitat will include identification of any potential mosquito or other pest larvae. A qualified and licensed pest controller is required to be engaged to prevent the growth of these pests if identified.

5.3 Water Treatment Plant Sample Collection

Grab samples will be collected manually from the WTP and sent to a National Association of Testing Authorities (NATA) accredited laboratory for analysis. The volume of the sample will be adequate to measure the required physio-chemical (field) parameter analysis using a multi-probe water quality meter(s).

5.4 Recording of monitoring results

All monitoring and sampling will be documented and transferred to a central electronic database under the responsibility of the I&M Contractor.

Results for each monitoring location will be recorded on appropriate field sheets (hard copy or digital) using unique sampling identification nomenclature and will record the following information:

- Site ID
- Time and date of sampling
- Prevailing weather conditions
- Name of sampler
- Other relevant information and commentary

5.5 Decontamination

Sampling equipment will be cleaned (decontaminated) between each sample. Where a sample site shows evidence of contamination (ie. there is an algal bloom, or the site smells strongly of hydrocarbons or sewage etc) equipment will need to be cleaned thoroughly. In addition, equipment will need to be cleaned periodically to prevent a build-up of dirt.

The following method of decontamination will be followed:

- Rinse equipment in tap water
- Clean with De-Con 90 (a phosphate free detergent), or equivalent;
- Rinse again with tap water;
- Rinse three times with de-ionised water, and
- Allowed to dry

5.6 Quality Assurance and Documentation

Quality assurance and control protocols during sampling and recording of physio-chemical (field) parameters will be undertaken in accordance with ANZECC/ARMCANZ (2000b) to ensure the integrity of the dataset.

As part of sampling, quality assurance and control samples during sampling will be undertaken to ensure the integrity of the dataset. This includes:

- Rinsate blanks (one per sampling event only);
- Bind duplicates (at a rate not less than 20% of total samples);
- Split duplicates (at a rate not less than 20% of total samples.

If samples can not be analysed in the field with the multi-probe meter and are required to be sent off to the laboratory for analysis. The samples are then to be transported to a NATA-accredited laboratory under document chain-of custody protocols.

Field results will be checked for accuracy before leaving the site, and errors or discrepancies will be cross-checked and further investigation will be initiated if required.

Monitoring and calibration records will be maintained in accordance with the appropriate standard.

6 Compliance Management

6.1 Roles, Responsibility and Training

The I&M contractor's organisational structure and overall roles and responsibilities are outlined in section 5.8 of the OEMP. Specific responsibilities for the implementation of SWQ related environmental controls are detailed in the OSWQP section 6.6.

All employees, contractors and utility staff working on the Asset will undergo site induction and targeted training relating to surface water management risks detailed in the OSWQP.

Further details regarding staff induction and training are outlined in section 6 Of the OEMP.

6.2 Monitoring and Inspection

Section 6.6 and Table 6-2 of the OSWQP as well as section **Error! Reference source not found.** of this d ocument provide detailed inspection criteria including:

- Monitoring locations
- The parameters to be monitored
- Type and frequency of monitoring
- Monitoring methodology
- Spills and Erosion and sediment control focused monitoring at the Campbell Road MOC and Basin 9.SWB.02 Basin
- Mosquito breeding monitoring at Basin 9.SWB.02

Additional requirements and responsibilities in relation to inspections are documented in section 9.1 of the OEMP.

6.3 Response to unsatisfactory performance

Table 6-1: Response to Monitoring Performance

Monitoring area	Response
Basin 9.SWB.02 Biofiltration Swale stability.	If the basin outlet, in particular the rock rip-rap is identified as unstable or where debris is sited, a maintenance work order will be raised by the I&M contractor within 24 hours for rectification in accordance with the Code of Maintenance Standard and the Operational Maintenance Manual.
Monthly visual inspection of Basin 9.SWB.02 Biofiltration Swale oil baffle performance.	If the basin swale oil baffle is identified as not being in accordance with the As-built design (stability and location) a maintenance work order will be raised by the I&M contractor within 24 hours for rectification in accordance with the Code of Maintenance Standard and the Operational Maintenance Manual.
Swale 7B.SW04 (southern edge of Campbell Rd)	If the visual inspection identifies that the basin swale is either unstable, affected by debris or not in a condition consistent with the As-built design, a maintenance work order will be raised by the I&M contractor within 24 hours for rectification in accordance with the Code of Maintenance Standard and the Operational Maintenance Manual.
Monthly monitoring of Operational Water Treatment Plant chemical	If the monitoring of the Operational Water Treatment Plant chemical storage area identifies a non-compliance, evidence of a spill or damage to the bund a maintenance work order will be raised by the I&M contractor within 24 hours for

Monitoring area	Response
storage control measure compliance	rectification in accordance with the Code of Maintenance Standard and the Operational Maintenance Manual.
Landscaped areas within the asset boundary	If the visual inspection of landscaped areas identifies instability or areas where on site erosion could present a sedimentation risk, a maintenance work order will be raised by the I&M contractor within 24 hours for rectification in accordance with the Code of Maintenance Standard and the Operational Maintenance Manual.
Monthly monitoring of Operational Water Treatment Plant Discharge	Upon receipt of monthly sampling results described in Section 5.3, should any criteria exceed the defined EPL discharge limits, a review of the WTP operations, recent incidents and asset maintenance activities will be undertaken by the I&M contractor. A follow up grab sample will be taken from the WTP upon completion of this review and any required rectification works. Should the same criteria exceed the EPL discharge limit on the follow up sample, this result will be classified as an incident and notification will be made in accordance with section 8.2.4 of the OEMP.

6.4 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this Program, CoA, and other relevant approvals, licenses and guidelines.

Audit requirements are detailed in section 9.3 of the OEMP.

6.5 Reporting

Reporting and data provision requirements relevant to this OSWQMP are outlined in Section 7.1 of the OSWQP.

7 Review and Improvement

Continual improvement is achieved through constant measurement and evaluation, audit and review of the effectiveness of the plan, and adjustment and improvement of the OEMP, project environmental outcomes and I&M Environmental Management System.

This program will be updated as required:

- 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 legislation;
- Where requested or required by the NSW Department of Planning and Environment or any other Authority;
- Following a review of 12 months of operational phase monitoring data; or
- In response to internal or external audits or quarterly management reviews.

During operation the updated program will be reviewed and approved in accordance with the process in section 10 of the OEMP.

8 References

AECOM, 2017. WestConnex M4-M5 EIS Technical Working Paper: Surface Water and Flooding, August 2017.

ANZECC/ARMCANZ, 2000a. Australian and New Zealand Guidelines for Fresh and Marine Water Quality

ANZECC/ARMCANZ, 2000b. Australian Guidelines for Water Quality Monitoring and Reporting.

EPA, 2004. Approved Methods for the Sampling and Analysis of Water Pollutants in NSW.

Landcom, 2004. Managing Urban Stormwater: Soils and Construction. Landcom, (4th Edition)

March 2004 (reprinted 2006) (the “Blue Book”). Volume 1 and Volume 2.

NSW Department of Conservation and Land Management, 1989. Soil Landscapes of the Sydney 1:100,000 Sheet 9130

Annexure A Baseline SWQ monitoring results

Parameter	Units	ANZECC 2000 guideline							Baseline data SW10				
		South-east Australia default triggers			Freshwater		Marine						
		NSW Lowland Rivers	Estuarine	Recreation	99% Protection	95% Protection	99% Protection	95% Protection	count	mean	min	max	80th percentile
Physiochemical parameters													
pH	-	6.5-8.5	7.0-8.5	6.5-8.5	-	-	-	-	26	7.72	5.78	9.79	8.19
Temperature	°C	-	-	-	-	-	-	-	27	19.7	15.5	24.5	22.1
Conductivity	µS/cm	125-2,200	-	-	-	-	-	-	27	684	111	4830	510
Oxidation Reduction Potential	mV	-	-	-	-	-	-	-	26	338	249	470	375
Dissolved Oxygen	mg/L	-	-	>6.5	-	-	-	-	27	12.4	5.6	65.2	10.2
Dissolved Oxygen	% sat	85-110	80-110	>80	-	-	-	-	-	-	-	-	-
Turbidity	NTU	6-50	0.5-10	-	-	-	-	-	23	19	1	93	25
Chemical analytes													
Ammonia as N	µg/L	20	15	10	320	900	500	910	-	-	-	-	-
Nitrogen (Total Oxidised)	mg/L	0.04	0.015	10/1	-	-	-	-	-	-	-	-	-
Nitrogen (Total)	mg/L	0.35	0.3	-	-	-	-	-	-	-	-	-	-
Phosphorous filterable reactive (P)	mg/L	0.02	0.005	-	-	-	-	-	1	0.025	0.025	0.025	0.025
Reactive Phosphorus as P	mg/L	0.02	0.005	-	-	-	-	-	2	0.005	0.005	0.005	0.005
Phosphorus (Total)	mg/L	0.025	0.03	-	-	-	-	-	2	0.025	0.025	0.025	0.025
Arsenic	mg/L	-	-	0.05	0.001/0.0008	0.024/0.013	ID	ID	3	0.0042	0.0026	0.005	0.005
Cadmium	mg/L	-	-	0.005	0.00006	0.0002	0.0007	0.0055	19	0.0005	0.0005	0.0005	0.0005
Chromium (III+VI)	mg/L	-	-	0.05	ID/0.00001	ID/0.001	0.008/0.00014	0.027/0.0044	7	0.0009714	0.0005	0.0038	0.0038
Copper	mg/L	-	-	1	0.0010	0.0014	0.0003	0.0013	1	0.036	0.036	0.036	0.036
Ferrous Iron	mg/L	-	-	0.3	ID	ID	ID	ID	4	0.025	0.025	0.025	0.025
Iron	mg/L	-	-	0.3	ID	ID	ID	ID	1	2.57	2.57	2.57	2.57
Lead	mg/L	-	-	0.05	0.001	0.0034	0.0022	0.0044	3	0.0087333	0.005	0.0162	0.0162
Manganese	mg/L	-	-	0.1	1.2	1.9	ID	ID	2	0.0575	0.005	0.11	0.11
Mercury	mg/L	-	-	0.001	0.00006	0.0006	0.0001	0.0004	27	7.778E-06	0.000005	0.00008	0.00008
Nickel	mg/L	-	-	0.1	0.008	0.011	0.007	0.07	6	0.0008083	0.00025	0.0036	0.0036
Zinc	mg/L	-	-	5	0.0024	0.008	0.007	0.015	1	0.134	0.134	0.134	0.134

Parameter	Units	ANZECC 2000 guideline							Baseline data SW10				
		South-east Australia default triggers			Freshwater		Marine						
		NSW Lowland Rivers	Estuarine	Recreation	99% Protection	95% Protection	99% Protection	95% Protection	count	mean	min	max	80th percentile
Benzene	µg/L	-	-	10	600	950	500	700	29	0.5	0.5	0.5	0.5
Ethylbenzene	µg/L	-	-	-	ID	ID	ID	ID	29	1	1	1	1
Toluene	µg/L	-	-	-	ID	ID	ID	ID	29	1	1	1	1
Xylene (m & p)	µg/L	-	-	-	ID	ID	ID	ID	29	1	1	1	1
Xylene (o)	µg/L	-	-	-	200	350	ID	ID	29	1	1	1	1
Xylene Total	µg/L	-	-	-	-	-	-	-	29	1	1	1	1
Naphthalene	µg/L	-	-	-	2.5	16	50	70	29	2.5	2.5	2.5	2.5
C6-C10	mg/L	-	-	-	-	-	-	-	29	0.01	0.01	0.01	0.01
C6-C10 less BTEX (F1)	mg/L	-	-	-	-	-	-	-	29	0.01	0.01	0.01	0.01
F2-NAPHTHALENE	mg/L	-	-	-	-	-	-	-	29	0.05	0.05	0.05	0.05
C10-C16	mg/L	-	-	-	-	-	-	-	29	0.05	0.05	0.05	0.05
C16-C34	mg/L	-	-	-	-	-	-	-	28	0.05	0.05	0.05	0.05
C34-C40	mg/L	-	-	-	-	-	-	-	29	0.05	0.05	0.05	0.05
C10 - C40 (Sum of total)	mg/L	-	-	-	-	-	-	-	26	0.05	0.05	0.05	0.05
C6 - C9	mg/L	-	-	-	-	-	-	-	29	0.01	0.01	0.01	0.01
C10 - C14	mg/L	-	-	-	-	-	-	-	29	0.025	0.025	0.025	0.025
C15 - C28	mg/L	-	-	-	-	-	-	-	29	0.05	0.05	0.05	0.05
C29-C36	mg/L	-	-	-	-	-	-	-	29	0.025	0.025	0.025	0.025
+C10 - C36 (Sum of total)	mg/L	-	-	-	-	-	-	-	29	0.025	0.025	0.025	0.025

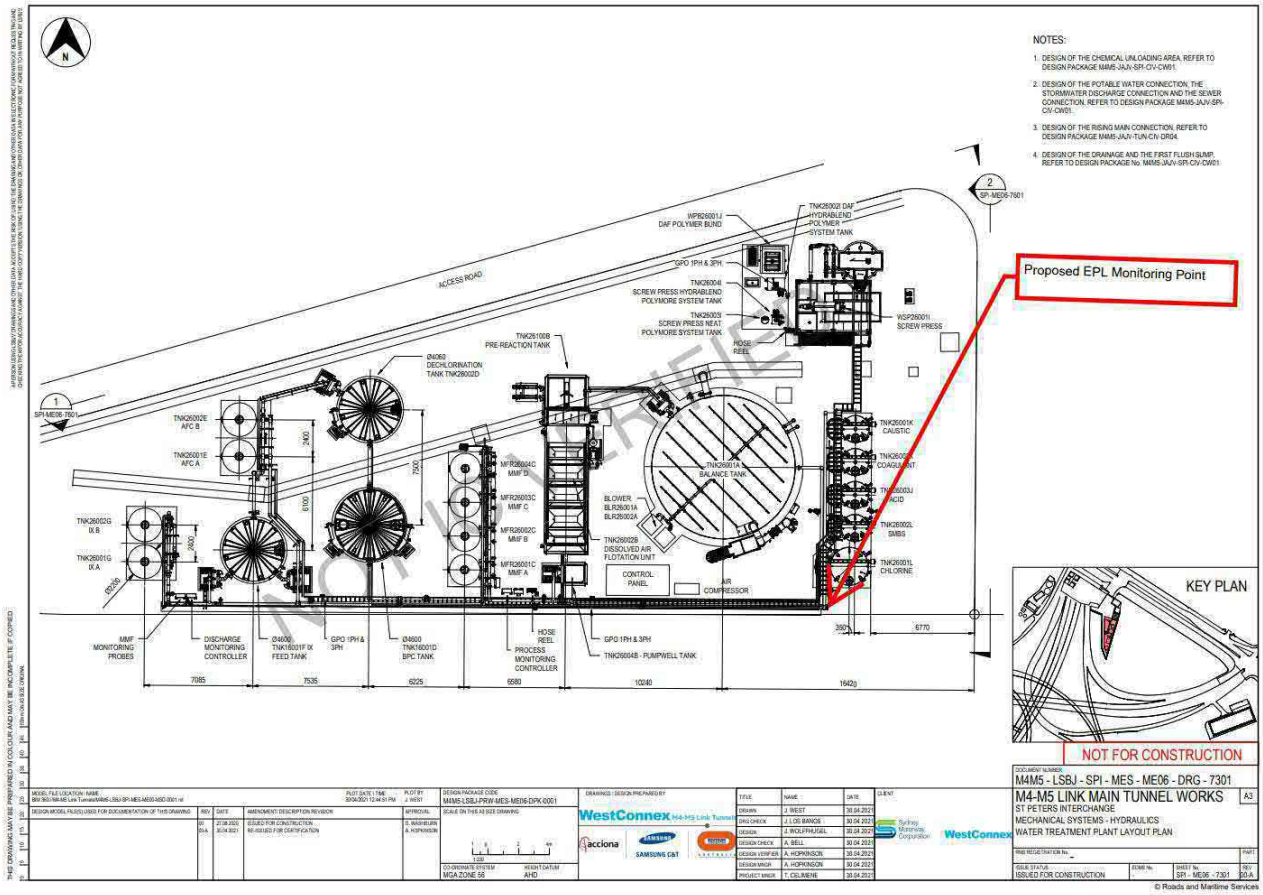
Parameter	Units	ANZECC 2000 guideline							Baseline data SW15				
		South-east Australia default triggers			Freshwater		Marine						
		NSW Lowland Rivers	Estuarine	Recreation	99% Protection	95% Protection	99% Protection	95% Protection	count	mean	min	max	80th percentile
Physiochemical parameters													
pH	-	6.5-8.5	7.0-8.5	6.5-8.5	-	-	-	-	27	7.46	5.65	7.97	7.89
Temperature	˚C	-	-	-	-	-	-	-	27	20.14	15.70	25.10	24.17
Conductivity	µS/cm	125-2,200	-	-	-	-	-	-	27	42066.69	402.90	52314.60	49676.20
Oxidation Reduction Potential	mV	-	-	-	-	-	-	-	27	320.17	28.70	590.00	386.24
Dissolved Oxygen	mg/L	-	-	>6.5	-	-	-	-	27	7.40	0.16	66.20	6.57
Dissolved Oxygen	% sat	85-110	80-110	>80	-	-	-	-	-	-	-	-	-
Turbidity	NTU	6-50	0.5-10	-	-	-	-	-	24	4.93	0.00	18.70	9.02
Chemical analytes													
Ammonia as N	µg/L	20	15	10	320	900	500	910	-	-	-	-	-
Kjeldahl Nitrogen Total	mg/L	-	-	-	-	-	-	-	17	0.25	0.25	0.25	0.25
Nitrite (as N)	mg/L	-	-	-	-	-	-	-	19	0.005	0.005	0.005	0.005
Nitrogen (Total Oxidised)	mg/L	0.04	0.015	10/1	-	-	-	-	-	-	-	-	-
Nitrogen (Total)	mg/L	0.35	0.3	-	-	-	-	-	18	2541.6667	250	41500	250
Reactive Phosphorus as P	mg/L	0.02	0.005	-	-	-	-	-	2	0.005	0.005	0.005	0.005
Phosphorus (Total)	mg/L	0.025	0.03	-	-	-	-	-	16	0.025	0.025	0.025	0.025
Arsenic	mg/L	-	-	0.05	0.001/0.0008	0.024/0.013	ID	ID	11	0.0047545	0.0023	0.005	0.005
Cadmium	mg/L	-	-	0.005	0.00006	0.0002	0.0007	0.0055	23	0.0005	0.0005	0.0005	0.0005
Chromium (III+VI)	mg/L	-	-	0.05	ID/0.00001	ID/0.001	0.008/0.00014	0.027/0.0044	21	0.0005	0.0005	0.0005	0.0005
Copper	mg/L	-	-	1	0.0010	0.0014	0.0003	0.0013	10	0.0047	0.002	0.005	0.005
Ferrous Iron	mg/L	-	-	0.3	ID	ID	ID	ID	13	0.025	0.025	0.025	0.025
Iron	mg/L	-	-	0.3	ID	ID	ID	ID	9	0.0534444	0.05	0.081	0.05
Lead	mg/L	-	-	0.05	0.001	0.0034	0.0022	0.0044	10	0.00463	0.0013	0.005	0.005
Manganese	mg/L	-	-	0.1	1.2	1.9	ID	ID	8	0.00515	0.005	0.0062	0.005
Mercury	mg/L	-	-	0.001	0.00006	0.0006	0.0001	0.0004	28	0.000005	0.000005	0.000005	0.000005
Nickel	mg/L	-	-	0.1	0.008	0.011	0.007	0.07	14	0.000275	0.00025	0.0006	0.00025
Zinc	mg/L	-	-	5	0.0024	0.008	0.007	0.015	7	0.0244286	0.015	0.026	0.026

Parameter	Units	ANZECC 2000 guideline							Baseline data SW15				
		South-east Australia default triggers			Freshwater		Marine						
		NSW Lowland Rivers	Estuarine	Recreation	99% Protection	95% Protection	99% Protection	95% Protection	count	mean	min	max	80th percentile
Benzene	µg/L	-	-	10	600	950	500	700	31	0.5	0.5	0.5	0.5
Ethylbenzene	µg/L	-	-	-	ID	ID	ID	ID	31	1	1	1	1
Toluene	µg/L	-	-	-	ID	ID	ID	ID	30	1	1	1	1
Xylene (m & p)	µg/L	-	-	-	ID	ID	ID	ID	29	1	1	1	1
Xylene (o)	µg/L	-	-	-	200	350	ID	ID	29	1	1	1	1
Xylene Total	µg/L	-	-	-	-	-	-	-	28	1	1	1	1
Naphthalene	µg/L	-	-	-	2.5	16	50	70	31	2.5	2.5	2.5	2.5
C6-C10	mg/L	-	-	-	-	-	-	-	30	0.01	0.01	0.01	0.01
C6-C10 less BTEX (F1)	mg/L	-	-	-	-	-	-	-	31	0.01	0.01	0.01	0.01
F2-NAPHTHALENE	mg/L	-	-	-	-	-	-	-	31	0.05	0.05	0.05	0.05
C10-C16	mg/L	-	-	-	-	-	-	-	31	0.05	0.05	0.05	0.05
C16-C34	mg/L	-	-	-	-	-	-	-	31	0.05	0.05	0.05	0.05
C34-C40	mg/L	-	-	-	-	-	-	-	31	0.05	0.05	0.05	0.05
C10 - C40 (Sum of total)	mg/L	-	-	-	-	-	-	-	29	0.05	0.05	0.05	0.05
C6 - C9	mg/L	-	-	-	-	-	-	-	31	0.01	0.01	0.01	0.01
C10 - C14	mg/L	-	-	-	-	-	-	-	30	0.025	0.025	0.025	0.025
C15 - C28	mg/L	-	-	-	-	-	-	-	31	0.05	0.05	0.05	0.05
C29-C36	mg/L	-	-	-	-	-	-	-	31	0.025	0.025	0.025	0.025
+C10 - C36 (Sum of total)	mg/L	-	-	-	-	-	-	-	30	0.025	0.025	0.025	0.025

Annexure B Construction phase SWQ monitoring results

Upstream: SW10								Downstream: SW15/LSB01							
Parameter	Temp (°C)	pH	ORP (mV)	EC (mS/cm)	Turbidity (NTU)	DO (%)	TDS (g/L)	**Parameter**	Temp (°C)	pH	ORP (mV)	EC (mS/cm)	Turbidity (NTU)	DO (%)	TDS (g/L)
Sample Count	45	45	45	45	45	45	45	**Sample Count**	45	45	45	45	45	45	45
Min	12.8	7.2	2.7	0.2	1.2	54.4	0.1	**Min**	11.7	6.8	-81.0	0.9	2.1	16.7	0.5
Mean	19.5	8.1	145.8	0.6	83.9	88.4	0.3	**Mean**	19.2	7.6	125.8	25.3	24.9	65.3	13.6
Median	19.4	8.1	140.0	0.6	5.3	81.7	0.3	**Median**	19.1	7.6	130.0	28.3	9.5	61.6	16.0
Max	28.0	9.4	417.0	1.3	3172.0	195.1	0.7	**Max**	28.4	8.8	417.0	56.9	504.0	178.9	34.2

Annexure C Monitoring Location Guide



Annexure H Operational Groundwater Management Plan and Monitoring Program

WestConnex M4-M5 Link Mainline Tunnels

Operational Groundwater Management Plan

Project:	M4-M5 Link Mainline Tunnels – Design and Construct
Contract Number:	TBC
Document Number:	M4M5-LSBJ-PRW-GEN-OP01-PLN-0003
Revision Date:	November 2022

Document Approval

Rev	Date	Prepared by	Reviewed by	Remarks
00	15/09/2022	ASBJV	DPE	
01	02/11/2022	ASBJV	DPE	Update to address DPE feedback

WestConnex

Table of Contents

Annexures

Tables

Figures

Glossary of terms

Term/acronym	Definition
AIP	NSW Aquifer Interference Policy (NSW Office of Water 2012)
ANZECC	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ARI	Annual Rainfall Index
Asset	M4-M5 Link Mainline Tunnels between the M4 at Haberfield and the M8 at St Peters.
CoA	Conditions of Approval
CSSI	Critical State Significant Infrastructure
DAF	Dissolved Air Flotation
DLWC	Department of Land and Water Conservation
DPE	NSW Department of Planning and Environment (now DPE)
DPI	NSW Department of Primary Industries
DPE	NSW Department of Planning, Industry and Environment (formerly DPE)
DPE Water	NSW Department of Industry Water (formerly DPI Water)
DWE	NSW Department of Water and Energy
EC	Electrical Conductivity
EIS	Environmental Impact Statement
EMS	Environmental Management System
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
GDE	Groundwater Dependent Ecosystems
GWL	Groundwater Level
GWQ	Groundwater Quality (EC)
HSS	Hawkesbury Sandstone
I&M	Incident and Maintenance
I&M Contractor	TBC
KPI	Key performance indicator
LPS	Low Point Sump
mAHD	elevation in metres with respect to the Australian Height Datum
mBTOC	metres below top of casing
mBGL	Metres below ground level
NATA	National Association of Testing Authorities
NEPM	National Environment Protection Measure
NRAR	Natural Resources Access Regulator (formerly part of DPI Water)
NSW	New South Wales
OEMP	Operational Environmental Management Plan
OGMP	Operational Groundwater Management Sub-Plan
OGWMP	Operational Groundwater Monitoring Program
ORP	Oxidation Redox. Potential
POEO Act	Protection of the Environment Operations Act 1997

Term/acronym	Definition
PPE	Personnel Protective Equipment
QA	Quality Assurance
REMM	Revised Environmental Management Measures
SDS	Safety Data Sheet
SOP	Standard Operating Procedure
SP	Standpipe piezometer
SPIR	Submissions and Preferred Infrastructure Report
SSTV	Site Specific Trigger Value
µS/cm	micro-Siemens per centimetre
VWP	Vibrating Wire Piezometer
WTP	Water Treatment Plant

1 Introduction

1.1 Context

This Operational Groundwater Management Sub-plan (OGMP) forms part of the Operation Environmental Management Plan (OEMP) for the M4-M5 Link Mainline Tunnels (the Asset). This document also includes the Operational Groundwater Monitoring Program (OGWMP).

This OGMP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the WestConnex M4-M5 Link Environmental Impact Statement (EIS), the revised environmental management measures (REMM) listed in the Project Submissions and Preferred Infrastructure Report (SPIR), the WestConnex M4-M5 Link Mainline Tunnel Modification reports and all applicable legislation.

1.2 Asset background

The M4-M5 Link EIS (AECOM 2017) initially assessed the impacts of construction and operation of the Project on groundwater, within Chapter 19 and Appendix T (Technical working paper: Groundwater). Groundwater impacts have been further assessed during the design and construction of the Project and are summarised in Section 4.2

Both the EIS and Project groundwater investigations identified the potential for impacts on groundwater during operation typically associated with drawdown and changes to water quality. However, they concluded any potential impacts could be managed by the environmental control measures described in this OGMP.

Please refer to Section 2 of OEMP for Asset description.

1.3 Scope of the Sub-plan

The scope of this OGWMP is specific to the operation of the Asset and outlines how the Incident and Maintenance (I&M) Contractor propose to manage and protect groundwater as described in the EIS.

1.4 Implementation of the Sub-plan

The OEMP Sub-plans must be submitted to the Secretary for approval no later than one (1) month prior to the commencement of the operation. Any of the OEMP Sub-plans may be submitted to the Secretary along with, or subsequent to, the submission of the OEMP.

Operation must not commence until the required Operational Monitoring Programs have been approved by the Secretary, and all the relevant baseline data has been collected in accordance with CoA D15.

Operational documents, as approved by the Secretary, and as amended from time to time, must be implemented for the duration of operation. Where the CSSI is being staged, operation of that stage is not to commence until the relevant OEMP, OEMP sub-plans and monitoring programs have been approved by the Secretary.

1.5 Environmental management system overview

The environmental management system overview is described in Section 5.1 of the OEMP.

2 Purpose and objectives

2.1 Purpose

The purpose of this Plan is to describe how the I&M Contractor proposes to manage and protect groundwater during operation of the Project. This Plan should be read in conjunction with the OEMP.

2.2 Objectives

The key objective of the OGMP is to ensure all CoA, REMM, and licence/permit requirements relevant to groundwater during operation are described, scheduled, and assigned responsibility as outlined in:

- The EIS prepared for WestConnex M4-M5 Link
- The SPIR prepared for WestConnex M4-M5 Link
- The Modification reports for WestConnex M4-M5 Link Mainline Tunnel
- CoA granted to the Project on 17 April 2018 and as altered by the Modification reports
- The Roads and Maritime Services (Roads and Maritime) specifications G36, G38 and G40
- The Project's Environment Protection Licence (EPL)
- All relevant legislation and other requirements described in Section 3 of this Plan.

2.3 Environmental performance outcomes and targets

The targets presented in Table 2-1 have been established for the management of groundwater during operation of the Asset. Key performance indicators (KPIs) have been established for these targets.

Table 2-1: KPIs for groundwater management during operation

Target / KPI number	Target	KPI	Records	Source
GW1	Groundwater management during the operation phase of the Project performed in accordance with this OGMP	Compliance with OGMP	Operational Monitoring Reports Audit Reports	CoA
GW2	Water Treatment Plant (WTP) discharge within defined water quality discharge criteria	Treated water will be of suitable quality for discharge to the receiving environment	Water quality monitoring results Discharge records	CoA / EPL
GW3	Groundwater changes in level and salinity in line with EIS and Asset Groundwater Model	Groundwater drawdown consistent with model predictions	Groundwater monitoring results	EIS Appendix A (project performance outcome)
GW4	Minimal impacts on groundwater quality during the Project operation	No measurable decline in water quality of receiving waters outside of predictions	Groundwater monitoring results	EIS Appendix A (project performance outcome)

Target / KPI number	Target	KPI	Records	Source
GW5	Groundwater monitoring during the operation phase of the project performed in accordance with the Operation Groundwater Monitoring Program (OGWMP) (refer to Annexure A)	Compliance with OGWMP	Operational Monitoring Reports	CoA

3 Environmental obligations

3.1 Legislation

All legislation relevant to this OGMP is described Section 4.1.3 of the OEMP.

3.2 Guidelines and standards

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

- Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC): National Water Quality Management Strategy, Paper No. 4, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1, The Guidelines (ANZECC 2000)
- Environment Protection Authority (EPA): Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (EPA 2004)
- Department of Planning and Environment (DPE): Guideline for riparian corridors on waterfront land (DPE 2012)
- Department of Land and Water Conservation (DLWC):
  - NSW Groundwater Dependent Ecosystems Policy (DLWC 2002)
  - NSW Groundwater Policy Framework Document (DLWC 1998)
  - NSW Groundwater Quality Protection Policy (DLWC 1998)
  - NSW Groundwater Quantity Management Policy (DLWC 2007)
- Department of Water and Energy (DWE): NSW Water Extraction Monitoring Policy (DWE 2007)
- NSW Office of Water (NoW):
  - NSW Aquifer Interference Policy (NoW 2012)
  - Water Sharing Plan, Greater Metropolitan Regional Groundwater Sources Background Document, Sydney (NoW 2011)

3.3 Conditions of approval

Conditions of Approval (CoA) relevant to groundwater management during operation and maintenance activities are included in Table 3-1. A cross-reference is included to indicate where the condition is addressed in this OGMP or other project management documents.

Table 3-1: Relevant Conditions of Approval

CoA	Relevant requirement	Reference
D3(a)	Where an OEMP is required, the Proponent must include the following OEMP Sub-plans in the OEMP: (a) Groundwater management - DPI Water and Sydney Water	This document
D4	Each of the OEMP Sub-plans must include the information set out in Condition D2 (a), (b) and (c). The OEMP Sub-plans must be developed in consultation with relevant authorities as identified in Condition D3.	Section 3.5

CoA	Relevant requirement		Reference
	D2	An OEMP is not required for the CSSI if the Proponent has an Environmental Management System (EMS) or equivalent as agreed with the Secretary, and can demonstrate, to the written satisfaction of the Secretary, that through the EMS: (a) the performance outcomes, commitments and mitigation measures, detailed in the documents listed in Condition A1, and specified relevant terms of this approval, can be achieved;	Sections 2.3 and 3
		(b) issues identified through ongoing risk analysis can be managed; and	Sections 4 and 5
		(c) procedures are in place for rectifying any non-compliance with this approval identified during compliance auditing, incident management or any other time during operation	Section 6
D5	The OEMP Sub-plans must be submitted to the Secretary as part of the OEMP.		Section 1.4
D8	The following Operational Monitoring Programs must be prepared in consultation with the relevant authorities identified for each Operational Monitoring Program to compare actual operational performance against predicted performance. (b) Groundwater Monitoring Program - DPI Water, relevant council(s), EPA and Sydney Water		Section 2.3 of OGWMP (Annexure A)
D9	Each operational monitoring program must include: (a) details of baseline data;		Section 3 of OGWMP (Annexure A)
	(b) details of all monitoring of the project to be undertaken;		Section 4 of OGWMP (Annexure A)
	(c) the parameters of the project to be monitored;		Section 4 of OGWMP (Annexure A)
	(d) the frequency of monitoring to be undertaken;		Section 4 of OGWMP (Annexure A)
	(e) the location of monitoring;		Section 4 of OGWMP (Annexure A)
	(f) the reporting of monitoring and analysis results against relevant criteria;		Sections 4 and 6 of OGWMP (Annexure A)
	(g) details of the methods that will be employed to analyse the monitoring data;		Section 5 of OGWMP (Annexure A)
	(h) procedures to identify and implement additional mitigation measures where results of monitoring are unsatisfactory; and any consultation to be undertaken in relation to the monitoring programs.		Sections 2.2 and 4.1 of OGWMP (Annexure A)
D11	The Operational Groundwater Monitoring Program must include: (a) daily measurement of the amount of water discharged from all water treatment plants;		Section 4.3 of OGWMP (Annexure A)
	(b) water quality testing results of the water discharged from all water treatment plants;		Section 4.3 of OGWMP (Annexure A)
	(c) monitoring of groundwater pore pressures in the Hawkesbury Sandstone aquifers adjacent to the tunnel alignment, in consultation with DPI Water		Section 4.1 of OGWMP (Annexure A)

CoA	Relevant requirement	Reference
D11	(d) monitoring of groundwater electrical conductivity in key locations between saline water bodies and the tunnel as identified by the project groundwater model including: (i) in the Haberfield / Lilyfield area to the south of Iron Cove, (v) in the St Peters area to the north west of Alexandra Canal, with a minimum of two (2) groundwater monitoring wells provided in each key location in consultation with DPI Water;	Section 4.1 of OGWMP (Annexure A)
	(e) measures to record or otherwise estimate and report groundwater inflows into the tunnels;	Sections 4.2 and 6 of OGWMP (Annexure A)
	(f) a method for providing the data collected in (a) and (b) to Sydney Water every three (3) months to demonstrate the project's compliance with the discharge criteria and, if applicable, the Proponent's trade waste licence;	Section 6 of OGWMP (Annexure A)
	(g) a process for annually forwarding data on the monthly volume of groundwater discharged from each water treatment plant to DPI Water for a minimum period of five (5) years, consistent with Condition D12; and	Section 6 of OGWMP (Annexure A)
D12	Groundwater monitoring must continue for a period of at least five (5) years following the completion of construction of the Rozelle Interchange (and commence once the mainline tunnels are operational). At least one (1) month prior to the end of the five (5) year monitoring period, the Proponent must undertake a review of future monitoring requirements in consultation with DPI Water. The review must determine if additional monitoring is required, and the time period for continued monitoring. The Proponent must notify the Secretary within two (2) weeks of the review as to the outcomes of the review and any requirements for future monitoring.	Sections 4 and 6 of OGWMP (Annexure A)
D13	The Operational Monitoring Programs must be developed in consultation with relevant authorities as identified in Condition D8 of this approval.	Section 2.3 of OGWMP (Annexure A)
D14	The Operational Monitoring Programs must be submitted to the Secretary for approval at least one (1) month prior to the commencement of operation.	Section 1.3 of OGWMP (Annexure A)
D15	Operation must not commence until the Secretary has approved all of the required Operational Monitoring Programs, and all relevant baseline data has been collected.	Section 1.3 of OGWMP (Annexure A)
D16	The Operational Monitoring Programs, as approved by the Secretary, must be implemented for the duration identified in the relevant Operational Monitoring Program or specified by the Secretary, whichever is the greater.	Section 1.3 of OGWMP (Annexure A)
D17	The results of the Operational Monitoring Programs must be submitted to the Secretary, and relevant regulatory authorities, for information in the form of an Operational Monitoring Report at the frequency identified in the relevant Operational Monitoring Program.	Section 6 of OGWMP (Annexure A)
D18	Where a relevant OEMP Sub-plan exists, the relevant Operational Monitoring Program may be incorporated into that OEMP Sub-plan.	OGWMP is contained in Annexure A of this document
E187	The CSSI operational water treatment plant discharge criteria must comply with the ANZECC (2000) 95 per cent species protection level and a 99 per cent protection level for contaminants that bioaccumulate unless other discharge criteria are agreed in consultation with relevant stakeholders including EPA, DPI Water and Sydney Water. Discharge criteria for iron during operation must comply with the ANZECC (2000) recreational water quality criteria.	Section 5.5
E190	The Proponent must take all practicable measures to limit operational groundwater inflows into each tunnel to no greater than one litre per second across any given kilometre (1L/s/km). Compliance with this condition cannot be determined by averaging groundwater inflows across the length of the tunnel.	Section 5.1 and 5.2

CoA	Relevant requirement	Reference
E191	The Proponent must identify and commit to the implementation of 'make good' provisions for groundwater users in the event of a decline in water supply levels, quality and quantity from registered existing bores associated with groundwater changes from either construction and/or ongoing operational dewatering caused by the CSSI.	Sections 3.5 and 4.2.3.3

3.4 Revised environmental management measures

The revised environmental management measures (REMMs) included in the WestConnex M4-M5 Link Submissions and Preferred Infrastructure Report that are relevant to the management of groundwater during the operations and maintenance of the Asset are included in Table 3-2.

Table 3-2: Relevant revised environmental management measures

No.	Relevant requirement	Reference
OSW16	The operational water treatment facilities will be designed and managed such that effluent will be of suitable quality for discharge to the receiving environment. Discharge criteria will be developed in accordance with the ANZECC (2000) and relevant NSW WQOs, including the following discharge criteria: • 0.3 milligrams per litre for iron • 1.9 milligrams per litre for manganese. The discharge criteria for the treatment facilities will be nominated during detailed design in consultation with relevant stakeholders and included in the OEMP.	Section 5.5
GW2	Appropriate waterproofing measures will be identified and included in the detailed design to permanently, where reasonable and feasible, reduce the inflow into the tunnels to below one litre per second per kilometre for any kilometre length of the tunnel.	Section 5.1 and 5.2
OGW10	The groundwater monitoring program prepared and implemented during construction will be augmented and continued during the operational phase. Groundwater will be monitored during the operations phase for three years or as otherwise required by the project conditions of approval and will include trigger levels for response or remedial action based on monitoring results and relevant performance criteria.	Section 4 of OGWMP (Annexure A)
	At least three monitoring wells and vibrating wire piezometers (VWPs) should be constructed as close as possible to the tunnel centrelines to allow for the comparison of pore pressures and standing water levels. The wells could be constructed about 5-10 metres above the top of the tunnel crown to allow for groundwater drawdown monitoring in the Hawkesbury Sandstone.	Section 4.1.1 of OGWMP (Annexure A)
	The program will include procedures for monitoring and reporting of extracted groundwater volumes to DPI-Water annually for the duration of construction and operation, unless otherwise agreed to or directed by the Secretary. The operational groundwater monitoring program will be developed in consultation with the NSW EPA, DPI-Water and the relevant councils and documented in the OEMP or EMS.	Sections 2.3 and 6 of OGWMP (Annexure A)
OGW11	Where the corrosion assessment that will be carried out prior to construction indicates potential issues, corrosion and other associated impacts of highly aggressive groundwater on the tunnel infrastructure will be monitored during operations. The monitoring program will be documented in the OEMP or EMS. Corroded or otherwise impacted infrastructure will be repaired or replaced as required to maintain operational integrity of the road infrastructure.	Sections 4.2.4.1 and 5.2
OGW12	In accordance with the NSW Aquifer Interference Policy (DPI-Water 2012), measures will be taken to 'make good' the impact on an impacted water supply bore by restoring the water supply to pre-development levels. The measures taken will be dependent upon the location of the impacted bore but could include, for example, deepening the bore, providing a new bore or providing an alternative water supply.	Sections 3.5 and 4.2.3.3

3.5 Aquifer Interference Policy

The Aquifer Interference Policy (AIP) was released in 2012 to address the assessment of potential impacts, and water licensing of aquifer interference activities within NSW. The AIP defines the regime for protecting and managing the impacts of aquifer interference activities on NSW's water resources. Approval for aquifer interference activities will not be granted unless the Minister is satisfied that adequate arrangements are in place to ensure that no more than minimal harm will be done to any water source, or its dependent ecosystems as a consequence of the interference.

The 'minimal impact considerations' are employed to assess impacts to water table levels, water pressure levels and water quality in different groundwater systems. If the predicted impacts are less than 'Level 1 minimal impact considerations' as defined in the AIP, then these impacts are considered acceptable. However, if impacts exceed the 'Level 1' thresholds then monitoring must be undertaken and mitigation measures such as 'make good' provisions may be required for impacted sources and receptors. As the Asset will intercept groundwater during operation, it is defined as an aquifer interference activity under the AIP.

The majority of the groundwater around the Asset is considered to be in the 'less productive' groundwater source category as defined in the AIP, based on the low number of registered groundwater users. The minimal impact assessment (AECOM 2017) indicates compliance with all 'Level 1' thresholds with the exceptions of groundwater drawdown at one registered bore in the vicinity of the Asset. As a result, 'make good' provisions in accordance with CoA E191 will be investigated in consultation with the bore owner (refer to Section 4.2.3.3).

3.6 Consultation

This Plan and the Operation Groundwater Monitoring Program (OGWMP) in Annexure A were provided to DPE Water and Natural Resources Access Regulator (NRAR) (formerly DoI Water), Sydney Water, City of Sydney Council, Inner West Council and the Environment Protection Authority (EPA) for review and comment in accordance with CoA D3 and D8(b).

Refer to Section 1.5 of the OEMP for consultation requirements relating to the OEMP, sub-plans and monitoring programs.

All community feedback, complaints and notification (including those relating to groundwater) will be managed in accordance with Section 7.3 of the OEMP.

4 Environmental aspects and impacts

4.1 Operational activities

Key aspects of the operation of the Asset that could result in adverse impacts to groundwater include:

- Dewatering of groundwater inflows into tunnels
- Operation of the Water Treatment Plant (WTP)

Environmental risks including those on groundwater will be identified, monitored and managed in accordance with Section 8 of the OEMP. Refer to the Aspects and Impacts Register included in Annexure D of the OEMP.

4.2 Potential Impacts

4.2.1 Overview

The potential for impacts on groundwater will be dependent on the nature, extent, and magnitude of operation activities and their interaction with the natural environment. Potential impacts in addition to those described in the EIS in relation to groundwater attributable to operation may include:

- Reduced groundwater recharge
- Groundwater level decline (drawdown due to tunnel inflows) including potential impacts on:
  - GDEs
  - Existing groundwater users
  - Surface water baseflow
  - Ground movement (settlement)
- Changes in groundwater quality, as a result of:
  - Intercepting contaminated groundwater
  - Saline intrusion

Groundwater impacts attributable to the operation of the Asset are anticipated and initially predicted in the baseline groundwater model (AECOM 2017). These predictions were refined as part of the detailed design of the Project (compliance with CoA E193/194) using a three-dimensional regional groundwater model (Golders Associates 2020) which also includes the M4 and M8 Motorways to ensure cumulative impacts were captured. The results of the model have been used to evaluate potential groundwater impacts associated with the operation of the Asset. They have also been used to inform the detailed design of the tunnel including durability, water treatment and ground improvement requirements.

4.2.2 Reduced groundwater recharge

The majority of the Asset is below ground and will not directly impact groundwater recharge.

The above ground footprint represents a small increase in built infrastructure including the motorway operations complexes, ventilation infrastructure, substations and WTP. Given the scale of the above ground footprint, a reduction in rainfall recharge is considered negligible (AECOM 2017).

4.2.3 Groundwater level decline

4.2.3.1 Groundwater inflows and drawdown

Operation of drained tunnels beneath the water table is expected to cause ongoing groundwater inflow to the tunnels, inducing groundwater drawdown along the tunnel alignment. Actual groundwater level drawdown would be dependent on a number of factors, including proximity to the tunnel alignment, the specific geological conditions present as well as any water treatment measures implemented during construction (AECOM 2017).

As expected, tunnel inflows were predicted to be greatest immediately after tunnel excavation and would decrease with time while the surrounding water table decline would gradually continue outwards from the tunnel until a steady state equilibrium is reached. At the commencement of operation, the majority of groundwater inflows are predicted to comply with the criteria of 1 litre per second across any given kilometre (1 L/sec/km) as required by CoA E190.

Modelling (Golders Associates 2020) indicated that two sections of tunnel may initially exceed inflow criteria of 1 L/s/km due to increased rock permeability associated with the Luna Park Fault and Hawthorne Canal high permeability zone. Observations during construction however showed the Luna Park Fault was generally dry and following the completion of ground improvement (i.e. grouting) works, Hawthorne Canal will comply with inflow criteria. Isolated locations, such as tunnel cross passage four and five at Haberfield, have seen higher than predicted groundwater inflows locally. These elevated inflows have been monitored during construction and will not impact the overall capacity of the WTP or Asset drainage system. Overall groundwater inflows are expected to be significantly lower than the initially forecast 17 L/sec on opening of the Asset Refer to Section 5.3 for details of reasonable and feasible measures such as ground improvement (i.e. grouting) implemented during construction to minimise groundwater inflows.

Groundwater drawdown and depressurisation of the aquifer along Asset alignment is expected to occur to elevations equivalent to tunnel inverts as expected for fully drained tunnels. Modelling suggests groundwater drawdowns will potentially extend laterally more than 2 km from the tunnel alignment, with greatest drawdowns occurring along permeable geological structures within the Hawkesbury Sandstone and Ashfield Shale. Long-term steady state drawdown predictions are shown in Figure 4-1.

Groundwater levels in bores along the tunnel alignment will be routinely monitored during operation and compared against predictions as detailed in the Operation Groundwater Monitoring Program (OGWMP) in Annexure A.

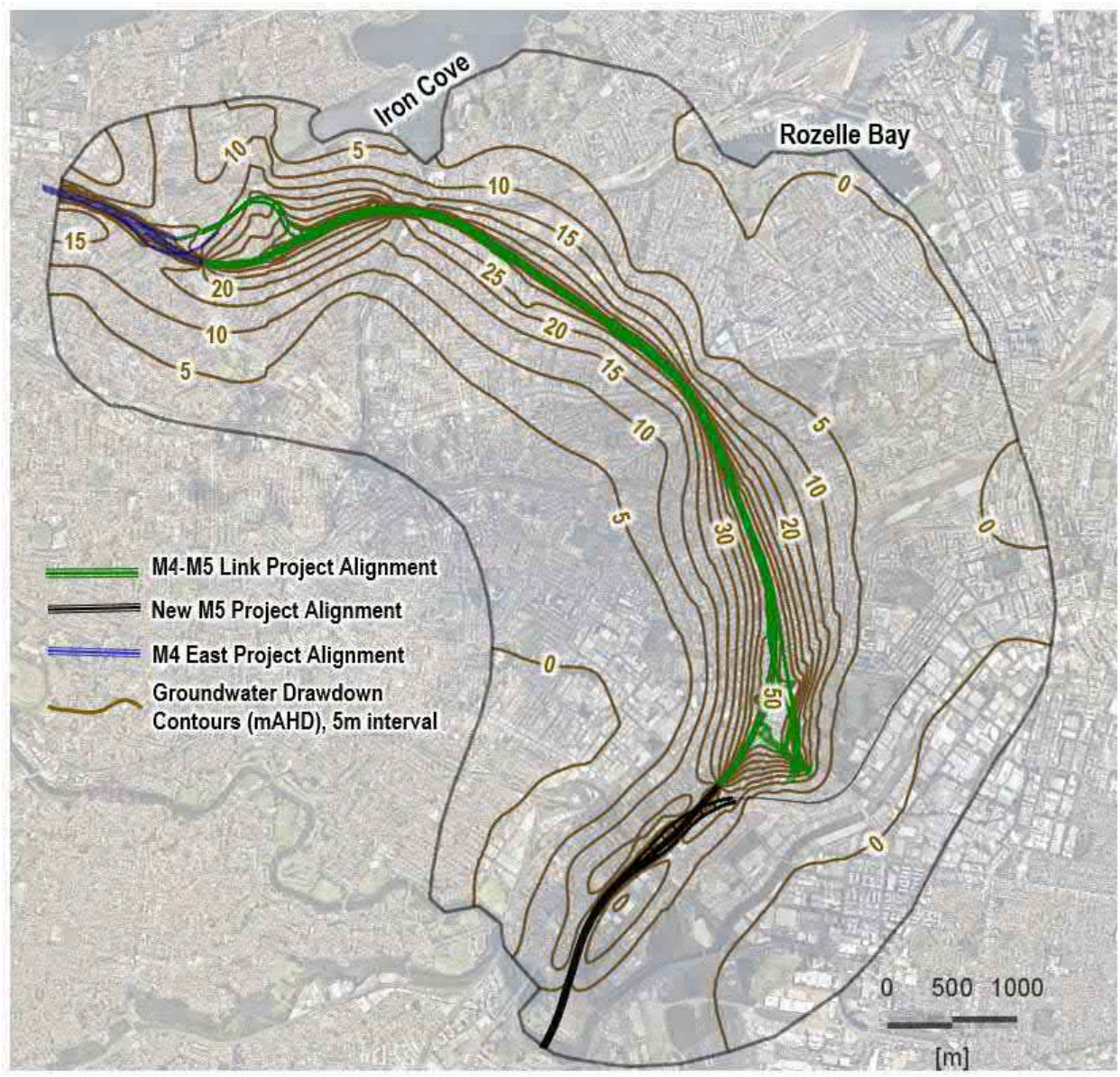


Figure 4-1: Predicted long-term groundwater drawdown (100 years after opening)

4.2.3.2 Potential impacts on groundwater dependent ecosystems (GDE)

Groundwater dependent ecosystems (GDE) are communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater, such as wetlands and vegetation on coastal sand dunes. Priority GDE are ecosystems with a high ecological value which are considered high priority for management action as defined in the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources (2011).

As identified in the EIS (AECOM, 2017) and construction-phase groundwater investigations, there are no priority GDE within 5 km of the Project alignment. No groundwater aquatic, terrestrial or subterranean GDE along or within 10 km of the Asset alignment were identified in the National Atlas of Groundwater Dependent Ecosystems. Consequently, no GDEs are likely to be impacted by groundwater level decline or changes to groundwater quality associated with the operation of the Asset.

4.2.3.3 Potential impacts on groundwater users

One bore registered for domestic use (GW110247) was identified within the Asset's hydrogeological zone of influence. GW110247 is a 210m deep bore constructed in 2009 at the University of Sydney at Camperdown. The land which the bore is located is now owned by Moore Theological College.

GW110247 is predicted to have a drawdown of approximately 5 m to the hydraulic head in Hawkesbury Sandstone during the design life of the tunnel (Golders Associates 2020). As detailed in Section 3.5, this predicted drawdown exceeds 'Level 1' minimal impact thresholds as defined in the NSW AIP (DPI Water 2012) and triggers the need implement 'make good' provisions in accordance with CoA E191 and REMM OGW12.

Consultation with the owner of the registered bore, confirmed GW112047 was decommissioned prior to developing the property in 2016. Therefore, groundwater drawdown associated with the operation of the Asset will have no impact as groundwater is no longer being used for domestic purposes and 'make good' provisions will not be required.

4.2.3.4 Potential impacts on surface water baseflows

Predicted long-term changes to baseflow from the groundwater modelling (Golders Associates 2020) indicate that the overall contribution to flow to surface watercourses from groundwater is relatively small, since the watercourses in the vicinity of the Asset are typically highly modified including concrete lined channels. AECOM (2017) concluded that flows of the creeks and canals is primarily derived from stormwater run-off and tidally driven flow rather than groundwater flow.

4.2.3.5 Groundwater movement (settlement)

Ground movement (settlement) or subsidence can be caused by the compression of the soil structure due to groundwater drawdown.

Within the Project footprint, residual soil profiles developed on the weathered Hawkesbury Sandstone and Ashfield Shale bedrock are typically relatively thin, stiff, and of low compressibility and as such would be less susceptible to ground settlement (AECOM 2017). In areas of alluvium such as Hawthorne Canal, sediments are more compressible and vary in thickness and are therefore more susceptible to potential settlement induced by groundwater drawdown. Groundwater levels will be monitored during operation in these areas of alluvial sediments as detailed in the OGWMP in Annexure A.

4.2.4 Groundwater quality

4.2.4.1 Intercepting contaminated groundwater

Contamination assessments and modelling indicates that groundwater from contaminant sources in the vicinity of Asset alignment may migrate to the tunnel during its design life. These contaminant sources include a range of former landfills and other industrial sources. Migration of contaminants such as ammonia would be induced by groundwater inflows towards the tunnel during operation.

The mobilisation of contaminated groundwater towards the tunnel has been considered in the design and construction of the Asset with secondary linings constructed in various locations to ensure the tunnel achieves the specified design life to prevent issues such as corrosion. Additional monitoring bores have also been installed in St Peters to monitor any potential contamination migration during operation and validate model predictions.

Any contaminated groundwater that inflows to the tunnel will be captured by the tunnel drainage system and treated by the water treatment plant (WTP) at St Peters Interchange as detailed in Sections 5.4 and 5.5 and discharged in accordance with an Environmental Protection Licence (EPL).

Contamination generated within the tunnels as result of incidents and spills is unlikely to impact on groundwater quality as flow gradients will be towards the tunnel. This contamination would also be captured within the tunnel drainage system and removed by the WTP.

4.2.4.2 Saltwater intrusion

Over time, groundwater drawdown and reduced hydraulic pressure in the aquifer is predicted to result in saline water flowing towards the tunnels.

In accordance with CoA E192, an assessment of potential saltwater intrusion using particle tracking was undertaken as part of the groundwater model (Golders Associates 2020). Saltwater migration from Iron Cove and Iron Cove Creek is predicted to reach the northern portion of the mainline tunnels and Wattle St ramps generally between 25 and 50 years. Saltwater is predicted to travel faster along Hawthorne Canal and is predicted to reach those tunnel sections within about 10 years. The groundwater model also indicates saline migration from Rozelle Bay is unlikely to occur due to the Asset. No saltwater intrusion was predicted from Alexandra Canal in St Peters.

As detailed in the EIS (AECOM, 2017), the areas where saltwater intrusion is predicted are located close to the shorelines and their groundwater composition is assumed to be consistent with the water in the Iron Cove. Therefore, groundwater quality impacts due to saltwater migration and considered negligible.

Groundwater quality (salinity as Electrical Conductivity (EC)) during operation will be routinely monitored at key locations between saline water bodies and the tunnel as identified by the groundwater model (Golders Associates 2020) including in the Haberfield / Lilyfield area to the south of Iron Cove and adjacent to Hawthorne Canal. Details of operational groundwater monitoring are presented in the OGWMP (Annexure A).

Changes to groundwater quality as a result of saltwater migration was considered in the design of the WTP. Water captured in the tunnel and treated by the WTP will be discharged to Alexandra Canal. Alexandra Canal is an estuary which drains into the Cooks River catchment and is tidally influenced by brackish conditions. Discharges of saline groundwater would be consistent with the existing water quality of Alexandra Canal and would therefore have no environmental impact.

Saltwater intrusion during the operation of the Asset was considered with tunnel design measures implemented to ensure durability during the entire 100 year design life (refer to Section 5.1).

5 Environmental Control measures

5.1 Tunnel design

The Project mainline tunnel was designed and constructed to meet the groundwater inflow criteria of 1 litre per second across any given kilometre (1 L/sec/km) using water-control treatments along the mainline tunnel. Five lining types were installed, depending on the ground conditions and the level of water ingress observed:

- Type A: shotcrete and rockbolts
- Type B: Type A + weepholes (where required), strip drains at >3000mm spacing and shotcrete
- Type C: Type A + weepholes (where required), strip drains at >500mm spacing and shotcrete
- Type D: Type B/C + spray-on membrane between the primary and secondary layers of shotcrete
- Type E: Type B + geotextile and sheet membrane between primary and secondary layers of shotcrete

Where specific areas within the tunnel were still likely to exceed the 1 L/sec/km criterion after the implementation of reasonable and feasible measures, consultation with, and agreement by DPE Water was sought.

The remaining ongoing inflow of groundwater into the tunnels will be managed through the tunnel drainage system, which has been designed to accommodate the capture, removal, treatment and discharge of groundwater.

Groundwater inflows during operation will be estimated and reported to relevant stakeholders. Further detail on groundwater inflow monitoring is detailed in Section 4.2 of the OGWMP (Annexure A).

5.2 Tunnel durability

As detailed in Section 4, groundwater quality assessments and modelling were undertaken to inform the durability design of all tunnel components to achieve the specified design life. These additional durability measures ensure Asset infrastructure will not be impacted or corroded by groundwater during operation and therefore, monitoring in accordance with REMM OGW11 is not required.

Additional action has also been taken in regards to the contaminant migration predicted in St Peters, where additional monitoring bores were installed to validate this prediction. Any potential contamination migration in this region will be detected in these bores before contaminated groundwater reaches the tunnel and its durability lining. This monitoring will also provide an early warning should conditions be observed to vary from those predicted and provide insight into any rectification works to be undertaken if required.

Durability for saline intrusion has been considered during the design phase and validation has occurred during the construction phase. Observed saline groundwater locations have been broadly consistent with assumptions in the design phase around Hawthorne canal and other areas of the Haberfield.

5.3 Ground improvement

In accordance with CoA E190 and REMM GW2, reasonable and feasible measures including ground improvement by grouting was undertaken in the tunnel and above ground where required to limit groundwater inflows and potential settlement risks during construction and operation.

Ground improvement by grouting aims to fill voids and fissures in the rock as much as practical to reduce and control groundwater inflows and achieve compliance with the criteria of 1 L/sec/km. Depending on the level of groundwater inflows predicted or observed during construction of the Asset, grouting was undertaken at one or combination of the following stages:

- Pre-excavation grouting from surface
- Pre-excavation grouting in the tunnel
- Post grouting in the tunnel.

Groundwater inflows and surrounding water levels during operation will monitored as detailed in Section 4 of the OGWMP (Annexure A).

5.4 Tunnel sump and pump

A sump with two separate chambers to capture groundwater, hydrocarbons and stormwater/deluge water within the tunnels is located at the Northern and Southern low points. The storage capacity of each sump is detailed in 1 and has been designed to store the following concurrent water inputs.

- First flush surface water flows outside tunnel portals
- Liquid tanker spill
- Fire-fighting foam in spill containment
- Deluge water generated by twenty minutes operation of the fire protection system
- Groundwater ingress (including from other interfacing WestConnex stages).

The Northern Low Point Sump is located adjacent the cross passage and Substation on the Northbound side under Haberfield and the Southern Low Point Sump adjacent to the cross passage on the Southbound side under Camdenville Park as shown in Figure 5-1.

Water captured in the Northern sump will be pumped over the high point in the tunnel, into the drainage pipes, and will gravity flow into the Southern sump. The Southern Sump will pump water to the Water Treatment Plant (WTP) on the surface at St Peter's Interchange for treatment prior to discharge under the requirements of an EPL.

The sumps capture and transfer all liquids from within the tunnels (groundwater, washdown, deluge water and hydrant water) as well as any stormwater ingress from the daylight portals. The two chambers consist of the Minor Flows Sump and the High Flows Sump.

The Minor Flows Sump allows the pumping of minor inflows (predominately groundwater and first flush from the tunnel portal) to the WTP. As the inflow to the Minor Flows Sump increases (either during normal operation, deluge, or a critical event), the water level in the sump will rise and overtop the under/over weirs into the High Flow Storage Sump. The under/over weir system will trap hydrocarbons (including those from a major spill) in the Minor Flow Sump. Foam suppression will also be triggered on detection of hydrocarbons in the Minor Flow Sump to reduce combustion risks.

Table 5-1 Low point sump capacity

Water input	Northern sump (m^3)	Southern sump (m^3)
Minor Flow: Groundwater inflow and hydrocarbon spill storage	66	66
High Flow: Buffer storage for high flow events	440	423

WestConnex M4-M5 Link Mainline Tunnels

Figure 5-1: Tunnel Low Point Sumps, Operational WTP and Discharge Location

Legend

- Tunnel Alignment
- Tunnel Low Point Sump
- Water Treatment Plant
- WTP Discharge Location
- Ancillary Facility Boundary
- Operational Ancillary Infrastructure

Notes

0 0.5 1 km

This map is shown for reference purposes only. Acciona provides this information "as is" with the understanding that it is not guaranteed to be accurate, correct or complete and conclusions drawn from such information are the responsibility of the user. While every effort is made to ensure the information displayed is as accurate and current as possible, Acciona will not be held responsible for any loss, damage or inconvenience caused as a result of reliance on such information or data.

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Esri, Geoscience Australia, NASA, NGA, USGS

5.5 Water treatment

During the operation of the Asset, there will be an ongoing inflow of groundwater into the tunnels. The tunnel drainage system has been designed to accommodate the capture, removal, treatment and discharge of groundwater. Groundwater inflows would be directed to one of the two low point sumps at Haberfield and St Peters Interchange. During normal operation, the WTP will treat and discharge a maximum of approximately 24 L/s.

The WTP has been designed to treat water in accordance with CoA E187 and REMM OSW16 to ensure water is of suitable quality for discharge to the receiving environment in compliance with applicable ANZECC (2000) criteria and in accordance with the WTP EPL. It has also been designed with consideration of predicted groundwater inflow quality including the potential effects of saltwater intrusion and migration of contaminants such as ammonia from former landfills in the vicinity of the Asset.

The WTP will consist of the following steps:

- Water from the tunnel is pumped to the surface from the Southern Low Point Sump through a trash screen to remove any large solids, plastics and debris. Incoming raw water will be monitored for conductivity, pH, ORP and turbidity. If a raw water alarm is triggered, the transfer pumps will be inhibited so water can be removed by other means (i.e. tanker truck).
- At the Balance Tank, water is flow balanced and aerated to oxidise heavy metals, remove ammonia and suspend solids for later removal.
- Water from the Balance Tank is pumped to the Dissolved Air Flotation (DAF) Reaction Tank and is dosed with caustic or acid depending on the in-tank pH readings, coagulant and polymer to aid in the removal of solids. Accumulated solids will be pumped to the Sludge Tank for removal by the Screw Press. Water from the sludge removal process will be pumped back to the Balance Tank for treatment.
- Clean water from the DAF flows through the multimedia filtration system for further polishing of metals and metal oxides. Backwashing will be undertaken to remove waste metal oxides that gradually build up during the filtration process. Filtered water will then flow to a Breakpoint Chlorination Tank to remove ammonia and then pass through Activated Carbon and Ion Exchange filters. Under treatment water quality (pH, turbidity, ORP, chlorine and conductivity) will be monitored to inform chemical dosing rates.
- pH, conductivity and turbidity will be monitored in the treated water and if of acceptable quality will discharge into a piped surface water drainage network on Campbell Road that ultimately drains into Alexandra Canal.

The WTP is controlled and monitored via an external control room with full control functionality. At the control room the operator is able to monitor the quality of water at various stages in the treatment process, along with the status of all water treatment plant system alarms and plant.

The discharge location was selected as the nearest saline environment. The discharge location is identified in Figure 5-1. The use of existing infrastructure also minimises the potential impacts due to excavation and laying new pipes.

Additional information regarding the operational water treatment plant, including treatment criteria and monitoring is found in Section 4.3 of the OGWMP (Annexure A).

5.6 Management measures

Steps that will be implemented to plan, manage, monitor and/or review environmental impacts are identified in Table 5-1.

Table 5-2: Environmental management controls

	Groundwater management controls	Responsibility
Encountering and handling contaminants		
General provisions		
	Prepare and implement an SOP for managing and handling contaminated materials that accords with the Guideline for The Management of Contamination (Roads and Maritime, 2013), RMS Quality Assurance Specification G36: Environmental Protection, and National Environment Protection Measure (NEPM) guidelines on contaminated land management. The SOP will provide detail on: • areas of known contamination; • the management of unexpected contamination finds; • actions to be taken for any land contamination caused by the I&M Contractor.	I&M Contractor
Encountering unexpected contamination finds		
	Prepare and implement an SOP for dealing with unexpected contaminated materials (or include in a combined contaminated materials SOP, referenced above). This will include a stop-work procedure and the need to notify the Project Company Representative within 24-hours of encountering any suspected or potential contamination.	I&M Contractor
Groundwater quality monitoring and auditing		
	After a major spill or accident, implement the Emergency Response Plan (or associated documents – refer Section 8.2 of the OEMP).	I&M Contractor / Project Company
	Ensure that all monitoring is undertaken in accordance with the Groundwater Monitoring Program.	I&M Contractor
	Record any exceedances of the water quality parameters as a non-conformance and report this directly to the Project Company Representative. Implement the response action process nominated in the Groundwater Monitoring Program.	I&M Contractor

5.7 Operational monitoring

An OGWMP has been developed to describe how I&M Contractor propose to monitor potential impacts to groundwater during operation of the Asset (refer to Annexure A).

5.8 Licences and permits

Operation of the WTP will be regulated by an EPL issued by the EPA. The EPL typically prescribes water quality parameters to be measured and associated discharge criteria from licensed discharge points. They also detail the monitoring and analytical requirements by reference to authority publications (e.g. Methods for Sampling and Analysis of Water Pollutants in NSW (EPA 2004)).

As detailed in Section 4.1.4 of the OEMP, other relevant licences or permits will be obtained in the lead up to and during operation as required

6 Monitoring, Notification and Reporting

Monitoring, notification and reporting for operational activities of the Asset will be undertaken in accordance with Section 8 and Section 9 of the OEMP. Specific requirements relevant to this OGMP are identified below.

6.1 Groundwater monitoring

In accordance with CoA D12, groundwater monitoring will commence at operation and be undertaken for a period of at least 5 years following the completion of construction of the Rozelle Interchange project (Stage 2). This will enable the I&M Contractor to assess the performance of the Asset against the objectives and KPIs detailed in Section 2 and identify potential impacts and management responses.

Operational monitoring requirements are detailed in the OGWMP (Annexure A) and include:

- Groundwater monitoring locations
- Parameters/analytes to be monitored
- Type of monitoring
- Frequency of monitoring
- Monitoring methodology

6.2 Notification

Project Company will immediately notify and consult with DPE Water and/or NRAR (formerly DPI Water) on any groundwater bores (for monitoring or otherwise) removed or damaged as a result of operational activities.

6.3 Reporting

Reporting and data provision requirements relevant to this OGMP are outlined in Table 6-1.

Table 6-1: Reporting requirements

Schedule (during operation)	Requirements	Recipient (relevant authority)
Reporting		
Operational Groundwater Monitoring Reports (every six months for a minimum of 5 years)	Raw groundwater data to be collected and tabulated. Trigger exceedances to be highlighted. Report to confirm implementation and compliance of required operational water control measures including the operational WTP. Extracted groundwater volumes to be reported in accordance with CoA D11(g).	DPE, DPE Water (formerly DPI Water), Relevant Council(s), EPA, Sydney Water, TfNSW
EPL Monitoring Reports and Annual Returns	EPL monitoring data reports will be prepared in accordance with the requirements of the EPL. An EPL Annual Return will be prepared in respect of each EPL reporting period (typically 12 months).	EPA
Groundwater Monitoring Review (1 month prior to end of 5-year monitoring period)	Report of justification for continuation or cessation of the Groundwater Monitoring Program. To demonstrate compliance with CoA D12.	DPE, TfNSW

Schedule (during operation)	Requirements	Recipient (relevant authority)
WTP Performance (monthly)	Compliance report for WTP performance and discharge criteria.	Project Company, TfNSW
Data provision		
Quarterly (every 3 months)	WTP discharge water quality and volume data (raw data collated and tabulated in Excel) To demonstrate compliance with the CoA D11(f) and the EPL	Sydney Water, TfNSW

7 Auditing and review

7.1 Continuous improvement

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

The continuous improvement process will be designed to:

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

7.2 OGMP update and amendment

The processes described in Sections 9 and 10 of the OEMP may result in the need to update this OGMP and its associated monitoring program. Plan updates will occur on an as needed basis.

As outlined in Table 6.1 and as required by CoA D12, at least one (1) month prior to the end of the five (5) year monitoring period, a review of future monitoring requirements in consultation with DPI Water will be undertaken. The review must determine if additional monitoring is required, and the time period for continued monitoring. The Secretary must be notified within two (2) weeks of the review as to the outcomes of the review and any requirements for future monitoring.

Document updates to the plan in response to regular reviews (refer to Section 10.1 of the OEMP) may be approved internally if they are considered minor. Where necessary, the OGMP will be provided to relevant stakeholders for review and comment if required and provided to the Secretary for approval.

A copy of updated plans will be made public ally available on the WestConnex project website (https://www.westconnex.com.au/) and provided to the relevant stakeholders on request.

7.3 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this Plan, CoA and other relevant approvals, licenses, and guidelines.

Audit requirements are detailed in Section 9.3 of the OEMP.

Annexure A Operation Groundwater Monitoring Program

WestConnex M4-M5 Link Mainline Tunnels

Annexure A - Operational Groundwater Monitoring Program

Project:	M4-M5 Link Mainline Tunnels – Design and Construct
Contract Number:	TBC
Revision Date:	November 2022

Document Approval

Rev	Date	Prepared by	Reviewed by	Remarks
00	15/09/2022	ASBJV	DPE	
01	02/11/2022	ASBJV	DPE	Update to address DPE feedback

WestConnex

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Annexures

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1 Introduction

1.1 Context

This Operational Groundwater Monitoring Program (OGWMP or Program) has been prepared for the operation and maintenance of the M4-M5 Link Mainline Tunnels (the Asset).

The OGWMP addresses the requirements of the Minister's Conditions of Approval (CoA), the WestConnex M4-M5 Link Environmental Impact Statement (EIS), the revised environmental management measures (REMM) listed in the WestConnex M4-M5 Link Submissions and Preferred Infrastructure Report (SPIR), the WestConnex M4-M5 Link Mainline Tunnel Modification reports and all applicable guidance and legislation.

1.2 Scope

The scope of this OGWMP is to describe how the Incident and Maintenance (I&M) Contractor propose to monitor groundwater during operation of the Asset.

1.3 Implementation

Operational Monitoring Programs must be submitted to the Secretary for approval at least one (1) month prior to commencement of operation.

Operation will not commence until the Secretary has approved all of the required Operational Monitoring Programs relevant to that activity and all the relevant baseline data has been collected.

The Operational Monitoring Programs, as approved by the Secretary, must be implemented for at least five (5) years following the completion of construction of the Rozelle Interchange project (Stage 2) and for any longer period set out in the monitoring program or specified by the Secretary, whichever is the greater.

2 Purpose and objectives

2.1 Purpose

The purpose of the OGWMP is to describe how the I&M Contractor propose to monitor the extent and nature of potential impacts to the groundwater level and quality during operation of the Asset.

The OGWMP will be implemented to monitor the effectiveness of mitigation measures implemented as part of the Asset. Monitoring of groundwater will be undertaken to identify potential impacts and ensure a comprehensive management regime can be implemented to address those impacts and manage local groundwater quality.

This Program provides details of the groundwater monitoring network, frequency of monitoring, and test parameters. This OGWMP supplements the Operational Groundwater Management Sub-plan (OGMP), which, itself, is an annexure of the Operational Environmental Management Plan (OEMP).

This OGWMP is based on baseline studies developed for the project EIS (AECOM 2017) and the potential impacts predicted by the Groundwater Model developed by Golders Associates during the design and construction phase of the Asset.

2.2 Objectives

The key objective of the OGWMP is to ensure all CoA, REMM, and licence/permit requirements relevant to groundwater monitoring are described, scheduled, and assigned responsibility as outlined in:

- The EIS prepared for WestConnex M4-M5 Link
- The SPIR prepared for WestConnex M4-M5 Link
- The Modification reports for WestConnex M4-M5 Link Mainline Tunnel
- CoA granted to the project on 17 April 2018 and as altered by the Modification reports
- The Asset's Environment Protection Licence (EPL)
- All relevant legislation and other requirements

2.3 Consultation

This program was provided to Department of Planning and Environment (DPE) Water/Natural Resources Access Regulator (NRAR) (formerly Department of Primary Industries (DPI) Water), Sydney Water, City of Sydney Council, Inner West Council and the Environment Protection Authority (EPA) for review and comment in accordance with CoA D8(b) and REMM OGW10.

Refer to Section 1.5 of the OEMP for consultation requirements relating to the OEMP, sub-plans and monitoring programs.

An overarching Consultation Report has been prepared separately to this program to provide detail relating to the consultation received and where feedback has been coverer or addressed in this document.

3 Baseline groundwater monitoring

Groundwater level and groundwater quality monitoring from the baseline groundwater monitoring network commenced in June 2016. This baseline dataset was augmented by data collected since October 2015 for adjacent M4 and M8 Projects.

The baseline monitoring network was installed between May 2016 and May 2017 and consisted of 19 monitoring bores intersecting groundwater within the alluvium, Ashfield Shale, and Hawkesbury Sandstone as listed in Table 3-2 and shown in Figure 3-1. Monitoring bores were designed and constructed to target the expected tunnel zone and allowed assessment of potential impacts to groundwater. At one location where alluvium was present, nested monitoring bores were constructed,

The majority of monitoring bores (13) target the Hawkesbury Sandstone. Five bores target the Ashfield Shale, and one bore intersects the alluvial sediments associated with the Hawthorne Canal.

In addition to the collection of groundwater quality and groundwater level data, baseline studies to inform the project EIS (AECOM 2017) included the collection of hydraulic data for the local aquifer systems (including packer tests). This data is not discussed further in this document as it has no relevance to the operational monitoring program.

Baseline groundwater monitoring data has provided inputs to the groundwater modelling documented in the Groundwater Modelling Report prepared to satisfy CoA E192 and E193 and 24-Month Construction Monitoring Groundwater Review required by CoA E194. The baseline monitoring bore network is shown in Table 3-2 and Figure 3-1, and is detailed in Appendix T (Technical working paper: Groundwater) of the EIS (AECOM 2017).

3.1 Groundwater level

Baseline groundwater level data included monthly manual dips and continuous data from dedicated pressure logging transducers (dataloggers). Dataloggers were installed in key groundwater monitoring bores and programmed to record baseline data on an hourly basis. The data was corrected for barometric pressure effects, converted to a groundwater level measurement and compared to local rainfall.

The purpose of the baseline groundwater level monitoring was to establish pre-construction groundwater level and flow conditions across the project area to inform groundwater modelling and the EIS (AECOM 2017).

Manual baseline groundwater level monitoring results are included in Annexure A.

3.2 Groundwater quality

Baseline monthly groundwater quality monitoring commenced in June 2016 or later as each monitoring location became operational (refer to Table 3-2). The objectives of the baseline groundwater quality monitoring program included:

- Characterise the existing hydrogeochemistry in the three main aquifers units (alluvium, Ashfield Shale, and Hawkesbury Sandstone)
- Establish the environmental value and beneficial use of groundwater under existing (pre-construction) conditions
- Develop a groundwater quality baseline dataset to inform the EIS
- Characterise the potential aggressiveness of the native groundwater to the building material used to construct the project infrastructure
- Obtain a preliminary understanding of the groundwater treatment requirements required prior to discharge during the construction and operation phases

A summary of the groundwater quality samples collected from June 2016 for each aquifer formation is shown in Table 3-3.

Table 3-1: Baseline groundwater quality sampling program

	Alluvium	Ashfield Shale	Hawkesbury Sandstone	Total
Number of samples	12	30	66	108

A summary of the baseline water quality data is included in Annexure A. Interpretation of the baseline groundwater monitoring data is included in the EIS (AECOM 2017) and is summarised in Table 3-3.

Table 3-2: Baseline groundwater monitoring network

Bore ID	Location	Easting	Northing	Screened interval (mBGL)	Lithology screened	Start of baseline groundwater level monitoring	Start of baseline Groundwater quality monitoring
HB_BH02	Haberfield	327574.77	6250197.42	14 - 17	HSS	June 2016	July 2016
HB_BH03	Haberfield	327764.93	6250217.19	14 - 17	HSS	August 2016	August 2016
HB_BH08d	Haberfield	328751.96	6250138.18	22 - 25	HSS	June 2016	June 2016
HB_BH08s	Haberfield	328750.60	6250135.51	10 - 13	Alluvium	June 2016	June 2016
HB_BH12	Haberfield	329047.41	6250099.10	27 - 30	HSS	July 2016	July 2016
HB_BH14	Haberfield	329206.55	6250086.27	37 - 40	HSS	July 2016	July 2016
HB_BH15	Haberfield	329396.41	6250142.83	19 - 22	HSS	June 2016	June 2016
SP_BH01	St Peters	331750.58	6246432.73	36 - 39	Ashfield Shale	September 2016	October 2016
SP_BH02	St Peters	331844.84	6246375.94	4 - 10	Residual Clay (Shale)	June 2016	July 2016
SP_BH04	St Peters	331657.95	6246185.60	32 - 35	Ashfield Shale	August 2016	August 2016
SP_BH06	St Peters	331800.08	6246136.08	20 - 23	Ashfield Shale	June 2016	June 2016
SP_BH09	St Peters	331800.90	6245948.32	23 - 26	Ashfield Shale	June 2016	June 2016
MT_BH02	Main Line Tunnel	329696.1	6249704.0	42 - 45	HSS	February 2017	March 2017
MT_BH07	Main Line Tunnel	330355.81	6249914.91	43 - 46	HSS	February 2017	February 2017
MT_BH11	Main Line Tunnel	330670.67	6249095.13	48 - 51	HSS	March 2017	NA
MT_BH14	Main Line Tunnel	331168.37	6248149.99	27 - 30	HSS	January 2017	January 2017
MT_BH19	Main Line Tunnel	331680.25	6246735.87	55 - 58	HSS	NA	January 2017

Bore ID	Location	Easting	Northing	Screened interval (mBGL)	Lithology screened	Start of baseline groundwater level monitoring	Start of baseline Groundwater quality monitoring
MT_BH20	Main Line Tunnel	330379.4	6249503	41 - 44	HSS	March 2017	NA
MT_BH21	Main Line Tunnel	330066.72	6249771	47 - 50	HSS	February 2017	February 2017

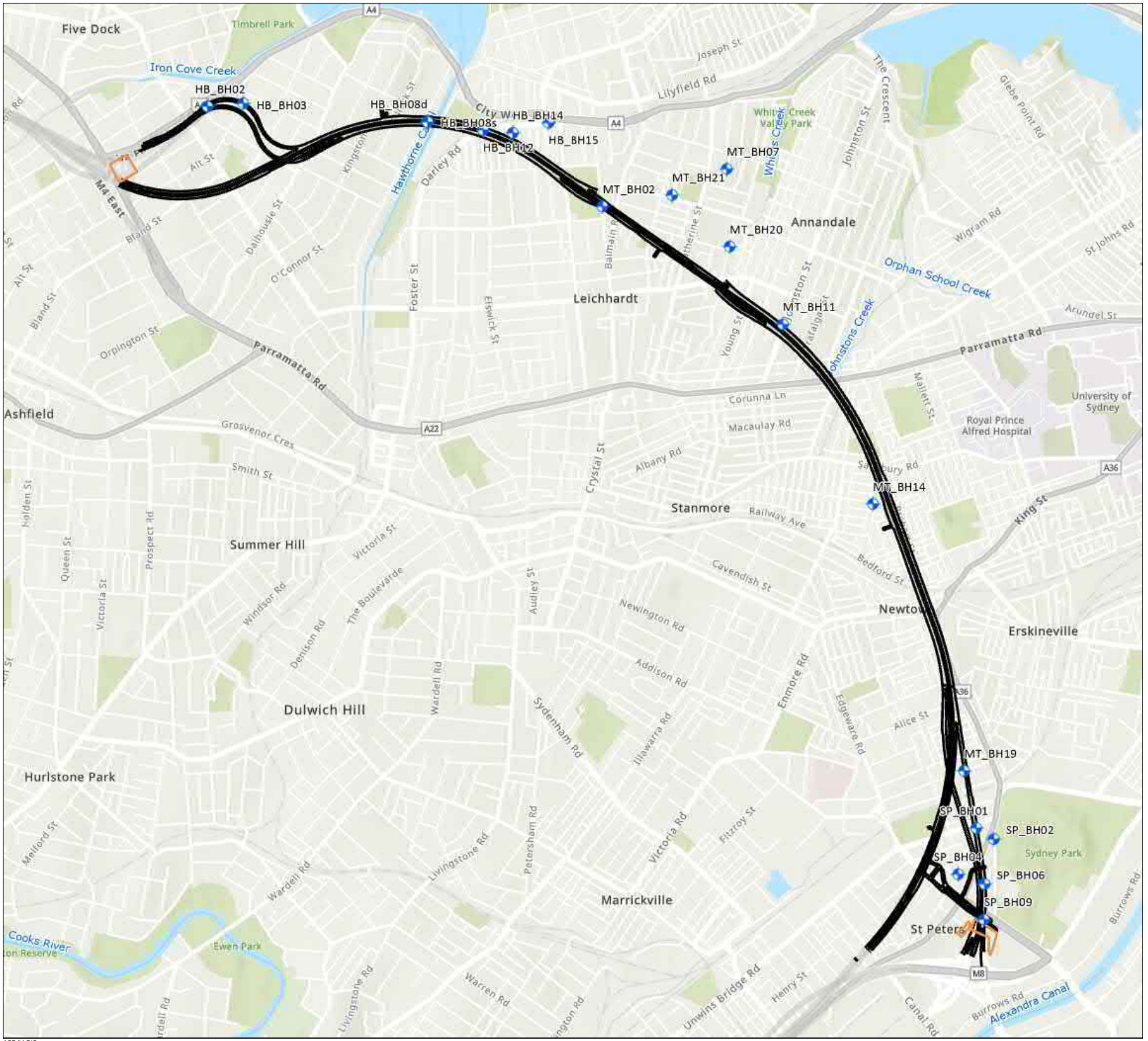
Notes: HSS = Hawkesbury Sandstone; NA = no baseline data available

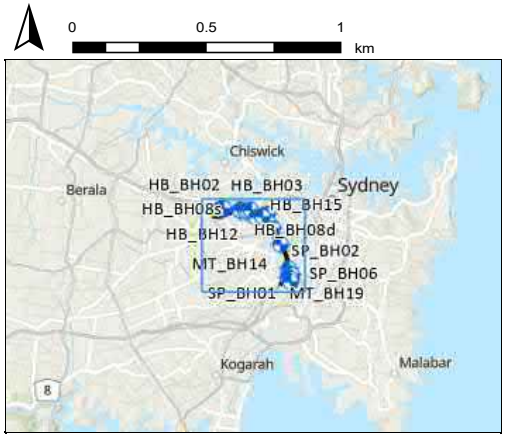
WestConnex M4-M5 Link Mainline Tunnels

Figure 3-1: Location of baseline groundwater monitoring bores

Legend:

- Groundwater monitoring bore
- Tunnel alignment
- Ancillary Facility Boundary





ASBJV GIS

Table 3-3: Summary of baseline groundwater quality

Parameter	Alluvium	Ashfield Shale	Hawkesbury Sandstone
Electrical Conductivity (EC)	Variable marginal to slightly saline Range: 1,561 to 9,068 µS/cm	Fresh to moderately saline Range: 242 to 11,986 µS/cm	Fresh to moderately saline Range: 558 to 16,300 µS/cm
pH	Weakly acidic to weakly basic Range: 5.96 to 8.06	Acidic to strongly basic Range: 5.51 to 12.13	Slightly acidic to strongly basic Range: 5.77 to 12.69
Major ions	Dominated by sodium, magnesium, chloride and bicarbonate. The dominance of sodium and chloride is attributed to tidal influences.	Highly variable, likely due to the intermittent development of secondary mineralisation such as calcite (calcium carbonate) and siderite (iron carbonate) and the variable flushing of salts of marine origin.	Dominated by sodium and chloride, which may be in part due to the influence of saline water intrusion.
Metals	Maximum levels exceeded guideline[1] concentration values for all but cadmium and nickel. In most cases the exceedance is marginal, indicating that background levels are already elevated.	Maximum levels exceeded relevant guideline[1] concentration values for chromium, copper, iron, manganese, nickel and zinc. Iron and manganese are commonly elevated within the Ashfield Shale.	Maximum levels exceeded guideline[1] concentration values for chromium, copper, iron, lead, manganese, nickel and zinc. Consistently elevated iron and manganese.
Nutrients	Nitrite and nitrate concentrations indicate that background nutrient levels are low. Reactive phosphorous levels are also low and ammonia values exceeded guideline[1] value.	Nitrite and nitrate concentrations indicate that background nutrient levels are low. Reactive phosphorous levels are also low and ammonia values exceeded guideline[1] value.	Nitrite and nitrate concentrations indicate that background nutrient levels are low. Reactive phosphorous levels are very low and ammonia values marginally exceeded guideline[1] value.
Sulfate reducing bacteria[2]	Sulfate reducing bacteria was not assessed for alluvium.	No pattern was assessed for sulfate reducing bacteria because many samples were above the measurement limit (500,000 CFU/ml). Seawater is a known prime habitat for sulfate reducing bacteria, and it is possible that the dissolution of marine salts from the Ashfield Shale into the Hawkesbury Sandstone makes the groundwater prone to sulfate reducing bacteria growth.	
Soil salinity	Salt concentrations within the alluvium are variable and impacted by tidal influences.	Ashfield Shale typically has a high salt content due to the presence of connate marine salts.	Salt concentrations within the Hawkesbury Sandstone are variable.
Groundwater aggressivity	Groundwater aggressivity was not assessed for alluvium.	Groundwater within the Ashfield Shale is: 1. Non-aggressive towards concrete piles for average concentrations of chloride, pH, and sulfate 2. Non-aggressive towards steel piles for average concentrations of chloride and pH Moderately aggressive towards steel pipes for groundwater with low conductivity.	Groundwater within Hawkesbury sandstone is: 1. Mildly aggressive towards concrete piles for average concentrations of chloride, pH, and sulfate 2. Mildly aggressive towards steel piles for average concentrations of chloride and pH Severely aggressive towards steel piles for groundwater with low conductivity.

Notes: µS/cm = micro-Siemens per centimetre

[1]Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000a)

[2]measured as a colony forming unit (CFU) per 100 ml

4 Operational groundwater monitoring

In accordance with CoA D12, groundwater monitoring will commence at operation, being once the mainline tunnels (Stage 1) are operational and continue for a minimum period of five years following the completion of construction of the Rozelle Interchange project (Stage 2). It will be undertaken in accordance with Australian Standards, ANZECC/ARMCANZ (2000) and the OEMP.

As discussed in Section 4 of the OGMP, potential impacts on groundwater during operation are identified as:

- Groundwater level decline due to tunnel inflows (groundwater drawdown)
- Intrusion of saline water in tidal zones (increase in groundwater salinity in the area to the south of Iron Cove)

Groundwater level and groundwater quality monitoring will be carried out during operation at monitoring bores located in the vicinity of the tunnel alignment. Groundwater inflows intercepted in the tunnel during operation and their subsequent discharge via the water treatment plant (WTP) at St Peters Interchange, will also be monitored.

4.1 Groundwater monitoring

4.1.1 Overview

Groundwater level and groundwater quality (as electrical conductivity (EC)) monitoring will be carried out during operation at the monitoring network listed in Table 4-1 and shown in Figure 4-1.

Monitoring bores target the three main aquifer units (alluvium, Ashfield Shale, and Hawkesbury Sandstone) around the tunnel alignment with a minimum of two groundwater monitoring bores located in the following key locations:

- Haberfield / Lilyfield area to the south of Iron Cove
- St Peters area to the north west of Alexandra Canal

Three vibrating wire piezometers (VWPs) were installed in accordance with REMM OGW10 (with the exception of depth, following consultation with DPE Water) as close as possible to the tunnel centrelines of the Project mainline tunnels to allow for the comparison of pore pressure (recorded by the VWPs) and groundwater water level (recorded by standpipe groundwater monitoring bores).

The VWPs were constructed below the depth of the tunnel invert to allow for groundwater drawdown monitoring in the Hawkesbury Sandstone. The VWPs are located as close to an existing standpipe piezometer and target equivalent depths to allow comparison (refer to Table 4-1 and Figure 4-1).

Table 4-1: Operational groundwater monitoring network

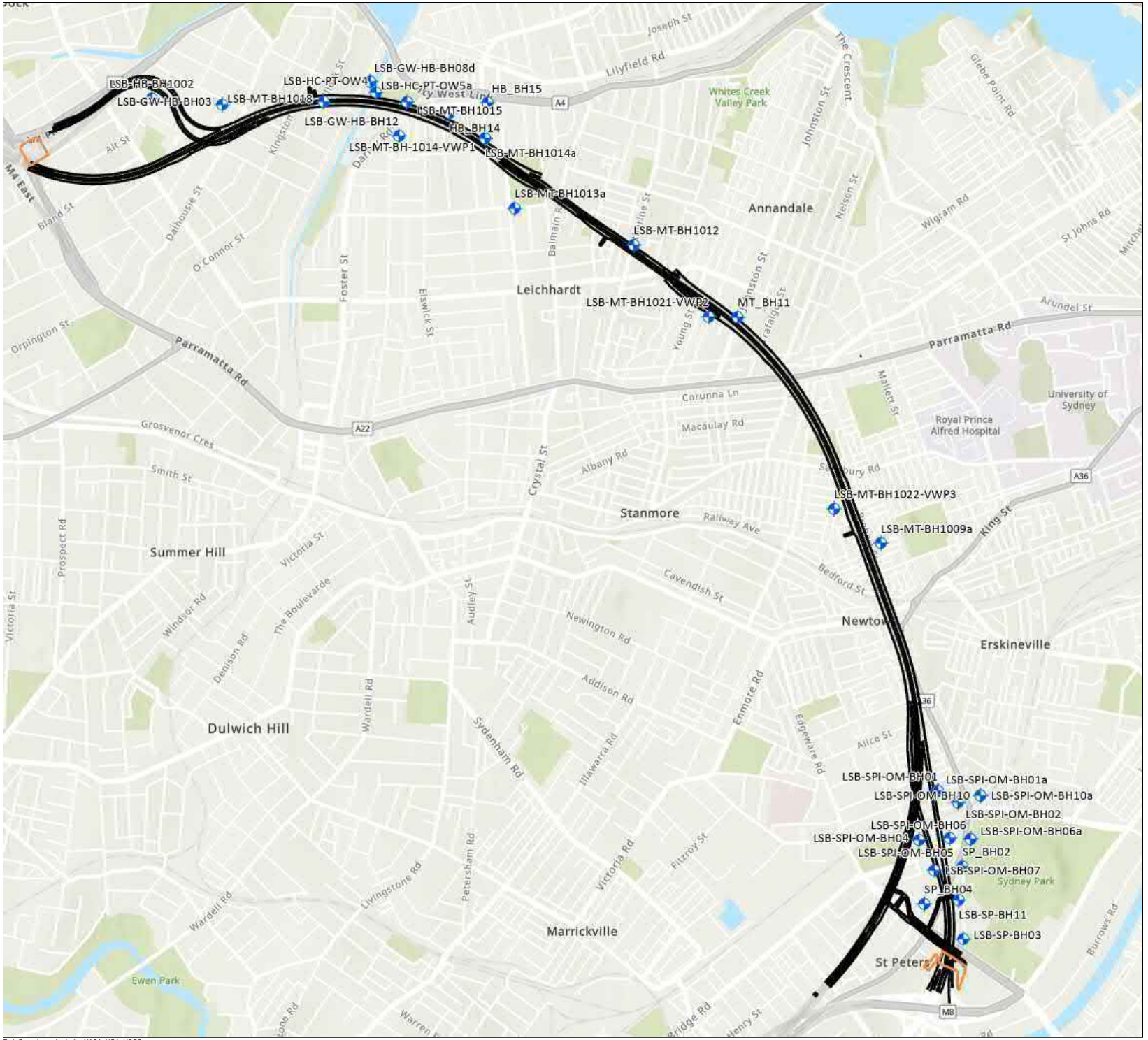
Bore ID	Location	Easting	Northing	Surface Elevation (mAHD)	Screened interval (mBGL)	Lithology screened	Type	Parameters
LSB-GW-HB-BH03	Haberfield	328069.55	6250108.81	20.78	54.4 – 60.4	HSS	SP	GWL
LSB-HB-BH1002	Haberfield	327716.76	6250133.19	4.97	22.15 – 28.15	HSS	SP	GWL
LSB-GW-HB-BH08d	Haberfield	328807.04	6250235.62	1.78	22.45 – 25.45	HSS	SP	GWL/GWQ (EC)
LSB-HC-PT-OW5a	Haberfield	328808.19	6250236.19	1.79	10.5 – 13.5	Alluvium	SP	GWL/GWQ (EC), Atmospheric Pressure
LSB-MT-BH1018	Haberfield	328575.12	6250131.40	8.92	46.5 – 51	HSS	SP	GWL/GWQ (EC)
LSB-GW-HB-BH12	Haberfield	328955.61	6249968.52	4.95	37.4 – 43.4	HSS	SP	GWL/GWQ (EC)
LSB-MT-BH1015	Haberfield	328993.20	6250137.84	2.39	33.5 – 39.5	HSS	SP	GWL/GWQ (EC)
LSB-HC-PT-OW4	Haberfield	328836.57	6250183.01	1.83	33 – 39	HSS	SP	GWL
HB_BH14	Haberfield	329206.55	6250086.27	4.27	37 – 40	HSS	SP	GWL
HB_BH15	Haberfield	329396.41	6250142.83	17.87	19 – 22	HSS	SP	GWL/GWQ (EC)
LSB-MT-BH1014a	Haberfield	329386.68	6249963.88	17.48	41.78– 47.78	HSS	SP	GWL/GWQ (EC)
LSB-MT-BH1014-VWP1	Mainline Tunnel	329387.53	6249962.30	17.49	48.5	HSS	VWP	Pore pressure/GWL
MT_BH11	Mainline Tunnel	330670.67	6249095.13	28.67	48 – 51	HSS	SP	GWL
LSB-MT-BH1021-VWP2	Mainline Tunnel	330526.59	6249094.96	27.08	49.5	HSS	VWP	Pore pressure/GWL

Bore ID	Location	Easting	Northing	Surface Elevation (mAHD)	Screened interval (mBGL)	Lithology screened	Type	Parameters
LSB-MT-BH1012	Mainline Tunnel	330144.20	6249445.60	21.96	40.7 – 46.7	HSS	SP	GWL
LSB-MT-BH1022-VWP3	Mainline Tunnel	331171.89	6248149.11	27.28	54	HSS	VWP	Pore pressure/GWL
LSB-MT-BH1009a	Mainline Tunnel	331407.74	6247978.94	40.17	18 – 24	Ashfield Shale	SP	GWL
SP_BH02	St Peters	331844.84	6246375.94	19.49	4 – 10	Residual Clay (Shale)	SP	GWL
SP_BH04	St Peters	331657.95	6246185.60	12.31	32 – 35	Ashfield Shale	SP	GWL
LSB-SP-BH11	St Peters	331829.58	6246208.19	13.63	24.06 – 30.06	Ashfield Shale	SP	GWL/GWQ (EC)
LSB-SP-BH03	St Peters	331854.25	6246012.89	12.52	14.95 – 20.32	Ashfield Shale	SP	GWL/GWQ (EC)
LSB-SPI-OM-BH01	St Peters	331716.12	6246749.00	17.00	69.96 – 73.96	HSS	SP	GWL
LSB-SPI-OM-BH01a	St Peters	331716.12	6246749.00	17.00	60 – 64	HSS	SP	GWL
LSB-SPI-OM-BH02	St Peters	331816.81	6246692.38	17.50	55.5 – 59.5	HSS	SP	GWL
LSB-SPI-OM-BH04	St Peters	331626.41	6246504.05	10.50	55.3 – 59.3	HSS	SP	GWL
LSB-SPI-OM-BH05	St Peters	331778.83	6246514.89	15.00	57.4 – 61.4	HSS	SP	GWL
LSB-SPI-OM-BH06	St Peters	331882.17	6246512.72	17.50	56.5 – 60.5	HSS	SP	GWL
LSB-SPI-OM-BH06a	St Peters	331882.17	6246512.72	17.50	32.2 – 36.2	Ashfield Shale	SP	GWL
LSB-SPI-OM-BH07	St Peters	331703.61	6246354.01	18.50	54.5 – 58.5	HSS	SP	GWL
LSB-SPI-OM-BH10	St Peters	331927.91	6246730.24	18.50	59.2 – 63.2	HSS	SP	GWL
LSB-SPI-OM-BH10a	St Peters	331927.91	6246730.24	18.50	41 – 45	Ashfield Shale	SP	GWL

HSS = Hawkesbury Sandstone; GWL = Groundwater level; GWQ (EC) = Groundwater quality (electrical conductivity); SP = Standpipe piezometer; VWP = Vibrating Wire Piezometer

WestConnex M4-M5 Link Mainline Tunnels

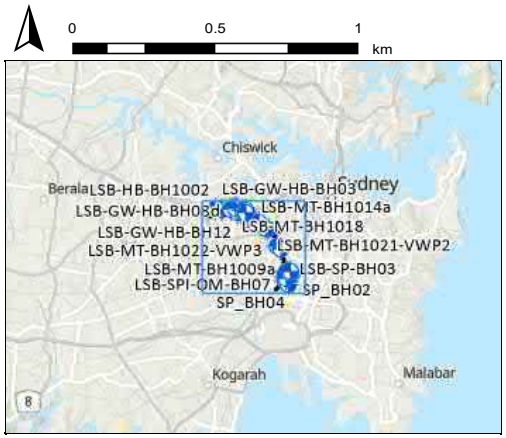
Figure 4-1: Location of operational groundwater monitoring bores



Esri, Geoscience Australia, NASA, NGA, USGS

Legend:

- Groundwater monitoring bore
- Tunnel alignment
- Ancillary Facility Boundary



4.1.2 Groundwater level

Dataloggers which measure groundwater level (as pressure) will be installed in each monitoring bore (refer to Table 4-1) to provide continuous data collection. Dataloggers will be programmed to record on six-hourly intervals. The VWPs will also be equipped with dataloggers set to record pore pressures on six-hourly intervals.

To supplement the above continuous monitoring, manual measurements of water levels at each bore will be collected quarterly, pending access. Measurements will be recorded in metres below top of casing (mBTOC) and converted to metres Australian Height Datum (mAHD). Details on the methods for measuring static water levels in bores are summarised in Section 5.2.

Recorded data will be compensated for barometric pressure and converted to a groundwater level measurement. Manual monitoring data will be used to verify continuous data.

Groundwater level data will be compared to local rainfall records to assess trends.

4.1.2.1 Performance Criteria

Groundwater levels will be compared to the results of the groundwater model (Golders Associates 2020) to determine if drawdown exceeds the predictions. The Project groundwater model was developed in accordance with CoA E192 and was updated with 24 months of available construction monitoring data in accordance with CoA E194.

If drawdown is identified outside of model predictions contained in Annexure B and attributable to the Asset, a management response will be triggered as presented in Figure 4-3.

4.1.3 Groundwater quality

Dedicated groundwater level dataloggers which also measure electrical conductivity (EC) will be installed at key monitoring bores between the tunnel alignment and saline water bodies (refer to Table 4-1). These dataloggers will be programmed to record on hourly intervals. Figure 4-2 presents the predicted saltwater particle pathways for mainline carriageway tunnels at 100 years after excavation. Dataloggers will be downloaded quarterly. EC results will be assessed to detect changes in water quality that may indicate the intrusion of saline water towards the tunnel in accordance with CoA D11 (d).

4.1.3.1 Performance criteria

Baseline monitoring showed that some groundwater quality parameters exceed the default ANZECC (2000) water quality trigger values for slightly to moderately disturbed ecosystems. This is not unexpected given the highly disturbed and urbanised Asset area.

Site-specific trigger values (SSTV) (Table 4-2) for EC have been developed for each water quality monitoring bore using the baseline data used to inform the EIS (AECOM 2017).

The SSTV's were derived by calculating the 80th percentile values of the baseline or construction EC data. A percentile is the value below which a given percentage of observations fall. The 80th percentile is therefore the value below which 80% of observations are found. Using these percentiles removes anomalous data that is outside of the normal range (defined here as 0 – 80 % of values).

The SSTV's provide an easily identifiable indication of a potential change in salinity. A management response would be initiated if any of the following occurs:

- The EC data continuously exceeds the SSTV over the period of three months and depicts a rising trend
- The EC data exceeds the SSTV at any time by more than 100%

In the event that one or both of the above EC triggers are observed a review will be initiated to determine the significance of the exceedance(s) and possible causes. The review will assess the historical and surrounding monitoring bore data, and modelling predictions which do forecast potential saline migration from Iron Cove to surrounding groundwater.

If the exceedance is determined to be attributable to the Asset and outside of approved model predictions for saline intrusion (Golder Associates 2020) a management response will be triggered as presented in Figure 4-4.

Table 4-2: Water quality EC (electrical conductivity) trigger values

Monitoring bore	Lithology	Baseline / Construction data			SSTV[2] (µS/cm)
		Sample count	EC min (µS/cm)	EC max (µS/cm)	
LSB-HC-PT-OW5a	Alluvium	6,507	16,600	20,838	19,700
LSB-GW-HB-BH08d	HSS	65	558	16,300	4,700
LSB-GW-HB-BH12					
HB_BH15					
LSB-MT-BH1018					
LSB-MT-BH1015					
LSB-MT-BH1014a					
LSB-SP-BH11	Ashfield Shale	30	242	11,986	4,000
LSB-SP-BH03					

[2]SSTV = site specific trigger value (80th percentile of baseline data, rounded to nearest 100)

Figure 4-2 Predicted Saltwater Particle Pathways for Mainline Carriageway Tunnels at 100 Years after Excavation

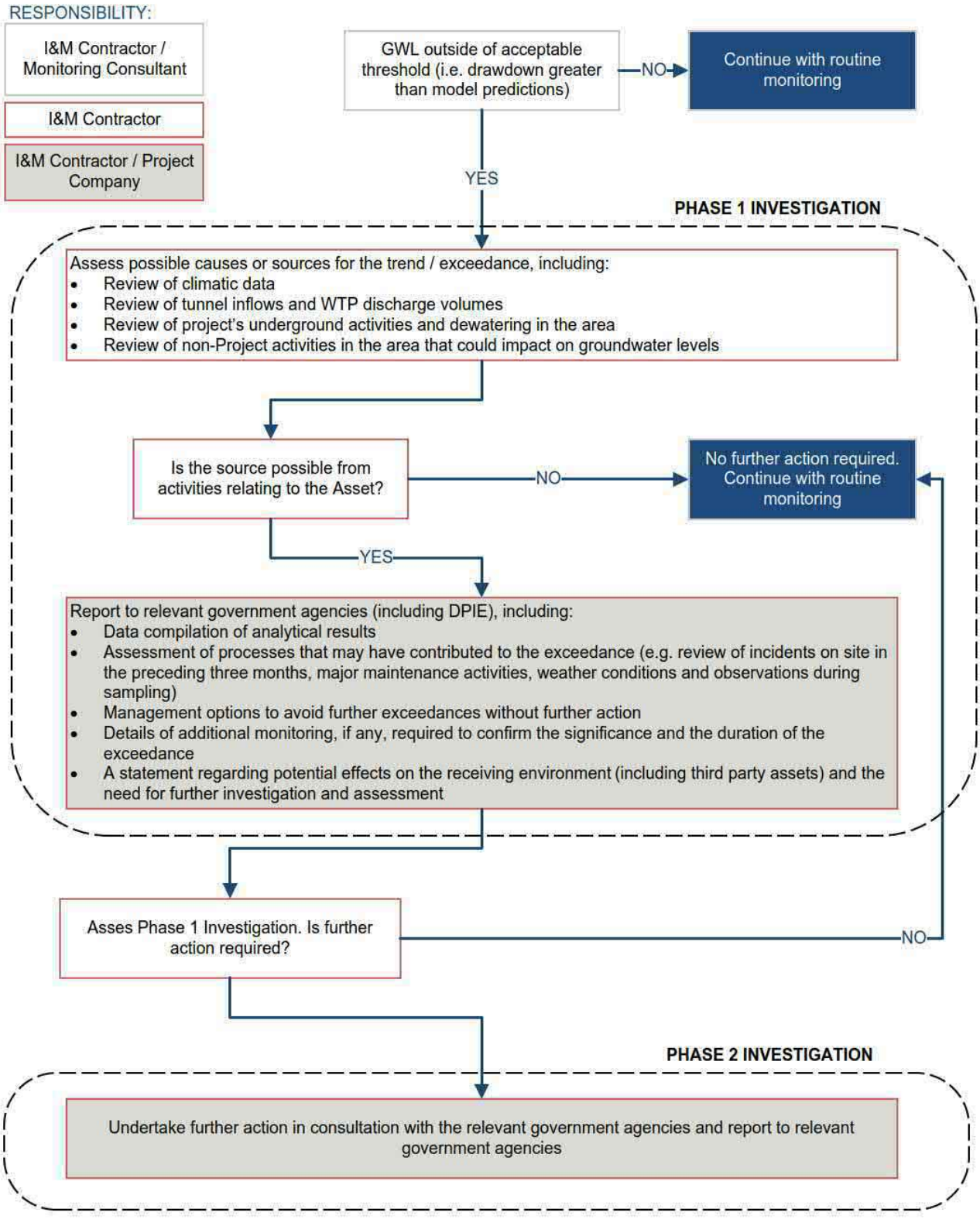


Figure 4-3: Management Response process flow for exceedance of groundwater level threshold

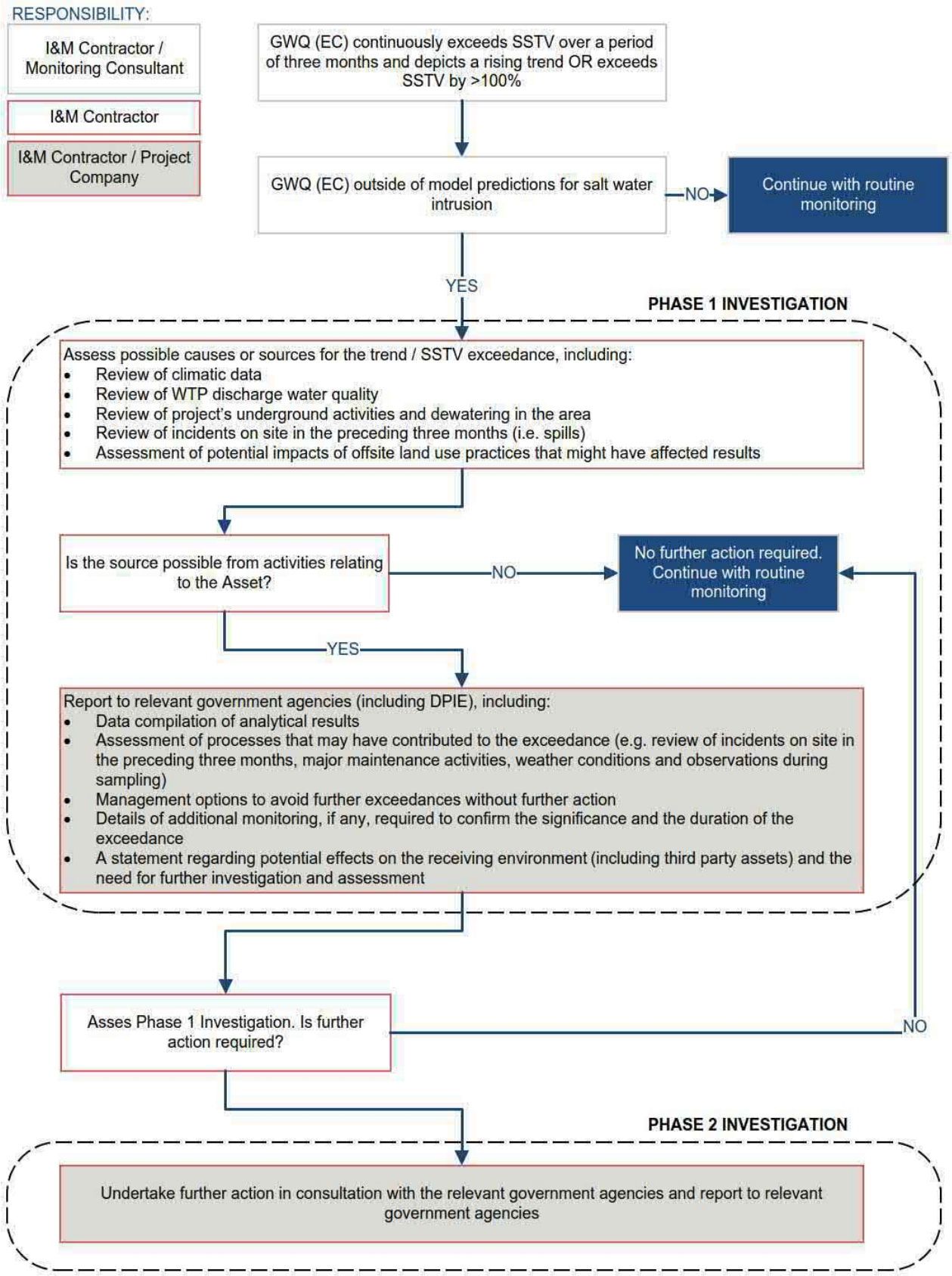


Figure 4-4: Management Response process flow for exceedance of groundwater quality SSTV

4.2 WTP discharge monitoring

Metering will be installed at various locations throughout the WTP to enable the daily measurement of the amount of incoming water and outgoing discharges from the WTP at St Peters Interchange.

The WTP has been designed in accordance with CoA E187 and REMM OSW16 to ensure water is of suitable quality for discharge to the receiving environment in compliance with the applicable discharge criteria. Further information on the WTP treatment process is detailed in Section 5.4 of the OGMP.

Water within the WTP will be continuously monitored for physical parameters including pH, oxidation reduction potential (ORP), turbidity, EC and chlorine to inform the treatment process. Once treated, water will also be continuously monitored for pH, turbidity and EC before being discharged.

Treated water from the WTP will also be monitored at the discharge point on a monthly basis for compliance against the following performance criteria or as permitted under the Asset EPL:

- ANZECC (2000) 95 per cent species protection level
- ANZECC (2000) 99 per cent protection level for contaminants that bioaccumulate
- ANZECC (2000) recreational water quality criteria for iron

Further details on WTP discharge quality sampling are provided in Section 5.4.

4.3 Tunnel inflows

During operation, groundwater will flow into the tunnel and will be captured by the drainage system and pumped to the WTP for treatment prior to discharge as detailed in Section 5 of the OGMP. The tunnel was also designed and constructed using water-resisting treatments and ground improvement to ensure compliance with the performance criteria of 1 litre per second across any given kilometre (1 L/s/km) in accordance with CoA E190. As a first pass, tunnel inflows will be estimated by monitoring incoming water to the WTP. Using this data, a simple water balance approach will be applied to estimate groundwater inflows to the tunnel during operation:

Groundwater inflow = incoming WTP water – Asset water inputs

As detailed in Section 4.2, WTP discharge volumes will be monitored using a water meter on the stormwater discharge line.

Asset water inputs that will need to be considered and potentially estimated during operation include:

- Surface water ingress from the portals at St Peters Interchange and Wattle St
- Surface water ingress from the Ventilation Building Cut and Cover at St Peters Interchange
- Occurrence and duration of any deluge events and/or fire hydrant use in the tunnel including testing events
- Operation and maintenance activities including washdown
- Any large spills or incidents that occurred in the tunnel including rupture of the fire main

Where required, in-tunnel measurements of inflows to be undertaken during planned 3-monthly shutdown periods to further validate estimates made using the water balance approach. During these shutdowns, water inflows could be measured at tunnel drainage pits using a portable flow meter to enable a flow rate (L/s) to be calculated for any section of tunnel. Pending the outcomes of this inflow monitoring, a management response will be actioned as outlined in Figure 4-5.

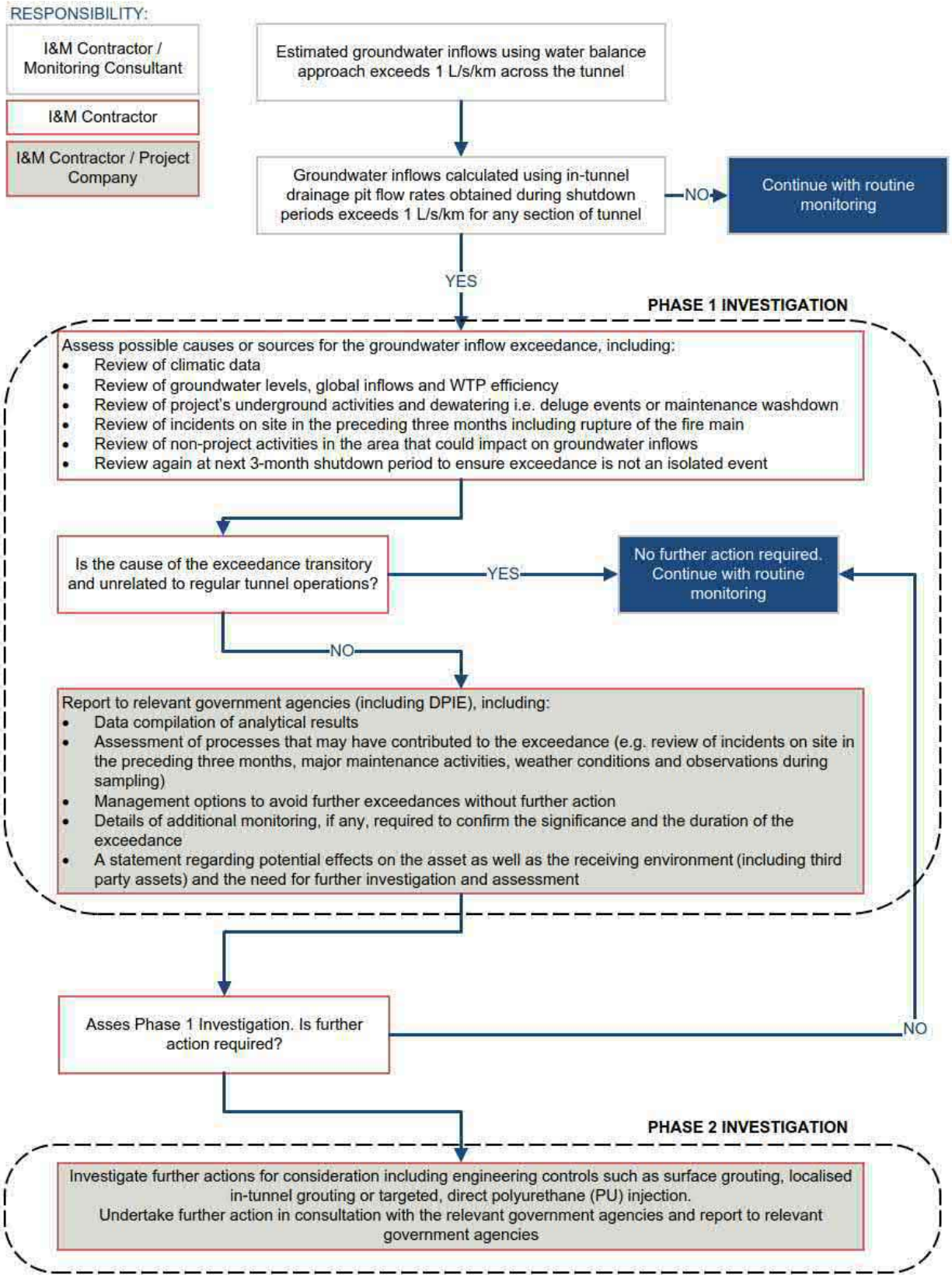


Figure 4-5: Management Response process flow for exceedance of tunnel inflows

5 Monitoring Methodology

5.1 Overview

The methodology for monitoring groundwater for the project includes:

- Assessment of groundwater level (manual measurement and datalogger download)
- Assessment of groundwater quality as EC (datalogger download)
- Assessment of WTP discharge water quality (grab samples and analysis)
- Assessment of groundwater inflows
- Implementation of quality control plan including appropriate chain-of-custody for laboratory analysis and provision of appropriate documentation.

Groundwater monitoring is to be undertaken by suitably qualified personnel at all times.

5.2 Manual groundwater level measurements

Groundwater monitoring will be overseen by personnel with appropriate qualifications and experience. Trained field personnel will complete monitoring rounds using appropriate personal protective equipment (PPE) and monitoring equipment.

The static groundwater level will be measured and recorded at each standpipe groundwater monitoring bore using an electronic groundwater level dip meter (dipper) to verify the continuous data recorded by dataloggers. Levels will be measured prior to dataloggers being downloaded. The level (to the nearest millimetre) will be referenced to a known (and consistent) surveyed point at the top of the bore casing (mTOC). This measurement will be corrected to mAHD using survey data. Recorded groundwater level will be tabulated in mBTOC and mAHD.

The base of the bore will be measured and recorded periodically by lowering the dipper to the base of the bore until it touches the bottom.

5.3 Continuous groundwater level and quality (EC) measurements

Groundwater level (as pressure) and EC will be measured continuously by calibrated dataloggers at key monitoring locations and VWPs (pore pressure only). Continuous data (recorded every 6 hours) will be periodically validated by manual measurements.

Data loggers will be downloaded in accordance with the manufacturer's guidelines. It will be ensured that the datalogger is located in the groundwater column at a depth below expected natural fluctuations (or near the base of the monitoring bore and within the range of the logging device) and that the hanger cable is not tangled or damaged.

Groundwater level/pressure measurement will be converted to standing mAHD using calibration coefficients, installation data, and survey data. Spreadsheets will be maintained detailing the conversion and converted groundwater level measurement.

Dataloggers will be downloaded quarterly and will be checked and maintained as necessary before being re-calibrated and then returned to the monitoring bore at a known depth below the top of casing.

5.4 WTP discharge samples

5.4.1 Sample collection

Grab samples will be collected manually from the WTP and sent to a National Association of Testing Authorities (NATA) accredited laboratory for analysis.

5.4.2 Field measurements

Field physico-chemical parameters including pH, and turbidity will be measured at the Operational WTP at St Peters Interchange using fully calibrated water quality probes.

The water quality meter probes will be calibrated against known standards, as supplied by the manufacturer, at the start and completion of each day of water quality sampling. Calibration records will be maintained in accordance with the appropriate standard.

5.4.3 Decontamination

Equipment will need to be cleaned periodically to prevent a build-up of dirt and cross contamination.

The following method will be followed:

- Rinse the equipment in tap water
- Clean with De-Con 90 (a phosphate free detergent), or equivalent
- Rinse again with tap water
- Rinse three times with de-ionised water, and finally
- Allow to dry.

De-ionised and tap water will be available for washing equipment in the field, if required.

5.4.4 Quality assurance and documentation

Quality assurance and control protocols during sampling and recording of physico-chemical (field) parameters will be undertaken in accordance with ANZECC/ARMCANZ (2000b) to ensure the integrity of the dataset.

As part of sampling, quality assurance and control samples during sampling will be undertaken to ensure the integrity of the dataset, including:

- Samples were collected in clearly labelled bottles with appropriate preservation solutions;
- Samples were delivered to the laboratories within the specified holding times;
- Unstable parameters were analysed in the field (physico-chemical parameters); and
- Duplicate and triplicate samples (Quality Assurance (QA) samples) were collected at a rate of one in ten samples.

All containers are to be clearly labelled with the location, date/time, method, name and duplicate details, with the same documented on dedicated field sheets. Samples are to be placed immediately in chilled containers and transported to a NATA-accredited laboratory under documented chain-of-custody protocols.

Field results will be checked for accuracy before leaving the site and errors or discrepancies will be cross-checked, and further investigation initiated if required.

5.5 Recording and documentation of results

All monitoring and sampling will be documented and transferred to a central electronic database under the responsibility of the I&M Contractor.

Results for each monitoring location will be recorded on appropriate field sheets (hard copy or digital) using unique sampling identification nomenclature and will record the following information:

- Site ID
- Time and date of sampling
- Prevailing weather conditions
- Condition of bore headworks (i.e. absent end-caps, presence of surface water inside the gattic cover) (where applicable)
- Name of sampler
- Other relevant information and commentary

6 Reporting

Reporting and data provision requirements relevant to this OGWMP are outlined in Section 6.3 of the OGMP.

7 Review and improvement

Continual improvement is achieved through constant measurement and evaluation, audit and review of the effectiveness of the plan, and adjustment and improvement of the OEMP, project environmental outcomes and I&M Contractor's Environmental Management System (EMS).

This program will be updated as required:

- 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 DPE or any other Authority; or
- In response to internal or external audits or quarterly management reviews.

During operation the updated program would be reviewed and approved in accordance with the process in Section 10.1 of the OEMP.

Annexure A Baseline groundwater monitoring results

Monitoring Well	Lithology Screened	screen interval (m)	RL toc mAHD	SWL mbtoc	SWL mAHD	SWL mbtoc	SWL mAHD	SWL mbtoc	SWL mAHD	SWL mbtoc	SWL mAHD	SWL mbtoc	SWL mAHD	SWL mbtoc	SWL mAHD	SWL mbtoc	SWL mAHD
				Jun-16		Jul-16		Aug-16		Sep-16		Oct-16		Nov-16		Dec-16	
HB_BH02	Hawkesbury Sandstone	14-17	2.80	2.19	0.61			2.28	0.52								
HB_BH03	Hawkesbury Sandstone	14-17	6.15					2.01	4.14	2.06	4.09	2.25	3.90	2.504	3.65		
HB_BH08d	Hawkesbury Sandstone	22-25	1.49	flowing	1.49+	flow	1.49+	flowing	1.49+					flowing	1.49+		
HB_BH08s	Alluvium	10-13	1.43	0.31	1.12	0.37	1.06	0.39	1.04	0.45	0.98	0.52	0.92	0.626	0.80	0.60	0.83
HB_BH12	Hawkesbury Sandstone	27-30	2.13			0.02	2.11	0.02	2.11			0.05	2.08			0.05	2.08
HB_BH14	Hawkesbury Sandstone	37-40	4.20			1.69	2.51	1.66	2.54							1.73	2.47
HB_BH15	Hawkesbury Sandstone	19-22	17.80	9.6	8.20	9.66	8.14	9.76	8.04	9.327	8.47	9.60	8.20	9.695	8.11	9.68	8.12
SP_BH01	Ashfield Shale	36 - 39	17.71							8.27	9.44			9.028	8.68	9.05	8.66
SP_BH02	Residual Clay (Shale)	4-10	19.42	2.39	17.03	2.75	16.67	2.50	16.92	2.552	16.87	9.00	10.43	3.082	16.34		
SP_BH04	Ashfield Shale	32 - 35	12.23					8.55	3.68	7.86	4.37	8.10	4.13	8.023	4.21	8.03	4.20
SP_BH06	Ashfield Shale	20-23	13.28	2.4	10.88									6.055	7.23	6.59	6.69
SP_BH09	Ashfield Shale	23-26	12.84	3.82	9.02	16.37	-3.53										
MT_BH02	Hawkesbury Sandstone	42-45	34.10														
MT_BH07	Hawkesbury Sandstone	43-46	24.41														
MT_BH11	Hawkesbury Sandstone	48-51	28.67														
MT_BH14	Hawkesbury Sandstone	27-30	27.31														
MT_BH20	Hawkesbury Sandstone	41-44	12.27														
MT_BH21	Hawkesbury Sandstone	47-50	25.05														

Note: Blank cells indicate data not available

Monitoring Well	Lithology Screened	screen interval (m)	RL toc mAHD	SWL mbtoc	SWL mAHD	SWL mbtoc	SWL mAHD	SWL mbtoc	SWL mAHD	SWL mbtoc	SWL mAHD	SWL mbtoc	SWL mAHD
				Jan-17		Feb-17		Mar-17		Apr-17		May-17	
HB_BH02	Hawkesbury Sandstone	14-17	2.80										
HB_BH03	Hawkesbury Sandstone	14-17	6.15			2.73	3.42	0.578	5.57	2.20	3.95	2.475	3.68
HB_BH08d	Hawkesbury Sandstone	22-25	1.49							flowing	1.49+		
HB_BH08s	Alluvium	10-13	1.43	0.64	0.79	0.60	0.83	0.503	0.93	0.28	1.15	0.505	0.93
HB_BH12	Hawkesbury Sandstone	27-30	2.13			0.08	2.05	0.02	2.11	0.02	2.11	0.2	1.93
HB_BH14	Hawkesbury Sandstone	37-40	4.20			1.73	2.47	1.538	2.66			1.518	2.68
HB_BH15	Hawkesbury Sandstone	19-22	17.80	9.66	8.14	9.62	8.18	9.674	8.13	9.64	8.16	9.677	8.12
SP_BH01	Ashfield Shale	36 - 39	17.71	9.06	8.65	9.066	8.64	9.069	8.64	9.10	8.61	9.091	8.62
SP_BH02	Residual Clay (Shale)	4-10	19.42			3.454	15.97					3.239	16.18
SP_BH04	Ashfield Shale	32 - 35	12.23	7.95	4.28	7.975	4.26	7.961	4.27	7.51	4.72	8.786	3.44
SP_BH06	Ashfield Shale	20-23	13.28										
SP_BH09	Ashfield Shale	23-26	12.84										
MT_BH02	Hawkesbury Sandstone	42-45	34.10			25.79	8.31	25.431	8.669	25.50	8.60	25.258	8.84
MT_BH07	Hawkesbury Sandstone	43-46	24.41			19.01	5.40	18.837	5.573	18.78	5.63	17.918	6.49
MT_BH11	Hawkesbury Sandstone	48-51	28.67					19.706	8.96				
MT_BH14	Hawkesbury Sandstone	27-30	27.31	16.71	10.60	3.591	23.72	16.726	10.584	16.61	10.70		
MT_BH20	Hawkesbury Sandstone	41-44	12.27					1.956	10.31				
MT_BH21	Hawkesbury Sandstone	47-50	25.05			10.51	14.54	10.26	14.79				

Note: Blank cells indicate data not available

	Date	Temperature (°C)	Dissolved Oxygen (ppm)	Conductivity (µS/cm)	pH	Redox Potential (mV)
HB_BH08S	8/06/2016	20.2	0.2	9068	6.76	-105.4
HB_BH08S	27/07/2016	17.5	1.74	1561	8.06	-105.9
HB_BH08S	30/08/2016	14	1.53	2667	7.12	-78.3
HB_BH08S	27/09/2016	19.6	0.12	3609	6.97	-125
HB_BH08S	26/10/2016	21.4	1.7	5699	6.21	-105.3
HB_BH08S	30/11/2016	21.1	1.47	2637	7.57	-57.9
HB_BH08S	14/12/2016	21.7	3.61	3680	7.31	-89
HB_BH08S	17/01/2017	22.6	2.96	5380	7.02	-71
HB_BH08S	15/02/2017	23	1.66	3467	5.96	-100.4
HB_BH08S	15/03/2017	22.03	3.23	5658	7.37	53.4
HB_BH08S	28/04/2017	19.48	4.05	5065.3	7.51	131
HB_BH08S	25/05/2017	19.9	3.8	1857	6.94	181
SP_BH01	26/10/2016	23.5	1.91	2088	7.23	-103.3
SP_BH01	30/11/2016	22.2	0.8	901	9.79	-216.1
SP_BH01	13/12/2016	22.4	7.26	1824	7.18	-185
SP_BH01	17/01/2017	22.9	2.07	1544	7.19	-166
SP_BH01	15/02/2017	21.6	2.61	2801	6.86	-255.8
SP_BH01	15/03/2017	22.9	0.31	2165.4	7.36	-203
SP_BH01	27/04/2017	19.8	4.95	2681.6	8.43	-169.2
SP_BH01	26/05/2017	18.7	2.28	1062	8.98	-6.5
SP_BH02	27/07/2016	20	0.88	2988	5.95	-29.7
SP_BH02	31/08/2016	21.4	2.51	2349	5.85	19.9
SP_BH02	27/09/2016	19.1	1.52	3548	5.85	-60.1
SP_BH02	26/10/2016	24.4	1.49	2385	6.2	-86.9
SP_BH02	30/11/2016	23	0.2	1015	10.88	-109.3
SP_BH02	15/02/2017	25.1	0	11986	5.51	-103.7
SP_BH02	15/03/2017	23.92	1.89	2429.3	6.16	-1.3
SP_BH02	26/05/2017	20.44	2.09	2913.8	6.43	36.3
SP_BH04	10/08/2016	21.8	0.56	3665	6.99	-86
SP_BH04	29/09/2016	17.8	8.7	5150	7.11	-182.6
SP_BH04	26/10/2016	23.2	0.54	3301	7.46	-121.3
SP_BH04	30/11/2016	21.3	1.29	3141	8.27	-213.6
SP_BH04	13/12/2016	24.1	2.11	3050	7.11	42
SP_BH04	17/01/2017	21.9	2.7	3270	7.14	-88
SP_BH04	15/02/2017	22.1	0.08	5934	6.68	-196
SP_BH04	15/03/2017	22.38	1.48	5114.7	7.05	-28
SP_BH04	27/04/2017	19.93	4.11	5448.3	8.13	-123.7
SP_BH04	26/04/2017	19.46	0.28	3551.4	8.34	-9.6
SP_BH06	8/06/2016	20.9	0.75	9881	12.13	-1619
SP_BH06	30/11/2016	20.6	0.13	1030	12.03	-200.5
SP_BH09	8/06/2016	25.6	0	242	8.19	-288
SP_BH09	27/07/2016	17	3.51	1748	7.69	-62.3
HB_BH02	8/06/2016	20.1	0.5	5574	6.34	-43.4
HB_BH02	27/07/2016	18	1.9	2604	7.08	-164.6
HB_BH02	30/08/2016	19.7	2.43	1793	7.3	-95.1
HB_BH02	15/02/2017	22.9	0.38	1107	6.04	-180.7
HB_BH03	10/08/2016	21.1	1.17	1176	5.94	35.8

	Date	Temperature (°C)	Dissolved Oxygen (ppm)	Conductivity (µS/cm)	pH	Redox Potential (mV)
HB_BH03	29/09/2016	19.4	1.5	558	6.53	-33.2
HB_BH03	26/10/2016	21.1	1.64	792	6.7	-101.4
HB_BH03	30/11/2016	22	1.12	934	8	-72.3
HB_BH03	15/03/2017	23.03	3.02	872.4	7.05	-102.9
HB_BH03	28/04/2017	19.2	5.57	955.4	8.52	-125.5
HB_BH03	25/05/2017	17.38	2.68	1199	6.56	23.1
HB_BH08D	8/06/2016	19.9	1.16	2775	8.75	-228.4
HB_BH08D	30/08/2016	19.3	1.49	2430	7.28	-206.1
HB_BH08D	27/09/2016	19.6	0.16	3154	6.47	-161.8
HB_BH08D	26/10/2016	20.9	2.55	3029	6.53	-106.1
HB_BH08D	30/11/2016	21.4	1.7	2951	7.28	-97.6
HB_BH08D	14/12/2016	22.1	1.92	2660	7.18	-74
HB_BH08D	17/01/2017	26.1	2.85	2030	7.07	-68
HB_BH08D	15/02/2017	22.1	1.28	2964	5.91	-161.3
HB_BH08D	15/03/2017	22.22	3.19	2581.7	7.93	-32
HB_BH08D	24/04/2017	19.93	2.41	2800.2	7.57	-70.9
HB_BH08D	25/05/2017	19.59	1.48	2492.3	6.81	-30.2
HB_BH12	14/07/2016	17.6	1.73	1037	11.19	178.6
HB_BH12	30/08/2016	18.8	1.36	7670	12.25	-235.7
HB_BH12	28/09/2016	18.6	0.22	11946	12.33	-216.5
HB_BH12	26/10/2016	20.6	1.08	5223	11.68	-116.8
HB_BH12	14/12/2016	23.5	1.98	6210	12.03	-15
HB_BH12	15/02/2017	22.3	1.94	4520	10.7	-205.4
HB_BH12	15/03/2017	21.77	0.43	6111.5	12.52	-137.9
HB_BH12	28/04/2017	20.39	2.43	7878.9	11.83	-163
HB_BH12	25/05/2017	18.48	1.86	5422	12.24	16.5
HB_BH14	14/07/2016	19.8	1.31	2169	6.91	141.6
HB_BH14	27/07/2016	19.5	3.75	1196	8.82	-155.3
HB_BH14	30/08/2016	18.9	1.83	1264	7.26	-124.7
HB_BH14	14/12/2016	24.6	2.87	2106	8.72	-138
HB_BH14	15/02/2017	21.9	0.39	2166	7.39	-162.5
HB_BH14	15/03/2017	22.09	1.42	1211.2	8.39	-95.2
HB_BH14	26/05/2017	20.51	2.59	568.8	8.26	43.1
HB_BH15	8/06/2016	19.8	1.68	675	8.25	-14.7
HB_BH15	27/07/2016	19.9	2.37	1010	6.79	-103.7
HB_BH15	30/08/2016	18.5	20.9	958	6.29	-73.4
HB_BH15	28/09/2016	20.2	0.65	1556	7.02	-93
HB_BH15	26/10/2016	22.6	1.61	1517	5.77	-76.7
HB_BH15	30/11/2016	21.7	1.92	967	7.21	-131.8
HB_BH15	14/12/2016	22.7	2.96	16300	7.45	-130
HB_BH15	17/01/2017	24.3	2.97	1385	6.31	-45
HB_BH15	15/02/2017	21.3	2.03	1340	7.08	-136
HB_BH15	15/03/2017	22.11	3.55	1108.3	6.79	15.8
HB_BH15	28/04/2017	19.84	4.46	1337.8	11.01	-229.1
HB_BH15	25/05/2017	20.07	1.29	1216	8.64	-82
MT_BH02	15/03/2017	22.02	4.72	8899.9	12.69	-33.5
MT_BH02	28/04/2017	19.57	5.06	8700.5	11.33	-101

	Date	Temperature (°C)	Dissolved Oxygen (ppm)	Conductivity (µS/cm)	pH	Redox Potential (mV)
MT_BH02	26/05/2017	19.37	4.16	8185.3	12.33	58.1
MT_BH07	17/02/2017	20.4	1.13	2880	10.8	-295.1
MT_BH07	14/03/2017	21.95	1.93	2362	12.13	42.3
MT_BH07	27/04/2017	17	6.12	2139.7	11.73	-40.7
MT_BH07	26/05/2017	20.15	3.48	1737.6	11.22	51.3
MT_BH14	17/01/2017	22.8	2.47	2170	8.18	-51
MT_BH14	17/02/2017	20.8	0.13	2296	7.66	-267.2
MT_BH14	15/03/2017	22.22	1.93	2036.5	8.05	-51
MT_BH14	28/04/2017	17.1	5.27	1961	8.24	-133.2
MT_BH19	16/01/2017	24.2	5.94		12.2	-60
MT_BH19	17/02/2017	22.4	3.12	6690	11.85	-276.7
MT_BH19	26/05/2017	19.54	3.44	3768.3	12.04	27.4
MT_BH21	17/02/2017	20.6	1.76	2797	11.18	-246.3
MT_BH21	14/03/2017	22.31	3.69	1984.6	8.22	194.9

Annexure B Groundwater level model predictions

Bore ID	Predicted Drawdown Level[1] (mAHD)
LSB-GW-HB-BH03	27.5
LSB-HB-BH1002	21.7
LSB-GW-HB-BH08d	14.9
LSB-HC-PT-OW5a	11.2
LSB-MT-BH1018	40.6
LSB-GW-HB-BH12	24.2
LSB-MT-BH1015	30.2
LSB-HC-PT-OW4	19.9
HB_BH14	22.6
HB_BH15	16.4
LSB-MT-BH1014a	32.2
LSB-MT-BH1013a	27.4
LSB-MT-BH1014-VWP1	32.1
MT_BH11	31.0
LSB-MT-BH1021-VWP2	26.5
LSB-MT-BH1012	34.7
LSB-MT-BH1022-VWP3	33.0
LSB-MT-BH1009a	24.3
SP_BH02	4.6
SP_BH04	41.0
LSB-SP-BH11	11.9
LSB-SP-BH03	6.4
LSB-SPI-OM-BH01	42.9
LSB-SPI-OM-BH01a	43.2
LSB-SPI-OM-BH02	31.8
LSB-SPI-OM-BH04	52.1
LSB-SPI-OM-BH05	42.4
LSB-SPI-OM-BH06	21.6
LSB-SPI-OM-BH06a	12.7
LSB-SPI-OM-BH07	45.9
LSB-SPI-OM-BH10	22.6
LSB-SPI-OM-BH10a	21.0

[1] Steady-state predictions from Project groundwater model (Golders Associates, 2022)

Annexure I Environmental Control Plan

WestConnex M4-M5 Link Mainline Tunnels

Environmental Control Map 1 of 8

Legend

- Tunnel Alignment
- Ancillary Facility Boundary
- Operational Ancillary Infrastructure
- NCA Boundary

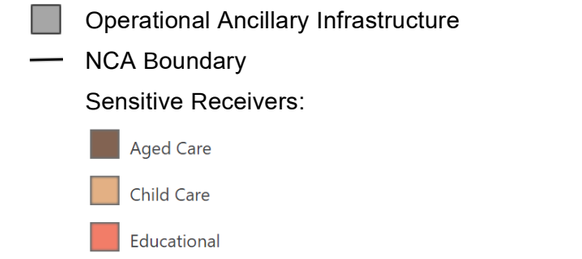
Sensitive Receivers:

- Aged Care
- Child Care
- Educational
- Medical
- Place of Worship
- Other

LEP Heritage:

- Conservation Area - General
- Item - Archaeological
- Item - General
- Item - Landscape

- S170 Heritage
- State Heritage
- Waterbody
- Augmented M8 Basin



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WestConnex M4-M5 Link Mainline Tunnels

Environmental Control Map 2 of 8

Legend

- Tunnel Alignment
- Ancillary Facility Boundary
- Operational Ancillary Infrastructure
- NCA Boundary

Sensitive Receivers:

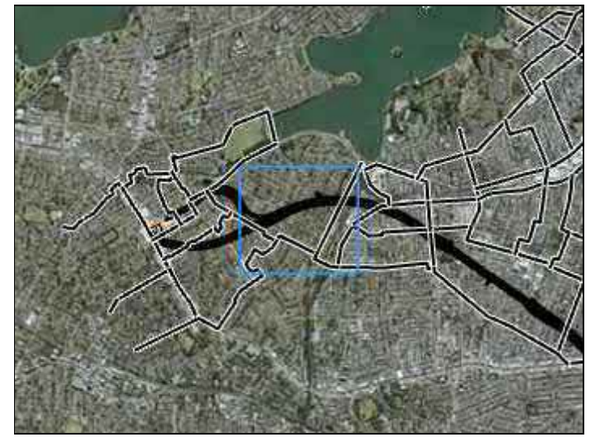
- Aged Care
- Child Care
- Educational
- Medical
- Place of Worship
- Other

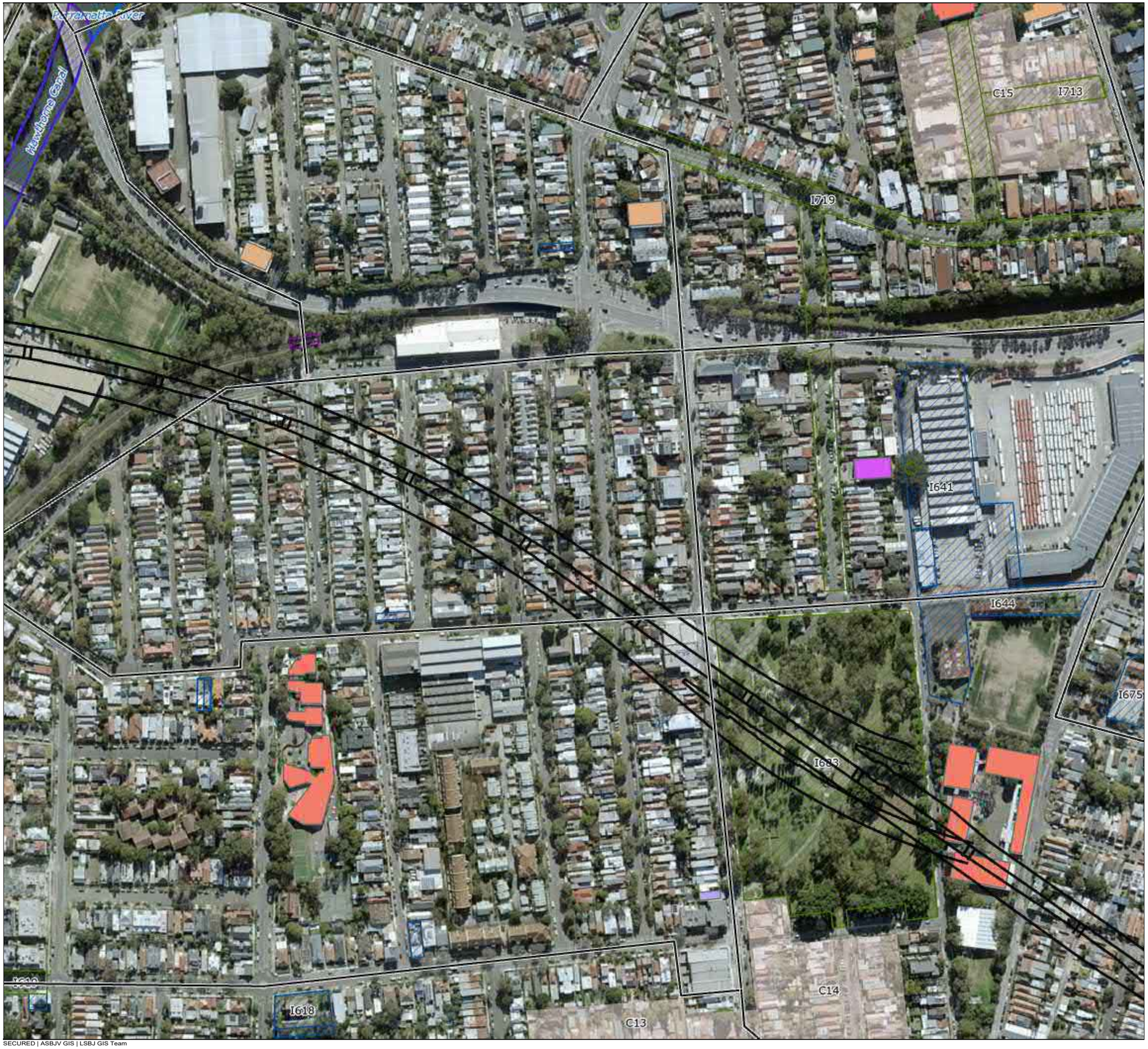
LEP Heritage:

- Conservation Area - General
- Item - Archaeological
- Item - General
- Item - Landscape

- S170 Heritage
- State Heritage
- Waterbody
- Augmented M8 Basin

0 100 200 m





WestConnex M4-M5 Link Mainline Tunnels

Environmental Control Map 3 of 8

Legend

- Tunnel Alignment
- Ancillary Facility Boundary
- Operational Ancillary Infrastructure
- NCA Boundary

Sensitive Receivers:

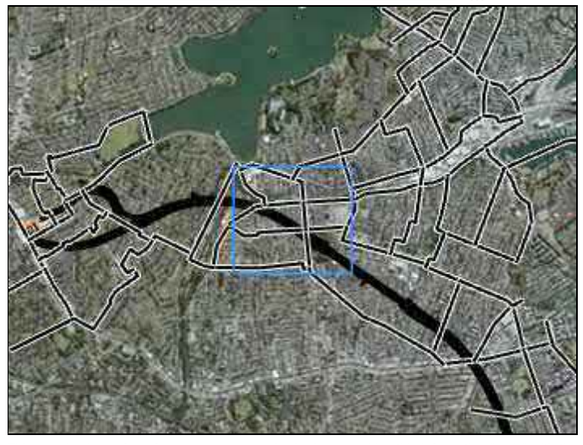
- Aged Care
- Child Care
- Educational
- Medical
- Place of Worship
- Other

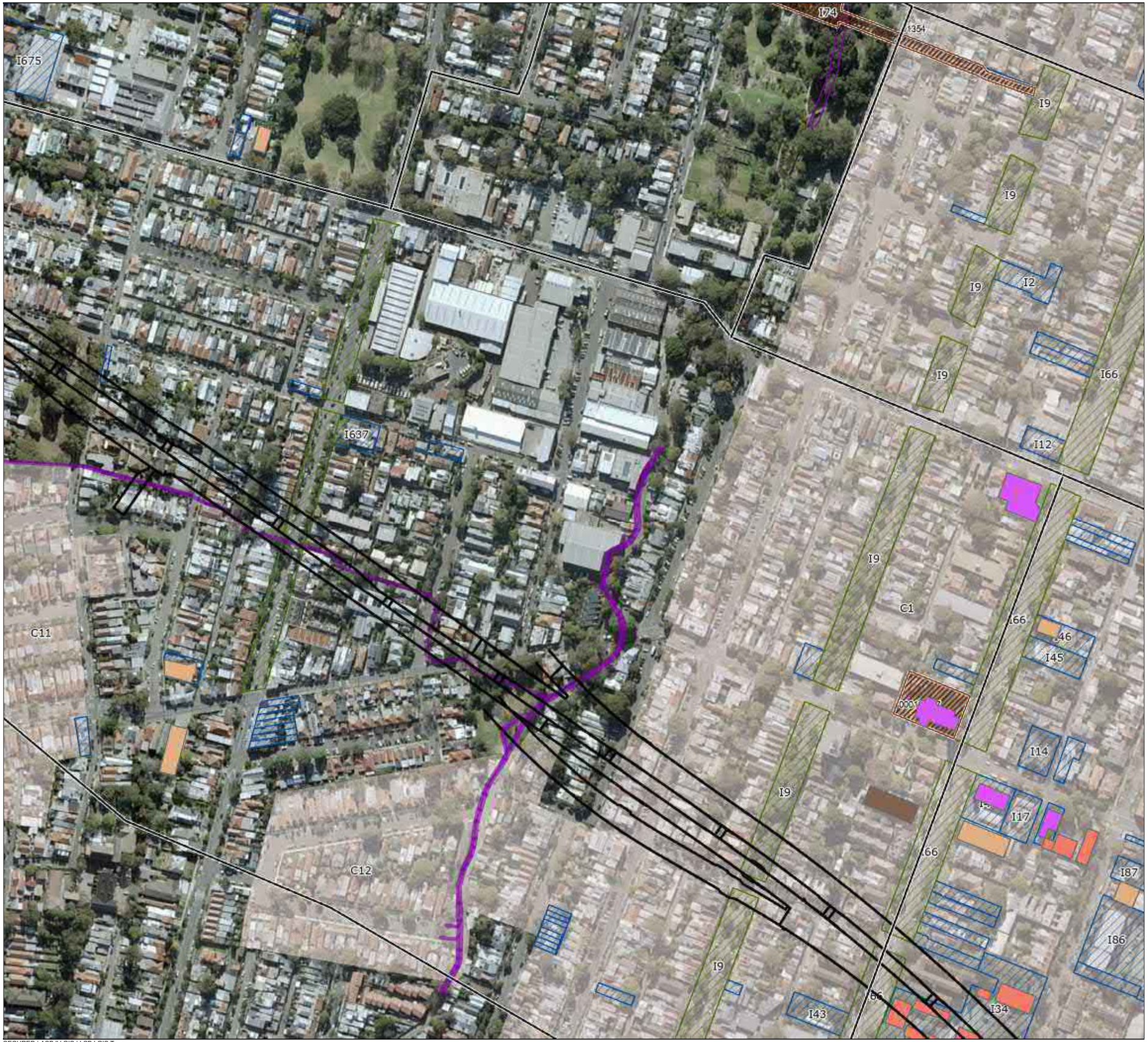
LEP Heritage:

- Conservation Area - General
- Item - Archaeological
- Item - General
- Item - Landscape

- S170 Heritage
- State Heritage
- Waterbody
- Augmented M8 Basin

0 100 200 m





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WestConnex M4-M5 Link Mainline Tunnels

Environmental Control Map 4 of 8

Legend

- Tunnel Alignment
- Ancillary Facility Boundary
- Operational Ancillary Infrastructure
- NCA Boundary

Sensitive Receivers:

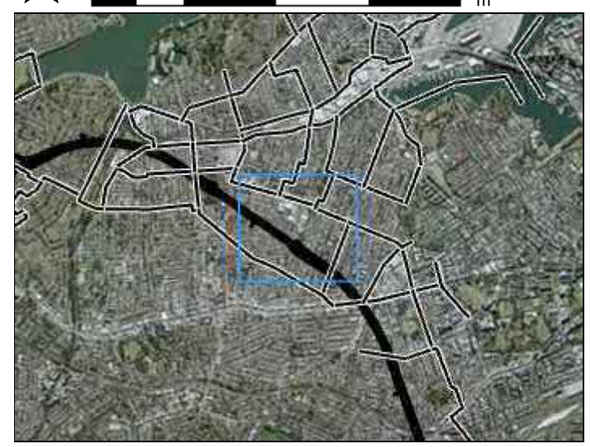
- Aged Care
- Child Care
- Educational
- Medical
- Place of Worship
- Other

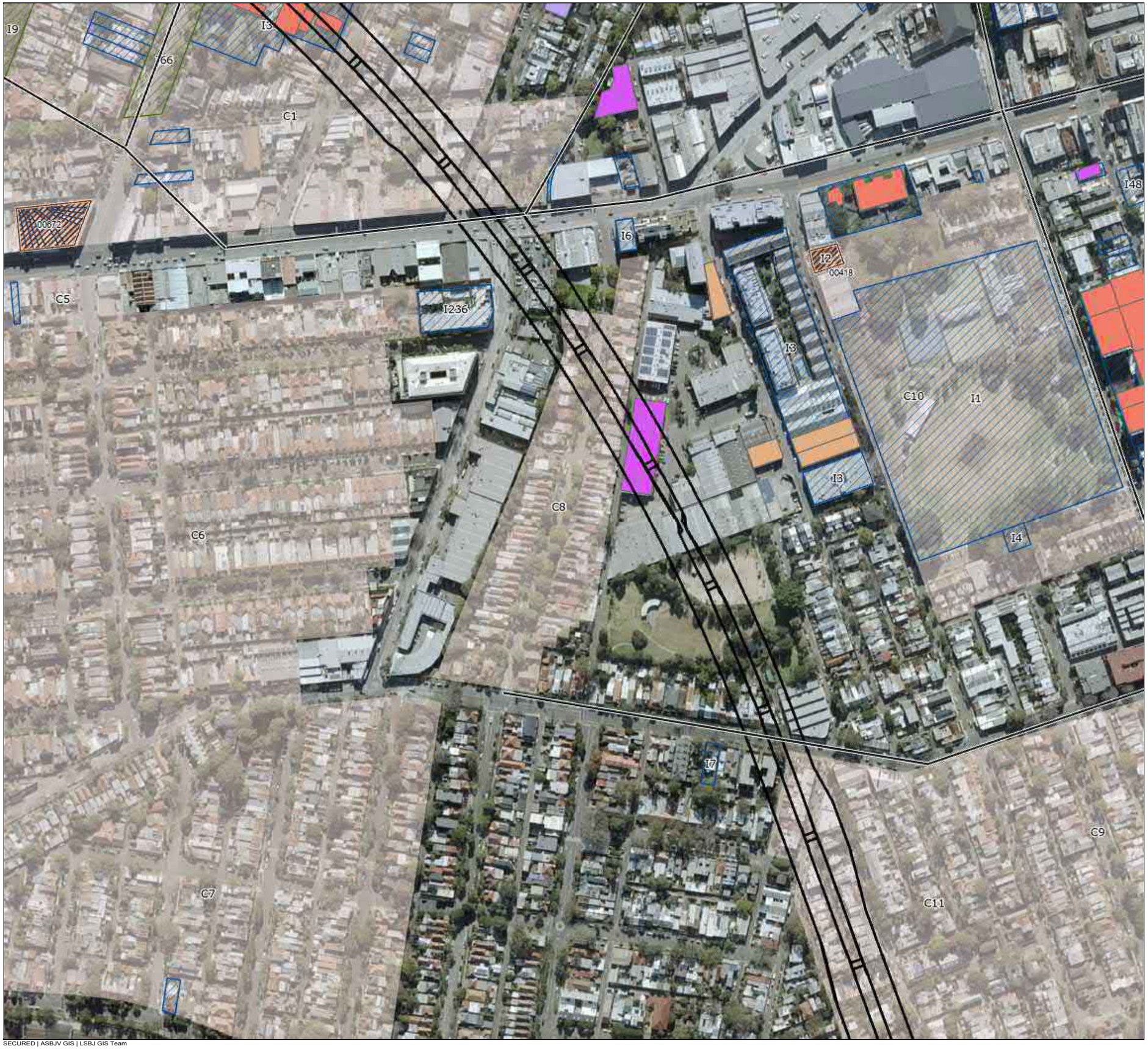
LEP Heritage:

- Conservation Area - General
- Item - Archaeological
- Item - General
- Item - Landscape

- S170 Heritage
- State Heritage
- Waterbody
- Augmented M8 Basin

0 100 200 m





WestConnex M4-M5 Link Mainline Tunnels

Environmental Control Map 5 of 8

Legend

- Tunnel Alignment
- Ancillary Facility Boundary
- Operational Ancillary Infrastructure
- NCA Boundary

Sensitive Receivers:

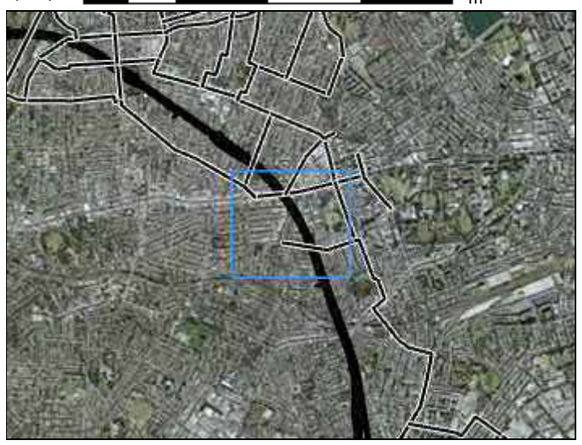
- Aged Care
- Child Care
- Educational
- Medical
- Place of Worship
- Other

LEP Heritage:

- Conservation Area - General
- Item - Archaeological
- Item - General
- Item - Landscape

- S170 Heritage
- State Heritage
- Waterbody
- Augmented M8 Basin

0 100 200 m



WestConnex M4-M5 Link Mainline Tunnels

Environmental Control Map 6 of 8

Legend

- Tunnel Alignment
- Ancillary Facility Boundary
- Operational Ancillary Infrastructure
- NCA Boundary

Sensitive Receivers:

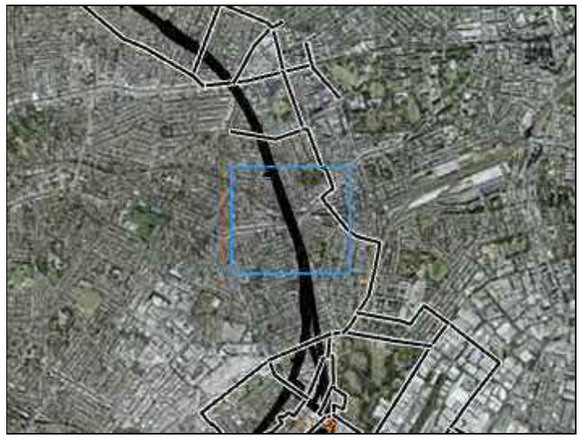
- Aged Care
- Child Care
- Educational
- Medical
- Place of Worship
- Other

LEP Heritage:

- Conservation Area - General
- Item - Archaeological
- Item - General
- Item - Landscape

- S170 Heritage
- State Heritage
- Waterbody
- Augmented M8 Basin

0 100 200 m



WestConnex M4-M5 Link Mainline Tunnels

Environmental Control Map 7 of 8

Legend

- Tunnel Alignment
- Ancillary Facility Boundary
- Operational Ancillary Infrastructure
- NCA Boundary

Sensitive Receivers:

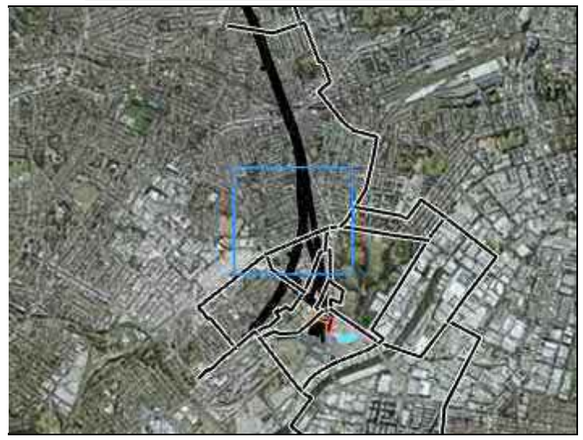
- Aged Care
- Child Care
- Educational
- Medical
- Place of Worship
- Other

LEP Heritage:

- Conservation Area - General
- Item - Archaeological
- Item - General
- Item - Landscape

- S170 Heritage
- State Heritage
- Waterbody
- Augmented M8 Basin

0 100 200 m



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WestConnex M4-M5 Link Mainline Tunnels

Environmental Control Map 8 of 8

Legend

- Tunnel Alignment
- Ancillary Facility Boundary
- Operational Ancillary Infrastructure
- NCA Boundary

Sensitive Receivers:

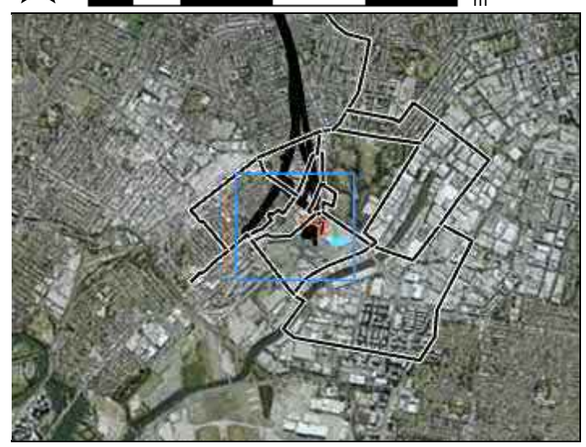
- Aged Care
- Child Care
- Educational
- Medical
- Place of Worship
- Other

LEP Heritage:

- Conservation Area - General
- Item - Archaeological
- Item - General
- Item - Landscape

- S170 Heritage
- State Heritage
- Waterbody
- Augmented M8 Basin

0 100 200 m



Annexure J Consultation for the M4-M5 Link Mainline Tunnels OEMP and sub-plans

Available upon request

Annexure K Asset Performance Outcomes

Desired performance outcomes (PO) from Appendix A of the EIS relevant to operation of the Asset.

Desired performance outcome		Reference
Air Quality	The project is designed, constructed and operated in a manner that minimises air quality impacts (including nuisance dust and odour) to minimise risks to human health and the environment to the greatest extent practicable.	Air quality impacts during operation will be managed through the implementation of the OAQMP. Refer to Annexure F.
Noise and Vibration – Amenity	Increases in noise emissions and vibration affecting nearby properties and other sensitive receivers during operation of the project are effectively managed to protect the amenity and well-being of the community.	Operational noise impacts and required mitigation measures were assessed in the ONVR required by CoA E92. Within 12 months of the commencement of operation, monitoring will be undertaken to compare actual noise performance of the Asset against the ONVR noise predictions and assess whether additional mitigation is required. This monitoring and assessment will be documented in an Operational Noise Compliance Report. Refer to Section 9.2 and 9.7. Mitigation measures relevant to noise and vibration are detailed in Section 5.4.
Noise and Vibration – Structural	Increases in noise emissions and vibration affecting environmental heritage as defined in the Heritage Act 1977 during operation of the project are effectively managed	Mitigation measures relevant to vibration-induced damage to heritage features are detailed in Section 5.4.
Water – Hydrology and Quality	Long term impacts on surface water and groundwater hydrology (including drawdown, flow rates and volumes) are minimised. The environmental values of nearby, connected and affected water sources, groundwater and dependent ecological systems including estuarine and marine water (if applicable) are maintained (where values are achieved) or improved and maintained (where values are not achieved). Sustainable use of water resources. The project is designed, constructed and operated to protect the NSW Water Quality Objectives where they are currently being achieved, and contribute towards achievement of the Water Quality Objectives over time where they are currently not being achieved, including downstream of the project to the extent of the project impact including estuarine and marine waters (if applicable).	Surface water and groundwater impacts during operation will be managed through the implementation of the OSWQP and OGMP which include Operational Monitoring Programs. Refer to Annexure G and H. The Asset has been designed to incorporate features which will reduce the consumption of potable water throughout operation and promote the reuse of non-potable water. These reuse options were assessed in the Operational Water Reuse Strategy which was prepared to address CoA E198.

Desired performance outcome		Reference
Flooding	The project minimises adverse impacts on existing flooding characteristics. Construction and operation of the project avoids or minimises the risk of, and adverse impacts from, infrastructure flooding, flooding hazards, or dam failure.	The design of the Asset's drainage and water treatment systems were informed by flooding modelling to ensure adverse impacts were minimised. Refer to the OSWQP (Annexure G). In accordance with CoA E153, a Flood Review Report will be prepared after the first defined flood event. This review will assess the actual flood impact against that predicted by the flood modelling completed during detailed design. This review will also assess whether additional mitigation measures are required to minimise adverse impacts on nearby properties, structures and infrastructure. Refer to Section 9.4 and 9.7.
Heritage	The design, construction and operation of the project facilitates, to the greatest extent possible, the long-term protection, conservation and management of the heritage significance of items of environmental heritage and Aboriginal objects and places. The design, construction and operation of the project avoids or minimises impacts, to the greatest extent possible, on the heritage significance of environmental heritage and Aboriginal objects and places.	Heritage will be managed in accordance with the relevant legislation and guidelines detailed in Section 4.1 and 4.2. As detailed in Section 5.4, heritage has not been identified as a moderate or high risk for the operation of the Asset.
Waste	All wastes generated during the construction and operation of the project are effectively stored, handled, treated, reused, recycled and/or disposed of lawfully and in a manner that protects environmental values.	Waste generated during operation will be managed in accordance with the relevant legislation and guidelines detailed in Section 4.1 and 4.2. Mitigation measures relevant to waste management are detailed in Section 5.4.