

Goulburn Liverpool (NSW) Pty Ltd  
C/- Kanebridge Pty Ltd



## Remedial Action Plan: 17 – 23 Goulburn Street, Liverpool, NSW

ENVIRONMENTAL



WATER



WASTEWATER



GEOTECHNICAL



CIVIL



PROJECT  
MANAGEMENT



P1505008JR04V01  
March 2017

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# 1 Introduction

## 1.1 Overview

This Remedial Action Plan (RAP) has been prepared by Martens and Associates Pty Ltd for the purpose of addressing observed soil contamination at 17 – 23 Goulburn Street, Liverpool, NSW ('the site').

This RAP outlines the remedial actions and management practices required in relation to the presence of soil contamination identified on site as part of a recent detailed site investigation (DSI) prepared by MA (2017). The DSI should be read in conjunction with this document. Further discussion regarding previous onsite contamination investigations is found in Section 3.

Preparation of this RAP is in general accordance with NSW OEH (2011), ASC NEPC (1999, amended 2013), NSW DEC (2006) and requirements of SEPP 55 – Contaminated Land.

## 1.2 Previous Studies

Previous assessment of site contamination includes:

- Martens and Associates (2015a) *Preliminary Site Investigation: 17 – 23 Goulburn Street, Liverpool, NSW* (Ref: P1505008JR01V01).
- Martens and Associates (2017) *Detailed Site Investigation: 17 – 23 Goulburn Street, Liverpool, NSW* (Ref: P1505008JR03V01).

## 1.3 Objectives and Scope of the RAP

Objectives of the RAP are:

- Set remediation goals and criteria.
- Review the available remedial options and select the preferred option(s).
- Provide details of preferred remedial option(s).
- Outline procedures and activities for implementation of the preferred remedial option.
- Outline requirements for contractors to prepare environmental and occupational health and safety plans for the remediation.
- Outline requirements for contingency planning.

- Outline the regulatory compliance requirements.
- Provide details of contacts for the period of remediation works.
- Provide a framework for environmental management for the site during remediation.

The format of this RAP is as follows:

- Summary of previous study and contamination status and data gaps (Section 3).
- Remediation options and criteria (Section 4).
- Remediation plan and validation requirements (Section 5).
- A guide for site control during remediation and site specific health and safety for remediation and validation (Section 6).
- Regulatory compliance requirements (Section 7).
- Remediation contacts (Section 8).
- Contingency plan (Section 9).

#### **1.4 Abbreviations**

ACM – Asbestos containing material

AEC – Area of environmental concern

AMP – Asbestos management plan

ASC NEPM – National Environmental Protection (Assessment of site contamination) Measure

BTEX – Benzene, toluene, ethyl benzene, xylene

CEMP – Construction Environmental Management Plan

COPC – Contaminants of potential concern

DA – Development application

DEC – NSW Department of Environment and Conservation

DECC – Department of Energy and Climate Change

DP – Deposited plan

DSI – Detailed site investigation

EAC – Ecological assessment criteria

EIL – Ecological investigation levels

ENM – Excavated natural material

EPA – NSW Environmental Protection Authority

ESA – Environmental site assessment

ESL – Ecological screening levels

HIL – Health investigation levels

HHRA – Human health risk assessment

LCC – Liverpool City Council

LOR – Limit of reporting

LGA – Local government area

mbgl – Metres below ground level

NATA – National Association of Testing Authorities

OCP – Organochloride pesticides

OEH – NSW Office of Environment and Heritage

OPP – Organophosphate pesticides

PACM – Potential asbestos containing material

PAH – Polycyclic aromatic hydrocarbons

PPE – Personal protective equipment

PSI – Preliminary site investigation

RAC - Remediation action criteria

RAP – Remedial action plan

SEPP – State Environmental Planning Policy

SOP – Standard operating procedure



TPH – Total petroleum hydrocarbons

TRH – Total recoverable hydrocarbons

VENM – Virgin excavated natural material

WHSP – Worker health and safety plan

## 2 Site Identification

### 2.1 Location and Setting

Site information is summarised in Table 1.

**Table 1:** Site background information

<b>Site address</b>	17 – 23 Gouburn Street, Liverpool, NSW.
<b>Lot and DP (Title Information)</b>	Lots 1, 2, 3 and 4, DP 13932.
<b>LGA</b>	Liverpool City Council.
<b>Site area</b>	2871.5 m <sup>2</sup> (from site plan provided by Gus Fares Architects).
<b>Current land use</b>	Residential.
<b>Proposed land use</b>	High density residential.
<b>Surrounding land uses</b>	Residential and commercial.
<b>Geology and Soil Landscape</b>	<p>The Penrith 1:100,000 Geological Series Sheet 9030 (NSW Dept. of Mineral Resources, 1991) indicates that the site is underlain by Bringelly Shale, consisting of shale, carbonaceous claystone, laminite and coal in parts.</p> <p>The NSW Environment and Heritage eSPADE website identifies the site as having soils of the Blacktown soil landscape, described generally as shallow to moderately deep hardsetting mottled texture contrast soils, red and brown podzolic soils on crests grading to yellow podzolic soils on lower slopes and in drainage lines.</p>
<b>Drainage</b>	No defined natural surface drainage lines were observed on the allotment or neighbouring allotments.
<b>Groundwater</b>	No groundwater was observed during previous onsite borehole investigations for geotechnical assessment to a depth of 10.1 mBGL (MA, 2015b)
<b>Environmental receptors</b>	No environmental receptors were identified during detailed site investigations.
<b>Human receptors</b>	<ul style="list-style-type: none"><li>o Future construction workers and builders.</li><li>o Future residents and visitors.</li><li>o Neighbouring residents.</li></ul>

## **3 Summary of Previous Investigation**

### **3.1 Overview**

Preliminary and Detailed Site Investigations prepared by Martens and Associates (MA, 2015a and MA, 2017) for the subject site should be read in conjunction with this RAP. A brief summary of the site history, results, conclusions and recommendations of the previous investigations is provided in the following sections.

### **3.2 Preliminary Site Investigation (PSI) Summary**

A review of historic aerial photographs, council records, EPA records and detailed site walkover found the following:

- The current site use is residential.
- The site has been used for residential purposes since at least 1955.
- Council records indicate the construction of a swimming pool on 17 Goulburn Street, which has since been removed.
- Two OEH records exist in the LCC LGA, however they are not expected to have impacted the site.
- Multiple weatherboard (PACM) dwellings and sheds were identified on 19, 21 and 23 Goulburn Street.
- Potential site filling may have been used for site levelling purposes.

The PSI identified the following areas of environmental concern (AEC):

- Current and former dwellings and sheds.
- Stockpiles and general refuse on site.
- Site filling of former in-ground pool.
- Site filling under hardstand for site levelling purposes.

Information regarding AEC and associated contaminants of potential concern (COPC) is presented in Table 2.

**Table 2:** AEC and associated COPC

AEC <sup>1</sup>	Potential for Contamination	COPC	Contamination Likelihood
A – Dwellings <sup>2</sup>	Pesticides may have been used underneath dwellings. Dwelling construction may include ACM and/or lead based paints.	HM, OCP/OPP and asbestos	Medium
B – Former/current sheds <sup>2</sup>	Sheds may currently (or have previously) stored fuel, oils, asbestos sheeting (PACM), pesticides and/or been treated with pesticides (pest control). Shed construction may include ACM and/or lead based paints.	HM, TRH, BTEX, PAH, OCP/OPP and asbestos	Medium
C – Stockpiles and general refuse.	Contaminants from unknown contents of stockpiles and general refuse may have spilt or leaked onto underlying soil. Asbestos may be included in the waste.	HM, TRH, BTEX, PAH, OCP/OPP and asbestos	Medium – high
D – Site filling of former in-ground pool	Fill material of unknown origin and quality.	HM, TRH, BTEX, PAH, OCP/OPP and asbestos.	Medium
E – Hardstand area	Possible fill for levelling and possible heavy metal and hydrocarbon impacts from vehicle use.	HM, TRH, BTEX, PAH, OCP/OPP and asbestos	Low

**Notes**

<sup>1</sup> AEC extents 1 m from outer wall/eave of structures

As a consequence of the findings of the PSI, an intrusive soil sampling investigation was undertaken. Testing was recommended in areas of potential filling under hardstand areas and in vicinity of former swimming pool and under and around existing sheds and dwellings.

### 3.3 Detailed Site Investigation (DSI) Summary

Intrusive soil investigations were undertaken at the site, targeting identified AECs outlined in the PSI. Samples were sent for laboratory analyses for identified COPCs and assessment against site acceptance criteria (SAC).

Laboratory results indicated elevated heavy metals across site soils. Two samples (**5008/SS15** and **5008/SS22**) indicated lead concentrations which exceeded adopted SAC. One sample (**5008/SS02**) indicated F2 TRH concentrations which exceeded the adopted SAC.

Identified site contamination is summarised in Table 3 and located on a site plan in Attachment A. Laboratory reports are provided as Attachment B.

**Table 3:** Summary of identified contamination exceeding adopted SAC.

Analyte	Results Compared to SAC			
	17 Goulburn St	19 Goulburn St	21 Goulburn St	23 Goulburn St
Heavy Metals <sup>1</sup>	<u>HILs</u> All results below SAC.	<u>HILs</u> Lead exceeded adopted HIL (1200 mg/kg) at <b>5008/SS15 (1200 mg/kg)</b>	<u>HILs</u> Lead exceeded adopted HIL (1200 mg/kg) at <b>5008/SS22 (1200 mg/kg)</b>	<u>HILs</u> All results below SAC.
OCP/OPP	<u>HILs</u> All results below SAC.	<u>HILs</u> All results below SAC.	<u>HILs</u> All results below SAC.	<u>HILs</u> All results below SAC.
BTEX/TRH	<u>HSLs</u> All results below SAC. <u>Management limits</u> All results below SAC.	<u>HSLs</u> All results below SAC. <u>Management limits</u> All results below SAC.	<u>HSLs</u> F2 TRH <sup>2</sup> exceeded adopted HSL for 1-2 m (240 mg/kg) at <b>5008/SS02 (330 mg/kg)</b> <u>Management limits</u> All results below SAC.	<u>HSLs</u> All results below SAC. <u>Management limits</u> All results below SAC.
PAH	<u>HILs</u> All results below SAC.	<u>HILs</u> All results below SAC.	<u>HILs</u> All results below SAC.	<u>HILs</u> All results below SAC.

**Notes**

<sup>1</sup> Heavy metals – arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc.

<sup>2</sup> F2 includes TRH >C10-C16 fraction less naphthalene.

Based on likely contaminant sources, we expect contaminated soils are limited to near the surface.

It was concluded that, for the subject site to be suitable for the proposed residential development, remediation of lead and hydrocarbon impacted soils was required.

### 3.4 Remaining Data Gaps

The DSI had the following data gaps:

- Vertical extent of contamination – As only shallow sampling was undertaken, the vertical extent of contamination, whilst likely to be limited to near surface, has not been verified.

The vertical extent of lead and hydrocarbon contamination will need to be delineated during the remediation stage. As almost all near surface soil is to be removed as part of the proposed development, *in-situ* testing or validation testing of excavations following removal is recommended in order to accurately determine the vertical extent of contamination and confirm waste classification.

## 4 Remediation Options and Criteria

### 4.1 General Remediation Goals

The remediation goal is to remediate contaminated soils to enable proposed residential land use. The remediation plan will provide a plan to delineate the extent of site material requiring remediation and to formally classify the material being removed from site as part of remediation and construction works.

### 4.2 Extent of Remediation Required

Remediation requirements are developed based on identified contamination and Client advice regarding site development scenario. It is understood that site is to be redeveloped to be used for high-density residential land use.

Three contamination 'hotspots' were identified during the DSI, where laboratory results indicated contaminant concentrations exceeding SAC. These areas include sampling locations **5008/SS02**, **5008/SS15** and **5008/SS22** and soils in the immediate vicinity of these locations. A site plan and sampling locations are provided in Attachment A.

Remediation of site material impacted by lead and hydrocarbons is required prior to proposed residential use. DSI findings have identified a data gap in the contamination extent at depth. Considering the mode of site soil contamination it is expected that contamination is limited to topsoils. This will be confirmed during the remediation stage.

As the proposed development plan involves the removal of almost all near surface soils for the development of a two level basement, contaminated topsoils will be removed during bulk excavation for redevelopment. If final development plans require the onsite retention of soils which exceed the adopted human health or ecological investigation criteria, a site specific risk assessment shall be required and measures to address the risk shall be developed.

### 4.3 Remediation Criteria

As the final site development involves a high density residential flat building human health risk must be assessed. The majority of near surface soils are to be removed as part of the proposed development plan, as a result there will be limited areas of ecological significance and ecological impacts are not considered as part of the remediation criteria.

Threshold concentrations outlined in ASC NEPM (1999, amended 2013) National Environmental Protection (Assessment of Site Contamination) Measure guidelines are used in determining project remediation criteria (Table 4).

Health investigation levels (HILs) for residential land use with minimal opportunities for soil access, provided in Table 1A(1) (NEPM, 1999, amended 2013) were adopted as the soil investigation levels.

Management limits for TPH fractions F1 to F4, provided in Table 1B(7) (NEPM, 1999, amended 2013) were adopted based on residential land use for coarse grained soils.

A remediation criterion of “no asbestos impacted soil at the surface” has been adopted for this site.

Adopted remediation action criteria (RAC) are outlined in Table 4.

**Table 4:** Summary of remediation acceptance criteria (RAC) for the site.

Chemicals	HIL / HSL <sup>1</sup>	Management Limits <sup>2</sup>
	Residential B (sand) <sup>3</sup>	Residential / Open space
F1:TRH C <sub>6</sub> -C <sub>10</sub> less BTEX	45	-
F2:TRH C <sub>10</sub> -C <sub>16</sub> less naphthalene	110	-
TRH C <sub>6</sub> -C <sub>10</sub>	-	700
TRH C <sub>10</sub> -C <sub>16</sub>	-	1,000
F3:TRH C <sub>16</sub> -C <sub>34</sub>	-	2,500
F4:TRH C <sub>34</sub> -C <sub>40</sub>	-	10,000
Benzene	0.5	-
Toluene	160	-
Ethylbenzene	55	-
Xylene	40	-
Naphthalene	3	-



Chemicals	HIL / HSL <sup>1</sup>	Management Limits <sup>2</sup>
	Residential B (sand) <sup>3</sup>	Residential / Open space
Benzo(a)pyrene	-	-
Carcinogenic PAHs <sup>4</sup>	4	-
Total PAHs	400	-
Arsenic	500	-
Cadmium	150	-
Chromium (VI)	500	-
Chromium (III)	-	-
Copper	30,000	-
Lead	1,200	-
Mercury	120	-
Nickel	1,200	-
Zinc	60,000	-
DDT	-	-
DDT + DDE + DDD	600	-
Aldrin and dieldrin	10	-
Chlordane	90	-
Endosulfan	400	-
Endrin	20	-
Heptachlor	10	-

#### **Notes**

<sup>1</sup> Residential land use (minimal access to soil) HIL / HSLs have been derived from ASC NEPM (1999, amended 2013) - Table 1A(1) – Health investigation levels for soil contaminants and Table 1A(3) Soil HSLs for vapour intrusion (sand soil).

<sup>2</sup> Management limits have been derived from ASC NEPM (1999, amended 2013) Table 1B(7) Management Limits for TPH fraction in soil.

<sup>3</sup> Soil HSLs may be adjusted for clay subsoil if residual contamination is identified following excavation of sandy topsoils

<sup>4</sup> Carcinogenic PAHs as measured by benzo(a)pyrene TEQ.316

## **4.4 Remediation Options**

### *4.4.1 Remediation Hierarchy*

DEC (2006) provides a preferred hierarchy of options for site clean-up and/or management, which was originally developed in ASC NEPM (1999, amended 2013). The hierarchy is outlined as follows:

- Onsite treatment of the contamination so that it is destroyed and the associated risk is reduced to an acceptable level.
- Offsite treatment of excavated soil, so that the contamination is destroyed or the associated risk is reduced to an acceptable level, after which the soil is returned to the site.

#### **If the above is not practicable:**

- Removal of contaminated material to an approved facility, followed, where necessary, by replacement with appropriate material.
- Consolidation and isolation of the soil onsite by containment within a properly designed barrier.

If a remediation option would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy would be required.

### *4.4.2 Review of Remediation Options*

A range of site remediation strategies have been considered for the site, with alternate strategies assessed with regards to their:

- Effectiveness at achieving remediation objectives.
- Suitability in light of the proposed development.
- Anticipated costs.
- Ongoing environmental and public health adequacy.

Based on the above, the following strategies may be applicable to the remediation of contaminated material:

- Onsite treatment of hydrocarbon contaminated soil through landfarming.

- Excavation, waste classification, and offsite disposal of lead and hydrocarbon contaminated soil to landfill.
- Residual risk could be managed on-site through capping removing direct exposure pathways between the known and likely contaminated soil and future users of the site.

A review of treatment options is presented in Table 5.

**Table 5:** Review of soil remediation options.

Remediation Options	Advantages	Disadvantage	Comments
Capping and containment	<ul style="list-style-type: none"> <li>Often a low cost option.</li> <li>Can be used to mitigate risk of hydrocarbon and heavy metal contaminated soils.</li> </ul>	<ul style="list-style-type: none"> <li>Will not remove contamination.</li> <li>Human health risk is mitigated by burying, but contamination remains onsite.</li> <li>Remaining future liability.</li> <li>A long term EMP required to manage remaining contamination.</li> <li>Note on title indicating presence of onsite contamination</li> </ul>	Capping is considered an unsuitable remediation technique to deal with identified lead and hydrocarbon impacted soils as it places future land use restrictions on the site with the requirement of an EMP and note on title and is likely to be costly due to the proposed site basement.
Onsite treatment (landfarming)	<ul style="list-style-type: none"> <li>Allows for the reuse of site soils for landscaping purposes.</li> <li>Offsite removal of soils not required thereby limiting unnecessary waste.</li> </ul>	<ul style="list-style-type: none"> <li>Likely to increase remediation time and cost.</li> <li>Not suitable for the treatment of heavy metal contamination.</li> </ul>	<p>Landfarming and treatment of hydrocarbon impacted soils is considered an unsuitable remediation technique due to the significant time and cost requirements for treatment. As the proposed development does not require the soils to remain on site for landscaping purposes, this remediation technique will not be adopted.</p> <p>Additionally, landfarming and treatment of soil will not remediate lead impacted soils.</p>
Offsite disposal	<ul style="list-style-type: none"> <li>Provides the shortest timeframe for remediation.</li> <li>Removes human health risks and long term management requirements.</li> <li>Meets redevelopment objectives as the proposed plan requires removal of site soils.</li> </ul>	<ul style="list-style-type: none"> <li>High cost for material transport and disposal charges.</li> <li>Additional cost associated with classifying wastes prior to offsite disposal.</li> <li>Both disadvantages are offset by the need for site excavation and material disposal inspection of contamination identified.</li> </ul>	<p>This proven and reliable technique for managing onsite contamination is suitable as it removes identified contamination and associated risk to human health as well as long term site management responsibilities.</p> <p>This remediation will meet development objectives and will render the site suitable for the proposed development in a short timeframe and will be adopted for the site.</p> <p>As the development includes removal of soil material for construction of a basement carpark, so this technique aligns with the proposed development.</p>

#### *4.4.3 Preferred Soil Remediation Option*

Considering remediation options (Table 5) and the nature of site soil contamination, offsite disposal of contaminated soil is the most suitable site solution. Details of the remediation procedure are outlined in Section 5.

## **5 Remediation Plan**

### **5.1 Remediation Planning**

**Unless otherwise identified, activities discussed below will be the responsibility of the contractor or its representative.**

#### *5.1.1 Overview*

The following sections outline works required to remediate contaminated soils at the site. These are in addition to general typical environmental controls and mitigation measures required for similar construction works.

#### *5.1.2 Remediation Strategy*

The remediation strategy will preferably involve the offsite removal of soil with contaminant levels greater than adopted health investigation levels. Successful remediation requires all site soils remaining onsite conform to RAC criteria in Table 4.

The remediation process shall be completed in the stages outlined in the following sections.

### **5.2 Regulatory Approvals**

Notification to Liverpool City Council is required in accordance with SEPP 55 (1998) where other development consents do not cover the remediation works. At the conclusion of remediation works, Council shall also be notified outlining completion of remediation.

### **5.3 Appointment of Remediation Contractor / Environmental Consultant**

For remediation works to be successfully completed, the appointment of a suitably qualified environmental / earthworks contractor is required. An environmental consultant to be engaged to oversee and document all stages of the remediation works, perform validation testing where required and prepare a validation report. The consultant will also be responsible for clearance inspections and site supervision.

### **5.4 Site Establishment**

Initial activities on the site shall involve the establishment of all site plant and equipment necessary for remediation works including:

- Establishment of site offices, work sheds and amenities of site workers.

- Appropriate physical barriers and site signage is to be erected surrounding site areas requiring remediation. Physical barriers are to be designed with consideration to potential health and safety risks which may arise from contaminated soil.
- Establishment of site holding/stockpiling areas for contaminated material. Site areas nominated to store material are to have appropriate environmental controls in place including storm water diversion, erosion and sedimentation controls and dust suppression.

## **5.5 Remediation Methodology**

### *5.5.1 Demolition*

It is recommended that existing structures on site are to be demolished and all rubble and refuse removed prior to commencement of remedial excavations.

### *5.5.2 Remedial Excavation*

An experienced environmental engineer is to be present onsite during hotspot remedial works to define excavation extents, guide excavation activities, and identify areas that require additional excavation, with guidance from soil sampling and laboratory analysis.

### *5.5.3 Stockpiling Contaminated Soils*

If waste classification has been completed in-situ prior to excavation of soils, material may be excavated and disposed offsite without the need to stockpile excavated material.

If waste classification has not been conducted in-situ, excavated spoil generated during remedial excavation shall be stockpiled and sampled for waste classification purposes.

Soil stockpile management procedures include:

- Stockpiles to be placed on sealed surfaces (concrete, asphalt or HDPE liner) to ensure no cross contamination with underlying soils occurs.
- Stockpiles to be placed in a secure site area away from the site boundary.
- Stockpiles to be placed on a level area.

- Appropriate bunding and erosion control measures are to be implemented to ensure surface runoff does not come into contact with soil stockpiles.
- Detailed records of stockpile material, location and volume are to be prepared and kept onsite. Stockpile records are to be maintained and updated with any changes (i.e. offsite disposal).
- No placement of soil or other material on Council properties (footpaths / nature strips) unless prior Council approval is obtained.

Stockpiled material is to be removed from site as soon as practical following formal waste classification confirmation to an appropriate licensed facility.

#### 5.5.4 Waste Classification of Excavated Soils

All material to be removed from site must be waste classified prior to offsite disposal. Samples are to be collected at a rate of approximately 1:50 m<sup>3</sup> and assessed in accordance with NSW EPA (2014) Waste Classification Guidelines Part 1: Classifying Waste. Waste classification sampling may be conducted in-situ or in stockpiled material.

Collected samples are to be analysed for TRH, BTEX, OCP/OPP, PAH, heavy metals, and asbestos. Results are to be documented for the purpose of offsite disposal.

Total volumes of material requiring offsite disposal will be dependent on development plans and extent of impacted surface soil contamination.

## 5.6 Site Validation and Waste Management

### 5.6.1 Overview

To verify the effectiveness of proposed remediation works and to document the suitability of the site for proposed residential use, the collection of validation data is required. Given the extent of the remediation works, validation data is required to ensure that:

- The identified contaminated soils have been effectively removed.
- Appropriate waste classification and waste management practices have been employed.



### 5.6.2 Soil Validation and Waste Classification Analytical Program

The proposed soil validation and waste classification sampling and analytical program is outlined in Table 7.

**Table 6:** Soil validation and waste classification sampling program.

Item	Sampling frequency				Analytes
	Excavation floors	Excavation walls (from each distinct material type)	Stockpiles	In Situ Sampling at Depth	
Hot spot excavations	1/50 m <sup>2</sup>	1/10 m	NA	1 soil sample at 1.0 mbgl from each surface sampling point followed by 1 soil sample for every metre thereafter.	TPH, BTEX, PAH, heavy metals, OCP/OPP and asbestos
Waste classification (prior to offsite disposal)			1/50 m <sup>3</sup> Minimum of 3 samples per stockpile.	1/50 m <sup>3</sup>	TPH, BTEX, PAH, heavy metals, OCP/OPP and asbestos

Sampling programme outlined in Table 6 is based on the following rationale:

#### Hot spot excavations

A nominated value of 10 m grids for excavation validation sampling is capable of detecting a circular hot spot with a radius of at least 5.9m or greater with 95% confidence using Procedure A for NSW EPA (1995) *Contaminated Site Sampling Design Guidelines*. This is deemed appropriate based on the size of the proposed excavation.

#### Waste classification

Waste classification sampling rates are designed to enable reliable 95% UCL calculations as outlined in ASC NEPM (1999, amended 2013) and EPA Victoria (2009) *Industrial Waste Resource Guidelines*.

Waste classification sampling may be conducted *in-situ* or following excavation and stockpiling of material.

### 5.6.3 Validation Sampling Methodology

- All sampling is to be completed by an experienced Martens engineer.
- Sample depth and location within excavation or stockpile to be documented.

- iii. Validation samples collected for laboratory analysis will be preferably taken directly from surface being sampled. Where sampling uses excavation machinery samples shall be taken from the centre of the excavator bucket from undisturbed bulk soil material.
- iv. Validation samples will be analysed by a NATA accredited testing laboratory, for criteria listed in Table 7 and compared against remediation acceptance criteria (RAC) outlined in Table 4.
- v. Where validation samples exceed adopted remediation criteria, further remedial excavation shall be completed followed by further validation testing.

#### *5.6.4 Waste Disposal, Materials Tracking and Management*

Stockpiled contaminated spoil shall be recorded on a site diagram and daily site logs by the remediation contractor and supervising environmental consultant. These documents shall be updated daily and kept in the site office. The daily site log shall record the area in which work was conducted for that day, general description of the works completed, onsite movement of materials, etc.

Material being disposed of offsite will require tracking. This shall entail recording of vehicle registration numbers, number of truck movements, approximate volume of materials transported. Material tracking documentation is to be supplied to MA upon completion of remediation works, along with tipping documents supplied by the accepting landfill.

Contaminated spoil should be disposed of to a landfill suitably licensed to accept the specified waste. The disposal of contaminated material to landfill shall be undertaken by appropriately licensed contractor.

All waste classification documentation and waste dockets from the receiving landfill are to be kept and provided to MA for site validation purposes.

#### 5.6.5 Quality Assurance and Quality Control

The following field QA/QC measures will be completed and reported for during remediation works:

- A clean pair of disposable gloves will be used when handling each soil sample.
- Soil samples collected with dedicated sampling equipment will be decontaminated between collection of each sample.
- Collection of intra-laboratory duplicate samples at a rate of 1 per 10 primary samples to assess sampling analytical process and laboratory replication of results.
- Soil trip spikes and trip blanks to assess cross-contamination and losses.

All samples will be analysed by a NATA accredited testing laboratory. The analytical laboratory will be required to perform internal quality control procedures specific to analytical methods and guidance documents. These include, but are not limited to:

- Laboratory blanks – Analysed with each set of samples to assess analytical accuracy.
- Duplicate – Complete duplicate analysis of a sample from the process batch to assess reproducibility of results.
- Matrix Spike – Used to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
- Surrogate Spike – Assessment of matrix effects and sample preparation losses.

#### 5.6.6 Validation Reporting

A site validation report will be prepared at the completion of remediation works. This report shall document the remediation and validation sequence, detail all validation sampling, results of assessment and tipping receipts. The document shall also include details regarding any remaining site contamination, and identify residual risks posed by remaining contaminants.

## **6 Site Management Plan for Remediation**

### **6.1 Overview**

A site specific Construction and Environmental Management Plan (CEMP) and Worker Health and Safety Plan (WHSP) are to be prepared by the Contractor prior to the commencement of onsite works. The following sections are intended as a guide to the information that should be included in these plans.

### **6.2 Construction Environmental Management Plan**

A site specific CEMP shall be prepared to ensure works do not negatively impact on potential receptors (humans and environment) and comply with applicable environmental legislation.

Based on the site condition and proposed remediation method, primary environmental hazards requiring management during remedial works may include:

- Stormwater and soil management.
- Noise controls.
- Odour control.

Additional onsite management issues that may be included in the CEMP include:

- Site access and security.
- Signage and contact information.
- Traffic control.
- Hours of operation.

Suggested requirements for these management points are discussed in the following sections.

#### *6.2.1 Stormwater and Soil Management*

The contractor will put adequate stormwater runoff, runoff and sediment control measures in place for the remedial works to avoid sediment discharge to adjacent areas and the stormwater system (if present) and degradation of the water quality in nearby waterways.

### *6.2.2 Noise Control*

To mitigate noise impacts which may arise as a result of remedial works, the Contractor will undertake works in accordance with state and local noise regulations. The contractor's machinery, including machinery hired by the contractor, should be in good working order so that abnormal machine noise is avoided.

All works are to be undertaken with the Blacktown City Council designated working hours (Section 6.2.8).

### *6.2.3 Odour Control*

Based on the identified site contaminants (heavy metals and ACM) odour is not considered to be major environmental concern. Should odours be encountered contingency measures including the covering of stockpiles and the use of odour suppressant sprays should be implemented.

### *6.2.4 Site Access and Security*

Prior to works commencing, barricades shall be erected to control access to the designated work area, along the proposed remediation area boundary. Signage should be erected, identifying "no unauthorised access". A gate should be installed to allow access to the remediation area. These site access controls must remain in place during site remediation.

### *6.2.5 Signage and Contact Information*

Security fencing and appropriate signage around all open excavations must be installed and maintained by the contractor.

A sign displaying the contact details of the contractor (including the onsite foreman or manager) shall be displayed for the duration of onsite works.

#### 6.2.6 Traffic Control

Prior to exiting the site, vehicles shall be required to pass through a stabilised exit point to remove potentially contaminated soil that may have accumulated while onsite. Prior to leaving the site, during the decontamination phase, earthworks machinery are required to decontaminate upon plastic sheeting laid beneath vehicles, with all accumulated potentially contaminated soil removed. Plastic sheeting and contaminated soils collected should be disposed of with classified waste for subsequent offsite disposal.

#### 6.2.7 Hours of Operation

Onsite works are only permitted during the following hours as outlined in the Liverpool City Council code of practice:

- Monday – Saturday: 7am – 6pm
- Saturday: 8am – 1:00 pm
- Sunday and public holidays: No work permitted.

#### 6.2.8 Monitoring Requirements

During excavation and movement of identified contaminated materials onsite, it is recommended that a suitably qualified environmental consultant is present on site during this process to observe and record the condition of the material. This is additional to project contingency plan arrangements (Section 9). Such recorded observations will be included in a Validation Report, to be completed at the conclusion of remediation.

Where contaminated soils are removed from site, they are to be disposed of to a suitably licensed landfill facility, with material volume and tracking documentation supplied to MA upon completion of remediation works.

### 6.3 Worker Health and Safety Plan

Worker health and safety of all onsite workers or visitors is the responsibility of the contractor. The purpose of a WHSP is to provide relevant health and safety information for all personnel undertaken work or visiting the site.

All onsite personnel and visitors must read the WHSP and acknowledge the requirements prior to entering the site.

The WHSP should include (but not necessarily be limited to):

- Legislation requirements.
- Hazardous materials identification (including fuel and chemical management).
- Induction requirements.
- Worker facilities.
- Designation, delineation and control of access to various work zones.
- Community notification.
- Contingency management.
- Roles and responsibilities.
- Training and competency.
- Hazard identification and risk assessment.
- Control measures including personal protective equipment (PPE).
- Incident and emergency response.
- Safe work method statement.
- Audits.

#### *6.3.1 WHSP Legislation and Standards*

All onsite works should comply with current legislation, regulation and standards. As a minimum all work is to comply:

- Workplace Health and Safety Act (2011).
- Workplace Health and Safety Regulation (2011).

Additional codes of practices and standards that should be followed include:

- AS2601 (2011) – The Demolition of Structures
- AS 1940 (2004) – The Storage and Handling of Flammable and Combustible Liquids
- AS 2436 (2010) – Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites;
- Hazardous Manual Tasks Code of Practice (December 2011)
- Managing the Work Environment and Facilities Code of Practice (December 2011);
- Managing Noise and Preventing Hearing Loss at Work Code of Practice (December 2011);
- Work Health and Safety Consultation, Co-operation and Co-ordination Code of Practice (December 2011).

#### 6.3.2 Hazard Assessment

An OH&S health and safety hazards assessment is to be completed by the contractor and incorporated into the WHSP. Key hazards may include:

- Onsite chemical hazards (storage of fuels, contaminated soils, ACM in existing buildings).
- Heat exposure for workers.
- Buried services.
- Noise.
- Dust.
- Operation of heavy equipment.
- Operation of electrical equipment.



### 6.3.3 Worker Facilities

Facilities for workers at the site must be supplied in accordance with the Work Health and Safety Regulation (2011) including the relevant Codes of Practice.

Lunch rooms and toilet/washing facilities shall be separate from the designated work areas.

### 6.3.4 Site Inductions

Prior to starting works, site workers involved in the project shall attend a site-specific safety induction.

Documented evidence of the safety induction/s must be readily available on site and will be recorded on forms. The contractor should supply site workers including visitors to the site with appropriate PPE as outlined in Section 6.3.6.

### 6.3.5 Personal Protective Equipment

To reduce short and long term health risks associated with the potential exposure to the chemicals of concern, the minimum level of PPE required for people, depending on the site activity, are listed below.

**Body Protection:** High visibility clothing/vest requisite for site works.

**Eye Protection:** Eye protection is required to prevent eye injuries resulting from contact with contaminated soil or liquid. Safety glasses are required to be worn by site personnel during handling of soil and liquid.

**Foot Protection:** Steel toed boots will be worn by all on-site personnel.

**Skin Protection:** Long sleeves and trousers must be worn at all times. Skin protection will be required to prevent absorption of contaminated soil into the body. Gloves should be worn by personnel involved in site activities which will come into contact with contaminated soil or liquid. Sunscreen (SPF +30) shall also be worn to protect exposed skin areas not covered by PPE from the sun.

**Hearing Protection:** Personnel who are likely to be exposed to potentially harmful noise levels on site will wear hearing protection (ear plugs or ear muffs).

**Respiratory Protection:** Appropriate respiratory protection shall be utilised to prevent inhalation of airborne dusts, asbestos fibres (if present), organic vapours (if present).

Site personnel should be aware that personal protection equipment required to be worn may limit manual dexterity, hearing, visibility and may increase the difficulty of performing tasks. PPE places an additional strain on the user when performing work that requires physical activity.

Eating, drinking, chewing gum or tobacco, smoking or any practice that involves hand to mouth transfer increases the probability of ingestion of foreign matter into the body. Hands must be thoroughly washed before eating, drinking or smoking. Clothing which becomes dirty from onsite work should be washed separately from other clothing.

## **7 Identification of Regulatory Compliance Requirements**

### **7.1 State Environmental Planning Policies**

In accordance with SEPP 55 - Remediation of Land (1998), it is considered proposed remediation works would likely classify as Category 2, and therefore would not require specific development consent. Where works are completed without development consent, Council notification in accordance with Clause 16 of SEPP 55 is required.

### **7.2 Waste Disposal Requirements**

All soil is to be waste classified in accordance with NSW EPA (2014) Waste Classification Guidelines prior to offsite disposal. Should soils be transported to a landfill, it is a requirement that the receiving landfill be licenced to accept the category of waste leaving the site.

Waste classification documentation and waste dockets from the receiving landfill are to be kept for site validation purposes.

### **7.3 Asbestos Licences**

Should asbestos containing material be identified during excavation works, subsequent asbestos removal shall be undertaken in accordance with relevant work health and safety regulation including but not limited to:

- WorkCover Asbestos – Guidelines for Licensed Asbestos Removal Contractors (2008).
- Work Safe Australia – How to Safely Remove Asbestos: Code of Practice (2011).

### **7.4 Groundwater Discharge**

If water is to be discharged from the site as part of any dewatering activities, relevant discharge consent from Liverpool City Council (BCC), Sydney Water and / or the NSW EPA will be required. Further, any dewatering activities using groundwater will require consent from the NSW Department of Primary Industries' Office of Water.

## **8 Remediation Contacts**

Names and phone numbers of appropriate personnel for contact during the remediation will be provided prior to commencement of remediation work.

## 9 Contingency Plan for Remediation and Redevelopment

### 9.1 Overview

It is considered possible that unexpected situations may occur during remediation and site redevelopment works including the possibility to uncover unidentified contamination. A site contingency plan for managing unexpected situations should be prepared by the Contractor. Unexpected situations that may arise include:

- Inability to fully remediate the site.
- Uncovering types of contamination that are not presently identified.
- Uncovering of any asbestos waste.
- Generation of unacceptable dust.
- Generation of unacceptable noise.
- Excessive rainfall.
- Collection of water in excavations.

The following sections shall outline procedures to be adopted should any of the above listed events occur.

A flow chart outlining unexpended funds protocol is presented in Attachment C.

#### 9.1.1 Incomplete Remediation

As stated in Section 5.1.2 all soil to be retained onsite must conform to site (and site area) specific health investigation levels. In the event that this requirement cannot be achieved the following actions will be required to ensure site suitability for residential and open space land use.

- Preparation of a site specific human health risk assessment (HHRA).
- Development of an environmental management plan.

The EMP will be required to describe the nature and location of contamination remaining onsite, required management procedures and any ongoing monitoring and auditing requirements if required.

### 9.1.2 Unknown Materials

If during remedial/construction work, material is encountered which appears to be potentially contaminated, and appears to be different from the soils encountered during the DSI (MA, 2015a), or point sources of contamination (i.e. buried drums or ACM sheeting), which were not expected to be present are encountered, the following procedures are to be applied:

1. Suspicious material/soil which has been excavated should be stockpiled on bunded, strong, impermeable plastic sheeting, protected from erosion, with seepage retained.
2. Excavation works at that part of the site where the suspicious material (soil, fill or other) was encountered should cease until observed by an experience environmental consultant.
3. Based on visual inspection, the environmental consultant will provide interim advice on construction health and safety, soil storage and soil disposal to allow construction to proceed if practicable.
4. Based on sampling and analysis of the material, the environmental consultant will provide final advice, based on comparison of laboratory test results to suitable criteria relating to human health, potential environmental impacts and waste disposal.

In the context of the above, some examples of "suspicious" material would include oily or odorous material, drums or metal or plastic chemical containers.

### 9.1.3 Asbestos Waste

Asbestos sampling has not been fully undertaken across the site at this stage and demolition of existing dwellings remains to be completed. Therefore, it is possible that during excavation work, asbestos containing material (ACM) may be encountered. Should ACM be encountered during excavation works, all site works are to cease in that area of the site and an asbestos management plan to remove and validate the respective areas shall be prepared and implemented.

Asbestos management plans will document specific health and safety requirements associated with the management of asbestos containing material. The plan should include but not be limited to:

- Documentation of any unexpected encounter of asbestos containing material.

- Assessment by a suitably qualified environmental consultant which may involve laboratory assessment of soil or material.
- Appropriate PPE.
- Air monitoring for asbestos fibres.
- Appropriate decontamination procedures.

Reference should be made to WorkCover (2011) *How to Safely Remove Asbestos* prior to the preparation of an Asbestos Management Plan.

#### 9.1.4 Control of Dust

Contingency measures are to be prepared and implemented if dust levels exceed acceptable levels (based on onsite observation, measurements by dedicated dust monitoring equipment or community complaints). Possible measures shall include:

- Increased use of water sprays.
- Sheeting utilised to cover exposed areas.
- Changing work protocols i.e. avoid work on windy days.

#### 9.1.5 Control of Noise

Should excessive noise be generated during remediation works, contingency measures shall be implemented which include:

- Identification and isolation of the source.
- Modification of the action of the source.
- Erection of temporary noise barriers.

#### 9.1.6 Excessive Rainfall

Contingency measures to be undertaken in the event of excessive rainfall include:

- Ensure that sediment and surface water controls are operating correctly.
- Diversion of surface water away from excavations, soil stockpiles and active work areas.
- Appropriate cover over stockpiles.

#### *9.1.7 Collection of Water in Excavation*

Should water accumulate inside excavations, an assessment of water quality is to be undertaken by a suitable qualified environmental consultant to prepare appropriate discharge options.



## 10 Limitations

The recommendations presented in this report include specific issues to be addressed during the detailed design phase of the project. In the event that any of the recommendations presented in this report are not implemented, the general recommendations may become inapplicable and Martens and Associates accept no responsibility whatsoever for the performance of the project where recommendations are not implemented in full and properly tested, inspected and documented.

Site assessment undertaken and documented in this and previous site reports have been conducted in accordance with the current industry standard, however no site sampling strategy can be considered to be a complete and exhaustive characterisation of a site nor can it be guaranteed that any assessment shall identify and characterise all areas of contamination. Therefore, this report should not be read as a guarantee that no hitherto unidentified contamination will be present within site materials. Should material be exposed during site works which was not encountered during the previous investigations undertaken, the newly discovered material should be specifically assessed by Martens and Associates.

Occasionally, sub-surface conditions between and below the completed boreholes / test pits / other tests may be found to be different (or may be interpreted to be different) from those expected. Variation can also occur with groundwater conditions, especially after significant rainfall even. If such differences appear to exist, we recommend that you immediately contact Martens and Associates.

If you require any further information, please do not hesitate to contact the writer.

ASC NEPM (1999, amended 2013) National Environmental Protection (Assessment of Site Contamination) Measure – Referred to as ASC NEPM (1999, amended 2013).

EPA Victoria (2009) *Industrial Waste Guidelines*.

Martens and Associates (2015a) *Preliminary Site Investigation: 17 – 23 Goulburn Street, Liverpool, NSW. (P1505008JR01V01)*.

Martens and Associates (2015b) *Preliminary Geotechnical Investigation: 17 – 23 Goulburn Street, Liverpool, NSW. (P1505008JR02V01)*.

Martens and Associates (2017) *Detailed Site Investigation: 17 – 23 Goulburn Street, Liverpool, NSW. (P1505008JR03V01)*.

NSW DEC (2006) 2<sup>nd</sup> Ed. *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme*.

NSW EPA (1995) *Contaminated Sites: Sampling Design Guidelines*.

NSW EPA (2014a) *Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014; The excavated natural material order 2014*.

NSW EPA (2014b) *Resource Recovery Exemption under Part 9, Clauses 91 and 92 of the Protection of the Environment Operations (Waste) Regulation 2014; The excavated natural material exemption 2014*.

NSW EPA (2014c) *Waste Classification Guidelines Part 1: Classifying Waste*.

NSW OEH (2011) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*.

State Environmental Planning Policy No. 55 (1998) – *Remediation of Contaminated Land (SEPP 55, 1998)*.

## 12      Attachment A – Site Plan



KEY

APPROXIMATE SITE BOUNDARY

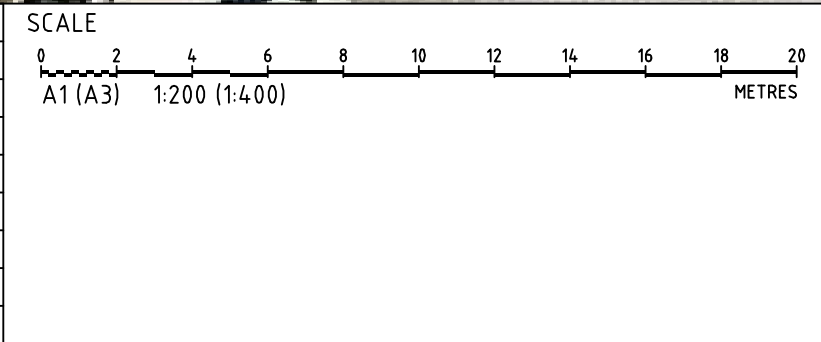
SURFACE SAMPLE LOCATION (MA 2017)

BOREHOLE LOCATION (MA 2017)

APPROX. AEC LOCATION (MA 2015a)

EXCEEDANCE OF SAC (MA 2017)

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	INITIAL RELEASE	17/03/2017	KH	RH	JF	JF
A	INITIAL RELEASE	07/03/2017	KH	RM		



GRID

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DATUM

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PROJECT MANAGER

JF

CLIENT

GOULBURN LIVERPOOL (NSW) PTY LTD

PROJECT NAME/PLANSET TITLE

REMEDIAL ACTION PLAN

17-23 GOULBURN STREET, LIVERPOOL, NSW

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DRAWING TITLE				
SITE PLAN				
PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1505008	PS02	R02	PS02-J120	B

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A1 / A3 LANDSCAPE (A1L\_C\_02.0.01)

## 13      **Attachment B – Unexpected Finds Protocol**

## Unexpected Finds Protocol

