nation partners

SOLUTIONS
FOR COMPLEX
PROJECTS

Lapstone Hill Tunnel Remediation Action Plan

NSW Department of
Industry, Lands & Water

5 April 2018

nation partners

SOLUTIONS
FOR COMPLEX
PROJECTS

We help solve complex problems for projects

We believe that well-planned and targeted advice can help shape a project that is not only better developed, but is delivered more effectively, with greater acceptance and positive outcomes.

Nation Partners isn't your regular consulting firm. A certified B Corporation, we attract and develop the brightest thinkers and take an active part in shaping the world.

With expertise in projects in the government, transport, water, property and urban development sectors, we provide a suite of services aptly tailored to each client and project at hand.

Document title
Lapstone Hill Tunnel Remediation Action Plan

Version
1.0

Date
April 2018

Prepared by
Daniel Wedgwood

Approved by
Chris Duesterberg

File name
Lapstone RAP v1.0.docx

Nation Partners Pty Ltd
ABN 96 166 861 892

Level 3, The Alley, 75-77 Flinders Lane
Melbourne Vic 3000

Suite 108, 50 Holt St
Surry Hills NSW 2010

1300 876 976
info@nationpartners.com.au
nationpartners.com.au

Certified B Corporation

Table of Contents

1. Introduction

1.1. Background and Context

The NSW Department of Industry, Lands & Water (DoI) owns land located off Barnett Street on the Greater Western Highway, Glenbrook. The Site includes:

» an area formerly used as a staging site for mushroom farming (the Former Mushroom Farm Land-base (FMFL));

» the Eastern Portal and rail cutting; and

» the Lapstone Hill Tunnel (the Tunnel) a former rail tunnel 660 metres in length running from the FMFL to the Eastern Portal.

The location of the Site is provided in Figure 1 and the general Site configuration is shown in Figure 2.

Portions of the land have historically been subject to uncontrolled filling and have been used for various purposes, including mushroom farming and storage of munitions and mustard gas. The Site has been included in the Scenic Eastern Escarpment Master Plan prepared by Blue Mountains City Council (Council), and DoI are in the process of generating a strategic land use plan for the future use of the Site. The Lapstone Hill Tunnel is listed on the NSW State Heritage Register.

The Site may in the future be managed by Blue Mountains City Council (Council) and redeveloped for the purposes of community access, including car parking, mountain biking and picnic facilities.

To enable the re-use of the FMFL, the Tunnel and the associated Eastern Portal for recreational purposes, DoI is undertaking clean-up and remediation works.

To support the project objectives, Nation Partners was engaged by DoI to develop a Remediation Action Plan (RAP) for the Site. For the purposes of this RAP, the 'Site' refers to the FMFL, the Lapstone Hill Tunnel, and the Eastern Portal. Each area of the Site is shown in Figure 2.

1.2. Purpose

DoI is seeking to remediate the Site to address potential safety, environmental, reputational and stakeholder risks associated with contamination, and to enable beneficial re-use of the area. The remediation works must satisfy Council with regards to long term management of contamination risks at the Site.

The purpose of this RAP is to identify and present the goals, objectives, target area, strategy, methodology and proposed validation program for the remediation works.

The objectives of the RAP are to:

» Identify suitable remediation strategies for the Site;

» Set remediation goals and criteria, and identify remediation strategies, that will ensure the target remediation area is suitable for open space recreational activities;

» Identify and develop a remediation strategy that allows for the expeditious completion of remediation works with minimal disturbance to environmental receptors and the local community;

» Incorporate the remediation into the proposed redevelopment plans for the Site to facilitate a sustainable, effective, and financially responsible remediation approach;

» Outline the general procedures and plans to be implemented to reduce risks to acceptable levels during the remediation works;

» Establish the preliminary environmental safeguards required to complete the remediation in an environmentally acceptable manner;

» Detail the requirements for the validation of the remediation works and the management of residual contamination; and

» Present a framework for reporting on the remedial works and validation program.

The RAP defines the remediation strategy and delivery methodology via a thorough assessment of the remediation options, and the provision of a clearly defined remediation scope. Technical and logistical constraints associated with successful delivery of the remediation works are identified, evaluated and resolved through the options assessment and scope definition process.

At the time of writing, it was unclear if the remediation works and redevelopment of the Site will proceed as a single package of works, or if it will be delivered in a staged manner. The RAP therefore allows for a staged approach to remediation, while separately identifying opportunities where remediation and redevelopment of the Site is completed in a coordinated manner.

1.3. Remediation Objectives

In order to meet DoI's objectives for the Site, the remediation works must:

» Suitably mitigate risks from contamination to the health of future Site users;

» Suitably mitigate impacts from contamination on the environment;

» Complement the proposed Site redevelopment;

» Minimise ongoing management requirements; and

» Mitigate potential reputational risks to DoI and Council.

Specifically, the objectives of the remediation for each area of the Site include:

» Tunnel – Safe removal of waste materials and efficient management of surface water within the Tunnel to facilitate long term recreational access and infrastructure upgrade works at the Eastern Portal;

» Eastern Portal – Safe and efficient removal of vegetation and soils within the Eastern Portal cutting to facilitate long term recreational access;

» FMFL – Remediation of identified soil contamination to allow for future recreational use and minimise ongoing management requirements.

1.4. Guidelines and Standards

Guidelines and standards endorsed by the NSW Environmental Protection Agency (EPA) have been adopted in the preparation of this RAP. These documents are listed on the NSW EPA website (www.epa.nsw.gov.au/clm/guidelines.htm) and, as at October 2017, comprise:

» Sampling Design Guidelines (NSW EPA, 1995)

» Guidelines for the NSW Site Auditor Scheme (3rd Edition) (NSW EPA 2017)

» Guidelines for the Assessment and Management of Groundwater Contamination (NSW EPA, 2007)

» Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 (EPA, 2015)

» Guidelines for Consultants Reporting on Contaminated Sites (NSW EPA, 2011)

Other relevant standards and guidelines from Australian regulatory authorities and endorsed by the NSW EPA have been considered for this RAP, including:

» Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC & NHMRC, 1992)

» Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ, 2000)

» National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 No. 1 (NEPM, 2013)

» Management of Asbestos in the Non-Occupational Environment (enHealth, 2005)

» Code of Practice for the Management and Control of Asbestos in the Workplaces (NOHSC, April 2005)

» Management of Small-Scale Low-Risk Soil Asbestos Contamination (WA Department of Health, May 2009b)

» Code of Practice - How to Safely Remove Asbestos (Safe Work Australia, 2016)

» Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soils – Non-Volatile and Semi-Volatile Compounds (Australian Standard AS 4482.1-2005)

» Guide to the Sampling and Investigation of Potentially Contaminated Soils – Volatile Substances (Australian Standard AS 4482.2-1999)

» Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014 - The compost order 2016 (NSW EPA, 2016).

» Guidelines for the assessment, remediation and management of asbestos- contaminated sites in Western Australia, Western Australian Department of Health and Western Australian Department of Environment and Conservation, 2009 (WA DOH, 2009)

1.5. Definitions

The following key definitions are adopted throughout this document for consistency and are clearly shown in Figure 2**.**

» **Site** – Refers to the land owned by DoI which is subject to this RAP, comprising the FMFL, the Lapstone Hill Tunnel, the Eastern Portal and the cutting immediately downgradient of the Eastern Portal.

» **FMFL** – Refers to Lot 1 DP196131 and Lot 7010 DP026604.

» **Knapsack Gully** – Refers to the ephemeral stream/gully that exists on the northern boundary of the FMFL

» **Tunnel** – Refers to the full extent of the Lapstone Hill Tunnel which is also referred to as the former Glenbrook Rail Tunnel (from the Western Portal through to the Eastern Portal).

» **Eastern Portal** – Refers to the Eastern Entrance of the Lapstone Hill Tunnel, and Part of Lot 9 DP1097785 which is downstream of the Portal and within the associated rail cutting.

» **Eastern Portal Cutting** – Refers to the cutting immediately downgradient (to the east) of the Eastern Portal.

» **Western Portal** – Refers to the Western Entrance of the Lapstone Hill Tunnel at the FMFL.

» **Remediation Contractor** – The contractor engaged to deliver the remediation works. References to the Remediation Contractor include their sub-contractors engaged to deliver elements of the remediation scope.

» **Principal** – DoI or their nominated representative.

2. Site Characterisation

2.1. Site Details

The Site, owned by DoI, is in a semi-rural area in the municipality of Blue Mountains City Council (refer Figure 1). The Site is comprised of the FMFL, the Lapstone Hill Tunnel, and the Eastern Portal (refer Figure 2).

Table 2.1 – Site Details

Current Site Owner:	Department of Industry (DoI)
Address:	Off Barnett St, Glenbrook
Location:	Approximately 62 kilometres west of Sydney's CBD
Legal Identification:	FMFL: ▪ Lot 1 DP196131 ▪ Lot 7010 DP1026604 Eastern Portal: ▪ Lot 9 DP1097785
Site Area:	▪ FMFL: ~ 1.1 ha ▪ Lapstone Hill Tunnel: 660m long ▪ Eastern Portal: ~ 0.2 ha
Local Government Area:	City of Blue Mountains Council
Zoning:	▪ L.E.P. 2005 Regional Transport Corridor – Rail ▪ L.E.P. 2005 Regional Transport Corridor Road – Existing ▪ Draft L.E.P 2013 SP2 – Special Purpose (Rail) ▪ Draft L.E.P. 2013 Proposed General Provision/s – Protected Area – Riparian Land (Clause 6.7) – Protected Area – Watercourse (Clause 6.7) – Protected Area – Ecological Buffer Area (Clause 6.6) – Groundwater Vulnerability – Moderately High (Clause 6.8) – Adjoins SP2 – Special Purpose (Classified Road).
Site History Summary	The Tunnel and the Eastern Portal cutting operated as a rail line from 1892 until 1913, following which the Tunnel and FMFL area was leased for the purposes of mushroom farming. From 1939 to 1946 the Tunnel was utilised by the Royal Australian Air Force (RAAF) for the storage of explosives and mustard gas. During this time, the base of the Tunnel was concreted and the Eastern Portal cutting was used for vehicle access and possibly for the maintenance of explosives stored in the Tunnel. Historic photos suggest that the eastern Portal cutting floor was improved during this time to allow for vehicle access. Following 1946 the FMFL and Tunnel reverted to use as a mushroom growing site while the Eastern Portal cutting fell into disuse. During 2016, mushroom farming in the Tunnel ceased and the Tunnel and FMFL were abandoned by the tenant. Significant volumes of rubbish and other refuse was abandoned on site. During 2016, DoI undertook clean up and demolition works on the FMFL area and have undertaken works to restrict unauthorised access into the Tunnel.

	The FMFL area has been historically filled with unknown fill materials. It is unclear from available information when this may have occurred.

2.2. Site Development and Future Use

The exact future use of the Site is unknown and the layout of any future development has not been finalised. However, for the purposes of this RAP, future Site use and Site configuration has been assumed to include the following elements:

» Public access to all areas of the FMFL and Eastern Portal for parking and recreational purposes;

» Public access to the Tunnel initially via guided tours, however unrestricted access may be considered in the future;

» Maintenance worker access of facilities and landscaping in all portions of the Site;

» Incidental excavation for the purposes of utility services maintenance and installation;

» The areas of the Site currently sealed with hardstand are to remain sealed with the exception of the raised concrete slab in the central portion of the FMFL (refer Figure 3), which is to be removed;

» The surface levels of the Site can be adjusted in order to efficiently achieve remediation objectives; and

» No enclosed structures are to be constructed on the FMFL.

3. Site Contamination

The following provides a summary of available and relevant contamination data for the Site. The data and information has been re-interpreted in the context of the Site remediation. Data summary tables are provided as Appendix B.

Refer to the original reports for a full description of Site data, noting however that some assumptions have changed.

3.1. Historical Site Investigations

Available and relevant Site investigation reports associated with the Site have been listed and summarised in **Table 3.1.**

Table 3.1 – Site Investigation Summaries

Report	Key findings
Chemical Weapons and Railway Tunnels, 2008 (Australian Railway history)	The document provides a general history of the storage and handling of chemical weapons within railway tunnels in Australia. The following is considered relevant to the current investigation: ▪ Photos showing the storage/stockpiling of chemicals and chemical weapons at both the Eastern Portal and Western Portal of the Lapstone Hill Tunnel are provided; ▪ Weapons stored are identified as predominantly mustard gas and 65lb bombs; ▪ Weapons and chemicals were maintained and 'vented' at the Eastern Portal The area leading up to the Eastern Portal appears to have been filled to facilitate truck access into the tunnel.
Lapstone Tunnel Contamination Assessment, 2016 (SESL)	The scope of the investigation was to undertake a site assessment at the Eastern Portal in order to: ▪ evaluate the quality of the water and sediment within the water body; ▪ conduct air monitoring to provide evidence of airborne contaminants; and ▪ identify potential contaminants of concern via soil sampling. The following sampling was conducted: ▪ soil samples were collected at two locations; ▪ three water samples were collected from within the tunnel (eastern extreme), immediately outside the tunnel, and downstream of the tunnel; and ▪ air quality was taken at the entrance to the tunnel. Results indicated elevated levels of Polycyclic Aromatic Hydrocarbons (PAHs), Polychlorinated Biphenyls (PCBs), heavy metals, and Total Recoverable Hydrocarbons (TRHs) in a soil sample collected immediately adjacent to the Eastern Portal. The report conclusion suggests that surface water is not suitable for discharge to nearby surface water bodies due to the presence of contaminants exceeding relevant ANZECC (2000) Guideline criteria for protection of slightly to moderately disturbed ecosystems. Elevated nutrient levels and minor concentrations of E. Coli were also identified within all three surface water samples. Air quality results were considered acceptable, though it was noted that wind conditions were not ideal to capture emissions from the tunnel. No data specific to the former use of the up-gradient tunnel for the storage of chemical weapons or explosives was collected as part of this assessment.
Contaminated Environmental Site Audit Assessment,	EnviroTech was engaged to conduct a detailed site inspection (for clarity, it is noted that the assessment was not an Audit under the Contaminated Lands Management Act (1997)). The assessment was conducted to:

2016 (EnviroTech)	▪ determine the potential human health and environmental risks associated with the former FMFL area; and ▪ to provide advice on managing contamination to allow future use of the site as a public area. A comprehensive desktop review and a site visit was conducted. Due to the observed presence of significant volumes of abandoned rubbish, refuse, chemical containers and general poor housekeeping, the report indicated high potential that contamination is present within the soils at the FMFL, posing potential human health and environmental risks, and that the tunnel has a moderate potential for contamination. The report suggested a detailed site investigation (DSI) be conducted.
Glenbrook – Contamination Technical Advice, 2017 (Nation Partners)	In 2017 Nation Partners was engaged to undertake a desktop assessment of available site data and provide recommendations to facilitate proposed clean-up works and future beneficial reuse. The objectives of the review were to: ▪ Determine the technical adequacy of site investigations undertaken to date; ▪ Provide practical guidance with regards to the current recommendations; ▪ Provide clear guidance to allow; – the Lapstone Hill Tunnel Eastern Portal access management works to proceed; – the former FMFL to be redeveloped; – appropriate management of contamination with regards to human health, environmental and regulatory risk; and ▪ For the purposes of obtaining internal funding for future works, make a determination with regards to the known or suspected contamination status of the site(s). The review identified that the reliability of the available data may not be sufficient to allow for appropriate management decisions and is not suitable nor sufficiently detailed for the design of remediation.
Analysis report: STC-722-12356 ASB 1, 2017 (ADE Consulting Group)	This report provides results associated with sampling for the identification of asbestos in an old boiler on the south-eastern portion of the site. Material within the boiler was found to be mostly ash, and did not contain asbestos. The results are as follows: ▪ No Chrysotile asbestos found ▪ No Amosite asbestos found ▪ No Crocidolite asbestos found ▪ No Synthetic Mineral Fibres found ▪ Organic (non-asbestos) fibres found
Preliminary Geotechnical Assessment Lapstone Hill Tunnel, Great Western High (Rev0), 2017 (Douglas Partners)	Douglas Partners undertook a geotechnical investigation and concluded that the Tunnel is in relatively sound condition, and from a geotechnical perspective, could be opened to the public with some minor rectification and civil works, including: ▪ Cleaning out and repair of drainage holes and installation of new drains at locations where seepage is evident in the tunnel walls; ▪ Construction of a drainage system either side of the tunnel; and ▪ Groundwater testing to assess whether treatment is required prior to releasing into the drainage system. Regular geotechnical and structural inspection of the tunnel should be conducted to monitor the integrity of the tunnel lining. Previous uses of the site may have left residual contamination in some parts of the tunnel, and Douglas Partners recommended that a separate environmental assessment be carried out to confirm its suitability for the proposed use.

Lapstone Hill Railway Tunnel (Glenbrook Tunnel) Heritage Assessment Preliminary Site Assessment Report, 2017 (ERM)	The report provides a brief description of the site history and the relevant legislation associated with heritage management. The report recommends that in order to remove the unsafe and non-heritage items from the Glenbrook Tunnel and undertake remediation, DoI should make an application to the Heritage Council for approval to carry out works on the heritage listed Glenbrook Tunnel. The report notes that based on the Standard Exemptions (Heritage Council 2008) it is unlikely that environmental remediation of the tunnel or the removal of fixtures within the tunnel meets the requirements of a standard exemption. In order to be considered acceptable under a standard exemption, works carried out at the site must be conducted without the removal of or damage to the existing fabric or the introduction of new materials (Heritage Council 2008: 10). ERM therefore recommends that the DoI submit a Section 60 application and accompanying paperwork such as a Statement of Heritage Impact (SoHI) to the Heritage Council.

3.2. Remediation Planning Investigation

Nation Partners were engaged to undertake site investigation works to facilitate the remediation of the Site. The investigation scope included a targeted site investigation, including soil and surface water sampling, and preparation of the *Lapstone Hill Tunnel – Detailed Site Investigation, NSW Department of Industry, Nation Partners, January 2018* report (the DSI).

The results of the DSI are summarised in Sections 3.2.3 to 3.2.2 and have been further interpreted in the context of the proposed Site remediation. Investigation data is provided in Appendix A.

3.2.1. The Lapstone Hill Tunnel

Site Description

The Tunnel is constructed internally of brick (some areas are cement rendered) and a cement floor. It is approximately 660 metres in length, passing beneath the ridge which carries the Great Western Highway. The Western Portal, which is the main entry point, is located near to the edge boundary of Knapsack Reserve within the FMFL area. The Eastern Portal is located near Railway Reserve.

Refuse, Rubbish and Mushroom Growing Medium in the Tunnel

The interior of the Tunnel contains a significant volume of refuse including metal frames, wood, tools, electrical supply infrastructure and multiple other forms of rubbish (herein referred to as ‘refuse’). The Tunnel also includes a large volume of mushroom growing medium (sawdust) within both small ‘bags’ and within larger bulker bags located toward the eastern end of the Tunnel.

Sawdust which has escaped containment (i.e. from bags or other storage containers) has accumulated in significant volumes at the eastern end of the Tunnel. Ponded water was present over the final 80m length of the Tunnel (closest to the Eastern Portal) was observed to be a mix of water and fully saturated sawdust. The sawdust was in varying states of decomposition. Samples collected from this material indicated the presence of BaP (TEQ) at concentrations exceeding the HILC criteria. Concentrations of Copper and Nickel were also elevated above background levels and exceed the EIL, indicating that sawdust which has been in contact with ponded water in the base of the tunnel is not suitable for beneficial reuse or composting (on-site or offsite).

Samples of sawdust within bags and bulker bags were not collected, however multiple bags were opened and the contents observed. Observations indicate that there is no reason to believe that sawdust within bags and bulker bags is contaminated (where it is not in contact with water on the base of the Tunnel). The sawdust is therefore considered suitable for recovery and reuse on-site or via an offsite, licenced facility.

Surface Water

Surface water is present within the majority of the Tunnel. The base of the Tunnel was saturated along large sections and water had ponded over the last 80m of Tunnel length (closest to the Eastern Portal). Anecdotal evidence suggests this volume of water fluctuates significantly throughout the year.

Samples of flowing water and ponded water indicate the presence of elevated concentrations of multiple dissolved heavy metals exceeding the ANZECC criteria for the protection of slightly to moderately disturbed ecosystems, as well exhibiting elevated concentrations of nutrients. The surface water appears to originate from seepage of groundwater into the tunnel from multiple fractures, weep points within the Tunnel walls and possibly leaking pipes adjacent to the Eastern Portal. The flow of water within the Tunnel was observed to increase steadily from east to west, with the downward gradient of the Tunnel. Water flowing on the floor of the Tunnel flows through multiple stockpiles of sawdust and other refuse before it exits the Tunnel at the Eastern Portal. At the time of sampling, it was estimated (based on field observations) that the flow did not exceed 1-2L/min at any point within the tunnel.

Following clean out of the refuse, no sources of contamination will exist within the Tunnel and water exiting at the Eastern Portal will subsequently be representative of background conditions and would consequently be suitable for passive discharge.

Mustard Gas and Explosives

The components of mustard gas break down quickly when in contact with water. Due to the extended period of time since the storage of munitions in the Tunnel and the very moist environment observed, it is highly unlikely that significant contamination from such munitions remains within the Tunnel, unless munitions remain present in sealed containers amongst the refuse. A detailed inspection of refuse was not possible to confirm the presence of such containers.

Contaminants associated with explosives were not found to be present within any of the soil or water samples collected.

Hazardous Materials

Refuse within the tunnel was not observed to contain likely ACM, however the DSI indicates that electrical switchboards located at regular intervals on the tunnel walls may have included ACM in the backing boards. DoI have subsequently advised that electrical infrastructure (including all switchboards) has been removed from the tunnel and disposed in accordance with legislative requirements.

The presence or absence of lead based paints was not assessed.

Waste Classification

Preliminary waste classification data indicates that decomposing growth medium (sawdust) within the Tunnel is likely classifiable as General Solid Waste (putrescible) for the purposes of offsite disposal.

The remaining refuse materials requiring disposal are likely to meet the pre-classification requirements for General Solid Waste, however will require assessment as they are removed.

Air Quality

Air quality analysis did not indicate the presence of significant concentrations of deleterious gases within ambient air within the tunnel. Minor spikes of H_2S were recorded, however noting the significant volumes of decomposing waste within the tunnel, this is to be expected. At all times air quality readings remained well below the exposure standards adopted. It is expected that the cleaning of the Tunnel and preservation of appropriate ventilation at both the Western Portal and Eastern Portal will be sufficient to maintain air quality suitable for maintenance and future community and recreational uses.

Summary

» The Tunnel is unlikely to represent a threat to human health or the environment in its current state and based on the current usage scenario (intermittent access for maintenance and testing).

» Concentrations of some contaminants and the presence of significant refuse mean that in its current state the Tunnel is unlikely to be suitable for opening to the public. Rectification and remediation in the form of the removal of refuse and mushroom growing medium are required to facilitate safe public access.

» Decomposing mushroom growing medium (sawdust) within the Tunnel which is in contact with the surface water is unsuitable for beneficial reuse and is likely classifiable as General Solid Waste (putrescible) for offsite disposal.

» Mushroom growing medium contained within bags or bulker bags is likely to be suitable for composting at an offsite licensed facility.

» Refuse and sawdust in the Tunnel is likely contributing to elevated concentrations of heavy metals and nutrients within surface water.

3.2.2. The Eastern Portal

Site Description

The Eastern Portal and the adjacent cutting is significantly overgrown by vegetation (refer Figure 5). From the Eastern Portal extending downgradient to sample location EP-E (approximately 100m) the base of the cutting is covered by a consistent 200mm of vegetation and roots. This is underlain by approximately 300mm of saturated, loose, silty/sandy mud followed by roadbase gravels and rail ballast. Downgradient of sample location EP-E, the depth of vegetation and soil gradually reduces.

Surface water is visible at the Eastern Portal and has a depth in the order of 0.5m. Visible surface water quickly disappears into the vegetation and loose sediments and is no longer visible at the surface from approximately 15m downgradient of the Eastern Portal.

The observations are consistent with the Site history which indicates that the cutting was used by the Air Force for vehicle access to the Tunnel during World War 2, following which the cutting was abandoned. The shallow gradient and flow of nutrient rich water from the Tunnel have, over time, resulted in significant buildup of sediment and vegetation.

Soil Contamination

Laboratory results and site observations indicate that both Copper and Nickel is present in shallow soils at concentrations exceeding adopted environmental criteria, but remains below the corresponding health criteria. The significant density of the vegetation and shallow gradient within the cutting results in a low velocity water flow. There is therefore limited opportunity for sediments to migrate significantly. In addition, leaching tests on soil/sediment samples indicates that the metals present do not leach significantly under neutral conditions (conditions similar to those in the water within the cutting).

Site observations and laboratory analysis indicate the presence of elevated hydrocarbons at soil sample location EP-C (approximately 40m downstream of the Eastern Portal – refer to Figure 5). The sample exhibited a strong diesel odour and a sheen was visible during collection of the sample. The laboratory results indicate that the hydrocarbons are likely associated with a diesel or engine oil source. An inspection of the area did not indicate any obvious signs of vegetation stress, spills, containers or other chemical sources. Additional hand augers undertaken both immediately upgradient and downgradient of EP-C indicate that the extent of the contamination is likely to be limited. The concentrations of petroleum based TRH in soils at this location exceed the EILs and NEPM management limits; however, downgradient water samples do not indicate the presence of elevated hydrocarbons in surface water. Based on these results the impact on the environment associated with the contamination hotspot is expected to be minor (where the contamination remains undisturbed).

Soil and groundwater results were generally in accordance with the results of sampling reported in SESL (2016), with the exception of the presence of PCBs in soil, which were not observed during this round of sampling. No likely sources of PCBs were observed in the vicinity of the Eastern Portal cutting.

Surface Water

Exceedances of ANZECC criteria in water within the cutting are generally associated with Zinc and Nitrate as N. Concentrations of these contaminants exhibit a significant reduction with distance from the Eastern portal

(i.e. downgradient). All contaminants of concern were less than the limit of reporting in the most downgradient sample (EP3).

Both Zinc and Nitrate as N are significantly elevated within water samples collected within the Tunnel. Evidence suggests that the elevated concentrations of Zinc and Nitrate are likely associated with the flow of water from the Tunnel and not a contaminant source in the cutting. The remaining contaminants evident in the Tunnel water samples are not elevated above the ANZECC criteria within any samples in the Eastern Portal cutting and are therefore likely to have been diluted or otherwise removed via natural processes.

Waste Classification

Waste classification results (adopting the silica gel cleanup outcomes) indicate that, if necessary, the soils within the cutting are likely to be suitable for offsite disposal as General Solid Waste. This includes the sample collected at location EPC.

Summary

» Soils within the Eastern Portal cutting are unlikely to represent a significant risk to human health or the environment while left undisturbed. Soils not contaminated with hydrocarbons may be suitable for beneficial reuse on the Site where it can be shown that the EIL exceedances do not represent a significant risk to the local environment.

» Ponded water at the Eastern Portal and within the Tunnel includes contaminants exceeding the ANZECC criteria. The water currently discharges to the downstream environment via the Eastern Portal cutting which provides sufficient polishing of the water such that ANZECC criteria are not exceeded at a distance of approximately 150m downstream. The current scenario therefore does not represent a significant risk to the downstream environment.

» If ponded water is pumped or otherwise significantly mobilised, it is not suitable for direct discharge to the downstream environment.

» Ponded water does not represent a significant health and safety risk for workers and contamination risks can be suitably managed via controls to avoid significant ingestion during maintenance/remediation and future access management works.

3.2.3. The FMFL

Uncontrolled Fill

Site observations and laboratory data indicate that contamination on the FMFL is associated with the presence of uncontrolled fill and asbestos-containing materials (ACM) at the ground surface. Data suggests the presence of significant volumes of fill in the northern portion of the FMFL. Fill was observed to depths exceeding 2.5m in proximity to the northern boundary and the fill embankment was observed to be >3m in height in the north eastern portions of the FMFL (bordering Knapsack Gully – as shown in Figure 3). Depth of fill was observed to increase with proximity to Knapsack Gully and is likely representative of uncontrolled filling undertaken historically to level portions of the FMFL. Areas exhibiting significant volumes of fill are indicated in Figure 3 and are referred to as Remediation Areas 1, 2 and 3.

The easternmost portion of the FMFL is significantly higher than the remainder. Field observations suggest this is due to both uncontrolled filling and the natural terrain. Testpits in this portion of the Site were constrained by the presence of the hardstand (a concrete slab) and depth of fill could not be confirmed, it is however likely that significant volumes of fill exist beneath the slab in this area. Refer to Figure 3 for the approximate extent of hardstand present on the FMFL.

Soil Contamination

Samples collected at locations TP4 and TP5 within near surface fill, in the central-northern portion of the FMFL contained elevated concentrations of Benzo(a)Pyrene (BaP) Toxic Equivalence Quotient (TEQ) and total

PAHs which exceeded the adopted criteria for recreational use of the Site. The exceedances are greater than 2.5 times criteria and are therefore considered to be hotspots.

All remaining chemical analysis indicated that contaminant concentrations were below the HILC. Sample locations and criteria exceedances are shown in Figure 4.

Site observations indicate the presence of ACM on the FMFL surface in multiple locations. ACM was observed in multiple bonded forms, with a particularly high concentration noted to be present on the fill embankment running along the northern edge of the FMFL. ACM on the ground surface was generally noted to be in reasonably poor condition and was highly fragmented, suggesting that free asbestos fibres (AF) may be present (although this was not reflected in the limited laboratory analysis). Analysis of ACM samples collected from within the fill indicated the presence of ACM within fill soils (not just on the surface).

The presence of elevated heavy metals and TRH concentrations exceeding the EILs in multiple fill samples indicate that fill on the Site may represent a risk to the local environment and the adjacent Knapsack Gully.

Data indicates that the contamination at the FMFL may represent a risk to current users of the FMFL (Council workers, maintenance workers as well as trespassers) and possible future recreational users. Remediation of the FMFL area is required in order to facilitate future development for recreational and public access uses.

Waste Classification

A preliminary waste classification indicates that, if necessary, the majority of the fill soils on the FMFL can likely be disposed off-site as Special Waste (General Solid Waste with Asbestos), with some Restricted Solid Waste and Hazardous Waste also present.

Surface Water and Groundwater

Surface water was not observed to be present on the site. Contamination at the site poses a low risk to groundwater.

3.3. Conceptual Site Model

A conceptual site model, based on the identified contamination sources, pathways, and receptors, has been completed and is presented in Table 3.2

» Source - The cause or source of the contamination.

» Pathway - The transport, migration and/or exposure pathway is the route the contaminants take to reach a given receptor.

» Receptor - If contamination is to cause harm, it must reach a receptor (a person, an environment or another at risk entity).

A risk from contamination only exists when a source, pathway and receptor are present (an SPR linkage).

Based on available data the SPR linkages relevant to the future use and remediation of the Site are identified in **Table 3.2**.

Table 3.2 – Source Pathway Receptor model

Area	Source	Pathways	Receptors
Lapstone Hill Tunnel	Historic storage of explosives and mustard gas. Refuse and chemical storage	Surface water runoff Dermal contact / ingestion	Tunnel Gully and the downgradient environment. Site contractors, trespassers, visitors during future potential use of Site.
Eastern Portal & cutting	Hydrocarbon impacted soils	Dermal contact / ingestion	Site contractors, trespassers, visitors during future potential use of Site. Tunnel Gully and the downgradient environment.
FMFL Area	Uncontrolled fill and asbestos on the Site surface	Dust / odour inhalation and Dermal contact / ingestion	Site workers, contractors, trespassers and recreational Site users during future potential use of Site. Knapsack Gully and the downgradient environment.

3.4. Remediation Requirements

Based on the CSM, the remediation requirements for the Site are summarised as follows:

3.4.1. Tunnel

Remediation requires:

- the removal of all refuse within the Tunnel;
- the removal of ponded water currently present within the Tunnel (for clarity, it is noted that ponded water at the Eastern Portal is proposed to be remediated as part of the Tunnel remediation and is therefore excluded from the Eastern Portal scope discussed below); and
- the management of surface water during remediation.

Once refuse is removed from the Tunnel, no sources of potential contamination will exist and the water is considered to be suitable to passively discharge to the Eastern Portal Cutting.

3.4.2. Eastern Portal

Remediation requires:

- the removal of all vegetation;
- the excavation and removal of all soils within the cutting, down to the historic Site surface characterised by roadbase/ballast;
- the management of surface water during remediation.

Once excavation and construction works within the Eastern Portal cutting are complete, the water is considered to be suitable to passively discharge to the downstream environment without additional management.

3.4.3. FMFL

Fill on the FMFL contains chemical contaminants and asbestos at concentrations which represent a risk to future users of the Site. Remediation of the FMFL area therefore requires:

» action to prevent exposure of future recreational users and maintenance workers to asbestos and chemical contaminants within the fill;

» controls to prevent the migration of contaminants to the offsite environment;

» measures to ensure ongoing compliance with relevant legislation; and

» action to manage ongoing reputational risk.

4. Remediation Options Assessment

The remediation options suitable for application to the Site are driven by the following practical considerations associated with future development and use of the Site:

» The Site is to be redeveloped and used in a manner that will allow public access;

» Contamination on the FMFL represents a risk to human health and the environment under current and future landuse scenarios;

» Contamination and waste materials within the Tunnel and at the Eastern Portal do not represent a significant risk to human health or the environment under the current land use scenario. Contamination and waste materials may however represent a risk to future Site users and the environment under the proposed future recreational and public access land use scenario;

» In order to facilitate future use of the Site:

– all materials within the Tunnel will require removal to prevent trip hazards and generally improve aesthetics;

– all vegetation and accumulated soils/sediments within the Eastern Portal cutting will require removal to allow safe recreational access;

» The Site may be remediated and redeveloped in a single package of work or in multiple stages.

Remediation options for each area of the Site are assessed in Sections 4.1 to 4.3. A breakdown of the preferred remediation method is then detailed in Section 5.

4.1. Tunnel – Remediation Options

Remediation of the Tunnel requires the removal of waste and ponded water to facilitate future Site access for recreational users and allow for infrastructure maintenance works to proceed at the Eastern Portal gate. These requirements can feasibly be achieved via adoption of the following remediation methods:

Table 4.1 – Tunnel Remediation Options

Option	Summary Remediation Option
Solid Materials Option 1 – Remove and dispose	▪ Mechanically remove all waste from the Tunnel ▪ Classify waste and dispose direct to landfill
Solid Materials Option 2 – Remove and Recycle	▪ Mechanically remove all waste from the Tunnel ▪ Segregate and transport waste to licenced recycling facilities
Solid Materials Option 3 – Remove and Reuse Onsite	▪ Mechanically remove all waste from the Tunnel ▪ Segregate and reuse waste onsite
Surface Water Option 1 – Passive Discharge	▪ Undertake minor upgrades to drainage at the Eastern Portal/Tunnel interface to allow ponded water to passively discharge to the downstream environment via the vegetated railway cutting (water must not enter the downstream natural water course without filtering through the cutting vegetation).
Surface Water Option 2 – Trade Waste	▪ Obtain a trade waste agreement with Sydney Water ▪ Dispose of water to sewer via pumping (in accordance with the trade waste agreement) ▪ Upgrade drainage to prevent additional ponding
Surface Water Option 3 – Offsite Disposal	▪ Pump and tanker water to an offsite licenced facility for treatment ▪ Upgrade drainage to prevent additional ponding.

Option	Summary Remediation Option
Surface Water Option 4 - Treat and discharge	▪ Import portable water treatment system; ▪ Treat the water on-site to meet the relevant guideline criteria and discharge to the downstream environment.

Remediation works within the Tunnel are driven and constrained by:

» future access requirements, which require all items that may result in health and safety risks to future Site users to be removed. This includes, but is not limited to, contamination, hazardous materials, refuse, waste and other related items; and

» heritage requirements preventing damage to or removal of the Tunnel fabric.

Remediation options for solid materials are therefore limited to the removal of wastes followed by disposal to landfill and/or offsite recycling and/or onsite reuse.

In order to achieve appropriate financial, sustainability and project outcomes, the most appropriate remediation option involves the following:

» Removal of non-contaminated sawdust from the Tunnel and onsite reuse (where practicable) and/or beneficial offsite reuse via recycling at an offsite licenced facility;

» Recycling of steel and other recoverable valuables at an offsite licenced facility;

» Separation and recycling of bulk wastes (paper, plastic) at an offsite licenced facility (where practicable);

» Disposal to landfill of all wastes (including contaminated saw dusts, any hazardous materials and all other items required to clear the Tunnel); and

» Wash down of walls and floor to remove remnant nutrients, sediments and contaminants.

No other viable remediation options that achieve project objectives are available and as such a multi-criteria assessment has not been undertaken. The extent to which materials are reused/recycled will largely be dependent on the project cost/benefits and schedule. Costs of implementing reuse/recycling will be specific to the Contractors work methods, recycling suppliers and the final Site levels (which cannot be fully assessed at this time).

Remediation options for surface water are largely constrained by the financial implications of each option. A detailed assessment of the cost of each option is not viable based on available data. The following is however a pragmatic management hierarchy which will require refinement/optimisation by the Remediation Contractor based on project schedule, practical Site considerations and cost:

1. Wherever practicable, reuse ponded water on-site for the purposes of dust management;
2. Undertake works to improve drainage immediately downgradient of the Eastern Portal/Tunnel interface. The works should allow passive drainage of the water ponded at the Tunnel/Eastern Portal interface via the heavily vegetated cutting and prevent further ponding of water at the Eastern Portal; OR
3. Where upgrades to the drainage are not practicable or otherwise unsuccessful, more resource intensive options may be required. The most cost effective approach should be adopted:
    a. Pump and tanker the water offsite for treatment at an appropriately licenced facility; OR
    b. treat the water to meet the ANZECC 95% protection levels for surface water and discharge downstream; OR
    c. obtain a Trade Waste Agreement with Sydney Water and dispose to sewer in accordance with the agreement.

For clarity, remediation and management of water is only required during the delivery of remediation works. Once the Tunnel has been remediated, no further management of water is required and flow can passively discharge via the Eastern Portal.

4.2. Eastern Portal – Remediation Options

Remediation of the Eastern Portal requires the removal of all vegetation and soils, down to the historic Site surface characterised by roadbase/ballast. The work must facilitate future recreational access and allow for the civil works component of access management works at the Eastern Portal/Tunnel interface. These requirements can feasibly be achieved via adoption of the following remediation methods:

Table 4.2 – Eastern Portal Remediation Options

Option	Summary Remediation Option
Solid Materials Option 1 – Excavate and dispose	▪ Excavate all vegetation and soil from the cutting ▪ Dispose of all vegetation and soil as waste to an appropriately licenced landfill.
Solid Materials Option 2 – Excavate and Recycle	▪ Excavate all vegetation and soil from the cutting ▪ Dispose of all soil as waste to an appropriately licenced landfill. ▪ Recycle vegetation at offsite facilities.
Solid Materials Option 3 – Excavate and Reuse	▪ Excavate all vegetation and soil from the cutting ▪ Reuse soils on the Site ▪ Reuse vegetation on-site via chipping, mulching and composting.

Remediation at the Eastern Portal and within the associated cutting is constrained by:

» Difficult access to the portal and cutting due to the terrain and overgrown vegetation;

» The need to allow future public access via safe walkways on the cutting floor. This will require the stripping of vegetation and excavation and removal all soils to the depth of the roadbase/ballast;

» The presence of minor contamination in water ponded at the Eastern Portal at concentrations which prevents unrestricted discharge to the downstream environment; and

» The presence of limited soil contamination.

In order to achieve appropriate financial, sustainability and project outcomes the most appropriate remediation option involves the following:

» Chipping and reuse of trees on-site (where practicable);

» Stripping, composting and on-site reuse of ground level vegetation (where possible);

» Offsite reuse/recycling of vegetation that cannot practicably be reused on the Site;

» Re-use of soils excavated from the Eastern Portal and gully at the FMFL area (beneath the cap), where suitable from a practical, geotechnical and contamination perspective; and

» Off-site disposal of contaminated soils and excess soils to a licenced landfill.

No other viable remediation options that achieve project objectives are available and as such a multi-criteria assessment has not been undertaken.

The extent to which materials are reused/recycled will largely be associated with the project cost/benefits and schedule. Costs of implementing reuse/recycling will be specific to the Contractors work methods, recycling suppliers and the final Site levels (which cannot be fully assessed at this time). It is noted that the movement

of materials from the Eastern Portal to the FMFL may be impractical and may render some reuse options financially unviable.

With regards to the management of surface water, the Remediation Contractor must ensure that water is managed in accordance with all relevant legislation and appropriate guidance, including the Blue Book and the POEO Act (1997). There are however no specific requirements for remediation of surface water within the Eastern Portal Cutting (noting that ponded water at the Eastern Portal/Tunnel interface is addressed in the Tunnel remediation scope).

4.3. FMFL – Remediation Options

Remediation of the FMFL area requires action to prevent exposure of future recreational users and maintenance workers to asbestos and chemical contaminants within the fill, to prevent ongoing harm to the on-site and off-site environments and to ensure ongoing compliance with relevant legislation. These requirements can feasibly be achieved via adoption of the following remediation methods:

Table 4.3 – FMFL Remediation Options

Option	Summary Remediation Option
Option 1 – Fencing and Management	▪ Emu-pick of bulk ACM present on FMFL area surface ▪ Prevention of access to all high-risk portions of the FMFL via the construction and maintenance of security fencing (this would include all portions of the FMFL subject to filling, effectively limiting access to only the access road and other hardstand areas). ▪ Development of a Long-Term Environmental Management Plan (LTEMP) including ongoing monitoring of controls, regular maintenance requirements and regular inspections.
Option 2 – Capping	▪ Capping of the high-risk portions of the FMFL via the placement of a suitable depth of clean materials on contaminated surfaces; ▪ Development of an LTEMP to manage minor ongoing risks; and ▪ Landscaping/revegetation.
Option 3 – Treatment	▪ Emu-pick of bulk ACM on the FMFL surface; ▪ On-site removal of asbestos fragments from soils via screening; ▪ Validate and re-use treated soils on-site; ▪ Offsite disposal of recovered asbestos; ▪ Removal and offsite disposal/treatment of chemical contamination hotspots; ▪ Development of an LTEMP to manage ongoing risks; and ▪ Landscaping/revegetation.
Option 4 – Disposal	▪ Excavate and dispose of asbestos contaminated fill soils to a licenced offsite facility; ▪ Importation of clean materials to return the FMFL to appropriate grade; and ▪ Landscaping/revegetation.

Each option has been assessed qualitatively in Table 4.4 against the following criteria:

» Ability to achieve project objectives;

» Reliability;

» Cost of implementation;

» On-going management costs;

» Protection of recreational users;

» Protection of maintenance workers;

» Protection of environment;

» Reputation and Community Impacts;

» Environmental cost of implementation; and

» Sustainability.

Table 4.4 – Multi Criteria Analysis of Remediation Options

Criteria	Option 1 - Fencing	Option 2 – Capping	Option 3 – Treatment	Option 4 - Disposal
Achieves project objectives	Partial – Allows access to current hardstand areas and access into the Tunnel, however will prevent access/use of the majority of the remainder of the site.	Yes – Allows reuse of the site for recreational purposes.	Yes – Allows reuse of the site for recreational purposes (assuming successful treatment)	Yes – Complete source removal allows unrestricted use of the site for recreational purposes.
Reliability	Moderate to Low – Access prevention measures such as fences are not always effective, require ongoing maintenance and are not a permanent solution. The approach also relies on regular site inspections.	High – Proven approach with limited opportunity for failure. Cap may be compromised due to erosion or excavation, but such impacts can be mitigated through appropriate management.	Low – There is a significant chance that soil treatment cannot effectively remove asbestos from soils.	Very High – Proven approach with limited opportunity for failure.
Cost of implementation	Low	Moderate	High to Very High	Very High
On-going management costs	Very High – Ongoing management of fences, sediment controls, site access etc.	Low – Limited ongoing maintenance of cap and integration of controls with site inductions.	Low - Ongoing inspection for remnant ACM and integration with controls to site inductions.	None
Protection of recreational users	Moderate – Source remains. The contamination will only be accessible to trespassers.	High – Source remains however there is no exposure to capped contamination.	Moderate – Majority of contaminants removed. Some risk of exposure to remnant ACM, AF and unidentified chemical contaminants in fill.	High – Source removed.
Protection of maintenance workers	Low – Source remains and represents an ongoing risk to workers accessing high risk areas for maintenance purposes.	Moderate to High – Only represents a risk where the cap is pierced during excavation.	Moderate - Majority of contaminants removed. Some risk of exposure to remnant ACM, AF and unidentified chemical contaminants in fill.	High – Source removed.
Protection of environment	Moderate – Source remains. Landscaping and vegetation can effectively prevent offsite migration of contaminants. Impacts to the onsite environment will be ongoing.	High – Offsite migration of contaminants will be prevented by the cap. The cap will allow for placement of clean material to prevent significant ongoing impacts to the onsite environment.	Moderate – Chemical contaminants in fill will not be removed by treatment and will still require offsite disposal or containment via capping, landscaping and revegetation of the site.	High – Source removed.

Criteria	Option 1 - Fencing	Option 2 – Capping	Option 3 – Treatment	Option 4 - Disposal
Reputation and Community Impacts	Mixed – Limited impact on community during implementation, however long-term concern remains.	Positive – Proactive action to remove risk.	Mixed – Proactive action to remove risk however on-site treatment may result in community concern during implementation. Risk of failure may impact reputation.	Positive – Proactive action to remove risk.
Environmental cost of implementation	Low – Requires installation of fencing.	Moderate – Requires import of clean capping materials.	Moderate to high – requires excavation, handling screening and replacement of fill soils.	High – Requires excavation, transport and disposal of fill to an offsite facility.
Sustainability	Moderate – Low Greenhouse Gas Emissions (GHG), however does not allow full beneficial re-use or high levels of protection of the local environment.	High – Implementation includes some GHG emission associated with import of clean materials and general site works however the option provides long term protection of the local environment and allows for beneficial reuse of the entire site.	Moderate – Implementation includes some GHG emission associated with soil treatment and does not provide strong protections for the local environment. Beneficial reuse of the entire site may be achieved.	Low – Implementation includes significant GHG emissions associated with excavation, disposal and import of clean soils. Beneficial reuse of the entire site is achieved.
Summary of Suitability	**Unsuitable** Does not guarantee achievement of objectives, results in large parts of the site remaining inaccessible to the public, significant liabilities are evident, safety risks to workers and trespassers are only marginally mitigated.	**Suitable** Achieves objectives, and limits long term risks. Has a comparatively low implementation cost and requires only minimal ongoing management of remnant liabilities.	**Unsuitable** Very high risk that asbestos cannot be removed from soil. High risk of failure and ongoing management costs.	**Unsuitable** Achieves objectives and limits long term risks. Unacceptably high costs of implementation are likely and the approach is not environmentally sustainable.
Additional Notes	This approach may be suitable if the site is to be used solely for access to adjacent properties and the western portal of the Tunnel. Careful control of maintenance and trespass would be required. The approach is not an appropriate long-term solution and will lead to further degradation of ACM.	This approach is suitable in most scenarios. The contamination liability will remain onsite, however exposure opportunities for site users are minimal. On-going maintenance requirements are low.	This approach is considered to be unsuitable in most foreseeable scenarios. Failure of treatment may not be observable until unexpected discovery of ACM during future use.	This approach is generally suitable but has very high financial and environmental costs during implementation.

5. Remediation Works

In order to achieve the remediation goals, the preferred remediation strategy comprises key tasks identified in Sections 5.1 to **Error! Reference source not found.**.

As previously identified, the strategy assumes that the areas are remediated separately, however also provides opportunities for material reuse which are relevant where the remediation and redevelopment of the Site is completed in a coordinated manner.

5.1. Early Works

Early works for each portion of the Site and/or each stage of remediation will generally comprise the following key tasks. The scope of each task will be specific to the stage and scope of works and as necessary, will be applicable to the entire Site or a smaller defined area:

» Preliminaries – Preparation and submission of Quality, Health, Safety and Environmental (QHSE) Plan (including a Construction Environmental Management Plan (CEMP) and associated sub-plans identified in Section 8.2), as well as associated Safe Work Method Statements.

» Mobilisation to Site, establishment, floating of plant, service location and provision of rumble grid (where required);

» Establishment of Site fencing;

» Establishment of environmental controls in accordance with the requirements of Section 8.2 – including all necessary sediment controls, dust and asbestos management measures;

» Site survey and cut/fill assessment (FMFL and Eastern Portal cutting). The Site survey must be sufficient to allow for accurate assessment of cut/fill requirements to facilitate soil reuse and capping suitable to meet RAP requirements.

» Preparation of materials handling areas:

– Preparation of hardstand areas (and other areas) as necessary to facilitate dewatering, handling and storage of all materials generated during the works.

– The scale of the stockpile/sorting areas required will be informed by the Site survey, the cut/fill assessment and the scale of onsite composting/bioremediation/reuse proposed.

5.2. Tunnel - Remediation Scope

Table 5.1 – Tunnel remediation scope and rationale

Task #	Description	Reasoning and General Comment
T1	Inspection and repair of pipes/services in the vicinity of the Tunnel such that only naturally occurring groundwater drains to the Tunnel.	▪ Site observations suggest leaking water pipes are present within the Tunnel close to the Eastern Portal. ▪ Sydney Water supply pipes were previously leaking at the Western Portal. ▪ The inspection and repair of pipes as part of early stages of work will help to limit surface water management requirements during subsequent clean-up of the Tunnel and Eastern Portal.

Task #	Description	Reasoning and General Comment
T2	Preliminary drainage works at the Eastern Portal.	▪ The water discharging from the Tunnel is not suitable for direct discharge to the downstream environment (via pumping or other bulk movement approach). The DSI identifies that the vegetation in the cutting is likely acting as a natural buffer preventing significant contamination exiting the cutting. The dewatering of the Tunnel can therefore seek to take advantage of this buffer via introducing minor upgrades to drainage at the Eastern Portal/Tunnel interface to allow ponded water to drain slowly to the downstream environment. ▪ Preliminary works may therefore be undertaken to improve drainage in the immediate vicinity of the Eastern Portal opening (nominally <50m from the opening) without the need to dispose of or treat the water if: – The bulk of the water is not significantly disturbed; – The water is allowed to drain slowly through the natural vegetation buffer in a manner similar to the pre-works flow regime; and – Where a suitable contingency plan is in place for unexpected outcomes. ▪ Where this approach is not practicable, the water must be treated such that it meets the acceptance criteria identified in Section 7.3 prior to release to the downstream environment, or it is to be disposed off-site via a trade waste agreement with Sydney Water (or other appropriately licenced management approach). ▪ Direct discharge of the water (via pumping or other bulk discharge) to the downstream environment may represent a pollution event and an offence under the POEO Act (1997). For clarity this only applies prior to and during remediation; once remediation is complete passive discharge is appropriate.
T3	Hazardous Materials survey of the Tunnel.	▪ No assessment of the presence/absence of asbestos, lead paint or other hazardous materials has been undertaken within the Tunnel. ▪ Lead paint may be present on steel structures and may influence recycling/disposal.
T4	Removal of all Hazardous Materials from the Tunnel.	▪ To be informed by the Hazardous Materials survey. ▪ Where a hazardous materials survey is not undertaken, it must be assumed until proven otherwise, that hazardous materials exist within the Tunnel. Removal and disposal must therefore be undertaken in accordance with Section 6.7. ▪ Where a hazardous materials survey is not undertaken, any works to strip paint on-site must assume that paint contains high concentrations of Lead.
T5	Install surface water capture and treatment/disposal infrastructure at the Eastern Portal;	▪ Clean up works within the Tunnel will mobilise sediment and contaminants such that water exiting the Tunnel during the clean-up process is unlikely to be suitable for discharge; ▪ Surface water must be captured and managed to prevent contamination of waterways downstream of the Eastern Portal cutting; ▪ The method for treatment/disposal of surface water will be dependent on financial and practical project drivers, however must be managed in accordance with Section 6.9.
T6	Removal and segregation of all refuse and other materials in the Tunnel to the FMFL;	▪ The manner in which waste is removed from the Tunnel will be driven by safety and practical considerations. This includes the need to manage air quality risks associated with operation of plant in poorly ventilated spaces.

Task #	Description	Reasoning and General Comment
T7	Waste is to be disposed to an appropriately licenced landfill. Contaminated sludge (including saturated/decomposing sawdust), soil and sediments removed from the Tunnel are to be stockpiled, dewatered and classified for offsite disposal (likely as General Solid Waste – Putrescible);	▪ Materials not suitable for recycling or reuse (on or offsite) are to be segregated and disposed offsite in accordance with Section 6.5. ▪ Saturated sawdust and sludge is unsuitable for reuse on the FMFL area. ▪ Sludge and other soils from the base of the Tunnel will require dewatering and classification prior to offsite disposal.
T8	Steel, and other recyclable or reusable materials are to be segregated and recycled at a licenced offsite facility.	▪ Recycling of waste is to be adopted wherever practicable. It is appropriate that the Remediation Contractor optimises the segregation approach to provide the best project outcome. ▪ Materials suitable for recycling are to be transported to a licenced offsite facility. The Remediation Contractor must satisfy the Principal that all materials are lawfully managed/recycled.
T9	Sawdust (from bags and bulker bags) is to be removed to an offsite facility for reuse and/or composting.	▪ Sawdust contained within bulker bags and the numerous smaller plastic bags within the Tunnel is suitable for recycling/composting at an offsite licenced facility and/or reuse onsite in accordance with Section 6.6.4 . ▪ No additional analysis of this sawdust is required where there is no visual or olfactory signs of contamination. The Remediation Contractor must however confirm, to the satisfaction of the Principal, that the material meets the requirements of the licence of the recycling facility.
T10	The Tunnel is to be cleaned;	▪ At completion of removal of all refuse and wastes, the floors and the vertical portions of the Tunnel walls are to be cleaned/cleared of all sediment and dust. This may be achieved via the use of a high-pressure water wash or other appropriate method.
T11	Surface water capture and treatment & disposal infrastructure decommissioned.	▪ Following clearing and cleaning of the Tunnel, water entering the Tunnel and draining to the Eastern Portal will be notionally representative of background groundwater conditions and is therefore suitable for passive discharge via the Eastern Portal with no further ongoing management. ▪ It is noted that final cleaning of the Tunnel and removal of all surface water management infrastructure must occur at a time and in manner that minimises the risk of contamination to the downstream environment.
T12	Tunnel Validation	▪ Validation of Tunnel remediation works will include the following main elements: – Visual inspection of surfaces and Tunnel contents confirming removal of all materials; – Photo log showing removal of all waste; – Waste classification information for all materials disposed to landfill; – Validation information/data for all materials recycled at an offsite facility (confirming materials were suitable for recycling under the relevant licence/approval); – Surface water management data; and – Waste/materials tracking data for all solids and liquids removed from the Tunnel.

5.2.1. Tunnel Clean-up Opportunities

Where the clean-up of the Tunnel is undertaken prior to, or in parallel with the FMFL remediation:

» Sawdust may be suitable for composting onsite and subsequent reuse as a soil amendment (if required);

» Sawdust may be suitable for direct reuse in landscaping (as a mulch);

» Sawdust may be suitable for direct reuse (without composting) as a soil amendment, however it is noted that this may be detrimental to Site revegetation in the short to medium term and must therefore be carefully managed.

Where the clean-up of the Tunnel is undertaken prior to, or in parallel with the Eastern Portal and cutting:

» Sawdust is suitable from a contamination perspective as an amendment to aid in the handling, spadeability and/or dewatering of saturated materials (soil or vegetation);

» Sawdust may be suitable for use during the management of wet haul roads; and/or

» In accordance with an appropriately detailed Construction Environment Management Plan and vegetation management plan, sawdust may be suitable as mulch or soil amendment during revegetation of downgradient portion of the Eastern Portal cutting.

5.3. Eastern Portal – Remediation Scope

A survey of the Site levels is not available. An accurate assessment of volumes of waste associated with the scope in Table 5.2 is not possible based on current Site data.

Table 5.2 – Eastern Portal remediation scope and rationale

Task #	Description	Reasoning and General Comment
E1	Install temporary downgradient water capture and treatment infrastructure;	▪ The stripping of vegetation and soils within the Eastern Portal cutting will remove any natural bio filtering effect and will materially alter the contamination status of surface water. As such surface water must be managed throughout the construction period to prevent damage to downgradient environments. ▪ Surface water must be managed in accordance in Section 6.9.
E2	Strip vegetation within the cutting.	▪ Stripped vegetation is to be disposed off-site to an appropriately licenced facility for recycling/composting. ▪ Where appropriate, materials may be directly used onsite or offsite (e.g. woodchips), however the Remediation Contractor must, to the satisfaction of the Principal, confirm that direct re-use of the material is appropriate, lawful and will not unduly impact the local environment.

Task #	Description	Reasoning and General Comment
E3	Remove the hydrocarbon hotspot and transport to the stockpile area and dewater. Undertake sampling to facilitate re-use, bio-remediation and/or offsite disposal (likely as General Solid Waste);	▪ A hotspot of hydrocarbon contaminated soil is present in the vicinity of sample location EP-C (approximately 40m downstream of the Eastern Portal – refer to Figure 5). As the sample location was not surveyed accurately the location of the hotspot is approximate only and its extent has not been fully delineated. ▪ Delineation of the hydrocarbon contamination is required. Delineation will require visual/PID validation and sampling and analysis of soils in accordance with the requirements of Section 6.4 during excavation. ▪ Insufficient data is available for in-situ waste classification of the hydrocarbon contaminated soils and as such soils to be disposed offsite must be subject to additional waste classification sampling in accordance with Section 6.5. ▪ It is noted that there were no visual indicators at the surface of presence of hydrocarbon contamination at location EP-C, nor was a source identified. The presence of hydrocarbon contamination was easily identifiable via visual and olfactory assessments once the surface layer of vegetation was penetrated. ▪ Finds of additional hydrocarbon contamination are possible and must be considered in the CEMP.
E4	Strip remaining soils as necessary to achieve design levels, transport to staging area and stockpile/dewater. Undertake sampling to facilitate re-use and/or offsite disposal (likely as General Solid Waste).	▪ The soils/sediments within the cutting are to be stripped to a depth that coincides with the roadbase/ballast associated with the former rail/road. ▪ The DSI identified the presence of approximately 300mm depth of saturated soils and sediment between sample locations EP-A and EP-E, following which the depth of soil/sediment reduced to 50mm at location EP-G (refer Figure 5). All sample locations refused on a roadbase/ballast material. No information is available downgradient of EP-G. ▪ Soils to be disposed offsite are to be dewatered, stockpiled and classified in accordance with Section 6.5.
E5	Validation Sampling	▪ Exposed roadbase/ballast material in the vicinity of the hydrocarbon hotspot at sampling location EP-C (Figure 5) must be excavated and the area validated in accordance with Section 6.4. ▪ Where validation fails, additional excavation of materials may be required. Additional excavation and chase-out should be completed in accordance with Section 6.4. ▪ Unless there are visible, olfactory or other indicators of possible contamination, validation sampling is unnecessary in the remainder of the cutting.
E6	Install appropriate drainage;	▪ In order to prevent re-sedimentation of the cutting and/or dangerous access conditions, appropriate drainage infrastructure must be installed to prevent ponding. ▪ Drainage must be installed over the length of the cutting to minimise long term management costs (note that drainage design is beyond the scope of the RAP). ▪ Drainage should be effectively integrated to drainage upgrade works for the Tunnel.
E7	Decommission downgradient water capture and treatment infrastructure.	▪ At completion of Site works (including all drainage upgrades), surface water exiting the cutting will comprise groundwater seepage and rainfall runoff (from validated surfaces) and from a contamination perspective, will be suitable for passive discharge to the downstream environment with no ongoing sampling requirements.

5.3.1. Eastern Portal Remediation Opportunities & Risks

Where the remediation of the Eastern Portal and cutting is undertaken prior to, or in parallel with the remediation of the FMFL area, the following opportunities exist for optimising the remediation approach:

» With the exception of hydrocarbon contaminated soils, the soils recovered from the cutting are suitable, from a contamination perspective, for on-site reuse as part of the remediation works at the FMFL, beneath the capping layer (these soils are generally not suitable for use within the cap due to exceedances of relevant environmental criteria). The geotechnical capacity of these soils would require assessment prior to this reuse approach.

» Soils contaminated with hydrocarbons are may be suitable for on-site treatment (such as bioremediation or landfarming) and reuse on the FMFL. Bio-remediation must be undertaken in accordance with Section 6.6.2.

» Soils not subject to hydrocarbon contamination may be reusable as backfill in the regeneration of the downstream environment. The use of the soil may be constrained by the heavy metal contaminants exceeding the EILs. Where it is proposed that this soil be reused in the downstream environment, additional assessment of the soil and an assessment of environmental risks is required.

5.4. FMFL – Remediation Scope

A survey of the Site levels is not available. An accurate assessment of volumes associated with the scope detailed in Table 5.3 is not possible based on current Site data.

Table 5.3 – FMFL remediation scope and rationale

Task #	Description	Reasoning and General Comment
M1	Remove hardstand required.	▪ The Principal requires that the majority of the hardstand on the FMFL is retained, however a small area of hardstand in the central portion of the FMFL is to be removed as part of the remediation scope. This hardstand is identified in Figure 3. ▪ It must be assumed that any fill present beneath the hardstand is contaminated similar to that identified within other filled portions of the Site. ▪ Once exposed, the fill in this area may be treated as follows: – Validation of the fill in accordance with Section 7; or – Capping of the filled area in accordance with Section 6.1; or – Stripping of fill, disposal offsite and validation of the resulting surface in accordance with Section 6.4; or – Stripping of fill, reuse beneath the cap in the remainder of the FMFL and validation of the resulting surface in accordance with Section 6.4. ▪ The most appropriate method for management of fill beneath the slab will not be apparent until such time as the slab is removed. Due to the limited area and volume of fill in this area it is appropriate that this is managed during remediation works.
M2	Undertake earthworks as necessary to prepare the FMFL for capping (including stripping of fill adjacent to hardstand);	▪ The final design levels are not defined at the time of writing. The Remediation Contractor must undertake earthworks as necessary to ensure achievement of design levels and to minimise project costs (by maximising the reuse of materials and minimising/eliminating offsite disposal of waste). ▪ Fill soils adjacent to hardstand that are to be retained are to be stripped to a depth of 0.5m to allow the capping layer to meet the hardstand at grade. The stripped fill materials are to be placed on-site beneath the cap.
M3	Place marker layer;	▪ The marker layer must be placed in accordance with the requirements of Section 6.1.

Task #	Description	Reasoning and General Comment
M4	Import, place and compact 500mm of VENM across the capped area of the FMFL.	▪ Imported materials must meet the definition of VENM or ENM in accordance with Section 6.8. ▪ Imported materials are to comprise crushed sandstone. ▪ Imported materials, must as far as is practicable support the revegetation of the FMFL and include appropriate drainage characteristics to minimise long term drainage management costs. ▪ Materials must be compacted as necessary to facilitate future landuse requirements, must be geotechnically stable and allow for revegetation with locally native species.
M5	Landscape and revegetate in accordance with the approved design.	▪ Landscape design is beyond the scope of this RAP. ▪ All landscaping (or other works) must ensure that the thickness and integrity of the capping layer is maintained at greater than or equal to 500mm.
M6	Develop and submit Validation Report;	▪ Refer Section 7.4
M7	Develop and submit Long Term Environmental Management Plan.	▪ Refer Section 11

5.4.1. FMFL Remediation Opportunities & Risks

» In accordance with Sections 5.2 and 5.3 materials won from the Tunnel and Eastern Portal cutting may be suitable for reuse on the FMFL.

» Remediation Areas 2 and 3 (Figure 3) may be suitable for emu-pick and validation instead of capping.

– The DSI identified the presence of ACM in both Remediation Area 2 and 3, however based on available data it is possible that the asbestos contamination is associated with poor demolition practice rather than being entrained within the fill.

– Where the project schedule allows, an alternate strategy for these areas includes an emu-pick of asbestos (in accordance with Section 6.3) on the ground surface and subsequent validation for asbestos (in accordance with Section 7.2.2).

– Where validation fails, capping of this area will be required.

» The retention of the hardstand in the central portion of the FMFL may reduce remediation liabilities. Due to the unknown nature of fill beneath the slab, the removal of the slab represents a financial risk to the project.

6. Remediation Standards

6.1. Capping Design (FMFL)

The NEPM (2013) encourages the management of asbestos in-situ (which includes the covering of contamination with uncontaminated fill or other protective layers). NEPM (2013) also states that further guidance is available for in-situ management strategies within the *Guidelines for the assessment, remediation and management of asbestos- contaminated sites in Western Australia (WA DOH, 2009)*.

To control risks associated with asbestos contamination in soil, WA DOH 2009 recommends the installation of a barrier cover to a depth of 1m for public open spaces and 0.5m in residential premises where the risk of the cap being pierced is minimal. The guideline provides for the depth of an engineered cap to be reduced where appropriate risk management is implemented. The nature of the proposed Site use, the proposed use of crushed sandstone and the ability of DoI/Council to maintain control of maintenance activities on the Site, result in a low risk that a 0.5m cap will be compromised. Where excavation during maintenance work may intercept the contaminated soils, DoI/Council will have sufficient visibility over works to implement appropriate safety controls.

The guidelines also note that for covers of less than 3m depth, additional management measures including geotextile barriers, a long-term site management plan and vegetation cover are necessary.

On the basis that a geotextile barrier will be installed, the FMFL will be vegetated and an LTEMP will be developed and implemented for the Site, a cap of 0.5m of clean material is sufficient to prevent exposure to identified asbestos contamination at the FMFL. The cap will also provide sufficient protection to future Site users with regards to the identified B(a)P hotspot and will prevent significant impacts to the local environment associated with the identified EIL exceedances in soil.

The capping design therefore includes the following major components:

» Placement of a geotextile marker layer at the interface of the contaminated fill soils and the imported clean materials. This marker layer may be specialised or improvised, however must be water permeable, be highly visible, be rot-proof, chemically inert and have high tensile strength. The marker layer must be installed a minimum of 0.5m beyond the boundary of the contaminated materials (horizontally) and sheets must overlap a minimum of 200mm at all intersections.

» Placement and compaction of a minimum 500mm of imported VENM on all areas of the Site subject to capping. In accordance with the requirements of DoI the entire thickness of capping material is to constitute crushed sandstone. Any changes to the composition of the VENM backfill must be agreed with the Principal in advance of the materials being imported to the Site; and

» Development of a Long Term Environmental Management Plan (LTEMP) which includes controls for maintenance of the capping layer and the vegetation. The plan must include controls associated with any works which may compromise the capping layer and must be developed in accordance with Section 11.

Some portions of the Site which require capping may be too steep to allow capping as described above. Where this is the case, the area must be graded to allow capping to proceed OR the cap must be redesigned to allow installation (however the new design must afford the same level of protection to future Site users).

6.2. Extent of Capping (FMFL)

The approximate extent of capping required is defined as:

» Remediation Area 1 – Approximate Area 2400m^2

» Remediation Area 2 – Approximate Area 470m^2

» Remediation Area 3 – Approximate Area 490m^2

Each Remediation Area is shown in Figure 3. The Site and Site features have not been surveyed and as such the estimates are approximate only and the Remediation Contractor must include provision for some variation in the lateral extent of the capping layer. The extent of capping must be such that the risk associated with exposure to contaminated fill is appropriately mitigated.

Portions of the Site with hardstand that is to be maintained during and after remediation are excluded from the requirement for capping. For clarity, only one portion of hardstand is to be removed during remediation and this area is defined in Figure 3.

The capping installation and design must be such that the Site drains freely to the adjacent Knapsack Gully. Where the installation of drains/pipes or other drainage infrastructure is necessary, this must be integrated to the design and shall not require the cap to be unduly disturbed, compromised or otherwise damaged following project completion and validation.

In accordance with Sections **Error! Reference source not found.** and where they are shown to be appropriately validated, Remediation Areas 2 and 3 may not require capping.

6.3. Emu Pick

Where an area of the Site is considered suitable for emu-picking of asbestos, the emu pick must be conducted in accordance with the following:

» At least two passes of picking (and of raking if appropriate) made with 90 degree direction change between each and using a grid pattern. Rake teeth should be < 7 mm spaced apart and > 10 cm long;

» Locations and weights of asbestos material should be recorded;

» Material should not be further damaged or buried by the process;

» Final visual inspection of the area should not detect surface ACM; and

» The area must be subject to clearance by an appropriately qualified hygienist.

Where Remediation Area 2 and Remediation Area 3 are subjected to an Emu-Pick for the purposes of remediation, validation is required in accordance with Section 7.2.2 (as the asbestos cannot be attributed to a specific event and may be incorporate in the fill).

Where the emu pick is conducted within Knapsack Gully, validation in accordance with Section 7.2.2 is not required due to:

» the presence of vegetation and the nature of the geography meaning the approach is impractical; and

» the lack of fill in this area meaning that the asbestos is due to isolated surface dumping and incidental transfer from the adjacent fill embankments.

6.4. Contamination Chase-out

Where contaminated soils have not been fully delineated and require excavation to facilitate the Site remediation and/or development, the following requirements apply:

» Contaminated materials are to be excavated and stockpiled for waste classification. Excavation should extend to all soils exhibiting odours, visual signs of contamination and/or PID readings exceeding 30ppm. Materials removed are to be stockpiled for disposal, validation or bioremediation in accordance with the requirements of this RAP;

» Validation sampling of the resulting excavation is to be undertaken at a rate of 1 sample per 10 lineal metres from each wall of the excavation and 1 sample per 100m^2 of excavation base.

» Samples are to be analysed for appropriate Contaminants of Concern and where an exceedance of the Remediation Acceptance Criteria (RAC) is identified, the excavation shall be extended and sampling repeated (as necessary).

» Excavation and sampling is to continue until such time as the area has been fully validated or until further chase-out of materials cannot occur (due to geotechnical, heritage or other constraints).

For clarity, it is expected that this approach is only likely to be required in the Eastern Portal cutting and beneath the area of removed hardstand on the FMFL.

6.5. Waste Characterisation and Disposal

All soils to be disposed off-site will be assessed and classified in accordance with the POEO Act and specifically the *Waste Classification Guidelines NSW EPA (2014)*.

The *Waste Classification Guidelines, Part 1: Classifying Waste* NSW EPA (2014) provide criteria for assessing the classification of material requiring offsite disposal, and to subsequently determine the most appropriate disposal location.

When assessing waste, the Remediation Contractor must also consider relevant orders and exemptions under the Protection of the Environment Operations (Waste) Regulation 2014, including the Compost Order 2016.

Sampling density for soils to be disposed offsite are to be at a rate of 1 sample per 25m^3 of material (ex-situ) with a minimum of 3 samples analysed. Where sampling occurs in-situ the density should make allowance for a bulking factor of 25% during excavation (such that the 1:25m^3 ratio is maintained post excavation). Where the materials exhibit high levels of heterogeneity additional samples may be required to appropriately classify the soil. For volumes larger than 200m^3 a reduced sampling density can be adopted where it is appropriately justified by the Remediation Contractor.

6.6. Beneficial Reuse Options

6.6.1. Soil Reuse

Soils won from the Eastern Portal cutting which are to be re-used on the Site must meet the Remediation Acceptance Criteria (RAC) defined in Section 7.2.

Based on available data, soils won from the Eastern Portal may represent a risk to the local environment (due to EIL exceedances) and are only to be reused beneath the capping on the FMFL. Where alternate locations for reuse are considered, a specific assessment of the associated risks will be required.

6.6.2. Bioremediation

A hydrocarbon hotspot was identified during sampling (location EP-C). Where the project schedule and practical site considerations allow, the hydrocarbon impacted soils may be suitable for on-Site bioremediation and beneficial reuse beneath the capped portion of the FMFL. If adopted, bio-remediation must be undertaken in accordance with the requirements of the *Best Practice Note: Landfarming, State of NSW and Environment Protection Authority (2014)*.

Bioremediation will require stockpiling in a suitably contained area, on an impermeable liner base and with ongoing management of dust, odour and sediment. The material to be bioremediated will require dewatering and the addition of an appropriate carbon source (sawdust from the Tunnel, partially composted vegetation won from the Site or imported carbon source), regular turning of stockpiles and validation sampling.

Following bioremediation, the soils must meet the RAC detailed in Section 7.2 prior to reuse.

It is noted that the practical and financial viability of this option will depend on the volume and nature of contaminated materials excavated as well as the availability of a suitable remediation area.

6.6.3. Vegetation

Vegetation stripped from the Eastern Portal and the FMFL is suitable for reuse on the FMFL and other appropriate locations on the Site, via placement as weed control, mulch or as an amendment to imported soil. Reuse of this material is subject to the following constraints:

» Composting of materials must be undertaken such that noxious weeds will not regenerate when placed on Site; and

» Soils and Site surface finishes must be suitable in all regards to meet project requirements, including those associated with the long term prevention of erosion and maintenance of vegetation.

Where vegetation cannot be reused on-site it must be transported offsite to an appropriately licenced facility for composting/recycling/reuse.

Where vegetation is to be composted offsite the materials to be exported must meet the requirements of the recycling facility and the Compost Order 2016.

6.6.4. Sawdust

Sawdust which is contained in bulker bags and small plastic bags within the Tunnel is suitable for reuse on the FMFL without additional analysis.

The sawdust may be used as a soil amendment where it has been appropriately composted or as a mulch/stabiliser at the Site surface. When reused on-site the plastic content of sawdust shall not exceed that defined in the Compost Order 2016 (refer Section 7.2.3).

Where sawdust is to be recycled offsite, the Remediation Contractor must confirm to the satisfaction of the Principal that it is managed in accordance with all relevant laws (including the Compost Order 2016 and the POEO Act, 1997).

Due to the presence of Benzo(a)Pyrene, sawdust on the floor of the Tunnel which is not contained within bags or bulker bags, is not suitable for reuse or recycling and is to be disposed off-site to an appropriately licenced facility. The available data is insufficient to allow for in-situ waste classification and as such additional sampling and analysis is necessary and must be undertaken in accordance with Section 6.5.

6.7. Asbestos Excavation

Removal of asbestos (including asbestos containing soils) from the Site will require a Class A asbestos removal licence issued by SafeWork NSW. The licensed removalist must develop an Asbestos Removal Control Plan (ARCP) and nominate an asbestos removal supervisor who must be readily available to any worker carrying out asbestos removal work whenever the work is being carried out. All asbestos workers at the Site must be appropriately trained in asbestos works and in the ARCP. The training must include information on health risks associated with asbestos, and the rights of asbestos workers under the WHS Regulation.

The licensed asbestos removalist must keep records of all training works.

An appropriate air monitoring program must be implemented to ensure the works do not release airborne asbestos fibres. Monitoring for airborne asbestos fibres is to be carried out by the independent Asbestos Assessor during the asbestos works as required to meet WHS Act, regulation and SafeWork NSW requirements. The Asbestos Assessor will be responsible for determining when air monitoring is required, and an appropriate scope of monitoring for the works.

The Asbestos Assessor is to provide prompt results of air monitoring to the Asbestos Contractor to allow appropriate action to be taken if any respirable asbestos is detected.

If respirable asbestos fibre levels are recorded at 0.01 fibres/mL or more, but not more than 0.02 fibres/mL the following must be implemented immediately:

» Investigate the cause of the respirable asbestos fibre level; and

» Implement controls to prevent exposure of anyone to asbestos; and

» Prevent further release of respirable asbestos fibres.

If respirable asbestos fibre levels are recorded at more than 0.02 fibres/ml the following must be implemented immediately:

» Order the asbestos related work to stop; and

» Notify the regulator; and

» Investigate the cause of the respirable asbestos fibre level; and

» Implement controls to prevent exposure of anyone to asbestos; and

» Prevent the further release of respirable asbestos fibre.

6.8. Importation of Clean Fill / Capping Layer

Importation of clean fill will be required to facilitate the remediation works and the placement of the capping layer. Imported material shall meet the statutory definition of virgin excavated natural material (VENM) or excavated natural material (ENM) as recommended by the NSW EPA. It is a requirement of the Principal that the VENM used in capping of the Site is crushed sandstone.

In accordance with Schedule 1 of the POEO Act), VENM is natural material:

» that has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as the result of industrial, commercial, mining or agricultural activities and

» that does not contain any sulphidic ores or soils or any other waste, and

» includes of excavated natural materials that meet such criteria as may be approved by the NSW EPA.

The Contractor shall provide VENM certificates verifying the material source and providing sample results prior to the material being brought on to Site. The Contractor shall collect samples of VENM brought on to Site at a rate of one sample per 1,000m^3, with a minimum of three samples taken (from each VENM site).

ENM may be imported to the Site where it is shown to the satisfaction of DoI (prior to transport of material to Site), that it meets all requirements of '*The excavated natural material order 2014*' (Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014). ENM means naturally occurring rock and soil (including but not limited to materials such as sandstone, shale, clay and soil) that has:

» been excavated from the ground;

» contains at least 98% (by weight) natural material; and

» does not meet the definition of Virgin Excavated Natural Material in the Act.

Excavated natural material does not include material located in a hotspot; that has been processed; or that contains asbestos, Acid Sulfate Soils (ASS), Potential Acid Sulfate soils (PASS) or sulfidic ores.

The analytical suite for VENM and ENM will include heavy metals, Total Recoverable Hydrocarbons (TRH), Polyaromatic Hydrocarbons (PAHs), Benzene, Toluene, Ethyl-benzene and Xylene (BTEX) and Nutrients (in addition to any Site specific, ENM specific or material specific requirements).

Prior to importation of any materials, the Contractor must confirm in writing, that the imported materials are suitable to ensure protection of the long-term quality of groundwater. Particular care must be taken to avoid the importation of VENM or ENM with naturally high concentrations of contaminants (such as heavy metals or nutrients) which may have long term impacts on local groundwater conditions.

6.8.1. Revegetation

At completion, all capped areas on the Site are to be revegetated with locally native species. The Remediation Contractor must ensure that the Site is suitable for revegetation in accordance with the requirements of the Principal.

A complete revegetation plan is beyond the scope of this RAP. A Revegetation Management Plan is to be developed by a suitably qualified person or entity in accordance with DoI requirements (at the time of remediation).

6.9. Surface Water Management

Where discharge of waters captured or otherwise encountered during remediation is proposed, it must be shown (to the satisfaction of the Principal) to be compliant with the 95% level of protection for aquatic ecosystems as defined in ANZECC 2000.

Where appropriate, captured water may be suitable for reuse onsite for the purposes of dust management and washdown. The Remediation Contractor must satisfy the Principal that reused water is suitable for this purpose.

Where surface waters do not meet these requirements, they are to be disposed off-site via a Trade Waste Agreement with Sydney Water or otherwise removed to an appropriately licenced facility.

At completion of remediation works the water discharging from the Tunnel and Eastern Portal cutting will be suitable for passive discharge to the downstream environment (as it will be representative of natural groundwater conditions and run-off).

Final drainage designs must ensure that sediment runoff is minimised in high rainfall events.

7. Validation Program

7.1. Data Quality Objectives and Indicators

The validation assessment will be conducted in accordance with appropriate Data Quality Objectives (DQOs) and Quality Assurance/Quality Control (QA/QC) procedures to ensure the reliability of validation results.

The validation assessment will be planned in accordance with the following DQOs:

» State the Problem;

» Identify the Decision;

» Identify Inputs to the Decision;

» Define the Boundary of the Assessment;

» Develop a Decision Rule;

» Specify Acceptable Limits on Decision Errors; and

» Optimise the Design for Obtaining Data.

A checklist of Data Quality Indicators (DQI) in accordance with NEPM (2013) Schedule B2 will be completed as part of the validation assessment. The DQIs are:

» Documentation completeness;

» Data completeness;

» Data comparability and representativeness; and

» Data precision and accuracy.

An assessment of the overall data quality in accordance with DQPO requirements shall be presented in the Validation Report.

7.2. Remediation Acceptance Criteria

The remediation involves the possible reuse of some materials won from the Tunnel and/or the Eastern Portal cutting on the FMFL area. The following materials have been identified as possibly being suitable for reuse from a contamination perspective. The Remediation Acceptance Criteria (RAC) for each material is also defined.

Table 7.1 – Summary Acceptance Requirements

Source Material	Reuse Option	RAC
Tunnel – Sawdust	Soil amendment or mulch in revegetation areas	No visible or olfactory signs of contamination. Plastic content of sawdust cannot exceed that identified in Section 7.2.3.
Eastern Portal – Trees/woodchips	Mulch in revegetation areas of the FMFL	No visible or olfactory signs of contamination. Plastic content of the material cannot exceed that identified in Section 7.2.3.

Source Material	Reuse Option	RAC
Eastern Portal – Ground level vegetation	Soil amendment or mulch in revegetation areas	No visible or olfactory signs of contamination. Plastic content of sawdust cannot exceed that identified in Section 7.2.3. Must be composted or otherwise treated to meet the requirements of Section 7.2.3.
Eastern Portal – Soils/Sediments	Soil/fill beneath the FMFL capping layer.	Materials without visible, olfactory or Photo-Ionisation Detector (PID) indicators of the presence of hydrocarbons or other contaminants are suitable for reuse without additional sampling. Materials with visible, olfactory or PID indicators of hydrocarbon or other contamination must be sampled and validated in accordance with the requirements of Section 7.2 and must meet the RAC prior to reuse.
FMFL - Vegetation	Soil amendment or mulch in revegetation areas	No visible or olfactory signs of contamination. Plastic content cannot exceed that identified in Section 7.2.3. Must be composted or otherwise treated to meet the requirements of Section 7.2.3.
FMFL	Soil/fill beneath the capping layer.	No additional validation is required for soils present in Remediation Areas 1, 2 and 3. Where unexpected contamination is identified and the material is to ultimately be contained beneath the Site cap, then the material must be validated against the RAC (Capped Materials). The presence of ACM will not trigger the need for additional sampling.
Unexpected contamination finds	-	Where unexpected contamination is identified, the RAC to be applied are defined in Section 7.2.1 and 7.2.2.

7.2.1. Reuse Remediation Acceptance Criteria (Chemical)

Adopted soil criteria are identified in Table 7.2. The adopted criteria are applicable to the re-use of materials sourced on-site for beneficial reuse, and are not to be applied to imported materials.

» Where materials require additional analysis in accordance with this RAP, and they are to be reused beneath the cap they must be validated against the RAC (Capped Materials) as defined in Table 7.2. The adoption of the RAC for materials to be placed below the cap is based on the following assumptions:

– following the placement of the cap, exposure scenarios for all recreational users entering the FMFL will exclude any direct contact with the fill soils;

– all future excavation and maintenance will be undertaken by workers in accordance with the requirements of the LTEMP (refer Section 11) which will fully account for the contamination risks;

– materials are to be sourced from the Eastern Portal Cutting (where investigation has indicated very low leachability of metals); and

– no enclosed structures are planned for the FMFL.

» If for any reason soil won from other areas of the Site is to be reused in portions of the Site which are not going to be capped, the materials must be validated against the following RAC:

– the HILC criteria for public open space (Table 7.2);

– the Site environmental criteria i.e. the EILs (Table 7.2); and

– the Asbestos RAC defined in Section 7.2.2.

Table 7.2 – Remediation Acceptance Criteria

Contaminant of Concern	RAC Health-Based Criteria[1] (mg/kg) Recreational HIL(C)	RAC Capped Materials (mg/kg)	RAC Environmental Criteria[2] (mg/kg) EIL[1]
Heavy Metals			
Arsenic	300	NL	100[3]
Cadmium	90	NL	-
Chromium[4]	300	NL	195[5]
Copper	17000	NL	560[6]
Lead	600	NL	1100[7]
Mercury	80	NL	-
Nickel	1200	NL	35[4]
Zinc	30000	NL	250[8]
Organochlorine Pesticides			
DDT+DDE+DDD	400	NL	180
Aldrin and Dieldrin	10	NL	-
Chlordane	70	NL	-
Endrin	20	NL	-
HCB	10	NL	-
Phenols		NL	
Phenol	40000	NL	-
Pentachlorophenol	120	NL	-
Cresols	4000	NL	-

[1] Generic land uses are described in detail in Schedule B7 Section 3, NEPM 2013.
[2] Conservatively the investigation has adopted criteria for 'areas of ecological significance'. If exceeded the criteria will be reassessed on a case by case basis applying less conservative criteria where appropriate.
[3] Added Contaminant Limit (Table 1B(5)) and ABC = 0
[4] Value for chromium(VI) used for health-based criteria as a conservative measure; value for chromium(III) used for EIL
[5] Added Contaminant Limit (Table 1B(3)) NEPM (Cr(III) ACL= 190 and ABC = 5)(Ni ACL = 30 & ABC = 5)
[6] Added Contaminant Limit (Table 1B(2)) NEPM and pH = 7.5
[7] Added Contaminant Limit (Table 1B(4)) NEPM
[8] Added Contaminant Limit (Table 1B(1)) NEPM (pH = 7.5, CEC = 5 (worst case), ABC = 20mg/kg (Zn))
NL= Not Limiting

Contaminant of Concern	RAC Health-Based Criteria[1] (mg/kg) Recreational HIL(C)	RAC Capped Materials (mg/kg)	RAC Environmental Criteria[2] (mg/kg) EIL[1]
PCB			
PCB	1	NL	-
BTEX			
Benzene	NL	NL	10
Toluene	NL	NL	10
Ethylbenzene	NL	NL	1.5
Total Xylenes	NL	NL (or 230 if an enclosure is planned)	1.6
TRH[9]			
F1[10]	700	NL (or 260 if an enclosure is planned)	125
F2[11]	1000	1000	25
F3 (C_{17}-C_{34})	2500	3500	-
F4 (C_{35}-C_{40})	10000	10000	-
PAHs			
Benzo(a)pyrene	3	NL	0.7
Total PAHs	300	NL	-
Naphthalene	-		170[3]
Asbestos	Refer Section 7.2.2		

7.2.2. Reuse Remediation Acceptance Criteria (Asbestos)

The adopted criteria are applicable to the re-use of materials on-site and/or portions of the site that have been emu-picked. They are not to be applied to imported materials.

The asbestos criteria are not applicable to materials to be placed beneath the engineered capping layer.

The NEPM provides specific guidance for the assessment of asbestos in soils and identifies three groups of asbestos contamination:

» ACM: asbestos which is bound in a matrix (in sound condition) which cannot pass through a 7 mm x 7 mm sieve;

[9] TRH concentrations have been conservatively adopted as the HSL A for Sandy Soils between 0 and 1m depth (NEPM 2013). If exceeded, TRH will be re-assessed against the HSLs for the appropriate depth and nature of the media sampled.
[10] To obtain F1 subtract the sum of BTEX concentrations from the C6-C10 fraction.
[11] To obtain F2 subtract naphthalene from the >C10-C16 fraction

» Fibrous Asbestos (FA): friable asbestos material, such as severely weathered ACM and loose fibrous material such as insulation products. FA is defined as asbestos material that is in a degraded condition such that it can be broken or crumbled by hand pressure; and

» Asbestos Fines (AF): includes free fibres of asbestos, small fibre bundles and ACM fragments that pass through a 7 mm x 7 mm sieve.

The HSLs for asbestos documented in NEPM 2013 have been adopted for the purposes of reuse of Overburden as follows:

» Bonded ACM <0.01% (w/w);

» FA and AF <0.001% (w/w);

» No visible asbestos.

Sampling for validation of emu-picked portions of the Site is to be completed as follows:

» At least one 10 L sample from every 100m^2 of Site surface to be validated (with a minimum of 3 samples);

» Sample screened manually on-site through a < 7 mm sieve or spread out for inspection on a contrasting colour material;

» Identified ACM and FA weighed to calculate asbestos soil concentration for individual samples as per guidance provided in the WA DOH Guidelines.

» At least one wetted 500 ml sample from each relevant sample location is to be submitted for laboratory analysis.

» Noting the significant sampling burden and the risk that validation will fail, the capping of these portions of the Site may be more practicable and acceptable from a project perspective. This will however depend on the project schedule and costs of capping vs. sampling and validation.

NEPM 2013 endorsed sampling procedures must be adopted when determining the % composition of asbestos in soils.

7.2.3. Criteria for Onsite Composting and Reuse

Where materials won from the Site are to be reused on-site the Remediation Contractor must ensure the following:

» All reused materials must contain:

  – Less than 0.5% (dry weight) of glass, metal and rigid plastics; and

  – Less than 0.05% light, flexible or film plastics; and

  – Must not include any visual, olfactory or other indicators of contamination.

» Reused materials will not result in the spread of any environmental weeds or any other undue harm to the environment; and/or

» Where used as a soil amendment the materials will support the revegetation and long term management objectives for the Site (noting that the addition of uncomposted sawdust to soils may reduce the ability of soils to support vegetation in the short to medium term).

7.2.4. Criteria for Offsite Composting of Vegetation

Where materials are to be sent to an offsite facility for composting in accordance with the Compost Order 2016, the supplier of a compost for application to land must ensure that the absolute maximum or other value of that attribute in the compost does not exceed the values listed in **Table 7.3.**

It is a requirement that materials exported from the Site meet the % criteria for attributes 1 and 2 of **Table 7.3**.

The composting process (undertaken at an offsite facility) will be required to reduce the pathogen populations such that they meet the requirements of the Compost Order 2016 (and is the responsibility of the facility undertaking the composting). Materials transported to offsite facilities for composting do not require testing for attributes 3,4 and 5 where there is no reasonable source of contamination.

Table 7.3 – Limits for compost application to land (the Compost Order 2016)

Attributes	Absolute maximum (% 'dry weight' unless otherwise specified)
1. Glass, metal and rigid plastics > 2 mm	0.5
2. Plastics – light, flexible or film > 5 mm	0.05
3. Salmonella spp	absent in 25 g
4. Escherichia Coli (E. Coli)	<100 MPN/g*
5. Faecal coliforms	<1000 MPN/g*

7.2.5. Waste Tracking

A materials tracking system will be required to control and track the movement of materials on and off the Site. This system should control each of the different material handling phases that occur during the project including excavation, stockpiling, re-use, off site treatment and off-site disposal.

The system will track all Site materials from "cradle-to-grave" and will provide detailed and accurate information about the location and quantity of all materials both on and off-site.

Waste tracking data shall be reconciled with documentation provided by waste transporters and waste receivers.

All waste tracking must be undertaken via the EPA online tracking system, wherever required. Tracking is a requirement of Part 4 of the Protection of the Environment Operations (Waste) Regulation 2014.

7.3. Water and Waste Water

Water disposed offsite, must be validated in accordance with the relevant licence agreement and/or the licence of the relevant disposal facility.

In accordance with direction by the NSW EPA, a Trigger Action Response Program (TARP) must be developed to manage water flowing within the Tunnel or the Eastern Portal Cutting where it may discharge to the naturally occurring downstream waterway (this applies only during remediation activities and is not required when no disturbance of the site is occurring). The TARP must identify and define conditions (or "triggers") which may result in contaminants migrating offsite via surface water and actions which site managers and supervisors must follow when those trigger events occur. The TARP must also clearly define responsibility for implementation of each action once triggered.

Where it is not proposed to discharge surface water to the downstream environment, a TARP is still required and as a minimum triggers & actions must be associated with uncontrolled release of waters.

If during construction or remediation water is discharged to the downstream environment, validation (via application of the TARP) must include sampling and analysis of water indicating contaminant concentrations do not exceed those defined for the protection of 95% of aquatic species in ANZECC 2000.

The TARP may form an addendum to the Construction Environmental Management Plan (CEMP).

7.4. Validation Reporting

Validation information is to be collected to verify the effectiveness of the remediation works and document the condition of the Site as being suitable for the proposed future use(s).

The validation report will be prepared in general accordance with NSW EPA Guidelines for Consultants Reporting on Contaminated Sites (2000). The validation report will include the following:

» Details on the implementation of all elements of the RAP;

» Clear waste tracking data for all materials removed offsite;

» Materials tracking data for all materials reused on-site;

» Surveys, as-built drawings, geotechnical compaction reports and field notes/photos as necessary to demonstrate compliance;

» Verification of regulatory compliance;

» A clear statement on whether the Site is considered suitable for its intended land use and whether it is considered to present an unacceptable risk to human health and the environment;

» Details of the long term EMP; and

» Any limitations, assumptions and uncertainties relevant to the conclusions of the report.

Given the nature and extent of remediation works, validation data and reporting shall specifically verify that:

» All refuse, waste and other materials within the Tunnel have been removed. In addition, the cleaning of the surfaces within the Tunnel must have been completed. Validation of the Tunnel clean-up will be achieved via:

  – Inspection, field notes/records and photo logs.

  – An asbestos clearance certificate from an appropriately qualified hygienist;

  – Materials tracking data for recovered and reused sawdust (if adopted);

  – Materials tracking data for all recyclables transported to licenced offsite facilities;

  – Waste classification and disposal tracking information for sludge, soils and all other materials disposed to licenced landfills;

  – Details of process, field records and sampling data clearly indicating that all surface water removed from or otherwise leaving the site boundary was managed in accordance with the requirements of this RAP;

  – No validation sampling within the Tunnel is necessary.

» Soils and vegetation within the Eastern Portal have been removed in accordance with the design requirements. Validation will be achieved via:

  – Inspection, field notes/records and photo logs;

  – Materials tracking data for any recyclable/compostable/reusable material transported offsite OR to the Mushroom farm for reuse;

  – Waste classification and disposal tracking information for all soils and other wastes disposed to landfill;

  – Survey of final Site levels indicating compliance with design requirements;

  – Soil validation sampling details and data for the portions of the cutting subject to hydrocarbon contamination;

» Validation of the FMFL area will involve:

  – assurance that the cap has been installed as per the design requirements. This will be achieved via Principal Site inspections, field notes/records, photo logs, VENM/ENM and topsoil validation and materials tracking data, geotechnical/compaction records as well as survey of the capping marker layer, survey of

final Site levels confirming compliance with design requirements and appropriately detailed as-built drawings.

- The scope of remediation and validation includes confirmation by the Remediation Contractor that all portions of the Site subject to significant filling have been capped in accordance with this RAP OR are suitably free of asbestos in accordance with the validation criteria presented in Section 7.2.
- Materials tracking data and destination facility licences for any recyclable/compostable/reusable material transported offsite;
- Waste classification and disposal tracking information for all soils and other wastes disposed to landfill.

8. Work Health, Safety and Environment

8.1. Remediation Health and Safety Plan

Several potential health and safety hazards are anticipated to be present during the course of the remediation works. These relate to physical hazards posed by the completion of a large-scale earthworks project, work within poorly ventilated spaces and chemical and asbestos fibre hazards associated with the contaminated soils.

A Remediation Health and Safety Plan (RHSMP) will be required prior to the commencement of works. As a minimum the RHSMP will need to detail the following items:

» Assessment of potential hazards posed by works including detailed descriptions of potential impacts from contaminants present in soil underlying the Site;

» Project specific objectives, performance measures, project contacts, personnel responsibilities and details as wells as conduct standards;

» Measures to eliminate hazards (where possible);

» Procedures / controls to be put in place to control hazards where elimination is not possible;

» Personal protective equipment to be worn by the Site workforce;

» Exposure standards;

» Requirements for occupational monitoring to be completed during the remediation works;

» Decontamination procedures;

» Requirements for pre-works training of the Site workforce and Site inductions;

» Emergency response, evacuation plans and directions for medical assistance / first aid; and

» Incident/near miss reports and procedures.

Additional requirements for the RHSMP may be identified during the course of remediation.

The Remediation Contractor shall be responsible for the location of all services within or around the remediation target area that may be impacted by the works, and for the appropriate protection of such services throughout the duration of the works. The Contractor shall endeavour to protect any property and infrastructure at the Site, and mitigate impacts to the surrounding environment to the extent practicable, throughout the works.

8.2. Construction Environmental Management Plan

Prior to the commencement of Site works, the Contractor shall prepare a Construction Environmental Management Plan (CEMP). This plan will include specific details and work method statements describing all environmental controls to be implemented and followed during the remediation works.

The following critical elements are to be included in the CEMP:

» Measures and procedures to minimise impacts to the local environment. This includes management of impacts on all portions of the Site, to neighbouring properties and all areas outside of the Site which may be impacted by the transport of waste. Impacts requiring assessment in the CEMP include but are not limited to:

  – Biosecurity;

  – Flora and fauna;

- Sediment management, particularly with regards to stockpile management;
- Water management (surface and subsurface);
- Dust management measures;
- Noise; and
- Chemical handling, spills and pollution events.

» Measures necessary to ensure the protection of the heritage values of the Tunnel and the associated heritage curtilage;

» Measures and procedures to minimise environmental impacts associated with dust and asbestos;

» Site establishment tasks defined in the CEMP shall include, but may not be limited to:

- Erection of temporary fencing to demarcate the remediation area(s);
- Preparation and establishment of stormwater diversions, surface water management measures and sedimentation controls;
- Provision of dust and odour suppression measures and equipment as necessary;
- Establishment of traffic routes and controls; and
- Establishment of decontamination measures.

» Measures and procedures to manage enquiries from stakeholders and the community regarding the project.

The CEMP shall include the following information and control plans:

» **Soil and Water Management Plan** – This plan should include erosion and sediment controls, stockpiling and contamination controls.

» **Air Quality Management Plan** – This plan should include dust, odour and vapour controls.

» **Noise and Vibration Management Plan** – This should include details of noise and vibration standards to be met, noise and vibration monitoring requirements (if necessary) and noise and vibration control measures to be implemented.

» **Traffic Management Plan** – This should include details on Site access/exit, preferred transport routes, special conditions to Site entry/exit, transport materials and community impacts.

» **Waste Management Plan** - This plan will outline waste management procedures, including waste recycling and reuse measures and waste storage and disposal measures. The waste management plan will:

- provide clear guidance regarding the identification and segregation process for different types of waste during project delivery including; soil handling, stockpiling and offsite disposal;
- be developed to minimise the generation of waste and maximise reuse, recovery and recycling of waste products.
- detail waste tracking requirements and plans in accordance with the requirements of Part 4 of the Protection of the Environment Operations (Waste) Regulation 2014.
- detail all measures necessary to ensure wastes are handled, segregated and disposed in accordance with the NSW EPA Waste Classification Guidelines.
- detail all measures necessary to allow for cradle to grave tracking of waste and recycled materials.

» **Trigger Action Response Plan** – Refer to Section 7.3.

» **Asbestos Removal Control Plan** – Detail measures as necessary to ensure asbestos is handled, transported, disposed and otherwise managed in accordance with the requirements of the Code of Practice

(How to Safely Remove Asbestos, Safe Work Australia, 2016). As a minimum the Asbestos Management Plan will include;

- clear guidance regarding the asbestos identification and segregation process during the excavation of the Cell, soil handling, stockpiling and offsite disposal;
- safeguards to ensure that asbestos contamination is not reused on-site or sent to off-site facilities for any purpose other than disposal to landfill (i.e. asbestos contamination must not be composted).
- setting the boundaries of the asbestos contamination;
- ensuring there is minimal disturbance of the contaminated soil until the asbestos management procedures have been implemented;
- isolating and securing the removal work site using signs and barriers;
- controlling dust with dust suppression techniques (such as water and wetting agents);
- providing PPE based on the level of contamination and the control measures implemented;
- sampling and/or air monitoring;
- providing education and training for workers on hazards and safe work practices to minimise airborne dust exposure;
- implementing decontamination procedures for the workers and the equipment.

» Monitoring and Auditing – The monitoring methods, locations, frequency, criteria, reporting and responsibilities will be detailed in this section of the EMP.

9. Contingency Planning

Unexpected conditions that could feasibly occur at the Site and proposed contingency actions are detailed in Table 9.1.

Table 9.1 Remedial Works Contingency Planning

Potential Issue	Proposed Corrective Action
Increased Volumes of Waste or Contaminated Material	Throughout the remediation works the Contractor will monitor the quantity and nature of waste materials encountered. If evidence suggests that the level and extent of contamination is significantly greater than estimated, further investigation would be performed to determine its extent. In the case of a significant increase in the estimated volume of contaminated material to be excavated, DoI will be informed immediately and a review of the remediation strategy will be undertaken by the project team.
Unknown Types of Materials	The presence of unknown materials would be highlighted during remedial works by the observation of any unusual physical or sensory (e.g. olfactory) characteristics of the material being targeted, the results of air and dust monitoring (including asbestos monitoring), and/or validation sampling. Site personnel will be trained specifically to identify and act upon unexpected finds. In the event that any significant unknown type of material is identified at the Site, an assessment of the influence of the material on the works will be undertaken. If required, a variation or addition to the RAP would be made to address the find following review and approval by DPI. Any additional remediation works would be documented in the reporting and completion phase of the works.
Spills and Leaks	It is not anticipated that significant volumes of hazardous liquids would be stored on-site during the works, although minor quantities of fuel and/or oils may be required by the Contractor. The Contractor should minimise the amount of these types of liquid stored at the Site outside of working hours. Contingency measures shall be implemented when spills and/or leaks of hazardous materials occur either at the Site or off-site. On-site contingency measures that shall be in place throughout the works to protect the surrounding community from hazards posed by chemical spills and leaks, including: Emergency supply spill control equipment (e.g. oil absorbent materials); and Containment of any storage tanks or drums within bunded areas having a capacity of 110% of the largest tank contained or 25% of the total volume of all drums, whichever is greater.
Excessive Odours, Vapour and Dust	Where possible, odour and dust generation shall be kept to a minimum by undertaking a staged approach to excavation and emplacement, thereby minimising the size of the disturbed area. Direct excavation and loading of materials for haulage will also be adopted where possible to minimise materials handling requirements. Odour and dust generation will be controlled through the use of water sprays and mists. If necessary, the area under direct excavation will be wetted with sprays and movable mist sprays will be set up on the fences to provide additional protection from fugitive emissions and dusts. In the event that additional measures are required, the Contractor shall modify potential dust or odour generating operations to achieve acceptable air quality levels. Modifications may include: ▪ Reduction in the area of disturbed surfaces; ▪ Installation of perimeter sprays on the site boundary fencing; ▪ Limiting works to more favorable weather conditions; ▪ Modifying the manner in which excavation works are conducted; and ▪ The use of chemical dust-suppressants (e.g. bitumen emulsifiers), provided the chemicals do not pose any risk for contaminating the ground or surface waters and do not pose any unacceptable WH&S hazard.
Unmanageable mud in excavation zone	Improve drainage collection system; add geotextile/gravel in problem areas; strip off mud/slurry materials. Consider use of sawdust and/or woodchips generated by the project.

Potential Issue	Proposed Corrective Action
Excessive stormwater	Minimise active contaminated work area; improve stormwater diversion.
Excessive dust	Use water sprays; stop dust-generating activity until better dust control can be achieved or apply interim capping systems.
Excessively wet materials	Stockpile and dewater on Site or add absorbents.
Excessive noise	Noise barrier (hoarding) installation. Augment muffler systems on excavation machinery or haulage trucks.
Excessive vibration	Reassess vehicle movement routes and speeds. Static roll backfilled areas requiring compaction.
Ineffective odour controls	Alternative control method will be assessed and applied. Controls should include masking agents (e.g. Anotec, AirRepair), chemical additives (Biosolve) or containment materials (foam, HDPE covers).
Equipment failures	Maintain spare equipment or parts; keep rental options available or shut down affected operations until repairs are made.

10. Environmental Planning and Approvals

A preliminary review of relevant planning approval instruments has been undertaken and is detailed in Sections 10.1 and 10.2.

10.1. State Environmental Planning Policy 55 – Remediation of Lands

State Environmental Planning Policy (SEPP) 55 provides the planning framework for the remediation of contaminated land within NSW. SEPP 55 defines Category 1 remediation works as works that require consent and Category 2 as work not needing consent. Clause 9 defines the triggers for Category 1 remediation works and includes the following trigger:

> *(e) carried out or to be carried out in an area or zone to which any classifications to the following effect apply under an environmental planning instrument:*
>
> *(ii)* ***conservation or heritage conservation****,*

Based on available information, the Site is listed on both the State and Local Heritage Register and is therefore considered Category 1 Remediation under SEPP 55 where it takes place within the curtilage of the heritage listed Tunnel.

A review of the remaining triggers under SEPP 55 indicates that no others are likely to be applicable.

The consent authority is therefore likely to be Blue Mountains City Council. This outcome will require verification by an appropriately qualified Environmental Planner.

10.2. Protection of the Environment Operations Act

The Protection of the Environment Operations Act, 1997 (POEO Act) commenced operation on July 1 1999. Chapter 3 of the POEO Act provides for a single licensing arrangement to replace the different licenses and approvals that were required under separate Acts relating to air pollution, water pollution, noise pollution and waste management. Under the POEO Act, the NSW EPA is made the regulatory authority for activities carried out by State or public authorities, activities that require a license under Schedule 1 of the POEO Act and other activities for which a license regulating water pollution is required.

A review of the scheduled activities requiring an Environment Protection Licence (EPL) under the POEO Act found it is unlikely that an EPL will be required under the POEO Act for the Site.

11. Long Term Environment Management Plan

The remediation and validation outlined within this RAP is sufficient to manage risk on the Site in accordance with relevant guidance made or approved by the NSW EPA and to achieve project objectives. The extent of remediation proposed is such that the Source-Pathway-Receptor risks are eliminated via the elimination of the pathways to exposure.

To ensure the ongoing protection of Site users, a Long Term Environmental Management Plan will be required at the completion of the remediation. The content of the LTEMP will be dictated by the exact manner in which the remediation is delivered, however as a minimum, shall include:

» Cap maintenance requirements;

» Vegetation cover maintenance requirements;

» Regular inspection requirements (likely annual inspections);

» Controls to be implemented during any future maintenance activities on the Site including all excavation; and

» Signage requirement (if necessary).

12. Limitations

The sole purpose of this report is to present the remediation and validation strategy in the form of a Remediation Action Plan (RAP; the 'Report') for the target remediation area as defined in this report at Glenbrook, NSW. This RAP has been prepared by Nation Partners for the sole use of the NSW Department of Industry, Lands & Water (the 'Client') and in accordance with the scope of services developed and agreed between Nation Partners and the Client.

All reports and conclusions that deal with sub-surface conditions are based on interpretation and judgement of Site conditions at the time Site investigations were conducted, and as a result the description of Site conditions have inherent uncertainty attached to them. Conditions at the Site may have changed due to natural forces and/or operations on or near the Site. Any decisions based on the findings of the Report must take into account any subsequent changes in Site conditions and/or developments in legislative and regulatory requirements. Nation Partners accepts no liability to the Client for any loss and/or damage incurred as a result of a change in the Site conditions and/or regulatory/legislative framework since the date of the Report.

This Report should only be presented in full and should not be used to support any objective other than those detailed in the Report. In particular, the Report does not contain sufficient information to enable it to be used for any use other than the project specific requirements for which the Report was carried out. Nation Partners accepts no liability to the Client for any loss and/or damage incurred as a result of changes to the usage, size, design, layout, location or any other material change to the intended purpose contemplated under this Agreement. The Report is based on an interpretation of factual information available and the professional opinion and judgement of Nation Partners. Unless stated to the contrary, Nation Partners has not verified the accuracy or completeness of any information received from the Client or a third party for the purposes of preparing the Report. Nation Partners accepts no liability to the Client for any loss and/or damage incurred as a result of any inaccurate or incomplete information.

Any reliance on this Report by a third party shall be entirely at such party's own risk. Nation Partners provides no warranty or guarantee to any third party, express or implied, as to the information and/or professional advice indicated in the Report, and accepts no liability for or in respect of any use or reliance upon the Report by a third party.

nation partners

SOLUTIONS FOR
COMPLEX PROJECTS

Appendices

Appendix A – Figures

Appendix B - Data

Appendix A - Figures

Figure 1 – Location Map

Figure 2 – Plan View and Defined Areas of the Site

Figure 3 – FMFL Detail

Figure 4 – FMFL Sample Locations & Exceedances

Figure 5 – Eastern Portal Sample Locations & Exceedances

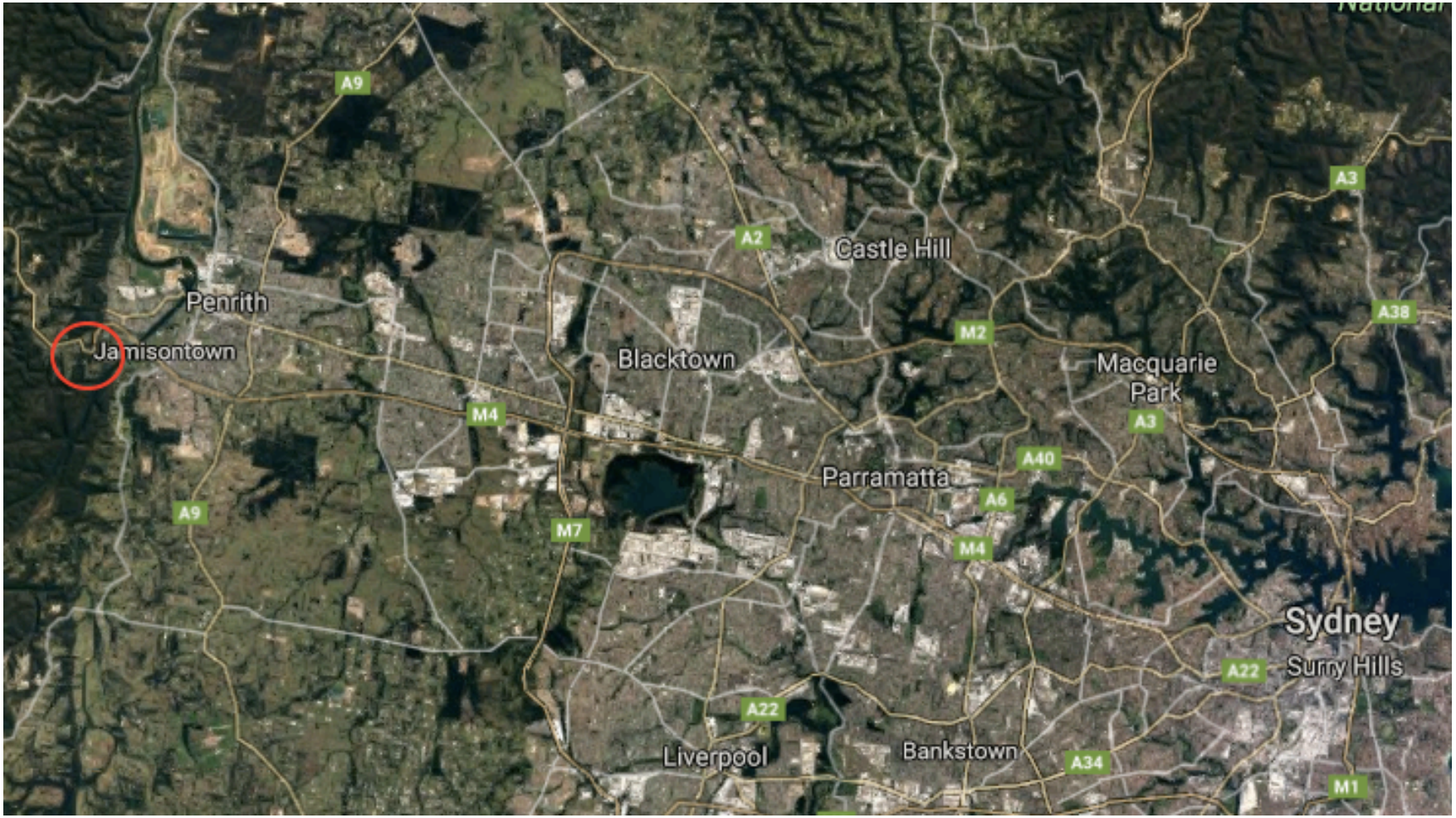

Figure 1: Site Location

Lapstone Hill Tunnel Remediation Action Plan (RAP)

nation partners

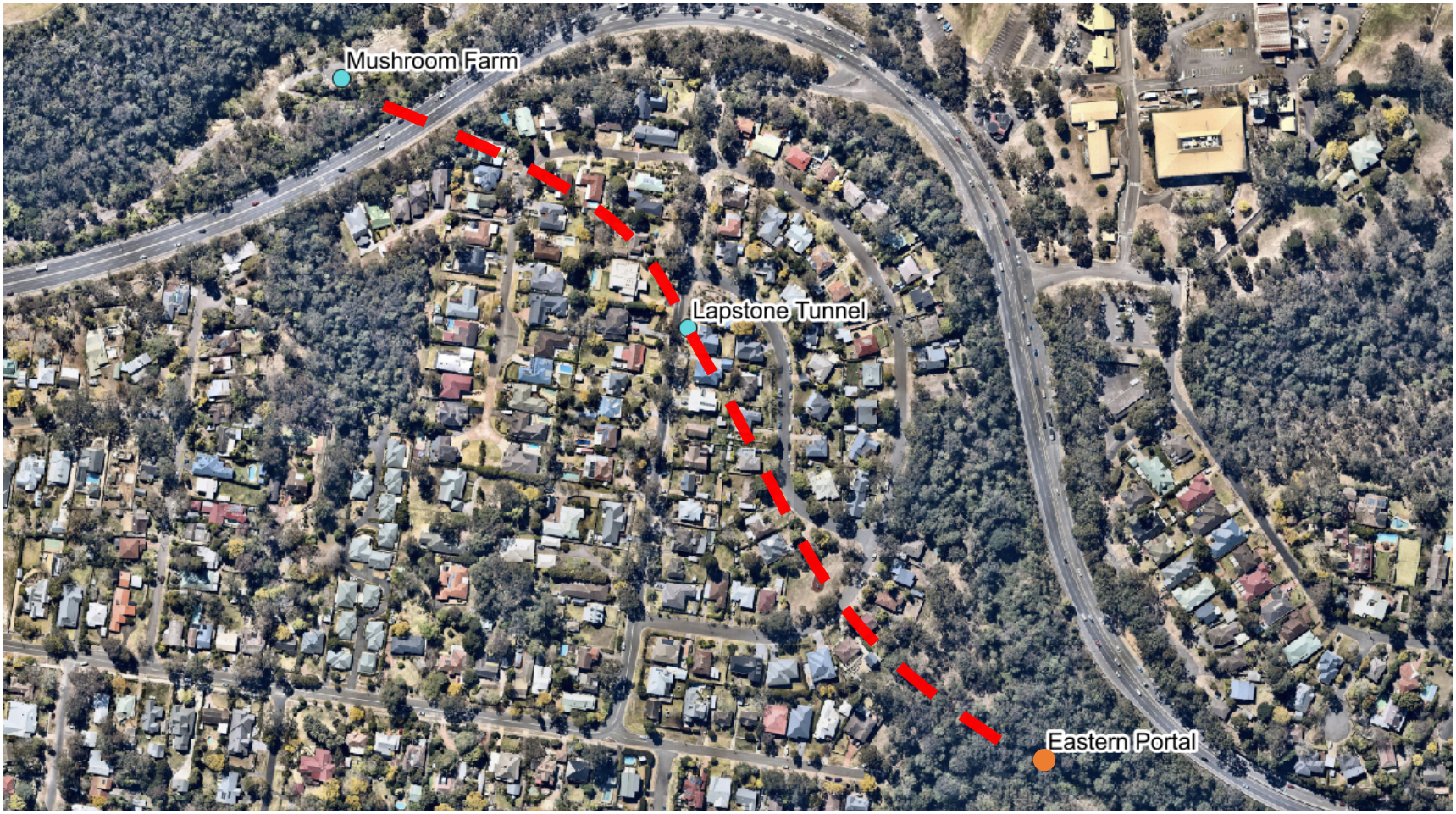

Figure 2: Site Layout

Lapstone Hill Tunnel Remediation Action Plan (RAP)

Legend

- Mushroom Farm (FMFL)
- Lapstone Tunnel
- Eastern Portal

nation partners

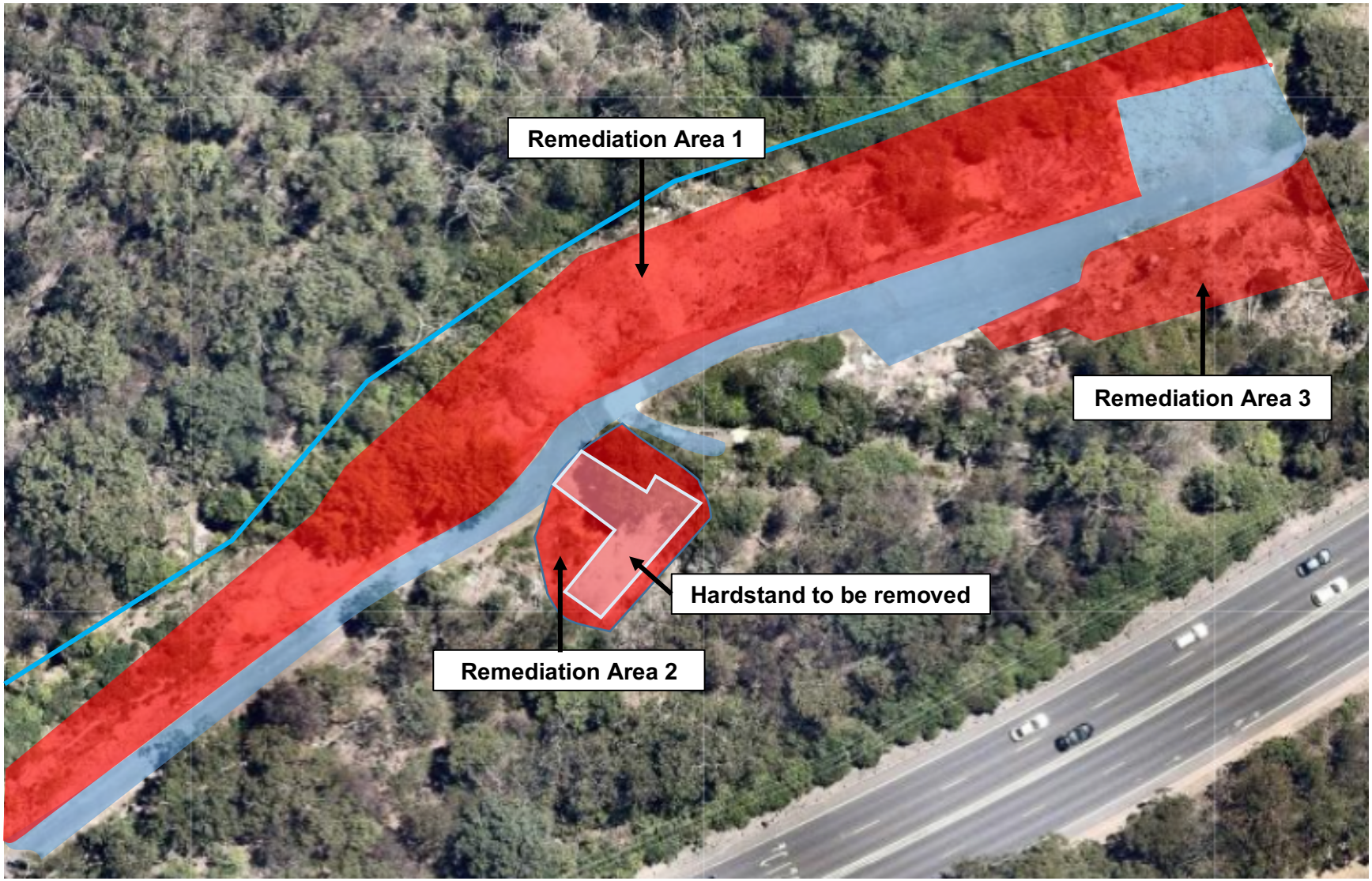

Figure 3: Former Mushroom Farm Landbase (FMFL)

Lapstone Hill Tunnel Remediation Action Plan (RAP)

Legend

- Hardstand Area
- Remediation Areas
- Knapsack Gully

nation partners

Figure 4: FMFL Testpit and Handauger Sampling Locations

Lapstone Hill Tunnel Remediation Action Plan (RAP)

0m 50m

Scale is indicative only

Legend

- Testpit Locations
- Handauger Locations
- FMFL

nation partners

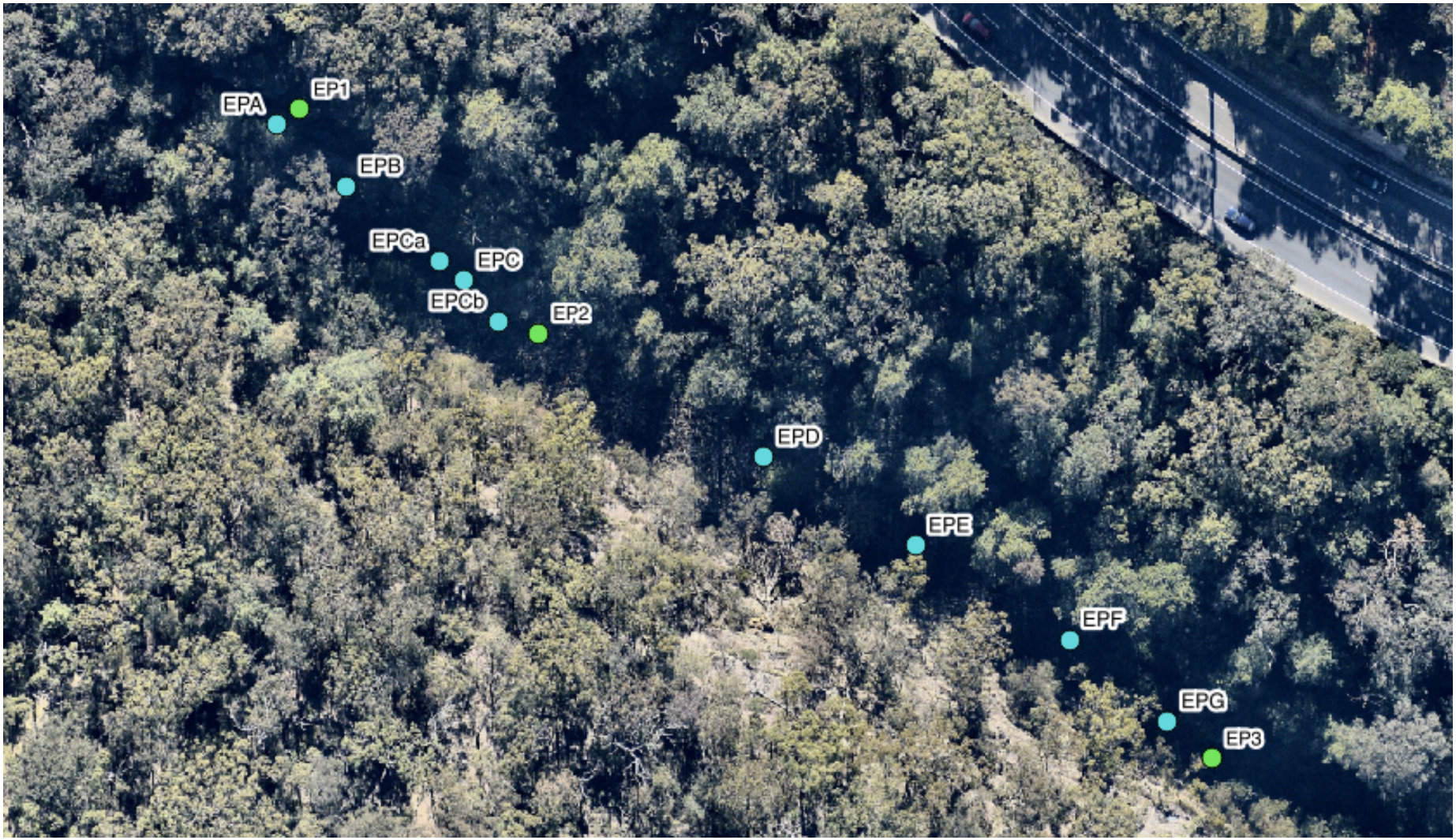

Figure 5: Eastern Portal Sampling Locations

Lapstone Hill Tunnel Remediation Action Plan (RAP)

0m 50m

Scale is indicative only

Legend

- Water Sampling Locations
- Soil / Sediment Sampling Locations

nation partners

Appendix B - Data

Table B1 Mushroom Farm SOIL Assessment

						ALS Sample number:	ES1726194001	ES1726194003	ES1726194005	ES1726194007	ES1726194009	ES1726194010	ES1726194012	ES1726194016	ES1726194018	ES1726194019	ES1726194020	ES1726194022	ES1726194032	ES1726194034	ES1726194036	ES1726194038	ES1726194040	ES1726194041
						Sample ID	TP1-0.2	TP1-1.0	TP2-0.3	TP3-0.5	TP4-0.1	TP4-0.5	TP5-0.3	TP7-0.1	TP8-0.1	TP9-0.1	TP9-1.2	TP10-0.1	TP13-0.1	QC1	QC3	HA1-0.5	HA3-0.1	HA4-0.1
						Sample date:	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17
						Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Analyte Name	**Units**	HILC	HILD	EIL	**Maximum**	**Reporting Limit**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Moisture Content	%				37.4	1	10.6	15.4	10.7	14.5	14.9	22.1	15	10.7	37.4	8.5	5.9	29.7	22.3	17.1	19.3	25.8	20.9	17.9
Total Metals																								
Arsenic	mg/kg	300	3000	100	39	5	<5	5	<5	39	<5	10	<5	<5	<5	<5	<5	7	<5	9	<5	<5	<5	20
Cadmium	mg/kg	90	900	–	0	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium (III + VI)	mg/kg	300	3600	195	208	2	7	22	24	28	9	10	8	7	10	10	4	16	5	8	9	8	18	208
Copper	mg/kg	17000	240 000	560	121	5	10	34	26	31	10	121	22	12	20	10	9	22	<5	104	20	16	<5	44
Lead	mg/kg	600	1500	1100	176	5	17	48	13	21	35	42	44	71	176	23	<5	42	12	29	144	31	7	14
Nickel	mg/kg	1200	6000	35	284	2	12	11	24	4	5	8	3	2	5	3	<2	10	<2	7	5	2	11	284
Zinc	mg/kg	30000	4E+05	250	508	5	66	302	89	105	116	27	84	152	508	88	<5	232	33	20	389	109	22	97
Mercury	mg/kg	80	750	–	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1
Nutrients																								
Ammonia as N	mg/kg				0	20	----	<20	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Nitrite as N (Sol.)	mg/kg				0	0.1	----	<0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Nitrate as N (Sol.)	mg/kg				2.5	0.1	----	2.5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Nitrite + Nitrate as N (Sol.)	mg/kg				2.5	0.1	----	2.5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Total Kjeldahl Nitrogen as N	mg/kg				1520	20	----	1520	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Total Nitrogen as N	mg/kg				1520	20	----	1520	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Total Phosphorus as P	mg/kg				370	2	----	370	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Reactive Phosphorus as P	mg/kg				0	0.1	----	<0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
PCB's																								
Total Polychlorinated biphenyls	mg/kg	1	1	-	0	0.1	----	<0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Organochlorine Pesticides (OC)																								
alpha-BHC	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Hexachlorobenzene (HCB)	mg/kg	10	80	-	0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
beta-BHC	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
gamma-BHC	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
delta-BHC	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Heptachlor	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Aldrin	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Heptachlor epoxide	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Total Chlordane (sum)	mg/kg	70	530	-	0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
trans-Chlordane	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
alpha-Endosulfan	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
cis-Chlordane	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Dieldrin	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
4.4`-DDE	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Endrin	mg/kg	20	100	-	0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
beta-Endosulfan	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
4.4`-DDD	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Endrin aldehyde	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Endosulfan sulfate	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
4.4`-DDT	mg/kg				0	0.2	----	<0.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.2	----
Endrin ketone	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Methoxychlor	mg/kg				0	0.2	----	<0.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.2	----
Sum of DDD + DDE + DDT	mg/kg	400	3600	3	0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Sum of Aldrin + Dieldrin	mg/kg	10	45	-	0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Organophosphorus Pesticides (OP)																								
Dichlorvos	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Demeton-S-methyl	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Monocrotophos	mg/kg				0	0.2	----	<0.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.2	----
Dimethoate	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Diazinon	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Chlorpyrifos-methyl	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Parathion-methyl	mg/kg				0	0.2	----	<0.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.2	----
Malathion	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Fenthion	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Chlorpyrifos	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Parathion	mg/kg				0	0.2	----	<0.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.2	----
Pirimphos-ethyl	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Bromophos-ethyl	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Fenamiphos	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Prothiofos	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Ethion	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Carbophenothion	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Azinphos Methyl	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Triazines																								
Atrazine	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----

Table B1 Mushroom Farm SOIL Assessment

						ALS Sample number:	ES1726194001	ES1726194003	ES1726194005	ES1726194007	ES1726194009	ES1726194010	ES1726194012	ES1726194016	ES1726194018	ES1726194019	ES1726194020	ES1726194022	ES1726194032	ES1726194034	ES1726194036	ES1726194038	ES1726194040	ES1726194041
						Sample ID	TP1-0.2	TP1-1.0	TP2-0.3	TP3-0.5	TP4-0.1	TP4-0.5	TP5-0.3	TP7-0.1	TP8-0.1	TP9-0.1	TP9-1.2	TP10-0.1	TP13-0.1	QC1	QC3	HA1-0.5	HA3-0.1	HA4-0.1
						Sample date:	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17
						Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Analyte Name	**Units**	HILC	HILD	EIL	**Maximum**	**Reporting Limit**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Simazine	mg/kg				0	0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Cypermethrins																								
Cypermethrins (total)	mg/kg				0	0.2	----	<0.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.2	----
Polynuclear Aromatic Hydrocarbons (PAH)																								
Naphthalene	mg/kg				0	0.5	<0.5	<0.5	<0.5	<0.5	<4.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	mg/kg				18.1	0.5	<0.5	<0.5	<0.5	<0.5	18.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	mg/kg				10	0.5	<0.5	<0.5	<0.5	<0.5	10	<0.5	1.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	mg/kg				33.3	0.5	<0.5	<0.5	<0.5	<0.5	33.3	<0.5	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	mg/kg				399	0.5	<0.5	<0.5	1.3	<0.5	399	0.9	28.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	mg/kg				67.3	0.5	<0.5	<0.5	<0.5	<0.5	67.3	<0.5	7.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	mg/kg				439	0.5	<0.5	0.7	4.3	<0.5	439	1.1	40	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.9	<0.5	<0.5
Pyrene	mg/kg				422	0.5	<0.5	0.7	3.7	<0.5	422	1	49.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.2	<0.5	<0.5
Benz(a)anthracene	mg/kg				138	0.5	<0.5	<0.5	1.2	<0.5	138	0.6	16.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.4	<0.5	<0.5
Chrysene	mg/kg				128	0.5	<0.5	<0.5	1.1	<0.5	128	0.6	16.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.5	<0.5	<0.5
Benzo(b+j)fluoranthene	mg/kg				169	0.5	<0.5	<0.5	1.5	<0.5	169	0.7	16.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2	<0.5	<0.5
Benzo(k)fluoranthene	mg/kg				61.7	0.5	<0.5	<0.5	0.6	<0.5	61.7	<0.5	5.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5
Benzo(a)pyrene	mg/kg				194	0.5	<0.5	<0.5	1.4	<0.5	194	<0.5	13.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.9	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	mg/kg				107	0.5	<0.5	<0.5	1	<0.5	107	<0.5	3.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5
Dibenz(a.h)anthracene	mg/kg				17.3	0.5	<0.5	<0.5	<0.5	<0.5	17.3	<0.5	1.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	mg/kg				172	0.5	<0.5	<0.5	1.2	<0.5	172	<0.5	4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	<0.5	<0.5
Total PAHs	mg/kg	300	4000	-	2380	0.5	<0.5	1.4	17.3	<0.5	2380	4.9	206	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	13.9	<0.5	<0.5
Benzo(a)pyrene TEQ (zero)	mg/kg				262	0.5	<0.5	<0.5	1.8	<0.5	262	<0.5	19	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.4	<0.5	<0.5
Benzo(a)pyrene TEQ (half LOR)	mg/kg				262	0.5	0.6	0.6	2.1	0.6	262	0.7	19	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	2.7	0.6	0.6
Benzo(a)pyrene TEQ (LOR)	mg/kg	3	40		262	0.5	1.2	1.2	2.4	1.2	262	1.2	19	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.9	1.2	1.2
Total Petroleum Hydrocarbons (TPH)																								
C6 - C9 Fraction	mg/kg				0	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C10 - C14 Fraction	mg/kg				0	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	mg/kg				4510	100	<100	<100	<100	<100	4510	400	760	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	mg/kg				2550	100	130	220	180	<100	2550	190	360	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
C10 - C36 Fraction (sum)	mg/kg				7060	50	130	220	180	<50	7060	590	1120	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Total Recoverable Hydrocarbons - NEPM 2013 Fractions																								
C6 - C10 Fraction	mg/kg				0	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C6 - C10 Fraction minus BTEX (F1)	mg/kg	700	700	125	0	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
>C10 - C16 Fraction	mg/kg				190	50	<50	<50	<50	<50	190	70	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
>C16 - C34 Fraction	mg/kg				5900	100	120	240	180	<100	5900	520	980	<100	120	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C34 - C40 Fraction	mg/kg				1740	100	160	240	240	<100	1740	130	250	<100	120	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C10 - C40 Fraction (sum)	mg/kg				7830	50	280	480	420	<50	7830	720	1230	<50	240	<50	<50	<50	<50	<50	<50	<50	<50	<50
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	1000	1000	25	190	50	<50	<50	<50	<50	190	70	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
BTEXN																								
Benzene	mg/kg	NL	NL	10	0	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	NL	NL	10	0	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	NL	NL	1.5	0	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	mg/kg	NL	NL		0	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	mg/kg				0	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylenes	mg/kg	NL	NL	1.6	0	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sum of BTEX	mg/kg				0	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	mg/kg	-	-	10	2	1	<1	<1	<1	<1	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Identification of Asbestos in Soils (AS 4964 - 2004)																								
Asbestos Detected	g/kg				0	0.1	----	----	No	----	----	----	----	No	No	----	----	----	----	----	----	----	No	----
Asbestos Type	--				0		----	----	-	----	----	----	----	-	-	----	----	----	----	----	----	----	-	----
Sample weight (dry)	g				44	0.01	----	----	21.4	----	----	----	----	12.6	24.1	----	----	----	----	----	----	----	44	----
Description	--				0		----	----	d brown sandy s	----	----	----	----	d brown sandy s	d brown sandy s	----	----	----	----	----	----	----	d brown sandy s	----
APPROVED IDENTIFIER:	--				0		----	----	S.SPOONER	----	----	----	----	S.SPOONER	S.SPOONER	----	----	----	----	----	----	----	S.SPOONER	----

Table B2 - Tunnel SOIL Assessment

						ALS Sample number:	ES1726194050	ES1726194049
						Sample ID	TS2	TS1
						Sample date:	18/10/17	18/10/17
						Matrix	Soil	Soil
Analyte Name	**Units**	HILC	HILD	EIL	**Maximum**	**Reporting Limit**	**Result**	**Result**
Moisture Content	%				89	1	89	77.6
Total Metals								
Arsenic	mg/kg	300	3000	100	7	5	7	6
Cadmium	mg/kg	90	900	–	1	1	<1	1
Chromium	mg/kg	300	3600	195	25	2	16	25
Copper	mg/kg	17000	240 000	560	148	5	102	148
Lead	mg/kg	600	1500	1100	90	5	70	90
Nickel	mg/kg	1200	6000	35	72	2	46	72
Zinc	mg/kg	30000	4E+05	250	1690	5	1690	1690
Mercury	mg/kg	80	750	–	0.4	0.1	0.3	0.4
Nutrients								
Ammonia as N	mg/kg				100	20	100	----
Nitrite as N (Sol.)	mg/kg				0.5	0.1	0.5	----
Nitrate as N (Sol.)	mg/kg				3.7	0.1	3.7	----
Nitrite + Nitrate as N (Sol.)	mg/kg				4.2	0.1	4.2	----
Total Kjeldahl Nitrogen as N	mg/kg				14400	20	14400	----
Total Nitrogen as N	mg/kg				14400	20	14400	----
Total Phosphorus as P	mg/kg				8370	2	8370	----
Reactive Phosphorus as P	mg/kg				5	0.1	5	----
PCB's								
Total Polychlorinated biphenyls	mg/kg	1	1	-	0	0.1	<0.2	<0.1
Organochlorine Pesticides (OC)								
alpha-BHC	mg/kg				0	0.05	<0.12	<0.06
Hexachlorobenzene (HCB)	mg/kg	10	80	-	0	0.05	<0.12	<0.06
beta-BHC	mg/kg				0	0.05	<0.12	<0.06
gamma-BHC	mg/kg				0	0.05	<0.12	<0.06
delta-BHC	mg/kg				0	0.05	<0.12	<0.06
Heptachlor	mg/kg				0	0.05	<0.12	<0.06
Aldrin	mg/kg				0	0.05	<0.12	<0.06
Heptachlor epoxide	mg/kg				0	0.05	<0.12	<0.06
Total Chlordane (sum)	mg/kg	70	530	-	0	0.05	<0.12	<0.06
trans-Chlordane	mg/kg				0	0.05	<0.12	<0.06
alpha-Endosulfan	mg/kg				0	0.05	<0.12	<0.06
cis-Chlordane	mg/kg				0	0.05	<0.12	<0.06
Dieldrin	mg/kg				0	0.05	<0.12	<0.06
4.4`-DDE	mg/kg				0	0.05	<0.12	<0.06
Endrin	mg/kg	20	100	-	0	0.05	<0.12	<0.06
beta-Endosulfan	mg/kg				0	0.05	<0.12	<0.06
4.4`-DDD	mg/kg				0	0.05	<0.12	<0.06
Endrin aldehyde	mg/kg				0	0.05	<0.12	<0.06
Endosulfan sulfate	mg/kg				0	0.05	<0.12	<0.06
4.4`-DDT	mg/kg				0	0.2	<0.5	<0.3
Endrin ketone	mg/kg				0	0.05	<0.12	<0.06
Methoxychlor	mg/kg				0	0.2	<0.5	<0.3
Sum of DDD + DDE + DDT	mg/kg	400	3600	3	0	0.05	<0.12	<0.06
Sum of Aldrin + Dieldrin	mg/kg	10	45	-	0	0.05	<0.12	<0.06
Organophosphorus Pesticides (OP)								
Dichlorvos	mg/kg				0	0.05	<0.12	<0.06
Demeton-S-methyl	mg/kg				0	0.05	<0.12	<0.06
Monocrotophos	mg/kg				0	0.2	<0.5	<0.3
Dimethoate	mg/kg				0	0.05	<0.12	<0.06
Diazinon	mg/kg				0	0.05	<0.12	<0.06
Chlorpyrifos-methyl	mg/kg				0	0.05	<0.12	<0.06
Parathion-methyl	mg/kg				0	0.2	<0.5	<0.3
Malathion	mg/kg				0	0.05	<0.12	<0.06
Fenthion	mg/kg				0	0.05	<0.12	<0.06
Chlorpyrifos	mg/kg				0	0.05	<0.12	<0.06
Parathion	mg/kg				0	0.2	<0.5	<0.3
Pirimphos-ethyl	mg/kg				0	0.05	<0.12	<0.06
Bromophos-ethyl	mg/kg				0	0.05	<0.12	<0.06
Fenamiphos	mg/kg				0	0.05	<0.12	<0.06
Prothiofos	mg/kg				0	0.05	<0.12	<0.06
Ethion	mg/kg				0	0.05	<0.12	<0.06
Carbophenothion	mg/kg				0	0.05	<0.12	<0.06
Azinphos Methyl	mg/kg				0	0.05	<0.12	<0.06
Triazines								
Atrazine	mg/kg				0	0.05	<0.12	<0.06
Simazine	mg/kg				0	0.05	<0.12	<0.06
Cypermethrins								
Cypermethrins (total)	mg/kg				0	0.2	<0.5	<0.3
Polynuclear Aromatic Hydrocarbons (PAH)								
Naphthalene	mg/kg				0	0.5	<2.0	<1.0
Acenaphthylene	mg/kg				0	0.5	<2.0	<1.0
Acenaphthene	mg/kg				0	0.5	<2.0	<1.0
Fluorene	mg/kg				0	0.5	<2.0	<1.0
Phenanthrene	mg/kg				2.3	0.5	<2.0	2.3
Anthracene	mg/kg				1.1	0.5	<2.0	1.1
Fluoranthene	mg/kg				6.4	0.5	5.4	6.4
Pyrene	mg/kg				6.6	0.5	5.6	6.6

Table B2 - Tunnel SOIL Assessment

						ALS Sample number:	ES1726194050	ES1726194049
						Sample ID	TS2	TS1
						Sample date:	18/10/17	18/10/17
						Matrix	Soil	Soil
Analyte Name	**Units**	HILC	HILD	EIL	**Maximum**	**Reporting Limit**	**Result**	**Result**
Benz(a)anthracene	mg/kg				2.9	0.5	2.5	2.9
Chrysene	mg/kg				3	0.5	2.3	3
Benzo(b+j)fluoranthene	mg/kg				5.8	0.5	4.3	5.8
Benzo(k)fluoranthene	mg/kg				2.1	0.5	<2.0	2.1
Benzo(a)pyrene	mg/kg				4.2	0.5	3	4.2
Indeno(1.2.3.cd)pyrene	mg/kg				2.4	0.5	<2.0	2.4
Dibenz(a.h)anthracene	mg/kg				0	0.5	<2.0	<1.0
Benzo(g.h.i)perylene	mg/kg				3.2	0.5	<2.0	3.2
Total PAH	mg/kg	300	4000	-	40	0.5	23.1	40
Benzo(a)pyrene TEQ (zero)	mg/kg				5.6	0.5	3.7	5.6
Benzo(a)pyrene TEQ (half LOR)	mg/kg				5.8	0.5	4	5.8
Benzo(a)pyrene TEQ (LOR)	mg/kg	3	40		6.1	0.5	4.3	6.1
Total Petroleum Hydrocarbons (TPH)								
C6 - C9 Fraction	mg/kg				0	10	<10	<10
C10 - C14 Fraction	mg/kg				0	50	<110	<60
C15 - C28 Fraction	mg/kg				1080	100	1080	750
C29 - C36 Fraction	mg/kg				1460	100	1460	1250
C10 - C36 Fraction (sum)	mg/kg				2540	50	2540	2000
Silica Gel Cleanup (TPH)								
C10 - C14 Fraction	mg/kg						<110	----
C15 - C28 Fraction	mg/kg						<220	----
C29 - C36 Fraction	mg/kg						<220	----
C10 - C36 Fraction (sum)	mg/kg						<110	----
Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	mg/kg				0	10	<10	<10
C6 - C10 Fraction minus BTEX (F1	mg/kg	700	700	125	0	10	<10	<10
>C10 - C16 Fraction	mg/kg				0	50	<110	<60
>C16 - C34 Fraction	mg/kg				1910	100	1910	1570
>C34 - C40 Fraction	mg/kg				1380	100	1380	960
>C10 - C40 Fraction (sum)	mg/kg				3290	50	3290	2530
>C10 - C16 Fraction minus Naphtha	mg/kg	1000	1000	25	0	50	<110	<60
Silica Gel Cleanup (TRH)								
>C10 - C16 Fraction	mg/kg						<110	----
>C16 - C34 Fraction	mg/kg						<110	----
>C34 - C40 Fraction	mg/kg						<110	----
>C10 - C40 Fraction (sum)	mg/kg						<110	----
>C10 - C16 Fraction minus Naphtha	mg/kg						<110	----
BTEXN								
Benzene	mg/kg	NL	NL	10	0	0.2	<0.5	<0.2
Toluene	mg/kg	NL	NL	10	0	0.5	<0.5	<0.5
Ethylbenzene	mg/kg	NL	NL	1.5	0	0.5	<0.5	<0.5
meta- & para-Xylene	mg/kg	NL	NL		0	0.5	<0.5	<0.5
ortho-Xylene	mg/kg				0	0.5	<0.5	<0.5
Total Xylenes	mg/kg	NL	NL	1.6	0	0.5	<0.5	<0.5
Sum of BTEX	mg/kg				0	0.2	<0.2	<0.2
Naphthalene	mg/kg	-	-	10	0	1	<1	<1
Explosives								
HMX	mg/kg				0	0.1	<0.5	----
RDX	mg/kg				0	0.1	<0.5	----
1.3.5-Trinitrobenzene	mg/kg				0	0.1	<0.5	----
1.3-Dinitrobenzene	mg/kg				0	0.1	<0.5	----
Tetryl	mg/kg				0	0.1	<0.5	----
2.4.6-TNT	mg/kg				0	0.1	<0.5	----
4-Amino.2.6-DNT	mg/kg				0	0.1	<0.5	----
2-Amino-4.6-DNT	mg/kg				0	0.1	<0.5	----
4-& 2-AM-DNT(Isomeric Mixture)	mg/kg				0	0.1	<0.1	----
2.4-Dinitrotoluene	mg/kg				0	0.1	<0.5	----
2.6-Dinitrotoluene	mg/kg				0	0.1	<0.5	----
2.4-& 2.6-DNT(Isomeric Mixture)	mg/kg				0	0.1	<0.1	----
Nitrobenzene	mg/kg				0	0.1	<0.5	----
2-Nitrotoluene	mg/kg				0	0.1	<0.5	----
3-Nitrotoluene	mg/kg				0	0.1	<0.5	----
4-Nitrotoluene	mg/kg				0	0.1	<0.5	----
Nitroglycerine	mg/kg				0	1	<5	----
PETN	mg/kg				0	1	<5	----
Identification of Asbestos in Soils (AS 4964 - 2004)								
Asbestos Detected	g/kg				0	0.1	----	----
Asbestos Type	--				0		----	----
Sample weight (dry)	g				0	0.01	----	----
Description	--				0		----	----
APPROVED IDENTIFIER:	--				0		----	----

Table B3 - Eastern Portal SOIL Assessment

						Sample Name	ES1726194052	ES1726194053	ES1726194054	ES1726194055	ES1726194056	ES1726194051
						Sample ID	EPA-0.4	EPB-0.3	EPC-0.2	EPD-0.15	QC8	EPA-0.1
						Sample date:	18/10/17	18/10/17	18/10/17	18/10/17	18/10/17	18/10/17
						Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Analyte Name	**Units**	HILC	HILD	EIL	**Max.**	**Reporting Limit**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Moisture Content	%				88.6	1	31.2	86.1	81.6	19.5	88.6	34.5
Total Metals												
Arsenic	mg/kg	300	3000	100	31	5	<5	20	31	<5	20	<5
Cadmium	mg/kg	90	900	–	3	1	<1	3	<1	<1	2	<1
Chromium	mg/kg	300	3600	195	20	2	8	17	20	8	18	6
Copper	mg/kg	17000	240 000	560	235	5	25	105	235	70	107	17
Lead	mg/kg	600	1500	1100	236	5	44	85	236	51	88	26
Nickel	mg/kg	1200	6000	35	193	2	8	193	53	8	160	3
Zinc	mg/kg	30000	4E+05	250	2440	5	158	2440	574	126	1750	52
Mercury	mg/kg	80	750	–	0.4	0.1	<0.1	0.4	0.4	<0.1	0.4	<0.1
Nutrients												
Ammonia as N	mg/kg				0	20	----	----	----	----	----	----
Nitrite as N (Sol.)	mg/kg				0	0.1	----	----	----	----	----	----
Nitrate as N (Sol.)	mg/kg				0	0.1	----	----	----	----	----	----
Nitrite + Nitrate as N (Sol.)	mg/kg				0	0.1	----	----	----	----	----	----
Total Kjeldahl Nitrogen as N	mg/kg				0	20	----	----	----	----	----	----
Total Nitrogen as N	mg/kg				0	20	----	----	----	----	----	----
Total Phosphorus as P	mg/kg				0	2	----	----	----	----	----	----
Reactive Phosphorus as P	mg/kg				0	0.1	----	----	----	----	----	----
PCB's												
Total Polychlorinated biphenyls	mg/kg	1	1	-	0	0.1	<0.1	<0.2	<0.2	<0.1	<0.2	----
Organochlorine Pesticides (OC)												
alpha-BHC	mg/kg				0	0.05	----	----	----	----	----	----
Hexachlorobenzene (HCB)	mg/kg	10	80	-	0	0.05	----	----	----	----	----	----
beta-BHC	mg/kg				0	0.05	----	----	----	----	----	----
gamma-BHC	mg/kg				0	0.05	----	----	----	----	----	----
delta-BHC	mg/kg				0	0.05	----	----	----	----	----	----
Heptachlor	mg/kg				0	0.05	----	----	----	----	----	----
Aldrin	mg/kg				0	0.05	----	----	----	----	----	----
Heptachlor epoxide	mg/kg				0	0.05	----	----	----	----	----	----
Total Chlordane (sum)	mg/kg	70	530	-	0	0.05	----	----	----	----	----	----
trans-Chlordane	mg/kg				0	0.05	----	----	----	----	----	----
alpha-Endosulfan	mg/kg				0	0.05	----	----	----	----	----	----
cis-Chlordane	mg/kg				0	0.05	----	----	----	----	----	----
Dieldrin	mg/kg				0	0.05	----	----	----	----	----	----
4.4`-DDE	mg/kg				0	0.05	----	----	----	----	----	----
Endrin	mg/kg	20	100	-	0	0.05	----	----	----	----	----	----
beta-Endosulfan	mg/kg				0	0.05	----	----	----	----	----	----
4.4`-DDD	mg/kg				0	0.05	----	----	----	----	----	----
Endrin aldehyde	mg/kg				0	0.05	----	----	----	----	----	----
Endosulfan sulfate	mg/kg				0	0.05	----	----	----	----	----	----
4.4`-DDT	mg/kg				0	0.2	----	----	----	----	----	----
Endrin ketone	mg/kg				0	0.05	----	----	----	----	----	----
Methoxychlor	mg/kg				0	0.2	----	----	----	----	----	----
Sum of DDD + DDE + DDT	mg/kg	400	3600	3	0	0.05	----	----	----	----	----	----
Sum of Aldrin + Dieldrin	mg/kg	10	45	-	0	0.05	----	----	----	----	----	----
Organophosphorus Pesticides (OP)												
Dichlorvos	mg/kg				0	0.05	----	----	----	----	----	----
Demeton-S-methyl	mg/kg				0	0.05	----	----	----	----	----	----
Monocrotophos	mg/kg				0	0.2	----	----	----	----	----	----
Dimethoate	mg/kg				0	0.05	----	----	----	----	----	----
Diazinon	mg/kg				0	0.05	----	----	----	----	----	----
Chlorpyrifos-methyl	mg/kg				0	0.05	----	----	----	----	----	----
Parathion-methyl	mg/kg				0	0.2	----	----	----	----	----	----
Malathion	mg/kg				0	0.05	----	----	----	----	----	----
Fenthion	mg/kg				0	0.05	----	----	----	----	----	----
Chlorpyrifos	mg/kg				0	0.05	----	----	----	----	----	----
Parathion	mg/kg				0	0.2	----	----	----	----	----	----
Pirimphos-ethyl	mg/kg				0	0.05	----	----	----	----	----	----
Bromophos-ethyl	mg/kg				0	0.05	----	----	----	----	----	----
Fenamiphos	mg/kg				0	0.05	----	----	----	----	----	----
Prothiofos	mg/kg				0	0.05	----	----	----	----	----	----
Ethion	mg/kg				0	0.05	----	----	----	----	----	----
Carbophenothion	mg/kg				0	0.05	----	----	----	----	----	----
Azinphos Methyl	mg/kg				0	0.05	----	----	----	----	----	----
Triazines												
Atrazine	mg/kg				0	0.05	----	----	----	----	----	----
Simazine	mg/kg				0	0.05	----	----	----	----	----	----
Cypermethrins												
Cypermethrins (total)	mg/kg				0	0.2	----	----	----	----	----	----
Polynuclear Aromatic Hydrocarbons (PAH)												
Naphthalene	mg/kg				0	0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Acenaphthylene	mg/kg				0	0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Acenaphthene	mg/kg				0	0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Fluorene	mg/kg				0	0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Phenanthrene	mg/kg				0	0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Anthracene	mg/kg				0	0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Fluoranthene	mg/kg				5.8	0.5	<0.5	<2.0	5.8	<0.5	<2.0	<0.5
Pyrene	mg/kg				8.1	0.5	<0.5	<2.0	8.1	<0.5	<2.0	<0.5

Table B3 - Eastern Portal SOIL Assessment

						Sample Name	ES1726194052	ES1726194053	ES1726194054	ES1726194055	ES1726194056	ES1726194051
						Sample ID	EPA-0.4	EPB-0.3	EPC-0.2	EPD-0.15	QC8	EPA-0.1
						Sample date:	18/10/17	18/10/17	18/10/17	18/10/17	18/10/17	18/10/17
						Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Analyte Name	**Units**	HILC	HILD	EIL	**Max.**	**Reporting Limit**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Benz(a)anthracene	mg/kg				0	0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Chrysene	mg/kg				0	0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Benzo(b+j)fluoranthene	mg/kg				2.2	0.5	<0.5	<2.0	2.2	<0.5	<2.0	<0.5
Benzo(k)fluoranthene	mg/kg				0	0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Benzo(a)pyrene	mg/kg				0	0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Indeno(1.2.3.cd)pyrene	mg/kg				0	0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Dibenz(a.h)anthracene	mg/kg				0	0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Benzo(g.h.i)perylene	mg/kg				0	0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Total PAH	mg/kg	300	4000	-	16.1	0.5	<0.5	<1.0	16.1	<0.5	<1.0	<0.5
Benzo(a)pyrene TEQ (zero)	mg/kg				0	0.5	<0.5	<1.0	<1.0	<0.5	<1.0	<0.5
Benzo(a)pyrene TEQ (half LOR)	mg/kg				0.6	0.5	0.6	<1.0	<1.0	0.6	<1.0	0.6
Benzo(a)pyrene TEQ (LOR)	mg/kg				1.4	0.5	1.2	1.2	1.4	1.2	1.2	1.2
Total Petroleum Hydrocarbons (TPH)												
C6 - C9 Fraction	mg/kg				0	10	<10	<10	<10	<10	<10	<10
C10 - C14 Fraction	mg/kg				2230	50	<50	<110	2230	<50	<110	<50
C15 - C28 Fraction	mg/kg				12800	100	<100	540	12800	<100	<220	<100
C29 - C36 Fraction	mg/kg				1530	100	<100	790	1530	<100	<220	130
C10 - C36 Fraction (sum)	mg/kg				16600	50	<50	1330	16600	<50	<110	130
Silica Gel Cleanup (TPH)												
C10 - C14 Fraction	mg/kg						---	<110	730	----	----	----
C15 - C28 Fraction	mg/kg						---	<220	3410	----	----	----
C29 - C36 Fraction	mg/kg						---	<220	160	----	----	----
C10 - C36 Fraction (sum)	mg/kg						---	<110	4300	----	----	----
Total Recoverable Hydrocarbons - NEPM 2013 Fractions												
C6 - C10 Fraction	mg/kg				0	10	<10	<10	<10	<10	<10	<10
C6 - C10 Fraction minus BTEX (F1)	mg/kg	700	700	125	0	10	<10	<10	<10	<10	<10	<10
>C10 - C16 Fraction	mg/kg				5280	50	<50	<110	5280	<50	<110	<50
>C16 - C34 Fraction	mg/kg	2500	3500		10400	100	120	1050	10400	120	<110	120
>C34 - C40 Fraction	mg/kg	10000	10000		1080	100	<100	610	1080	<100	<110	140
>C10 - C40 Fraction (sum)	mg/kg				16800	50	120	1660	16800	120	<110	260
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	1000	1000	25	5280	50	<50	<110	5280	<50	<110	<50
Silica Gel Cleanup (TRH)												
>C10 - C16 Fraction	mg/kg						---	<110	1840	----	----	----
>C16 - C34 Fraction	mg/kg	2500	3500				---	<110	2490	----	----	----
>C34 - C40 Fraction	mg/kg	10000	10000				---	<110	<100	----	----	----
>C10 - C40 Fraction (sum)	mg/kg						---	<110	4330	----	----	----
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	1000	1000	25			---	<110	1840	----	----	----
BTEXN												
Benzene	mg/kg	NL	NL	10	0	0.2	<0.2	<0.5	<0.5	<0.2	<0.5	<0.2
Toluene	mg/kg	NL	NL	10	0	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	NL	NL	1.5	0	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	mg/kg	NL	NL		0	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	mg/kg				0	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylenes	mg/kg	NL	NL	1.6	0	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sum of BTEX	mg/kg				0	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	mg/kg	-	-	10	0	1	<1	<1	<1	<1	<1	<1
Explosives												
HMX	mg/kg				0	0.1	<0.1	----	----	----	----	----
RDX	mg/kg				0	0.1	<0.1	----	----	----	----	----
1.3.5-Trinitrobenzene	mg/kg				0	0.1	<0.1	----	----	----	----	----
1.3-Dinitrobenzene	mg/kg				0	0.1	<0.1	----	----	----	----	----
Tetryl	mg/kg				0	0.1	<0.1	----	----	----	----	----
2.4.6-TNT	mg/kg				0	0.1	<0.1	----	----	----	----	----
4-Amino.2.6-DNT	mg/kg				0	0.1	<0.1	----	----	----	----	----
2-Amino-4.6-DNT	mg/kg				0	0.1	<0.1	----	----	----	----	----
4-& 2-AM-DNT(Isomeric Mixture)	mg/kg				0	0.1	<0.1	----	----	----	----	----
2.4-Dinitrotoluene	mg/kg				0	0.1	<0.1	----	----	----	----	----
2.6-Dinitrotoluene	mg/kg				0	0.1	<0.1	----	----	----	----	----
2.4-& 2.6-DNT(Isomeric Mixture)	mg/kg				0	0.1	<0.1	----	----	----	----	----
Nitrobenzene	mg/kg				0	0.1	<0.1	----	----	----	----	----
2-Nitrotoluene	mg/kg				0	0.1	<0.1	----	----	----	----	----
3-Nitrotoluene	mg/kg				0	0.1	<0.1	----	----	----	----	----
4-Nitrotoluene	mg/kg				0	0.1	<0.1	----	----	----	----	----
Nitroglycerine	mg/kg				0	1	<1	----	----	----	----	----
PETN	mg/kg				0	1	<1	----	----	----	----	----
Identification of Asbestos in Soils (AS 4964 - 2004)												
Asbestos Detected	g/kg				0	0.1	----	----	----	----	----	----
Asbestos Type	--				0		----	----	----	----	----	----
Sample weight (dry)	g				0	0.01	----	----	----	----	----	----
Description	--				0		----	----	----	----	----	----
APPROVED IDENTIFIER:	--				0		----	----	----	----	----	----

Table B4 - Tunnel SOIL Waste Classification

					ALS Sample number:	ES1726194050	ES1726194049
					Sample ID	TS2	TS1
					Sample date:	18/10/17	18/10/17
					Matrix	Soil	Soil
Analyte Name	**Units**	GSW	RSW	**Maximum**	**Reporting Limit**	**Result**	**Result**
Moisture Content	%				1	89	77.6
Total Metals							
Arsenic	mg/kg	100	400	7	5	7	6
Cadmium	mg/kg	20	80	1	1	<1	1
Chromium	mg/kg	100	400	25	2	16	25
Copper	mg/kg			148	5	102	148
Lead	mg/kg	100	400	90	5	70	90
Nickel	mg/kg	40	160	72	2	46	72
Zinc	mg/kg			1690	5	1690	1690
Mercury	mg/kg	4	16	0.4	0.1	0.3	0.4
				0			
Nutrients				0			
Ammonia as N	mg/kg			100	20	100	----
Nitrite as N (Sol.)	mg/kg			0.5	0.1	0.5	----
Nitrate as N (Sol.)	mg/kg			3.7	0.1	3.7	----
Nitrite + Nitrate as N (Sol.)	mg/kg			4.2	0.1	4.2	----
Total Kjeldahl Nitrogen as N	mg/kg			14400	20	14400	----
Total Nitrogen as N	mg/kg			14400	20	14400	----
Total Phosphorus as P	mg/kg			8370	2	8370	----
Reactive Phosphorus as P	mg/kg			5	0.1	5	----
				0			
PCB's				0			
Total Polychlorinated biphenyls	mg/kg	50	50	0	0.1	<0.2	<0.1
				0			
Organochlorine Pesticides (OC)				0			
alpha-BHC	mg/kg			0	0.05	<0.12	<0.06
Hexachlorobenzene (HCB)	mg/kg			0	0.05	<0.12	<0.06
beta-BHC	mg/kg			0	0.05	<0.12	<0.06
gamma-BHC	mg/kg			0	0.05	<0.12	<0.06
delta-BHC	mg/kg			0	0.05	<0.12	<0.06
Heptachlor	mg/kg			0	0.05	<0.12	<0.06
Aldrin	mg/kg			0	0.05	<0.12	<0.06
Heptachlor epoxide	mg/kg			0	0.05	<0.12	<0.06
Total Chlordane (sum)	mg/kg			0	0.05	<0.12	<0.06
trans-Chlordane	mg/kg			0	0.05	<0.12	<0.06
alpha-Endosulfan	mg/kg			0	0.05	<0.12	<0.06
cis-Chlordane	mg/kg			0	0.05	<0.12	<0.06
Dieldrin	mg/kg			0	0.05	<0.12	<0.06
4.4`-DDE	mg/kg			0	0.05	<0.12	<0.06
Endrin	mg/kg			0	0.05	<0.12	<0.06
beta-Endosulfan	mg/kg			0	0.05	<0.12	<0.06
4.4`-DDD	mg/kg			0	0.05	<0.12	<0.06
Endrin aldehyde	mg/kg			0	0.05	<0.12	<0.06
Endosulfan sulfate	mg/kg			0	0.05	<0.12	<0.06
4.4`-DDT	mg/kg			0	0.2	<0.5	<0.3
Endrin ketone	mg/kg			0	0.05	<0.12	<0.06
Methoxychlor	mg/kg			0	0.2	<0.5	<0.3
Sum of DDD + DDE + DDT	mg/kg			0	0.05	<0.12	<0.06
Sum of Aldrin + Dieldrin	mg/kg			0	0.05	<0.12	<0.06
				0			
Organophosphorus Pesticides (OP)				0			
Dichlorvos	mg/kg			0	0.05	<0.12	<0.06
Demeton-S-methyl	mg/kg			0	0.05	<0.12	<0.06
Monocrotophos	mg/kg			0	0.2	<0.5	<0.3
Dimethoate	mg/kg			0	0.05	<0.12	<0.06
Diazinon	mg/kg			0	0.05	<0.12	<0.06
Chlorpyrifos-methyl	mg/kg			0	0.05	<0.12	<0.06
Parathion-methyl	mg/kg			0	0.2	<0.5	<0.3
Malathion	mg/kg			0	0.05	<0.12	<0.06
Fenthion	mg/kg			0	0.05	<0.12	<0.06
Chlorpyrifos	mg/kg			0	0.05	<0.12	<0.06
Parathion	mg/kg			0	0.2	<0.5	<0.3
Pirimphos-ethyl	mg/kg			0	0.05	<0.12	<0.06
Bromophos-ethyl	mg/kg			0	0.05	<0.12	<0.06
Fenamiphos	mg/kg			0	0.05	<0.12	<0.06
Prothiofos	mg/kg			0	0.05	<0.12	<0.06
Ethion	mg/kg			0	0.05	<0.12	<0.06
Carbophenothion	mg/kg			0	0.05	<0.12	<0.06
Azinphos Methyl	mg/kg			0	0.05	<0.12	<0.06
				0			
Triazines				0			
Atrazine	mg/kg			0	0.05	<0.12	<0.06
Simazine	mg/kg			0	0.05	<0.12	<0.06
				0			
Cypermethrins				0			
Cypermethrins (total)	mg/kg			0	0.2	<0.5	<0.3
				0			
Polynuclear Aromatic Hydrocarbons (PAH)				0			
Naphthalene	mg/kg			0	0.5	<2.0	<1.0
Acenaphthylene	mg/kg			0	0.5	<2.0	<1.0
Acenaphthene	mg/kg			0	0.5	<2.0	<1.0
Fluorene	mg/kg			0	0.5	<2.0	<1.0
Phenanthrene	mg/kg			2.3	0.5	<2.0	2.3
Anthracene	mg/kg			1.1	0.5	<2.0	1.1
Fluoranthene	mg/kg			6.4	0.5	5.4	6.4
Pyrene	mg/kg			6.6	0.5	5.6	6.6

Table B4 - Tunnel SOIL Waste Classification

					ALS Sample number:	ES1726194050	ES1726194049
					Sample ID	TS2	TS1
					Sample date:	18/10/17	18/10/17
					Matrix	Soil	Soil
Analyte Name	**Units**	GSW	RSW	**Maximum**	**Reporting Limit**	**Result**	**Result**
Benz(a)anthracene	mg/kg			2.9	0.5	2.5	2.9
Chrysene	mg/kg			3	0.5	2.3	3
Benzo(b+j)fluoranthene	mg/kg			5.8	0.5	4.3	5.8
Benzo(k)fluoranthene	mg/kg			2.1	0.5	<2.0	2.1
Benzo(a)pyrene	mg/kg	0.8	3.2	4.2	0.5	3	4.2
Indeno(1.2.3.cd)pyrene	mg/kg			2.4	0.5	<2.0	2.4
Dibenz(a.h)anthracene	mg/kg			0	0.5	<2.0	<1.0
Benzo(g.h.i)perylene	mg/kg			3.2	0.5	<2.0	3.2
Total PAH	mg/kg	200	800	40	0.5	23.1	40
Benzo(a)pyrene TEQ (zero)	mg/kg			5.6	0.5	3.7	5.6
Benzo(a)pyrene TEQ (half LOR)	mg/kg			5.8	0.5	4	5.8
Benzo(a)pyrene TEQ (LOR)	mg/kg			6.1	0.5	4.3	6.1
				0			
Total Petroleum Hydrocarbons (TPH)				0			
C6 - C9 Fraction	mg/kg	650	2600	0	10	<10	<10
C10 - C14 Fraction	mg/kg			0	50	<110	<60
C15 - C28 Fraction	mg/kg			1080	100	1080	750
C29 - C36 Fraction				1460	100	1460	1250
C10 - C36 Fraction (sum)	mg/kg	10000	40000	2540	50	2540	2000
Silica Gel Cleanup (TPH)							
C10 - C14 Fraction	mg/kg				50	<110	----
C15 - C28 Fraction	mg/kg				100	<220	----
C29 - C36 Fraction	mg/kg				100	<220	----
C10 - C36 Fraction (sum)	mg/kg				50	<110	----
				0			
Total Recoverable Hydrocarbons - NEPM 2013 Fractions				0			
C6 - C10 Fraction	mg/kg			0	10	<10	<10
C6 - C10 Fraction minus BTEX (F1	mg/kg			0	10	<10	<10
>C10 - C16 Fraction	mg/kg			0	50	<110	<60
>C16 - C34 Fraction	mg/kg			1910	100	1910	1570
>C34 - C40 Fraction	mg/kg			1380	100	1380	960
>C10 - C40 Fraction (sum)	mg/kg			3290	50	3290	2530
>C10 - C16 Fraction minus Naphtha	mg/kg			0	50	<110	<60
Silica Gel Cleanup (TRH)							
>C10 - C16 Fraction	mg/kg				50	<110	----
>C16 - C34 Fraction	mg/kg				100	<110	----
>C34 - C40 Fraction	mg/kg				100	<110	----
>C10 - C40 Fraction (sum)	mg/kg				50	<110	----
>C10 - C16 Fraction minus Naphtha	mg/kg				50	<110	----
				0			
BTEXN				0			
Benzene	mg/kg	10	40	0	0.2	<0.5	<0.2
Toluene	mg/kg	288	1152	0	0.5	<0.5	<0.5
Ethylbenzene	mg/kg	600	2400	0	0.5	<0.5	<0.5
meta- & para-Xylene	mg/kg			0	0.5	<0.5	<0.5
ortho-Xylene	mg/kg			0	0.5	<0.5	<0.5
Total Xylenes	mg/kg	1000	4000	0	0.5	<0.5	<0.5
Sum of BTEX	mg/kg			0	0.2	<0.2	<0.2
Naphthalene	mg/kg			0	1	<1	<1
				0			
Explosives				0			
HMX	mg/kg			0	0.1	<0.5	----
RDX	mg/kg			0	0.1	<0.5	----
1.3.5-Trinitrobenzene	mg/kg			0	0.1	<0.5	----
1.3-Dinitrobenzene	mg/kg			0	0.1	<0.5	----
Tetryl	mg/kg			0	0.1	<0.5	----
2.4.6-TNT	mg/kg			0	0.1	<0.5	----
4-Amino.2.6-DNT	mg/kg			0	0.1	<0.5	----
2-Amino-4.6-DNT	mg/kg			0	0.1	<0.5	----
4-& 2-AM-DNT(Isomeric Mixture)	mg/kg			0	0.1	<0.1	----
2.4-Dinitrotoluene	mg/kg			0	0.1	<0.5	----
2.6-Dinitrotoluene	mg/kg			0	0.1	<0.5	----
2.4-& 2.6-DNT(Isomeric Mixture)	mg/kg			0	0.1	<0.1	----
Nitrobenzene	mg/kg			0	0.1	<0.5	----
2-Nitrotoluene	mg/kg			0	0.1	<0.5	----
3-Nitrotoluene	mg/kg			0	0.1	<0.5	----
4-Nitrotoluene	mg/kg			0	0.1	<0.5	----
Nitroglycerine	mg/kg			0	1	<5	----
PETN	mg/kg			0	1	<5	----
				0			
Identification of Asbestos in Soils (AS 4964 - 2004)				0			
Asbestos Detected	g/kg			0	0.1	----	----
Asbestos Type	--			0		----	----
Sample weight (dry)	g			0	0.01	----	----
Description	--			0		----	----
APPROVED IDENTIFIER:	--			0		----	----

Table B5 - Eastern Portal SOIL Waste Classification

					Sample Name	ES1726194052	ES1726194053	ES1726194054	ES1726194055	ES1726194056	ES1726194051
					Sample ID	EPA-0.4	EPB-0.3	EPC-0.2	EPD-0.15	QC8	EPA-0.1
					Sample date:	18/10/17	18/10/17	18/10/17	18/10/17	18/10/17	18/10/17
					Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Analyte Name	**Units**	GSW	RSW	**Maximum**	**Reporting Limit**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Moisture Content	%				1	31.2	86.1	81.6	19.5	88.6	34.5
Total Metals											
Arsenic	mg/kg	100	400	31	5	<5	20	31	<5	20	<5
Cadmium	mg/kg	20	80	3	1	<1	3	<1	<1	2	<1
Chromium	mg/kg	100	400	20	2	8	17	20	8	18	6
Copper	mg/kg			235	5	25	105	235	70	107	17
Lead	mg/kg	100	400	236	5	44	85	236	51	88	26
Nickel	mg/kg	40	160	193	2	8	193	53	8	160	3
Zinc	mg/kg			2440	5	158	2440	574	126	1750	52
Mercury	mg/kg	4	16	0.4	0.1	<0.1	0.4	0.4	<0.1	0.4	<0.1
Nutrients											
Ammonia as N	mg/kg				20	----	----	----	----	----	----
Nitrite as N (Sol.)	mg/kg				0.1	----	----	----	----	----	----
Nitrate as N (Sol.)	mg/kg				0.1	----	----	----	----	----	----
Nitrite + Nitrate as N (Sol.)	mg/kg				0.1	----	----	----	----	----	----
Total Kjeldahl Nitrogen as N	mg/kg				20	----	----	----	----	----	----
Total Nitrogen as N	mg/kg				20	----	----	----	----	----	----
Total Phosphorus as P	mg/kg				2	----	----	----	----	----	----
Reactive Phosphorus as P	mg/kg				0.1	----	----	----	----	----	----
PCB's											
Total Polychlorinated biphenyls	mg/kg	50	50	0	0.1	<0.1	<0.2	<0.2	<0.1	<0.2	----
Organochlorine Pesticides (OC)											
alpha-BHC	mg/kg				0.05	----	----	----	----	----	----
Hexachlorobenzene (HCB)	mg/kg				0.05	----	----	----	----	----	----
beta-BHC	mg/kg				0.05	----	----	----	----	----	----
gamma-BHC	mg/kg				0.05	----	----	----	----	----	----
delta-BHC	mg/kg				0.05	----	----	----	----	----	----
Heptachlor	mg/kg				0.05	----	----	----	----	----	----
Aldrin	mg/kg				0.05	----	----	----	----	----	----
Heptachlor epoxide	mg/kg				0.05	----	----	----	----	----	----
Total Chlordane (sum)	mg/kg				0.05	----	----	----	----	----	----
trans-Chlordane	mg/kg				0.05	----	----	----	----	----	----
alpha-Endosulfan	mg/kg				0.05	----	----	----	----	----	----
cis-Chlordane	mg/kg				0.05	----	----	----	----	----	----
Dieldrin	mg/kg				0.05	----	----	----	----	----	----
4.4`-DDE	mg/kg				0.05	----	----	----	----	----	----
Endrin	mg/kg				0.05	----	----	----	----	----	----
beta-Endosulfan	mg/kg				0.05	----	----	----	----	----	----
4.4`-DDD	mg/kg				0.05	----	----	----	----	----	----
Endrin aldehyde	mg/kg				0.05	----	----	----	----	----	----
Endosulfan sulfate	mg/kg				0.05	----	----	----	----	----	----
4.4`-DDT	mg/kg				0.2	----	----	----	----	----	----
Endrin ketone	mg/kg				0.05	----	----	----	----	----	----
Methoxychlor	mg/kg				0.2	----	----	----	----	----	----
Sum of DDD + DDE + DDT	mg/kg				0.05	----	----	----	----	----	----
Sum of Aldrin + Dieldrin	mg/kg				0.05	----	----	----	----	----	----
Organophosphorus Pesticides (OP)											
Dichlorvos	mg/kg				0.05	----	----	----	----	----	----
Demeton-S-methyl	mg/kg				0.05	----	----	----	----	----	----
Monocrotophos	mg/kg				0.2	----	----	----	----	----	----
Dimethoate	mg/kg				0.05	----	----	----	----	----	----
Diazinon	mg/kg				0.05	----	----	----	----	----	----
Chlorpyrifos-methyl	mg/kg				0.05	----	----	----	----	----	----
Parathion-methyl	mg/kg				0.2	----	----	----	----	----	----
Malathion	mg/kg				0.05	----	----	----	----	----	----
Fenthion	mg/kg				0.05	----	----	----	----	----	----
Chlorpyrifos	mg/kg				0.05	----	----	----	----	----	----
Parathion	mg/kg				0.2	----	----	----	----	----	----
Pirimphos-ethyl	mg/kg				0.05	----	----	----	----	----	----
Bromophos-ethyl	mg/kg				0.05	----	----	----	----	----	----
Fenamiphos	mg/kg				0.05	----	----	----	----	----	----
Prothiofos	mg/kg				0.05	----	----	----	----	----	----
Ethion	mg/kg				0.05	----	----	----	----	----	----
Carbophenothion	mg/kg				0.05	----	----	----	----	----	----
Azinphos Methyl	mg/kg				0.05	----	----	----	----	----	----
Triazines											
Atrazine	mg/kg				0.05	----	----	----	----	----	----
Simazine	mg/kg				0.05	----	----	----	----	----	----
Cypermethrins											
Cypermethrins (total)	mg/kg				0.2	----	----	----	----	----	----
Polynuclear Aromatic Hydrocarbons (PAH)											
Naphthalene	mg/kg				0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Acenaphthylene	mg/kg				0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Acenaphthene	mg/kg				0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Fluorene	mg/kg				0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Phenanthrene	mg/kg				0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Anthracene	mg/kg				0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Fluoranthene	mg/kg				0.5	<0.5	<2.0	5.8	<0.5	<2.0	<0.5
Pyrene	mg/kg				0.5	<0.5	<2.0	8.1	<0.5	<2.0	<0.5

Table B5 - Eastern Portal SOIL Waste Classification

					Sample Name	ES1726194052	ES1726194053	ES1726194054	ES1726194055	ES1726194056	ES1726194051
					Sample ID	EPA-0.4	EPB-0.3	EPC-0.2	EPD-0.15	QC8	EPA-0.1
					Sample date:	18/10/17	18/10/17	18/10/17	18/10/17	18/10/17	18/10/17
					Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Analyte Name	**Units**	GSW	RSW	**Maximum**	**Reporting Limit**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Benz(a)anthracene	mg/kg				0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Chrysene	mg/kg				0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Benzo(b+j)fluoranthene	mg/kg				0.5	<0.5	<2.0	2.2	<0.5	<2.0	<0.5
Benzo(k)fluoranthene	mg/kg				0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Benzo(a)pyrene	mg/kg	0.8	3.2	0	0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Indeno(1.2.3.cd)pyrene	mg/kg				0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Dibenz(a.h)anthracene	mg/kg				0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Benzo(g.h.i)perylene	mg/kg				0.5	<0.5	<2.0	<2.0	<0.5	<2.0	<0.5
Total PAH	mg/kg	200	800	16.1	0.5	<0.5	<1.0	16.1	<0.5	<1.0	<0.5
Benzo(a)pyrene TEQ (zero)	mg/kg				0.5	<0.5	<1.0	<1.0	<0.5	<1.0	<0.5
Benzo(a)pyrene TEQ (half LOR)	mg/kg				0.5	0.6	<1.0	<1.0	0.6	<1.0	0.6
Benzo(a)pyrene TEQ (LOR)	mg/kg				0.5	1.2	1.2	1.4	1.2	1.2	1.2
Total Petroleum Hydrocarbons (TPH)											
C6 - C9 Fraction	mg/kg	650	2600	0	10	<10	<10	<10	<10	<10	<10
C10 - C14 Fraction	mg/kg				50	<50	<110	2230	<50	<110	<50
C15 - C28 Fraction	mg/kg				100	<100	540	12800	<100	<220	<100
C29 - C36 Fraction	mg/kg				100	<100	790	1530	<100	<220	130
C10 - C36 Fraction (sum)	mg/kg	10000	40000	16600	50	<50	1330	16600	<50	<110	130
Silica Gel Cleanup (TPH)											
C10 - C14 Fraction	mg/kg					----	<110	730	----	----	----
C15 - C28 Fraction	mg/kg					----	<220	3410	----	----	----
C29 - C36 Fraction	mg/kg					----	<220	160	----	----	----
C10 - C36 Fraction (sum)	mg/kg					----	<110	4300	----	----	----
Total Recoverable Hydrocarbons - NEPM 2013 Fractions											
C6 - C10 Fraction	mg/kg				10	<10	<10	<10	<10	<10	<10
C6 - C10 Fraction minus BTEX (F1	mg/kg				10	<10	<10	<10	<10	<10	<10
>C10 - C16 Fraction	mg/kg				50	<50	<110	5280	<50	<110	<50
>C16 - C34 Fraction	mg/kg				100	120	1050	10400	120	<110	120
>C34 - C40 Fraction	mg/kg				100	<100	610	1080	<100	<110	140
>C10 - C40 Fraction (sum)	mg/kg				50	120	1660	16800	120	<110	260
>C10 - C16 Fraction minus Naphtha	mg/kg				50	<50	<110	5280	<50	<110	<50
Silica Gel Cleanup (TRH)											
>C10 - C16 Fraction	mg/kg					----	<110	1840	----	----	----
>C16 - C34 Fraction	mg/kg					----	<110	2490	----	----	----
>C34 - C40 Fraction	mg/kg					----	<110	<100	----	----	----
>C10 - C40 Fraction (sum)	mg/kg					----	<110	4330	----	----	----
>C10 - C16 Fraction minus Naphtha	mg/kg					----	<110	1840	----	----	----
BTEXN											
Benzene	mg/kg	10	40	0	0.2	<0.2	<0.5	<0.5	<0.2	<0.5	<0.2
Toluene	mg/kg	288	1152	0	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	600	2400	0	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	mg/kg				0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	mg/kg				0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylenes	mg/kg	1000	4000	0	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sum of BTEX	mg/kg				0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	mg/kg				1	<1	<1	<1	<1	<1	<1
Explosives											
HMX	mg/kg				0.1	<0.1	----	----	----	----	----
RDX	mg/kg				0.1	<0.1	----	----	----	----	----
1.3.5-Trinitrobenzene	mg/kg				0.1	<0.1	----	----	----	----	----
1.3-Dinitrobenzene	mg/kg				0.1	<0.1	----	----	----	----	----
Tetryl	mg/kg				0.1	<0.1	----	----	----	----	----
2.4.6-TNT	mg/kg				0.1	<0.1	----	----	----	----	----
4-Amino.2.6-DNT	mg/kg				0.1	<0.1	----	----	----	----	----
2-Amino-4.6-DNT	mg/kg				0.1	<0.1	----	----	----	----	----
4-& 2-AM-DNT(Isomeric Mixture)	mg/kg				0.1	<0.1	----	----	----	----	----
2.4-Dinitrotoluene	mg/kg				0.1	<0.1	----	----	----	----	----
2.6-Dinitrotoluene	mg/kg				0.1	<0.1	----	----	----	---	----
2.4-& 2.6-DNT(Isomeric Mixture)	mg/kg				0.1	<0.1	----	----	----	----	----
Nitrobenzene	mg/kg				0.1	<0.1	----	----	----	----	----
2-Nitrotoluene	mg/kg				0.1	<0.1	----	----	----	----	----
3-Nitrotoluene	mg/kg				0.1	<0.1	----	----	----	----	----
4-Nitrotoluene	mg/kg				0.1	<0.1	----	----	----	----	----
Nitroglycerine	mg/kg				1	<1	----	----	----	----	----
PETN	mg/kg				1	<1	----	----	----	----	----
Identification of Asbestos in Soils (AS 4964 - 2004)											
Asbestos Detected	g/kg				0.1	----	----	----	----	----	----
Asbestos Type	--					----	----	----	----	----	----
Sample weight (dry)	g				0.01	----	----	----	----	----	----
Description	--					----	----	----	----	----	----
APPROVED IDENTIFIER:	--					----	----	----	----	----	----

Table B6 TCLP Data

						ALS Sample number:	ES1727998001	ES1727998002	ES1727998003	ES1727998004	ES1727998005	ES1727998006	ES1727998007
						Sample ID	TS1	TS2	EPC - 0.2	EPB-0.3	TP8-0.1	HA4-0.1	TP4-0.1
						Sample date:	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17
						Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Analyte Name	**Units**	TCLP	SCC1	TCLP2	SCC2	**Max.**	**porting Limit**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Metals														
Lead	mg/L	5	1500	20	6000	0	0.1	----	----	<0.1	----	<0.1	----	----
Nickel	mg/L	2	1050	8	4200	0.2	0.1	<0.1	<0.1	<0.1	0.2	----	<0.1	----
						0								
PAHs						0								
Naphthalene	Âµg/L					12.2	1	----	----	----	----	----	----	12.2
Acenaphthylene	Âµg/L					1.7	1	----	----	----	----	----	----	1.7
Acenaphthene	Âµg/L					5.7	1	----	----	----	----	----	----	5.7
Fluorene	Âµg/L					10.1	1	----	----	----	----	----	----	10.1
Phenanthrene	Âµg/L					27.3	1	----	----	----	----	----	----	27.3
Anthracene	Âµg/L					5.9	1	----	----	----	----	----	----	5.9
Fluoranthene	Âµg/L					8.7	1	----	----	----	----	----	----	8.7
Pyrene	Âµg/L					7.3	1	----	----	----	----	----	----	7.3
Benz(a)anthracene	Âµg/L					0	1	----	----	----	----	----	----	<1.0
Chrysene	Âµg/L					0	1	----	----	----	----	----	----	<1.0
Benzo(b+j)fluoranthene	Âµg/L					0	1	----	----	----	----	----	----	<1.0
Benzo(k)fluoranthene	Âµg/L					0	1	----	----	----	----	----	----	<1.0
Benzo(a)pyrene	Âµg/L					0	0.5	<0.5	<0.5	----	----	----	----	<0.5
Indeno(1.2.3.cd)pyrene	Âµg/L					0	1	----	----	----	----	----	----	<1.0
Dibenz(a.h)anthracene	Âµg/L					0	1	----	----	----	----	----	----	<1.0
Benzo(g.h.i)perylene	Âµg/L					0	1	----	----	----	----	----	----	<1.0
Sum of polycyclic aromatic hydrocarbons	Âµg/L	NA	200	NA	800	78.9	0.5	----	----	----	----	----	----	78.9
Benzo(a)pyrene TEQ (zero)	Âµg/L	0.04	10	0.16	23	0	0.5	----	----	----	----	----	----	<0.5

Table B7 ASLP Data

							ALS Sample number:	ES1726194001		
							Sample ID	TS1	EPC-0.2	EPB-0.3
							Sample date:	17/10/17	17/10/17	17/10/17
							Matrix	Soil	Soil	Soil
Analyte Name	**Units**	TCLP	SCC1	TCLP2	SCC2	**Max.**	**Reporting Limit**	**Result**	**Result**	**Result**
Copper	mg/L					**0**	0.1	----	<0.1	----
Lead	mg/L	5	1500	20	6000	**0**	0.1	----	<0.1	----
Nickel	mg/L	2	1050	8	4200	**0**	0.1	<0.1	----	<0.1
BaP	Âµg/L	0.04	10	0.16	23	**0**	0.5	<0.5	----	----

Table B8 QA/QC Data

		ALS Sample number:		ES1726194010	ES1726194034			ES1726194018	ES1726194036			ES1726194053	ES1726194056	
		Sample ID		TP4-0.5	QC1			TP8-0.1	QC3			EPB-0.3	QC8	
		Sample date:		17/10/17	17/10/17			17/10/17	17/10/17			18/10/17	18/10/17	
		Matrix		Soil	Soil			Soil	Soil			Soil	Soil	
Analyte Name	**Units**	**Reporting Limit**		**Result**	**Result**			**Result**	**Result**			**Result**	**Result**	
Moisture Content	%	1		22.1	17.1			37.4	19.3			86.1	88.6	
Total Metals														
Arsenic	mg/kg	5		10	9	11%		<5	<5	0%		20	20	0%
Cadmium	mg/kg	1		<1	<1	0%		<1	<1	0%		3	2	50%
Chromium	mg/kg	2		10	8	22%		10	9	11%		17	18	6%
Copper	mg/kg	5		121	104	15%		20	20	0%		105	107	2%
Lead	mg/kg	5		42	29	37%		176	144	20%		85	88	3%
Nickel	mg/kg	2		8	7	13%		5	5	0%		193	160	21%
Zinc	mg/kg	5		27	20	30%		508	389	27%		2440	1750	39%
Mercury	mg/kg	0.1		<0.1	<0.1	0%		0.1	0.1	0%		0.4	0.4	0%
PCB's														
Total Polychlorinated biphenyls	mg/kg	0.1		----	----	NA		----	----	NA		<0.2	<0.2	0%
Decachlorobiphenyl (PCB surrogate)	%	0.1		----	----	NA		----	----	NA		78.6	92.6	15%
Polynuclear Aromatic Hydrocarbons (PAH)														
Naphthalene	mg/kg	0.5		<0.5	<0.5	0%		<0.5	<0.5	0%		<2.0	<2.0	0%
Acenaphthylene	mg/kg	0.5		<0.5	<0.5	0%		<0.5	<0.5	0%		<2.0	<2.0	0%
Acenaphthene	mg/kg	0.5		<0.5	<0.5	0%		<0.5	<0.5	0%		<2.0	<2.0	0%
Fluorene	mg/kg	0.5		<0.5	<0.5	0%		<0.5	<0.5	0%		<2.0	<2.0	0%
Phenanthrene	mg/kg	0.5		0.9	0.5	57%		<0.5	<0.5	0%		<2.0	<2.0	0%
Anthracene	mg/kg	0.5		<0.5	<0.5	0%		<0.5	<0.5	0%		<2.0	<2.0	0%
Fluoranthene	mg/kg	0.5		1.1	0.5	75%		<0.5	<0.5	0%		<2.0	<2.0	0%
Pyrene	mg/kg	0.5		1	0.5	67%		<0.5	<0.5	0%		<2.0	<2.0	0%
Benz(a)anthracene	mg/kg	0.5		0.6	0.5	18%		<0.5	<0.5	0%		<2.0	<2.0	0%
Chrysene	mg/kg	0.5		0.6	0.5	18%		<0.5	<0.5	0%		<2.0	<2.0	0%
Benzo(b+j)fluoranthene	mg/kg	0.5		0.7	0.5	33%		<0.5	<0.5	0%		<2.0	<2.0	0%
Benzo(k)fluoranthene	mg/kg	0.5		<0.5	<0.5	0%		<0.5	<0.5	0%		<2.0	<2.0	0%
Benzo(a)pyrene	mg/kg	0.5		<0.5	<0.5	0%		<0.5	<0.5	0%		<2.0	<2.0	0%
Indeno(1.2.3.cd)pyrene	mg/kg	0.5		<0.5	<0.5	0%		<0.5	<0.5	0%		<2.0	<2.0	0%
Dibenz(a.h)anthracene	mg/kg	0.5		<0.5	<0.5	0%		<0.5	<0.5	0%		<2.0	<2.0	0%
Benzo(g.h.i)perylene	mg/kg	0.5		<0.5	<0.5	0%		<0.5	<0.5	0%		<2.0	<2.0	0%
Sum of polycyclic aromatic hydrocarbons	mg/kg	0.5		4.9	0.5	163%		<0.5	<0.5	0%		<1.0	<1.0	0%
Benzo(a)pyrene TEQ (zero)	mg/kg	0.5		<0.5	<0.5	0%		<0.5	<0.5	0%		<1.0	<1.0	0%
Benzo(a)pyrene TEQ (half LOR)	mg/kg	0.5		0.7	0.6	15%		0.6	0.6	0%		<1.0	<1.0	0%
Benzo(a)pyrene TEQ (LOR)	mg/kg	0.5		1.2	1.2	0%		1.2	1.2	0%		1.2	1.2	0%
Total Petroleum Hydrocarbons (TPH)														
C6 - C9 Fraction	mg/kg	10		<10	<10	0%		<10	<10	0%		<10	<10	0%
C10 - C14 Fraction	mg/kg	50		<50	<50	0%		<50	<50	0%		<110	<110	0%
C15 - C28 Fraction	mg/kg	100		400	100	120%		<100	<100	0%		540	220	**145%**
C29 - C36 Fraction	mg/kg	100		190	100	62%		<100	<100	0%		790	220	**259%**
C10 - C36 Fraction (sum)	mg/kg	50		590	50	169%		<50	<50	0%		1330	110	**1109%**
										0%				0%
Total Recoverable Hydrocarbons - NEPM 2013 Fractions										0%				0%
C6 - C10 Fraction	mg/kg	10		<10	<10	0%		<10	<10	0%		<10	<10	0%
C6 - C10 Fraction minus BTEX (F1)	mg/kg	10		<10	<10	0%		<10	<10	0%		<10	<10	0%
>C10 - C16 Fraction	mg/kg	50		70	50	33%		<50	<50	0%		<110	<110	0%
>C16 - C34 Fraction	mg/kg	100		520	100	**135%**		120	100	18%		1050	110	**855%**
>C34 - C40 Fraction	mg/kg	100		130	100	26%		120	100	18%		610	110	**455%**
>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50		70	50	33%		<50	<50	0%		<110	<110	0%
BTEXN														
Benzene	mg/kg	0.2		<0.2	<0.2	0%		<0.2	<0.2	0%		<0.5	<0.5	0%
Toluene	mg/kg	0.5		<0.5	<0.5	0%		<0.5	<0.5	0%		<0.5	<0.5	0%
Ethylbenzene	mg/kg	0.5		<0.5	<0.5	0%		<0.5	<0.5	0%		<0.5	<0.5	0%
meta- & para-Xylene	mg/kg	0.5		<0.5	<0.5	0%		<0.5	<0.5	0%		<0.5	<0.5	0%
ortho-Xylene	mg/kg	0.5		<0.5	<0.5	0%		<0.5	<0.5	0%		<0.5	<0.5	0%
Total Xylenes	mg/kg	0.5		<0.5	<0.5	0%		<0.5	<0.5	0%		<0.5	<0.5	0%
Sum of BTEX	mg/kg	0.2		<0.2	<0.2	0%		<0.2	<0.2	0%		<0.2	<0.2	0%
Naphthalene	mg/kg	1		<1	<1	0%		<1	<1	0%		<1	<1	0%

Table B9 ACM Results

		Sample Name	ES1726194001	ES1726194003	ES1726194005	ES1726194007	ES1726194009	ES1726194010
		Sample ID	TP1-ACM2	TP10-ACM1	TP12-ACM1	HA2-ACM1	ACM SURFACE 1	ACM SURFACE 5
		Sample date:	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17
		Matrix	Soild	Soild	Soild	Soild	Soild	Soild
Analyte Name	**Units**	**Reporting Limit**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Asbestos Detected	g/kg		No	Yes	Yes	No	Yes	Yes
Asbestos Type	--		-	Ch + Am + Cr	Ch	-	Ch	Ch
Sample weight (dry)	g		6.21	17.7	3.05	9.19	7.98	5.75
Description	--		A collection of synthetic mineral fibre insulation.	One piece of asbestos cement sheeting approximately 80 x 45 x 5mm.	One piece of asbestos cement sheeting approximately 25 x 20 x 4mm.	Two pieces of cement sheeting approximately 40 x 25 x 5mm.	One piece of asbestos cement sheeting approximately 50 x 40 x 4mm.	One piece of asbestos cement sheeting approximately 50 x 25 x 4mm.

Table B10 Mushroom Farm Waste Classification

					ALS Sample number:	ES1726194001	ES1726194003	ES1726194005	ES1726194007	ES1726194009	ES1726194010	ES1726194012	ES1726194016	ES1726194018	ES1726194019	ES1726194020	ES1726194022	ES1726194032	ES1726194034	ES1726194036	ES1726194038	ES1726194040	ES1726194041
					Sample ID	TP1-0.2	TP1-1.0	TP2-0.3	TP3-0.5	TP4-0.1	TP4-0.5	TP5-0.3	TP7-0.1	TP8-0.1	TP9-0.1	TP9-1.2	TP10-0.1	TP13-0.1	QC1	QC3	HA1-0.5	HA3-0.1	HA4-0.1
					Sample date:	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17
					Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Analyte Name	**Units**	GSW	RSW	**Max.**	**Reporting Limit**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Moisture Content	%				1	10.6	15.4	10.7	14.5	14.9	22.1	15	10.7	37.4	8.5	5.9	29.7	22.3	17.1	19.3	25.8	20.9	17.9
Total Metals																							
Arsenic	mg/kg	100	400	39	5	<5	5	<5	39	<5	10	<5	<5	<5	<5	<5	7	<5	9	<5	<5	<5	20
Cadmium	mg/kg	20	80	0	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium	mg/kg	100	400	208	2	7	22	24	28	9	10	8	7	10	10	4	16	5	8	9	8	18	208
Copper	mg/kg			121	5	10	34	26	31	10	121	22	12	20	10	9	22	<5	104	20	16	<5	44
Lead	mg/kg	100	400	176	5	17	48	13	21	35	42	44	71	176	23	<5	42	12	29	144	31	7	14
Nickel	mg/kg	40	160	284	2	12	11	24	4	5	8	3	2	5	3	<2	10	<2	7	5	2	11	284
Zinc	mg/kg			508	5	66	302	89	105	116	27	84	152	508	88	<5	232	33	20	389	109	22	97
Mercury	mg/kg	4	16	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1
Nutrients																							
Ammonia as N	mg/kg				20	----	<20	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Nitrite as N (Sol.)	mg/kg				0.1	----	<0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Nitrate as N (Sol.)	mg/kg				0.1	----	2.5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Nitrite + Nitrate as N (Sol.)	mg/kg				0.1	----	2.5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Total Kjeldahl Nitrogen as N	mg/kg				20	----	1520	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Total Nitrogen as N	mg/kg				20	----	1520	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Total Phosphorus as P	mg/kg				2	----	370	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Reactive Phosphorus as P	mg/kg				0.1	----	<0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
PCB's																							
Total Polychlorinated biphenyls	mg/kg	50	50	0	0.1	----	<0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Organochlorine Pesticides (OC)																							
alpha-BHC	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Hexachlorobenzene (HCB)	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
beta-BHC	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
gamma-BHC	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
delta-BHC	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Heptachlor	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Aldrin	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Heptachlor epoxide	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Total Chlordane (sum)	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
trans-Chlordane	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
alpha-Endosulfan	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
cis-Chlordane	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Dieldrin	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
4.4`-DDE	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Endrin	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
beta-Endosulfan	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
4.4`-DDD	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Endrin aldehyde	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Endosulfan sulfate	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
4.4`-DDT	mg/kg				0.2	----	<0.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.2	----
Endrin ketone	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Methoxychlor	mg/kg				0.2	----	<0.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.2	----
Sum of DDD + DDE + DDT	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Sum of Aldrin + Dieldrin	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Organophosphorus Pesticides (OP)																							
Dichlorvos	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Demeton-S-methyl	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Monocrotophos	mg/kg				0.2	----	<0.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.2	----
Dimethoate	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Diazinon	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Chlorpyrifos-methyl	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Parathion-methyl	mg/kg				0.2	----	<0.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.2	----
Malathion	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Fenthion	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Chlorpyrifos	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Parathion	mg/kg				0.2	----	<0.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.2	----
Pirimphos-ethyl	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Bromophos-ethyl	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Fenamiphos	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Prothiofos	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Ethion	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Carbophenothion	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Azinphos Methyl	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Triazines																							
Atrazine	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Simazine	mg/kg				0.05	----	<0.05	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.05	----
Cypermethrins																							
Cypermethrins (total)	mg/kg				0.2	----	<0.2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	<0.2	----
Polynuclear Aromatic Hydrocarbons (PAH)																							
Naphthalene	mg/kg				0.5	<0.5	<0.5	<0.5	<0.5	<4.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	mg/kg				0.5	<0.5	<0.5	<0.5	<0.5	18.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Table B10 Mushroom Farm Waste Classification

					ALS Sample number:	ES1726194001	ES1726194003	ES1726194005	ES1726194007	ES1726194009	ES1726194010	ES1726194012	ES1726194016	ES1726194018	ES1726194019	ES1726194020	ES1726194022	ES1726194032	ES1726194034	ES1726194036	ES1726194038	ES1726194040	ES1726194041
					Sample ID	TP1-0.2	TP1-1.0	TP2-0.3	TP3-0.5	TP4-0.1	TP4-0.5	TP5-0.3	TP7-0.1	TP8-0.1	TP9-0.1	TP9-1.2	TP10-0.1	TP13-0.1	QC1	QC3	HA1-0.5	HA3-0.1	HA4-0.1
					Sample date:	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17	17/10/17
					Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Analyte Name	**Units**	GSW	RSW	Max.	**Reporting Limit**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Acenaphthene	mg/kg				0.5	<0.5	<0.5	<0.5	<0.5	10	<0.5	1.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	mg/kg				0.5	<0.5	<0.5	<0.5	<0.5	33.3	<0.5	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	mg/kg				0.5	<0.5	<0.5	1.3	<0.5	399	0.9	28.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	mg/kg				0.5	<0.5	<0.5	<0.5	<0.5	67.3	<0.5	7.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	mg/kg				0.5	<0.5	0.7	4.3	<0.5	439	1.1	40	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.9	<0.5	<0.5
Pyrene	mg/kg				0.5	<0.5	0.7	3.7	<0.5	422	1	49.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.2	<0.5	<0.5
Benz(a)anthracene	mg/kg				0.5	<0.5	<0.5	1.2	<0.5	138	0.6	16.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.4	<0.5	<0.5
Chrysene	mg/kg				0.5	<0.5	<0.5	1.1	<0.5	128	0.6	16.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.5	<0.5	<0.5
Benzo(b+j)fluoranthene	mg/kg				0.5	<0.5	<0.5	1.5	<0.5	169	0.7	16.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2	<0.5	<0.5
Benzo(k)fluoranthene	mg/kg				0.5	<0.5	<0.5	0.6	<0.5	61.7	<0.5	5.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5
Benzo(a)pyrene	mg/kg	0.8	3.2	194	0.5	<0.5	<0.5	1.4	<0.5	194	<0.5	13.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.9	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	mg/kg				0.5	<0.5	<0.5	1	<0.5	107	<0.5	3.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5
Dibenz(a.h)anthracene	mg/kg				0.5	<0.5	<0.5	<0.5	<0.5	17.3	<0.5	1.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	mg/kg				0.5	<0.5	<0.5	1.2	<0.5	172	<0.5	4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	<0.5	<0.5
Total PAH	mg/kg	200	800	2380	0.5	<0.5	1.4	17.3	<0.5	2380	4.9	206	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	13.9	<0.5	<0.5
Benzo(a)pyrene TEQ (zero)	mg/kg				0.5	<0.5	<0.5	1.8	<0.5	262	<0.5	19	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.4	<0.5	<0.5
Benzo(a)pyrene TEQ (half LOR)	mg/kg				0.5	0.6	0.6	2.1	0.6	262	0.7	19	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	2.7	0.6	0.6
Benzo(a)pyrene TEQ (LOR)	mg/kg				0.5	1.2	1.2	2.4	1.2	262	1.2	19	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.9	1.2	1.2
Total Petroleum Hydrocarbons (TPH)																							
C6 - C9 Fraction	mg/kg	650	2600	0	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C10 - C14 Fraction	mg/kg				50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	mg/kg				100	<100	<100	<100	<100	4510	400	760	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	mg/kg				100	130	220	180	<100	2550	190	360	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
C10 - C36 Fraction (sum)	mg/kg	10000	40000	7060	50	130	220	180	<50	7060	590	1120	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Total Recoverable Hydrocarbons - NEPM 2013 Fractions																							
C6 - C10 Fraction	mg/kg				10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C6 - C10 Fraction minus BTEX (F1	mg/kg				10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
>C10 - C16 Fraction	mg/kg				50	<50	<50	<50	<50	190	70	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
>C16 - C34 Fraction	mg/kg				100	120	240	180	<100	5900	520	980	<100	120	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C34 - C40 Fraction	mg/kg				100	160	240	240	<100	1740	130	250	<100	120	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C10 - C40 Fraction (sum)	mg/kg				50	280	480	420	<50	7830	720	1230	<50	240	<50	<50	<50	<50	<50	<50	<50	<50	<50
>C10 - C16 Fraction minus Naphtha	mg/kg				50	<50	<50	<50	<50	190	70	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
BTEXN																							
Benzene	mg/kg	10	40	0	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	288	1152	0	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	600	2400	0	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	mg/kg				0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	mg/kg				0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylenes	mg/kg	1000	4000	0	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sum of BTEX	mg/kg				0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	mg/kg				1	<1	<1	<1	<1	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Explosives																							
HMX	mg/kg				0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
RDX	mg/kg				0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1.3.5-Trinitrobenzene	mg/kg				0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1.3-Dinitrobenzene	mg/kg				0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Tetryl	mg/kg				0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
2.4.6-TNT	mg/kg				0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
4-Amino.2.6-DNT	mg/kg				0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
2-Amino-4.6-DNT	mg/kg				0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
4-& 2-AM-DNT(Isomeric Mixture)	mg/kg				0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
2.4-Dinitrotoluene	mg/kg				0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
2.6-Dinitrotoluene	mg/kg				0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
2.4-& 2.6-DNT(Isomeric Mixture)	mg/kg				0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Nitrobenzene	mg/kg				0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
2-Nitrotoluene	mg/kg				0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
3-Nitrotoluene	mg/kg				0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
4-Nitrotoluene	mg/kg				0.1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Nitroglycerine	mg/kg				1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
PETN	mg/kg				1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Identification of Asbestos in Soils (AS 4964 - 2004)																							
Asbestos Detected	g/kg				0.1	----	----	No	----	----	----	----	No	No	----	----	----	----	----	----	----	No	----
Asbestos Type	--					----	----	-	----	----	----	----	-	-	----	----	----	----	----	----	----	-	----
Sample weight (dry)	g				0.01	----	----	21.4	----	----	----	----	12.6	24.1	----	----	----	----	----	----	----	44	----
Description	--					----	----	d brown sandy s	----	----	----	----	d brown sandy s	d brown sandy s	----	----	----	----	----	----	----	d brown sandy s	----
APPROVED IDENTIFIER:	--					----	----	S.SPOONER	----	----	----	----	S.SPOONER	S.SPOONER	----	----	----	----	----	----	----	S.SPOONER	----