REMEDIATION ACTION PLAN

21 February 2017

MINTO WAREHOUSE AND LOGISTICS HUB

Remediation Action Plan

Submitted to:
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1.0 INTRODUCTION

Golder Associates (Golder) was engaged by Tactical Group (Tactical) on behalf of Qube to prepare a Remediation Action Plan (RAP) for the Minto Warehouse and Logistics Hub, located at Minto, NSW.

The Minto Warehouse and Logistics Hub project involves the construction and operation of an intermodal terminal facility at 5 and 9 Culverston Road, Minto (the 'site'). The proposal will involve:

- Bulk earthworks across the site to provide four (4) building pads;
- Provision of infrastructure and services;
- Four (4) Warehouse facilities;
- Ancillary hardstand areas, car parking and external storage hardstand area.

In total, the development will be carried out over three (3) stages as follows;

- Stage 1 – Warehouse 1A;
- Stage 2 – Warehouse 1B + 1C; and
- Stage 3 – Warehouse 1D

The site is currently used for industrial purposes comprising the storage and processing of motor vehicles and associated activity. The proposed operation of the site will be for the purpose of storage and distribution of Fast Moving Consumer Goods.

This remediation action plan will focus on remediation / management works of the high risk fuel infrastructure, including aboveground storage tanks (ASTs) and bowsers.

The site locality and property boundary is shown below in Figure 1 (APPENDIX A). The previous investigation locations and an overview of the remediation area are presented in Figure 2 (APPENDIX A) and described further in Section 2. A more detailed figure showing the locations of the tanks and fuel type is shown in Figure 3 (APPENDIX A).

1.1 Remediation Objectives

Generally, the objectives of the remediation works is to remediate and/or manage contamination risks at the site, such that the site is suitable for the proposed commercial / industrial land use.

1.2 RAP Purpose

This RAP documents the proposed remediation and environmental validation works associated with the preparation of the site for the proposed commercial/industrial development works including:

- A site description, a summary of the site history, site conditions and surrounding environment;
- A description of the soil contamination that has been identified and the extent of remediation required;
- Identification of regulatory compliance requirements and development permissions granted for the development of the site;
- Documenting the nominated remediation and/or management approaches for impacted materials located at the site; and
- Identifying the suitable validation protocols, including criteria, for the remediation works.

2.0 BACKGROUND

2.1 Site Identification

Table 1 summarises the site identification information, the site and the associated property boundaries are shown on Figure 2

Table 1: Site Identification

Item	Details
Address	5 & 9 Culverston Rd, Minto, NSW
Title Identification Details/ Legal Description	Lot 3 in DP 817793 and Lot 400 in DP 875711
Local Government Authority (LGA)	Campbelltown City Council
Total IMT Site area	Approximately 229.63 hectares

2.2 Site Description

The subject site is identified as 5 and 9 Culverston Road, Minto and currently operates as an automotive logistics facility, which involves the storage and logistics of roughly 10,000 vehicles, with approximately 90% of the facility used for vehicle storage. There are six industrial buildings on site, including one large industrial building (for administrative and vehicle-related activities) called the warehouse, which includes the 'build shed.' There is netting/shade cloth over a large portion of the Site.

The Site has been historically developed for industry and is currently used for a vehicle storage and processing facility.

Existing attributes of the Site are noted as follows:

- Existing development on the Site comprises hardstand, shade structures and a warehouse building.
- The Site is generally clear of vegetation, with the exception of planting adjacent to the Site boundaries.
- Access is obtained via Culverston Road from the round-about intersection of Culverston Road and Airds Road.
- The site's eastern boundary corresponds with a drainage corridor and the Main Southern Railway line while the site's western boundary corresponds with the Bow Bowing Canal. The site's northern boundary also corresponds with a drainage channel.

Figures 1 and 2 below provide an overview of the site layout (as existing) and the surrounding land uses.

Figure 1: Site Locality (SIX Maps, 2016)

Figure 2: Subject Site (SIX Maps, 2016)

The site is located within the Campbelltown LGA to the south-west of the Sydney metropolitan area. The site is serviced by major transport infrastructure providing local and regional connectivity including the Hume Motorway with access facilitated in close proximity of the site. Other major road infrastructure in the general vicinity of the site includes Narellan Road (A9), Camden Bypass, Camden Valley Way and the M7.

Located approximately 50 km from the Sydney CBD and 40 km from Sydney Airport, the site affords access to vital infrastructure which reinforces its suitability for warehousing and logistics purposes.

2.3 Site History

A detailed history of the site is presented in the Phase 1 and Limited Phase 2 Environmental Site Assessment complete by Golder (Golder, 2016a).

Using information from the land title searches, it was revealed that the land was previously owned by a dairyman and private occupiers prior to be acquired by the State Planning Authority in 1970. In the aerial photographs, the land appeared to be undeveloped from at least the 1940s until the 1970. The land was cleared and visibly disturbed from 1975 onwards and the land was then owned by State Planning Authority of New South Wales in the early to mid-1970s, successively the New South Wales Planning and Environment Commission in the from mid 1970s to the early 1980s and then The Director of the Macarthur Growth Area in 1985. The aerial photographs show that from 1994 onwards, the Site layout was relatively consistent with the present state. Filling appears to have occurred between 1970 and 1975 as there was visible land disturbance between this time. The site is currently owned by Minto Properties Pty Ltd (Lot 400 DP 875711) as of 2015.

2.4 Surrounding Environment

The site is located in an area with mainly commercial/industrial development in the immediate vicinity. Main Southern Railway is located to the east of the Site. The surrounding land uses noted at the time of the Phase 1 ESA site inspection are identified in **Table 2**.

Table 2: Surrounding Land Use

Direction	Description
North	Airds Rd then industrial properties
South	Rose Payten Drive then industrial properties and Campbelltown Sports Stadium
East	Main Southern Railway then industrial properties, then residential development
West	Airds Rd then industrial properties then the Hume Motorway (M5)

The site exhibits three (3) street frontages being Airds Road to the north and west and Rose Payten Drive to the south which is elevated in respect of the site. The site is also transected by Culverston Road running north-west through the northern and central portions of the site. To the east the site adjoins a drainage corridor and the Main Southern Railway line.

The subject site is surrounded by similar industrial and warehouse development. The site is also in reasonable proximity of Pembroke Park, the Campbelltown Sports Stadium and other recreational infrastructure. The nearest residential development is located approximately 300 m to the west of the site and comprises low-density suburbs.

2.5 Geology

A review of the NSWGeologyPlus (Geological Survey of NSW, LPI NSW, METI & NASA) geological map on the NSW Resource and Energy website indicates that the site is located in an area mapped with Quaternary alluvial deposits as the underlying formation. These sediments comprise recent mud, silt, sand and gravel deposited by river (alluvial) systems.

2.6 Hydrogeology

A search of on-line records held by the NSW Department of Primary Industry Office of Water was performed on 4th February 2016. The search indicated there were three licensed groundwater bores located within 1000 m of the site. These groundwater bores were all property of Integral Energy, privately owned and were intended for monitoring purposes. The results of the search are summarised in Table 3.

From the groundwater bores in the area, standing water level is expected to occur between 1.4 m and 6.3 m below ground level (mbgl) and these levels may be influenced by rain and seasonal fluctuations. Water bearing zones within the licenced bores ranged from 11.5m to 13.1m bgl.

Table 3: Summary of Groundwater Bore Information

Bore	Approximate distance and direction from site	Depth (m)	Standing water level (m bgl)	Comments
GW110577	~700m E	15	6.3	WBZ 14.0 to 15.0m; Geology logged as Fill (Clayey Gravel) 0.2-0.5m, Fill (Gravelly Clay 0.5-2.0m and Sandstone 2.0-15.0m
GW110576	~700m E	13.1	1.4	WBZ 13.0 to 13.1m; Geology logged as Fill (Sandy Silt) 0.3-1.0, Sandy Clay 1.0-1.8m and then Sandstone 1.8-13.1m
GW110575	~700m E	14.2	4.3	WBZ 11.5 to 14.2m (2.7m thick); Geology logged as Fill (Sandy Clay) 0.30-2.0m, Gravelly Sand 2-2.5m and then Sandstone 2.5-14.20m

Notes
-: no information provided
m: metres
mbgl: metres below ground level
WBZ: water bearing zone
mg/L: milligrams per litre

2.7 Acid Sulfate Soils

The Australian Soil Resource Information System (ASRIS) indicates that the majority of the Minto Warehouse and Logistics Hub site has no known occurrence of Acid Sulfate Soils (ASS) and shows the majority of the site as located in an area of “Low probability” of ASS

3.0 REMEDIATION REGULATORY REQUIREMENTS

3.1 Contaminated Land Management Act 1997

In NSW, the management of contaminated land is shared by the NSW EPA, the NSW Department of Planning & Infrastructure (NSW DoPI) and planning consent authorities (usually local councils).

Under the *Contaminated Land Management Act (CLM Act) 1997*, the NSW EPA regulates contaminated sites where the contamination is Significant Enough to Warrant Regulation (SEWR). Contaminated sites that are not regulated by the NSW EPA are managed by local councils through land use planning processes (such as change of land use, or some remediation works).

The NSW EPA also administers the NSW Site Auditor scheme under Part 4 of the *CLM Act*. The NSW EPA accredits individuals under the Act as Site Auditors to provide independent review of work conducted by contaminated site consultants.

3.1.1 Guidelines under the CLM Act

Section 105 of the CLM Act allows the EPA to make of approve guidelines connected with the objectives of the CLM Act. These guidelines must be taken into consideration by the EPA and by accredited site auditors when conducting a site audit.

The current list of guidelines made or approved by the EPA under the CLM Act are available on the NSW EPA http://www.epa.nsw.gov.au/clm/guidelines.htm.

The NSW EPA approved guidelines include the national guidance on the assessment of contaminant concentrations on sites is presented in the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (NEPC 2013), herein referred to as the ASC NEPM (NEPC, 2013). The ASC NEPM (NEPC, 2013) present generic Tier 1 trigger values for contaminant concentrations in both soil and groundwater. These are derived based on exposure settings for particular land uses such as low and high density residential; recreational/open space; and commercial / industrial land uses.

As the site is proposed for commercial / industrial purposes it is considered appropriate to compare the results of soil analysis against the investigation levels for commercial / industrial land.

3.2 Environmental Planning and Assessment Act 1979

Under the NSW Government process and staged development approval will be sought under the NSW approvals process as a State Significant Development (SSD) under the *NSW Environmental Planning and Assessment Act 1979 (EP&A Act)*.

3.2.1 SEPP 55 – Remediation of Land

The *State Environmental Planning Policy No. 55 (SEPP 55) – Remediation of Land* under the *Environmental Planning and Assessment Act (EP&A Act) 1979* provides a state wide planning approach for the remediation of contaminated land. In particular, *SEPP 55* provides for Category 1 and Category 2 remediation. Projects classified as Category 1 require development consent.

3.3 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act* 1997 (NSW*) (POEO Act)* is the key piece of environment protection legislation administered by the NSW EPA.

The POEO Act provides a single integrated licensing arrangement to control the air, noise, water and waste impacts of an activity. The NSW EPA is the regulatory authority for the licensing of activities specified under Schedule 1 of the *POEO Act* (scheduled activities) and in most cases councils are the regulatory authority for non-scheduled activities. Licences can also be issued to regulate water pollution from activities that are not in Schedule 1. Such licences can provide protection against prosecution for water pollution if the licence conditions are complied with.

The *POEO Act* also provides the key mechanisms (including the issuing of three types of environment protection notices including: clean-up, prevention and prohibition notices) for protecting the environment. It also provides the regulatory regime for waste management under the Protection of the Environment Operations (Waste) Regulation 2005 (Waste Regulation).

All remediation works completed at the site will be conducted in compliance with the relevant requirements of the *POEO Act*.

3.3.1 Protection of the Environment Operations (Waste) Regulation 2005

The following outlines the required documentation and approvals required for the handling, off site transport and disposal of waste during the remediation works in accordance with the *Protection of the Environment Operations (POEO) (Waste) Regulation 2005* and the *POEO Act 1997.*

The *POEO Act* defines **waste** as:

a) any substance (whether solid, liquid or gaseous) that is discharged, emitted or deposited in the environment in such volume, constituency or manner as to cause an alteration in the environment, or

b) any discarded, rejected, unwanted, surplus or abandoned substance, or

c) any otherwise discarded, rejected, unwanted, surplus or abandoned substance intended for sale or for recycling, processing, recovery or purification by a separate operation from that which produced the substance, or

d) any processed, recycled, re-used or recovered substance produced wholly or partly from waste that is applied to land, or used as fuel, but only in the circumstances prescribed by the regulations, or

e) any substance prescribed by the regulations to be waste.

A substance is not precluded from being waste for the purposes of this Act merely because it is or may be processed, recycled, re-used or recovered.

Waste Classification

Wastes will need to be characterised in accordance with the NSW EPA *Waste Classification Guidelines, Part 1: Classifying Waste* (NSW EPA, 2014a). The following characteristics of the waste must also be determined:

- The form of the waste (the physical state e.g. solid);
- The waste code;
- The waste description; and
- The Dangerous Goods properties (if applicable).

Waste classification is a six step process, which includes answering the following questions:

1) *Is the waste special waste?* – This includes determining if the waste is asbestos waste, which are defined as "Any waste that contains asbestos,"

2) *Is the waste liquid waste?*

3) *Is the waste pre-classified?* – This includes waste gazetted[1] by the NSW EPA in particular pre-classifications, such as building and demolition waste, and virgin excavated natural materials.

4) *Does the waste possess hazardous characteristics?* – Which stipulates a waste must be classified 'hazardous waste' if it is a dangerous good under the Transport of Dangerous Goods Code.

[1] http://www.epa.nsw.gov.au/waste/types.htm

5) *Determine a waste classification using chemical assessment.*

6) *Is the waste putrescible or non-putrescible?*

If an immobilisation approval applies to a waste, a generator who complies with the terms of that approval may classify the waste as set out in the approval, rather than the Waste Classification Guidelines (NSW EPA, 2014a).

Where it can be demonstrated that a specific type of waste can safely be used for another purpose, rather than being disposed of in accordance with the waste regulations, the NSW EPA may grant permission for that waste to be used for the specific purpose, subject to strict conditions. In these cases, the NSW EPA will issue a resource recovery order and resource recovery exemption[2]. These are to be considered within the waste classification process.

Waste Transport Requirements

Under Schedule 1, Part 2 of the *POEO Act 1997* the transport of several classifications of waste in loads exceeding 200 kilograms is declared to be a scheduled activity for which a licence is required. As such the proposed transport of the selected wastes from the site to off-site disposal facilities will require the use of licensed transporters.

Under the POEO (Waste) Regulations 2014 the proximity principle was introduced which makes it an offence to transport waste generated in NSW by motor vehicle for disposal more than 150 kilometres from the place of generation, unless the waste is transported to one of the two nearest lawful disposal facilities to the place of generation.

Waste Tracking Requirements

The *POEO (Waste) Regulation 2005* specifies requirements for the tracking of waste both within NSW and interstate. The wastes that must be tracked are listed in the Schedule 1 of the Regulation (this Schedule includes soil contaminated with waste oil/ water, hydrocarbons/ water mixtures or emulsions).

A NSW EPA on line tracking system is available to track waste that is transported within NSW or into NSW from other states or territories.

Waste Disposal Facilities Licences

Before wastes are transported from the site, it is necessary to confirm that the facility (e.g. landfill/ recycling facility) where the waste is being transported to is legally able to accept the waste. These include facilities licenced to receive and process soils.

Waste Records

If not using an approved on line tracking system records must be maintained of the waste transport certificates for at least four years. The use of the NSW EPA on line tracking system removes the requirement to maintain these records.

3.4 Work Health and Safety Act 2011

The *Work Health and Safety Act* 2011 (NSW) *(WHS Act)* is the key piece of work safety legislation administered by SafeWork NSW and provides the regulatory mechanism for the management of asbestos within NSW. Those specific to the remediation works include, but are not limited to:

- Work Health and Safety Act & Regulation 2011.
- NSW WorkCover Code of Practice – Work Health and Safety, Consultation, Co-operation and Co-ordination, 2011
- AS 1715 - 2009 Selection use and maintenance of respiratory protective devices;

[2] http://www.epa.nsw.gov.au/wasteregulation/orders-exemptions.htm

- AS 1716 - 2012 respiratory protective devices;
- AS/NZS 2161.1:2000 Occupational protective gloves - Selection, use and maintenance.
- AS/NZS 2161.2:2005 Occupational protective gloves - General requirements
- Department of Environment, Climate Change and Waste Classification Guidelines Part 1: Classifying Waste (NSW EPA, 2014a).

4.0 SUMMARY OF PREVIOUS INVESTIGATIONS

Two environmental investigations have been previously carried out at the Proposal site. These reports are summarised in the Table 4 below.

Table 4: Summary of Previous Investigations

Report Title	Summary
Golder Associates April 2016 (Golder, 2016a) Phase I and Limited Phase II Environmental Site Assessment – Minto Warehouse and Logistics Hub, 5 and 9 Culverston Rd, Minto, NSW	This report involved a Phase 1 and Phase 2 investigation. The purpose of the Phase 1 part of the ESA was to provide an interpretation of the site history assessment as they relate to potential environmental contamination. The Phase 2 component was a limited intrusive investigation. Soil samples were collected from twelve on-site locations, includes eight boreholes (GA-BH01-GA-BH08) and four hand auger locations (GA-HA01-04). Four of these boreholes were converted into monitoring wells (GA-HA01-04) and groundwater samples were collected and analysed. The assessment indicated that the concentrations of reported analytes in both soil and groundwater were generally less than guidelines for the protection of human health, and ecological receptors within the nearby fresh water receiving environment. An exception was the elevated concentrations of cadmium and zinc. Cadmium was not reported as an exceedance at the downgradient site boundary, hence the risk to fresh water receptors was considered to be low. The zinc exceedances were reported in groundwater entering site from both the south and eastern boundary, and therefore were likely indicative of natural background conditions. At the time of the investigations Golder were not permitted undertake intrusive investigations in the central portion of the Site.
Golder Associates August 2016 (Golder, 2016b) Detailed Site Investigation Central Precinct (Draft), Minto Warehouse and Logistics Hub, 5 and 9 Culverston Rd, Minto, August 2016.	A detailed Phase II ESA was conducted on the central precinct of the site. Soil samples were collected from eleven boreholes. Groundwater samples were collected from five boreholes that were converted into groundwater monitoring wells. These results were assessed against the guidelines to assess the suitability of the site for the proposed development. The soil analytical results reported exceedances of the NEPM 2013 Management Limit criteria at locations SB6 and MW4 (locations within close proximity to the fuel storage area) and exceedances of the ESL criteria at SB6, however, the ESL exceedances were not believed to be significant enough to warrant further assessment or remediation, when taking the future site use into consideration. The groundwater results reported minor exceedances of the NEPM 2013 GILs of cadmium, zinc and nickel in the groundwater wells as well as exceedances of the NEPM 2013 GILs (fresh water) criteria reported for naphthalene at monitoring wells MW3 and MW4. The report concluded that an assessment of the soil and groundwater quality at nominated locations positioned in the central precinct of the site, indicates that a remediation action plan for soil will be required for the fuel infrastructure area, due to the reported exceedance for the NEPM 2013 Management Limit criteria at two locations (SB6 and MW4) for TRH >C_{10}-C_{16} fraction F2. This remediation action plan should focus on the areas to the north and east of the fuel infrastructure.

Report Title	Summary
	Other than this, the assessment of the soil and groundwater quality at nominated locations positioned around the central precinct of the site indicates that the concentrations of reported analytes in both soil and groundwater were generally less than guidelines for the protection of human health, and ecological receptors within the nearby fresh water receiving environment. An exception was the elevated concentrations of cadmium, nickel, zinc and naphthalene, however, none are expected to present a risk based on future land development.

5.0 REMEDIATION REQUIREMENTS AND EXTENT

The proposed remediation and validation program is based on the identified contamination and the nature of the intended land use, i.e. intermodal facilities and warehousing involving substantial covering of the site with pavements and buildings.

An estimate of the remediation requirement at each area nominated as requiring remediation are presented Section 7. An overview of the remediation area is shown in APPENDIX A (Figure 2).

In summary the following area warranted direct remediation:

- the known aboveground storage tanks (ASTs), petroleum infrastructure and associated hydrocarbon impacted soils;

5.1 Data Gaps

Limited assessment information is available and the following aspects should be assessed further as part of the remediation works;

- the assessment of soil and groundwater directly beneath the fuel storage and related infrastructure

5.2 Contaminants of Potential Concern

The contaminants of interest warranting consideration during the remediation works included:

- Total Recoverable Hydrocarbons (TRH) and Total Petroleum Hydrocarbons (TPH);
- Benzene, Toluene, Ethylbenzene and Xylene (BTEX compounds);
- Lead
- Polycyclic Aromatic Hydrocarbons (PAHs); and
- Phenols

5.3 Remediation Options Appraisal

5.3.1 Regulatory Guidance

NSW EPA's preferred position on the selection of remediation options, as stated in the DEC, NSW (2006) *Auditor Guidelines,* specify the preferred order of options for site soil remediation and management to be as follows:

- On-site treatment of the soil so that the level of contaminant is either destroyed or the associated hazard is reduced to an acceptable level; and
- Off-site treatment of excavated soil, which, depending on the residual levels of contamination in the treated material is then returned to the site, removed to an approved waste disposal site or facility or used as fill for landfill.

Should it not be possible for either of these options to be implemented, the NSW EPA Auditor guidelines specify other options that should be considered as including:

- Removal of contaminated soil to an approved site or facility, followed where necessary by replacement with clean fill (if needed);
- Isolation of the soil by covering with a properly designed barrier;
- Choosing less sensitive land use to minimise the need for remedial works which may include partial remediation; and
- Leaving contaminated material in situ providing there is no immediate danger to the environment or community and the site has appropriate controls in place.

The NSW EPA Auditor guidelines also emphasises that:

- The appropriateness of any particular option will vary depending on a range of local factors; and
- Acceptance of a specific option or mix of options in any particular set of circumstances is a matter for the responsible authority.

5.3.2 Sustainability

The preferred remediation option should preferably incorporate sustainability concepts and principles. In particular it should, to the extent practicable, minimise the requirement for off-site waste disposal. In NSW achieving a reduction in waste generation and turning waste into recoverable resources is a priority for NSW EPA. Waste avoidance and resource recovery is promoted under the Waste Avoidance and Resource Recovery (WARR) Act 2001. An option with a low energy requirement is also preferable.

In summary, an objective of the preferred remediation option should be a net environmental benefit. This should also include consideration of impacts on other segments of the environment and energy consumption, carbon emissions and the conservation of fossil fuels.

5.3.3 Site Specific Constraints

As stated under ANZECC & NHMRC (1992) the appropriateness of a particular option is likely to depend on a range of local factors. For the PA1 the site-specific constraints are identified as those constraints primarily associated with working within a commercial / industrial land use and setting, in particular the requirement to minimise noise, air quality and traffic impacts from the proposed works.

5.3.4 Appraisal Methodology

The appropriate remedial strategy for the site should allow for remediation goals to be achieved. However, there are different options for the remediation area which may be feasible. To establish the most appropriate strategy, a decision making process is required to enable differentiation of different options. The following factors have been adopted to assess the relative merits of potential remedial options:

- Technical feasibility;
- Environmental impact;
- Relative cost benefit;
- Timeframe; and
- Ongoing maintenance requirements.

From assessment of these issues, qualitative comparative analysis has been carried out.

It is important to note that in discussion of remedial strategy, there may be some decisions which are made on the basis of a single parameter. For example, if there is only one technically feasible option then the other factors (such as environmental impact, relative cost benefit and ongoing maintenance) are inconsequential to the selection of remedial strategy. Consequently, not all of these parameters need be assessed in each instance. However, where multiple parameter decisions are required, the above list can be used as an appropriate guideline.

5.4 Possible Remediation Options

The following presents a qualitative review, with consideration to the adopted decision making parameters, of each of the broad remediation activities required on the site. A detailed review of remediation options for each remediation areas is presented in Table 5.

The remediation on the site will be required to either treat or manage the following:

- Hydrocarbon impacted soils;

The preferred remediation option will aim to:

- Minimise the adverse impact on development opportunity by on-site management;
- Maximise the re-use potential of the site materials;
- Minimise long term liability issues associated with the managed material; and
- Remediate/manage in a cost effective manner, the remaining material that cannot be reused onsite.

5.4.1.1 Do Nothing

Within the areas containing hydrocarbon impacted soils, the identified soil contamination concentrations exceed the adopted assessment criteria for the proposed future land use, therefore to achieve the remediation objectives a do nothing approach is not viable.

5.4.1.2 Excavation and On-Site Soil Treatment

Excavation and on-site treatment option is the preferred option of NSW EPA under the remediation hierarchy and subject to the availability of a suitable technology as it presents an opportunity to incorporate sustainability concepts and principles through minimisation of disposal to land fill and beneficial reuse of treated soils.

5.4.1.3 Excavation and Off-Site Soil Treatment

Off-site treatment options for the site petroleum hydrocarbons and lead are proven and commercially available in Australia. The offsite treatment of soils impacted with asbestos are not commercially available within NSW.

The offsite treatment of soils impacted with petroleum hydrocarbons would not allow on-site reuse and would require off-site disposal and as such offers no advantages over the excavation and on-site treatment option. Based on the expected volume of soil impacted with lead, the implementation of an off-site treatment option provides no cost benefit when compared with an off-site disposal option. This option should be re-considered if significant contamination (i.e. Hazardous Waste) is encountered.

5.4.1.4 Excavation and Off Site Disposal

Whilst this option does not satisfy the objective of waste avoidance and resource recovery it is an option which is technically feasible particularly in regards to the lead and asbestos contamination. The merits of this approach also need to be considered in relation to the cost benefits, and should be re-considered if significant contamination, which inhibits on-site treatment is encountered or where capping and containment presents significant imposition to the future development of the site.

5.4.1.5 Consolidation and Isolation of Contaminated Soils

Although this method would be feasible and would meet remediation objectives it may not meet stakeholder expectations. Contamination is not removed or destroyed. Indefinite ongoing environmental management would be required through the implementation of a LTEMP.

The merits of this approach need to be considered in relation to the cost benefits, the potential impacts on future redevelopment (i.e. restriction on land use) and the ability to enforce a LTEMP.

Table 5: Assessment of Remediation Options

Option	Hydrocarbon Impacted Soils	Preferred Option?
Excavation and on site treatment.	***Technical feasibility*** On-site treatment options for petroleum hydrocarbon impacted soils are proven and commercially available.	**Yes – Hydrocarbon impacted soils**

Option	Hydrocarbon Impacted Soils	Preferred Option?
	Landfarming / biopiling activities. Bioremediation will be completed in accordance with the EPA Best Practice Note: Landfarming (NSW EPA, 2014b). ***Environmental impact*** The options maximises the re-use of materials on-site. The on-site treatment process will require management to reduce disruption to surrounding property owners/occupants, and environmental receptors. ***Relative cost benefit.*** This option is considered the most cost efficient. ***Timeframe;*** Treatment is likely to achieve the required project time frame. And there is sufficient space available on the site to complete ex-situ onsite treatment within an area of the site unlikely to impact on the immediate future works on site. ***Ongoing maintenance requirements.*** Subject to successful treatment, no further management is required.	
Excavation and offsite treatment.	***Technical feasibility*** Off-site treatment options for petroleum hydrocarbon impacted soils are proven and commercially available. ***Environmental impact*** The option does not maximise the re-use of materials on-site, and will require offsite transport and disposal of materials reducing the sustainability of the project. Offsite treatment facilities will need to hold appropriate Environmental Protection Licences. ***Relative cost benefit.*** This option is considered the less cost efficient when compared with other options. ***Timeframe;*** Treatment is likely to achieve the required project time frame. ***Ongoing maintenance requirements.*** No further management is required.	No – Hydrocarbon impacted soils
Excavation and offsite disposal.	***Technical feasibility***	No – Hydrocarbon impacted soils

Option	Hydrocarbon Impacted Soils	Preferred Option?
	Off-disposal options for petroleum hydrocarbon impacted soils are proven and commercially available. ***Environmental impact*** The option does not maximise the re-use of materials on-site, and will require offsite transport of materials reducing the sustainability of the project. The offsite disposal of materials is the least preferred approach of the NSW EPA. Disposal facilities will need to hold appropriate Environmental Protection Licences. ***Relative cost benefit.*** This option is considered the least cost efficient when compared with other options. ***Timeframe;*** Offsite disposal is likely to achieve the required project time frame. ***Ongoing maintenance requirements.*** No further management is required.	
Consolidation and isolation.	***Technical feasibility*** An isolation strategy is only appropriate for contaminants which will not present a potential vapour risk to future site occupiers. This option is not suitable for soils impacted with soils impacted with volatile hydrocarbons. ***Environmental impact*** Not considered further due to technical constraints ***Relative cost benefit*** Not considered further due to technical constraints ***Timeframe*** Not considered further due to technical constraints ***Ongoing maintenance requirements*** Not considered further due to technical constraints	No – Hydrocarbon impacted soils

6.0 ASSESSMENT AND VALIDATION CRITERIA

It is noted that the exceedance of an assessment criteria does not indicate that remediation and/or management is necessarily required. Where an exceedance occurs, further investigation and evaluation of conditions is warranted, and these may include undertaking a qualitative assessment of the risks posed by the exceedance, undertaking statistical analysis or undertaking a Tier 2 Quantitative Risk Assessment.

Subsequently, a staged approach will be used in the application of generic Tier 1 Soil and Groundwater criteria as validation criteria:

1) Analytical Results will be screened against the Tier 1 criteria applicable for the intended future land use;

2) Exceedances of the Tier 1 criteria will be qualitatively assessed taking into consideration the risk the exceedance may pose of the future land use (i.e. consideration of an exceedance of an ecological screening criteria for soils positioned within the proposed commercial / industrial development foot print);

3) Exceedances of the Tier 1 criteria will be examined using a range of summary statistics to ensure the analytical data set appropriately represents the source being considered and the exposure being evaluated (refer to Section 4.1);

4) Following the comparison of the analytical data against the generic Tier 1 criteria (including any adopted statistical analysis), a decision will be made in consultation with the Site Auditor as to whether there is value in completing a Tier 2 human health and / or ecological risk (refer to Section 4.2)

As a reference, generic Tier 1 Soil and Groundwater guidelines appropriate for the proposed land uses, and adopted during the site investigation stages, are presented in APPENDIX B.

6.1 Statistical Analysis

An exceedance of the Tier 1 assessment criteria indicates that there is an increased likelihood of an adverse impact on human health or ecological values, however, does not indicated that remediation and/or management is mandatory. The magnitude of the exceedance should be considered in the context of the potential exposure pathway and whether the exposure will results in harm. In accordance with the NEPM (NEPC, 2013), a qualitative risk assessment may be sufficient to evaluate the potential impact of minor exceedances of the Tier 1 assessment guidelines. The qualitative assessment of the classification or validation data would need to be supported by relevant statistical measurements.

The adopted statistical approach may examine a range of summary statistics including the contaminant range, median, arithmetic / geometric mean, standard deviation and 95% upper confidence limit (UCL). However, the adopted approach needs to ensure the metric appropriately represents the source being considered and it is appropriate for the exposure being evaluated (i.e. the statistic should be calculated for the relevant soil unit etc.).

As a minimum, when classifying or validating materials the maximum and 95% UCL of the arithmetic mean contaminant concentration is to be compared to the Tier 1 criteria. However, where there is sufficient data available, and it is appropriate, the arithmetic mean can also be compared with the adopted Tier 1 criteria (NEPC, 2013).

The implications of localised hotspots (i.e. elevated values relative to surrounding data) also need to be considered. To determine whether a hot spot does not exist and the results meet the following criteria (i.e. should the following not be met, a hot spot may be present):

- The standard deviation of the results are less than 50% of the relevant investigation or screening level; and
- No single value exceeds 250% of the relevant criteria.

6.2 Tier 2 Human Health Risk Assessment

Following the comparison of the analytical data against the generic Tier 1 criteria (including any adopted statistical analysis), a decision will be made in consultation with the Site Auditor as to whether there is value in completing a Tier 2 human health and / or ecological risk assessment or if the exceedances warrant additional specific remediation / or management actions. In accordance with the NEPM (NEPC, 2013) the response will be determined on an area specific basis and will be proportional to the potential risk posed to human health and/or the environment. Where appropriate the Tier 2 human health risk assessment will include the derivation of site specific trigger values (SSTLs), which will be adopted as the Remediation and / or Validation Criteria.

7.0 REMEDIATION AND VALIDATION ACTIVITIES

We note that the terms of "remediation" and "management" in the context of this document refer to actions required to either treat material, remove it offsite or to isolate it on-site to provide an acceptable risk outcome for the proposed land uses. The context of "management" is also inclusive of administrative controls put in place during development and construction to ensure the risks posed by contamination are appropriately managed.

7.1.1 Fuel Infrastructure Removal and Contaminated Soil Excavation

The fuel infrastructure identified on the site includes aboveground storage tanks [USTs], fuel lines, bowsers, POLs and other petroleum related infrastructure is to be removed and the associated soil contamination remediated as part of the remediation works.

Removal works will be undertaken by an experienced licensed subcontractor. The USTs and associated infrastructure shall be decommissioned and removed, and shall be undertaken (as appropriate) in accordance with the following guidance documents:

- WorkCover's Factsheet 3_1 Dangerous Goods Abandoning Disused Underground Tanks;
- Standards Australia (2008). AS4976-2008. The removal and disposal of underground petroleum storage tanks;
- Clause 204 (2) of the *Work Health and Safety Regulation 2011*: Control of risks arising from installation or commissioning; and
- UPSS Technical Note: Decommissioning, Abandonment and Removal of UPSS.

The location and nature of the identified underground storage infrastructure are summarised in Table 6 and are shown on Figure 4 (Appendix A). The following is to be implemented at each location:

1) The ASTs, pipe work and above ground infrastructure are to be emptied (if required), degassed and removed for off-site disposal for recycling to an appropriately licensed facility.

2) Where ASTs and/or pipework cannot be removed immediately off-site, they will be temporarily placed on hardstand or plastic sheeting to mitigate the potential risk of contamination.

3) Photographic records of the condition of each of the tanks and fuel lines or pipe work are to be collected by the Environmental Consultant to assist in identifying potential contaminant sources within the area.

4) Soils will be excavated to facilitate the removal of the underground fuel infrastructure. Soil excavation works will be guided by the Environmental Consultant and excavated materials will be visually inspected and head space screened in the field with a portable photo-ionisation detector (PID) for the presence of volatile petroleum hydrocarbon contamination.

5) Upon removal of the fuel infrastructure the open excavations will be visually inspected and additional excavation of hydrocarbon impacted soils will be undertaken as required to the extent practicable. Excavations will be extended until field observations (visual inspection and PID readings) indicate that contaminated soil above the adopted site remediation criteria (refer Appendix C) is likely to have been removed.

6) Excavation is generally anticipated to extent approximately 0.5m below the lowest depth of the tank and or contaminated soils. Grossly impacted soils observed to extend below this depth will be excavated to the extent practical, to mitigate potential risks to groundwater beneath the site.

7) The depth and extent of excavations will be continued until validated by the Environmental Consultant or until practicable limits of excavation are reached. The practicable limit of excavation will be evaluated by consideration of:

    a. Geotechnical constraints associated with excavation safety and excavation stabilisation requirements (e.g. benching, shoring);

b. Geotechnical constraints associated with potential effects on nearby infrastructure; and

c. Structural constraints if the excavation extends to close proximity of roadways/footpaths, buildings, below ground services/conduits. This may be of particular concern if 'chasing out' contaminated materials extends towards adjoining buildings.

8) Excavated soils will be treated onsite through bioremediation (refer to Section 7.1.2).

9) If required, prior to treatment the excavated materials will be placed in designated stockpile areas comprising a paved surface or plastic sheeting to provide a separation layer between potentially contaminated soils and surface soils. Stockpiles will be covered to mitigate generation of dust or impacted surface water runoff.

10) Excavations will be maintained in accordance with WorkCover, NSW (March 2000) Excavation Work, Code of Practice.

7.1.1.1 Validation of AST Pits and Petroleum Infrastructure Excavations

Excavation validation soil sampling will be carried out to confirm that contaminated soil has been removed, or to assess residual concentrations. The walls and bases of the excavations will be validated through the collection of representative soil samples to identify the presence of residual contamination. The excavations will be left open and fenced to prevent access until analytical validation results have been obtained and confirm acceptable residual concentrations of contaminants of concern.

Validation samples will be collected in accordance with the EPA *Technical Note: Investigation of Service Station Sites*, and will include the following sampling requirements:

- Tanks – minimum of two samples per tank pit or footprint, with samples collected from the each tank pit wall and floor, with samples recommended to be taken at or below the base of the tanks;
- Backfill Sands – minimum two samples (though may not be necessary, if backfill sands are found to be unaffected);
- Tank Pit water – minimum one sample;
- Dispensers – minimum one sample in backfill and one sample in natural soil;
- Fuel lines – minimum one sample every 5 lineal metres;
- Remote Fill Points – one sample per fill point (not expected to be required, as tanks observed during the Audit had direct fill points);
- Above ground fuel storage (POL, and drum stores etc) – minimum one sample per 25m^2; and
- Below ground waste oil/ wastewater tank – minimum two samples per tank.

Upon receipt of validation sample results confirming that concentrations of residual contamination are below the adopted criteria (refer to Appendix C), the excavations will considered validated and nominated for backfilling.

7.1.2 Bioremediation / Landfarming

Bioremediation will be undertaken, and the treatment process will be completed in accordance with the EPA *Best Practice Note: Landfarming* (NSW EPA, 2014b). In general the process will involve spreading the materials in a thin layer, and stimulating the aerobic microbial activity within the soils through aeration and/or addition of nutrients and moisture.

The treatment process will be determined on a batch process, taking into consideration the baseline condition of the soils being treated. The initial assessments will include characterisation of

- the contaminant mass;

- the moisture content;
- the nutrient levels;
- the geochemical parameters including temperature, pH, oxygen etc

The initial assessment will then be used to determine how often the materials require aeration and whether there is a requirement for additional nutrients. The progress of the treatment process will be assessed with consideration of rate of carbon dioxide production, and biodegradation rates. Treated materials will then be validated in accordance with the validation criteria presented in Appendix C.

7.1.2.1 Landfarm Surface Preparation

Prior to placement of materials within a landfarm, the proposed treatment area will be prepared by:

- Establishing stormwater diversion around the landfarm areas;
- Establishing a leachate collection system for the landfarm areas.

Each landfarm must have a unique identifier and appropriate signage as part of the Materials Tracking Plan.

7.1.2.2 Landfarm Management

The treatment process will be managed such that there is no unacceptable off-site impact as a result of treatment process. As a minimum, this will include t:

- Generally create landfarms which are not less than 250 m^3 in volume and not greater than 2,500 m^3 in volume, with materials generally placed < 0.3 thick.
- Manage all landfarms to minimise the generation of dust, unacceptable odours or release of volatile emissions, control leachate and stormwater;
- Record the movement of all material into and out of the any landfarm in accordance with the requirements of the Materials Tracking Plan;
- Manage all stormwater in the vicinity of any landfarm to minimise the volume of water coming into contact with the stockpiles;
- Line all landfarms at the base and cover them with plastic sheeting or other approved material to minimise contamination of surface soils and leachate generation,
- Manage all volatile emissions using covers, structural enclosures, and abatement techniques to ensure emission present no health risks and achieve compliance with air quality standards;
- Manage and maintain landfarms of different material types separately during the classification process; and
- Manage leachate from any in accordance with the CEMP;

7.1.2.3 Landfarm Validation / Classification

Validation / Classification testing will be undertaken by the Environmental Consultant in accordance with the following:

- All landfarms must be validated;
- Classification / validation testing will be undertaken by the Environmental Consultant in accordance with validation sampling process presented in this RAP;
- Classification sampling will be collected from the land farm materials at the following sampling frequency:
  - One test per 25 m^3 for soils assessed for volumes less than 200 m^3; or

  - The use of the 95% UCL value for the data set from each stockpile, with a total number of samples of not less than 10 collected from each stockpile (e.g. for a maximum size stockpile of 2500m^3, the sampling frequency of one test per 250m^3 will be adopted).
- Classification samples will be collected in accordance with the method described in Section XXX.
- Laboratory analytical results will be compared to the adopted screening criteria for suitability for reuse or off-site disposal as applicable (refer to Section 6.0 and Appendix B).

8.0 VALIDATION METHODOLOGIES

The validation works will require the implementation of a range of field investigation methodologies. The following provides a description of the methodologies that will be implemented during the works.

8.1 Pre-site works / Surveying

The following works will be undertaken by the Environmental Consultant prior to the site works commencing:

- Site inductions, including attendance of the site inductions required by the Remediation Contactor.
- Consultation with site stakeholders, as required.
- Initial remediation area survey using a GPS and pre-marking the proposed remediation area locations will be undertaken in consultation with the Remediation Contractor. The Remediation Contractor will be responsible for the identification and isolation of underground services within each remediation area.

8.2 Excavation Sampling

The following works will be undertaken for excavation sampling:

- Excavation walls and materials excavated from remediation areas shall be logged in detail including the description of fill materials, soil types and the presence of absence or indicators of contamination (such as staining, odour, unusual colours, or ACM) and photographed with a linear scale indicating depth.
- Field screening of collected samples utilising a photo ionisation detector (PID). The PID will be calibrated daily, in accordance with the manufactures instructions. PID samples will comprise of an approximately equal volume of soil, placed in individual a ‘zip lock’ plastic bags and will be allowed to equilibrate to ambient temperature before being screened. Water vapour filters will be used, and the presence of moisture in the sample bag noted during sampling.
- Samples will be collected directly from the bucket of the excavator. Soil samples from the walls of excavations will be applied to each depth unit within each excavation with a minimum of one validation sample per exposed face or per 10 m length of exposed face for every one metre depth of each depth unit will be collected.
- Where a change in geological profile, subjective impacts or PID field screening reports potential volatile organic compounds additional samples will be collected, if possible.
- The sample jars will be placed in a cool box filled with ice and delivered to NATA registered laboratories under Chain of Custody (COC) procedures. If warranted, couriers will be arranged to collect samples at 3 pm on Monday to Thursday and at 2 pm on Friday to meet the short holding time of some analytes.
- Test pits, if completed, will be backfilled upon completion with backfill material compacted using the bucket of the backhoe in layers not more than 300 mm thick. Excess spoil will be mounded over the test pit. The backhoe will be used to track over the test pit mound to aid in compaction. Where possible, the upper turf layer will be repositioned over the completed test pit to enable rapid site regeneration. Where required, additional non-invasive grass seeds will be spread over the test pit mound to enable rapid site regeneration.
- Remediation excavations will be back filled upon receipt of validation sample results confirming that concentrations of residual contamination are below the adopted criteria (refer to Section 6.0 and Appendix B), and the excavations is be considered to have been validated.

8.3 Stockpile / Landfarm Sampling

The following works will be undertaken for stockpile / Landfarm sampling:

- Stockpile materials excavated from remediation areas shall be logged in detail including the description of fill materials, soil types and the presence of absence of indicators of contamination (such as staining, odour, unusual colours, or ACM) and photographed with a linear scale indicating depth.

- Field screening of collected samples utilising a photo ionisation detector (PID). The PID will be calibrated daily, in accordance with the manufactures instructions. PID samples will comprise of an approximately equal volume of soil, placed in individual zip lock bags and will be allowed to equilibrate to ambient temperature before being screened. Water vapour filters will be used, and the presence of moisture in the sample bag noted during sampling.
- Where the Environmental Consultant has observed the excavation, transport and placement of the stockpile and is confident the materials within the stockpile are uniform, from a single source and the sampling is occurring immediately following placement. Samples will be collected directly from the stockpile, by hand excavation to 0.1 m into the stockpile;
- Where the Environmental Consultant has not observed the generation of the stockpile samples will be collected with an excavator, or by hand excavation into the middle of the stockpile.
- The sample jars will be placed in a cool box filled with ice and delivered to NATA registered laboratories under Chain of Custody (COC) procedures. If warranted, couriers will be arranged to collect samples at 3 pm on Monday to Thursday and at 2 pm on Friday to meet the short holding time of some analytes.

8.4 Nomenclature

All samples collected should will unique identification that facilitates tracking and cross-referencing of sample information. This will also include QA/QC samples that are uniquely numbered. Further details are provided in Appendix B.

8.5 Laboratory Analysis

Sample analysis will generally be completed using NATA registered methods (where available) and in accordance with Schedule B(3) of the ASC NEPM 2013.

8.6 Quality Assurance and Quality Control

It is important that the data collected in the proposed site remediation validation program is of a quality suitable to meet the objectives of the validation works. Possible sources of error in the collection of soil and soil vapour data can arise in the collection, handling and analysis of samples. An effective field QA/QC program aims to minimise these sources of error and increase the reliability of the results. Details of the QA/QC program are provided in Appendix D.

Table 6: Fuel Storage and Related Infrastructure Remediation Areas

Identification	Reported Impacts	Delineation	Uncertainties	Discussion
AST #1 'DIESEL' (Refer to APPENDIX A, Figure 3)	TRH>C10-C16 (F2) detected at MW4 and SB6 (see APPENDIX A, Figure 2)	Vertical – at SB6, TRH is detected at 0.1 and 1.0 Lateral – TRH detected north (MW4) and east of this AST (SB6). Hydrocarbon odours encountered in soil stockpile north of the ASTs during site inspection (labelled 'Stockpile' in APPENDIX A, Figure 3).	Limited information on lateral delineation extent. Limited information on soil impacts below the fuel infrastructure.	The area around the tanks is bunded. Tank length is ~5000L and has the label 'DIESEL' on it. There is a bowser to the east of it, labelled 'DIESEL' used to supply small quantities of fuel to on-site vehicles. The tank is currently in use (as stated by staff at the time of the site visit). Pictures featured below. 

Identification	Reported Impacts	Delineation	Uncertainties	Discussion
				
AST#2 'KEROSINE' (Refer to APPENDIX A, Figure 3)	TRH>C10-C16 (F2) detected at MW4 and SB6 (see APPENDIX A, Figure 2)	Vertical – at SB6, TRH is detected at 0.1 and 1.0 Lateral – TRH detected north and east of this AST. Hydrocarbon odours found in soil stockpile to the north of the ASTs 9 during site inspection (labelled 'Stockpile' in APPENDIX A, Figure 3).	Limited information on lateral delineation extent. Limited information on soil impacts below the fuel infrastructure.	The area around the tanks is bunded, currently not in use (as stated by staff at the time of the site visit). Tank capacity is ~5000L and has the label 'KEROSINE' on it. There is a bowser to the east of it (labelled 'PETROL') used to supply small quantities of fuel to on-site vehicles. Pictures featured below.

Identification	Reported Impacts	Delineation	Uncertainties	Discussion
				 
AST#3 'UNLEADED' (Refer to APPENDIX A, Figure 3)	TRH>C10-C16 (F2) detected at MW4 and	Vertical – at SB6, TRH is detected at 0.1 and 1.0	Limited information on lateral delineation extent.	Tank capacity is ~5000L. The area around the tanks is bunded, currently in use (as stated by staff at the time of the site visit).

Identification	Reported Impacts	Delineation	Uncertainties	Discussion
	SB6 (see APPENDIX A, Figure 2)	Lateral – TRH detected north and east of this AST. Hydrocarbon odours found in soil stockpile to the north of the ASTs 9 during site inspection (labelled 'Stockpile' in APPENDIX A, Figure 3).	Limited information on soil impacts below the fuel infrastructure.	The tank is below ground level and sunk into an uncovered concrete-lined storage vessel and labelled 'UNLEADED.' Pictures featured below. 

Identification	Reported Impacts	Delineation	Uncertainties	Discussion
				

9.0 ROLES AND RESPONSIBILITIES

9.1.1 General

The implementation of this RAP is the responsibility of the site owner (Qube).

9.1.2 Superintendent

The Superintendent's responsibilities include contract administration, quality control and compliance. The Superintendent's responsibilities also include liaison with stakeholders, including the Environmental Consultant, the Accredited Environmental Site Auditor and the EPA.

9.1.3 Environmental Consultant

The Environmental Consultant's responsibilities include:

- undertaking additional soil and groundwater assessment as required to validate the completed site remedial/management activities;
- supporting the Remediation Works, including by:
    a) providing on-site technical advice and management;
    b) undertaking investigation programs in areas previously inaccessible;
    c) undertaking validation testing and reporting;
    d) undertaking validation of excavations;
    e) stockpile validation and classification;
    f) site observations with respect to materials associated with remediation and other earthworks; and
    g) providing technical assistance to the Contractor, as required.
- upon completion of on-site Remediation Works, preparing a Remediation and Validation Report (RVR); and
- as requested assisting liaison with the Remediation Contractor, EPA or Local Council.

9.1.4 Remediation Contractor Responsibilities

The Contractor’s responsibilities include:

- obtaining all permits and Approvals to complete the remediation of the site, including those associated with excavation and disposal of contaminated soil from the site;
- development and compliance with and implementation of the approved Site Management Plans, Work Health and Safety Plan, Construction Environmental Management Plan (inclusive of the EOW and UXO, Asbestos, Heritage, Flora and Fauna, and Acidic Soils Management Plans), Quality Assurance Plan, Materials Tracking Plan and other management plans developed during the Remediation Works;
- implementation and compliance with the Materials Tracking System;
- achieving Remediation Completion in accordance with the requirements of the:
    a) Contract;
    b) the Specification;
    c) Drawings; and
    d) all other documents which form part of the Contract;
- completion of works as required by the Contract Administrator;

- gaining acceptance from the receiving landfill for material disposed off-site, based on the information provided by the Environmental Consultant. The Contractor must supplement this information including by providing additional sampling where required by the receiving landfill;
- full cooperation with all relevant consultants, subcontractors and Other Contractors on the Project
- collation and provision of all transport and disposal documentation related to off-site disposal of soils classified by the Environmental Consultant; and
- earthworks conformance testing for all site filling and operations in accordance with the required Earthworks Specification.

10.0 ENVIRONMENTAL MANAGEMENT

The following sections of the RAP outline the general environmental controls to be adopted to protect the environment both on-site and immediately surrounding the site. The controls aim to protect surface water, groundwater and air quality, cross contamination and to control odour, noise and vibration levels by preventing the release of dusts, contaminated soils, contaminated sediments and contaminated water to the extent practicable. Where visual observations or monitoring indicates unsatisfactory performance, then work methods and/or controls will be modified.

It is expected that the Contractor will prepare a Construction Environmental Management Plan (CEMP) for the works which will provide site specific environmental controls and will also stipulate the actions to be taken should additional contamination be identified during the development of the site (i.e. an unexpected finds protocol).

10.1 Environmental Aspects

Elements of the proposed works that can interact with the environment are termed ‘environmental aspects’. For the proposed works, these are identified as broadly including the following:

- Surface water and groundwater discharge;
- Dust/vapour emissions;
- Noise emission and vibration;
- Odour;
- Waste haulage;
- Fuel/oil leaks/spills; and
- Spillage of contaminated materials.

10.2 Environmental Controls

10.2.1 Site Access and Traffic

During the works traffic entering and exiting the site will be limited to the Contractors vehicles, remediation equipment (e.g. excavators) and trucks removing waste materials to off-site waste management facilities. The frequency and timing of truck movements will be a function of staging of the works by the appointed Contractor. A traffic management plan will be documented by the Contractor prior to the commencement work with due consideration given to designated routes for trucks to travel on. Heavy machinery will be utilised for the remediation works. These vehicles will be stored on site during the remediation phase.

Given the duration of the works and material to be removed from the site, it is considered that there will be a negligible impact on traffic conditions in the area. It is considered that any potential impact will be further managed and minimised with the implementation of the proposed mitigation measures.

- Traffic movements will be planned to minimise impacts to traffic flow in the vicinity of the site. Where possible, and subject to the staging of the works, one entry and one exit point will be utilised to avoid the need for vehicles turning on site;
- Public access to the site will be restricted by means of security fencing. Fencing will be covered with shade cloth;
- Hours of operation will be restricted to mitigate traffic and parking impacts on neighbours;
- The timing of truck arrivals shall be planned and coordinated to avoid congestion and excessive truck queuing / idling;
- Off-site parking is not expected to be required;

- There will be limited disturbance of site surface cover and therefore off-site tracking of sediment and soil is not expected to occur. Good housekeeping practices will be implemented and inspections will be undertaken. Identified sediment will be removed by sweeping;
- All loads will be covered except during loading and unloading activities; and
- Licenced transports will be engaged for the haulage of waste materials.

10.2.2 Surface Water, Erosion and Sedimentation

The nearest water course to the site is the Bow Bowing Creek to the west of the site. The river flows to the north. Potential impacts from the remediation works to local surface water are expected to be limited. The potential for increased sediment load or pollutant load from site run-off will be managed by erosion and sediment controls. The erosion and sediment control will be implemented by the appointed Contractor. Mitigation measures will include the following:

- Establishment of erosion and sediment measures prior to works commencing on the site and regular inspection and maintenance to confirm measures are in a functional condition throughout the works;
- Disturbance of site surface cover will be minimised where possible to reduce the potential for off-site tracking of sediment and soil;
- All site exits will remain paved during the works and truck tyres will be inspected prior to leaving site;
- The work areas will be enclosed within a sediment fence, erected on the down gradient perimeter of the works areas. The controls will ensure all run-off leaving the site is sediment-free;
- On-site stormwater inlets and kerb inlets will be protected using inlet filter devices;
- Good stockpile management practices will be put in place and stockpiled material will be stored within appropriate environmental controls (i.e. covered where practical) and outside of drainage lines;
- Should water accumulate in excavations across the site this will be treated as potentially contaminated water; and
- Maintenance on all stockpile control measures will be carried out on a daily, and during and following major storm events. Maintenance will be logged.

10.2.3 Groundwater and Seepage Water

Groundwater which accumulates within excavations must not be discharged directly to stormwater or surface water.

Groundwater beneath the site is encountered within sandy clay between approximately 3 and 3.5m depth, and subsequently may be encountered during the proposed UST excavations. However, groundwater in the vicinity of the USTs has been impacted with residual naphthalene concentrations above the ANZECC 95% protection levels for fresh water receiving environments. Subsequently, the impacted groundwater may present a possible risk to the receiving environment (Bow Bowing Creek) if the groundwater is discharged directly to stormwater.

The volume of water likely to accumulate within the excavation will be subject to the size of the excavation, the requirement for the excavation to be kept dry, and the duration the excavation is held open. However, given that groundwater was encountered at between 3 and 3.5m depth in sandy clay soils, a significant volume of water is not expected. The following general management approaches are presented, the first of which is the preferred approach. Should significant volumes of water be encountered, a more specific treatment design may need to be developed and implemented during the remediation works.

- ***Offsite Treatment and Disposal*** - Groundwater which accumulates within the UST excavation is pumped out and disposed at a licenced liquid waste facility by a licenced liquid waste transporter; or

- ***Onsite Treatment and Disposal as Trade Waste*** – Groundwater which accumulates within the UST excavation is pumped out and disposed to sewer as Trade Waste under an appropriate Sydney Water Trade Waste agreement. A trade waste agreement typically requires pre-treatment by an approved treatment device, and the final treatment method would be determined by the conditions imposed by Sydney Water through the trade waste agreement. Typical pre-treatment devices include but are not be limited to;
  - Oil / Water Separators;
  - Air Strippers; and
  - Granulated Activated Carbon drums.

There is potential for the groundwater to be treated and discharged to stormwater, however, such an approach is not recommended due the potential risks associated with discharging the groundwater directly to the receiving environment (Bow Bowing Creek). Furthermore, this approach would require additional approvals from the consent authority prior to implementation.

10.2.4 Air Quality

Due to the nature of the work there is potential that dust and odours will be generated for a short period of time during the works. Other short term impacts may exist in relation to increased exhaust fumes from equipment.

With the management of potential air quality impacts in accordance with the proposed mitigation measures, it is considered that local community impacts will be minimised. Potential impacts will be managed by good work practices, including:

- Trucks and construction plant entering the site should be well maintained in accordance with the manufacturer's specification. Vehicles with smoky exhausts (more than 10 seconds) shall be stood down for maintenance;
- Unnecessary idling for trucks and plant shall be avoided with engines turned off during periods of inactivity;
- All equipment shall be maintained in good working order;
- Dust retardant/ water spray will be used to prevent dust lift-off where necessary;
- Minimisation of number of stockpiles;
- Stockpiles of soil will require to be covered if remaining on-site for more than 24 hours;
- All dust generating loads will be covered except during loading and unloading activities; and
- Cessation of relevant works under adverse meteorological conditions such as high winds.

10.2.5 Odour Management

The objective of odour management is to control odours generated from the proposed works, and ensure minimal adverse impact on the air quality of the local area. There is potential that the excavation of hydrocarbon impacted soils during the remediation works may expose odorous materials/ volatile organic vapours.

Odour control measures will include, but not be limited to:

- During excavation of potentially contaminated materials a portable PID will be used to assess potential elevated volatile organic vapour concentrations;
- The area of contaminated soils exposed at any one time be minimised wherever possible by a localised staged program;

- Covering exposed surfaces, as required;
- Adequate maintenance of equipment and machinery to minimise exhaust emissions; and
- Conduct regular odour monitoring by olfactory observations.

10.2.6 Noise

The remediation works are likely to cause an increase in noise during the period of work (estimated to be approximately three to four weeks). With the management of noise in accordance with the proposed mitigation measures, it is considered that local community impacts will be minimised. Noise impacts will be managed by the following mitigation measures:

- Hours of operation will be restricted to 7:30 am to 6:00 pm from Monday to Friday, 8:00 am to 2:00 pm on Saturdays and at no time on Sundays and public holiday;
- The works will take place over a relatively short period of time;
- Where possible, the distance between noisy machinery and sensitive receptors will be maximised and noisy equipment/machinery will be oriented away from sensitive areas.
- Equipment will be well maintained;
- Unnecessary idling for trucks and plant shall be avoided with engines turned off during periods of inactivity (e.g. during loading);
- Remediation work will be carried out in accordance with this Work Plan, a copy of which will be located on site at all times during the works; and
- Complaints regarding excessive noise will be investigated and addressed appropriately.

10.2.7 General Waste Management

Works will include the implementation of measures to limit the need for waste disposal and the environmental impacts of waste. The Principle Contractor shall be responsible for safely handling, segregating and temporarily stockpiling wastes on the site. The proposed waste management approach is as follows:

- Waste materials generated on site will be managed so that the volume of waste transported to landfill is minimised;
- Wastes will be characterised and properly disposed of in order to minimise the potential for impacts to the environment; and
- Disposal of all contaminated soils is to be tracked by the Contractor and correlated with the waste disposal site operator's landfill records. This information will be provided to Golder for inclusion in the Remediation Validation Report.

10.2.7.1 Off-site Waste Disposal

If waste is required to be transported, it must be to a licensed off-site disposal facility licensed to accept such material. Material to be disposed off-site may include soil/fill impacted with concentrations of COPC in excess of the site remediation validation criteria.

All waste will be transported by a transporter licensed to transport the material and will have notified the licensed receiving landfill (or storage facility) of the type and quantity of each load of material being received. Each load of waste is required to be sealed at all times. Copies of all consignment authorities for each load will be retained in accordance with the *POEO (Waste) Regulation 2005.*

10.2.7.2 Waste Recycling

Where possible, buildings materials and concrete will be forwarded for recycling to an appropriately licenced recycling facility.

10.3 Environmental Control Performance Monitoring

10.3.1 Site Inspection Program

Regular site inspections will provide quantification of the effectiveness of the safeguards recommended. It will also enable auditing of the safeguard measures to ensure they achieve their objectives and to facilitate modification where necessary.

Site inspection will be undertaken during remediation in the following areas:

- Inspection of trucks used for transporting materials from the site to ensure that soil adhering to the wheels or undercarriage is minimised. Any accumulation of soil will be removed prior to departure from the site;
- Sedimentation control measures will be inspected weekly and after heavy rain. This will involve checking the sedimentation control structures are operating effectively, with no silt being discharged to stormwater. Corrective action will be instituted where necessary and a follow up inspection will be undertaken to verify the outcome of the corrective action;
- Inspection of soil segregation, stockpiling, testing and validation procedures and records; and
- Observation of site activities to assess the extent of dust generation from the work site.

Should routine site inspections and/or external parties identify a potential issue relating to the remediation works, potential issues will be logged, validated and where required, rectified.

10.4 Contingency Planning

10.4.1 Emergency Response Plan

An Emergency Response Plan will be prepared prior to the commencement of the remediation works. The purpose of the plan will be to identify possible emergency situations and to define procedures that would be used to ensure the safety of both on- and off-site personnel in the event of an emergency.

Emergency events may include but are not limited to:

- Oil or other contaminant spillage;
- Fire;
- Failure of any control structures; and
- Industrial accident.

In order to ensure that the environmental impact of such events is minimised, emergency procedures are to be followed. These may include:

- The first priority is the safety of any persons either workers or others involved in the events. Whatever reasonable actions necessary to protect the safety of potentially affected persons will be taken. The site-specific Health and Safety Plan (HASP) will outline actions to be taken in relation to safety of persons, if these circumstances eventuate.
- The second priority is to quickly minimise the environmental damage. All emergency action should take place as soon as possible after the event. Actions to be taken may include:
  - The containment of pollution by booms, silt fences or other means. Supplies of all pollution control equipment, as listed in the Contractor's EMP, should be maintained on site by the Contractor;
  - The temporary re-establishment of the control structure; and
  - The taking of appropriate samples to assess the extent of the problem.

In the event of an emergency situation arising, the Site Owners site representatives will be contacted immediately after all persons are accounted for and all possible immediate actions to control the pollution have been taken.

10.4.2 Contingency Management Plan

Table 7 below summarises conditions that can reasonably be expected and the resulting problems they may cause, and how these problems may be resolved within the context of the works.

Table 7: Contingency

Anticipated Problem	Corrective Action by Contractor
Further contamination identified	Stop work, notify the Environmental Consultant and Principal. Manage in accordance with remediation objectives and strategy.
Excessive rain/drainage	Cover exposed surfaces with plastic; or stop work until run-off is more manageable. Inspect and maintain sediment controls.
Excessive dust	Use of local and perimeter sprays, soaking of excavation areas, mobile sprays, covering with geofabric, monitoring of weather conditions or ceasing activity.
Equipment failures	Maintain spare equipment or parts; or maintain alternate rental options; or shut down affected operations until repairs are made.
Release of fuel/oil from machinery	Remove source, use spill kit to remove oil and make any repairs as required.
Silt fence fails	Stop work and repair fence to specifications.
Excessive noise	Identify source and review noise attenuation equipment and as necessary provide silencers on noisy equipment. Change work hours.
Excessive odours	Monitor for volatiles using PID in worker breathing zone and at boundary with residential properties (south of site). Use odour and volatile suppressing agents to eliminate or reduce odours as required.
Encounter suspected asbestos	Stop excavation and cover area. Notify the Principal, Environmental Consultant and Industrial Hygienist. Asbestos classification and management to be conducted by a suitably qualified/licensed contractor.

10.4.2.1 Unexpected Finds Protocol

It is possible that workers may unexpectedly encounter unexpected contaminated materials. The adverse conditions which may warrant additional assessment include;

- highly malodours soils or seepage water (e.g. strong residual petroleum odours);
- hydrocarbon sheen on surface water;
- discoloured chemical deposits or soil staining with chemical waste other than of a minor nature;
- large monolithic deposits of materials (e.g. gypsum as powder, or plaster board);
- presence of putrescible refuse including material that may generate hazardous levels of ground gases (e.g. methane) such as large quantities of green waste or timber waste; and
- presence of objects which may indicate the presence of chemical contamination, such as drums, tanks or other such storage items.

The immediate response should be on preventing the disturbance of material, while protecting workers in the immediate area and any surrounding receptors from potential exposure. The following procedure should be followed if unexpected contaminated materials are encountered.

1
- **STOP WORK**
- Fit appropriate PPE.
- Notify Superintendent and EC.
- Delineate the work are to prevent entry by others.

2
- Is the materal asbestos? If so wet the area down and cover to prevent the release of fibres and /or dust.
- Superintendent to install appropraite environmental controls (refer to Section 9.2), including stormwater, sediment, odour and vapour controls.
- EC to undertake assessment in accordance with this RAP and EPA Guidelines.

3
- If materials assessed as presenting an unacceptable risk, EC to forumulate remedaition approach in consultation with Site Auditor and Superintendent.
- EC to supervise remediation and undertake validation in accordance with the objectives of this RAP.
- EC to submit assesment / validation to Superintendent, Site Manager and Site Auditor at completion of validation works.

11.0 OCCUPATIONAL HEALTH AND SAFETY

A site-specific Health and Safety Plan (HASP) incorporating the safe work method statements will be prepared in accordance with the requirements of WorkCover, NSW. The implementation of the HASP will be the responsibility of Contractor during the works. At a minimum the plan shall include:

- Details of health and safety programme including an induction process for all personnel working on the site, as well as incident management and reporting plans;
- Safe work method statements (SWMSs) and/or Job Safety Analyses (JSAs);
- Emergency phone numbers;

- A map showing the shortest route to nearby hospitals or health centres;
- Daily toolbox meeting content and procedures;
- Definition of roles and responsibilities of personnel, including staff and subcontractors;
- Hazard identification procedures and control measures;
- Material safety data sheets;
- Soil, water and material handling procedures;
- Personal protective equipment requirements;
- Occupation health monitoring;
- Decontamination procedures; and
- Incident management.

Site workers and visitors shall be trained on the contents of site-specific health and safety plan prior to entry to the site.

12.0 VALIDATION REPORTING AND FUTURE SITE MANAGEMENT

12.1 Validation Reporting

A Remediation Validation Report will be prepared in general accordance with the requirements of the NSW EPA (1997[3]) Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites and the DEC, NSW (2006) Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (2nd Edition) (the Auditor Guidelines).

All field information and analytical data will be presented in the Remediation Validation Report.

[3] Reprinted 2011

13.0 IMPORTANT INFORMATION RELATING TO THIS REPORT

Your attention is drawn to the document titled - “Important Information Relating to this Report”, which is included in Appendix E of this report. The statements presented in that document are intended to inform a reader of the report about its proper use. There are important limitations as to who can use the report and how it can be used. It is important that a reader of the report understands and has realistic expectations about those matters. The Important Information document does not alter the obligations Golder Associates has under the contract between it and its client.

14.0 REFERENCES

ANZECC 2000	*Australian and New Zealand Guidelines for Fresh and Marine Water Quality;* Australian and New Zealand Environment and Conservation Council and Agriculture and Resources Management Council of Australia and New Zealand, 2000.
ANZECC/NHMRC 1992	*Guidelines for the Australian and New Zealand Assessment and Management of Contaminated Sites*
CLEP 2014	*Campbelltown City Council Local Environment Plan (2014)*
ASRIS 2016	*Australian Soil Resource Information System, Geoscience Australia, http://www.asris.csiro.au/mapping/viewer.htm, retrieved April 2016.*
CRC 2011	*Technical Report No. 10 HSLs for petroleum hydrocarbons in soil and groundwater;* Cooperative Research Centre for Contamination Assessment and Remediation of the Environment, 2011.
DEC NSW 2006	*Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (2nd Edition).*
DUAP and NSW EPA 1998	*Managing Land Contamination, Planning Guidelines, SEPP 55 – Remediation of Land, Department of Urban Affairs and Planning and NSW Environment Protection Authority.*
Golder 2016a	*Phase I and Limited Phase II Environmental Site Assessment – Minto Warehouse and Logistics Hub, 5 and 9 Culverston Rd, Minto, NSW.*
Golder 2016b	*Detailed Site Investigation Central Precinct (Draft), Minto Warehouse and Logistics Hub, 5 and 9 Culverston Rd, Minto, August 2016.*
NHMRC / NRMMC 2011	*Australian Drinking Water Guidelines; National Health and Medical Research Council (NHMRC) and Natural Resource Management Ministerial Council (NRMMC) (2011).*
NEPC 2013	*National Environment Protection (Assessment of Site Contamination) Measure 1999, National Environment Protection Council, 2013.*
NSW EPA 1997	*Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites.*
NSW EPA 2014a	*Waste Classification Guidelines: Part 1 Classifying Wastes, NSW EPA November 2014.*
NSW EPA 2014b	*Best Practice Note: Landfarming.*
Standards Australia 2008	*The Removal of Underground Petroleum Storage Tanks.*
USEPA (2008).	*National Functional Guidelines for Superfund Organic Methods Data Review.*

WA DOH 2009	*Guidelines for the assessment, remediation and management of asbestos contaminated sites in Western Australia.*
WorkCover, NSW March 2000	*Excavation Work, Code of Practice.*

Report Signature Page

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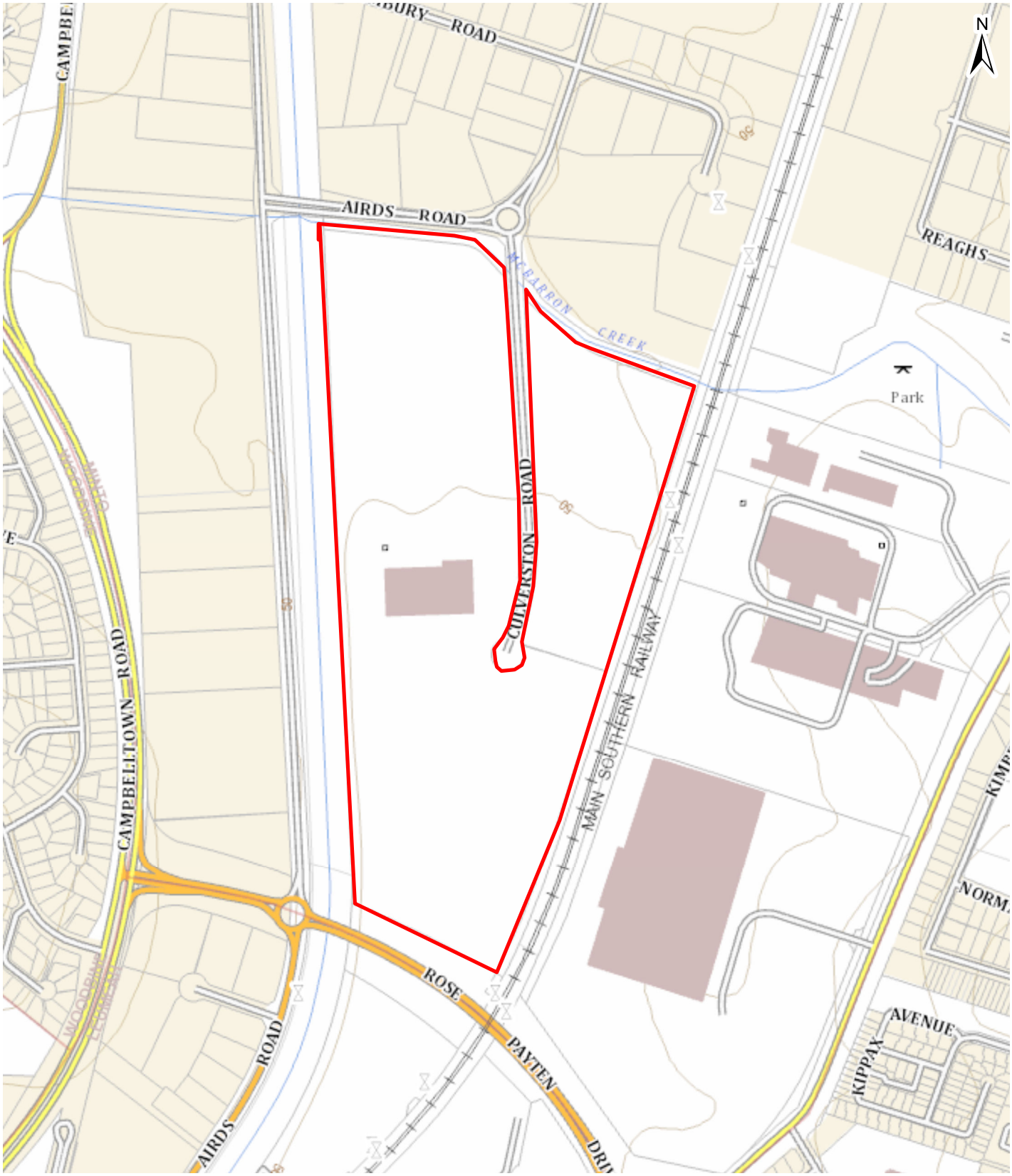
APPENDIX A

Figures



MINTO INTERMODAL TERMINAL

TACTICAL

SITE LOCALITY

LEGEND

Site Boundary

COPYRIGHT
Base map provided by SixMaps 2016.

0 20 40 80 120 160 200 metres

SCALE (at A4) 1:8,500

DATUM GDA 94, PROJECTION MGA Zone 55

PROJECT: **1648232**
DATE: **26/08/2016**
DRAWN: **NS**
CHECKED: **BS**

FIGURE 1

Golder Associates

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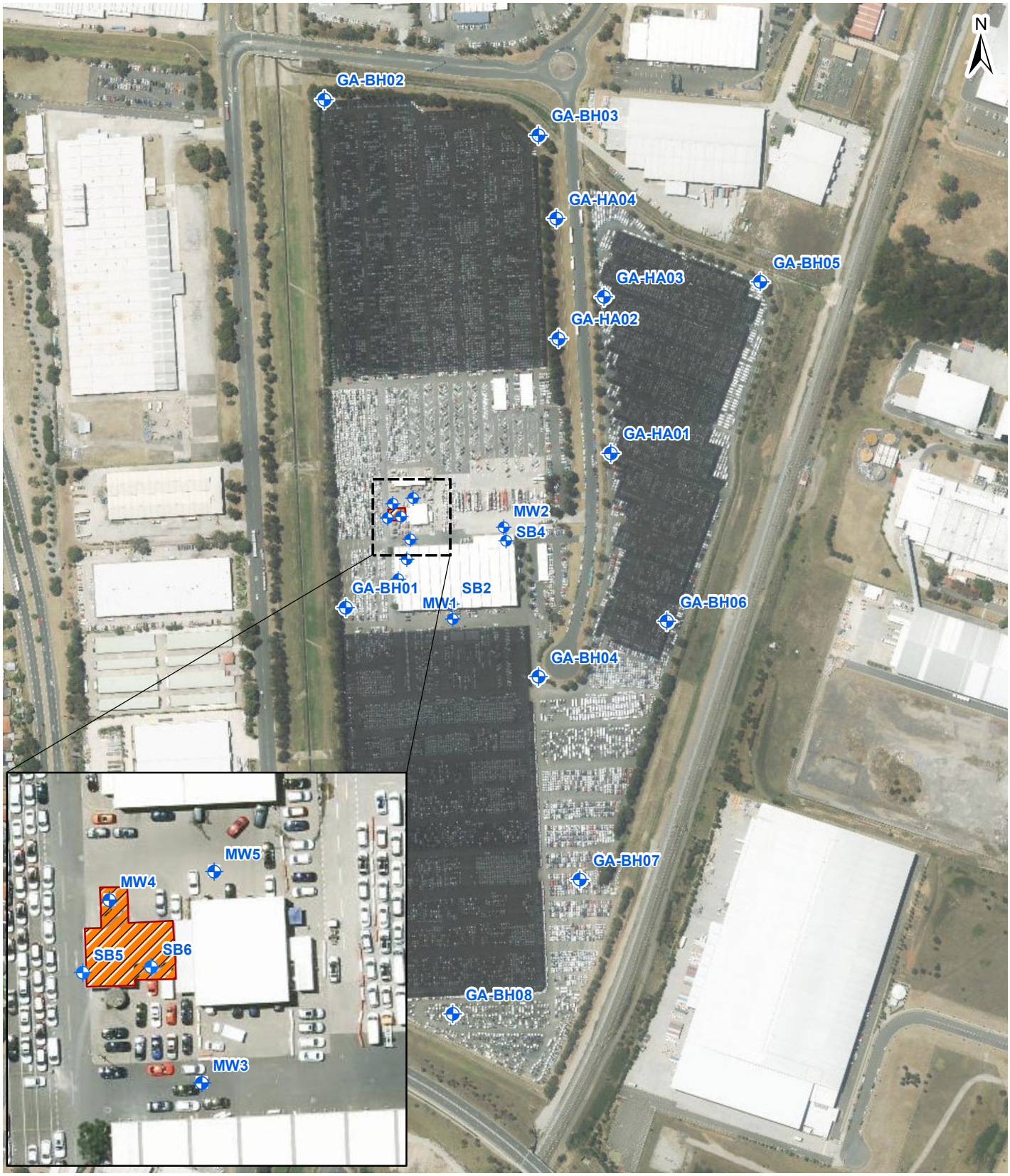

MINTO INTERMODAL TERMINAL

TACTICAL

INVESTIGATION LOCATIONS & REMEDIATION AREA

Legend

- Investigation Location
- Proposed Remediation Area

COPYRIGHT

Base map provided by LPI.
Figure provided by Tactical.

0 15 30 60 90 120 150 metres

SCALE (at A4) 1:6,204.63

DATUM GDA 94, PROJECTION MGA Zone 55

PROJECT: **1648232**
DATE: **26/08/2016**
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FIGURE 2

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MINTO INTERMODAL TERMINAL

TACTICAL

AST / UST Locations

LEGEND

- Remediation Area
- Borehole
- Monitoring Well
- AST
- Stockpile
- Bowsers

COPYRIGHT

Base map provided by LPI.
Figure provided by Tactical.

0 1 2 4 6 8 10 metres

SCALE (at A4) 1:400

DATUM GDA 94, PROJECTION MGA Zone 55

PROJECT: **1648232**
DATE: **26/08/2016**
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FIGURE 3

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APPENDIX B

Tier 1 Soil and Groundwater Assessment Criteria

Tier 1 Soil Criteria

Guidance on the assessment of contaminant concentrations on sites is presented in the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (NEPC 2013), herein referred to as the ASC NEPM (NEPC, 2013). Exposure settings considered in the ASC NEPM (NEPC, 2013) are low and high density residential; recreational/open space; and commercial / industrial land uses.

As the site is proposed for commercial / industrial purposes it is considered appropriate to compare the results of soil analysis against the investigation levels for commercial / industrial land.

The following health based criteria have been considered as assessment criteria:

- Health screening levels (HSLs) for petroleum hydrocarbons will be used to assess chronic human health risks of petroleum hydrocarbon impact via the vapour intrusion exposure pathway. The HSLs are also considered to be protective of direct contact. Soil HSLs are provided in the ASC NEPM 2013 for a variety of exposure settings based on land use, depth of impact and soil type. Table 1A(3) in Schedule B1 of ASC NEPM 2013 presents HSLs for the F1 (C_6-C_{10}) and F2 (>C_{10}-C_{16}) hydrocarbon fractions and for benzene, toluene, ethylbenzene, xylene and naphthalene (BTEXN). HSLs for F1 and F2 exclude BTEX and naphthalene concentrations respectively. Where appropriate, the health risk of potential exposure via direct contact for F3 (>C_{16}-C_{34}) and F4 (>C_{34}-C_{40}) hydrocarbon fractions will be assessed against guidance provided in CRC 2011;
- Health investigation levels (HILs) are generic assessment criteria for a range of metals and organic substances designed to be used in the first stage of the assessment of potential risks to human health from chronic exposure to contaminants. Table 1A(1) in Schedule B1 of ASC NEPM 2013 presents the HILs, which are generic to all soil types; and
- The ASC NEPM (NEPC, 2013), provides HSL for asbestos in soil, which are based on scenario specific likely exposure levels adopted from the Western Australia Department of Health (WA DoH) *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia* (WA DoH, 2009). Table 7 in Schedule B1 of ASC NEPM 2013 presents the HSLs for asbestos contamination in soil.

Although the majority of the site will be converted to terrestrial ecosystem of limited value (i.e. a commercial/ industrial development), in accordance with Section 2.5.3 in Schedule B1 of the ASC NEPM 2013, consideration should also be given to the ecological investigation levels (EILs) within commercial/industrial land uses and EILs have been derived for commercial/industrial land uses. As the site is proposed for commercial/industrial purposes it is considered appropriate to compare the results of the soil analysis against the ESLs/EILs for commercial/industrial land use. Therefore, the following ecological based criteria have been considered as assessment criteria:

- Ecological screening levels (ESLs) for selected petroleum hydrocarbon compounds and total petroleum hydrocarbon fractions are used for assessment of risk to terrestrial ecosystems. Table 1B(6) in Schedule B1 of NEPC 2013 presents the ESLs. ESLs are provided for coarse and fine soils under the commercial/ industrial land use scenario. ESLs are, however, not considered to be ESLs are relevant to the root zone and habitation zone in soil, corresponding to the top two metres of the finished level of a site;
- Generic ecological investigation levels (EILs) are provided for lead, arsenic, DDT and naphthalene. The generic EILs, which are presented in Table 1B(5) in Schedule B1 of NEPC 2013, are independent of soil type. Site specific EILs for chromium (III), copper, nickel and zinc can be calculated from the sum of the ambient background concentration (ABC) of the contaminant and on the added contaminant limit (ACL), which is based on soil specific properties such as pH, cation exchange capacity (CEC) and clay content. The ABC can be determined by measuring the concentration in a soil sample collected at a reference site not impacted by the contaminant. Where a reference site cannot be determined the ABC can be estimated based on urban metal levels or the method from Hamon et al. (Hamon, 2004) as specified in NEPC 2013. Alternatively, where background concentrations cannot be determined, the ACL may be adopted as the EIL as a conservative measure;

The ASC NEPM, 2013 includes management limits (MLs) for petroleum hydrocarbon compounds, which are designed to avoid or minimise the potential effects of petroleum hydrocarbons such as formation of observable light non-aqueous phase liquids (LNAPL), fire and explosive hazards and effects on buried infrastructure e.g. penetration of, or damage to, in-ground services by hydrocarbons. Table 1B(7) in Schedule B1 of ASC NEPM 2013 presents the MLs. The application of the management limits requires consideration of the depth of building basements and services and depth to groundwater.

Table 8: Summary of Adopted Commercial/Industrial Soil Assessment Criteria (mg/kg)

Analyte	HIL – D Comm/ Industrial	HSL-D, Sand 0-1m	HSL-D, Sand 1-2m	ESL*- Comm / Industrial, coarse	EIL- Comml / Industrial	Mgt Limits Comm / Industrial#
TRH						
F1	-	260	370	215*	-	700
F2	-	NL/20,000+	NL	170*	-	1,000
F3	-	NL/27,000+	NL	1,700	-	3,500
F4	-	NL/38,000+	NL	3,300	-	10,000
BTEXN						
Benzene	-	3	3	75	-	-
Toluene	-	NL/99,000+	NL	135	-	-
Ethylbenzene	-	NL/27,000+	NL	165	-	-
Total Xylenes	-	230	NL	180	-	-
Naphthalene	-	NL/11,000+	NL	-	370	-
Inorganics						
Lead	1,500	-	-	-	1,800	-
PAHs						
Total PAHs	4,000	-	-	-	-	-
Benzo(a)pyrene	-	-	-	1.4	-	-
Carcinogenic PAHs (as B[a]P TEQ)**	40	-	-	-	-	-
Phenols						
Phenol	240,000	-	-	-	-	-
Pentachlorophenol	660	-	-	-	-	-

Notes:
NL- non limiting
- No guideline available
+ HSLs for direct contact where HSL for vapour intrusion is NL adopted from CRC Care, 2011.
* ESLs are of low reliability except where indicated by * which indicates the ESL is of moderate reliability
**B[a]P TEQ – Benzo[a]pyrene toxicity equivalency quotient
TRH:

F1 = C_6-C_{10} (for HSL and ESL subtract BTEX)
F2 = >C_{10} – C_{16} (for HSL subtract naphthalene)
F3 = >C_{16} – C_{35}
F4 = >C_{34} – C_{40}

Management Limits are applied after consideration of relevant HSLs and ESLs.

APPENDIX C

Laboratory Detection Limits

Laboratory Reporting Limits

The analytical Limit of Reporting (LOR) for chemicals will generally be set below the assessment criteria using standard laboratory methodology and instrumentation. However it is recognised that there are a number of chemicals where the proposed criteria are lower than the LOR, and where there are no criteria which may result in uncertainty as to whether a lower LOR is required for the purposes of the Audit.

Chemicals with LOR below criteria, and those for which there are currently no criteria available, will be considered as part of the Audit Area assessments. There are circumstances where attaining a lower LOR may not be an economically viable or may not add further value to the understanding of the site conditions. For example, if a chemical is co-occurring with other chemicals that are drivers for remediation and therefore is likely to be remediated, further consideration of the chemical at that stage may not be required. Similarly, if a chemical has not been detected at the site and the secondary laboratory has a lower LOR and has also not detected the compound then further consideration may not be required.

The following will be considered with respect to whether lower LOR are required for individual chemicals or for a chemical group:

- is the chemical likely to be present in the soil? (i.e. was it used at the site or is it a breakdown product of known COI).
- has the chemical been detected elsewhere at the site and is it a driver for remediation?
- could a detection of this chemical highlight an area or chemical group which has not previously been identified as requiring remediation?
- if the chemical has not been detected by the primary laboratory, is the secondary laboratory LOR the same of higher?
- is the screening criteria based upon international guidelines?

Using the above screening approach, an assessment will be made as to whether the laboratory may be requested to provide results with a lower LOR, or a review of the appropriateness of the screening criteria may be required or derivation of Risk Based Criteria.

APPENDIX D

QA/QC Program

1.0 FIELD AND LABORATORY QUALITY ASSURANCE AND QUALITY CONTROLS (QA/QC)

It is important that the data collected in the proposed site remediation validation program is of a quality suitable to meet the objectives of the validation works. Possible sources of error in the collection of soil and soil vapour data can arise in the collection, handling and analysis of samples. An effective field QA/QC program aims to minimise these sources of error and increase the reliability of the results.

1.1 Field Quality Assurance

The sampling fieldwork will be completed in accordance with Golder's standard operating procedures (SOPs).

Surface and sub-surface characteristics and field observations will be fully documented, including photographic records. Samples will be labelled in the field with a unique sample identification code using waterproof indelible ink. CoC documentation will be used for the transport of samples from the field to the laboratory.

1.2 Field Quality Control

QC samples for the proposed soil and groundwater sampling programs will include duplicate samples and (for soil) blank samples. Duplicate samples consist of media collected at the same place and time and split into two samples. Blank samples are artificial samples designed to monitor the introduction of artefacts into the equipment cleaning and sample handling process.

The following duplicate and blank samples will be collected:

- ***Inter-laboratory duplicates (soil, groundwater and vapour)***: Individual samples are split into two sub portions in the field and placed into two separate containers. One sample is sent to the primary project laboratory and the other sample to an independent, secondary, check laboratory. The purpose of the inter-laboratory duplicates is to assess the analytical accuracy of the primary project laboratory and other factors including sampling methodology and the heterogeneity of the sample medium. Inter-laboratory samples will be collected and analysed at a rate of no less than 1 in 20 of total samples analysed.
- ***Intra-laboratory duplicates (soil, groundwater and vapour):*** Individual samples are split into two sub portions in the field and placed into two separate containers. Both samples are forwarded to the primary project laboratory with no communication on the relationship between the duplicate and the primary sample. The purpose of the intra-laboratory duplicates is to assess the analytical accuracy of the laboratory process and other factors including sampling methodology and the heterogeneity of the sample medium. Intra-laboratory soil and soil vapour samples should be collected and analysed at a rate of no less than 1 in 10 of total samples analysed.
- ***Equipment Blanks (soil and groundwater):*** These samples are prepared from the collection of the rinsate water used to complete the final rinse of the sampling equipment following decontamination. The collected water is then transferred to an appropriate sample bottle. Equipment blanks are a check on the equipment and decontamination process. A minimum of one equipment blank should be collected per day (when sampling is being undertaken) for the duration of the project.
- ***Trip Blanks (soil and groundwater):*** Trip blanks should be included in each batch where TPH (C_6 to C_9) and BTEX are being analysed in soil and groundwater.

1.3 Laboratory Quality Control

Laboratory analyses should be conducted in accordance with the standard test methods outlined in NEPC (2013) NEPM. The Practical Quantification Limits (PQLs) should be established at levels below the site adopted validation criteria. Laboratories selected for analysis are to be NATA Australia accredited for the analyses required.

Laboratory quality control procedures typically include analysis of the following:

- ***Laboratory duplicate samples:*** The laboratory collects duplicate sub-samples from a sample submitted for analysis. Analysis of these duplicate pairs is completed at a rate of 1 sample per 20 samples submitted for analysis, or one sample per batch. The purpose of the laboratory duplicate is to assess the analytical precision (repeatability) of the test result.
- ***Spiked samples:*** Samples submitted to the laboratory are spiked by adding a volume of known concentration of the target analyte prior to extraction and analysis. A spike documents the effect of the sample matrix on the extraction and analytical techniques.
- ***Surrogate spikes:*** Samples submitted to the laboratory are spiked with an organic compound, which is similar to the analyte of interest in terms of chemical composition and extractability. These organic compounds are not normally found in environmental samples. The surrogates spiked samples are used to assess if any gross error has occurred during a particular stage of the test method.
- Reported percent for continuing calibration verifications (CCV) samples for summa canisters for vapour samples.

1.4 Assessment of Quality Control

The validity of all analytical data will be performed in general accordance with:

- USEPA (June 2008). USEPA Contract Laboratory Program National Functional Guidelines for Organic Methods Data Review, EPA-540-R-08-01.

Accuracy and precision measurements from the appropriate QC check samples will be compared with the analytical Data Quality Objectives (DQOs) to assess the quality of the analytical data. Should data be found to fall outside acceptable limits of precision and accuracy, appropriate corrective actions will be implemented.

1.4.1 Field QC

An assessment of field quality control samples is completed by calculating the relative percent difference of duplicate samples.

The relative percent difference (RPD) of each duplicate set is calculated to assess overall precision, where:

$$\mathrm{RPD} = (\mathrm{C1} - \mathrm{C2})/((\mathrm{C1} + \mathrm{C2})/2)) \times 100\%$$

where; C1 = primary sample concentration C2 = duplicate sample concentration

Guidelines for the assessment of quality control results are provided in the NEPC (1999) NEPM. An acceptable RPD limit is 30%, however, this can be expected to be higher for concentrations near the PQL. A result exceeding this guideline does not necessarily mean that the data is invalid, but rather the effect of the difference needs to be considered.

1.4.2 Laboratory QC

Assessment of laboratory QC is undertaken internally by the laboratory. Laboratory QC includes:

- Relative Percent Differences – assessed as described above, but between internal laboratory duplicate pairs;
- Percent Recovery (PR) is used to assess the accuracy, where:

$$\mathrm{PR} = \frac{\mathrm{CS} - \mathrm{C}}{\mathrm{S}} \times 100\%$$

where; CS = spiked sample result C = sample result S = spike added.

1.4.3 Field Methods

Sample Labelling

The sample labels will include the sample identification number, place of collection, date of collection and initials of the sampling personnel. Each sample will be labelled with a unique sample identification number that will facilitate tracking and cross referencing of sample information.

Soil samples should be identified and labelled in the format of VX_Y.Y-Y.Y_date, where X is the soil validation sample location number, Y.Y is sample interval depth (m bgl) and 'date' is the sampling date. QAQC samples should be identified and labelled in the format of QC1XX and QC2XX for intra- and inter-laboratory duplicate samples, respectively, where XX is the sequential QAQC number.

Field Logs

A summary of activities performed at the site will be recorded in a field log book. Entries for each day will commence on a new page, which will be dated. Corrections will be made by marking through the error with a single line, to remain legible, and initialling this action followed by writing the correction.

The following types of information will be recorded for each sample collected:

- Unique sample identification number;
- Date of sample collection;
- Initials of the sampling personnel;
- Type of sample and sampling method;
- Analyses to be performed on sample; and
- Any other relevant comments (odour, colour, sheen, etc).

The following types of information will be recorded for each soil vapour well installed:

- Weather conditions;
- Date of installation;
- Type of equipment used;
- Length of time to complete the installation;
- Depth of the well;
- Well installation geological bore log;
- Well construction log; and
- Any other relevant comments.

Chain of Custody Records

Chain-of-Custody (CoC) records will be used to track samples from the time of collection to the arrival of samples at the laboratory. Each sample container being shipped to the laboratory will contain a CoC form. The laboratory, upon receiving the samples, will complete the remaining sample receipt fields and will return a completed CoC to Golder along with the data deliverables package.

Sample Containers and Handling

Samples will be placed in appropriate sample containers with the appropriate preservative, labelled and properly sealed. Samples will be cushioned within the shipping coolers by the use of bubble pack wrapping. Samples will be kept cool by the use of sealed plastic bags of ice or similar means.

Samples will be shipped to the project laboratory by commercial courier or delivered by hand. The coolers will be sealed, stored in a secure location, and then picked up by the courier or hand delivered on the same or next business day. A security seal will be placed over the lid on the front and back of each shipping cooler. The seal will secure the lid and provide evidence that the samples have not been tampered with en-route to the contracted laboratory.

Once used for sampling, vapour sample containers (6 L Summa canisters) will be sealed and vacuum pressure recorded on the COC. The containers will be couriered to the analytical laboratory.

Upon receipt of the sample containers by the laboratories, the designated custodian will inspect the samples. The sample custodian will note the condition of the samples and seal on the CoC form. The sample custodian will then check the contents against the information noted on the CoC form. If damage or discrepancies are observed, the discrepancies will be duly recorded in the remarks column of the CoC form. The form will then be signed and dated.

All samples will be analysed within analytical holding times.

Equipment Calibration

Equipment used to perform testing or data recording (including the field portable PID) will be calibrated to the manufacturer's specifications by the supplier prior to use. The calibration records will be retained by the field scientist/engineer. Calibration checks and adjustments will be performed as required during field operations. The identification of the specific device or equipment calibrated, date, reference standard, results or adjustments made and the signature of the person performing the calibration will be documented on field data sheets.

Equipment Decontamination

Decontamination of sampling equipment including sampling trowels, hand augers, shovels and augers is conducted to minimise the potential for contamination between sampling locations and cross contamination of samples. Decontamination of equipment is to be completed prior to coming on-site and after contact with potentially contaminated materials.

During decontamination procedures, nitrile (or equivalent) gloves are to be worn throughout and replaced as needed.

Decontamination of sampling equipment (hand augers, sampling trowels etc.) generally follows the procedures outlined below:

- Decontaminate two buckets with clean water, rinse with phosphate-free detergent (Decon 90), and thoroughly rinse again with clean water;
- Fill the first bucket with detergent and clean water;
- Fill the second bucket with clean water;
- Scrape or brush off any soil/product adhering to equipment;
- Clean equipment in detergent water; and
- Rinse twice in the clean water.

Following the final rinse, equipment will be visually inspected to verify that it is free of material that could contribute to possible cross contamination.

APPENDIX E

Limitations

IMPORTANT INFORMATION RELATING TO THIS REPORT

The document ("Report") to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd ("Golder") subject to the important limitations and other qualifications set out below.

This Report constitutes or is part of services ("Services") provided by Golder to its client ("Client") under and subject to a contract between Golder and its Client ("Contract"). The contents of this page are not intended to and do not alter Golder's obligations (including any limits on those obligations) to its Client under the Contract.

This Report is provided for use solely by Golder's Client and persons acting on the Client's behalf, such as its professional advisers. Golder is responsible only to its Client for this Report. Golder has no responsibility to any other person who relies or makes decisions based upon this Report or who makes any other use of this Report. Golder accepts no responsibility for any loss or damage suffered by any person other than its Client as a result of any reliance upon any part of this Report, decisions made based upon this Report or any other use of it.

This Report has been prepared in the context of the circumstances and purposes referred to in, or derived from, the Contract and Golder accepts no responsibility for use of the Report, in whole or in part, in any other context or circumstance or for any other purpose.

The scope of Golder's Services and the period of time they relate to are determined by the Contract and are subject to restrictions and limitations set out in the Contract. If a service or other work is not expressly referred to in this Report, do not assume that it has been provided or performed. If a matter is not addressed in this Report, do not assume that any determination has been made by Golder in regards to it.

At any location relevant to the Services conditions may exist which were not detected by Golder, in particular due to the specific scope of the investigation Golder has been engaged to undertake. Conditions can only be verified at the exact location of any tests undertaken. Variations in conditions may occur between tested locations and there may be conditions which have not been revealed by the investigation and which have not therefore been taken into account in this Report.

Golder accepts no responsibility for and makes no representation as to the accuracy or completeness of the information provided to it by or on behalf of the Client or sourced from any third party. Golder has assumed that such information is correct unless otherwise stated and no responsibility is accepted by Golder for incomplete or inaccurate data supplied by its Client or any other person for whom Golder is not responsible. Golder has not taken account of matters that may have existed when the Report was prepared but which were only later disclosed to Golder.

Having regard to the matters referred to in the previous paragraphs on this page in particular, carrying out the Services has allowed Golder to form no more than an opinion as to the actual conditions at any relevant location. That opinion is necessarily constrained by the extent of the information collected by Golder or otherwise made available to Golder. Further, the passage of time may affect the accuracy, applicability or usefulness of the opinions, assessments or other information in this Report. This Report is based upon the information and other circumstances that existed and were known to Golder when the Services were performed and this Report was prepared. Golder has not considered the effect of any possible future developments including physical changes to any relevant location or changes to any laws or regulations relevant to such location.

Where permitted by the Contract, Golder may have retained subconsultants affiliated with Golder to provide some or all of the Services. However, it is Golder which remains solely responsible for the Services and there is no legal recourse against any of Golder's affiliated companies or the employees, officers or directors of any of them.

By date, or revision, the Report supersedes any prior report or other document issued by Golder dealing with any matter that is addressed in the Report.

Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification.

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

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