



## **Site Audit Report**

**Ivanhoe Estate  
Macquarie Park, NSW 2113**

Prepared for

**Frasers Property Ivanhoe Pty Ltd**

**James Davis  
NSW EPA Accredited Contaminated Land Site Auditor  
Accreditation Number: 0301**

## **Final Report**

**April 2018**

**Report Reference: 600138\_0301-1803**

**Report Title****Site Audit Report****Ivanhoe Estate, Macquarie Park, NSW 2113**

Report Reference: Ref: 600138\_0301-1803

**Site Audit Details:**

Enviroview Project Reference: 600138

Site Auditor: James Davis

Site Auditor NSW EPA Accreditation Number: 0301

Date Audit Commenced: 7 February 2018

**List of Site Audit Statements that this report relates to:**

0301-1803

**Client Details:**

Site Audit Commissioned By: Frasers Property Ivanhoe Pty Ltd

Client Contact: Scott Clohessy

**Document Control:**

Revision Status	Date	Approved for Issue	Distribution		
			Client	Council	NSW EPA
Final	19 April 2018		SAR/SAS-e	SAS-e	SAS-e

*Notes: (e) – electronic soft copy; (h) – hard copy and number of copies;*

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## Executive Summary

This Site Audit Report (SAR) and subsequent Site Audit Statement (SAS) have been produced to document the findings of a Site Audit, conducted by James Davis of Enviroview Pty Ltd, a New South Wales Environmental Protection Authority (NSW EPA) Contaminated Land Accredited Site Auditor on the subject site identified as Ivanhoe Estate (including Ivanhoe Place, Wilcannia Way, Nyngan Way and Narromine Way) and part of 2-4 Lyon Park Road, Macquarie Park.

The Site Audit has been conducted following a request from Frasers Property Australia to undertake a Site Audit on the site and to determine in the Site Auditor's opinion whether the site can be made suitable for the proposed land use. It is understood that the site is proposed to be developed for low density residential land use.

The requirement for this Site Audit comes about as a requirement of Secretary's Environmental Assessment Requirements (SEARs) for a Development Application for the development of the site and the requirement is that a Remediation Action Plan (RAP) be prepared and submitted to the Department of Planning and Environment with a 'Section B' Site Audit Statement. As the Site Audit is not a specific requirement of a development consent or approval given under the *Environmental Planning and Assessment Act 1997* it has not been conducted as a Statutory Site Audit as defined by section 47(c) of the *Contaminated Land Management Act 1997*.

This Site Audit can only certify that the site can be made suitable for the proposed use regarding the Remediation Action Plan (RAP) that has been prepared for that purpose. This type of Site Audit is often referred to as a 'Section B' Site Audit with reference to the section of the Site Audit Statement that is prepared by the Site Auditor.

The objective and scope of the Site Audit was to independently review the site assessment and remediation planning as reported by the environmental consultant, and to determine whether the site can be made suitable for the proposed use with the implementation of the RAP. In order to achieve the objective, the Site Auditor has reviewed the work undertaken as reported by the various consultants and assessed whether the consultant's work complied with relevant procedures and guidelines, and provides a robust basis for determining whether the land can be made suitable for the proposed land uses. The proposed land uses comprises a mix of

The outcome of the Site Audit is this SAR and subsequent SAS, (SAS number 0301-1803) a copy of which is attached to the end of this report.

The Site Auditor has considered the following matters in relation to the reports prepared:

- The provisions of the *Contaminated Land Management Act 1997* and the Contaminated Land Management Act (1997) Regulations and subsequent amendments;
- The provisions of any environmental planning instruments applying to the site; and
- The guidelines made or approved by the NSW DEC under s.105 of the *Contaminated Land Management Act 1997*.

The reports relating to the assessment and remediation of the site have been reviewed and are considered to have met the requirements of the *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (3rd edition)* (NSW EPA, 2017) and other guidelines endorsed under s.105 of the *Contaminated Land Management Act 1997*, and therefore the objectives of the Site Audit.

A Remediation Action Plan (RAP) has been prepared that proposes to remediate a hotspot of contaminated fill at the site using a strategy of excavation and off-site disposal. Based on the work undertaken, as described in the reports reviewed, the Site Auditor is satisfied that the remedial plans provide sufficient detail of the proposed remediation works, that if implemented the site can be made suitable for the proposed land use.

The guidelines for the Site Audit Scheme (NSW EPA, 2017) prescribe that during an assessment of the suitability of a site for an existing or proposed land use in an urban context, Site Auditors must follow the decision process and checklist for assessing urban redevelopment sites provided in Appendix A of the guidelines. This decision process has been utilised by the Site Auditor in forming the opinion of whether the site can be made suitable for the proposed use.

With regard to the decision process for assessing urban redevelopment sites, it is considered that the site can be made suitable for the most sensitive of the proposed land uses being residential land use with gardens and accessible soil with the implementation of the DLA Remediation Action Plan. The Site Auditor is satisfied that the assessment and remedial planning as reported for the Site Audit site have demonstrated that the site can be made suitable for the proposed land uses.

The Site Auditor is satisfied that the assessment and remedial planning as reported for the Site Audit site have demonstrated that the site can be made suitable for the proposed land uses. A Site Audit Statement will be issued certifying that in the opinion of the Site Auditor the remediation plan is appropriate for the purpose of the remediation of the site for the proposed land uses including residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry; Day care centre, preschool, primary school; Residential with minimal opportunity for soil access, including units; Secondary school; Park, recreational open space, playing field; Commercial/industrial.

## Acronyms and Abbreviations

ACM	Asbestos Containing Material
AEC	Area of Environmental Concern
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
BTEX	benzene, toluene, ethylbenzene, and xylenes
bgl	Below Ground Level
COC	Chain of custody (can also be contaminants of concern)
DA	Development Application
DEC	Department of Environment and Conservation (NSW)
DECC	Department of Environment and Climate Change (NSW)
DECCW	Department of Environment, Climate Change and Water (NSW)
DP	Deposited Plan
HILs	health-based investigation levels
IA	interim advice
LOR	Limit of Reporting
m	Metre
MW	monitoring well
NEHF	National Environmental Health Forum
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
NRMMC	Natural Resource Management Ministerial Council
NSW	New South Wales
OCPs	Organochlorine pesticides
OEH	The NSW Office of Environment and Heritage
OPPs	Organophosphorus pesticides
PAH	polycyclic aromatic hydrocarbons
PID	Photoionisation Detector
PQL	Practical Quantification Limit
RAP	Remedial Action Plan
RPD	Relative Percent Difference
SAR	Site Audit Report
SAS	Site Audit Statement
SEPP 55	State Environmental Planning Policy No. 55 – Remediation of Land
TRH	Total Recoverable Hydrocarbons
VOCs	Volatile organic compounds

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# 1 Introduction

## 1.1 Overview

This Site Audit Report (SAR) and subsequent Site Audit Statement (SAS) have been produced to document the findings of a Site Audit, conducted by James Davis of Enviroview Pty Ltd, a New South Wales Environment Protection Authority<sup>1</sup> (NSW EPA) Contaminated Land Accredited Site Auditor accredited under Part 4 of the *Contaminated Land Management Act 1997* as a Site Auditor.

The Site Audit has been conducted in accordance with the requirements of the *Contaminated Land Management Act 1997* (the 'Act'). The Act defines the Site Audit as follows:

"site audit" means a review:

- (a) that relates to management (whether under this Act or otherwise) of the actual or possible contamination of land, and
- (b) that is conducted for the purpose of determining any one or more of the following matters:
  - (i) the nature and extent of any contamination of the land,
  - (ii) the nature and extent of any management of actual or possible contamination of the land,
  - (iii) whether the land is suitable for any specified use or range of uses,
  - (iv) what management remains necessary before the land is suitable for any specified use or range of uses,
  - (v) the suitability and appropriateness of a plan of management, long-term management plan or a voluntary management proposal.

Furthermore, the Act provides the following definitions:

"Site Audit Report" means a site audit report prepared by a site auditor in accordance with Part 4 [of the Act].

"site audit statement" means a site audit statement prepared by a site auditor in accordance with Part 4 [of the Act].

The *Contaminated Sites: Guidelines for the NSW Auditor Scheme (3<sup>rd</sup> edition)*, (NSW EPA, 2017) describes that the services of a site auditor can be used by anyone who needs an independent and authoritative review of information relating to possible or actual contamination of a site and that the review may involve independent expert technical advice or 'sign-off' of contaminated site assessment, remediation or validation work

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<sup>1</sup> The NSW EPA has undergone a number of name changes in the recent past; however statutory functions and powers have always and continue to be exercised in the name of the Environmental Protection Authority (NSW EPA). The NSW EPA is responsible for environmental regulation and associated activities throughout NSW including those activities regulated under the *Contaminated Land Management Act 1997*. The use of the names Department of Environment and Conservation (NSW DEC), NSW Department of Environment and Climate Change (NSW DECC), NSW Department of Environment, Climate Change and Water (NSW DECCW), NSW Office of Environment and Heritage (NSW OEH) in this report are used with regard to the name relevant at the time and context of the reference, but are considered generally interchangeable and can be interpreted as one and the same.

conducted by a contaminated site consultant. The guidelines describe the site assessment and Site Audit process where the contaminated land consultant designs and undertakes the site assessments, and if necessary all remediation and validation activities to achieve specified objectives. The Site Auditor independently reviews the consultant's work and prepares the material outcome of the Site Audit – the Site Audit Report and Site Audit Statement.

## 1.2 Guideline Documents

Guidelines made or approved by the NSW EPA under s.105 of the Act at the time of the Site Audit include:

- Contaminated Sites: Guidelines for the vertical mixing of soil on former broad-acre agricultural land, NSW EPA, 1995 (NSW EPA, 1995)
- Contaminated Sites: Sampling Design Guidelines, NSW EPA, 1995 (NSW EPA, 1995)
- Contaminated Sites: Guidelines for Assessing Banana Plantation Sites, NSW EPA, 1997 (NSW EPA, 1997a)
- Environmental Guidelines: Use and Disposal of Biosolids Products, NSW EPA, 1997 (NSW EPA, 1997b)
- Contaminated Sites: Guidelines for Assessing Former Orchards and Market Gardens, NSW DEC 2005 (NSW DEC, 2005)
- Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (3<sup>rd</sup> edition), NSW DEC, 2006 (NSW EPA, 2017)
- Contaminated Sites: Guidelines for the Assessment and Management of Contaminated Groundwater, NSW DEC, 2007 (NSW DEC, 2007)
- Contaminated Sites: Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997, NSW DECC, 2015 (NSW EPA, 2015)
- Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites, NSW OEH, 2011 (NSW OEH, 2011)
- National Environment Protection (Assessment of Site Contamination) Measure, National Environment Protection Council, 1999 (Amended May 2013) (NEPC, 1999, Amended 2013)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Paper No 4, 2000 (ANZECC/ARMCANZ, 2000)
- Australian Drinking Water Guidelines. National Health and Medical Research Council and Natural Resource Management Ministerial Council, 2011 (NHRMC/NRMMC, 2004)
- Composite Sampling. Lock, W. H., National Environmental Health Forum Monographs, Soil Series No.3, 1996, SA Health Commission, Adelaide (NEHF, 1996)

- Environmental Health Risk Assessment: Guidelines for assessing human health risks from environmental hazards. Department of Health and Ageing and EnHealth Council, Commonwealth of Australia, 2012 (EnHealth, 2012)
- Guidelines for the Assessment and Clean Up of Cattle Tick Dip Sites for Residential Purposes, NSW Agriculture and CMPS&F Environmental, February 1996 (NSW Agr., 1996)

From time to time the NSW EPA may amend the guidelines made or approved under s.105 of the Act. For instance, the Contaminated Sites: *Guidelines for Assessing Service Station Sites*, NSW EPA, 1994 (NSW EPA, 1994), have recently been rescinded and replaced with the Technical Note: Investigation of Service Station Sites (NSW EPA, 2014). The Technical Note is not made or approved under the Act.

A number of additional technical notes and guidance is also provided by the NW EPA that may not be made or approved under the *Contaminated Land Management Act 1997* that may be relevant to the site contamination management.

### 1.3 Site Auditor

James Davis of Enviroview Pty Ltd, is a NSW EPA Contaminated Land Accredited Site Auditor accredited as a Site Auditor under Part 4 of the *Contaminated Land Management Act 1997* (NSW EPA Accreditation Number 0301).

The Site Audit was initiated by a request from representatives of Frasers Property Ivanhoe Pty Ltd who engaged the Site Auditor in February 2018.

### 1.4 Type of Site Audit

The requirement for the Site Audit comes is a requirement of the Secretary's Environmental Assessment Requirements (SEARs) for a Development Application for the development of the site and the requirement is that a RAP is to be prepared and submitted to the Department of Planning and Environment with a 'Section B' Site Audit Statement.

Therefore, the engagement of the Site Audit by the client is to review the RAP and to certify that the site can be made suitable for the proposed use with the implementation of the Remediation Action Plan (RAP) that has been prepared for that purpose.

As the Site Audit is not a specific requirement of a development consent or approval given under the *Environmental Planning and Assessment Act 1997* it has not been conducted as a Statutory Site Audit as defined by section 47(c) of the *Contaminated Land Management Act 1997*. While this does not change the conduct of the Site Audit it does mean that the commencement of the Site Audit was not notified to the NSW EPA nor will the Site Audit Statement be provided to the local council and NSW EPA when issued as is required for Statutory Site Audits.

### 1.5 Objective and Scope of the Site Audit

The objective of the Site Audit was to independently review the site assessment and remedial planning works as reported by the environmental consultant and determine whether the site can be made suitable for the proposed use with regard to contaminated land. It is understood that the site is proposed to be developed into a combination of high

and low density residential land use, however the more conservative low density residential land use has been considered for the purpose of the site audit as this will inherently include those other less sensitive land uses.

To achieve this objective, the Site Auditor has reviewed the work undertaken as reported by the consultants and assessed whether the consultant's work complied with relevant procedures and guidelines, and provides a robust basis for determining whether the land can be made suitable for the proposed use with implementation of reviewed remedial planning works.

The outcome of the Site Audit is this SAR and subsequent SAS (SAS number 0301-1803), a copy of which will be attached to this report.

## 1.6 Documents Reviewed

The following documents were reviewed as part of this Site Audit:

JBS&G (2016). *Detailed Site Investigation, Ivanhoe Estate, Herring Road, Macquarie Park, NSW*. Document Ref: 52047/104956 (Rev 0). 24 October 2016 (JBS&G, 2016)

DLA Environmental Services (2016). Letter dated 11 October 2016 Re: *Summary of In-Ground Contamination – Ivanhoe Estate, Cnr Herring and Epping Roads, Macquarie Park NSW 2113*. Document Ref: DL3531\_S005491 (DLA, 2016)

DLA Environmental Services (June 2017). *Supplementary Site Investigation, Ivanhoe Estate, Corner Herring Road and Epping Road, Macquarie Road (STET) NSW 2113*. Document Ref: DL3953\_S006887. June 2017 (DLA, June 2017)

DLA Environmental Services (July 2017). *Supplementary Site Investigation - New Property Acquisition - Ivanhoe Estate, 2 Lyon Park Road, Macquarie Park (STET) NSW 2113*. Document Ref: DL3953\_S007076. 28 July 2017 (DLA, July 2017)

DLA Environmental Services (2018). *Remediation Action Plan, Ivanhoe Estate, Corner Herring Road and Epping Road, Macquarie Park NSW 2113*. Document ref: S008208 Version 1.2. 12 March 2018 (DLA, 2018)

## 1.7 Site Audit Inspections

Whilst undertaking the Site Audit an inspection of the site was conducted. The following table lists the details of the inspection of the site conducted by the Site Auditor.

**Table 1-1 Site Inspections**

Date	Attendance	Purpose
10 April 2018	James Davis – Enviroview Pty Ltd Scott Clohessy – Frasers Ivanhoe	Inspection of the site to be familiar with the site and site context

## 1.8 Audit Correspondence

Correspondence in the form of Site Audit Interim Advice was issued in regard to the Site Audit to clarify and request additional information and to provide guidance on the Site Audit requirements. Site Audit Interim Advice is provided in **Appendix A**.

## 1.9 Chronology of Site Assessment and Audit Works

The chronology of events of site assessment, auditor review and preparation of final audit statement and report undertaken at the site has been summarised in the following table.

**Table 1-2 Summary of Assessment and Site Audit Works**

Date	Action
24 October 2016	JBS&G issue the Detailed Site Investigation report
June 2017	DLA Issue the <i>Supplementary Site Investigation</i> report (Ivanhoe Estate)
28 July 2017	DLA issue the <i>Supplementary Site Investigation</i> report (New Property Acquisition)
7 February 2018	Engagement of Site Auditor
7 February 2018	DLA issue the <i>Draft Remediation Action Plan</i> for the site
24 February 2018	Interim Site Audit Advice 01 prepared by James Davis of Enviroview Pty Ltd.
12 March 2018	DLA issue finalised <i>Remediation Action Plan</i>
10 April 2018	Site Inspection by the Site Auditor
19 April 2018	Finalisation of a Site Audit Report and preparation of the Site Audit Statement for Audit number 0301-1803 conducted by James Davis of Enviroview Pty Ltd with regard to the remedial plan prepared for the site and whether the site can be made suitable for the proposed landuse.

## 2 Site Description

### 2.1 Site Identification

A summary of the site identification details is provided in **Table 2-1**.

**Table 2-1 Summary Site Details**

<b>Street Address:</b>	Ivanhoe Estate (Ivanhoe Place, Wilcannia Way, Nyngan Way and Narromine Way) and part of 2-4 Lyon Park Road, Macquarie Park
<b>Property Description:</b>	Lots 6 to 20 in DP 861433 Part Lot 1 in DP 859537 Lot 100 in DP 1223787 Lot 5 in DP 740753
<b>Zoning:</b>	B4 - Mixed Use under the Ryde Local Environmental Plan 2014
<b>Local Government Area:</b>	City of Ryde
<b>Site Area:</b>	8.2 Ha

Two plans are provided in **Appendix B**: Figure 1 identifies the site location and development site. A plan figure with the Site Audit Site is also presented.

The site comprises several parcels of land located on the corner of Epping Road and Herring Road. Additional land acquisitions to the east of the site will ultimately enable additional access from Lyonpark Road. The site is irregular in shape and has a combined area of approximately 8.2 hectares.

### 2.2 Site Condition and Surrounding Environment

The site is currently comprises 259 social housing residential dwellings with associated local access roads and public open space. The consultant DLA did not provide a detailed site description of the site condition at the time of investigation. However, the consultant JBS&G undertook site inspection in April 2016 and September 2016 and provided the following description in the Detailed Site Investigation report (JBS&G, 2016):

- The site comprised a moderately undulating parcel of land sloping towards the southeast, the ground surface of which was largely covered by building footprints and concrete, paving and asphalt hardstands. Historical cut and fill activities undertaken to facilitate the construction of larger developments in the estate were apparent.
- The buildings comprised primarily two storey brick and tile townhouses and multistorey apartment blocks. A single storey, standalone child care centre development also existed within the centre of the estate. The buildings were estimated to have been constructed between 1980 and 1990.
- The southeast section of the site (Lot 9 DP861433) comprised parkland area, bound to the southeast by Shrimptons Creek and an approximately 10 m wide strip of trees and shrubs. The parkland area was generally in good condition, with little to no bare soil and no signs of vegetative stress. The lot contained a disused recreational barbeque area, a skate park and was dissected by a shared path (pedestrian and cyclist). Several fire scars were observed on concrete hardstands and infrequent small collections of rubbish were noted around ground surfaces within the area.

- The southwest of the site comprised an allotment (Lot 8 DP861433) which was entirely covered by thick vegetation, which prevented detailed inspection of the site surfaces at the time of the investigation.
- A transformer existed on the northwest boundary of Lot 16 DP861433, situated on a concrete foundation. No staining or odours associated with the transformer were observed. Additionally, an unnatural undulation in topography was observed on the southwest corner of the lot, potentially associated with cut and fill activities required to meet construction requirements during development of the land.
- Significant alteration of the ground surfaces appeared to have taken place during construction, potentially being achieved from the importation of fill materials or utilisation of building and demolition waste mixed with site won soils. Cut/fill activities appear to have been localized.

The surrounding land uses was described by the consultant (JBS&G, 2016) as:

- North – the site is bound to the northwest by Herring Road and to the northeast by several medium density housing estates. Within the medium density housing estates lie Elouera Reserve, Quandong Reserve and Wilga Park and recreational parklands. Further north, across Herring Road, are some commercial premises including Trinity Chapel Macquarie and Dunmore Lang College then Kikkiya Creek followed by Macquarie University. To the northeast is the Macquarie Centre, a large commercial and retail development;
- East – immediately east and southwest of the site lies Shrimptons Creek. Further east were several commercial office and retail spaces followed by the Optus Business centre.
- South – the site is bound to the southwest by Epping Road and to the southeast by Shrimptons Creek. The land across Epping Road was observed to comprise standalone residences. Further south were a number of recreational parks and sporting fields comprising the Ryde Community Sports Centre; and
- West – the site is bound to the northwest by Herring Road and to the southwest by Epping Road. Adjacent to the Ivanhoe Estate, across Herring Road, were several commercial premises comprising Morling College and Morling Church as well as a large property redevelopment being undertaken at the time of the investigation. Further west, the land use appeared to be primarily low to medium density residential with recreational parkland interspersed between premises.

## 2.3 Topography and Hydrology

The consultant DLA (DLA, June 2017) reported that the site is elevated between approximately 47m Australian Height Datum (AHD) in the southern-most corner and 75m AHD along the north-western boundary. The Site exhibits an overall gradient from the north-western boundary down towards the south / south-east.

Shrimpton Creek runs along the south-eastern boundary of the Site and flows in a broadly northerly direction, ultimately discharging to the Lane Cove River which is located approximately 1.35 km to the north-east of the Site.

The surface of the Site comprises both sealed and unsealed surfaces. In areas of the Site where unsealed surfaces are present (i.e. lawns and garden beds), it is expected that surface



water (rainfall) would infiltrate into the subsurface. In areas of the Site where impervious pavements are present (i.e. roadways), or where the subsurface becomes waterlogged following periods of prolonged or heavy rainfall, runoff water would form overland flow and follow the gradient of the land.

## **2.4 Geology and Hydrogeology**

The consultant (DLA, June 2017) reported that the Geological Survey of NSW 1:100,000 (Sydney Series Sheet 9130) indicated the lithology of geology underlying the site is Triassic-aged Ashfield Shale of the Wianamatta Group and Hawkesbury Sandstone. Ashfield Shale comprises black and dark grey shale and laminite derived from lacustrine environments. Hawkesbury Sandstone comprises medium to coarse grained quartz sandstone with very minor shale and laminite lenses derived from braided alluvial channel fill.

Review of the NSW Office of Water groundwater data indicates that there are no registered bores within a 500m radius of the Site. The closest registered bore to the Site is located approximately 650m to the north / north-east and is registered for use for monitoring purposes. No details regarding the depth to groundwater are available for the nearby registered bores, however it is expected that regional groundwater would be present at depth within the underlying bedrock. Based on the hydrology of the local area, it is expected that groundwater underlying the Site would flow in a north-easterly direction towards the Lane Cove River.

## **2.5 Audit Discussion of Site Description**

The information provided by the consultants on the site condition and surrounding environment, topography and hydrology, geology and hydrogeology has been checked against, and meets the requirements of NSW EPA Guidelines (NSW OEH, 2011). The information provided in the consultant's report is also consistent with the observations made by the Site Auditor during the site inspection. As such, in the Site Auditor's opinion the information provided meets the requirements of the Site Audit.



### 3 Site History

Consultant JBS&G reportedly conducted a desktop historical review as part of a Preliminary Site Investigation report. The Auditor has not viewed the Preliminary Site Investigation report however the findings were summarised in the *Detailed Site Investigation* (JBS&G, 2016).

The consultant reported that the site has been used for market gardening, with a small number of historical structures, up until development of the site for its current use as government housing.

#### 3.1 Audit Discussion of Site History

The site historical review is limited and not all of the information (for example historical land titles) required by NSW EPA 1997 in regard to the documentation of the site history has been provided. Notwithstanding, the Auditor acknowledges that it appears a Preliminary Site Investigation, including review of the historical land use was conducted and the site has reportedly undergone a consistent land use until its current residential development.

Although limited, the site history information provided by the consultants is considered adequate for the purposes of identifying potential contamination issues at the site.

## 4 Potential Contaminants of Concern

As part of the investigation of the site, consultant JBS&G (2016) identified the following areas and contaminants of potential concern.

**Table 4-1 Areas of Environmental Concern and Contaminants of Potential Concern**

Area of Environmental Concern	Contaminants of Concern
Fill materials of unknown origin observed to be present as a result of site development activities.	Heavy metals, polycyclic aromatic hydrocarbons (PAHs), total recoverable hydrocarbons (TRH) / benzene, toluene, ethylbenzene and xylenes (BTEX), organochlorine pesticides (OCPs) / polychlorinated biphenyls (PCB) and asbestos.
Hazardous building materials associated with existing / former site structures.	Asbestos, PCBs and lead.
Former agricultural/market garden site activities.	OCPs, organophosphorus pesticides (OPPs) and heavy metals.

Following identification of an area requiring remediation, the consultant (DLA, 2018) optimised the potential contaminants of concern for remediation and validation activities to focus on TPH.

### 4.1 Audit Discussion of Potential Contaminants of Concern

The identified potential contamination at the site was based on the findings of the prior site assessments undertaken at the site. The list of potential contaminants is considered to have been suitably comprehensive noting the site location and history.

Therefore, the Auditor is satisfied that the potential contaminants of concern identified were appropriate for the assessment of the site and for carrying forward into the remedial works. The potential contaminants of concern were considered acceptable to enable assessing the suitability, post remediation, of the site for the intended land use and have met the objectives of the Site Audit.

## 5 Data Quality Objectives

The Data Quality Objectives (DQO) process is used to define the type, quantity and quality of data needed to support decisions relating to the environmental condition of a site. It provides a systematic approach for defining the criteria that a data collection design should satisfy. The USEPA developed the DQO process as a seven-step iterative planning approach, to be undertaken prior to investigative work.

The Site Auditor Guidelines (NSW EPA, 2017) states that Site Auditors must check that the consultant has properly addressed and adopted DQOs for the investigation or validation programme and that the consultant's report includes the following:

- A statement of predetermined DQOs for the field and laboratory procedures, including quantitative DQOs (in this instance these DQO are related to the implementation of adequate field and laboratory QA/QC and are referred to as Data Quality Indicators for the quantitative assessment of data quality);
- A plan to achieve pre-determined DQOs; and,
- Procedures to be undertaken if the data does not meet the expected DQOs.

### 5.1 Audit Discussion on Data Quality Objectives

JBS&G developed DQOs in relation to *Detailed Site Investigation* (JBS&G, 2016) and DLA developed DQO's for the Supplementary Site Investigations (DLA, June 2017) (DLA, July 2017) and remedial planning. The full seven steps were documented, and were consistent with the stated objectives of the assessment and provided detail on the management of data collection and use.

The details of the DQOs for the investigation and remedial planning works conducted are deemed sufficient and meet the objectives of this Site Audit.

## 6 Site Assessment

Site assessment works were conducted by JBS&G (2016) and DLA (June 2017) and (July 2017) at the site. A summary of the investigation works is presented in the following sections. A Site Audit evaluation of the site assessment works follows in **Section 0**.

### 6.1 Detailed Site Investigation (JBS&G, 2016)

JBS&G were engaged to conduct a Detailed Site Investigation (DSI) at the site prior to development. The scope of the DSI was based on the preliminary site assessment, previously conducted by JBS&G in 2016. The preliminary site investigation report has not been viewed by the Auditor, however was summarised in the DSI report. The following scope of work was undertaken as part of the DSI (JBS&G, 2016):

- Review of Preliminary Site Investigation report and other relevant documentation provided for the site;
- Detailed intrusive site investigations to enable collection and analysis of representative soil samples;
- Analysis of selected soil samples for heavy metals, polycyclic aromatic hydrocarbons (PAHs), total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene and xylenes (BTEX), organochlorine pesticides (OCPs), polychlorinated biphenyls (PCBs), herbicides, asbestos, pH, iron, and cation exchange capacity (CEC);
- Assessment of environmental data collected, including comparison of field and analytical data against appropriate EPA-made or endorsed investigation / screening levels for the proposed land use(s); and
- Preparation of a DSI report in accordance with EPA guidelines and State Environmental Planning Policy 55 – Remediation of Land (SEPP 55).

#### 6.1.1 Soil Assessment Criteria

The consultant compared soil analytical results to a range of health-based soil investigation levels and HSLs as included in the NEPM (NEPC, 1999, Amended 2013) based on the proposed mixed use of the site, including high-density residential (HIL/HSL-B), open space and recreational (HIL/HSL-C), commercial (HIL/HSL-D) and a child care centre (HIL/HSL-A). Ecological-based assessment criteria were also calculated and adopted by the consultant.

#### 6.1.2 Soil Sampling Programme

Soil sampling was conducted between 5-6 September 2016 at 32 locations using a hand auger. Sample locations are depicted on the consultant's Figure 4 included in **Appendix C** and were systematically located across the site, with some locations skewed to target an identified area of concern or to where access was able.

Soil samples were collected from various depths throughout the soil profile, with a maximum depth of investigation being 0.6 m below ground surface (bgs). Bore logs were provided and reported the ground conditions encountered at each of the hand auger locations. Hand auger locations were frequently terminated on sandstone cobbles, boulders and bedrock.

Ground conditions encountered by the consultant were reported to comprise brown, silty sand topsoil with organic matter to 0.1 m depth. Underlying natural materials included orange-brown, gravelly, clayey sand with sandstone gravels. Typically, one to two samples were selected from each location for laboratory analysis. The consultant reported that no potential asbestos containing materials were observed in the soil samples collected or soils observed in each of the sample locations.

The following is a summary of the soil analytical programme was provided by the consultant.

**Table 6-1 Soil Sampling and Analytical Program**

Area	Sample Type	No. Of Sample Location	Analysis (Excl. QA/QC)
Mixed Use Area	Soil	29 Sampling Locations (HA01 – HA29)	Heavy metals – 34 samples PAHs - 30 samples Asbestos – 30 samples TRH/BTEX – 12 samples PCBs – 19 samples OCPs – 19 samples Herbicides – 7 samples OC, CEC, Fe, pH, – 2 samples ASLP/TCLP (metals) – 1 sample TRHs with Silica Gel Clean-up – 1 sample
Public Recreation Area	Soil	3 Sampling Locations (HA30 – HA32)	Heavy metals – 6 samples PAHs - 2 samples Asbestos – 2 samples TRH/BTEX – 2 samples PCBs – 1 samples OCPs – 1 samples Herbicides – 1 samples TRHs with Silica Gel Clean-up – 1 sample

The primary laboratory utilised was Eurofins MGT and the secondary laboratory utilised was Envirolab Services.

### 6.1.3 Soil Analytical Results

Soil analytical results are summarised in the consultant's Table A which is included in **Appendix D**. The consultant reported the following results for the soil sampling programme:

- Heavy metals – concentrations were reported below the adopted human health and ecological criteria in all samples analysed.
- TRH/BTEX – concentrations of TRH (without silica gel clean-up) exceeded the adopted ecological criteria for urban, residential and public open space land use in two of the sample analysed (HA15\_0.0-0.1 – 440 mg/kg (>C16-C34 Fraction) and HA32\_0.0-0.5 – 540 mg/kg (>C16-C34 Fraction)). TRH and BTEX concentrations were reported below the adopted human health and ecological criteria in all remaining samples selected for analysis. Re-analysis of the two samples for TRH with silica-gel clean-up provided results below the LOR in both samples, indicating the TRH initially reported was likely associated with natural organic material in the soil profile, rather than any petroleum-based contaminants.
- PAHs – PAH concentrations exceeded the site criteria in the following samples:

- 2.5 mg/kg of benzo(a)pyrene (B(a)P) in HA20\_0.0-0.1, exceeding the adopted ecological criteria for urban, residential and public open space (0.7 mg/kg), and commercial industrial land use (1.4 mg/kg).
- 5.864 mg/kg of Carcinogenic PAHs as B(a)P toxicity equivalent quotient (TEQ) in HA15\_0.0-0.1, exceeding the adopted health based criteria for Residential A (3 mg/kg) and Residential B (4 mg/kg) land use scenarios.

PAH concentrations were reported below the adopted human health and ecological criteria in all remaining samples selected for analysis.

Statistical analysis was completed for Carcinogenic PAHs as B(a)P TEQ and benzo(a)pyrene which reported 95% UCLs within the adopted human health and ecological criteria.

- OCP and PCB – all reported concentrations were less than the adopted site assessment criteria.
- Herbicides – all reported concentrations were less than the adopted site assessment criteria.
- Asbestos – no asbestos detected in any of the samples analysed.

#### 6.1.4 Quality Assurance / Quality Control (QA/QC)

A programme of QA/QC sample collection was undertaken as part of field investigation. The consultant included the collection of two intra-laboratory duplicate samples, slightly below the proposed rate of 1 in 20 primary samples. Two inter-laboratory duplicates were analysed however it was noted by the consultant that one of the inter-laboratory duplicates was not analysed for the same suite of analytes as the primary sample, making one of the samples void.

Results of analysis for the intra-laboratory duplicate and inter-laboratory triplicate analysis were generally within the acceptance criteria of 0-30% RPD with the exception of some heavy metals and PAHs in the primary and inter- and intra-laboratory duplicate pairs. The discrepancies between the primary and duplicate samples were attributed to the reported concentrations being close to the limit of reporting and/or the soil heterogeneity.

A trip spike, trip blank and rinsate sample were also collected and analysed. The rinsate sample reported low concentrations of copper, nickel and zinc, however all concentrations were below the assessment criteria and were not considered to affect the usability of the data.

The internal laboratory QC criteria (spike recoveries, surrogate standards, and laboratory blanks) was reviewed by the consultant and found to be acceptable.

The consultant concluded that the results of the field and laboratory QA/QC program indicated that the data was of acceptable quality for the purpose of the assessment.

#### 6.1.5 Consultant's Conclusions and Recommendations

Based on the findings of the site assessment works the consultant SLR (2017a) presented the following conclusions:

- All contaminants concentrations, or 95% UCLs were within the adopted health based criteria for all land use scenarios at the site, therefore no health risks to future site users or workers have been identified at the site.
- Ecological criteria for the PAH benzo(a)pyrene were exceeded at one sample location, with regards to, all potential land uses. However, this exceedance is considered unlikely to present a significant ecological risk at the site as plant uptake of benzo(a)pyrene is typically very low. Based on the analytical results and the discussion above, no risks to onsite ecological receptors have been identified at the site.
- No staining, odours or ACM were observed at site. The fire scars observed on concrete surfaces during the initial JBS&G inspection were noted to have been removed. Areas of fly tipping were observed at the site, however these typically comprised small quantities of domestic items. No significant aesthetic issues were identified at the site.
- No unacceptable human health or ecological risks were identified associated with soils at the site. Contaminant concentrations in soil were generally low-level and not representative of gross or widespread contamination that would pose a risk of migration to groundwater or via surface water run-off.

The consultant concluded that based on the results of the assessment, the site is suitable for the proposed land uses.

## 6.2 Supplementary Site Investigation – Ivanhoe Estate (DLA, June 2017)

DLA were engaged to conduct a supplementary soil investigation at Ivanhoe Estate to address data gaps identified following completion of the DSI (JBS&G, 2016). The following scope of work was undertaken as part of the Supplementary Site Investigation (DLA, June 2017):

- Advancement of nine boreholes using a hand auger;
- Soil sampling and analysis;
- Data interpretation and reporting.

Hand auger locations targeted areas of the site not previously investigated, namely three areas where filling was considered likely due to the altered topography and identified as a data gap in previous assessment of the site.

### 6.2.1 Soil Assessment Criteria

The consultant compared soil analytical results to health-based soil investigation levels (HIL-A) and HSLs for low to high density residential land use as included in the NEPM (NEPC, 1999, Amended 2013). The HSLs adopted by the consultant were for “clay” soil conditions at a depth of 0 to <1 m. Management Limits for ‘fine’ soils in an urban residential and public open space setting were utilised and Ecological-based assessment criteria were also derived and considered by the consultant.

### 6.2.2 Soil Sampling Programme

Soil samples were collected from nine hand auger locations which were positioned to target areas of the site not previously investigated and where inspection had indicated filling had occurred to alter the topography of the site. Sample locations are depicted on the consultant's Figure 2 included in **Appendix E**

Boreholes were advanced to depths ranging from 0.4 m to 0.8 m bgs and soil samples were collected directly from the hand auger. Typically, one or two samples were selected from each location for laboratory analysis.

A PID was not utilised for the screening of samples for VOCs.

Soil bore logs were provided in the report and ground conditions encountered by the consultant were described as sandy loam topsoil to depths between 0.1m and 0.5m bgs, overlying reworked siltstone and claystone bedrock.

The following table provides the soil analytical programme as presented by the consultant.

**Table 6-2 Soil Analytical Schedule**

Analysis	No. Primary Samples
TRH	14
BTEX	14
PAH	14
Heavy Metals (As, Cd, Cr, Cu, Pb, Hg, Ni)	14
OC/OP Pesticides	8
PCB	8
Asbestos	8

The primary laboratory utilised was Envirolab Services in Sydney. A secondary laboratory was not utilised as part of the programme.

### 6.2.3 Soil Analytical Results

Soil analytical results are summarised in the consultant's Table LR1 which is included in **Appendix F**. The consultant reported the following results for the soil sampling programme:

- TRH / BTEX – Sample BH8\_0.1-0.1 reported a TRH F2 (>C<sub>10</sub>-C<sub>16</sub>) concentration of 250 mg/kg, exceeding the adopted HSL and ESL. Sample BH8\_0.1-0.4 reported a TRH F2 (>C<sub>10</sub>-C<sub>16</sub>) concentration of 120 mg/kg, exceeding the adopted ESL. All other soil samples reported concentrations less than the adopted assessment criteria.
- PAH – All soil samples reported concentrations less than the laboratory LOR and the adopted assessment criteria.
- Pesticides and PCBs - All soil samples reported concentrations less than the laboratory LOR and the adopted assessment criteria.
- Heavy metals – All soil samples reported concentrations less than the adopted assessment criteria.
- Asbestos – asbestos was not detected in any of the soil samples analysed.



#### **6.2.4 Quality Assurance / Quality Control (QA/QC)**

A limited programme of QA/QC sample collection was undertaken as part of field investigation. The consultant included the collection of two intra-laboratory duplicate samples, however no inter-laboratory duplicates, trip spike, trip blank or rinsate samples were collected.

The consultant reported the RPD (relative percentage differences) for the soil duplicates with two exceedances being reported associated with nickel and zinc concentrations in the duplicate pair BH7\_0.2-0.7/BH7\_0.2-0.7A. The exceedances were attributed to concentrations being at or near the laboratory LOR.

The internal laboratory QC criteria (spike recoveries, surrogate standards, and laboratory blanks) was reviewed and found to be acceptable.

The consultant stated that they considered the data was representative of the overall site condition at the time of fieldwork.

#### **6.2.5 Consultant's Conclusions and Recommendations**

Based on the findings of the site assessment works the consultant DLA (June 2017) presented the following conclusions:

- The combined data presented in the DSI (JBS&G, 2016) and the Supplementary Investigation report is considered sufficient to allow assessment of the suitability of the Site for future land use in accordance with the general requirements of SEPP 55.
- Based on the results of the current investigation data, DLA concludes that the area of the Site in the vicinity of borehole BH8 is not currently considered suitable for the proposed redevelopment from a contamination perspective due to the presence of TRH in soil.
- Although the Site is not considered suitable for the proposed land use in its current condition, DLA considers that the Site can be made suitable with further assessment and the implementation of an appropriate remediation strategy.
- Further investigation and remediation of the Site would include:
  1. Delineation soil sampling and laboratory analysis;
  2. Preparation of a Remediation Action Plan for the Site;
  3. Remediation of the Site which would include the excavation and appropriate off-site disposal of TRH contaminated soils;
  4. Validation sampling of the Site; and
  5. Preparation of a Site Validation Report.

### **6.3 Supplementary Site Investigation – New Property Acquisition (DLA, July 2017)**

DLA were engaged to conduct a soil contamination assessment on an additional allotment of land which will form part of the site. The additional allotment was referred to as Part of 2 Lyon Park Road, Macquarie Park. The allotment comprised paved access roads associated with an adjacent office building and an area of cleared bushland. It is proposed to redevelop

the area as a road reserve, providing vehicular access to the southern areas of Ivanhoe Estate. The following scope of work was undertaken as part of the Supplementary Site Investigation (DLA, July 2017):

- Advancement of six boreholes using a hand auger;
- Soil sampling and analysis;
- Data interpretation and reporting.

Field investigations carried out as part of the Supplementary Investigation comprised the collection of 11 primary soil samples from six boreholes (BH1 to BH6). Boreholes were placed systematically across the Site with the aim of achieving sufficient site coverage. Contaminants of potential concern identified by the consultant for assessment included pesticides, heavy metals, PCBs, PAHs and TRHs.

### 6.3.1 Soil Assessment Criteria

In consideration of the proposed use of the allotment as a road reserve, the consultant compared soil analytical results to health-based soil investigation levels (HILs-D) and HSLs for commercial/industrial land use as included in the NEPM (NEPC, 1999, Amended 2013). The HSLs adopted by the consultant were for “sand” soil conditions as the most conservative option.

Management Limits for ‘coarse’ soils in a commercial/industrial setting were utilised. Ecological-based assessment criteria were not considered by the consultant.

### 6.3.2 Soil Sampling Programme

Soil samples were collected from six boreholes (BH1 to BH6) located systematically across the area being assessed. Sample locations are depicted on the consultant’s Figure 2 included in **Appendix G**.

Boreholes were advanced to depths ranging from 0.4 m to 1.5 m bgs and soil samples were collected directly from the hand auger. Typically, one or two samples were selected from each location for laboratory analysis, although four samples were analysed from BH1 due to the depth achieved.

A PID was not utilised for the screening of samples for VOCs.

Soil bore logs were provided in the report and ground conditions encountered by the consultant were described as sand and clay fill with sandstone gravel and cobbles to the maximum extent of the boreholes, with the exception of borehole BH1 which encountered residual sandy clay at 1.4m bgs.

The following table provides the soil analytical programme as presented by the consultant.

**Table 6-3 Soil Analytical Schedule**

Analysis	No. Primary Samples
TRH	11
BTEX	11
PAH	11
Heavy Metals (As, Cd, Cr, Cu, Pb, Hg, Ni)	11
OC/OP Pesticides	5
PCB	5

The primary laboratory utilised was Envirolab Services in Sydney. A secondary laboratory was not utilised as part of the programme.

### 6.3.3 Soil Analytical Results

Soil analytical results are summarised in the consultant's tables included in **Appendix H**. The consultant reported the following results for the soil sampling programme:

- TRH / BTEX – All soil samples reported concentrations less than the laboratory LOR and the adopted assessment criteria.
- PAH – All soil samples reported concentrations less than the adopted assessment criteria.
- Pesticides and PCBs - All soil samples reported concentrations less than the laboratory LOR and the adopted assessment criteria.
- Heavy metals – All soil samples reported concentrations less than the adopted assessment criteria.

### 6.3.4 Quality Assurance / Quality Control (QA/QC)

A limited programme of QA/QC sample collection was undertaken as part of field investigation. The consultant included the collection of one intra-laboratory duplicate samples, however no inter-laboratory duplicates, trip spike, trip blank or rinsate samples were collected.

The consultant reported the RPD (relative percentage differences) for the soil duplicate were all with acceptable ranges for all analytes.

The internal laboratory QC criteria (spike recoveries, surrogate standards, and laboratory blanks) was reviewed and were overall found to be acceptable.

The consultant stated that they considered the data was representative of the overall site condition at the time of fieldwork.

### 6.3.5 Consultant's Conclusions and Recommendations

Based on the findings of the site assessment works the consultant DLA (July 2017) presented the following conclusions:

- Based on a review of the available investigation data, DLA consider that there is a low likelihood of unacceptable contamination to be present on the Site as a result of past and present land use activities.
- the Site is considered suitable for redevelopment as a road reserve from a contamination perspective.

## 6.4 Audit Discussion of Investigation Review

### 6.4.1 Investigation Sampling Design

In combination, sampling locations advanced during the assessment works at the site are considered to provide adequate site coverage. The number of sampling locations to date and those proposed by the data gap assessment meet the minimum requirements of the

NSW EPA Guidelines (NSW EPA, 1995). Sample locations were generally systematically positioned across the site, with some locations skewed to where access enabled or to target specific areas of concern.

The collection of samples generally focussed on shallow fill material, with deeper samples collected sporadically across the site. The soil sample intervals and depths of sampling locations were considered appropriate given the absence of identified point sources of potential contamination and the site geology.

Groundwater was not encountered during the site investigation and based on the limited soil contamination identified, the potential for groundwater impacts at the site is considered to be low.

#### **6.4.2 Quality Assurance/Quality Control**

All consultants utilised the seven-step DQO process as required by the NSW EPA guidelines for Site Auditors (NSW DEC, 2006) during assessment of the site. The consultants developed pre-determined data quality indicators following those referenced in the NEPM (NEPC, 1999, Amended 2013). Both a field and laboratory quality assurance/quality control (QA/QC) program was conducted during the site investigation works.

Intra-laboratory (blind duplicate) and intra-laboratory (split duplicate) samples were collected and analysed as part of the site investigation programs, however the rates of collection and analysis were slightly below what was deemed acceptable by the PARCC (Precision, Accuracy Representativeness, Comparability and Completeness) parameters.

The reported RPDs calculated were generally within acceptable ranges, with a small number of RPDs exceeding criteria primarily for low-concentration results. These are not considered to affect the reliability of the data reported.

Field trip blanks and trip spikes, where analysed, were within acceptable criteria. Concentrations of heavy metals were detected in the rinsate samples collected, although the reported concentrations were well below the assessment criteria and not considered to adversely impact the reliability of the data.

Matrix spike recoveries and surrogate spike recoveries reported by the laboratory were within the control limits indicating that the accuracy of the results are acceptable for assessing the suitability of the environmental condition of the site.

The laboratory QA/QC results have been reviewed and the results indicate that the laboratory analytical program was achieving adequate levels of precision and accuracy during the time when samples from the site were being analysed. While minor non-conformities with some aspects of the QA/QC program were observed, in general the sampling, analytical and quality protocols undertaken by the consultant were considered satisfactory and the data is considered to be adequately reliable for the purpose of assessing the contamination status of the site for the proposed mixed use.

Overall, the Auditors review of the quality assurance/quality control measures employed by the consultant and the laboratory was found to provide adequate information for the purpose of characterising the site.

### **6.4.3 Site Criteria**

The assessment criteria utilised for the site by the consultants were derived from the NEPM (NEPC, 1999, Amended 2013). Consideration was given to HILs and HSLs in the assessment of soils. The DLA investigations (DLA, June 2017) and (DLA, July 2017) also considered the Management Limits derived from the NEPM (NEPC, 1999, Amended 2013).

Ecological criteria, namely EILs and ESLs were considered during all investigations of the site.

The health-based criteria utilised are considered appropriate for the purpose of the investigations.

### **6.4.4 Investigation Results**

The consultants provided tables that summarised the soil laboratory results. The reported concentrations of contaminants by the consultant were reviewed and found to be consistent with those reported by the laboratory. The laboratory procedures were appropriate for the identified potential contaminants of concern.

The site plans provided by the consultant were to scale and adequately identified the sampling locations relevant to the main site features such as the existing buildings, boundaries and roads.

The investigation conducted by DLA (June 2017) reported an elevated hydrocarbon concentration in an isolated area of fill at location BH8.

Overall, the Auditor considers that the conclusions reached by the consultant in regard to the site assessment are considered appropriate given the data obtained from the site.

## 7 Remediation Action Plan

The planned remediation works were presented in a Remediation Action Plan (RAP) prepared by DLA in March 2018. The following sub-sections provide an overview of the content of the RAP.

### 7.1 Remediation Objectives

The consultant stated that the purpose of the RAP (DLA, 2018) was to detail all necessary actions to be undertaken at the site in order to render the site suitable for the proposed redevelopment, thereby posing no unacceptable risk to human health and the environment.

### 7.2 Remediation Options

In accordance with NSW DEC 2006, soil remediation and management is implemented in the following preferred order:

1. on-site treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level;
2. off-site treatment of excavated soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to site;
3. removal of contaminated soil to an appropriate facility, followed where necessary by replacement with appropriate material;
4. cap and contain material on-site within a properly designed barrier;
5. do nothing.

The consultant documented the range of remediation options available in the RAP (DLA, 2018) and discussed each in relation to the site. The consultant reported that excavation and off-site disposal of impacted material was considered to be the most appropriate option with respect to the identified contamination.

### 7.3 Proposed Remediation Works

The consultant identified one area of environmental concern requiring remediation, as shown in the consultant's Figure 2 presented in **Appendix I**. The remediation area at location BH8 was identified during the Supplementary Site Investigation (DLA, June 2017) conducted at the Ivanhoe Estate. Analytical results from location BH8 reported concentration of TRH which exceeded the adopted HSL and ecological criteria.

The following remediation approach was proposed by the consultant:

- Notification to relevant stakeholders of intent to remediate contaminated soils.
- Implementation of a Site Environmental Management Plan.
- Site establishment including establishment of necessary plant, equipment, site security and environmental safeguards.
- Additional investigations (Data Gap Assessment).
- Excavation of the hotspot of contamination identified at location BH8. The consultant noted that the vertical extent of the remedial excavations would be a minimum of 0.5 m depth and a PID would be utilised to guide the remedial works.

- Validation of excavation surfaces.
- Excavated material will be stockpiled in a designated area for waste classification and off-site disposal to an appropriately licenced waste facility.

The following remediation activities will be conducted in the vicinity of BH8:

1. AEC 1 will be delineated by marking an approximately 5 m x 5 m grid centred quadrant around the original borehole location (i.e. BH8);
2. Soil within the gridded AEC will be excavated to a minimum depth of 0.5 m bgl. Given that the vertical extent of the hydrocarbon impact has not yet been delineated, a PID will be used to screen the faces of the excavation to assist in assessing the likely presence of residual contamination. In the event that PID readings and/or visual or olfactory evidence suggests that contamination extends beyond the proposed depth of the remedial excavation, then excavation will continue until the evidence of contamination has been removed. Similarly, in the event that evidence of contamination is identified on the walls of the remedial excavation, then the excavation will be extended laterally until the evidence of contamination has been removed.
3. Excavated soil will be stockpiled within a designated area of the Site for waste classification in accordance with the RAP; and
4. The walls and base of the excavation will be validated in accordance with the validation strategy described by the RAP.

Following successful validation, where required, the excavation will be reinstated. The RAP states that only validated ENM or VENM will be imported to the site.

## 7.4 Data Gap Assessment

The RAP included an additional area of the site (recently acquired) that has not yet been subject to intrusive investigation. The area was identified as a data gap requiring assessment to confirm the area is suitable, from a contamination perspective, for the proposed land use. The area is depicted on the consultants figures in **Appendix I**.

The consultant stated that the assessment of the additional area will be conducted concurrently with the initial phases of remediation works.

The data gap area covers approximately 3,700 m<sup>2</sup> and the consultant proposed a total of 11 test locations to assess the area in accordance with the NSW EPA 1995 Guidelines.

At each test location, test pits will be excavated to depths sufficient to intercept natural ground, thereby confirming the vertical extent of fill material. In the case that access restrictions preclude the excavation of test pits, boreholes will be drilled using a mechanically operated drill rig that is able to extend to depths sufficient to intercept natural ground.

Soil samples will be collected from the fill material at regular intervals and submitted for laboratory analysis for the following analysis: heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn), TRH, BTEX, PAH, OC/OP Pesticides, PCBs and asbestos (only where visible evidence of asbestos is noted). Additional soil samples will be collected for quality assurance / quality control (QA/QC) purposes. Soil samples will also be screened in the field using a photoionisation detector (PID) to assess the presence of volatile organic compounds (VOCs).



The analytical results obtained during the data gap assessment will be assessed against the validation criteria presented in the RAP and the results of the data gap assessment will be used to assess whether additional areas of contamination are present that require remediation. In the case that additional areas of contamination are identified, remediation will be carried out in accordance with the strategy provided in the RAP.

## 7.5 Remediation Criteria

It is proposed that the site is redeveloped for low density residential land use. As such, the soil criteria proposed by the consultant to guide the remedial works for the residential areas of the site are Health-based Investigation Levels (HILs) for residential land use with accessible soil (HIL-A).

The consultant also included reference to the application of Ecological Screening Levels (ESLs) and Ecological Investigation Limits (EILs) for urban residential setting. Management Limits were not deemed applicable to the site.

## 7.6 Proposed Validation Programme

The consultant confirmed that validation samples would be collected from the base and walls of the remediation excavations. Base samples are to be collected at a rate of (at least) one sample per 5 m grid, while wall samples will be collected at a rate of (at least) one sample for each wall. The consultant acknowledged that additional samples may be required based on the extent of the excavation.

All excavated material from across the site will be assessed and sampled in accordance with the NSW EPA *Waste Classification Guidelines* (NSW EPA, 2014) for off-site disposal.

Groundwater sampling was not proposed as part of the validation programme.

## 7.7 Site Management

The consultant included site management provisions to reduce the impact of the remediation works on the remediation workforce and surrounding environment (including neighbouring properties).

## 7.8 Unexpected Finds Protocol

The consultant presented an unexpected finds protocol for dealing with unidentified contamination in soil. A protocol to mitigate the effects of potential incidents such as identification of asbestos containing soils, suspicious dumped or buried material and evidence of significant staining, odours and discolouration was provided.

## 7.9 Contingency Plans

A contingency plan was not specifically included in the RAP, although procedures were provided for dealing with unidentified contamination in soil. Noting the site history, the assessments conducted to date, the relatively limited extent of the remediation to be undertaken and the remedial method to be employed (excavate and dispose), the potential for encountering significant unidentified contamination or the remediation failing is low. The consultant noted that in the event unidentified contamination was encountered at the



site, the contamination would be assessed by a qualified and experienced environmental consultant and the material remediated in accordance with the RAP if necessary.

## 7.10 Audit Discussion of the Remediation Action Plan

Based on the information contained in the consultant's RAP (DLA, 2018), the Site Auditor finds that the proposed remediation:

- is technically feasible;
- is environmentally justifiable given the proposed development activities; and
- the proposed validation sampling plans are suitably comprehensive to ensure contamination above the remediation criteria is appropriately removed and managed.

The RAP identified the area of contamination, located as a result of previous assessment works at the site, that would be subject to remediation. The proposed remediation area comprises concentrations of contaminants of concern that is representative of a hotspot of contamination. In the event that additional contamination is identified during remediation or development works, the consultant has provided an unexpected finds protocol for implementation.

An additional area of the site has been identified by the RAP as a data gap that requires investigation to confirm the land is suitable for the proposed use, from a contamination perspective. This area will be assessed in conjunction with the proposed remedial works and in the event contamination is identified, will be remediated in accordance with the RAP.

The validation-sampling programme is based on a systematic sampling programme to evaluate the sufficiency of the excavation and assess the materials to remain in-situ. Specific validation sampling densities were also provided in the RAP. The validation sampling strategy is considered appropriate with implementation by a qualified environmental professional.

It is the Site Auditor's opinion that the proposed remediation works as detailed in the RAP is appropriate for the proposed low density residential development at the site. Following the successful implementation of the remediation and validation works as detailed in the RAP, it is considered that the site can be made suitable for the proposed development.

## 8 Consideration of Regulatory Requirements

As the Site Audit is not a requirement of a development consent or approval given under the *Environmental Planning and Assessment Act 1997* it has not been conducted as a Statutory Site Audit as defined by s.47(c) of the *Contaminated Land Management Act 1997*.

The Guidelines for the NSW Site Auditor Scheme (NSW EPA, 2017) do require the Auditor if they conclude that the site should be notified to take reasonable steps to clearly and in writing advise the person who commissioned the site audit of the duty of site owners and polluters to notify the NSW EPA of the contamination and to provide a copy of that written advice to the NSW EPA.

The duty to report contamination on development sites that are being assessed to determine remediation requirements is a complex legal issue.

The requirements for the site to be notified under the *Contaminated Land Management Act 1997* were considered by the Site Auditor in relation to the Guidelines for the NSW Site Auditor Scheme (NSW EPA, 2017).

The relevant sections of the Act state:

### *Section 60*

*(1) .....*

*(2) An owner of land that has been contaminated (whether before or during the owner's ownership of the land) must notify the EPA in writing in accordance with this section that the land has been so contaminated.*

*(3) A person is required to notify the EPA under subsection (1) or (2) only if:*

*(a) each of the following is true:*

*(i) the substance contaminating the land (the "contaminant") or any by-product of the contaminant has entered or will foreseeably enter neighbouring land, the atmosphere, groundwater or surface water,*

*(ii) the regulations prescribe for the purposes of this subparagraph, or the guidelines specify, a level of the contaminant or by-product in the neighbouring land, atmosphere, groundwater or surface water,*

*(iii) the level of the contaminant or by-product after that entry is, or will foreseeably be, above the level prescribed or specified and will foreseeably continue to remain above that level, or*

*(b) a guideline specifies a level of the contaminant in soils with respect to a current or approved use of the land and the level of the contaminant on or in any part of the soil on that land is equal to or above that specified in the guideline and a person has been, or foreseeably will be, exposed to the contaminant or any by-product of the contaminant, or*

*(c) the contamination meets any other criteria that may be prescribed by the regulations for the purposes of this subsection.*

In providing advice regarding the requirements of the Act the NSW EPA has prepared the Guidelines on the Duty to Report Contamination (NSW EPA, 2015) made under the

*Contaminated Land Management Act 1997*. These guidelines do not provide explicit direction in relation to development sites which are undergoing assessment and future or current remediation in relation to that development and the management of contamination. There is however an example (Section 2.6.3) of where the guideline states that further assessment is not needed and a person would not be expected to seek advice and indicate that there is 'no duty to report' where:

- The site is in use for any purpose.
- The site was previously used for commercial or industrial purposes.
- Site contamination is appropriately contained and disturbance of the cap is subject to:
  - an environmental management plan (EMP) and is carried out in accordance with that plan, or
  - a development consent and is carried out in accordance with that consent, or
  - a site audit statement has been issued certifying that the site is suitable for the current or approved use and no potentially contaminating activities have been carried out at the site since the statement was issued.

In the absence of specific evidence of levels above those specified to neighbouring properties, the atmosphere, groundwater or surface water or exposure of a person the issue of foreseeability becomes relevant. Foreseeability is discussed in the guideline and is to be assessed through the modes of transport of contaminants and in absence of specific data, a precautionary principle approach is to be applied.

Whilst the site does contain contamination of soils above levels specified in the duty to report guideline they are unlikely to have impacted neighbouring land, the atmosphere, groundwater or surface water above specified levels, and whilst under the control of the developer, or even within the context of the previous use, it is unlikely that a person would have been exposed or foreseeably exposed to those contaminants. In addition to this, the foreseeability that a person will be exposed is limited by the remediation that is planned to take place under the proposed land use where the objective of that remediation will be to enable the site to be suitable for that use. Further the disturbance of the site is to be carried out in accordance with development consent that has been approved.

On this basis, the Site Auditor concluded that there was not an obligation to report the contamination under s 60 of the *Contaminated Land Management Act (1997)*. This however does not present an opinion of the legal obligations of the owner, only the conclusion of the of the Site Auditor with regard to their responsibility under the Site Audit Scheme guidelines (NSW EPA, 2017) to take reasonable steps to advise the client of the obligations of the owner or polluter under the Act.

## 9 Evaluation of Site Land Use Suitability

The *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (3<sup>rd</sup> edition)* prescribe that during an assessment of the suitability of a site for an existing or proposed land use in an urban context, Site Auditors must follow the decision process and checklist for assessing urban redevelopment sites (Appendix A page 46-47) of the Site Audit Scheme Guidelines (NSW EPA, 2017).

For the purposes of this Site Audit the objective is to determine whether the site can be made suitable for the proposed residential development. In this instance the decision-making process has been applied to assess whether that objective can be met.

The findings of the Site Audit are presented for each requirement of the decision process:

**All site assessment, remediation and validation reports follow NSW EPA (1997) *Contaminated sites: Guidelines for consultants reporting on contaminated sites*.**

The documents provided by the consultant meet the requirements of the Site Audit in relation to the Guidelines for consultants reporting on contaminated sites (NSW OEH, 2011).

**Aesthetic issues have been addressed.**

Aesthetic issues have been considered in the works undertaken at the site with the consultants confirming the absence of staining, odours and significant anthropogenic inclusions at the majority of investigation locations. No asbestos material were identified during the assessments conducted at the site.

**Soils have been assessed against relevant health-based investigation levels and potential for migration of contamination from soils to groundwater has been considered**

Soils were assessed against the appropriate and equivalent health-based investigation levels during assessment works and levels detected above the assessment criteria deemed to be representative of hotspots of contamination have been the subject of the RAP (DLA, 2018). Due to the limited extent of soil contamination identified, the potential for groundwater contamination at the site is considered low and was not considered to present a risk to human health and the environment.

**Groundwater (where relevant) has been assessed against relevant health-based investigation levels and, if required, any potential impacts to buildings and structures from the presence of contaminants considered.**

Groundwater was not assessed and it is not considered to be at risk from contaminants and is not likely to pose a risk to building structures.

**Hazardous ground gases (where relevant) have been assessed against relevant health-based investigation levels and screening values.**

Hazardous ground gases are not considered a contaminant of concern at this site.

**Any issues relating to local area background soil concentrations that exceed appropriate site soil criteria have been adequately addressed in the site assessments report(s).**

No local background soil concentrations above the appropriate criteria were identified as an issue.

**All impacts of chemical mixtures have been assessed.**

No issues relating to chemical mixtures in relation to the identified contaminants of concern are expected.

**Any potential ecological risks have been assessed.**

The assessment of the site included the assessment of potential contaminants of concern against the ecological investigation or screening levels. The RAP (DLA, 2018) has been prepared to address the exceedances of the ecological criteria identified.

**Any evidence of, or potential for, migration of contaminants from the site has been appropriately addressed and reported to the site owner or occupier.**

There is not considered to be any evidence of, or potential for, off-site migration of contaminants identified at the site.

**The site management strategy is appropriate.**

The RAP (DLA, 2018) indicates that all known contamination will be addressed as part of the proposed remediation and validation works to be completed at the site, and further management will not be required.

On the basis of the above procedure and checks against the prescribed items for the proposed landuse the Site Auditor has considered whether the site can be made suitable for the proposed uses with the most sensitive being low density residential with garden / accessible soil.

## 10 Conclusions

The reports relating to the contamination of the site have been reviewed and are considered to have met the requirements of NSW EPA *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (2<sup>nd</sup> edition)* and other guidelines endorsed under s.105 of the *Contaminated Land Management Act 1997* and the objectives of the Site Audit.

With regard to the decision process for assessing urban redevelopment sites, it is considered that the site can be made suitable for the most sensitive of the proposed uses being residential land use with garden/accessible soil with the implementation of the DLA Remediation Action Plan.

## 11 Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the project brief only, and has been based in part on information obtained from the client and other parties. Enviroview Pty Ltd or the Site Auditor accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client, or amended in any way without prior approval by the Site Auditor, and should not be relied upon by other parties, who should make their own enquires other than regulatory and planning authorities as required under the *Contaminated Land Management Act 1997* and *State Environmental Planning Policy 55*.

The data used to support the conclusions reached in this report have been obtained by other consultants and have been audited with a reasonable level of scrutiny, care and diligence. Every reasonable effort has been made to identify and obtain all relevant data, reports and other information that provide evidence about the condition of the site, and those that were held by the client and the client's consultants, or that were readily available. No liability can be accepted for unreported omissions, alterations or errors in the data collected and presented by other consultants. Accordingly, the data and information presented by others are taken and interpreted in good faith.

Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements.

Limited sampling and laboratory analyses were undertaken as part of the investigations reviewed, as described herein. Ground conditions between sampling locations and media may vary, and this should be considered when extrapolating between sampling points. Chemical analyses selected are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site that was not identified in the site history and which may not be expected at the site.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, Enviroview Pty Ltd and the Site Auditor reserves the right to review the report in the context of the additional information.



## 12 References

- ANZECC/NHMRC. (1992). *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*. Australian and New Zealand Environment and Conservation Council (ANZECC) and the National Health and Medical Research Council (NHMRC).
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- DLA Environmental Services (2016). Letter dated 11 October 2016 Re: *Summary of In-Ground Contamination – Ivanhoe Estate, Cnr Herring and Epping Roads, Macquarie Park NSW 2113*.
- DLA Environmental Services (June 2017). *Supplementary Site Investigation, Ivanhoe Estate, Corner Herring Road and Epping Road, Macquarie Road (STET) NSW 2113*.
- DLA Environmental Services (July 2017). *Supplementary Site Investigation - New Property Acquisition - Ivanhoe Estate, 2 Lyon Park Road, Macquarie Pak (STET) NSW 2113*.
- DLA Environmental Services (2018). *Remediation Action Plan, Ivanhoe Estate, Corner Herring Road and Epping Road, Macquarie Park NSW 2113*.
- EnHealth. (2012). *Environmental Health Risk Assessment: Guidelines for assessing human health risks from environmental hazards*. Department of Health and Ageing and EnHealth Council Commonwealth of Australia.
- JBS&G (2016). *Detailed Site Investigation, Ivanhoe Estate, Herring Road, Macquarie Park, NSW*.
- NEHF. (1996). *Composite Sampling*. Adelaide, SA: National Environmental Health Forum South Australian Health Commission.
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- NSW DEC. (2007). *Contaminated Sites: Guidelines for the Assessment and Management of Contaminated Groundwater*.
- NSW DEC. (2006). *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (2nd edition)* (2nd ed.).
- NSW EPA. (1997a). *Contaminated Sites: Guidelines for Assessing Banana Plantation Sites*.
- NSW EPA. (1994). *Contaminated Sites: Guidelines for Assessing Service Station Sites*.
- NSW EPA. (2017). *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (23rd edition)* (3rd ed.).
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- NSW EPA. (2015). *Contaminated Sites: Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*.
- NSW EPA. (1995). *Contaminated Sites: Sampling Design Guidelines*.
- NSW EPA. (1997b). *Environmental Guidelines: Use and Disposal of Biosolids Products*.
- NSW EPA. (1997b). *Polychlorinated Biphenyl Waste (PCB) Chemical Control Order*.
- NSW EPA. (2014). *Technical Note: Investigation of Service Station Sites*.
- NSW EPA. (2014). *Waste Classification Guidelines Part 1 Classifying Waste*. NSW Department of Environment and Climate Change.
- NSW OEH. (2011). *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*.

**Appendix A:**  
**Site Audit Interim Advices**

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24<sup>th</sup> February 2018

Ref: 0301-1803\_01

Scott Clohessy  
Frasers Property Australia  
Suite 11 Lumiere Commercial  
Level 12, 101 Bathurst Street  
SYDNEY NSW 2000

Via email: [scott.clohessy@frasersproperty.com.au](mailto:scott.clohessy@frasersproperty.com.au)

Dear Scott,

**RE: Interim Site Audit Advice – Ivanhoe Estate, Macquarie Park**

James Davis of Enviroview Pty Ltd has been engaged to provide the services of a NSW EPA Contaminated Land Accredited Site Auditor, to conduct a Site Audit in relation to the site identified as 60 and 70 Seventh Avenue, Austral NSW (the 'Site'), in accordance with the *Contaminated Land Management Act 1997* and relevant guidelines made or approved under s105 of that Act.

The objective of the Site Audit is to provide a Site Audit Report and Site Audit Statement to certify, in the Auditor's opinion that, in relation to contaminated land, the site can be made suitable for the land use commensurate with the proposed development. The Site Audit is a requirement of the Secretary's Environmental Assessment Requirements (SEARs) for a Development Application for the development of the site and the requirement is that a RAP is to be prepared and this is to be reviewed and submitted to the Department of Planning and Environment with a 'Section B' Site Audit Statement.

A Site Audit Interim Advice is provided at a particular stage of the Audit to assist in the management of contamination issues with regard to the requirements of the Site Audit. An Interim Advice does not constitute a Site Audit Statement or a Site Audit Report and should not be considered pre-emptive of the final audit conclusions. A Site Audit Report and Site Audit Statement will be prepared at the conclusion of the Site Audit.

The purpose of this interim advice is to provide comment by the Auditor with regard to the following reports:

- JBS&G (2016). *Detailed Site Investigation, Ivanhoe Estate, Herring Road, Macquarie Park, NSW*. Document Ref: 52047/104956 (Rev 0). 24 October 2016.
- DLA Environmental Services (2016). Letter dated 11 October 2016 Re: *Summary of In-Ground Contamination – Ivanhoe Estate, Cnr Herring and Epping Roads, Macquarie Park NSW 2113*. Document Ref: DL3531\_S005491.
- DLA Environmental Services (2017a). *Supplementary Site Investigation, Ivanhoe Estate, Corner Herring Road and Epping Road, Macquarie Road (STET) NSW 2113*. Document Ref: DL3953\_S006887. June 2017.
- DLA Environmental Services (2017b). *Supplementary Site Investigation - New Property Acquisition - Ivanhoe Estate, 2 Lyon Park Road, Macquarie Pak (STET) NSW 2113*. Document Ref: DL3953\_S007076. 28 July 2017.

- DLA Environmental Services (2018). *Remediation Action Plan, Ivanhoe Estate, Corner Herring Road and Epping Road, Macquarie Park NSW 2113*. Document ref: DL3953\_S008076. 7 February 2018.

The following comments are made regarding the reports.

#### **Review Comments**

1. Depth of Fill. DLA (2016) states that although the fill encountered in the areas of *altered topography* was relatively homogenous, the full extent of fill was not determined and the depth of fill across the site is unknown. Subsequent investigation reports have not defined the depth of fill across the site and the borelogs provided are somewhat ambiguous regarding the presence, composition and depth of fill across the site. Is the consultant able to clarify the depth of fill across the site and provide confidence that the lateral and vertical extents of fill have been adequately characterised?
2. Additional Investigation and Site Validation. Figure 1 of the RAP includes an additional area of the site not previously investigated. Section 4.0 of the RAP references works to be conducted in this area, however the RAP does not currently provide any information regarding how this identified data gap will be addressed and how the remainder of the site will be validated.

The Auditor notes that assessment of the additional area will be required to achieve the site audit objectives and the approach for the assessment of data gaps at the site should be provided in the RAP.

3. Remediation Methodology and Validation. It is noted that the descriptions regarding remediation methodology, validation sampling and waste management in the RAP are very generic and appear to relate to remedial works involving much larger volumes of material than expected at the subject site. Further, the RAP states that excavation works will be guided by visual and olfactory evidence, neither of which was evident during assessment of the area to be remediated.

The sampling plan and management of excavated material should be considered with reference to the proposed works to demonstrate that adequate samples will be collected and the site appropriately validated.

4. Groundwater. The consultant should include discussion regarding the potential for groundwater impacts at the site and provide justification if groundwater assessment is not considered necessary.

Notwithstanding the above comments being addressed, the Site Auditor considered the RAP does generally address the site contamination appropriately. However, the outcome of the Site Audit is contingent on the above comments being addressed satisfactorily.

Thank you for your time in regard to this matter. If you require additional information or clarification, please do not hesitate to contact me.

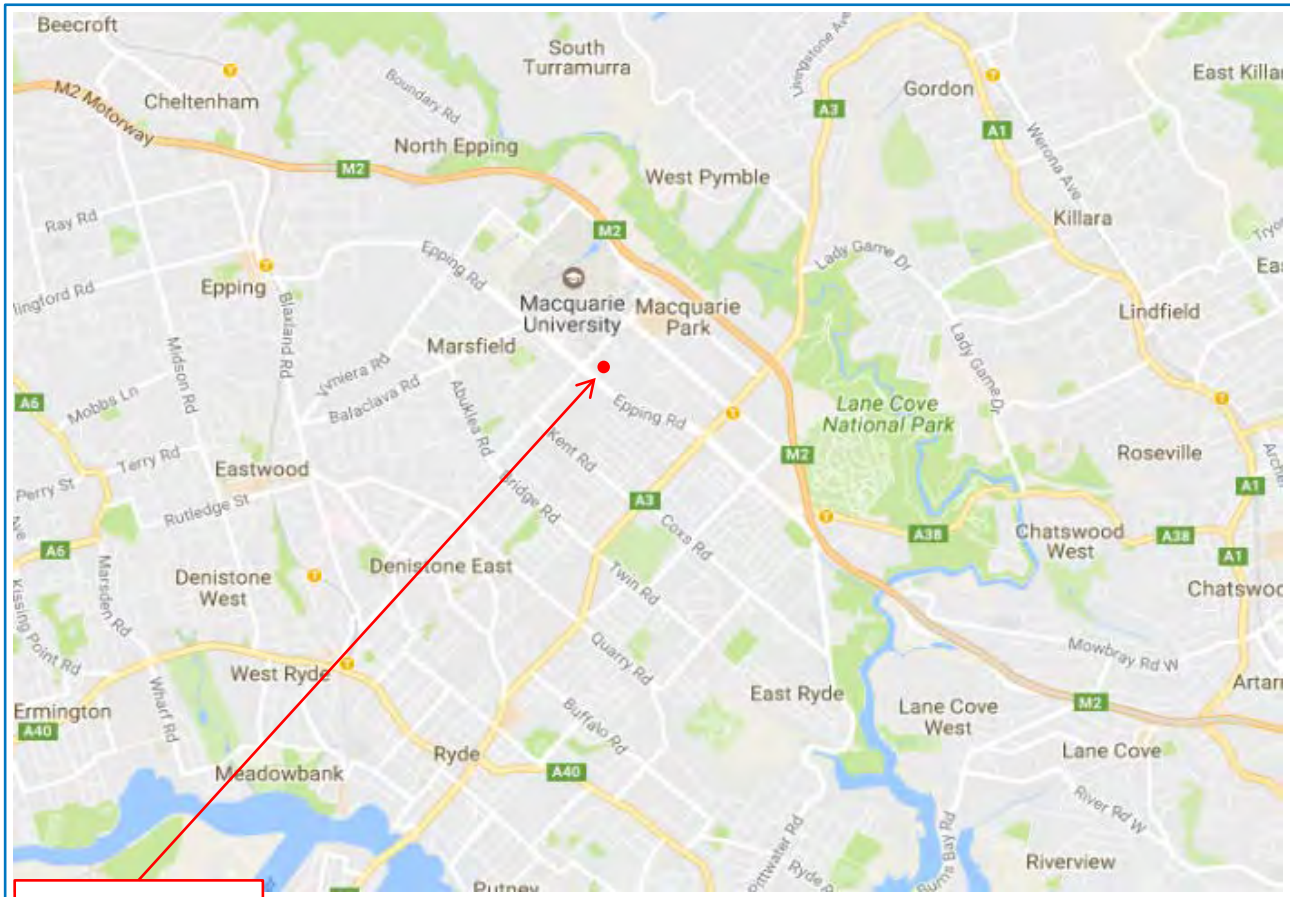
Yours sincerely



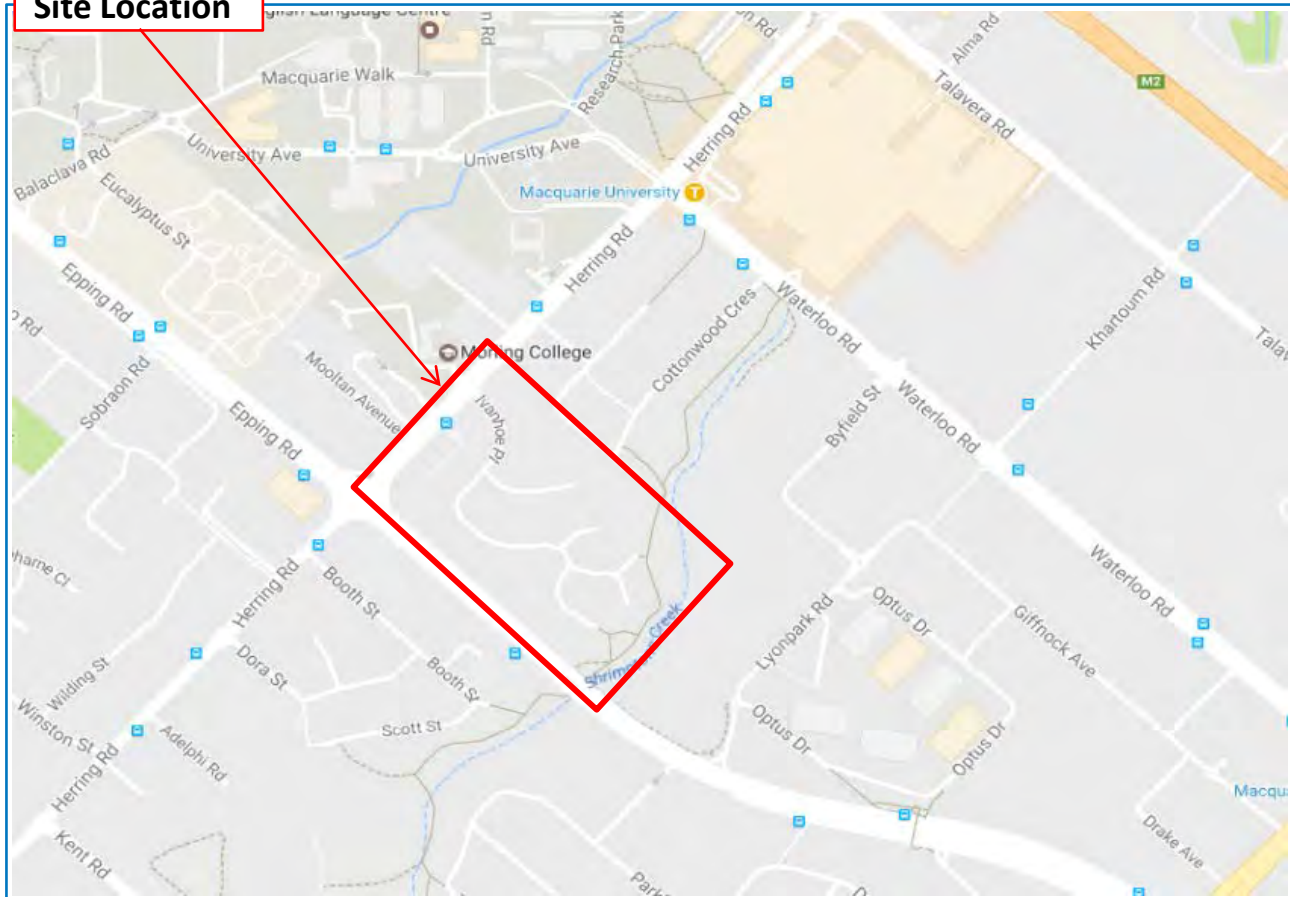
James Davis  
**NSW EPA Contaminated Land Site Auditor**  
**Enviroview Pty Ltd**

## **Appendix B: Site Audit Location Plans**

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**Site Location**



Unit 3, 38 Leighton Place  
Hornsby NSW 2077

**DESIGNED:**  
DLA  
**COMPILED:**  
SK  
**PROJ. No.**  
DL3953

**FIGURE TITLE:**

**PROJECT TITLE:**

**CLIENT:**

## SITE LOCATION

Ivanhoe Estate, Macquarie Park NSW

Frasers Property Australia

**DATE:**

02/06/2017

**FIGURE:**

1





**Legend**

- Site Boundary
- TRH Exceedance Location
- Remediation Area
- No investigations have been conducted in this area



Approximate Scale



Figure Title

Site Layout and Remediation Area

Project Title

Ivanhoe Estate, Macquarie Park

Client

Fraser's Property Australia

Project No.

DL 3953

Date

7/02/2018

Scale

As Shown

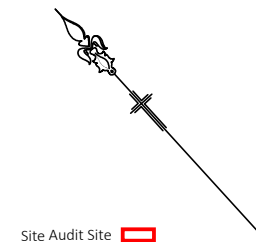
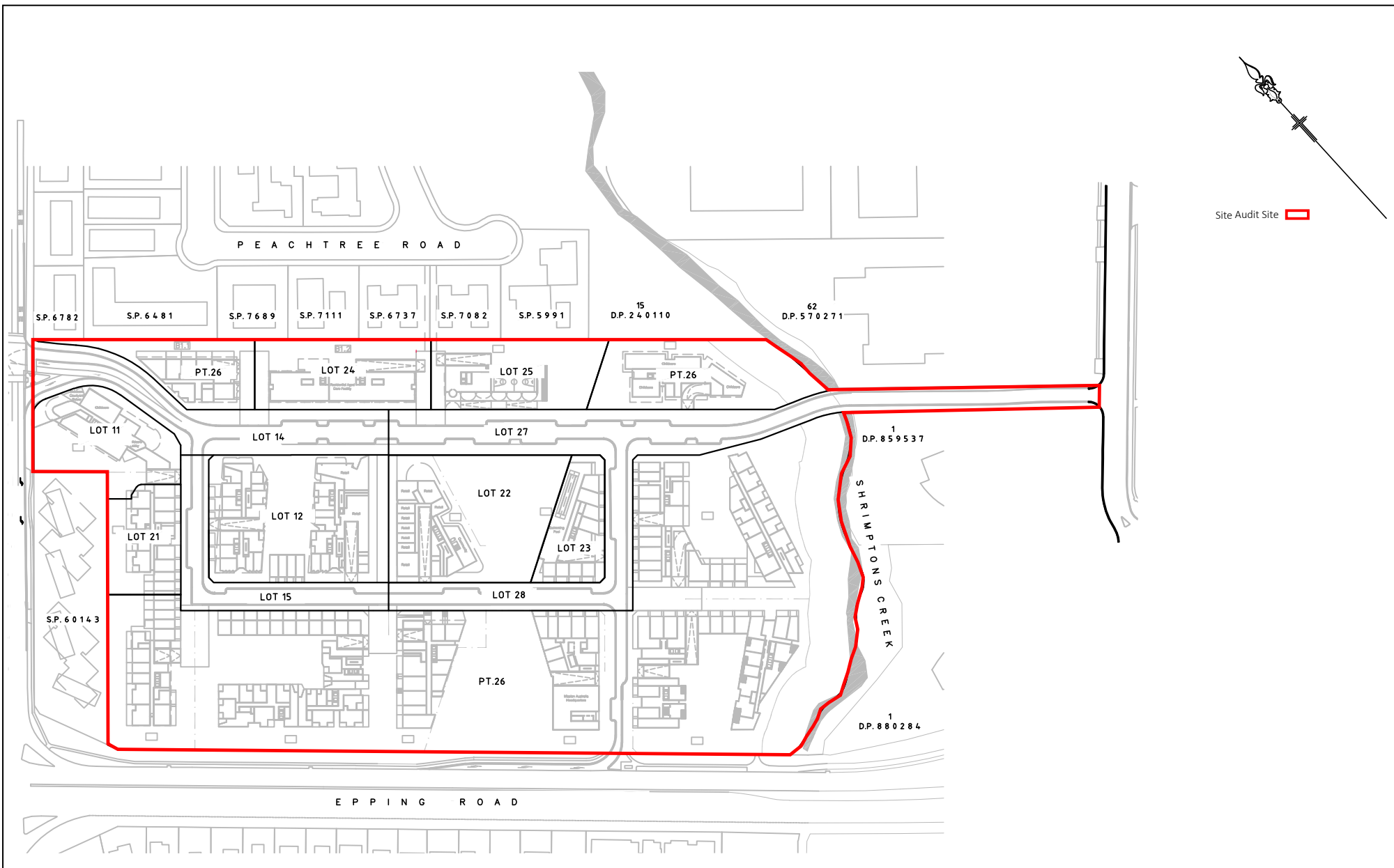
Figure No.

1

Revision

Version 1.1







## **Appendix C: JBS&G Detailed Site Investigation Location Plans**

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**Legend:**  
[Red outline] Approximate Site Boundary  
[Red hatched] Areas of Environmental Concern  
[Blue dot] Sample Location



Job No: 52047

Client: NSW Land & Housing Corporation

Version: R01 Rev A Date: 13-Oct-2016

Drawn By: SE Checked By: LB

Scale 1:2,500



Coor. Sys: GDA 1994 MGA Zone 56

Ivanhoe Estate,  
Located Off Herring Road,  
Macquarie Park, NSW

**AREAS OF ENVIRONMENTAL  
CONCERN AND SAMPLE  
LOCATIONS**

**FIGURE 4:**



## **Appendix D: JBS&G Detailed Site Investigation Data Summary Tables**

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[illegible]

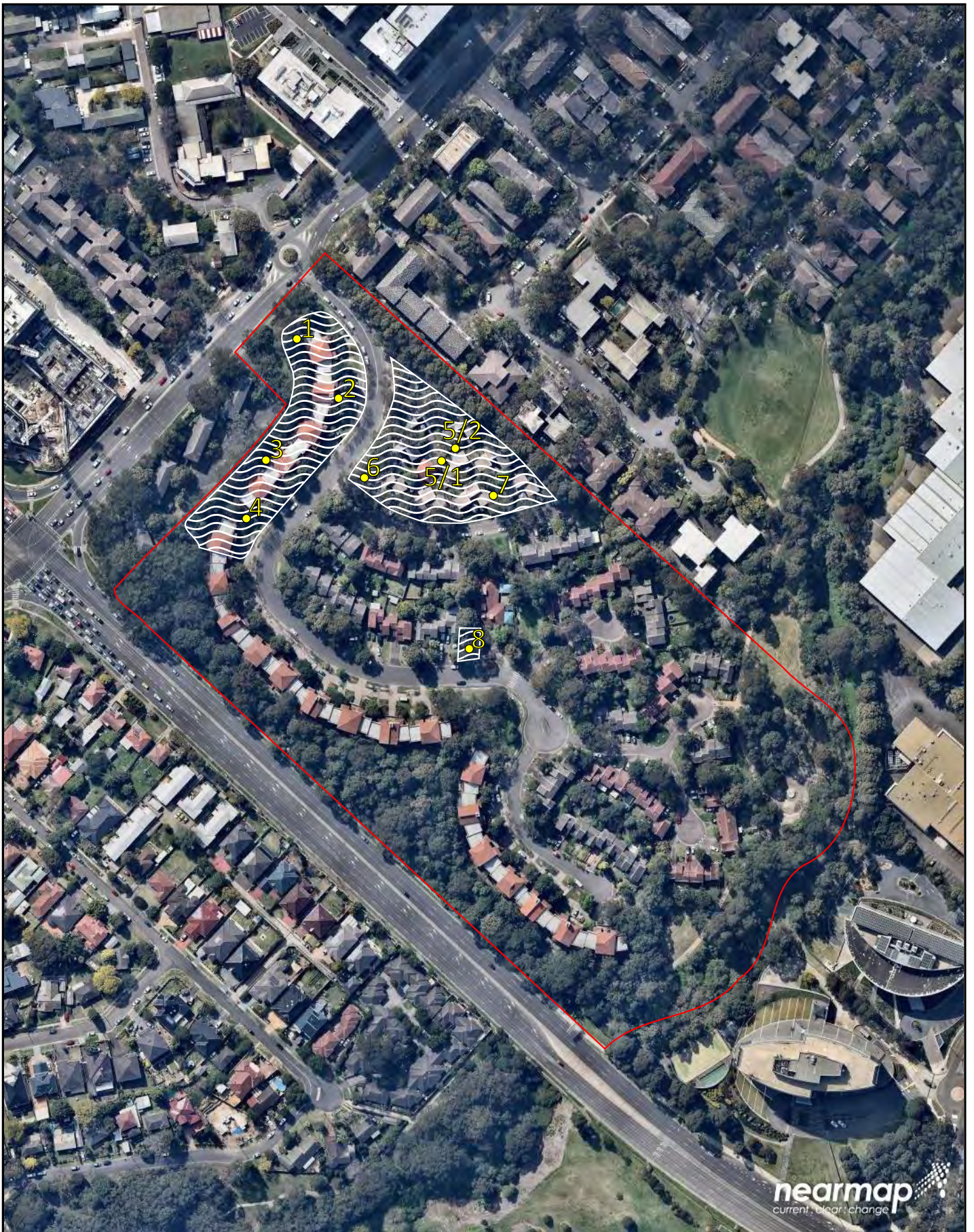
[illegible]

[illegible]

**Appendix E:**  
**DLA (June 2017) Supplementary Site Investigation Location**  
**Plans**

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#### Legend

- Site Boundary
- Sample Locations (approximate)
- Altered Topography Areas



Approximate Scale

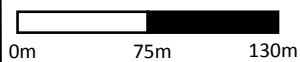


Figure Title

Additional Investigation Locations

Project Title

Ivanhoe Estate, Macquarie Park

Client

Frasers Property Australia

Project No.

DL 3953

Date

6/6/2017

Scale

As Shown

Figure No.

2

Revision

Version 1.0



**Appendix F:**  
**DLA (June 2017) Supplementary Site Investigation Data**  
**Summary Tables**

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Table 1 - Soil Analytical Results  
Supplementary Investigation  
'Ivanhoe Estate'  
Macquarie Park NSW

DLA Environmental Services  
A Pacific Environment company

Sample ID	Depth (m)	Date	Chemical Report	Asbestos	BTEx				Naphthalene	TRH				PAH		Pesticides		PCB	Heavy Metals							
					Benzene	Toluene	Ethylbenzene	Xylene		F1	F2	F3	F4	BaP TEQ	Total PAH	OCP	OPP		As	Cd	Cr VI	Cu	Pb	Hg	Ni	Zn
SITE ASSESSMENT CRITERIA																										
HIL A Residential (NEPC, 2013)				ND	-	-	-	-	-	-	-	-	-	3	300	-	-	-	100	20	100	6000	300	40	400	7400
HSL A Residential, 0-<1m, sand (NEPM, 2013)				-	0.5	160	55	40	3	45	110	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
HSL A Direct Contact (Friebel, et al, 2011)				-	400	14000	4500	12000	1400	4400	3300	4500	6300	-	-	-	-	-	-	-	-	-	-	-	-	
Management Limits, Urban Residential, fine (NEPC, 2013)				-	-	-	-	-	-	700	1000	2500	10000	-	-	-	-	-	-	-	-	-	-	-	-	
EIL Urban Residential / Public Open Space (NEPC, 2013)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-	410	217	1109	-	312	407
ESL Urban Residential / Public Open Space, coarse (NEPM, 2013)				-	50	85	70	45	-	180	120	300	2800	0.7	-	-	-	-	-	-	-	-	-	-	-	-
PRIMARY SAMPLES																										
BH1	0.1-0.2	24-May-17	167858	ND	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	<0.1	<0.1	<0.1	7	<0.4	20	21	25	<0.1	8	31
BH1	0.2-0.5	24-May-17	167858	-	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	-	-	-	7	<0.4	17	18	32	<0.1	7	29
BH2	0.1-0.4	24-May-17	167858	ND	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	<0.1	<0.1	<0.1	5	<0.4	45	17	11	<0.1	36	25
BH2	0.5-0.6	24-May-17	167858	-	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	-	-	-	7	<0.4	14	12	16	<0.1	3	7
BH3	0.0-0.1	24-May-17	167858	ND	<0.2	<0.5	<1	<1	<1	<25	<50	140	<100	<0.5	<0.05	<0.1	<0.1	<0.1	8	<0.4	23	8	22	<0.1	4	16
BH3	0.1-0.8	24-May-17	167858	-	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	-	-	-	7	<0.4	14	17	22	<0.1	2	16
BH4	0.1-0.2	24-May-17	167858	ND	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	<0.1	<0.1	<0.1	8	<0.4	9	5	6	<0.1	7	17
BH4	0.2-0.4	24-May-17	167858	-	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	-	-	-	5	<0.4	18	18	14	<0.1	14	33
BH5/1	0.1-0.5	24-May-17	167858	ND	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	<0.1	<0.1	<0.1	<4	<0.4	6	8	8	<0.1	5	32
BH5/2	0.5-0.8	24-May-17	167858	-	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	-	-	-	<4	<0.4	10	2	9	<0.1	2	7
BH6	0.1-0.5	24-May-17	167858	ND	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	<0.1	<0.1	<0.1	<4	<0.4	8	2	8	<0.1	1	4
BH7	0.2-0.7	24-May-17	167858	ND	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	<0.1	<0.1	<0.1	<4	<0.4	10	3	8	<0.1	1	7
BH8	0.0-0.1	24-May-17	167858	ND	<0.2	<0.5	<1	<1	<1	<25	250	650	170	<0.5	<0.05	<0.1	<0.1	<0.1	<4	<0.4	14	8	14	<0.1	3	22
BH8	0.1-0.4	24-May-17	167858	-	<0.2	<0.5	<1	<1	<1	<25	120	180	<100	<0.5	<0.05	-	-	-	<4	<0.4	12	5	12	<0.1	2	13
INTRA-LABORATORY DUPLICATE																										
BH2	0.1-0.4A	24-May-17	167858	ND	<0.2	<0.5	<1	<1	<1	<25	<50	140	<100	<0.5	<0.05	<0.1	<0.1	<0.1	4	<0.4	44	20	11	<0.1	42	29
BH7	0.2-0.7A	24-May-17	167858	ND	<0.2	<0.5	<1	<1	<1	<25	<50	140	<100	<0.5	<0.05	<0.1	<0.1	<0.1	<4	<0.4	10	4	8	<0.1	3	11
STATISTICAL ANALYSIS																										
Min	MiMin				0	0	0	0	0	0	120	140	170	0	0	0	0	0	5	0	6	2	6	0	1	4
Max	MaMax				0	0	0	0	0	0	250	650	170	0	0	0	0	0	8	0	45	21	32	0	36	33
Avg	AvAvg				-	-	-	-	-	-	185	323	170	-	-	-	-	-	7	-	16	10	15	-	7	19
Stdev					-	-	-	-	-	-	92	284	-	-	-	-	-	-	1	-	10	7	8	-	9	10

Reported in mg/kg unless stated otherwise

\* Depth relates to Depth Below Surface Level


nd = not detected above laboratory LOR

NL = Not Limiting

RED = Exceeds HIL Criteria


YELLOW = Exceeds EIL Criteria

**Table 2 - RPD Results**  
**Supplementary Investigation**  
**'Ivanhoe Estate'**  
**Macquarie Park NSW**



DLA Environmental Services  
A Pacific Environmental company

Sample ID	Date	Report	BTEX				Naphthalene	TRH				PAH	
			Benzene	Toluene	EthylBenzene	Xylene		F1	F2	F3	F4	B(a)P TEQ	Total
INTRA-LABORATORY													
BH2_0.1-0.4	24-May-17	167858	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05
BH2_0.1-0.4A	24-May-17	167858	<0.2	<0.5	<1	<1	<1	<25	<50	140	<100	<0.5	<0.05
RPD			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH7_0.2-0.7	24-May-17	167858	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05
BH7_0.2-0.7A	24-May-17	167858.0	<0.2	<0.5	<1	<1	<1	<25	<50	140	<100	<0.5	<0.05
RPD			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA



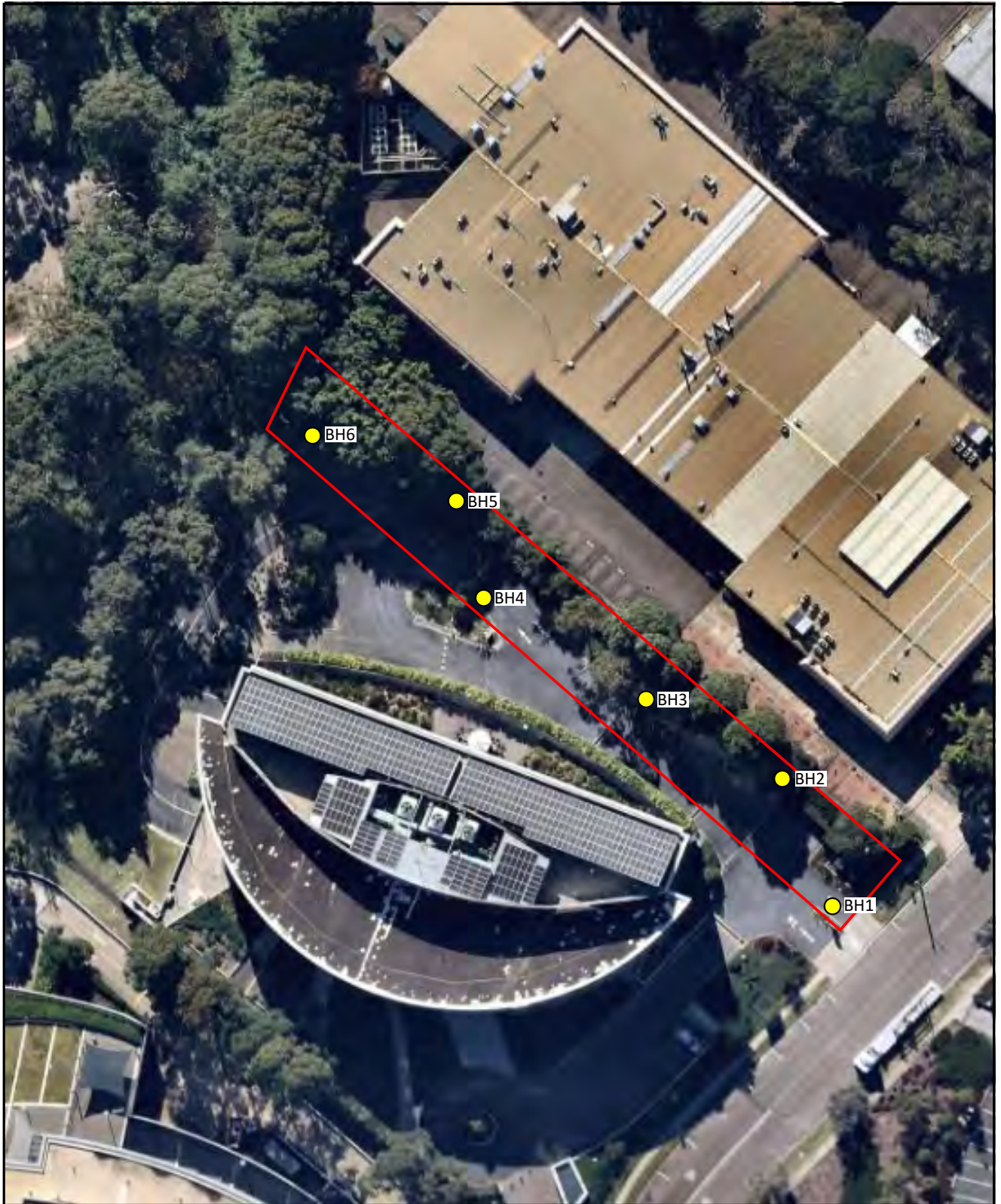
DLA

Environmental Services

A Pacific Environment company

Sample ID	Date	Report	Heavy Metals							
			As	Cd	Cr	Cu	Pb	Hg	Ni	Zn
INTRA-LABORATORY										
BH2_0.1-0.4	24-May-17	167858	5	<0.4	45	17	11	<0.1	36	25
BH2_0.1-0.4A	24-May-17	167858	4	<0.4	44	20	11	<0.1	42	29
RPD			22%	NA	2%	16%	0%	NA	15%	15%
BH7_0.2-0.7	24-May-17	167858	<4	<0.4	10	3	8	<0.1	1	7
BH7_0.2-0.7A	24-May-17	167858	<4	<0.4	10	4	8	<0.1	3	11
RPD			NA	NA	0%	29%	0%	NA	100%	44%

**Appendix G:  
DLA (July 2017) Supplementary Site Investigation Data  
Summary Tables**



#### Legend

- Approximate Site Boundary
- Sample Locations (approximate)



Approximate Scale

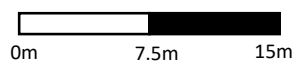


Figure Title

Site Layout and Sample Locations

Project Title

New Property Acquisition  
Ivanhoe Estate, Macquarie Park

Client

Frasers Property  
Australia

Project No.

DL3953

Date

10/7/2017

Scale

As Shown

Figure No.


2

Revision

Version 1.0

**Appendix H:  
DLA (July 2017) Supplementary Site Investigation Data  
Summary Tables**

Table 1 - Soil Analytical Results  
Supplementary Investigation  
New Property Aquisition  
'Ivanhoe Estate'  
Macquarie Park NSW

<div>DLA Environmental Services A Pacific Environment company</div>																									
Sample ID	Depth (m)	Date	Chemical Report	BTEX				Naphthalene	TRH				PAH		Pesticides		PCB	Heavy Metals							
				Benzene	Toluene	Ethylbenzene	Xylene		F1	F2	F3	F4	BaP TEQ	Total PAH	OCp	OPP		As	Cd	Cr VI	Cu	Pb	Hg	Ni	Zn
SITE ASSESSMENT CRITERIA				-	-	-	-	-	-	-	-	-	-	-	-	-	-	3000	900	3600	240000	1500	730	6000	400000
HSL D Commercial / Industrial (NEPC, 2013)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HSL D Commercial / Industrial, 0<1m, sand (NEPM, 2013)				3.0	NL	NL	230	NL	260	NL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HSL D Commercial / Industrial, 1<2m, sand (NEPM, 2013)				3.0	NL	NL	NL	NL	370	NL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HSL D Direct Contact (Friebel, et al, 2011)				430	99000	27000	81000	11000	26000	20000	27000	38000	-	-	-	-	-	-	-	-	-	-	-	-	-
Management Limits, Commercial / Industrial, coarse (NEPC, 2013)				-	-	-	-	-	700	1000	3500	10000	-	-	-	-	-	-	-	-	-	-	-	-	-
PRIMARY SAMPLES																									
BH1	0.2	27-Jun-17	170151	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	0.4	<0.1	<0.1	<0.1	<4	<0.4	12	24	47	<0.1	7	100
BH1	0.7	27-Jun-17	170151	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	0.9	-	-	-	<4	<0.4	11	13	70	<0.1	6	62
BH1	1.4	27-Jun-17	170151	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	<0.1	<0.1	<0.1	9	<0.4	24	5	24	<0.1	2	13
BH1	0.4	27-Jun-17	170151	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	-	-	-	4	<0.4	21	1	10	<0.1	2	3
BH2	0.5	27-Jun-17	170151	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	-	-	-	<4	<0.4	3	210	6	<0.1	5	42
BH3	0.2	27-Jun-17	170151	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	<0.1	<0.1	<0.1	<4	<0.4	5	9	6	<0.1	1	7
BH4	0.4	27-Jun-17	170151	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	-	-	-	<4	<0.4	1	2	4	<0.1	<1	5
BH5	0.2	27-Jun-17	170151	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	2.2	<0.1	<0.1	<0.1	<4	<0.4	3	5	9	<0.1	1	22
BH5	0.5	27-Jun-17	170151	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	-	-	-	4	0.5	12	10	17	<0.1	4	23
BH6	0.1	27-Jun-17	170151	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	0.51	<0.1	<0.1	<0.1	<4	<0.4	6	12	18	<0.1	2	35
BH6	0.4	27-Jun-17	170151	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	-	-	-	4	<0.4	12	5	15	<0.1	2	13
INTRA-LABORATORY DUPLICATE																									
BH1	1.4A	27-Jun-17	170151	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05	<0.1	<0.1	<0.1	8	<0.4	19	4	30	<0.1	2	15
STATISTICAL ANALYSIS																									
Min	MinMin			0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	1	1	4	0	1	3
Max	MaMax			0	0	0	0	0	0	0	0	0	0	2	0	0	0	9	1	24	210	70	0	7	100
Avg	AvAvg			-	-	-	-	-	-	-	-	-	-	1	-	-	-	5	1	10	27	21	-	3	30
Stdev				-	-	-	-	-	-	-	-	-	-	0.8	-	-	-	3	-	7	61	20	-	2	29

Reported in mg/kg unless stated otherwise

\* Depth relates to Depth Below Surface Level


nd = not detected above laboratory LOR

NL = Not Limiting

RED = Exceeds HIL Criteria


YELLOW = Exceeds EIL Criteria

**Table 2 - RPD Results  
Supplementary Investigation  
New Property Aquisition  
'Ivanhoe Estate'  
Macquarie Park NSW**



DLA Environmental Services  
A Public Environment company

Sample ID	Date	Report	BTEX				Naphthalene	TRH			PAH		
			Benzene	Toluene	EthylBenzene	Xylene		F1	F2	F3	F4	B(a)P TEQ	Total
INTRA-LABORATORY													
BH1_1.4	27-Jun-17	170151	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05
BH1_1.4A	27-Jun-17	170151	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5	<0.05
RPD			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA



DLA Environmental Services  
A Pacific Environmental company

Sample ID	Date	Report	Heavy Metals							
			As	Cd	Cr	Cu	Pb	Hg	Ni	Zn
INTRA-LABORATORY										
BH1_1.4	27-Jun-17	170151	9	<0.4	24	5	24	<0.1	2	13
BH1_1.4A	27-Jun-17	170151	8	<0.4	19	4	30	<0.1	2	15
RPD			12%	NA	23%	22%	22%	NA	0%	14%



## Appendix I: Remediation Action Plan Figures

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**Legend**

- Site Boundary
- TRH Exceedance Location
- No investigations have been conducted in this area
- Remediation Area



Approximate Scale



Figure Title

Site Layout and Remediation Area

Project Title

Ivanhoe Estate, Macquarie Park

Client

Frasers Property Australia

Project No.

DL 3953

Date

7/02/2018

Scale

As Shown

Figure No.

1

Revision

Version 1.1



## Site Audit Statement



## NSW Site Auditor Scheme

# Site Audit Statement

A site audit statement summarises the findings of a site audit. For full details of the site auditor's findings, evaluations and conclusions, refer to the associated site audit report.

This form was approved under the *Contaminated Land Management Act 1997* on 12 October 2017.

For information about completing this form, go to Part IV.

## Part I: Site audit identification

Site audit statement no. 0301-1803

---

This site audit is a:

- ☐ statutory audit  
☒ non-statutory audit

within the meaning of the *Contaminated Land Management Act 1997*.

### Site auditor details

(As accredited under the *Contaminated Land Management Act 1997*)

Name James Davis

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Company Enviroview Pty Ltd

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Address PO Box 327

---

GLADESVILLE NSW

Postcode 2110

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Phone 0467 375 481

---

Email james.davis@enviroview.com.au

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### Site details

Address Ivanhoe Estate (Ivanhoe Place, Wilcannia Way, Nyngan Way and Narromine Way) and part of 2-4 Lyon Park Road

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MACQUARIE PARK NSW

Postcode 2113

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## Property description

(Attach a separate list if several properties are included in the site audit.)

Lots 6 to 20 in DP 861433

Part Lot 1 in DP 859537

Lot 100 in DP 1223787

Lot 5 in DP 740753

(See Attached Plan)

Local government area

City of Ryde

Area of site (include units, e.g. hectares)

8.2 Ha

Current zoning

R4 High Density Residential

## Regulation and notification

To the best of my knowledge:

- ☐ **the site is** the subject of a declaration, order, agreement, proposal or notice under the *Contaminated Land Management Act 1997* or the *Environmentally Hazardous Chemicals Act 1985*, as follows: (provide the no. if applicable)

☐ Declaration no.

☐ Order no.

☐ Proposal no.

☐ Notice no.

- ☒ **the site is not** the subject of a declaration, order, proposal or notice under the *Contaminated Land Management Act 1997* or the *Environmentally Hazardous Chemicals Act 1985*.

To the best of my knowledge:

- ☐ the site **has** been notified to the EPA under section 60 of the *Contaminated Land Management Act 1997*
- ☒ the site **has not** been notified to the EPA under section 60 of the *Contaminated Land Management Act 1997*.

## Site audit commissioned by

Name Scott Clohessy

Company Frasers Ivanhoe Pty Ltd

Address Suite 11, Level 12, 101 Bathurst Street

SYDNEY NSW

Postcode

2000

Phone 02 9767 2078

---

Email            scott.clohessy@frasersproperty.com.au

---

**Contact details for contact person** (if different from above)

Name

---

Phone

---

Email

---

**Nature of statutory requirements** (not applicable for non-statutory audits)

- ☐ Requirements under the *Contaminated Land Management Act 1997*  
(e.g. management order; please specify, including date of issue)

---

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- ☐ Requirements imposed by an environmental planning instrument  
(please specify, including date of issue)

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- ☐ Development consent requirements under the *Environmental Planning and Assessment Act 1979* (please specify consent authority and date of issue)

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- ☐ Requirements under other legislation (please specify, including date of issue)

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## Purpose of site audit

- ☐ **A1** To determine land use suitability

Intended uses of the land: \_\_\_\_\_

OR

- A2** To determine land use suitability subject to compliance with either an active or passive environmental management plan

Intended uses of the land: \_\_\_\_\_

OR

(Tick all that apply)

- ☐ **B1** To determine the nature and extent of contamination

- ☒ **B2** To determine the appropriateness of:

☐ an investigation plan

☒ a remediation plan

☐ a management plan

- ☐ **B3** To determine the appropriateness of a **site testing plan** to determine if groundwater is safe and suitable for its intended use as required by the *Temporary Water Restrictions Order for the Botany Sands Groundwater Resource 2017*

- ☐ **B4** To determine the compliance with an approved:

☐ **voluntary management proposal** or

☐ **management order** under the *Contaminated Land Management Act 1997*

- ☒ **B5** To determine if the land can be made suitable for a particular use (or uses) if the site is remediated or managed in accordance with a specified plan.

Intended uses of the land: Combination of high and low density housing.

## Information sources for site audit

Consultancies which conducted the site investigations and/or remediation:

JBS&G, DLA Environmental Services

Titles of reports reviewed:

JBS&G (2016). Detailed Site Investigation, Ivanhoe Estate, Herring Road, Macquarie Park, NSW. Document Ref: 52047/104956 (Rev 0). 24 October 2016 (JBS&G, 2016)

DLA Environmental Services (2016). Letter dated 11 October 2016 Re: Summary of In-Ground Contamination – Ivanhoe Estate, Cnr Herring and Epping Roads, Macquarie Park NSW 2113. Document Ref: DL3531\_S005491 (DLA, 2016)

---

DLA Environmental Services (June 2017). Supplementary Site Investigation, Ivanhoe Estate, Corner Herring Road and Epping Road, Macquarie Road (STET) NSW 2113. Document Ref: DL3953\_S006887. June 2017 (DLA, June 2017)

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DLA Environmental Services (July 2017). Supplementary Site Investigation - New Property Acquisition - Ivanhoe Estate, 2 Lyon Park Road, Macquarie Pak (STET) NSW 2113. Document Ref: DL3953\_S007076. 28 July 2017 (DLA, July 2017)

---

DLA Environmental Services (2018). Remediation Action Plan, Ivanhoe Estate, Corner Herring Road and Epping Road, Macquarie Park NSW 2113. Document ref: S008208 Version 1.2. 12 March 2018 (DLA, 2018)

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Other information reviewed, including previous site audit reports and statements relating to the site:

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### Site audit report details

Title Site Audit Report, Ivanhoe Estate, Macquarie Park NSW

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Report no. 600138\_0301-1803

Date 19 April 2018

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## Part II: Auditor's findings

Please complete either Section A1, Section A2 or Section B, not more than one section.  
(Strike out the irrelevant sections.)

- Use **Section A1** where site investigation and/or remediation has been completed and a conclusion can be drawn on the suitability of land uses **without the implementation** of an environmental management plan.
- Use **Section A2** where site investigation and/or remediation has been completed and a conclusion can be drawn on the suitability of land uses **with the implementation** of an active or passive environmental management plan.
- Use **Section B** where the audit is to determine:
  - (B1) the nature and extent of contamination, and/or
  - (B2) the appropriateness of an investigation, remediation or management plan<sup>1</sup>, and/or
  - (B3) the appropriateness of a site testing plan in accordance with the *Temporary Water Restrictions Order for the Botany Sands Groundwater Source 2017*, and/or
  - (B4) whether the terms of the approved voluntary management proposal or management order have been complied with, and/or
  - (B5) whether the site can be made suitable for a specified land use (or uses) if the site is remediated or managed in accordance with the implementation of a specified plan.

---

<sup>1</sup> For simplicity, this statement uses the term 'plan' to refer to both plans and reports.

## Section A1

### ~~I certify that, in my opinion:~~

The **site is suitable** for the following uses:

~~(Tick all appropriate uses and strike out those not applicable.)~~

- ☐ ~~Residential, including substantial vegetable garden and poultry~~
  - ☐ ~~Residential, including substantial vegetable garden, excluding poultry~~
  - ☐ ~~Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry~~
  - ☐ ~~Day care centre, preschool, primary school~~
  - ☐ ~~Residential with minimal opportunity for soil access, including units~~
  - ☐ ~~Secondary school~~
  - ☐ ~~Park, recreational open space, playing field~~
  - ☐ ~~Commercial/industrial~~
  - ☐ ~~Other (please specify):~~
- 

### **OR**

- ☐ ~~I certify that, in my opinion, the **site is not suitable** for any use due to the risk of harm from contamination.~~

Overall comments:

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## Section A2

### ~~I certify that, in my opinion:~~

~~Subject to compliance with the **attached** environmental management plan<sup>2</sup> (EMP), the site is suitable for the following uses:~~

~~(Tick all appropriate uses and strike out those not applicable.)~~

- ☐ ~~Residential, including substantial vegetable garden and poultry~~
- ☐ ~~Residential, including substantial vegetable garden, excluding poultry~~
- ☐ ~~Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry~~
- ☐ ~~Day care centre, preschool, primary school~~
- ☐ ~~Residential with minimal opportunity for soil access, including units~~
- ☐ ~~Secondary school~~
- ☐ ~~Park, recreational open space, playing field~~
- ☐ ~~Commercial/industrial~~
- ☐ ~~Other (please specify):~~

---

### ~~EMP details~~

~~Title~~

~~Author~~

~~Date~~

~~No. of pages~~

### ~~EMP summary~~

~~This EMP (attached) is required to be implemented to address residual contamination on the site.~~

~~The EMP: (Tick appropriate box and strike out the other option.)~~

- ☐ ~~requires operation and/or maintenance of **active** control systems<sup>3</sup>~~
- ☐ ~~requires maintenance of **passive** control systems only<sup>3</sup>.~~

---

<sup>2</sup> Refer to Part IV for an explanation of an environmental management plan.

<sup>3</sup> Refer to Part IV for definitions of active and passive control systems.

## Site Audit Statement

Purpose of the EMP:

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Description of the nature of the residual contamination:

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Summary of the actions required by the EMP:

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How the EMP can reasonably be made to be legally enforceable:

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How there will be appropriate public notification:

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Overall comments:

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## Section B

Purpose of the plan<sup>4</sup> which is the subject of this audit:

Remediation of the site for the proposed landuse; High-rise residential with ground floor child care centre.

### I certify that, in my opinion:

(B1)

- ☐ ~~The nature and extent of the contamination **has** been appropriately determined~~  
☐ ~~The nature and extent of the contamination **has not** been appropriately determined~~

AND/OR (B2)

- ☒ The ~~investigation, remediation or management~~ plan **is** appropriate for the purpose stated above  
☐ ~~The investigation, remediation or management plan **is not** appropriate for the purpose stated above~~

AND/OR (B3)

- ☐ ~~The site testing plan:~~  
☐ ~~**is** appropriate to determine~~  
☐ ~~**is not** appropriate to determine~~  
~~if groundwater is safe and suitable for its intended use as required by the *Temporary Water Restrictions Order for the Botany Sands Groundwater Resource 2017*~~

AND/OR (B4)

- ☐ ~~The terms of the approved voluntary management proposal\* or management order\*\* (strike out as appropriate):~~  
☐ ~~**have** been complied with~~  
☐ ~~**have not** been complied with.~~

~~\*voluntary management proposal no.~~

~~\*\*management order no.~~

AND/OR (B5)

- ☒ The site **can be made suitable** for the following uses:  
(Tick all appropriate uses and strike out those not applicable.)  
☐ ~~Residential, including substantial vegetable garden and poultry~~  
☐ ~~Residential, including substantial vegetable garden, excluding poultry~~

---

<sup>4</sup> For simplicity, this statement uses the term 'plan' to refer to both plans and reports.

Site Audit Statement

- ☒ Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry
- ☒ Day care centre, preschool, primary school
- ☒ Residential with minimal opportunity for soil access, including units
- ☒ Secondary school
- ☒ Park, recreational open space, playing field
- ☒ Commercial/industrial
- ☐ ~~Other (please specify):~~

---

IF the site is remediated/~~managed~~\* in accordance with the following plan (**attached**):

\*Strike out as appropriate

Plan title      Remediation Action Plan, Ivanhoe Estate, Corner Herring Road and Epping Road, Macquarie Park NSW 2113. Document ref: S008208 Version 1.2.

---

Plan author    DLA Environmental

---

Plan date      12 March 2018

No. of pages   62 including cover

---

SUBJECT to compliance with the following condition(s):

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Overall comments:

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### Part III: Auditor's declaration

I am accredited as a site auditor by the NSW Environment Protection Authority (EPA) under the *Contaminated Land Management Act 1997*.

Accreditation no. 0301

---

**I certify that:**

- I have completed the site audit free of any conflicts of interest as defined in the *Contaminated Land Management Act 1997*, and
- with due regard to relevant laws and guidelines, I have examined and am familiar with the reports and information referred to in Part I of this site audit, and
- on the basis of inquiries I have made of those individuals immediately responsible for making those reports and obtaining the information referred to in this statement, those reports and that information are, to the best of my knowledge, true, accurate and complete, and
- this statement is, to the best of my knowledge, true, accurate and complete.

I am aware that there are penalties under the *Contaminated Land Management Act 1997* for wilfully making false or misleading statements.

Signed



Date 19 April 2018

---

## Part IV: Explanatory notes

To be complete, a site audit statement form must be issued with all four parts.

### How to complete this form

#### Part I

Part I identifies the auditor, the site, the purpose of the audit and the information used by the auditor in making the site audit findings.

#### Part II

Part II contains the auditor's opinion of the suitability of the site for specified uses or of the appropriateness of an investigation, or remediation plan or management plan which may enable a particular use. It sets out succinct and definitive information to assist decision-making about the use or uses of the site or a plan or proposal to manage or remediate the site.

The auditor is to complete either Section A1 or Section A2 or Section B of Part II, **not** more than one section.

#### Section A1

In Section A1 the auditor may conclude that the land is *suitable* for a specified use or uses OR *not suitable* for any beneficial use due to the risk of harm from contamination.

By certifying that the site is *suitable*, an auditor declares that, at the time of completion of the site audit, no further investigation or remediation or management of the site was needed to render the site fit for the specified use(s). **Conditions must not be** imposed on a Section A1 site audit statement. Auditors may include **comments** which are key observations in light of the audit which are not directly related to the suitability of the site for the use(s). These observations may cover aspects relating to the broader environmental context to aid decision-making in relation to the site.

#### Section A2

In Section A2 the auditor may conclude that the land is *suitable* for a specified use(s) subject to a condition for implementation of an environmental management plan (EMP).

##### *Environmental management plan*

Within the context of contaminated sites management, an EMP (sometimes also called a 'site management plan') means a plan which addresses the integration of environmental mitigation and monitoring measures for soil, groundwater and/or hazardous ground gases throughout an existing or proposed land use. An EMP succinctly describes the nature and location of contamination remaining on site and states what the objectives of the plan are, how contaminants will be managed, who will be responsible for the plan's implementation and over what time frame actions specified in the plan will take place.

By certifying that the site is suitable subject to implementation of an EMP, an auditor declares that, at the time of completion of the site audit, there was sufficient information satisfying guidelines made or approved under the *Contaminated Land Management Act 1997*

(CLM Act) to determine that implementation of the EMP was feasible and would enable the specified use(s) of the site and no further investigation or remediation of the site was needed to render the site fit for the specified use(s).

Implementation of an EMP is required to ensure the site remains suitable for the specified use(s). The plan should be legally enforceable: for example, a requirement of a notice under the CLM Act or a development consent condition issued by a planning authority. There should also be appropriate public notification of the plan, e.g. on a certificate issued under s.149 of the *Environmental Planning and Assessment Act 1979*.

#### *Active or passive control systems*

Auditors must specify whether the EMP requires operation and/or maintenance of active control systems or requires maintenance of passive control systems only. Active management systems usually incorporate mechanical components and/or require monitoring and, because of this, regular maintenance and inspection are necessary. Most active management systems are applied at sites where if the systems are not implemented an unacceptable risk may occur. Passive management systems usually require minimal management and maintenance and do not usually incorporate mechanical components.

#### *Auditor's comments*

Auditors may also include **comments** which are key observations in light of the audit which are not directly related to the suitability of the site for the use(s). These observations may cover aspects relating to the broader environmental context to aid decision-making in relation to the site.

## **Section B**

In Section B the auditor draws conclusions on the nature and extent of contamination, and/or suitability of plans relating to the investigation, remediation or management of the land, and/or the appropriateness of a site testing plan in accordance with the *Temporary Water Restrictions Order for the Botany Sands Groundwater Source 2017*, and/or whether the terms of an approved voluntary management proposal or management order made under the CLM Act have been complied with, and/or whether the site can be made suitable for a specified land use or uses if the site is remediated or managed in accordance with the implementation of a specified plan.

By certifying that a site *can be made suitable* for a use or uses if remediated or managed in accordance with a specified plan, the auditor declares that, at the time the audit was completed, there was sufficient information satisfying guidelines made or approved under the CLM Act to determine that implementation of the plan was feasible and would enable the specified use(s) of the site in the future.

For a site that *can be made suitable*, any **conditions** specified by the auditor in Section B should be limited to minor modifications or additions to the specified plan. However, if the auditor considers that further audits of the site (e.g. to validate remediation) are required, the auditor must note this as a condition in the site audit statement. The condition must not specify an individual auditor, only that further audits are required.

Auditors may also include **comments** which are observations in light of the audit which provide a more complete understanding of the environmental context to aid decision-making in relation to the site.

### **Part III**

In **Part III** the auditor certifies their standing as an accredited auditor under the CLM Act and makes other relevant declarations.

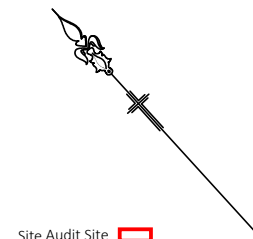
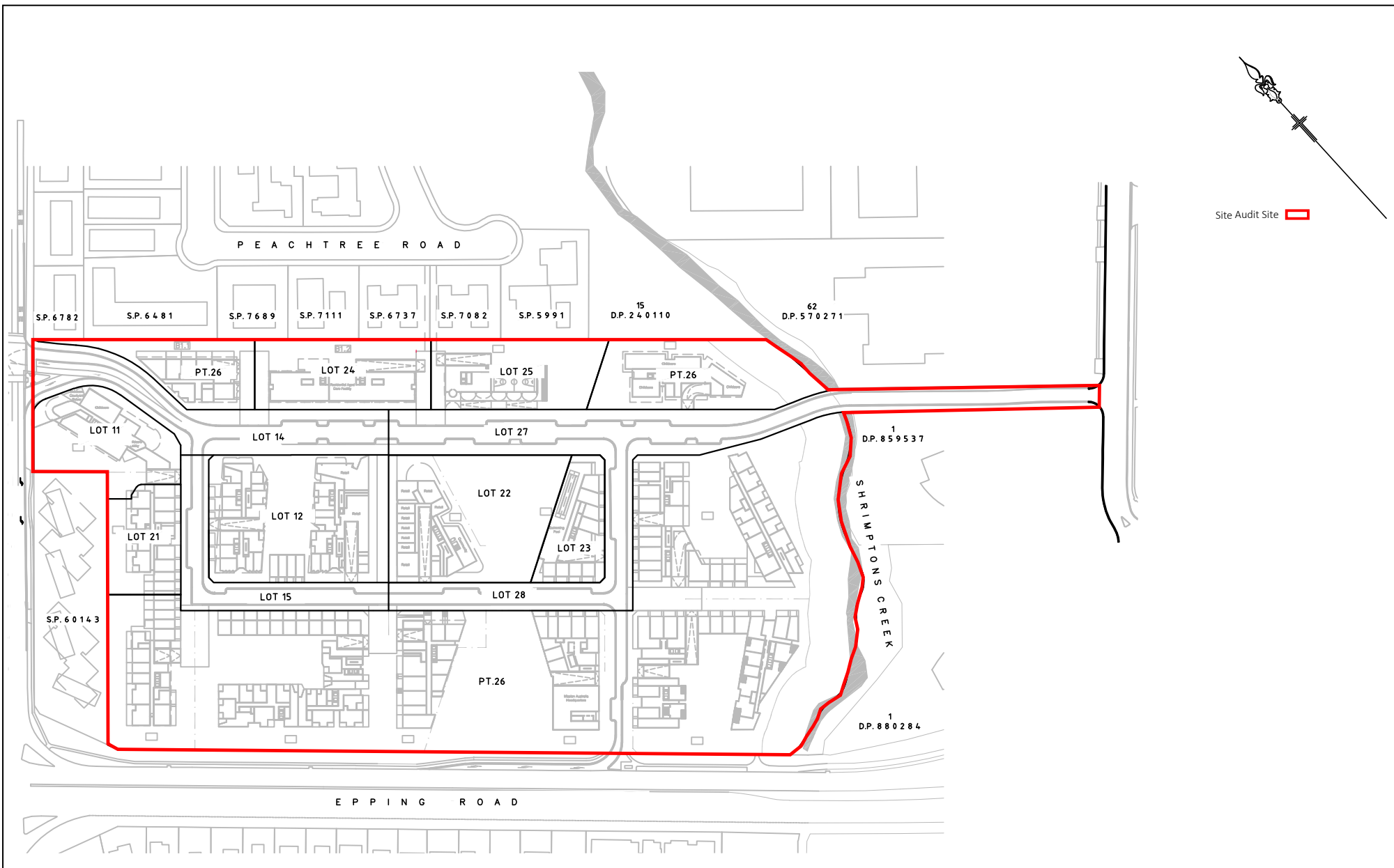
### **Where to send completed forms**

In addition to furnishing a copy of the audit statement to the person(s) who commissioned the site audit, statutory site audit statements must be sent to

- the **NSW Environment Protection Authority**:  
[nswauditors@epa.nsw.gov.au](mailto:nswauditors@epa.nsw.gov.au) or as specified by the EPA

AND

- the **local council** for the land which is the subject of the audit.



Site Audit Site



# Remediation Action Plan

Ivanhoe Estate  
Corner Herring Road and Epping Road  
Macquarie Park NSW 2113

Frasers Property Australia

0448889

March 2018



<b>PROJECT NAME</b>	Ivanhoe Estate, Macquarie Park
<b>PROJECT ID</b>	0448889
<b>DOCUMENT CONTROL NUMBER</b>	S008208
<b>PREPARED FOR</b>	Frasers Property Australia
<b>APPROVED FOR RELEASE BY</b>	Simon Spyrdz
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DOCUMENT CONTROL				
VERSION NO.	DATE	COMMENT	PREPARED BY	REVIEWED BY
Version 1.0	24.01.2018		Amy Dorrington	Sally King
Version 1.1	7.02.2018	After client review	Amy Dorrington	Sally King
Version 1.2	12.03.2018	After Site Auditor review	Sally King	Richard Bolton

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The conclusions presented in this report are relevant to the present condition of the Site and the state of legislation currently enacted as at the date of this report. DLA do not make any representation or warranty that the conclusions in this report will be applicable in the future as there may be changes in the condition of the Site, applicable legislation or other factors that would affect the conclusions contained in this report.

This report is limited to the scope defined herein. Sampling and chemical analysis of environmental media are based on representative samples, the intensity of those samples being in accordance with the usual levels of testing carried out for this type of investigation and appropriate for the objectives of this report. Due to the inherent variability in environmental media, DLA cannot warrant that the whole overall condition of the Site is identical or substantially similar to the representative samples.

## ABBREVIATIONS

A list of abbreviations used throughout the report is provided below:

<b>ABC</b>	Ambient Background Concentration
<b>ACL</b>	Added Contaminant Limit
<b>ACM</b>	Asbestos Containing Material
<b>AEC</b>	Area of Environmental Concern
<b>AHD</b>	Australian Height Datum
<b>BGL</b>	Below Ground Level
<b>BTEX</b>	Benzene, Toluene, Ethyl Benzene, Xylene
<b>COPC</b>	Contaminant of Potential Concern
<b>CSM</b>	Conceptual Site Model
<b>DEC</b>	Department of Environment and Conservation
<b>DLA</b>	DLA Environmental Services
<b>DSI</b>	Detailed Site Investigation
<b>EC</b>	Electrical Conductivity
<b>EIL</b>	Ecological Investigation Level
<b>ENM</b>	Excavated Natural Material
<b>EPA</b>	Environment Protection Authority (NSW)
<b>ESL</b>	Ecological Screening Level
<b>HIL</b>	Health-Based Investigation Level
<b>HSL</b>	Health Screening Level
<b>NA</b>	Not Applicable
<b>NATA</b>	National Association of Testing Authorities
<b>NEPC</b>	National Environment Protection Council
<b>NEPM</b>	National Environment Protection Measure
<b>NL</b>	Not Limiting
<b>NSW</b>	New South Wales
<b>OC/OP</b>	Organochlorine and Organophosphorus Pesticides
<b>PAH</b>	Polycyclic Aromatic Hydrocarbons
<b>PCB</b>	Polychlorinated Biphenyls
<b>PPE</b>	Personal Protective Equipment
<b>ppm</b>	parts per million
<b>PSI</b>	Preliminary Site Investigation
<b>QA/QC</b>	Quality Assurance and Quality Control
<b>RAP</b>	Remedial Action Plan
<b>SCC</b>	Specific Contaminant Concentration
<b>TCLP</b>	Toxicity Characteristic Leaching Procedure
<b>TEQ</b>	Toxicity Equivalence Quotient
<b>TRH</b>	Total Recoverable Hydrocarbons
<b>VAC</b>	Validation Acceptance Criteria
<b>VENM</b>	Virgin Excavated Natural Material

## EXECUTIVE SUMMARY

DLA Environmental Services was engaged Frasers Property Australia to prepare a Remediation Action Plan for the property identified as Ivanhoe Estate located at the corner of Herring Road and Epping Road, Macquarie Park, NSW, 2113 (the Site).

The RAP sets goals and documents the management procedures and environmental safeguards to be implemented during remediation works to ensure that the Site will be rendered suitable for future land use consistent with 'Residential A' as described in the *National Environment Protection (Assessment of Site Contamination) Measure 2013 (No.1)* (NEPC, 2013).

Remediation and validation works required under this Plan are in response to the identification of TRH contamination in soils in an area of the Site.

Excavation and off-site disposal of contaminated material is considered the most suitable remediation strategy as it is time efficient and offers no constraints on future land use. The strategy ensures removal of all contaminated materials and ongoing exposure risks, and can be carried out as part of the proposed redevelopment works.

The Remediation Action Plan also provides requirements for validation, waste disposal, Site management, and health and safety.

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<b>Figure 1</b>	Site Location
<b>Figure 2</b>	Site Layout and Remediation Area

## APPENDICES

<b>Appendix A</b>	Unexpected Finds Protocol
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## 1.0 INTRODUCTION

### 1.1 General

DLA Environmental Services (DLA) was engaged by Frasers Property Australia to prepare a Remediation Action Plan (RAP) for the following area:

#### IVANHOE ESTATE

Corner of Herring Road and Epping Road,  
Macquarie Park, NSW, 2113  
(the Site).

This RAP provides information on the works which are proposed to manage and remediate contamination previously identified at the Site. The RAP has been prepared utilising information obtained from previous assessment of the Site and from experience, knowledge, and current industry practice in the remediation of similar sites.

### 1.2 Objectives

The objective of this RAP is to detail all necessary actions to be undertaken at the Site in order to render the Site suitable for the proposed redevelopment, thereby posing no unacceptable risk to human health or the environment.

In particular, this RAP sets remediation goals and documents management procedures and environmental safeguards for the proposed future land use consistent with 'Residential A' as described in the *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013* (No.1) ('NEPM', NEPC, 2013).

### 1.3 Scope of Works

The scope of the RAP has been defined on the basis of the findings of the following reports:

- *Detailed Site Investigation – Ivanhoe Estate, Herring Road, Macquarie Park, NSW* (JBS&G, dated 30 September 2016, reference: 52047/10496 (Rev A));
- *Summary of In-Ground Contamination – Ivanhoe Estate, Corner Herring and Epping Roads, Macquarie Park,, NSW 2113* (DLA, dated 11 October 2016, reference: DL3953\_S005491); and

- *Supplementary Site Investigation – Ivanhoe Estate, Corner Herring Road and Epping Road, Macquarie Park, NSW, 2113* (DLA Environmental, dated June 2017, reference: DL3593\_S006887).

In this regard, the RAP includes:

- A summary of the history and environmental setting of the Site, including previous environmental investigations;
- A summary of the contamination identified on-site that requires remediation;
- An evaluation of available remediation options and a summary of the preferred remedial strategy that will render the Site suitable for the proposed development from a contamination perspective;
- A summary of the validation criteria to be adopted and design of a validation plan to confirm that the remediation strategy was successful; and
- Appropriate safeguards to perform the remediation works in an environmentally acceptable manner, having regard to best-practice work, health and safety procedures.

## 2.0 SITE DESCRIPTION

### 2.1 Site Identification

The Site identification details are summarised in Table 1.

**Table 1: Site Identification Summary**

ITEMS	DETAILS
<b>Site Name</b>	Ivanhoe Estate
<b>Address</b>	Corner Herring Road and Macquarie Park, NSW, 2113
<b>Local Government Authority</b>	City Of Ryde
<b>Lot and Deposited Plan</b>	Lots 6 to 17 and 18 to 20 in Deposited Plan 861433 Lot 1 in DP 859537 Lot 100 in Deposited Plan 1223787 Part Lot 5 in Deposited Plan 740753
<b>Site Zoning</b>	B4 – Mixed Use under the Ryde Local Environmental Plan 2014
<b>Current Use</b>	Residential (Department of Housing)
<b>Proposed Use</b>	Mixed Use
<b>Site Area (approx.)</b>	8.2 hectares
<b>Locality Map</b>	Refer to <b>Figure 1</b> – Site Location
<b>Site Plan</b>	Refer to <b>Figure 2</b> – Site Layout and Remediation Area

### 2.2 Proposed Development

DLA understands that the Site is to be subdivided and redeveloped into a combination of low and high density land use. The most conservative land use scenario has been adopted, which is consistent with the definition of ‘Residential with gardens and accessible soil’ provided in Schedule B7 of the NEPM (NEPC, 2013).

### 2.3 Boundaries and Surrounding Land Use

The boundary and surrounding landscape features of the site are summarised in Table 2.



**Table 2: Boundaries and Surrounding Land Use**

DIRECTION	DETAILS
North-west	Herring Road with high-density residential premises and Macquarie University beyond
North-east	Medium to high-density residential premises
South-west	Epping Road with low-density residential premises beyond
South-east	Commercial (offices) premises

## 2.4 Environmental Setting

The landscape and environmental setting of the Site is summarised in Table 3.

**Table 3: Environmental Setting**

DIRECTION	DETAILS
Topography	<p>The Site lies at elevations between approximately 47m Australian Height Datum (AHD) in the southern-most corner and 75m AHD along the north-western boundary. The Site exhibits an overall gradient from the north-western boundary down towards the south / south-east.</p>
Geology and Soils	<p>The 1:100,000 Sydney Geological Series Sheet (9130) indicates that the Site lies on the boundary of Triassic-aged Ashfield Shale of the Wianamatta Group and Hawkesbury Sandstone. Ashfield Shale comprises black and dark grey shale and laminite derived from lacustrine environments. Hawkesbury Sandstone comprises medium to coarse grained quartz sandstone with very minor shale and laminite lenses derived from braided alluvial channel fill.</p> <p>Subsurface conditions encountered on-site during previous investigation identified the presence of fill material across most of the Site area. Geotechnical investigations carried out on-site (Douglas Partners, 2017), indicate that the subsurface of the Site comprises the following:</p> <ul style="list-style-type: none"> <li>- Filling – including pavement materials, past filling from on-site and possibly imported materials, to variable depth but typically less than 1 m below ground level (bgl), though possibly deeper, particularly towards Shrimptons Creek; underlain by,</li> <li>- Residual Soil – likely to be generally stiff and very stiff silty clay, sandy clay and clayey sand, possibly with some ironstone or sandstone gravel fragments, to typical depths of 0.2 m to 1.5 m bgl, though likely to be generally deeper (and possibly weaker, with overlying alluvial soils) towards Shrimptons Creek; underlain by,</li> <li>- Sandstone bedrock.</li> </ul>

DIRECTION	DETAILS
<b>Acid Sulfate Soils</b>	The 1:25,000 Prospect / Parramatta River Acid Sulfate Soil Risk Map indicates that there are no known occurrences of acid sulfate soil in the vicinity of the Site.
<b>Hydrology</b>	<p>Shrimpton Creek runs along the south-eastern boundary of the Site. Shrimpton Creek flows in a broadly northerly direction, ultimately discharging to the Lane Cove River which is located approximately 1.35 km to the north-east of the Site.</p> <p>The surface of the Site comprises both sealed and unsealed surfaces. In areas of the Site where unsealed surfaces are present (i.e. lawns and garden beds), it is expected that surface water (rainfall) would infiltrate into the subsurface. In areas of the Site where impervious pavements are present (i.e. roadways), or where the subsurface becomes waterlogged following periods of prolonged or heavy rainfall, runoff water would form overland flow and follow the gradient of the land.</p>
<b>Hydrogeology</b>	Review of the NSW Office of Water groundwater data indicates that there are no registered bores within a 500m radius of the Site. The closest registered bore to the Site is located approximately 650m to the north / north-east and is registered for use for monitoring purposes. No details regarding the depth to groundwater are available for the nearby registered bores, however it is expected that regional groundwater would be present at depth within the underlying bedrock. Based on the hydrology of the local area, it is expected that groundwater underlying the Site would flow in a north-easterly direction towards the Lane Cove River.

## 3.0 SUMMARY OF PREVIOUS INVESTIGATIONS

### 3.1 Detailed Site Investigation

*Detailed Site Investigation – Ivanhoe Estate, Herring Road, Macquarie Park NSW (JBS&G, dated 30 September 2016, reference: 52047/104956 (Rev A)).*

The Detailed Site Investigation (DSI) comprised a review of previous investigations, historical information and intrusive sampling which included 26 grid-based and targeted borehole locations.

The results of the soil sampling and laboratory analysis reported contaminants of potential concern at concentrations less than the investigation criteria, with the exception of benzo(a)pyrene which exceeded the adopted ecological criteria at one sample location. This ecological exceedance was not considered to present an unacceptable ecological risk due to its expected limited effects on plant uptake.

The report concluded that the soils underlying the Site do not present an unacceptable risk to human health or the environment from a contamination perspective, and do not preclude redevelopment of the Site for its intended land use.

### 3.2 Summary of In-Ground Contamination

*Summary of In-Ground Contamination – Ivanhoe Estate, Cnr Herring and Epping Roads, Macquarie Park NSW 2113 (DLA, dated 11 October 2016, reference: DL3953\_S005491).*

The document was prepared in response to a review of the DSI report (JBS&G, 2016) which indicated that historical cut and fill activities were undertaken on-site to facilitate the construction of larger developments in the estate.

Based on a review of the available historical and investigation data, DLA concluded that there was a low likelihood of unacceptable contamination to be present on the Site as a result of past and present land use activities, however data gaps existed for the cut and fill areas.

DLA recommended that additional visual inspections and limited sampling be performed across the cut and fill areas with the aim of addressing the identified data gaps with regards to the presence of subsurface contamination associated with fill material.

### 3.3 Supplementary Site Investigation

*Supplementary Site Investigation – Ivanhoe Estate, Corner Herring Road and Epping Road, Macquarie Park, NSW, 2113* (DLA Environmental, dated June 2017, reference: DL3593\_S006887).

The Supplementary Investigation report provided environmental characterisation of soil across data gap areas identified on-site in order to assess the suitability of these areas for proposed future residential land use.

The investigation included the collection of soil samples collected from nine targeted boreholes. Soil samples collected from borehole BH8 reported petroleum hydrocarbons at concentrations exceeding the health and ecological screening levels, while all other samples reported contaminant concentrations below the investigation and screening levels.

Based on the results of the current investigation data, DLA concluded that the area of the Site in the vicinity of borehole BH8 was not suitable for the proposed redevelopment from a contamination perspective, however could be made suitable via the implementation of an appropriate remediation strategy.

## 4.0 EXTENT OF CONTAMINATION

Based on the available data, DLA has identified one Area of Environmental Concern (AEC) on-site as detailed in Table 4. The AEC defines the extent of remediation which is understood to be required to make the Site suitable for its proposed future land use.

**Table 4: Extent of Contamination: AECs**

AEC ID	LOCATION	CONTAMINANT OF CONCERN	MAXIMUM DEPTH (bgl)	REFERENCE
<b>AEC 1</b>	BH8	TRH	> 0.4m	DLA, 2017

Refer to **Figure 2** – Site Layout and Remediation Area.

A section of the Site to the east has not undergone any contamination investigations, therefore the presence of contamination within this area cannot be precluded. Assessment of this data gap area of the Site will be carried out as part of the initial phases of remediation works – refer to **Section 7.5.1** of this RAP.

Based on the nature of the current and former occupation of the Site, and the known limited extent of soil contamination identified to date, the potential for the significant contamination of groundwater underlying the Site is expected to be low. Although elevated concentrations of some contaminants may be present within the groundwater (i.e. heavy metals), these are expected to be representative of background conditions associated with highly disturbed urban environments. As such, the groundwater underlying the Site is not considered to present a risk to human health or the environment from a contamination perspective and, therefore, remediation or management is not considered necessary.

## 5.0 CONCEPTUAL SITE MODEL

### 5.1 Overview

A Conceptual Site Model (CSM) is a representation of an environmental system and the processes that determine the transport of contaminants from sources through environmental media to environmental receptors. The development of a CSM comprises an iterative process of characterising site contamination on the basis of historical, anecdotal, previous and current environmental data.

An exposure pathway is a means by which an ecosystem, human population or individual (receptor) may be exposed to site-derived contaminants. If a source, transport mechanism (pathway), an exposure point and a sensitive receptor are all present then a complete exposure pathway exists.

### 5.2 Potential Contaminants

Site-specific AECs and associated contaminants of potential concern (COPCs) are summarised in **Section 4.0** of this RAP.

### 5.3 Release and Transport Mechanisms

Contaminants generally migrate from a site via a combination of windblown dusts, infiltration, groundwater migration and surface water runoff. The potential for contaminants to migrate is a combination of:

- The nature of the contaminants (solid/liquid and mobility characteristics);
- The extent of the contaminants (isolated or widespread);
- The location of the contaminants (surface soils or at depth); and
- The site topography, geology, hydrology and hydrogeology.

#### **Windblown Dust Migration**

As the hydrocarbon impacted area is unsealed, windblown dust migration is a potential minor risk.

#### **Surface Water Migration**

The migration of chemical contaminants via surface water runoff is considered to be low considering the absence of widespread chemical contamination within the Site.

#### **Soil and Groundwater Migration**

The potential for migration of chemical contamination through the soil profile is considered to be low given the isolated nature of chemical contamination identified on-site and the generally impermeable nature of the clay soils comprising the subsurface of the Site.



## **Vapour Generation**

The vapour generation potential associated with volatile COPCs (i.e. petroleum hydrocarbons) is identified as a potential migration pathway. However, vapour generation would require significant subsurface contamination to be present which, based on previous investigations, is not expected.

### **5.4 Potential Exposure Pathways**

Based on the identified COPCs and future potential Site development activities, the exposure pathways for the Site's use include:

- Dermal contact with chemically impacted soils;
- Ingestion of chemically impacted soils; and
- Inhalation of hydrocarbon vapours.

### **5.5 Sensitive Receptors**

The potential sensitive receptors at the Site include:

- Present and future Site users;
- Construction and maintenance workers; and
- Visitors to the Site.

## 6.0 SELECTION OF PREFERRED REMEDIAL STRATEGY

### 6.1 Remediation Options

The preferred hierarchy of options for site remediation and/or management is set out in Section 6(16) of the NEPM (NEPC, 2013). According to this document, the order of preference for soil remediation and management is:

1. On-site treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level;
2. Off-site treatment of excavated soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the Site;
3. Removal of contaminated soil to an approved site or facility, followed where necessary by replacement with clean fill; and,
4. Consolidation and isolation of the soil on-site by containment within a properly designed barrier.

A review of the available remediation methods and technologies indicates that the following strategies may be applicable to the remediation of the Site.

#### 6.1.1 On-site Treatment of Contaminated Media

On-site treatment of contaminated media may include *in-situ* methods such as stabilisation and oxidation, and *ex-situ* methods such as thermal desorption and bioremediation. For the higher ranges of hydrocarbons, enhanced bio-remediation (addition of microbial agents) may be required for the timely breakdown of hydrocarbon compounds in soil. *Ex-situ* on-site treatment requires sufficient land area to facilitate the process for the life of the remediation program.

Both *in-situ* and *ex-situ* remediation methods often take an extended period of time to complete and have costs associated with mobilisation and monitoring. In addition, treatment technologies often target only one type of contaminant (i.e. volatile organics) and therefore are not typically suitable for sites with multiple types of contamination, especially heavy metals.

The benefits of on-site treatment of contamination are that off-site disposal of contaminated media is not typically necessary and the importation of Virgin Excavated Natural Material (VENM) to reinstate excavations is not required.

*The option for on-site treatment of contaminated media is considered suitable for implementation at the Site due to the relatively small volume of soil that requires remediation and the identified COPC.*

*However, given that in-situ treatment strategies typically require a longer time frame to achieve the required result, this approach is not considered a feasible option for implementation at the Site.*

### **6.1.2 Off-site Treatment of Contaminated Media**

Off-site treatment of contaminated media includes the same methods as on-site treatment however remediation is undertaken in an alternate location. This method is typically adopted when the remediation site has an insufficient land area to accommodate the remediation technology.

Unlike on-site treatment, off-site treatment requires excavation of contaminated soils, or extraction of contaminated groundwater, and transportation of the media to the treatment site. Reinstatement of on-site excavations is also required following treatment.

*The option for off-site treatment of contaminated media is considered suitable for implementation at the Site due to the relatively small volume of soil that requires remediation and the identified COPC. However, given that ex-situ treatment strategies typically require a longer time frame to achieve the required result, this approach is not considered a feasible option for implementation at the Site.*

### **6.1.3 Excavate and Off-Site Disposal**

Landfill disposal is the simplest of all remediation methods, and involves the excavation of the contaminated materials, and disposal off-site to a NSW EPA approved landfill disposal site with appropriate environmental safeguards. The formed excavation is then backfilled using clean, validated fill materials.

The selection of an appropriate landfill will normally depend largely upon the results of classification of the wastes. It is sometimes necessary for heavily contaminated soils to be pre-treated prior to disposal, to reduce the concentrations or minimise the mobility of the contaminants. Special criteria are sometimes applicable to certain categories of waste. Contaminants covered by Chemical Control Orders have restrictions placed on their handling and disposal.

*This option is considered suitable for implementation at the Site given the type of contamination identified on-site, and the proposed future land use.*

### **6.1.4 On-Site Capping and Containment**

On-site capping and containment involves the installation of a physical barrier around the contaminated areas to prevent potential migration pathways of contaminants.

*This option is not considered suitable for implementation at the Site given the proposed future land use and the need for the implementation of a long-term Environmental Management Plan.*

## 6.2 Preferred Strategy

The preferred remediation strategy is:  
**EXCAVATE, CLASSIFY AND DISPOSE OFF-SITE**

The Site strategy selected must be the most cost-effective solution, which does not bring about unacceptable long-term liabilities, and which does not impose unreasonable constraints on future Site developments or present operations. The strategy must also be capable of achieving the technical, environmental and economic objectives of the overall project.

Excavation and off-site disposal of contaminated material is considered the most suitable remediation strategy as it is time efficient and offers no constraints on future land use. This is the preferred strategy based on a minimal amount of material being disposed off-site. The strategy ensures removal of all contaminated materials and ongoing exposure risks, and can be carried out as part of the proposed redevelopment works.

## 7.0 IMPLEMENTATION OF REMEDIATION STRATEGY

### 7.1 General

The proposed remediation strategy incorporates the following elements:

1. Stakeholder consultation;
2. Implementation of an accepted Site Environmental Management Plan (SEMP) during remediation works;
3. Site establishment and pre-remedial works;
4. Additional investigations;
5. Remediation works; and
6. Validation.

### 7.2 Stakeholder Consultation

On approval of the strategy, the Stakeholders including on-site residents and relevant regulatory bodies will be informed of the intention to conduct remediation work, and the progress at all stages of the remediation works.

### 7.3 Implementation of Site Environmental Management Plan

A Site Environmental Management Plan (SEMP) covering the remedial works has been prepared for the Site. Before work commences it is imperative that all issues relating to potential impacts have been reviewed. The SEMP including Remediation Works Management and Health and Safety Plans is presented in **Section 10.0** of this RAP.

### 7.4 Site Establishment and Pre-Remedial Works

Initial activities at the Site shall involve the establishment of all plant and equipment necessary for the remediation works. Prior to the commencement of any earthmoving activities, it will be necessary to install environmental protection safeguards, as well as Site security measures. These measures are included as part of the SEMP presented in **Section 10.0** of this RAP.

## 7.5 Remediation Works

### 7.5.1 Data Gap Assessment

The south-eastern portion of the Site, shaded green in **Figure 2**, comprises a supplementary area of the Site that has not yet been subject to intrusive investigation to assess the presence, or otherwise, of contamination. As such, data gap investigations are required in order to assess the suitability of the land for future land use consistent with 'Residential A' (NEPC, 2013) from a contamination perspective.

The data gap assessment will be undertaken by a suitably qualified and experienced environmental consultant concurrently with the initial phases of remediation works.

The data gap area covers approximately 3,700 m<sup>2</sup>. Therefore, in accordance with the *Contaminated Sites: Sampling Design Guidelines* (NSW EPA, 1995), a total of 11 test locations will be targeted for assessment.

At each test location, test pits will be excavated to depths sufficient to intercept natural ground, thereby confirming the vertical extent of fill material. In the case that access restrictions preclude the excavation of test pits, boreholes will be drilled using a mechanically operated drill rig that is able to extend to depths sufficient to intercept natural ground.

Soil samples will be collected from the fill material at regular intervals and submitted for laboratory analysis for the following typical suite of COPC: heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn), Total Recoverable Hydrocarbons (TRH), Benzene, Toluene, Ethylbenzene, Xylene (BTEX), Polycyclic Aromatic Hydrocarbons (PAH), Organochlorine / Organophosphorus Pesticides (OC/OP), Polychlorinated Biphenyls (PCBs) and asbestos (only where visible evidence noted).

Additional soil samples will be collected for quality assurance / quality control (QA/QC) purposes in accordance with the strategy presented in **Section 9.2** of this RAP.

Each soil sample will be screened in the field using a photoionisation detector (PID) to assess the presence of volatile organic compounds (VOCs).

The analytical results obtained during the data gap assessment will be assessed against the validation criteria presented in **Section 9.3** of this RAP.

Where required, delineation sampling will be carried out to assess the lateral and vertical extent of contamination to assist in informing the remediation strategy for these areas of the Site.

The results of the data gap assessment will be used to assess whether additional areas of contamination are present on-site that require remediation. In the case that additional areas of contamination are identified, remediation will be carried out as described in **Section 7.5.3** of this RAP.

### 7.5.2 Remediation of AEC 1

AEC ID	LOCATION	CONTAMINANT OF CONCERN	MAXIMUM DEPTH (bgl)	REFERENCE
AEC 1	BH8	TRH	> 0.4m	DLA, 2017

For AEC 1, the following remediation activities will be undertaken:

1. AEC 1 will be delineated by marking an approximately 5 m x 5 m grid centred quadrant around the original borehole location (i.e. BH8);
2. Soil within the gridded AEC will be excavated to a minimum depth of 0.5 m bgl. Given that the vertical extent of the hydrocarbon impact has not yet been delineated, a PID will be used to screen the faces of the excavation to assist in assessing the likely presence of residual contamination. In the event that PID readings and/or visual or olfactory evidence suggests that contamination extends beyond the proposed depth of the remedial excavation, then excavation will continue until the evidence of contamination has been removed. Similarly, in the event that evidence of contamination is identified on the walls of the remedial excavation, then the excavation will be extended laterally until the evidence of contamination has been removed.
3. Excavated soil will be stockpiled within a designated area of the Site for waste classification in accordance with **Section 8.1** of this RAP; and
4. The walls and base of the excavation will be validated by a suitably qualified and experienced environment consultant in accordance with the validation strategy presented in **Section 9.0** of this RAP.

Following successful validation, where required, the excavation will be reinstated with material validated in general accordance with **Section 8.2** of this RAP.

### 7.5.3 Remediation of Additional AECs

For additional AECs identified as part of the data gap assessment (refer to **Section 7.5.1** of this RAP), the following remediation activities should be undertaken:

1. The AEC will be delineated by marking a grid centred on the original test location. The lateral extent of the grid will be based on the lateral extent of the identified contamination. Typically,

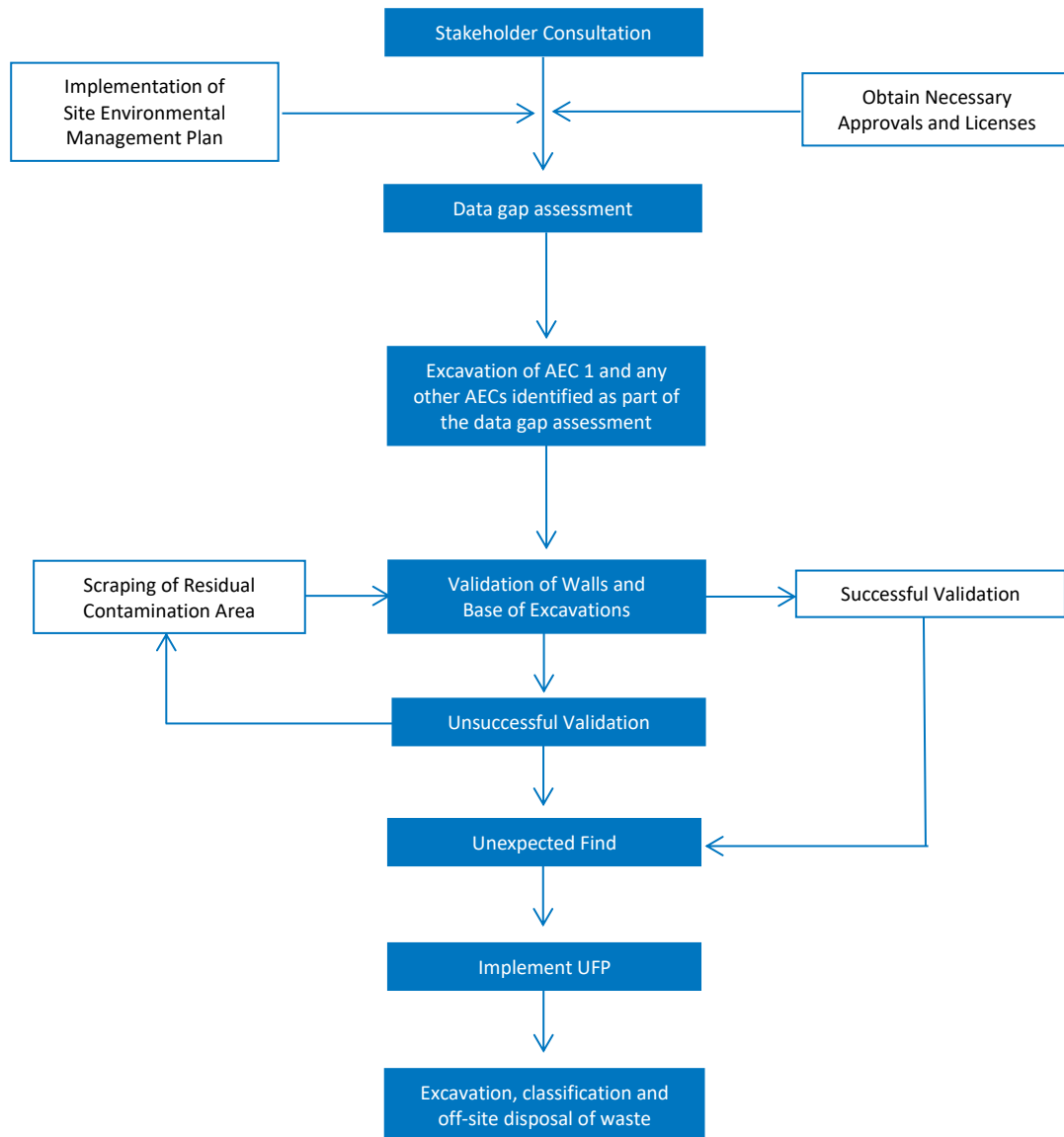


the gridded area will extend at least 2m beyond the known lateral extent of identified contamination. In the case that evidence of contamination is identified on the walls of the excavation (i.e. >2m beyond the known lateral extent of contamination), then the excavation will be extended laterally until the evidence of contamination has been removed or the excavation has been sufficiently extended that it can be delineated by surrounding 'clean' test locations.

2. Soil within the gridded AEC will be excavated to depths of at least 0.2m below the known vertical extent of identified contamination. In the case that visual or olfactory evidence of contamination is noted to extend beyond the proposed depth of the excavation (i.e. > 0.2m below the known vertical extent of contamination), then excavation will continue until the evidence of contamination has been removed.
3. Excavated soil will be stockpiled within a designated area of the Site for waste classification in accordance with **Section 8.1** of this RAP; and
4. The walls and base of the excavation will be validated by a suitably qualified and experienced environment consultant in accordance with the validation strategy presented in **Section 9.0** of this RAP.

Following successful validation, where required, the excavation will be reinstated with material validated in general accordance with **Section 8.2** of this RAP.

A schematic of the **Remediation Process** is shown overleaf:



## 8.0 WASTE MANAGEMENT

All waste disposal activities will be undertaken in accordance with *the Waste Classification Guidelines* (NSW EPA, 2014), the *Waste Avoidance and Resource Recovery Act 2001* (NSW), the *Protection of the Environment Operations Act 1997* (NSW) and other relevant legislation.

### 8.1 Waste Soil Classification

For waste classification purposes, representative soil samples will be collected at a rate of at least one sample per 25 m<sup>3</sup> of excavated material, with a minimum of two samples collected. In the event that soil samples are collected *in-situ* (i.e. fill material has not been excavated prior to sampling for waste classification purposes), a similar sampling density should be adopted, allowing for bulking factors.

The sampling frequency and analytical schedule may need to be adjusted on a “case by case” basis, depending on factors such as:

- The volume of the material;
- The homogeneity of the material; and
- The visual assessment of the material.

Where possible, to assist in efficient classification and off-site disposal (if required), less impacted soils will be segregated from those which have visual or olfactory indicators of contamination, or are suspected to contain asbestos.

Soil samples collated for waste classification purposes will be analysed for COPC including asbestos (presence / absence), heavy metals, TRH, BTEX, PAH, OC/OP and PCBs.

Where existing data is available and representative of the excavated soil, the analytical plan may be amended.

The results of the laboratory analysis will be compared against the *Waste Classification Guidelines* (NSW EPA, 2014).

Based on the results of the primary analysis, it may be required that toxicity characteristics leaching procedure (TCLP) testing be carried out for heavy metals and PAH to further define the appropriate classification for off-site disposal.

All soils that require off-site disposal as part of the remediation works will be disposed to an appropriately NSW EPA licensed landfill facility.

## 8.2 Importation of Soil

In the case that fill is to be imported to the Site, the material must be either:

- Virgin Excavated Natural Material (VENM); or
- Excavated Natural Material (ENM).

In accordance with the *Protection of the Environment Operations Act 1997*, VENM must be 'natural material (such as clay, gravel, sand, soil or rock fines) that:

- has been excavated or quarried from areas that are not contaminated with manufactured chemicals or process residues, as a result of industrial, commercial, mining or agricultural activities; and
- does not contain any sulfidic ores or soils or any other waste.'

The VENM must be accompanied by a validation certificate from the supplier which adequately certifies that the material is VENM, or otherwise be subject to validation sampling prior to importation to the Site.

Where validation of VENM is required, representative soil samples will be collected at a rate of approximately one sample per 50m<sup>3</sup> of VENM, with a minimum of two samples collected for analysis.

Soils will be analysed for the following COPC as a minimum: heavy metals, TRH, BTEX, PAH, OC/OP, PCB and asbestos.

In accordance with the *Protection of the Environment Operations (Waste) Regulation 2014*, ENM is naturally occurring rock and soil (including but not limited to materials such as sandstone, shale, clay and soil) that has:

- a) been excavated from the ground;
- b) contains at least 98% (by weight) natural material; and,
- c) does not meet the definition of VENM in the Act.

ENM does not include:

- a) material located in a contamination hotspot;
- b) material that has been processed; or
- c) material that contains asbestos, acid sulfate soil, potential acid sulfate soils, or sulfidic ores.

Assuming the material meets the above criteria, confirmation of the ENM classification is carried out by the comparison of contaminant concentrations against the thresholds presented in Table 4 of NSW EPA *The excavated natural material order 2014*.

Imported soil will be observed by a suitably qualified and experienced environmental consultant as it is delivered to Site to confirm:

- that it appears consistent with the source; and
- that there is no visual or olfactory evidence of contamination such as staining, anthropogenic materials or odours.

In the case that discrepancies exist, the imported material will be refused entry to the Site and not considered suitable for use until appropriately validated.

The appointed contractor will provide the environmental consultant with copies of dockets pertaining to imported fill soils to confirm the source, type and quantities of materials. These will be included in the validation report.

### **8.3 Stockpile Footprints**

Validation sampling of near-surface soils within the footprint of stockpiles generated as part of the remediation program will be carried out to assess whether contamination of the ground surface has occurred.

Stockpile footprints will be validated through the collection and analysis of approximately one sample per 50 m<sup>2</sup>, or part thereof.

Validation samples will be analysed for the relevant COPC.

### **8.4 Materials Handling**

Transport of waste and disposal of materials must be conducted in accordance with the requirements of the *Protection of the Environment Operations Act 1997*. Licences and approvals required for disposal of the material will be obtained prior to removal of materials from the Site. Removal of waste materials from the Site will only be carried out by contractors holding appropriate licences, consent and/ or approvals to manage, handle or dispose of the waste materials.

The contractor will track the movement of all materials excavated and handled as part of the remediation program. This will include tracking of (but is not limited to):

- Stockpile locations, with corresponding source of materials;
- Off-site disposal records for soils (trucking record, landfill dockets); and
- Estimated volume(s) of soils exported from the Site.

## 9.0 VALIDATION SAMPLING AND ANALYSIS QUALITY PLAN

### 9.1 Validation Procedure

#### 9.1.1 Validation Procedure for AECs

Validation of AEC1 and any other AEC identified as part of the data gap assessment will be performed by way of visual inspection and soil sampling. Visual inspections will directly observe for indications of contamination (e.g. odours, staining, asbestos), the presence of which may warrant a more intensive sampling approach. Validation sampling will be required for excavations created following the removal of the TRH impacted soils. As a minimum, sampling numbers and analysis will conform to the validation plan presented in Table 5.

**Table 5: Validation Plan for AECs**

LOCATIONS	SAMPLING DENSITY	ANALYTICAL STRATEGY
<b>Base</b>	At least one sample per 5 m by 5 m grid	COPC
<b>Walls (North, South, East, West)</b>	At least one sample from each wall.  Where the excavation extend to depths greater than 1 m bgl, there is a change of strata or staining is evident, additional sampling will be collected from each excavation wall to ensure appropriate validation.	

#### 9.1.2 Unexpected Finds

Validation of any unexpected find will be dependent on contaminant type and the individual circumstances of each contamination event. Sample numbers and analysis will be dependent on the area of impact and a review of initial assessment data.

In the case that previously unidentified contamination hotspots are identified following demolition of existing buildings and structures, the impacted material will be excavated as follows:

1. Delineation of excavation area/s by marking a grid around the identified impact;
2. Excavation of identified gridded areas to the required depths (based on the depth of the identified impact);
3. Stockpiling, waste classification and removal of associated soils in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014);
4. Validation of the resultant excavation in general accordance with the sampling density provided in Section 9.1.1 of this RAP with analysis targeting the relevant COPC; and
5. Backfilling of excavation with material assessed as suitable for the future land use if required.



Refer to **Appendix A** - Unexpected Finds Protocol.

## 9.2 Quality Assurance / Quality Control

The quality assurance / quality control (QA/QC) program for the Site will ensure the representativeness and integrity of samples and accuracy and reliability of the analysis results. This includes cleaning of tools before and between sampling, and delivery of samples to the laboratory within holding times and in good condition.

The QC program for the Site will monitor and measure the effectiveness of the QA procedures. This will involve the use:

- intra-laboratory field duplicate samples which will be collected at a rate of 10% of the total number of primary samples collected;
- inter-laboratory field duplicate samples which will be collected at a rate of 5% of the total number of primary samples collected;
- trip spike and trip blank samples which will be collected at a rate of one per day of fieldwork where samples are to be submitted for analysis for volatiles; and
- rinsate samples which will be collected at a rate of one per day of fieldwork where non-dedicated sampling equipment is used.

## 9.3 Validation Acceptance Criteria

The VAC and methods for assessing acceptable concentrations of contaminants at the Site were derived from the following publications:

- *NEPM* (NEPC, 2013); and
- *Health screening levels for petroleum hydrocarbons in soil and groundwater, Part 2: Application document*, CRC CARE Technical Report no. 10 (CRC Care, 2011).

### 9.3.1 Health Screening Levels

Health Screening Levels (HSLs) are used to assess selected petroleum compounds and fractions to assess the risk to human health via inhalation and direct contact with affected soils and groundwater. The HSLs were developed by the Co-operative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) and were derived through the consideration of health effects only, with particular emphasis on the vapour exposure pathway. Other considerations such as ecological risk, aesthetics, the presence of free phase product and explosive / fire risk are not addressed by the HSLs.

In order to determine whether the HSLs tabulated in Schedule B1 of NEPC (2013) are applicable or whether a site-specific determination is required, CRC CARE provide an application checklist which should be completed prior to using the HSLs. The following parameters were considered in completing the checklist:

- **Potential Contaminants** – Petroleum Hydrocarbons;
- **Land use** – HSL A;
- **Potential Pathways** – soil vapour intrusion, direct contact;
- **Media** – soil;
- **Soil Types** – previous investigations identified clay within the subsurface of the Site which has been adopted as the dominant soil profile; and
- **Depth to Contamination** – various, all data will initially be compared with the HSLs for the shallowest depth range, with any failures then further considered.

On the basis of these considerations, the following HSL has been adopted:

- HSL A – Residential A for ‘clay’ (or ‘fine’).

The adopted soil HSLs for vapour intrusion, from Table 1A(3), Schedule B1 of NEPM (NEPC, 2013), are summarised in Table 6.

**Table 6: TRH Soil Criteria for Vapour Intrusion (mg/kg)**

ANALYTES	HSL-A (Clay) 0 to 1.0m	HSL-A (Clay) 1.0 to <2.0m	HSL-A (Clay) 2.0 to <4.0m	Direct Contact HSL-A
<b>Benzene</b>	0.7	1	2	100
<b>Toluene</b>	480	NL	NL	14,000
<b>Ethylbenzene</b>	NL	NL	NL	4,500
<b>Xylenes</b>	110	310	NL	12,000
<b>Naphthalene</b>	5	NL	NL	1,400
<b>F1: C<sub>6</sub>-C<sub>10</sub></b>	50	90	150	4,400
<b>F2: C<sub>10</sub>-C<sub>16</sub></b>	280	NL	NL	3,300
<b>F3: C<sub>16</sub>-C<sub>34</sub></b>	NA	NA	NA	4,500
<b>F4: C<sub>34</sub>-C<sub>40</sub></b>	NA	NA	NA	6,300

**NL** = Not Limiting (i.e. the soil vapour concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario).

**NA** = Not Applicable (i.e. NEPM (NEPC, 2013) does not provide HSLs for the F3 and F4 hydrocarbon fractions).

Vapour Intrusion Criteria sourced from NEPM (NEPC, 2013) *Table 1A(3) – Soil HSLs for vapour intrusion*.

Direct Contact Criteria sourced from Friebel and Nadebaum 2011, Health Screening Levels for petroleum Hydrocarbons in Soil and Groundwater, Part 1: Technical Development Document, *Table A4 – Soil Health Screening Levels for Direct Contact*.

### 9.3.2 Management Limits

The NEPM (NEPC, 2013) states that Management Limits are relevant for operating sites where significant sub-surface leakage of petroleum compounds has occurred, and when decommissioning industrial sites. Considering that significant sub-surface leakage of petroleum compounds was not encountered in previous investigations at the Site, Management Limits are not deemed applicable for the validation of the Site.

### 9.3.3 Health Investigation Levels

The Health Investigation Levels (HILs) are scientifically based, generic assessment criteria designed to be used in the first stage (Tier 1) of an assessment of potential risks to human health from chronic exposure to contaminants. They are intentionally conservative and are based on a reasonable worst case scenario for four generic land use scenarios. Considering the proposed land use, the following HIL has been adopted:

- Residential A – Residential with garden/accessible soil.

The adopted HILs, from Table 1A(1) and Table 7, Schedule B1 of NEPM (NEPC, 2013), are shown in Table 7.

**Table 7: Site Assessment Criteria for Soils (mg/kg)**

ANALYTES		HIL-A
<b>Heavy Metals</b>		
	Arsenic	100
	Cadmium	20
	Chromium	100
	Copper	6,000
	Lead	300
	Mercury	40
	Nickel	400
	Zinc	7,400
<b>PAH</b>		
	Benzo(a)pyrene TEQ	3
	Total PAHs	300

ANALYTES		HIL-A
<b>PCB</b>		
PCB		1
<b>Pesticides</b>		
DDT+DDE+DDD		240
Aldrin and Dieldrin		6
Chlordane		50
Endosulfan		270
Endrin		10
Heptachlor		6
HCB		10
Methoxychlor		300
Mirex		10
Toxaphene		20
<b>Asbestos</b>		
Bonded ACM		0.01% w/w
Friable Asbestos/Asbestos Fines		0.001% w/w
Surface Asbestos (0.1m)		No Visible

TEQ: Toxic Equivalence Quotient, expresses an aggregate measure of toxicity based on a number of contributing PAH compounds.

### 9.3.4 Ecological Investigation Levels

According to NEPM (NEPC, 2013), Schedule B (5a) – *Guideline on Ecological Risk Assessment*, factors that may influence a Risk Management Decision (and therefore determine Ecological Risk Assessment outcomes) are generally based on economic, ecological or societal considerations.

Examples include:

- The size of the site, land value, cost of remediation (economic);
- The type of contaminants present, current and potential site land use, surrounding land use (societal); and,
- The ecological significance (e.g. a rare and endangered species or a species that supports a valued ecological process or a sensitive introduced species of low ecological significance) of the values identified in the Receptor Identification component of Ecological Risk Assessment to be protected.

Ecological Investigation Levels (EILs) have been implemented to environmentally manage the effect of contaminants on terrestrial ecosystems and species sensitivity. The EILs referenced in this report have been developed for the generic land use setting of urban residential areas and public open space. It is important to note that the contamination is assumed to be aged (>2 years), as fresh contamination associated with current industrial / agricultural activity and chemical spills are not likely present on-site. EILs have been derived for: Arsenic (As), Copper (Cu), Chromium (CrIII), DDT, naphthalene, Nickel (Ni), Lead (Pb) and Zinc (Zn).

#### **Ambient Background Concentration (ABC)**

For Ni, CrIII, Zn and Pb (aged contamination), the EILs are the sum of Added Contaminant Limits (ACLs) and ABCs. To establish the ABC of a contaminant, the recommended method is to measure the ABC at an appropriate unpolluted reference site.

For As, DDT and Naphthalene (aged contamination), the EILs are generically obtained (i.e. not dependent on soil type).

#### **Added Contaminant Limit (ACL)**

The ACL is the added contamination (in excess of the ABC). ACLs are applicable to Cr III, Cu, Ni and Zn and are based on soils properties of pH, Cation Exchange Capacity and the clay content.

The EILs to be adopted for comparison purposes would be calculated at the time of investigation using Site-specific data.

### **9.3.5 Ecological Screening Levels**

Ecological screening levels (ESLs) have been developed for selected petroleum hydrocarbon compounds and are applicable for assessing risk to terrestrial ecosystems. ESLs broadly apply to coarse and fine-grained soils and various land uses. They are generally applicable to the top 2 m of soil.

The adopted ESLs, from Table 1B(6), Schedule B1 of NEPM (NEPC, 2013), are summarised in

**Table 8.**

**Table 8: Ecological Screening Levels**

ANALYTES	ESL (Fine)
	Urban Residential and Public Open Space
<b>Benzene</b>	65
<b>Toluene</b>	105
<b>Ethylbenzene</b>	125
<b>Xylenes</b>	45
<b>Benzo(a)Pyrene</b>	0.7
<b>F1: C<sub>6</sub>-C<sub>10</sub></b>	180
<b>F2: C<sub>10</sub>-C<sub>16</sub></b>	120
<b>F3: C<sub>16</sub>-C<sub>34</sub></b>	1,300
<b>F4: C<sub>34</sub>-C<sub>40</sub></b>	5,600

### 9.3.6 Waste Classification Criteria

The characterisation of materials for off-site disposal during the remediation program of the Site will be performed in accordance with:

- *Waste Classification Guidelines* (NSW EPA, 2014);
- *Excavated Natural Material (ENM) Order* (NSW EPA, 2014) and *Excavated Natural Material Exemption* (NSW EPA, 2014);
- *Protection of the Environment Operations Act 1997* and associated regulations; and
- All other relevant resource recovery orders, resource recovery exemptions and approvals issued by the NSW EPA.

A selection of criteria from the aforementioned sources are summarised in Table 9.



**Table 9: Waste Classification Criteria**

ANALYTE	GENERAL SOLID WASTE			RESTRICTED SOLID WASTE			ENM	
	CT1 <sup>a</sup>	TCLP1 <sup>b</sup>	SCC1 <sup>c</sup>	CT2 <sup>d</sup>	TCLP2 <sup>e</sup>	SCC2 <sup>f</sup>	Ave. Conc. <sup>g</sup>	Max. Conc. <sup>h</sup>
	mg/kg	mg/L	mg/kg	mg/kg	mg/L	mg/kg	mg/kg	mg/kg
<b>BTEX</b>								
Benzene	10	0.5	18	40	2	72	--	0.5
Toluene	288	14.4	518	1,152	57.6	2073	--	65
Ethylbenzene	600	30	1080	2,400	120	4320	--	25
Xylenes (total)	1000	50	1800	4,000	200	7200	--	15
<b>TRH</b>								
C <sub>6</sub> – C <sub>10</sub>	NA	NA	650	NA	NA	2600	--	--
>C <sub>10</sub> – C <sub>36</sub>	NA	NA	10000	NA	NA	40000	250	500
<b>PAH</b>								
PAH (total)	NA	NA	200	NA	NA	800	20	40
Benzo(a)pyrene	0.8	0.04	10	3.2	0.16	23	0.5	1
<b>Heavy Metals</b>								
Arsenic	100	5.0	500	400	20	2000	20	40
Cadmium	20	1.0	100	80	4	400	0.5	1
Chromium	100	5	1900	400	20	7600	75	150
Copper	--	--	--	--	--	--	100	200
Lead	100	5	1500	400	20	6000	50	100
Mercury	4	0.2	50	16	0.8	200	0.5	1
Nickel	40	2	1050	160	8	4200	30	60
Zinc	--	--	--	--	--	--	150	300
<b>Other</b>								
pH (pH units)	--	--	--	--	--	--	5 to 9	4.5 to 10
Foreign Materials	--	--	--	--	--	--	0.05%	0.10%
E.C. (dS/m)	--	--	--	--	--	--	1.5	3.0

CT – Contaminant Threshold.

TCLP – Toxicity Characteristics Leaching Procedure.

SCC – Specific Contaminant Concentration

E.C. – Electrical Conductivity

NA – No applicable as these contaminants are only assessed using Specific Contaminant Concentrations.

a – *Waste Classification Guidelines* (NSW EPA, 2014), Table 1: CT1 & CT2 values for classifying waste by chemical assessment without the TCLP test, Column 1: General Solid Waste.

b – *Waste Classification Guidelines* (NSW EPA, 2014), Table 2: TCLP and SCC values for classifying waste by chemical assessment, General Solid Waste Column 1: Leachable concentration.

c – *Waste Classification Guidelines* (NSW EPA, 2014), Table 2: TCLP and SCC values for classifying waste by chemical assessment, General Solid Waste Column 2: Specific Contaminant Concentration.

d – *Waste Classification Guidelines* (NSW EPA, 2014), Table 1: CT1 & CT2 values for classifying waste by chemical assessment without the TCLP test, Column 2: Restricted Solid Waste.

e – *Waste Classification Guidelines* (NSW EPA, 2014), Table 2: TCLP and SCC values for classifying waste by chemical assessment, Restricted Solid Waste Column 1: Leachable concentration.

f – *Waste Classification Guidelines* (NSW EPA, 2014), Table 2: TCLP and SCC values for classifying waste by chemical assessment, Restricted Solid Waste Column 2: Specific Contaminant Concentration.

- 
- g –** *Excavated Natural Material Order* (NSW EPA, 2014), Table 4, Column 2 – Maximum Average Concentration for Characterisation.
- h –** *Excavated Natural Material Order* (NSW EPA, 2014), Table 4, Column 3 – Maximum Average Concentration for Characterisation.

### 9.3.7 Application of Criteria

Validation for chemically tested soils will be determined when concentrations are reported below the criteria, thereby not posing an unacceptable risk to human health or the environment. For chemical analysis, the individual contaminant concentration must not exceed the validation guidelines by more than 250%.

## 9.4 Validation Report

At the completion of the remediation activities, a Validation Report will be prepared by the environmental consultant engaged to validate the remedial works with reference to the *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (NSW OEH, 2011).

The validation report will include:

- Executive summary;
- Scope of work;
- Site identification details;
- Summary of the site history;
- Summary of the site condition and surrounding environment;
- Summary of the site geology and hydrogeology;
- Remediation activities undertaken (including extent and observations of excavation/s, waste documentation materials tracking and imported fill documentation);
- Validation sampling and analysis plan (including methodology);
- QA/QC protocols for field works and laboratory analysis;
- Basis for validation criteria and validation sampling records; and
- Conclusions and recommendations.

## 10.0 SITE ENVIRONMENTAL MANAGEMENT PLAN

### 10.1 General

The Principal Contractor will be responsible for control of the Site during remedial works.

The Principal Contractor will be responsible for preparing Remediation Work Method Statements (RWMS) that address environmental, health and safety hazards, and risks during the remediation. The RWMS shall address, but may not be limited to, the issues and controls presented in the following subsections.

### 10.2 Health and Safety

The Principal Contractor will prepare a project-specific occupational health and safety plan for the remediation works. This plan shall identify the potential risks associated with the works and detail the health and safety measures and procedures that are to be adopted to protect both on-site workers and the general public.

#### 10.2.1 Hours of Operation

Working hours for any on-site remedial works would be set in consultation with Ryde City Council, but it is envisaged the likely hours would be as follows:

<b>Mondays to Fridays</b>	7:00 am to 5:00 pm
<b>Saturdays</b>	7:00 am to 3:00 pm
<b>Sundays and Public Holidays</b>	No Work Permitted

#### 10.2.2 Emergency and Out of Hours Contact Numbers

<b>DLA</b>	+61 2 9476 1765	<b>NSW EPA</b>	131 555
<b>Simon Spyrdz DLA General Manager</b>	0413 628 438	<b>SafeWork NSW</b>	13 10 50
<b>Contractor</b>	To be confirmed	<b>Client representative</b>	To be confirmed

The RWMS will outline plans to respond to incidents associated with the works (e.g. fires, spills or other uncontrolled releases).

As part of site induction procedures, all employees, sub-contractors and visitors to the Site will be made aware of the emergency protocols in place.

### **10.2.3 Site Access**

Access to the Site will be restricted to authorised staff and contractors who have been inducted and appropriately trained for the works being undertaken. Fencing has been installed and will be maintained around the perimeter of the Site and the remediation area will also be secured from entry outside of remediation works occurring.

Signage, including Site contact details, will be erected near the Site entry gate. The signage will remain displayed at the entrance throughout the duration of the remediation works.

### **10.2.4 Personnel Protective Equipment**

All workers will be provided with and use the appropriate personal protective equipment (PPE).

When working in, or visiting, designated 'dirty' areas of the Site, the minimum level of PPE required will include disposable overalls, boots (steel toe cap and sole), gloves and eye protection.

In the event that workers will be exposed to asbestos-impacted soils or asbestos containing materials, a P2 respirator will be used.

All PPE shall conform to approved standards.

First aid and safety equipment including fire extinguishers will be provided within restricted zones for use in an emergency. In addition, hard hats and reflective high visibility clothing shall be provided and worn on-site at all times.

### **10.2.5 Training**

All Site personnel shall be informed and fully trained through an induction procedure in relation to the potential Site hazards.

### **10.2.6 Safety Officer / First Aid Personnel**

Designated Safety and First Aid Officer(s) shall be on-site at all times, and shall be trained for working on sites of a similar nature and be fully conversant with relevant procedures.

### **10.2.7 Vapours**

Potential hazards associated with volatile organic vapours shall be monitored using alarmed vapour detection devices in operational areas to monitor health and explosive/fire risks. The health and

safety plan will establish trigger levels and an associated action plan relating to gas risks during the works.

### **10.3 Erosion and Sediment Control**

Erosion and sediment control measures to be implemented during the remediation program will be in accordance with *Managing Urban Stormwater, Soils and Construction, 4th edition* (Landcom (2004)).

A Site-specific erosion and sediment control plan will be developed by the Principal Contractor, or their authorised representative. The plan will show the location of sediment control devices as required based on remediation works to be undertaken.

#### **10.3.1 Excavation Management**

To minimise erosion and sedimentation during the remediation works, where practicable, the area of exposed surfaces at any one time will be minimised through controlled sequencing of works and progressive excavation and restoration. Prior to the commencement of excavation works, sand bags or similar water diversion measures will be used to divert surface runoff away from work zones and proposed excavation areas towards any existing drains.

Activities that involve soil disturbance will be avoided during heavy rain periods.

Excavation areas will be isolated through the use of temporary barricades and fencing.

#### **10.3.2 Surface Water Management**

In order to minimise the need for treatment/disposal of potentially contaminated surface water from excavations, controls shall be implemented to divert surface water away from the remediation area.

#### **10.3.3 Stockpile Management**

Stockpiles will be designated and handled to ensure that excavated material is properly tracked and classified to avoid mixing of different classes of waste from occurring.

Where possible, to assist in efficient classification and off-site disposal, less impacted soils will be segregated from those which have visual or olfactory indicators of contamination, or suspected to contain asbestos. Stockpiles will be bunded with sediment control barriers to mitigate runoff from the stockpile areas to surrounding areas.

Stockpiles will not be placed within or immediately adjacent to drainage lines, easements, footpaths, roadways or existing stormwater drains.

Stockpiles will be positioned and formed to minimise potential for stockpile erosion where possible.

#### 10.3.4 Haulage of Soils

Soil must not be tracked off the Site as a result of vehicle, plant and equipment movements. To limit the potential for tracking of soil or sediment off-site via vehicle, plant or equipment movement, the following controls should be implemented:

- Vehicles, plant and equipment on the Site will be kept to a practical minimum;
- Vehicle, plant and equipment entry to and exit from the Site will be kept to a practical minimum; and
- Plant and equipment will be washed down before it leaves the Site.

Any vehicles carrying soil materials for off-site treatment or disposal will be covered in accordance with good industry practice, prior to leaving the Site.

#### 10.3.5 Inspection and Maintenance

Erosion and sediment control measures will be inspected at the start of each day during remediation works and also during and immediately after periods of heavy rainfall to ensure they are in good condition.

Erosion and sediment control will be maintained, as applicable, by ensuring silt fences are upright and securely fixed, and that any sediment or residue behind the fence or barrier is removed and disposed appropriately to maintain retention capacity of the structure.

Where control measures are found to be damaged, they will be either repaired or replaced promptly.

### 10.4 Noise Controls

Noise producing machinery and equipment will only be operated during working hours as approved by local Council and/or NSW EPA. Australian Standard *AS2436-1981 Guide to noise control on construction, maintenance and demolition sites*, outlines guidelines for the minimisation of noise on construction and demolition sites which are to be followed at all times.

No 'offensive noise' as defined under the *Protection of the Environment Operations Act 1997* should be created during remediation works/activities.

Mechanical plant, equipment and the like used during remediation works/activities will use practical and reasonable noise attenuating devices and measures to minimise noise being transmitted from the Site. All equipment and machinery must be properly maintained and operated in an efficient manner to minimise the emission of noise. Plant and equipment shall be switched off or throttled to a minimum when not in use.

### **10.5 Odour and Dust Control**

Controls to minimise dust and odour emissions from the Site may include:

- Staging excavation works to minimise the disturbance of any contaminated soil surfaces as well as minimising the size of the excavation face open at any one time;
- Use of odour neutralising or suppressant sprays. If strong odour is noticed on or off the Site, work will cease and odour sources will be covered (and treated, if necessary) until the odour dissipates; and
- Covering contaminated excavation faces and/or stockpiles with synthetic barriers or wetting down during periods of high wind.

### **10.6 Communication and Complaints**

Where complaints are made directly to the Principal Contractor, on Site workers or sub-contractors, this will be documented on an Environmental Complaint Form and will be recorded on a complaint register. After initial recording, the Principal Contractor will forward all complaints to Ryde City Council. Where complaints are received directly by Council, this would be communicated back to the Principal Contractor via the usual communication channels (e.g. email, phone, regular site meetings etc.)

Separate incident reporting will also be completed for complaints relating to environmental issues, which may include pollution arising from the works. Monitoring and/or corrective actions will be taken as soon possible depending on the nature of the complaint and followed up on the incident report. The Principal Contractor will report to Council as soon as practical following an incident.



## 11.0 ROLES AND RESPONSIBILITIES

### 11.1 Principal Contractor

The Principal Contractor will retain overall responsibility for ensuring that the RAP is appropriately implemented. The actual implementation of the RAP will be carried out by the Remediation Contractor on behalf of the Principal Contractor. The Principal Contractor will also be responsible for acquiring or organising the acquisition of all necessary approvals and licenses for the proposed remediation works proposed.

The Principal Contractor will provide relevant information regarding Site environmental management to contractors and subcontractors working at the Site, and will ensure that they are fulfilling the responsibilities for the work.

### 11.2 Remediation Contractor

The Remediation Contractor is responsible for day-to-day environmental performance of the remediation works, including the implementation and maintenance of acceptable environmental controls and plans during all remediation works. The Remediation Contractor will nominate a Site Manager who will be responsible for initial response to any unexpected finds encountered during remediation works.

The Remediation Contractor will maintain records and documents produced as a result of this RAP, and will implement an inspection and maintenance program.

The Remediation Contractor may also take on the role of Principal Contractor.

### 11.3 Sub-Contractors

Subcontractors will be advised of required work procedures through induction, training, and meetings provided by the Principal Contractor. Maintenance of subcontractor equipment will be the responsibility of the subcontractors. The subcontractor is responsible for ensuring that all works executed by the subcontractor complies with relevant SafeWork NSW requirements, as necessary.

### 11.4 Environmental Consultant

The Environmental Consultant will be primarily responsible for providing guidance on the implementation of this RAP to achieve Site validation. In achieving this end, the Consultant will be responsible for:

- Supervising, overseeing and directing remediation works;
- Undertake all validation assessment work in accordance with the RAP;
- Provide advice and recommendations based on inspections and validation results;
- Undertaking assessments for the characterisation, classification and disposal of wastes;
- Providing advice on issues under the *Protection of the Environment Operations Act 1997* (NSW); and
- Undertaking all necessary monitoring activities and preparation of management plans, if required.

## 12.0 APPROVALS AND LICENSES

### Remediation Works Consent

State Environmental Planning Policy (SEPP) No.55 – *Remediation of Land*, relates to the decision-making process in undertaking remediation activities and making planning decisions in regard to contaminated and potentially contaminated land. It is understood that the proposed remediation works are considered to be classified as ‘Category 2’ Remediation Works (i.e., not requiring consent) by reference to the following:

- The work is not designated development under Schedule 3 of the *Environmental Planning and Assessment Act 1979* or under a planning instrument;
- The work proposed is not on land identified as critical habitat under the *Threatened Species Conservation Act 1995*;
- Consideration of Section 5 of the *Environmental Planning and Assessment Act 1979* indicates that the remediation work is not likely to have a significant effect on threatened species, populations or ecological communities;
- The work is not proposed in a zone identified in a planning instrument as being of environmental significance; and
- The work does not require consent under another SEPP.

The notification requirements of SEPP 55 require Council to be notified 30 days before Category 2 remediation works commence.

### Development Approval Conditions

The *Environmental Planning and Assessment Act 1979* provides a framework for the development of land within NSW and indicates the level of assessment required and the consent authority responsible for assessing the development. The Act also specifies planning controls according to the nature and scale of development. All remediation and validation works are required to comply with SEPP 55 and relevant conditions of the Development Application.

## 13.0 CONCLUSION

The Site can be made suitable for the intended land-use subject to appropriate remediation in accordance with this RAP and SEPP 55.

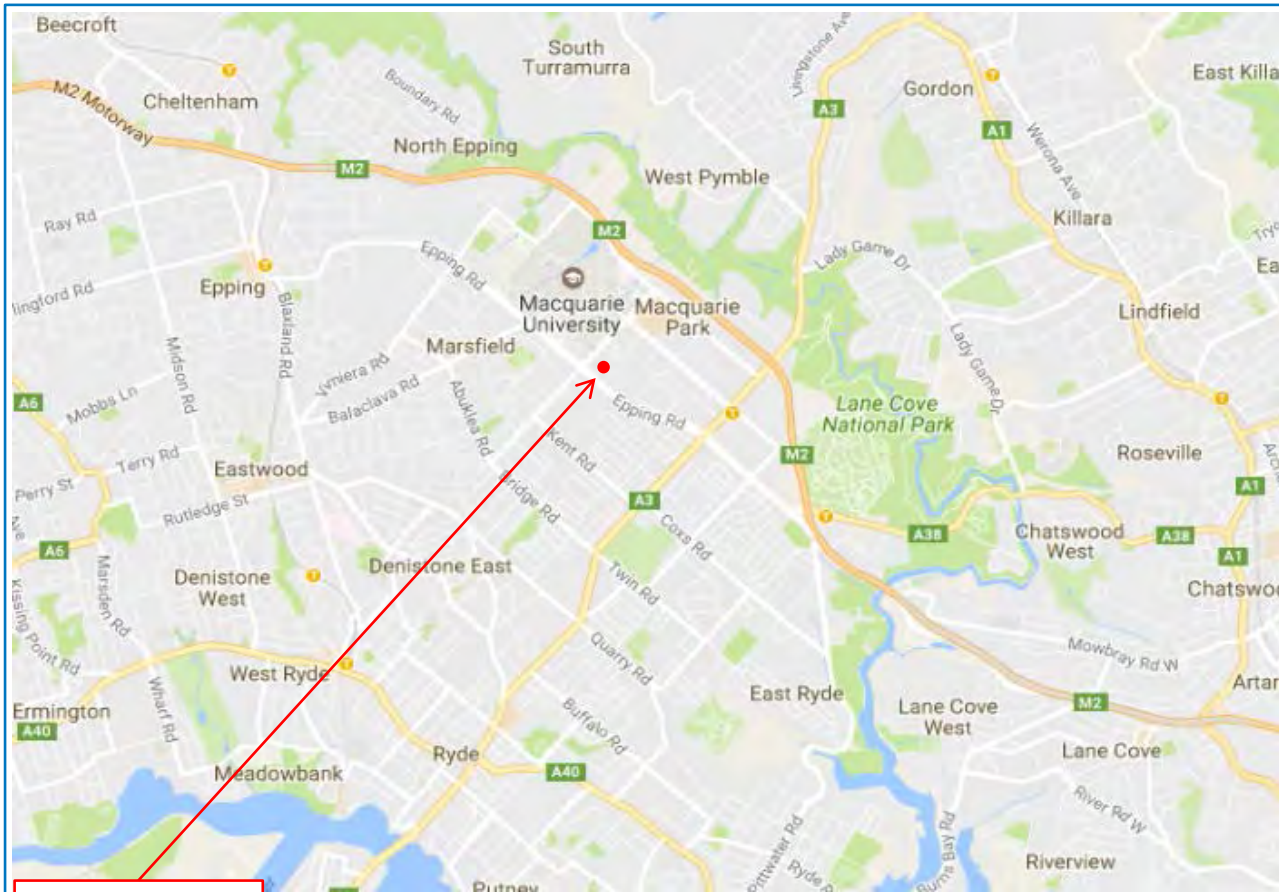
In conclusion, this RAP:

- Has been developed in a manner consistent with current industry practice;
- Has selected a preferred remediation strategy based on the site-specific issues and currently available technologies;
- Has outlined the means of validation for the completed works; and
- Has outlined options available when access to all of the Site is available.

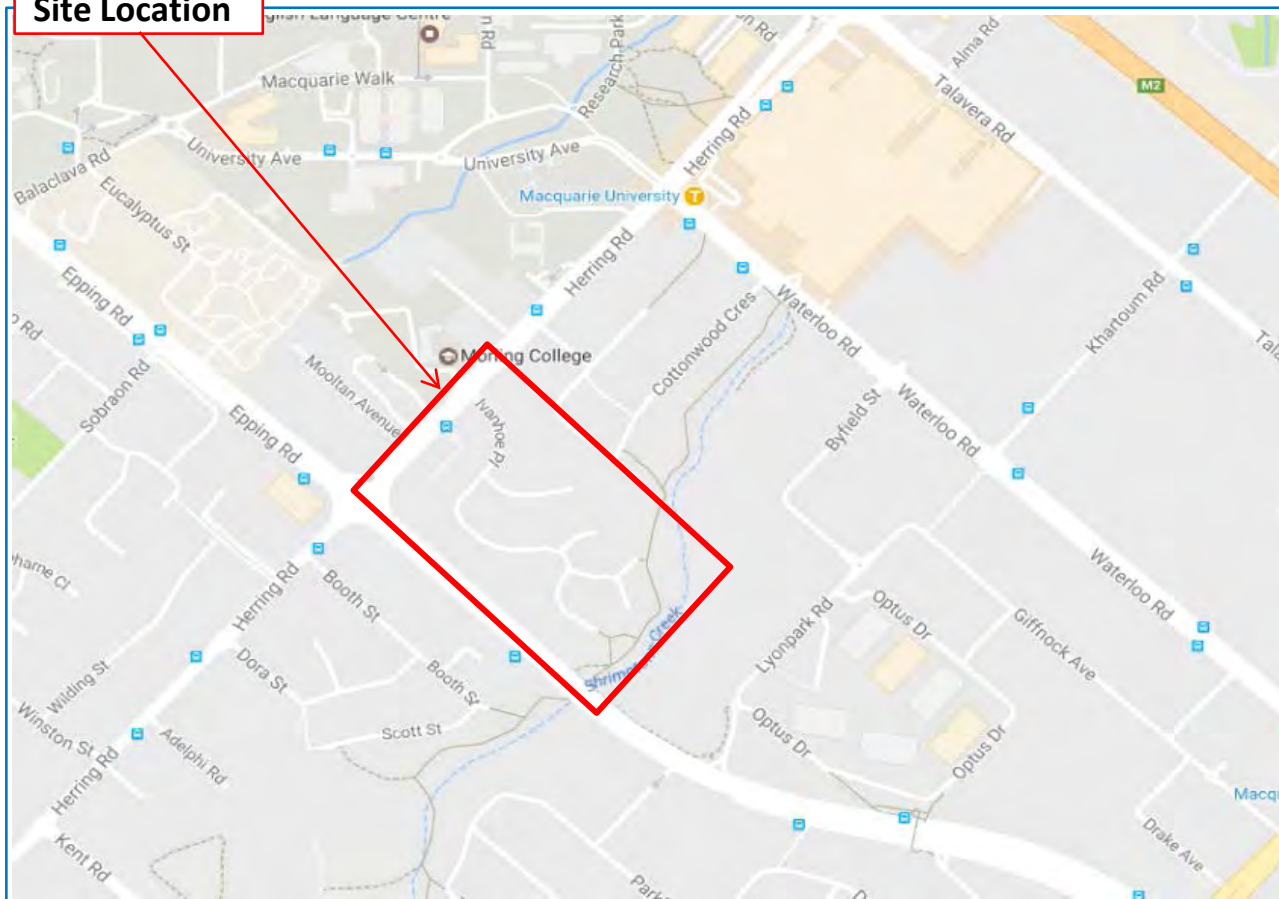
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**FIGURE 1 – SITE LOCATION**

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**Site Location**



Unit 3, 38 Leighton Place  
Hornsby NSW 2077

**DESIGNED:**  
DLA  
**COMPILED:**  
SK  
**PROJ. No.**  
DL3953

**FIGURE TITLE:**  
**PROJECT TITLE:**  
**CLIENT:**

## SITE LOCATION

Ivanhoe Estate, Macquarie Park NSW

Frasers Property Australia

**DATE:**  
02/06/2017

**FIGURE:**  
1

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**FIGURE 2 – SITE LAYOUT AND REMEDIATION AREA**

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**Legend**

- Site Boundary
- TRH Exceedance Location
- Remediation Area
- No investigations have been conducted in this area



Approximate Scale



Figure Title

Site Layout and Remediation Area

Project Title

Ivanhoe Estate, Macquarie Park

Client

Fraser's Property Australia

Project No.

DL 3953

Date

7/02/2018

Scale

As Shown

Figure No.

1

Revision

Version 1.1



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## APPENDIX A – UNEXPECTED FINDS PROTOCOL

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## UNEXPECTED FINDS PROTOCOL (UFP) – CORNER HERRING ROAD AND EPPING ROAD, MACQUARIE PARK, NSW, 2113.

DLA Environmental Services (DLA) have produced this Unexpected Finds Protocol (UFP) for the Site identified as:

**Ivanhoe Estate**

Lots 6 - 17 and 18 – 20 DP 861433, Lot 1 DP 85957, Lot 100 DP 1223787 Part Lot 5 DP 740753  
(the Site).

This UFP has been developed following the detection of a hydrocarbon hotspot during investigation works on Site.

Due to the history of the Site (both past and present), there is potential for residual asbestos materials and chemicals to be present in soils. These soils may require additional assessment or management. It is imperative that the potential for such material to impact Site workers and the remainder of the Site is minimised during remedial and construction works.

The Site has been historically been utilised for market gardens/agricultural activities, storage and application of herbicides/pesticides and heavy metals, uncontrolled filling, electrical transformers, with the potential of hazardous building materials from existing and former site structures. Although no evidence of contamination can be inferred following the completion of hydrocarbon hotspot removal works, it is thought prudent to implement a UFP to cover all possible potential contamination scenarios. Potential contamination on the Site which may exist outside the scope of the past environmental investigations will be managed through the following UFP.

## 1.0 TYPICAL FEATURES OF 'UNEXPECTED FINDS'

The main features to look for are:

- Material containing anthropogenic artefacts such as rubble, plastics, metal etc.;
- Material with an obvious unnatural odour, i.e. fuel, solvent, burnt odour;
- Material that is noticeably stained in colour;
- Asbestos or suspected asbestos containing material;
- Material with fibres visible;
- Any material that has evidently been dumped at the Site.

## 2.0 IMPLEMENTATION OF THE PROTOCOL

### 2.1 General

Prior to the commencement of any excavation or construction works onsite, an occupational health and safety induction should be attended by all Site staff. The aim and importance of the UFP and how it is to be implemented should be discussed at this time. Responsibility for its implementation will be assigned to the Principal Contractor.

Monitoring of environmental issues will be undertaken on a daily basis. If an unexpected find is revealed during Site works, the following protocol is to be followed.

### 2.2 Implementation Process

1. Cease disturbance of the affected portion of the site and evacuate the immediate area.
2. Contact the Principal Contractor and the Contractors Environmental Representative (CER) and advise the Developer (Frasers Property) immediately.
3. Principal Contractor to conduct an assessment of the location and extent of the unexpected find.
4. High risk areas should be isolated and secured against unintended access.
5. Temporary encapsulation (sealing) of the high risk area to ensure no airborne spread of contamination occurs may be appropriate. This may involve clean soil, plastic sheeting, etc.
6. Dust should be prevented by wetting the soil and drainage controls should be arranged where there is a potential for runoff to occur (runoff should be minimised).
7. Warning signs should be placed in the vicinity.
8. If the Principal Contractor considers that the material warrants further investigation, the area is to be barricaded to provide an exclusion zone.
9. If necessary, environmental controls should be established to minimise the potential for migration of contaminants from the impacted area.

10. Principal Contractor to complete UFP form (refer to **Section 3.0**) and issue to all relevant stakeholders.
11. The CER will undertake further visual assessment and sample collection and analysis. If necessary, samples will be sent to a NATA registered laboratory.
12. Evaluation of analytical data with respect to specific health screening levels will be undertaken. Determination will be made if soils are suitable for the proposed land use, need to be remediated or disposed of offsite to a suitably licensed facility. If soils are suitable to remain on-site and/or the area is found to be clean, a work instruction will be provided to this effect. **A waste classification letter must be provided prior to any offsite disposal.**
13. If the material is subsequently found to contain asbestos, an appropriately licensed contractor will be employed to remove it.
14. Affected areas will be reopened for earthworks following a clearance of the location and issuance of a report by the CER

### 2.3 Notes

1. Any suspected asbestos containing should be left in place and not disturbed. The CER will organise appropriate environmental professionals for further investigation purposes.
2. It is essential that material of differing compositions not be mixed.
3. All sampling for validation, waste classification or characterisation purposes will be carried out in accordance with the following documents:
  - *Contaminated Sites: Sampling Design Guidelines* (NSW EPA, 1995);
  - *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No.1)* (NEPC, 2013);
  - *Contaminated Sites: Guidelines for Assessing Service Station Sites* (NSW EPA, 1994);
  - *Waste Classification Guidelines* (NSW EPA, 2014).
4. Any unexpected finds encountered should be listed on a UFP register, which should include the action taken and the status of the unexpected find. A suitable register is included in **Section 4.0**.

5. Once an unexpected find has been identified and a UFP form filled in the Principal Contractor and CER should liaise with the client as to the appropriate means of managing the situation. This should include discussions around the handling, treatment and disposal of material, OH&S considerations and how the affected area will be validated and reopened for works.
6. Prior to closing out an unexpected find it will be important to ensure the appropriate documentation is obtained, such as: photographs, the UFP form, waste classification letter(s) and a validation report or letter.
7. A UFP form should be completed on each day of the remedial works as part of the daily site records. This will ensure that the process is being undertaken even if no unexpected finds are encountered. The form should include the name, company and the position of the person undertaking the field observations.



### 3.0 UNEXPECTED FINDS PROTOCOL FORM

*To be completed by the Site Controller/Environmental Representative*

**SITE:** \_\_\_\_\_

**PERSONNEL ON-SITE:** \_\_\_\_\_

**DATE:** \_\_\_\_\_

**DAILY SUMMARY:**

1. Suspect material encountered during daily activities: YES ☐ NO ☐  
(if YES, complete 2 to 5)

2. CER contacted: YES ☐ NO ☐

3. UFP Reference Number \_\_\_\_\_  
(label occurrences sequentially 1, 2, 3, etc.).

**DESCRIPTION OF MATERIAL ENCOUNTERED:**

4. Asbestos or suspected ACM present: YES ☐ NO ☐

5. Brief written description of material:

6. Material isolated: YES ☐ NO ☐

7. Location of contaminated material (incl. field sketch/map if required):

8. Photographs taken: YES ☐ NO ☐

**NAME:** \_\_\_\_\_

**SIGNATURE:** \_\_\_\_\_

## 4.0 UNEXPECTED FINDS REGISTER

UNEXPECTED FINDS REGISTER						
UFP No.	Date Found	Suspect Material	Description	Recorded on UFP Form	Action Taken	Status
				YES <input type="checkbox"/> NO <input type="checkbox"/>		
				YES <input type="checkbox"/> NO <input type="checkbox"/>		
				YES <input type="checkbox"/> NO <input type="checkbox"/>		
				YES <input type="checkbox"/> NO <input type="checkbox"/>		
				YES <input type="checkbox"/> NO <input type="checkbox"/>		
				YES <input type="checkbox"/> NO <input type="checkbox"/>		