



APPENDIX B10

Construction Contaminated Land Management Plan

*Whytes Lane to Pimlico Road Early
Works – Wave 2*

Woolgoolga to Ballina Pacific Highway
Upgrade

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Appendix A *Unexpected Discovery of Contaminated Land Procedure*

Glossary / Abbreviations

CEMP	Construction Environmental Management Plan
CLM Act	Contaminated Land Management Act 1997
CoA	Condition of approval
DP&I	Former NSW Department of Planning and Infrastructure (now DP&E)
DP&E	NSW Department of Planning and Environment
EIS	Woolgoolga to Ballina Pacific Highway Upgrade Environmental Impact Statement (December, 2012)
EPA	NSW Environment Protection Authority
EP&A Act	<i>NSW Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Commonwealth Environmental Protection and Biodiversity Conservation Act 1999</i>
EWMS	Environmental Work Method Statements
CHMP	Construction Heritage Management Plan
Minister, the	NSW Minister for Planning
NEPM	National Environment Protection Measure
NPW Act	<i>NSW National Parks and Wildlife Act 1974</i>
OEH	NSW Office of Environment and Heritage
PoEO Act	<i>NSW Protection of the Environment Operations Act 1997</i>
Project, the	Whytes Lane to Pimlico Road Early Works – Wave 2
Secretary	Secretary of the Department of Planning and Environment
SEE Civil	SEE Civil Pty Ltd
SPIR	Woolgoolga to Ballina Pacific Highway Upgrade Submissions Preferred Infrastructure Report (November, 2013)
SSI	State Significant Infrastructure
RMS, Roads and Maritime Services	NSW Roads and Maritime
VENM	Virgin Excavated Natural Material

I Introduction

1.1 Context

This Construction Contaminated Land Management Plan (CCLMP or Plan) forms part of the Construction Environmental Management Plan (CEMP) for the upgrade of the Whytes Lane to Pimlico Road Early Works – Wave 2 (the Project).

This CCLMP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA) and the mitigation measures listed in the Pacific Highway Upgrade Woolgoolga to Ballina Environmental Impact Statement (EIS) and all applicable legislation.

There are four tie in projects within the Woolgoolga to Ballina project limits, namely the Sapphire to Woolgoolga, Glenugie Upgrade, Devils Pulpit and Ballina Bypass projects. These tie in projects have been approved separately by the Minister for Planning. Relevant conditions of approval for these projects have been referenced in the Whytes Lane to Pimlico Road Early Works – Wave 2 CEMP and plans as appropriate.

Wave 2 (the Project) is located within Section 11 of the Woolgoolga to Ballina Pacific Highway Upgrade. Wave 2 of the Early Works (soft soil treatments) is to allow the future upgrade of the section of HW10 Pacific Highway, Woolgoolga to Ballina. The Project specifically covers the following soft soil site as detailed below:

- Soft Soil Site 11 – between Whytes Lane and Pimlico Road (W2P) (STN 159,900 to STN 163,800).

1.2 Background

The Pacific Highway Upgrade Woolgoolga to Ballina EIS (RMS 2012) assessed potential land contamination impacts from construction of the Project.

Based on the relevant findings of the EIS (Figure 9-22 in the EIS), there are no known areas of contamination (identified as 'potential areas of environmental concern') located within or near the Project boundary.

Additional management measures were provided within the *Woolgoolga to Ballina Submissions / Preferred Infrastructure Report Nov 2013*, with applicable management measures from that report included in Section 5 of this CCLMP.

1.3 Environmental management systems overview

The overall Environmental Management System for the Project is described in the Construction Environmental Management Plan (CEMP).

The CCLMP is part of the environmental management framework for the Project, as described in Section 4.1 of the CEMP.

Management measures identified in this Plan will be incorporated into site or activity specific Environmental Work Method Statements (EWMS). EWMS will be developed and signed off by environment and management representatives prior to associated works and construction personnel will be required to undertake works in accordance with the identified requirements and associated mitigation measures.

Used together, the CEMP, strategies, procedures and EWMS form management guides that clearly identify required environmental management actions for reference by SEE Civil personnel and sub-contractors.

The review and document control processes for this Plan are described in Section 1.6 and Chapters 9 and 10 of the CEMP.

2 Purpose and objectives

2.1 Purpose

The purpose of this CCLMP is to establish a set of best practice procedures for the identification and management of contaminated land if encountered during works undertaken for the Project.

This plan has been prepared to address the applicable statutory requirements and aims to ensure that the commitments with regard to contaminated land are met.

2.2 Objectives

The key objective of the CCLMP is to ensure that impacts from the disturbance of contaminated land are minimised and managed. Specifically:

- Avoid and minimise the environmental and human health risks arising from the disturbance of contaminated land encountered during construction of the Project.
- Follow the guidelines set out in the statutory requirements for managing contaminated land and the transport of contaminated goods.
- No degradation to the receiving environment as a result of disturbance of contaminated land.
- No contamination of soil, air or water as a result of spillages or other impacts arising from construction activities.

2.3 Targets

The following targets have been established for the management of contaminated land during the project:

- Ensure full compliance with the relevant legislative requirements, CoA and RMS specifications.
- Ensuring training on contaminated land management is provided to all construction personnel through site inductions.

3 Environmental requirements

3.1 Relevant legislation and guidelines

3.1.1 Legislation

Legislation relevant to contaminated land management includes:

- *Environmental Planning and Assessment Act 1979 (EP&A Act)*.
- *Contaminated Land Management Act 1997*.
- *Protection of the Environment Operations Act 1997*.
- *Environmentally Hazardous Chemicals Act 1985*.
- *Environmentally Hazardous Chemicals Regulation 2008*
- *Pesticides Act 1999*
- *Pesticides Regulation 2009*

Relevant provisions of the above legislation are explained in the register of legal and other requirements included in Appendix A1 of the CEMP.

3.1.2 Guidelines and standards

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

- NEPM Guidelines for the Assessment of Site Contamination.
- Waste Classification Guidelines – Part 1: Classification of waste (NSW EPA 2014).
- RMS QA Specification G36 – Environmental Protection, adjusted for this project (Version HW10 Pacific Highway Upgrade, Woolgoolga to Ballina Early Works – Wave 2, December 2014 Addendum 2).
- RMS Guideline for the Management of Contamination, September 2013.
- Environmental Procedure Management of Wastes on Roads and Maritime Services Land 2014 (RMS Publication).
- Roads & Maritime Services Environmental Incident Classification and Reporting Procedure (2012);
- NSW Department of Environment & Climate Change Guidelines for NSW Site Auditor Scheme;
- NSW Department of Planning State Environmental Planning Policy 55 – Remediation of Land;
- Department of Urban Affairs and Planning and Environment Protection Authority Planning Guidelines SEPP 55 – Remediation of Land (1998);
- NSW Office of Environment and Heritage (2011) Guidelines for Consultants Reporting on Contamination Sites;
- Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 OEH (2009); and
- RMS Contamination Management Factsheets:
 - FS1 Statutory Framework
 - FS2 Planning Context
 - FS3 Identification

- FS4 Assessment
- FS5 Health and Safety
- FS6 Land-based Contamination
- FS7 Estuarine and Marine Land
- FS8 Duty to Report
- FS9 Site Auditors
- FS10 Records Management
- FS11 Communication
- FS12 Managing Contamination
- FS13 Operational Management
- FS14 Acquisition of Land Strips

3.2 Minister’s Conditions of Approval

The CoA relevant to this Plan are listed Table 3 1.

Table 3-1 Conditions of Approval relevant to land contamination

CoA No.	Condition Requirements	Document Reference
B37	<p>Land Contamination</p> <p>Prior to the commencement of site preparation and excavation activities, or as otherwise agreed by the Secretary, in areas identified as having a moderate to high risk of contamination, a site audit shall be carried out by a suitably accredited contaminated site auditor. A Site Audit Report is to be prepared by the site auditor detailing the outcomes of Phase 2 contamination investigations within these areas. The Site Audit Report shall detail, where relevant, whether the land is suitable (for the intended land use) or can be made suitable through remediation.</p> <p>Where the investigations identify that the site is suitable for the intended operations and that there is no need for a specific remediation strategy, measures to identify, handle and manage potential contaminated soils, materials and groundwater shall be identified in the Site Audit Report and incorporated into the Construction Environmental Management Plan. Where the investigations identify that the site is suitable for the intended operations and that a remediation strategy is required, the Site Audit Report shall include a remediation strategy for addressing the site contamination, and how the environmental and human health risks will be managed during the disturbance, remediation and/or removal of contaminated soil or groundwater, and be incorporated into the Construction Environmental Management Plan.</p> <p>Where remediation is required, a Site Audit Statement(s) shall be prepared verifying that the site has been</p>	This plan

CoA No.	Condition Requirements	Document Reference
	<p>remediated to a standard consistent with the intended land use.</p> <p>Note <i>Terms used in this condition have the same meaning as in the Contaminated Land Management Act 1997.</i></p>	
D25 (d) (vii)	<p>The Applicant shall prepare and implement (following approval) a Construction Environmental Management Plan for the SSI, prior to the commencement of construction, or as otherwise agreed by the Secretary. The Plan shall be prepared in consultation with the EPA, OEHL, DPI (Fisheries), NOW and DoE and outline the environmental management practices and procedures that are to be followed during construction, and shall be prepared in consultation with the relevant government agencies and in accordance with the Guideline for the Preparation of Environmental Management Plans (Department of Infrastructure, Planning and Natural Resources, 2004). The Plan shall include, but not necessarily be limited to:</p> <p>(d) an environmental risk analysis to identify the key environmental performance issues associated with the construction phase and details of how environmental performance would be managed and monitored to meet acceptable outcomes, including what actions will be taken to address identified potential adverse environmental impacts (including any impacts arising from the staging of the construction of the SSI). In particular, the following environmental performance issues shall be addressed in the Plan:</p> <p>(vii) measures for the handling, treatment and management of contaminated materials;</p>	EWMS to be developed in response to Environmental Risk Management workshop held on 27 July, 2015. The EWMS will be incorporated and implemented as part of the site induction process.
D26 (c) (viii)	<p>As part of the Construction Environmental Management Plan for the SSI, the Applicant shall prepare and implement:</p> <p>(c) a Construction Soil and Water Quality Management Plan to manage surface and groundwater impacts during construction of the SSI. The Plan shall be developed in consultation with the EPA, DPI (Fisheries), NOW, Rous Water (in relation to the Woodburn borefield), DoE and the relevant council and include, but not necessarily be limited to:</p> <p>(viii) management measures for contaminated material and a contingency plan to be implemented in the case of unanticipated discovery of contaminated material during construction.</p>	This plan; CSWQMP

3.3 Existing environment

The following section summarises existing potential contaminated land within and adjacent to the Project area. The key reference document is Chapter 9 of the EIS.

Based on the relevant findings of the EIS (Figure 9-22 in the EIS), there are no known areas of contamination (identified as 'potential areas of environmental concern') located within or near the Project boundary.

4 Environmental aspects and impacts

4.1 Construction environmental aspects

The Project's environmental activities can have a direct and decisive impact on the environment and can contribute to a larger environmental change. The most significant construction activities relating to contaminated land management includes:

- demolition of buildings or historical road pavement;
- site clearing of vegetation;
- excavation and grading of topography in potentially contaminated sites;
- drainage water captured in excavation;
- building / construction waste;
- plant maintenance;
- importing, handling, stockpiling and transporting material resources; and
- general waste from service compounds.

The Aspects and Impacts Register can be found in Appendix A2 of the main CEMP.

4.2 Construction environmental impacts

Environmental impacts are changes to the environment caused by Project activities. These changes can be both positive and negative. The Project has the potential to remediate contaminated land that may be reused in accordance with the principles of the *CLM Act 1997*. How contaminated land is managed will affect the level of environmental impact. Potential environmental impacts associated with the Project in relation to contaminated land management include:

- increasing waste amounts from improper practices e.g. poor fill management;
- disturbance of unidentified contaminated land leading to adverse environmental impacts;
- contaminated or hazardous waste not being correctly disposed of;
- adverse effect on human health (construction personnel/ community);
- release of contaminant into surrounding and/or underlying soils;
- release of contaminant into surface waters and/or groundwater;
- movement of contaminated sediments into waterways; and
- adverse effect on flora and fauna.

5 Environmental mitigation and management measures

The Table below describes management strategies that will be proposed to mitigate any possible issues facing the Project.

Table 5-1 Potential issues and management strategies

Potential contaminated site	Issue	Treatment	Resources Required	Responsibility
Hazardous materials	Contaminated soil	An assessment would be required on the concentrations of the hazardous materials if encountered, in accordance with the Unexpected Discovery of Contaminated Land Procedure (Appendix A). This may demonstrate that no action is warranted, especially given the likely small volumes. If there are small volumes of soil that are contaminated, landfill disposal is the preferred option.	To be determined at time hazardous materials encountered	Contractor's Environment Manager
Demolition of houses	Contaminated soil	All houses & immediate surrounds would be tested for hazardous materials prior to demolition through a hazardous materials buildings assessment i.e. asbestos. Any hazardous materials identified from these areas would need to be removed from the site and disposed of at the EPA licensed facility.	Pre-Construction Land Condition Assessment	Contractor's Environment Manager
Accidental spills and oil leaks	Contaminated soil and groundwater/surface waters	A Pollution Incident Response Management Plan is incorporated in the	As per PIRMP	Contractor's Environment Manager

Potential contaminated site	Issue	Treatment	Resources Required	Responsibility
		soils and water management plan (Appendix B4). This plan would detail measures for the prevention, containment and clean-up of accidental spills of fuels and chemicals.		
Disturbance of unidentified contaminated land	Contaminated soil and groundwater/surface waters	If potentially contaminated material is encountered the Unexpected Discovery of Contaminated Land Procedure (Appendix A) will be followed. Works in the vicinity will be stopped or modified and will not recommence until the material has been analysed and management measures developed.	To be determined at time potentially contaminated material is encountered	Contractor's Environment Manager
Disturbance of acid sulfate material	Contaminated soil and groundwater/surface waters	A Construction Acid Sulfate Material Management Plan (Appendix B11) outlines management measures and procedures to be followed.	As per CASMMP	Contractor's Environment Manager

Persons whose activities have contaminated land and owners of land who become aware, or ought reasonably to be aware, that the land has been contaminated must notify the EPA as soon as practicable after becoming aware of the contamination, if the contamination meets certain criteria. The duty to notify is a requirement under section 60 of the *CLM Act 1997*. A person has a duty to notify if that person ought reasonably to have been aware of the contamination. The EPA will be notified using the Site Contamination Notification form.

The Guidelines on The Duty to Report Contamination under the *CLM Act 1997* provide information on two key aspects of the duty to report contamination. The guidelines set out the duty of landowners and persons whose activities have contaminated land to report to the EPA. This includes a range of considerations for those who encounter land contamination (including particular trigger levels for various contaminants) and information on how to

proceed where there is uncertainty. The guidelines also outline how the EPA assesses and determines whether or not contamination is significant enough to warrant regulation.

The RMS Representative, the Environmental Representative and relevant Authorities will be promptly notified of any suspected or potential contamination exposed during construction activities as required by the RMS Incident classification and reporting procedure.

5.1 Further investigation

As detailed in Section 3.3, there are no known areas of contamination within the Project Boundary. However, where through regular site inspection by the Contractor's Environmental Representative, as a result of unexpected finds or as a result of environmental incidents contamination events are identified, further investigation will be undertaken in accordance with the relevant guidelines as detailed in Section 3.

5.2 Areas of unexpected contamination

Where earthworks are required there is potential to expose unexpected forms of contamination within the surface and subsurface. In such instances, action is required to mitigate potential contaminated soil/material encountered during excavation or construction activities. If potentially contaminated material is encountered the Unexpected Discovery of Contaminated Land Procedure (Appendix A) will be followed. Works in the vicinity will be stopped or modified and will not recommence until the material has been analysed and management measures developed.

A range of environmental requirements and control measures are identified in the various environmental documents, including the Submission / Preferred Infrastructure Report (November 2013), the Conditions of Approval and relevant RMS documents. Specific measures and requirements to address impacts from land contamination are outlined in

Table 5-2.

Table 5-2 Contaminated land management and mitigation measures

Measure / Requirement	Project Stage	Accountability	Reference
CL1	Appropriate induction and management procedures would be implemented as part of the construction environmental management plan, to minimise the risk from disturbance of a site during construction.	Pre-construction / Construction	Construction Manager / Environment Manager G36; Good practice
CL2	<p>If potentially contaminated material is encountered the Unexpected Discovery of Contaminated Land Procedure (Appendix A) will be followed.</p> <p>All works shall cease immediately and the affected area isolated from workers and other persons with a physical barrier. The Environmental Manager shall be notified and suitably qualified Environmental Contamination Specialist contacted to inspect the site. RMS will be immediately notified as per the incident reporting procedure.</p> <p>Soil can only be excavated following approval from the Environmental Contamination Specialist. It may be that the Environmental Contamination Specialist requires the material to remain in-situ until an assessment has been carried out.</p> <p>For any work in identified areas the Environmental Contamination Specialist shall advise as to levels of Personal Protective Equipment required. A specific health and safety plan may be required depending on the extent and magnitude of the contamination.</p>	Pre-construction / Construction	Environment Manager/ Communications Manager/ Project Manager G36; Good practice
CL3	RMS and its contractors will manage any land contamination events identified onsite, whether or not caused by RMS or its contractors, in accordance with Roads & Maritime Services (2012) Environmental Incident Classification and Reporting Procedure.	Pre-construction / Construction	Project Manager/ Construction Manager /Superintendent/ Environment Manager / Environmental Officer G36; Good practice
CL4	The location of stockpiles of contaminated material will be identified in consultation with RMS and in accordance with the Stockpile Management Guidelines (RMS 2011).	Pre-construction / Construction	Construction Manager / Environment Manager Good Practice

	Measure / Requirement	Project Stage	Accountability	Reference
CL5	All potentially affected spoil will be stockpiled on a bunded, impermeable surface, covered to prevent wind blow and potential erosion.	Pre-construction / Construction	Construction Manager / Environment Manager	Good Practice
CL6	The disposal of contaminated material, whether solid or liquid, will be managed in accordance with the Construction Waste and Energy Management Plan.	Pre-construction / Construction	Construction Manager / Environment Manager	Good Practice
CL7	If soils are disposed off-site, then routine testing would be undertaken to assess the appropriate waste classification of the soils according to the EPA guidelines.	Pre-construction / Construction	Construction Manager / Environment Manager	Good Practice
CL8	If soil results are greater than the adopted health level criteria, the EPA will be notified. An EPA disposal permit will be required for offsite disposal. Leachate testing will be required before disposal at a licensed receivable facility (of the appropriate level). Personnel will wear appropriate PPE and an Environmental Contamination Specialist will supervise the work.	Pre-construction / Construction	Construction Manager / Environment Manager	Good Practice
CL9	A hazardous materials buildings assessment will be carried out before the demolition of any structures or buildings to identify the issues of concern and the management requirements. This is required under Clause 1.6 of Australian Standard AS 2601 – 2001 The Demolition of Structures.	Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW21)
CL10	A Pollution Incident Response Management Plan would be developed and incorporated into the Soil and Water Management Plan. This plan would detail measures for the prevention, containment and clean-up of accidental spills of fuels and chemicals.	Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW22)
CL11	The storage, handling and use of the chemicals and fuels will be in accordance with the Work Health and Safety Act 2000, WorkCover's Storage and Handling of Dangerous Goods Code of Practice (WorkCover, 2005), EPA "Bunding and Spill Management Guidelines" and RMS "Code of Practice for Water Management". The Pollution Incident Response Management Plan would be developed in accordance with these guidelines and legislation.	Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW23)

	Measure / Requirement	Project Stage	Accountability	Reference
CL12	All imported material shall be certified against Virgin Excavated Natural Material (VENM) or in accordance with other relevant resource recovery mechanisms	Construction	Construction Manager / Environment Manager	Good Practice
CL13	Implement relevant control measures to divert any surface runoff away from the contaminated land, and capture and treat any surface runoff contaminated by exposure to the contaminated land.	Construction	Construction Manager / Environment Manager	G36
CL14	Maintain a schedule of all hazardous materials (as defined by the Waste Minimisation and Management Act 1995 and Regulations 1996) in use on the construction site.	Construction	Construction Manager / Environment Manager	G36
CL15	Inspect all plant and equipment daily for leakages of fuel, oil or hydraulic fluid. Any leaks shall be repaired prior to using plant or equipment and records of plant inspections shall be maintained on site.	Construction	Construction Manager / Environment Manager	G36

6 Compliance management

6.1 Roles and responsibilities

The Project Team's organisational structure and overall roles and responsibilities are outlined in Section 4.2 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Section 5 of this Plan.

6.2 Training

All employees, contractors and utility staff working on site will undergo site induction training relating to actions to be taken in the event that contaminated land is discovered or suspected. The induction training will address elements related to contaminated land including:

- Targeted Toolbox training regarding identification of contaminated land will be regularly provided to maintain awareness of onsite environmental issues. Targeted training will also be provided on practices, controls to avoid pollution incidents from Contaminated Land and on the rapid response to and reporting of all environmental incidents.

Further details regarding staff induction and training are outlined in Section 5 of the CEMP.

6.3 Monitoring and inspection

Inspections of areas with the potential to be contaminated will occur for the duration of the project.

Table 6-1 Contaminated land monitoring

Monitoring				
Item	Frequency	Applicable standards	Responsibility	Reporting
Monitoring of groundwater	If required (Refer Soil and Water management Plan)	Set out in Soil and Water Management Plan (Appendix B4 to CEMP).	Environmental Manager	Monthly Environmental Report
If required, sampling of excess soil material.	If required, once prior to removal of soil material.	EPA NSW 2014 Waste Classification Guidelines.	Environmental Manager	Monthly Environmental Report

General requirements and responsibilities in relation to monitoring and inspections are documented in Section 8 of the CEMP.

6.4 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.

There are no known areas of contamination (identified as 'potential areas of environmental concern') located within the Project boundary. However should unexpected potential contamination be encountered, requirements for a site audit and subsequent reporting shall be undertaken in accordance with CoA B37.

Audit requirements are detailed in Section 8.3 of the CEMP.

6.5 Reporting

Reporting requirements and responsibilities are documented in Chapter 8 of the CEMP. These include specific reporting requirements associated with inspections.

7 Review and improvement

7.1 Continuous improvement

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

The continuous improvement process will be designed to:

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

7.2 CCLMP update and amendment

The processes described in Chapter 8 and Chapter 9 of the CEMP may result in the need to update or revise this Plan. This will occur as needed.

Any revisions to the CCLMP will be in accordance with the process outlined in Section 1.6 of the CEMP.

A copy of the updated plan and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure – refer to Section 10.2 of the CEMP.

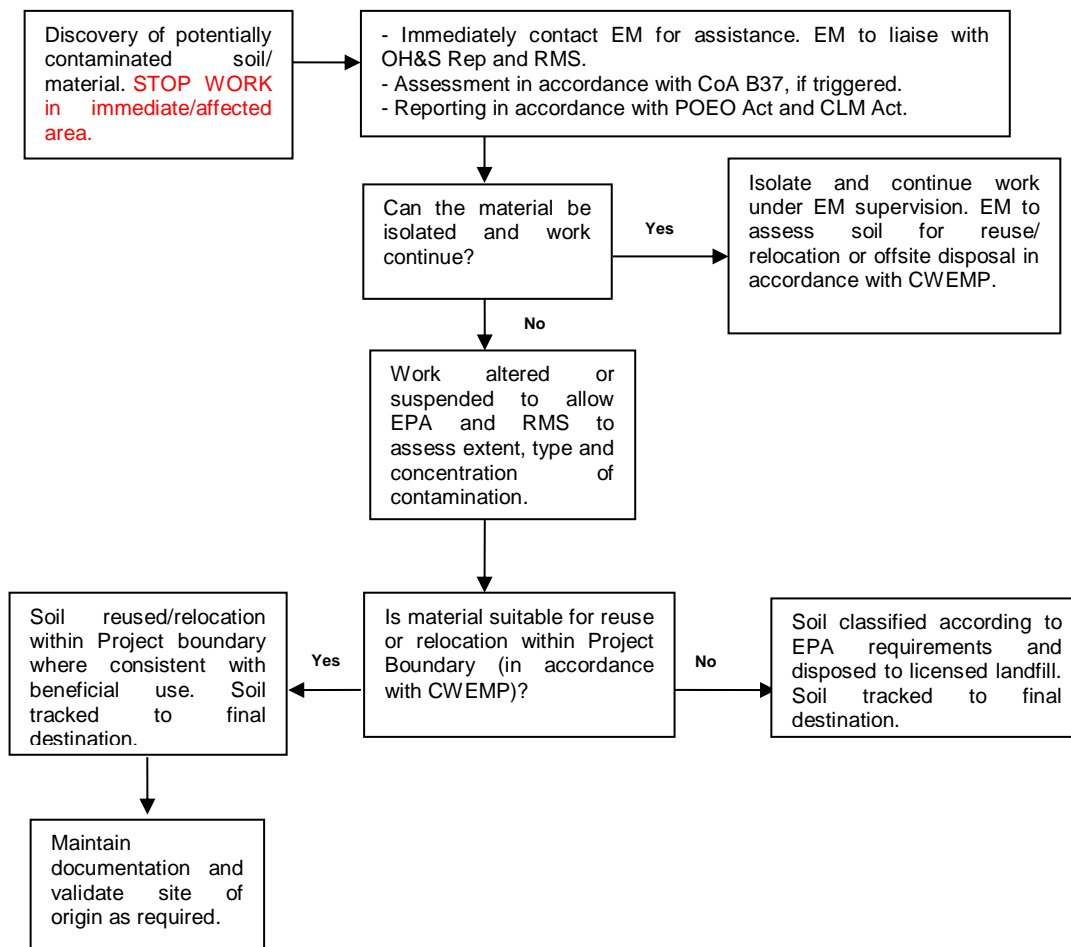
Appendix A

Unexpected Discovery of Contaminated Land Procedure

Unexpected Discovery of Contaminated Land Procedure

General contingency procedures and remedial actions for the management of excavated and placed potentially contaminated soil discovered along the Project are illustrated in the Contaminated Material Incidental Finds Protocol as identified Figure 1.

Figure 1 Contaminated Material Incidental Finds Protocol



Incident notification, recording and reporting are to be conducted in accordance with Section 7 of the CEMP.

Following reporting of unexpected contamination by SEE Civil and cessation of works within the vicinity, RMS may elect to manage the investigation and management of the unexpected contamination find, including any appointment of an EPA-accredited contaminated site auditor, in accordance with G36 4.2.3.

All materials management and disposal will be managed in accordance with *Appendix B7 – Construction Waste and Energy Management Plan*.

Potential Failure Modes, Contingencies and Remedial Actions

The potential failure modes, potential consequences, likelihood of occurring and remedial measures are listed in Table 1 (over page) for the activities associated with contaminated land and potentially contaminated land.

Table 1 Potential Failure Modes, Contingencies and Remedial Action

Potential Failure Mode	Potential Consequence	Likelihood of Occurring	Contingency Measures	Possible Remediation Action
Lack of space to place excavated contaminated soil.	Materials placed and untreated. Release of contaminants into immediate surrounds.	Unlikely due to small quantities of materials to be excavated.	Monitoring of placement areas by site personnel daily. Containment strategies must be identified and implemented to ensure that any contaminated material is contained for treatment or removal and is prevented from migrating off site.	Excavate materials not placed in correct areas. Verification testing of placed soil. The conceptual site model developed as part of any additional assessment required under the Unexpected Discovery of Contaminated Land Procedure would identify any sensitive receivers and actions required based on the classification of contaminants assessed.
Failure of contaminated land validation testing.	Release of contamination into underlying soils and groundwater.	Unlikely - may occur in some samples due to pockets of heterogeneous material.	Rapid re-application of remedial work where required. Abundance of plant on site to carry out re-application and mixing.	Re – apply remedial action and re test placed soil. The conceptual site model developed as part of any additional assessment required under the Unexpected Discovery of Contaminated Land Procedure would identify any sensitive receivers and actions required based on the classification of contaminants assessed.
Local flooding of stockpile area and movement of sediments or wash out of agent.	Movement of sediments containing contaminant off site.	Unlikely but not improbable during construction.	Majority of soil will be treated as it becomes available. Monitoring of surface and groundwater (ongoing).	Scrape up washed out sediments with excavator and place back into original area. The conceptual site model developed as part of any additional assessment required under the Unexpected Discovery of Contaminated Land Procedure would identify any sensitive receivers and actions required based on the classification of contaminants assessed.
Unacceptable impacts on groundwater such as: lowering/raising pH, increased metal toxicity, hydrocarbons and pesticides.	Release into the environment with effects on flora and fauna.	Unlikely to occur. This would only occur if insufficient site containment was incorporated into treatment area.	Monitoring to detect any impacts (ongoing). Remedial action where required. Additional containment strategies must be identified and implemented to ensure that any contaminated material is contained for treatment or removal and is prevented from migrating off site.	Installation of 'lime curtains' or re-injection spear pumps within the shallow aquifer to raise pH to an acceptable level in line with background trends.
Unacceptable impacts on surface water such as: lowering/raising pH, increased metal toxicity, hydrocarbons and pesticides.	Release into the environment with effects on flora and fauna.	Unlikely to occur. This would only occur if insufficient site containment was incorporated into treatment area too late.	Re – direction of flow to holding ponds to monitor and treat water. Monitoring to detect any impacts (ongoing). Remedial action where required.	Offsite disposal as soon as practicable.

Potential Failure Mode	Potential Consequence	Likelihood of Occurring	Contingency Measures	Possible Remediation Action
Unexpected exposure of contaminated soils/water	Release of contamination into underlying soils and groundwater	Unlikely, detailed investigation have delineated areas containing potentially contaminated sites.	Stop work, ensure disturbed materials are covered if <24hr. Or, remove, test and validate. If these circumstances occur, the process of managing contaminated soil as described in Figure 1 will be initiated. This will be undertaken in consultation with the Project EM or their representative.	Application of remedial work to manage contamination.
Poor treatment of remediated contamination	Release of contamination into underlying soils and groundwater	Unlikely, procedures in place to treat materials at required rates and validation reports required at completion of each stage.	Validation and characterisation laboratory testing will be carried out throughout the excavation and processing timeline during construction. Water quality monitoring will be conducted to assess any potential water quality changes.	Assess treatment procedures and laboratory results. Where additional remedial action is required, increase volume or activity. Increase the characterisation testing frequency.