Site Audit Report
0503-1901

771 Cudgen Road
Cudgen NSW

4 February 2019

55264/117086 (Rev 0)

JBS&G Australia Pty Ltd

www.jbsg.com.au

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. **0503-1901**

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 **Andrew Lau**

Company **JBS&G**

Address **Level 1, 50 Margaret Street**

Sydney NSW Postcode **2000**

Phone **02 8245 0300**

Email **alau@jbsg.com.au**

Site details

Address **771 Cudgen Road**

Cudgen NSW Postcode **2487**

Property description

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

Lot 11 in DP 1246853

Local government area **Tweed Shire Council**

Area of site (include units, e.g. hectares) **19.38 ha (approx.)**

Current zoning **RU1 Primary Production, R1 General Residential, 2C Urban Expansion, Agricultural Protection Zone and Environmental Protection (Habitat) Zone**

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 **Sue Folliott**

Company **Health Infrastructure c/o TSA Management**

Address **Level 15, 241 Adelaide Street**

Brisbane QLD Postcode **4000**

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Email **sfolliott@tsamanagement.com.au**

Contact details for contact person (if different from above)

Name As above

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)

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

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

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

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: Hospital

Information sources for site audit

Consultancies which conducted the site investigations and/or remediation:

OCTIEF

Cavvanba

Titles of reports reviewed:

- Soil Sampling Analysis and Quality Plan, 771 Cudgen Road, Cudgen, NSW, Version 2.0, OCTIEF Pty Ltd, 10 August 2018 (OCTIEF 2018a).
- Preliminary and Detailed Site Investigation – 771 Cudgen Road, Cudgen, NSW 2487, OCTIEF Pty Ltd, 17 October 2018 (OCTIEF 2018b).

- Remediation Action Plan, Tweed Valley Hospital site, 771, Cudgen Road, Cudgen NSW, OCTIEF Pty Ltd, 1 February 2019 (OCTIEF 2019).
- Hazardous Material Register, 771 Cudgen Creek Road, Cudgen NSW, Cavvanba Pty Ltd, 19 November 2018 (Cavvanba 2018a).
- Asbestos Clearance Certificate 18084-CC04, 771 Cudgen Road, Cudgen NSW, Cavvanba Consulting Pty Ltd, December 2018 (Cavvanba 2018b).
- Soil Investigation Report – Residential House, 771 Cudgen Road, Cudgen NSW, Cavvanba Consulting Pty Ltd, 24 January 2019 (Cavvanba 2019a).
- Remedial Action Plan Addendum – Residential House, 771 Cudgen Road, Cudgen NSW, Cavvanba Consulting Pty Ltd, 24 January 2019 (Cavvanba 2019b).
- Soil Investigation Report – Farm Shed, 771 Cudgen Road, Cudgen NSW, Cavvanba Consulting Pty Ltd, 24 January 2019 (Cavvanba 2019c).
- Remedial Action Plan Addendum – Farm Shed, 771 Cudgen Road, Cudgen NSW, Cavvanba Consulting Pty Ltd, 24 January 2019 (Cavvanba 2019d).

The following document was also considered during the site audit:

- Preliminary Site Investigation Contaminated Land, Due Diligence Summary Report – Shortlisted Sites, Tweed Valley Hospital Project, OCTIEF Pty Ltd, 28 June 2018 (OCTIEF 2018c).
- Additional Geotechnical Investigation, Proposed Tweed Valley Hospital, Lot 102 on DP870722, Cudgen Road, Kingscliff, Morrison Geotechnic, December 2018 (Morrison Geotechnic 2018).
- Cavvanba email correspondence dated 29 January 2019 (Appendix B), relating to an unexpected find comprising a concrete pit, concrete ramp, concrete drip pad and infilled pit and wastes including brake pads, spark plugs, a blue powder, red/purple sand, oil staining, and mechanical parts (Cavvanba 2019e).

Site audit report details

Title **Site Audit Report 0503-1901, 771 Cudgen Road, Cudgen NSW**

Report no. **55264/117086 (Rev 0)** Date **4 February 2019**

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[1], 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.

[1] 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:

_____

_____

_____

_____

_____

_____

Section A2

I certify that, in my opinion:

Subject to compliance with the **attached** environmental management plan[2] (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[3]

☐ requires maintenance of **passive** control systems only[3].

[2] Refer to Part IV for an explanation of an environmental management plan.
[3] Refer to Part IV for definitions of active and passive control systems.

~~Purpose of the EMP:~~

~~Description of the nature of the residual contamination:~~

~~Summary of the actions required by the EMP:~~

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

~~How there will be appropriate public notification:~~

~~Overall comments:~~

Section B

~~Purpose of the plan[4] which is the subject of this audit:~~

_____

_____

_____

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~~

[4] For simplicity, this statement uses the term 'plan' to refer to both plans and reports.

- ☐ ~~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):

  Hospital

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

*Strike out as appropriate

Plan title Remediation Action Plan Tweed Valley Hospital Site, 771 Cudgen Road, Cudgen NSW

Plan author OCTIEF Pty Ltd

Plan date 1 February 2019 No. of pages **62**

And the following Addenda to the above RAP:

- Remedial Action Plan Addendum – Residential House, 771 Cudgen Road, Cudgen NSW, Cavvanba Consulting Pty Ltd, 24 January 2019 (Cavvanba 2019b).
- Remedial Action Plan Addendum – Farm Shed, 771 Cudgen Road, Cudgen NSW, Cavvanba Consulting Pty Ltd, 24 January 2019 (Cavvanba 2019d).

SUBJECT to compliance with the following condition(s): Nil

Overall comments:

- The site investigations and proposed remediation and validation works are considered to have met the requirements of the Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme (3rd Edition) (EPA 2017).
- The site investigation activities identified lead and asbestos in soil which require remediation under the proposed land use as a hospital.
- An assessment of groundwater conditions was undertaken by consultant (OCTIEF 2018b). However, due to a number of data quality issues identified by the auditor, the groundwater data are considered to be indicative only and not suitable for comparison against the nominated criteria. In consideration of risk-based factors outlined in NEPC 2013, the auditor is satisfied that there is no evidence of potential migration of contaminants from the site which is likely to result in any unacceptable risks to surrounding human or ecological receptors.
- Should contamination arising from a potential cattle dip be identified during the proposed data gap investigation, a RAP addendum must be prepared and be provided to the

auditor for review and endorsement to document the processes required to address soil/groundwater contamination and to achieve the established site remediation goals.

- The RAP (OCTIEF 2019) and subsequent RAP addenda (Cavvanba 2019b and Cavvanba 2019d) prepared for the site addressed the identified contamination issues; with the remediation approach documented in the RAP and RAP addenda checked by the auditor and found to be: technically feasible; environmentally justifiable given the nature and extent of the identified contamination; and consistent with relevant laws, policies and guidelines.
- The auditor is satisfied that the requirements of SEPP 55 and DUAP 1998 have been adequately addressed in the site investigation reports, RAP and subsequent RAP addenda.
- The auditor notes that the remediation and validation procedures outlined in the RAP and RAP addenda are considered appropriate to make the site suitable for the proposed uses, subject to the following requirements:
    - A Validation Sampling Analysis and Quality Plan, Work Health and Safety Plan (WHSP), Asbestos Management Plan (AMP) and Emergency Response Procedures for the site must be reviewed and accepted by site auditor prior to commencement of remediation works;
    - The validation report must be reviewed and accepted by a site auditor following successful completion of site remediation/validation and prior to occupation of the site; and
    - A site audit statement (SAS) supported by a site audit report (SAR) confirming site suitability for the proposed use must be issued by the site auditor following successful completion of site remediation/validation and prior to occupation of the site.

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. 0503

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 4 February 2019

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 or as specified by the EPA

  AND

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

Site Audit Report
0503-1901

771 Cudgen Road
Cudgen NSW

4 February 2019

55264/117086 (Rev 0)
JBS&G Australia Pty Ltd

Table of Contents

Abbreviations vii

1. Introduction 1
   - 1.1 Introduction and Background 1
   - 1.2 Objectives of the Site Audit 1
   - 1.3 Type of Audit 1
   - 1.4 Documents Reviewed 2
   - 1.5 Site Inspections 2
   - 1.6 Chronology of Site Assessment Works 2

2. Site Description 4
   - 2.1 Site Identification 4
   - 2.2 Site Condition 4
   - 2.3 Topography 5
   - 2.4 Soils and Geology 5
   - 2.5 Acid Sulphate Soils 5
   - 2.6 Hydrology 6
   - 2.7 Hydrogeology 6
   - 2.8 Surrounding Environment 6
   - 2.9 Climate 7
   - 2.10 Audit Findings 7

3. Site History 8
   - 3.1 Site History Information Sources 8
   - 3.2 Aerial Photographs 8
   - 3.3 Tweed Shire Council Records 9
   - 3.4 Current and Historical Title Search 9
   - 3.5 NSW State Library Search 9
   - 3.6 NSW EPA Records 9
   - 3.7 Personnel Interviews 9
   - 3.8 Previous Environmental Investigations 9
     - 3.8.1 Desktop Reports 9
     - 3.8.2 Due Diligence Summary Report (OCTIEF 2018c) 10
     - 3.8.3 Hazardous Material Assessment (Cavvanba 2018a) 10
   - 3.9 Audit Opinions 10

4. Conceptual Site Model 12
   - 4.1 Sources of Contamination 12
   - 4.2 Potentially Affected Media 13
   - 4.3 Potential Human and Ecological Receptors 13

4.4 Potential Exposure Pathways 13
4.5 Potentially Complete Exposure Pathways 13
4.6 Audit Findings 14
5. Sampling Analytical and Quality Program 15
5.1 Audit Findings 25
6. Assessment Criteria 26
6.1 Soil Criteria 26
6.2 Groundwater and Surface Water Criteria 26
6.3 Sediment Criteria 27
6.4 Audit Findings 27
7. Site Investigation Results 29
7.1 Field Observations 29
7.2 Soil Analytical Results 29
7.2.1 PSI/DSI (OCTIEF 2018b) 29
7.2.2 Residential Building Soil Investigation (Cavvanba 2019a) 31
7.3 Farm Shed Soil Investigation (Cavvanba 2019c) 31
7.4 Groundwater Analytical Results 32
7.5 Surface Water Analytical Results 32
7.6 Sediment Analytical Results 33
7.7 Farm Dump Area Assessment 34
7.8 Consultant's Interpretations and Conclusions 34
7.9 Audit Findings 35
8. Remediation and Validation Requirements 38
8.1 Remediation Objective 38
8.2 Site Contamination Status 38
8.3 Potential Data Gaps 38
8.4 Remediation Options 38
8.5 Preferred Remediation Approach 39
8.6 Remediation Activities 39
8.6.1 Work Plans, Approvals and Licenses 39
8.6.2 Site Establishment 39
8.6.3 Vegetation Clearance 40
8.6.4 Excavation of Asbestos Impacted Soil Surrounding the Farm Shed 40
8.6.5 Excavation of Lead Impacted Soils Surrounding the Residence 40
8.6.6 Data Gap Investigation 40
8.6.7 Transport of Material 41
8.7 Key Contacts and Responsibilities 41
8.8 Validation Plan 42

8.8.1 Validation Acceptance Criteria 42
8.8.2 Validation Sampling and Analysis 42
8.8.3 Validation Quality Assurance and Quality Control 43
8.9 Waste Classification 43
8.10 Validation of Imported Fill Material 44
8.11 Validation Report 44
8.12 Contingency Plan 44
8.12.1 Unexpected Finds Protocol 44
8.13 Site Management Plan 45
8.13.1 Hazard Identification and Exposure Pathways 45
8.13.2 Interim Site Management 45
8.13.3 Site Management (Remediation Works) 46
8.13.4 Hours of Operation 46
8.14 Consultants Conclusions 46
8.15 Audit Findings 47
9. Evaluation of Land Use Suitability 49
9.1 Reporting in Accordance with EPA Requirements 49
9.2 Aesthetics Have Been Addressed 49
9.3 Soils Have Been Assessed Against the Appropriate Investigation Levels 49
9.4 Groundwater has been assessed against appropriate investigation levels 49
9.5 Background Soil Concentrations Have Been Adequately Addressed 49
9.6 All Impacts of Chemical Mixtures Have Been Assessed 49
9.7 Any potential ecological risks have been assessed 50
9.8 Site Management Strategy is Appropriate 50
9.9 Contaminant Migration (Actual or Potential) Has Been Addressed 50
10. Audit Summary Opinion 51
11. Limitations 52

List of Tables

Table 1.1: Summary of Investigation and Audit Works Undertaken at the Site 2
Table 2.1: Summary Site Details 4
Table 5.1 Data Usability Assessment (OCTIEF 2018b, Cavvanba 2019a and Cavvanba 2019c) 15
Table 7.1: Summary of Soil Analytical Results (mg/kg) (OCTIEF 2018b) 30
Table 7.2: Summary of Soil Analytical Results (mg/kg) (Cavvanba 2019a) 31
Table 7.3: Summary of Soil Analytical Results (mg/kg) (Cavvanba 2019c) 31
Table 7.4: Summary of Groundwater Analytical Results (mg/L) 32
Table 7.5: Summary of Surface Water Analytical Results (mg/L) 32

Table 7.6: Summary of Sediment Analytical Results (mg/kg) 33

Appendices

Appendix A Guidelines made or approved by the EPA
Appendix B Audit Correspondence
Appendix C Site Plans
Appendix D Consultant's Figures
Appendix E Consultant's Summary Results Tables
Appendix F Regulatory Search Results

Abbreviations

Term	Definition
As	Arsenic
AST	Aboveground Storage Tank
Cd	Cadmium
Cr	Chromium
Cu	Copper
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
B(a)P	Benzo(a) pyrene
DO	Dissolved oxygen
DP&E	NSW Department of Planning and Environment
DQO	Data Quality Objectives
EC	Electrical conductivity
EH	Redox potential
EIL	Ecological Investigation Level
EPA	New South Wales Environment Protection Authority
Hg	Mercury
HIL	Health Based Investigation Level
LOR	Limit of Reporting
MAH	Monocyclic Aromatic Hydrocarbon
Ni	Nickel
OCP	Organochlorine Pesticide
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PCB	Polychlorinated Biphenyls
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percentage Difference
SAR	Site Audit Report
SAS	Site Audit Statement
TPH	Total Petroleum Hydrocarbons
UST	Underground Storage Tank
Zn	Zinc

1. Introduction

1.1 Introduction and Background

Andrew Lau of JBS&G Australia Pty Ltd (JBS&G) was engaged by Health Infrastructure (HI, the client) on 27 July 2018 to conduct a site audit at the proposed Tweed Valley Hospital site located at 771 Cudgen Road, Cudgen, NSW, 2487 (the site). The site is legally identified as Lot 11 in DP 1246853 and encompasses an area of 19.38 hectares (ha). Refer to **Appendix C** for the site layout.

The proposed Tweed Valley Hospital Project (the Project) is understood to consist of:

- Delivery of a new Level 5 major referral hospital to provide the health services required to meet the needs of the growing population of the Tweed-Byron region, in conjunction with the other hospitals and community health centres across the region.
- Master planning for additional health, education, training and research facilities to support these health services, which will be developed with service partners over time. These areas will be used initially for construction site/ compound and at-grade car parking.
- Delivery of the supporting infrastructure required for the new hospital, including green space and other amenities, campus roads and car parking, external road upgrades and connections, utilities connections, and other supporting infrastructure.

It is understood that the development application pathway for the Project consists of a staged Significant Development Application under section 4.22 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

No previous Site Audit Statements (SAS) or Site Audit Reports (SAR) are known to exist for the site.

Andrew Lau is a Site Auditor accredited by the NSW Environment Protection Authority (EPA) under the Contaminated Land Management Act 1997 (CLM Act 1997) (Accreditation Number 0503). The audit was completed with the assistance of Penelope King, Kane Mitchell and Sahani Gunatunge, JBS&G's experienced audit assistants. The audit reference number is 0503-1901.

1.2 Objectives of the Site Audit

The objectives of this site audit were to:

- Independently review environmental investigation reports, Remediation Action Plan (RAP) and subsequent RAP addenda;
- Prepare a SAR and issue a SAS providing an opinion that the site can be made suitable for the proposed future hospital use (as detailed above in **Section 1.1**), subject to implementation of the RAP and RAP Addenda.

In accordance with the requirements of the CLM Act 1997, the site audit was undertaken with consideration to:

- The provisions of the CLM Act, Regulations and subsequent amendments;
- The provisions of any environmental planning instruments applying to the site; and
- Relevant guidelines made or approved by the EPA (**Appendix A**).

1.3 Type of Audit

The audit is not being undertaken in response to a legal requirement imposed by a consent authority or the EPA. As such, the site audit has been conducted as a non-statutory audit.

1.4 Documents Reviewed

The following documentation was reviewed as part of the site audit:

- *Soil Sampling Analysis and Quality Plan, 771 Cudgen Road, Cudgen, NSW, Version 2.0,* OCTIEF Pty Ltd, 10 August 2018 (OCTIEF 2018a).
- *Preliminary and Detailed Site Investigation – 771 Cudgen Road, Cudgen, NSW 2487*, OCTIEF Pty Ltd, 17 October 2018 (OCTIEF 2018b).
- *Remediation Action Plan, Tweed Valley Hospital site, 771, Cudgen Road, Cudgen NSW,* OCTIEF Pty Ltd, 1 February 2019 (OCTIEF 2019).
- *Hazardous Material Register, 771 Cudgen Creek Road, Cudgen NSW,* Cavvanba Pty Ltd, 19 November 2018 (Cavvanba 2018a).
- *Asbestos Clearance Certificate 18084-CC04, 771 Cudgen Road, Cudgen NSW,* Cavvanba Consulting Pty Ltd, December 2018 (Cavvanba 2018b).
- *Soil Investigation Report – Residential House, 771 Cudgen Road, Cudgen NSW,* Cavvanba Consulting Pty Ltd, 24 January 2019 (Cavvanba 2019a).
- *Remedial Action Plan Addendum – Residential House, 771 Cudgen Road, Cudgen NSW,* Cavvanba Consulting Pty Ltd, 24 January 2019 (Cavvanba 2019b).
- *Soil Investigation Report – Farm Shed, 771 Cudgen Road, Cudgen NSW,* Cavvanba Consulting Pty Ltd, 24 January 2019 (Cavvanba 2019c).
- *Remedial Action Plan Addendum – Farm Shed, 771 Cudgen Road, Cudgen NSW*, Cavvanba Consulting Pty Ltd, 24 January 2019 (Cavvanba 2019d).

The following document was also considered during the site audit:

- *Preliminary Site Investigation Contaminated Land, Due Diligence Summary Report – Shortlisted Sites, Tweed Valley Hospital Project*, OCTIEF Pty Ltd, 28 June 2018 (OCTIEF 2018c).
- *Additional Geotechnical Investigation, Proposed Tweed Valley Hospital, Lot 102 on DP870722, Cudgen Road, Kingscliff*, Morrison Geotechnic, December 2018 (Morrison Geotechnic 2018).
- Cavvanba email correspondence dated 29 January 2019 (**Appendix B**), relating to an unexpected find comprising a concrete pit, concrete ramp, concrete drip pad and infilled pit and wastes (Cavvanba 2019e).

Additional correspondence relating to the site audit is provided in **Appendix B**.

1.5 Site Inspections

Date	Attendance	Purpose
2 August 2018	Kane Mitchell (JBS&G)	Site inspection to observe site layout and condition

1.6 Chronology of Site Assessment Works

The process of the assessment and audits undertaken at the site has been chronologically listed in **Table 1.2**.

Table 1.1: Summary of Investigation and Audit Works Undertaken at the Site

Date	Purpose
27 July 2018	Commencement of the site audit (0503-1901).

Date	Purpose
August 2018	Development of a draft soil sampling analysis and quality plan (SAQP) by the OCTIEF to provide framework for contaminated land assessment works required to address a Stage 2 Contamination Assessment. Based on comments provided by the site auditor, a final report was issued on 10 August 2018 (OCTIEF 2018a).
October 2018	Completion of a combined preliminary and detailed site investigation (PSI/DSI) by OCTIEF. The scope of works comprised a desktop review of site history, intrusive soil investigation via 50 hand auger sample locations, groundwater sampling from one monitoring well and surface water and sediment sampling from onsite storage dam and subsequent laboratory analysis for identified contaminants of potential concern (COPCs). Based on comments provided by the site auditor, a final report was issued on 17 October 2018 (OCTIEF 2018b).
November 2018	Preparation of a hazardous material register (Cavvanba 2018a) for the residence and garage.
December 2018	Preparation of a remediation action plan (RAP) providing a summary of identified site contamination issues, description of proposed remediation and soil management programs, procedures and standards to be followed during preliminary works and redevelopment to ensure successful remediation of the site. Based on comments provided by the auditor, the final RAP was issued on 1 February 2019 (OCTIEF 2019).
December 2018	Assessment of farm dump area containing inert waste and subsequent visual clearance (Cavvanba 2018b).
December 2018	Completion of an additional soil investigation for potential lead and organochlorine pesticide (OCP) contamination issues associated with the residential house footprint. The scope of works comprised soil sampling via 22 test pit locations and subsequent laboratory analysis. Based on comments provided by the auditor, the final report was issued on 24 January 2019 (Cavvanba 2019a). Preparation of a RAP Addendum to address contamination issues associated with the residential house footprint. Based on comments provided by the auditor, the final report was issued on 24 January 2019 (Cavvanba 2019b).
January 2019	Completion of an additional soil investigation for potential contamination issues associated with the farm shed including asbestos containing material (ACM), lead and OCPs (Cavvanba 2019c). Temporary site management works were undertaken prior to demolition of the farm shed. Subsequently, soil sampling was undertaken via 21 test pits and subsequent laboratory analysis. Based on comments provided by the auditor the final report was issued on 24 January 2019 (Cavvanba 2019c). Preparation of a RAP Addendum to address contamination issues associated with the residential house footprint. Based on comments provided by the auditor, the final report was issued on 24 January 2019 (Cavvanba 2019d).
24 January 2019	Preparation of an Interim Audit Advice (0503-1901-1) confirming the status of the site audit.
4 February 2019	Preparation of a Section B site audit statement (0503-1901) and accompanying site audit report (JBS&G 2019) confirming the site can be made suitable for the proposed uses subject to remediation as outlined in the RAP (OCTIEF 2019) and subsequent RAP addenda (Cavvanba 2019b and Cavvanba 2019d).

2. Site Description

2.1 Site Identification

The site details have been summarised in **Table 2.1** and described in further detail in the following sections. Plans identifying the subject site has been presented in **Appendix C**. The site location and lay out is shown in **Appendix D**.

Table 2.1: Summary Site Details

Street Address	771 Cudgen Road, Cudgen, NSW
Property Description	Lot 11 in DP 1246853
Parish	Cudgen
County	Rous
Local Government Area	Tweed
Property Size	19.38 ha
Zoning	RU1 Primary Production (approx. 16 ha) R1 General Residential (approx. 0.446 ha) 2C Urban Expansion (0.267 ha) Agricultural Protection Zone (0.04 ha) Environmental Protection (Habitat) Zone (2.944 ha)
Previous Use	Agricultural (sugar cane farming)
Current Use	Agricultural (sweet potato farming)
Proposed Use	Tweed Valley Hospital

2.2 Site Condition

At the time of the detailed site investigation undertaken in June 2018, the consultant (OCTIEF 2018) reported that the site was primarily used for agricultural production, with cultivated paddocks covering approximately 16 ha of the site. The site was described as unfenced and irregular in shape with a residential building on the southern site boundary with access from Cudgen Road. The residential building was observed to be in good condition. The Chemical storage/equipment shed was observed on the southern property boundary to the east of the residential building. Some evidence of general weathering/degradation was observed on the main and vehicles sheds. An undeveloped wetland was observed in the northern/north-western portion of the site.

Additional observations made by the consultant (OCTIEF 2018b) are summarised below.

- A small farm dump was located on the edge of the vegetated area in the northwest corner of the site. A visual inspection of the dump identified only inert building materials such as fencing posts, and paving bricks, however due to extensive coverage by vegetation the full extent of the dump could not be clearly determined.
- No ground staining to suggest potential soil contamination was identified onsite.
- Asbestos guttering in poor condition was noted along the western side of the site shed, with isolated fragments of ACM (Asbestos containing material) noted adjacent to the northwest corner of the shed.
- Chemical storage onsite was limited to 10L and 20L containers of pesticides/herbicides (Dimethoate, Serenade Prime and Banjo) and motor oil and bags of fertiliser.
- Above ground diesel storage tank (approx. 1000L) was noted adjacent to farm shed, tank appeared in reasonable condition.
- A farm dam was identified on the edge of the vegetated area in the northern portion of the site, it was noted that the pump associated with the storage dam runs on mains power.
- A paddock of custard apple trees was identified in the north east corner of the property.

At the time of the additional investigations documented in Cavvanba (2019a) and Cavvanba (2019c), the following observations were reported by the consultant:

- The grass surface was observed to be in good condition around the edges of the residential building and the farm shed with no visible staining or contamination present;
- Potential lead paint was identified inside the residential house; and
- fragments of ACM were observed along the north eastern edge of the farm shed.

2.3 Topography

The consultant (OCTIEF 2018b) reported that based on a review of NSW Six Maps, the cultivated area of the site has an elevation between 25 m AHD to the south east and 8 m AHD to the north. The site was described as gradually sloping to the north.

2.4 Soils and Geology

The consultant (OCTIEF 2018b) reported that a review of the Tweed Heads 1: 250 000 map indicated that the site is underlain by Lamington Volcanics from the Tweed Range-Lamington Area. This consists of basalt with members of rhyolite, trachyte, tuff, agglomerate and conglomerate.

The consultant (OCTIEF 2018b) also reviewed the Department of Land and Water Conservation 1:100000 Murwillumbah to Tweed Heads Soil Landscape Series (Sheet 9541-9561), which described the landscape as a 'Residual Landscape' of low undulating hills and rises on tertiary basalt plateau. The soils were defined as Krasnozems (red to brown, acidic, strongly structured clay soils), with the Krasnozems specific to the area characterised as red, self-mulching, moderate plasticity clays with topsoil depths of 20-40 cm and total soil depth of 1-2 m.

Based on intrusive conditions encountered at the site during environmental and geotechnical investigations, the consultant (OCTIEF 2018b) identified the subsurface profile at the site typically comprised red brown silty clay with fine gravel to a depth of 0.15m underlain by red brown silty clay including fine to coarse gravel and extremely weathered basalt fragments to maximum depth of 3.6 m bgs further underlain by zones of high strength basalt and highly weathered clayey material. No fill material was encountered in the hand augers locations advanced during the OCTIEF (2018b) investigation.

During subsequent soil investigation in the vicinity of residential building, Cavvanba (2019a) observed dark brown to red silty clay material underlying the house, to a maximum depth of 0.6m bgs. Based on the review of the consultant's sample description notes, the auditor notes that anthropogenic inclusions of glass and tile were identified at test pits TP01, TP02, TP03, TP04, TP13 and TP14.

The soil investigation in the vicinity of the farm shed (Cavvanba 2019c) identified dark brown to red silty clay material underlying the shed to a maximum depth of 0.3 m bgs with anthropogenic inclusions of plastic and nails identified at TP43.

2.5 Acid Sulphate Soils

The consultant (OCTIEF 2018b) reported that a review of online Tweed Maps (2018) indicates that the site is within an acid sulfate soil area. The consultant (OCTIEF 2018b) further reported that majority of the site is reported to be within a Class 5 area, with the northern most part of the site listed as Class 2, and a middle length classified as Class 3.

Under Clause 7.1 of the council's Local Environment Plan 2015, development consent is required to undertake works on land shown as being Class 1 -5 on the Acid Sulfate Soil Planning Maps. The consultant (OCTIEF 2018b) considered that based on a preliminary review of information, the development would not trigger Class 5 provisions and therefore acid sulfate soil investigation and/or management was considered not to be required.

2.6 Hydrology

The consultant (OCTIEF 2018b) reported that a review of Tweed Maps – Flood Information Overlay Map indicates that the northern (currently undeveloped) area of the site is within a designated flood affected area.

2.7 Hydrogeology

The consultant (OCTIEF 2018b) described the site as situated within the Lamington Volcanics basalt, a fractured rock aquifer overlying the New England Fold Belt. Yields were noted to be moderate (up to 5 L/s) but may be higher in highly fractured areas. The aquifer is typically recharged by rainfall infiltration resulting in groundwater with low concentrations of dissolved constituents.

The consultant (OCTIEF 2018b) conducted a review of the NSW Office of Water groundwater bore database and reported that seven registered groundwater bores were located within a 500 m radius of the site. The results of the search are summarised in **Table 2.2**, below.

The consultant (OCTIEF 2018b) considered that groundwater at the site was likely to flow north-east towards the Wommin Bay approximately 1 km from the site. Cudgen Creek was identified 800 m to the south-east of the site.

Table 2.2: Summary of Registered Groundwater Bores (OCTIEF 2018b)

Registered No.	Date Registered	Standing Water Level (m bgs)	Aquifer Geology	Distance from Site	Use
GW307808	No data available			450 m NE	Unknown
GW304908	3/11/2004	3	0-5 m: sand grains (lithic)	475 m NE	Domestic
GW065030	16/10/1989	12	0-15 m: clay 15-17 m: weathered rock 17-20 m: basalt 20-24 m: weathered basalt 24-30 m: clay and sandstone	100 m South	Irrigation
GW047693	1/3/1980	NA	0-4.57 m: soil 4.57-14 m: shale	100 m South	Irrigation
GW047692	1/10/1980	NA	0-1.2 m: soil 1.2-7.6 m: clay, decomposed basalt 7.6-11.3 m: clay 11.3-21.3: basalt	100 m South	Irrigation
GW044188	1/1/1945	6	0-4.57m: soil 4.57-12.19 m: shale	100 m South	Domestic
GW069108	7/3/1991	NA	0-10 m: clay 10-13 m: basalt 13-16 m: clay 16-21 m: basalt 21-33 m: clay 33-40 m: basalt 40-47 m: clay 47-54 m: granite	150 m SW	Farming

2.8 Surrounding Environment

The consultant (OCTIEF 2018b) reported that the site is surrounded by the following:

- North – agricultural farm land to north-west; undeveloped land.
- East – low/medium density residential.
- South – open farmland and TAFE buildings (education facility).
- West – farmland and dense forest.

2.9 Climate

The consultant (OCTIEF 2018b) described the climate as moderate year-round, and provided the following statistics:

- mean maximum temperatures ranging from 20.5 °C in July to 28.1 °C in January/February;
- mean minimum temperatures ranging from 11.6 °C in July to 21.8 °C in January; and
- mean monthly rainfall ranging from 55 mm in September to 266 mm in February, with an average annual rainfall of 1 740 mm.

2.10 Audit Findings

The information provided by the consultant (OCTIEF 2018b and OCTIEF 2019) in regard to site condition and surrounding environment has been checked against, and generally meets the requirements of OEH 2011.

The auditor notes that at the time of the detailed site investigation (OCTIEF 2018b) the site was identified as Lot 102 in DP 870722 encompassing an area of 23.23 ha. Based on information provided in the RAP (OCTIEF 2019) including concept development plans (as provided in **Appendix C**), it is understood that the site is currently legally identified as Lot 11 in DP 1246853 encompassing an area of 19.38 ha.

The information provided regarding the site condition and surrounding environment was also consistent with the observations made during a site inspection conducted by the site auditor's assistant on the dates indicated in **Section 1.5**.

Overall, the information provided by the consultant (OCTIEF 2018b) in relation to site condition and the surrounding environment is considered adequately complete for the purposes of assessing the contamination status of the site.

3. Site History

3.1 Site History Information Sources

The consultant (OCTIEF 2018b) completed a comprehensive desktop investigation, including: interviews with relevant staff/ site owner; review of historical environmental reports pertaining to the site; review of historical aerial photographs; review of historical certificates of title; review of publicly available local government records; review of information held by the NSW State Library; and available local historical information.

Relevant historical information from the consultant's report (OCTIEF 2018b) is summarised as follows:

- The site was undeveloped prior to being cleared and utilised for agricultural purposes sometime after 1944 but prior to 1962.
- The site was believed to have been used for sugarcane farming, with an area of plantation to the north of the cropped area described between 1986 and 2003.
- The site was purchased by the current owners in 2010 and has been used for sweet potato farming since that time.

3.2 Aerial Photographs

The consultant (OCTIEF 2018b) reviewed historical aerial photographs for the site and surrounding areas, with the provided information summarised in **Table 3.1,** below.

Table 3.1: Summary of Historical Aerial Photograph Review

Date	Site Specific Observations	Surrounding Land Observations
1944	The site was undeveloped, no structures or site clearing were visible.	The immediate surrounding area was also undeveloped, with no visible clearing or structures adjacent to the site, with the exception of Cudgen Rd running past the southern site boundary.
1962	The site had been cleared and was being utilised for agricultural use. The cleared area appeared to match the current dimensions of the cropped area onsite. House and shed were visible on the site. No other structures were identified.	Surrounding properties to the west and south had also been cleared and were being used for agricultural use.
1976	The site appeared unchanged from the previous photo – cropping was still visible in all cleared areas of the site.	Surrounding properties to the west and south appeared unchanged and were still being used for agricultural use. Residential development was visible to the east of the site.
1986	Some paddocks along the western site boundary appeared to no longer to be actively cropped. Trees / plantation trees were visible on some of the paddocks on the northern side of the agricultural area onsite.	Surrounding properties to the west and south appeared unchanged and were still being used for agricultural cropping. A temporary water storage dam was adjacent to the eastern site boundary.
1995	No evidence of active cropping was visible, some plantation trees still visible on the same paddock.	Surrounding properties to the west and south appear unchanged and were still being used for agricultural cropping. Further residential development was visible to the south east of the site.
2003	Active cropping of the central paddocks onsite. Plantation trees on central northern paddock appeared to have been removed	TAFE campus was now visible to the south east of the site.

The consultant (OCTIEF 2018b) concluded that the results of the historical aerial photograph review identified ground disturbance on site and in neighbouring areas, associated with agricultural activities, has potential for soil contamination associated with pesticide storage and usage practices on the properties.

3.3 Tweed Shire Council Records

The consultant (OCTIEF 2018b) submitted a Contaminated Lands Search Request to Tweed Shire Council and received a response on 6 July 2018 stating:

- A radial search by the council revealed no known cattle dip sites within 200 m of the subject property; and
- Records revealed no known potentially contaminating activities at the subject property.

3.4 Current and Historical Title Search

The consultant (OCTIEF 2018b) conducted a title search for the property to identify historical site owners and associated potentially contaminating activities. Based on the title documentation, the initial title for the land was issued in 1881 and 1889 to Henry Robert Gazala and William warner Julius, respectively. Title documents indicate that the land has remained privately owned and as of 2010, Duane John Joyce and Kerry Douglas Prichard have been joint tenants.

3.5 NSW State Library Search

An online search of the NSW State Library for records pertaining to the site was undertaken by the consultant (OCTIEF 2018b) on 11 June 2018. No relevant records regarding potential sources of land contamination were identified.

3.6 NSW EPA Records

The consultant (OCTIEF 2018b) conducted a search of available NSW EPA online information databases, including the POEO register and the list of NSW Contaminated Sites Notified to EPA, with the following findings:

- A search of the POEO register did not identify any licences referring to the subject site or sites within close proximity to the site.
- A search of the list of NSW Contaminated Sites Notified to EPA did not identify any locations related to the subject site or sites within close proximity to the site.

3.7 Personnel Interviews

The consultant (OCTIEF 2018b) summarised the following anecdotal information provided by the site owner, at the time of the site inspection undertaken on 14 June 2018:

- Since purchase of the site in 2010, the current owner has predominantly used the site for sweet potato farming.
- No animals have been grazed at the property during the current ownership.
- The previous owner has used the site for growing sugar cane.

3.8 Previous Environmental Investigations

3.8.1 Desktop Reports

The consultant (OCTIEF 2018b) identified two historical desktop reports prepared during the site selection process for the proposed Tweed Valley Hospital referred to as HMC 2017 and Charter 2018, which identified the following:

- Broadacre intensive cropping across the cleared part of site may have been subject to agrichemical applications.
- 2-3 structures near Cudgen Road may have been used for storage/mixing of chemicals and storage of fuel.

- Further investigation in the form of detailed site inspection, additional site history and soil investigation was recommended prior to confirming site suitability, subject to final location of proposed development.

No further information was provided regarding the reports. The auditor notes that these reports were not made available for review and as such, do not form part of the current audit.

3.8.2 Due Diligence Summary Report (OCTIEF 2018c)

A due diligence summary report which included information pertaining to the site was produced in June 2018, as documented in OCTIEF (2018c). The desktop component of the assessment was summarised in **Section 3.8.1**, above. In addition to the desktop summary, a site inspection and limited soil sampling was undertaken. The relevant findings of the site inspection and soil sampling works were incorporated into the PSI/DSI (OCTIEF 2018b) as discussed in **Section 2.2** and **Section 7.2** respectively. The following conclusions were made in OCTIEF (2018c) regarding potential contamination at the site:

- Motor oil and chemical storage on site consisted of 20L drums and containers. These chemicals were stored on a cement floor and are considered unlikely to have resulted in environmental contamination. Low risk remains regarding historical storage practices.
- Potential asbestos guttering along the shed poses a low environmental risk.
- Small farm dump identified appears to be inert general waste and considered low risk.
- Analytical results from preliminary soil sampling reported no concentrations of contaminants of potential concern exceeding health-based investigation levels.
- Soil sample collected during the preliminary site investigation from adjacent to the onsite shed reported zinc concentrations above the environmental investigation levels considered a low risk.

The due diligence report recommended the clearance of vegetation overgrowing small farm dump identified to allow detailed inspection/sampling of materials.

3.8.3 Hazardous Material Assessment (Cavvanba 2018a)

A hazardous material assessment of the residence and attached garage was undertaken by Cavvanba in November 2018, as documented in Cavvanba (2018a). The hazardous material register identified lead paint on internal walls and the ceiling within the premises. Sampling of external building panelling indicated that the external paint was not lead paint. No asbestos containing material was identified within the premises.

3.9 Audit Opinions

The site history information provided by the consultant (OCTIEF 2018b) has been checked against, and generally meets the requirements of OEH 2011, with some exceptions as noted below.

The consultant did not undertake a search of the CLM register. For completeness, the auditor conducted a search of available NSW EPA online databases on 23 January 2019, including a search of the CLM register, as well as updated searches of the list of NSW Contaminated Sites Notified to EPA and the POEO register, with the following findings (search records provided in **Appendix F**).

- A search of the CLM register did not discover any notices related to the subject site or sites within close proximity to the site.
- A search of the POEO register did not identify any licences referring to the subject site or sites within close proximity to the site.

- A search of the List of NSW Contaminated Sites Notified to EPA did not identify any locations related to the subject site or sites within close proximity to the site.

Additionally, the consultant did not undertake a search of relevant heritage databases. For completeness, the auditor undertook a search of the Australian and NSW Heritage databases on 23 January 2019 which did not identify any heritage items listed on site (search records provided in **Appendix F**).

Further, the consultant did not complete a SafeWork NSW site search for Schedule 11 Hazardous Chemicals on premises. However, the auditor notes that the consultant (OCTIEF 2018b) undertook a detailed site inspection and interviews with site personnel confirming the location of known fuel/ chemical storage equipment. As such the absence of these records does not affect the outcomes of this audit.

The auditor considers that the extent of the site history information presented by the consultant (OCTIEF 2018b) is generally sufficient for identifying contamination issues at the site as part of the site investigation process.

4. Conceptual Site Model

The National Environment Protection (Assessment of Site Contamination) Measure, NEPC, 1999 (as amended 2013, NEPC 2013) identifies a conceptual site model (CSM) as a representation of site related information regarding contamination sources, receptors, and exposure pathways between those sources and receptors. The development of a CSM is an essential part of all site assessments and remediation activities.

NEPC (2013) identified the essential elements of a CSM as including:

- Known and potential sources of contamination and contaminants of concern including the mechanism(s) of contamination;
- Potentially affected media (soil, sediment, groundwater, surface water, indoor and ambient air);
- Human and ecological receptors;
- Potential and complete exposure pathways; and
- Any potential preferential pathways for vapour migration (if potential for vapours identified).

Based on the known contamination, each of the elements of the CSM are discussed in the following sections.

4.1 Sources of Contamination

Based on a review of site history review, the consultant (OCTIEF 2018b) identified the following potential sources of contamination:

- potential for the release of chemicals into the environment resulting from poor chemical storage or waste disposal practices;
- potential for the release of chemicals into the environment resulting from agricultural practices;
- asbestos building materials in onsite structures;
- above ground diesel tank;
- onsite farm dump; and
- onsite surface water storage dam.

In addition, the consultant (Octief 2019) also identified the potential for a cattle dip to be present based on anecdotal information provided by an external stakeholder during the development assessment and consultation process.

Based on the identified sources of contamination the consultant (OCTIEF 2018b) identified the following contaminants of potential concern:

- TRH;
- BTEX;
- PAHs;
- heavy metals;
- VOCs;
- asbestos; and

- OCPs/OPPs.

4.2 Potentially Affected Media

Potentially affected media considered in the preliminary conceptual site model included soil, groundwater, surface water and sediment. The results refined the understanding of potentially affected media, which is limited to soil.

4.3 Potential Human and Ecological Receptors

The consultant (OCTIEF 2018b) considered the following ecological receptors as relevant to the site:

- wetland in the north-east of the site; and
- groundwater.

The consultant (OCTIEF 2018b) considered the following human receptors as relevant to the site:

- maintenance/construction workers; and
- future site users (staff and patients).

4.4 Potential Exposure Pathways

The consultant (OCTIEF 2018b) considered the following potential exposure pathways:

- contaminated soil impacts affecting the quality of surface water runoff, consequently impacting on ecological receptors associated with the wetland;
- atmospheric dispersion of contaminated soil impacting ecological receptors;
- contaminants in soil leaching to groundwater;
- the lateral migration of potentially contaminated groundwater to impact ecological receptors associated with the wetland; and
- inhalation of asbestos fibres degraded ACM by maintenance/construction workers and future site users.

4.5 Potentially Complete Exposure Pathways

The consultant (OCTIEF 2018b) provided an assessment of potentially complete exposure pathways at the site based on the investigations conducted, as summarised in **Table 4.1.**

Table 4.1: Potentially Complete Exposure Pathways (OCTIEF 2018b)

Potential Source	Pathway	Receptor	Assessment of Completeness
Contaminated Soil	Surface water runoff	Ecological receptors	Unlikely - elevated zinc concentrations relatively minor and of limited extent.
	Atmospheric dispersion	Ecological receptors	Unlikely - elevated zinc concentrations relatively minor and of limited extent.
	Leaching to groundwater	Ecological receptors	Unlikely - elevated zinc concentrations relatively minor and of limited extent. Additionally, the depth to groundwater is >10m.
Contaminated Groundwater	Lateral migration of groundwater	Ecological receptors of wetland	Unlikely – concentrations of zinc identified in groundwater considered likely to be indicative of regional background conditions.
Asbestos Containing Materials	Inhalation of fibres	Maintenance/construction workers; future site users	Friable asbestos and/or asbestos fines were detected in surface soil sample HA1. Some bonded ACM was also observed which could release fibres if inappropriately managed. Area is limited in extent (associated with outbuildings).

4.6 Audit Findings

The consultant identified a number of potential contamination issues at the site and based on the site history review and investigations completed, and the auditor considers that list of COPCs identified by the consultant (OCTIEF 2018b) appropriate for assessing the contamination status of the site. The consultant also appropriately considered both human and ecological receptors and subsequent potential exposure pathways.

The consultant (OCTIEF 2018b) did not consider preferential pathways. However, based on the nature of contamination identified at the site being in solid form (i.e. asbestos, zinc and lead), this is not considered to affect the outcome of this audit.

The auditor also notes that the refined CSM prepared in OCTIEF (2019) as part of development of the RAP generally meets the requirements of NEPC 2013 and that the anecdotal information provided in relation to the potential presence of a cattle dip was appropriately addressed in the remediation plans for the site.

Overall, the auditor considers that the identified potential contamination issues and potentially contaminated media and potential exposure pathways and receptors were appropriate for assessing the nature and extent of contamination present at the site.

5. Sampling Analytical and Quality Program

An assessment of quality assurance and quality control (QA/QC) has been undertaken by the consultants (OCTIEF 2018b, Cavvanba 2019a and Cavvanba 2019c) by developing data quality indicators (DQIs), broadly based on the seven-step process referred to in NEPC 2013.

The auditor has undertaken a review of the QA/QC undertaken by the consultants, which has been summarised in **Tables 5.1** against the PARCC parameters (precision, accuracy, representativeness, comparability and completeness).

Table 5.1 Data Usability Assessment (OCTIEF 2018b, Cavvanba 2019a and Cavvanba 2019c)

Parameter	DQIs	Requirement	Auditor Assessment
Field and Lab QA/QC			
Precision	Intra-laboratory duplicates (blind)	Collected at a rate of 1 per 20 samples. Analysed for primary contaminants of concern. RPDs less than 50%.	Soil duplicates were collected at a rate of 5.4 % and were analysed for the main contaminants of concern during the OCTIEF (2018b) investigation works. RPDs ranged from 0-27 % and were all within DQIs. Soil duplicates were collected at a rate of 10% (lead) and 12.5% (OCP) during Cavvanba (2019a). Soil duplicates were collected at a rate of 4.8% (OCP), 7.7% (lead) and 7% (asbestos) during Cavvanba (2019c). RPDs ranged from 0-54%, with elevated RPD reported for lead. The consultant attributed this to inherent variability associated with metal concentrations in the soil matrix. The auditor concurs and finds the elevated RPDs not to affect the outcome of this audit.
			One groundwater duplicate was collected for the one primary sample and was analysed for the main contaminants of concern during the OCTIEF (2018b) investigation works. RPDs ranged from 0-66 % and were within the DQIs with the exception of copper. The consultant discounted this RPD exceedance as the reported values were less than 10 times the LOR. The auditor concurs with the consultant's findings and finds this minor non-conformance not to affect the outcome of this audit.
			No duplicates were collected for the two sediment samples and two surface water samples collected OCTIEF (2018b). The auditor considers this to be a relatively minor non-conformance on the basis of the small number of samples collected/analysed, and the absence of significant contamination identified in the primary sediment and surface water samples, or any other sample collected from the site.
Precision	Inter-laboratory duplicates (spilt) (triplicates)	Collected at a rate of 1 per 20 samples. Analysed for primary contaminants of concern. RPDs less than 50%.	Soil triplicates were collected at a rate of 5.4 % and were analysed for the main contaminants of concern during the OCTIEF (2018b) investigation works. RPDs ranged from 0-70 % and were within the DQIs, except for arsenic, copper, total chromium, nickel and DDT+DDE+DDD. The consultant discounted this RPD exceedance as the reported values were less than 10 times the LOR. The auditor concurs with the consultant's findings and finds this acceptable.

Parameter	DQIs	Requirement	Auditor Assessment
			Soil duplicates were collected at a rate of 10% (lead) and 12.5% (OCP) during Cavvanba (2019a). Soil duplicates were collected at a rate of 4.8% (OCP), 7.7% (lead) and 7% (asbestos) during Cavvanba (2019c). RPDs ranged from 0-86%, with elevated RPD reported for lead. The consultant attributed this to inherent variability associated with metal concentrations in the soil matrix. The auditor concurs and finds the elevated RPDs not to affect the outcome of this audit.
			One groundwater triplicate was collected for the one primary sample and was analysed for the main contaminants of concern during the OCTIEF (2018b) investigation works. RPDs ranged from 0-66 % and were within the DQIs with the exception of copper. The consultant discounted this RPD exceedance as the reported values were less than 10 times the LOR. The auditor concurs with the consultant's findings and finds this acceptable.
			No triplicates were collected for the two sediment samples and two surface water samples collected (OCTIEF 2018b). The auditor considers this to be a relatively minor non-conformance on the basis of the small number of samples collected/analysed, and the absence of significant contamination identified in the primary sediment and surface water samples, or any other sample collected from the site.
	Laboratory duplicates	One per batch. RPDs less than 50%.	Laboratory duplicates were undertaken by the primary and secondary laboratories. The analysis of laboratory duplicates was within the expected frequency. A review of the laboratory reports provided in OCTIEF (2018b) indicated that the reported RPDs were within the DQIs (< 50%). It is noted that an RPD of 31% was recorded for nickel for one duplicate sample in work order 611312-S, which was outside the general acceptable limit of 30% set by the laboratory, but within the QC acceptance criteria for results <10xLOR as well as project DQIs. A review of lab reports provided by Cavvanba (2019a and 2019c) indicated that RPDs were generally within DQI with the exception of OCP compounds in work order ES1837028 reported between 0-56.1%. The consultant considered the elevated RPD not to detract from the data sets precision as all samples collected and analysed for OCPs were below the adopted site criteria. The auditor concurs and considers this non-conformance not to affect the outcome of this audit.
Accuracy	Field rinsate blanks	Collected at a rate of 1 per piece of decontaminated sampling equipment. Analysed for primary contaminants of concern. Laboratory results below the	Four rinsate blanks were collected from the hand auger during soil and sediment sampling works (QC2, QC5, QC10 and QC11) and were analysed for the primary contaminants of concern, including metals, OCPs/OPPs in addition to PAHs TRH and BTEX at QC2. All results were reported at below the laboratory LOR, with the exception of minor concentrations of copper and zinc identified in QC10.

Parameter	DQIs	Requirement	Auditor Assessment
		laboratory limit of reporting (LOR).	A rinsate blank (QC9) was also collected from the disposable bailer utilized to collect groundwater sample GW1 (post-sample collection) and was analysed for the key COPC. Minor concentrations of zinc and copper were identified above LOR. These identifications were considered to not represent issues with decontamination procedures as the rinsate was collected from a single-use bailer, which had not been previously used, subsequent to the collection of the groundwater sample. Rinsate blanks were not collected from sampling equipment utilized for the collection of surface water samples. However, the auditor considers that as sampling was generally undertaken using suitably decontaminated equipment, with samplers using disposable gloves, the potential for cross-contamination of sampling equipment to occur is low. As such, the absence of the collection of rinsate blanks during surface water sampling does not affect the usability of the data. Rinsate blanks were not collected from sampling equipment utilised during Cavvanba (2019a and 2019c). However, the consultant noted that decontamination procedures to prevent cross contamination between samples included use of dedicated sampling equipment, otherwise decontamination of the sampling equipment between each sampling location (using DECON 90) and the use of dedicated sampling containers provided by the laboratory. Additionally, new disposable nitrile gloves were worn by field staff during handling of samples. The auditor considers the sampling methods employed by the consultant are unlikely to have resulted in significant cross-contamination between sample locations and a review of the available analytical data does not indicate that this has occurred.
Accuracy	Trip blanks	Collected at a rate of 1 per day of sampling where primary contaminants of concern include volatiles. Analysed for volatiles of concern. Laboratory results below laboratory LOR.	One trip blank (QC1) was collected for the duration of OCTIEF (2018b) field works with laboratory results reported below LOR. No trip blanks were collected during Cavvanba (2019a ad 2019c) investigation works. The consultant noted that analysis of volatile compounds was not conducted during the works. Further, all samples were placed immediately into chilled eskies following collection and delivered directly to the laboratory therefore limiting the chance for loss volatile compounds. The auditor notes that volatile compounds were discounted as COPCs during the Cavvanba (2019a) and Cavvanba (2019c) investigations. As such, the auditor concurs that the omission of trip blanks not to affect the outcome of this audit.
	Trip spike	Collected at a rate of 1 per batch where primary contaminants of concern include volatiles. Laboratory results / recovery within 30 %	Trip spikes were not collected during the OCTIEF (2018) investigation works. No trip spikes were proposed to be analysed in the SAQP, but the consultant did not provide a specific reason for this omission. The auditor considers that this is acceptable as volatile COPC were not considered a primary contaminant of concern. In addition, the consultant reported that all

Parameter	DQIs	Requirement	Auditor Assessment
		of the spiked concentration.	samples were collected and transported as per OCTIEF standard operating procedures and industry standards, and therefore the risk of volatile contaminant loss during transport was low. The omission of a trip spike is unlikely to affect the representativeness of the data. No trip spikes were collected during Cavvanba (2019a ad 2019c) investigation works. The consultant noted that analysis of volatile compounds was not conducted during the works. Further, all samples were placed immediately into chilled eskies following collection and delivered directly to the laboratory therefore limiting the chance for loss volatile compounds. The auditor notes that volatile compounds were discounted as COPCs during the Cavvanba (2019a) and Cavvanba (2019c) investigations. As such, the auditor concurs that the omission of trip spikes not to affect the outcome of this audit.
Accuracy	Laboratory method blanks	Laboratory method blanks to be performed as required by NATA accreditation, generally 1 blank per batch. Results to be below laboratory LOR.	All laboratory method blanks < LOR.
	Laboratory control samples (LCS)	LCS to be performed as required by NATA accreditation, generally one per 20 samples per batch. Recoveries to be within 70-130 % or 30-130 % (phenols only).	LCS recoveries ranged from 72-128 % and were within the laboratory control limits.
	Laboratory matrix spikes (MS)	MS to be performed as required as NATA accreditation, generally one per 20 samples per batch. Recoveries to be within 70-130 % or 30-130 % (phenols only).	Surrogate recoveries ranged from 70-129 % and were within laboratory control limits. Surrogate recoveries for OCP surrogates dibromo-DDE (64.5-138%) and DEF (41.1-126%) reported in Cavvanba (2019a) were within laboratory control limits. Surrogate recoveries for OCP surrogates dibromo-DDE (67.9-138) and DEF (41.1-117) reported in Cavvanba (2019c) were within laboratory control limits.
Soil Sampling - Analytical Schedule and Sampling Methodology			
Representativeness	Soil sampling locations	Samples to be collected on a representative basis consistent with the CSM.	As part of the Phase 2 investigation (OCTIEF 2018b), a total of 57 samples were collected from 55 locations across the site. Surface samples were collected from 7 targeted locations during the initial site inspection to provide a preliminary indication of contamination, for the purposes of assisting in the development of the SAQP. For cultivated areas within the proposed development footprint of the site, sampling densities recommended in the NSW EPA Guidelines for assessing banana

Parameter	DQIs	Requirement	Auditor Assessment
			plantations and NSW Guidelines for Assessing Former Orchards and Market Gardens were used. For cultivated areas outside of the proposed development footprint, a reduced sampling density was considered appropriate to identify areas of broadacre contamination. Composite sampling locations were generally based on a grid pattern layout. Targeted, discrete sampling was undertaken in the vicinity of identified potential source areas including the farm dump, storage dam, fuel storage and sheds. The number of soil sampling locations and the rationale adopted by the consultants during the site investigations provided sufficient coverage noting the potential areas of concern and associated COPCs identified as part of the site history review. Minor deviations from the SAQP were noted, including: • number of soil samples within the cultivated area within the hospital footprint reduced from 28 to 26 based on a revised understanding of the size of the proposed footprint; • number of soil samples within cultivated areas of the site, outside the proposed hospital footprint reduced from 18 to 17 locations based on site observations during fieldwork; • number of sediment samples reduced based on access restrictions; and • reduced number of sampling locations within farm dump area due to access constraints and field observations indicating the presence of inert waste only. The auditor considers that the sampling undertaken was adequate to assess the contamination status of soil and sediments at the site. As part of the additional soil investigation in the vicinity of the residential building (Cavvanba 2019a), a total of 22 test pits were reportedly advanced across the investigation area with a total of 30 samples collected. As part of the additional soil investigation in the vicinity of the farm shed (Cavvanba 2019c), a total of 21 test pits were advanced across the investigation area with a total of 35 samples collected. The number of soil sampling locations and the rationale adopted by the consultant provided sufficient coverage of the investigation areas. The asbestos assessment in Cavvanba 2019c was undertaken via targeted test pit locations rather than a grid-based approach. Further, the lateral extent of asbestos impact was not delineated due to the presence of an access road during Cavvanba (2019c), however, the auditor notes that the results were taken into consideration in developing the remediation strategy as documented in Cavvanba (2019d) with additional comments provided in **Section 8**.
	Soil sampling depths and intervals	Soil sampling depths should be consistent with the anticipated	The sampling depths and intervals at each of the sampling locations advanced in OCTIEG (2018b) were appropriate given the identified potential

Parameter	DQIs	Requirement	Auditor Assessment
		distribution of contamination as detailed in the consultant's CSM.	contamination sources and the site geology. Soil samples at discrete locations were collected from near surface, and at approximately 0.5 m bgs. The sampling depth were generally appropriate to assess the vertical extent of contamination across the site, with numerous sampling locations extending to the natural soils. During Cavvanba (2019a) investigation, soil samples were collected from 0.1m, 0.3m and 0.6m bgs. The sampling depth were generally appropriate to assess the vertical extent of lead/OCP contamination in the investigation area, with numerous sampling locations extending to the natural soils. During the Cavvanba (2019c) investigation, all soil samples were collected at 0.1 m bgs only one sample collected at 0.3 m bgs. As such, the soil sampling depths were not appropriate to delineate the vertical extent of asbestos impact. However, the auditor notes that the results were taken into consideration in developing the remediation strategy as documented in Cavvanba (2019d) with additional comments provided in **Section 8**.
	Soil sampling methodology	Soil samples to be collected using a methodology which is appropriate for the primary contaminants of concern.	During OCTIEF (2018b) Soil samples were collected directly from the hand auger. The consultant reported that disposable gloves were work during the soil sampling works. Soil and sediment samples collected during OCTIEF (2018b) were immediately transferred into laboratory supplied glass jars, completely filled to minimise headspace and capped immediately to minimise loss of volatiles. Sample jars were places into a cooled, insulated and sealed container for transport to laboratory under chain of custody conditions. Samples collected for asbestos were sub-sampled and placed in plastic zip-lock bags by the consultant (OCTIEF 2018b). Sampling for asbestos was undertaken in accordance with the WA DoH 2009 and NEPC 2013 by the consultant (OCTIEF 2018b). Overall the auditor considers that sampling was undertaken in accordance with WA DoH 2009 and NEPC 2013, with sampling generally appropriate to identify gross levels of bonded asbestos impact and / or significant friable / asbestos fines impact. The auditor considers that the soil and sediment sampling methods adopted by the consultant (OCTIEF 2018b) during the investigation works were appropriate. During Cavvanba (2019a and Cavvanba 2019c) investigations, the consultant reported that soil samples were collected using stainless steel hand tools, ensuring that soil sampled had not been in direct contact with the hand tool. All soil samples were collected into laboratory supplied glass jars and placed directly into chilled eskies and transported to the laboratory under chain of custody

Parameter	DQIs	Requirement	Auditor Assessment
			documentation, in accordance with the consultant's standard fieldwork procedures. Cavvanba (2019c) asbestos assessment did not include sampling in accordance with WA DoH 2009 and NEPC 2013, with samples only collected/analysed for asbestos identification. Whilst this is a non-conformance, the auditor considers it adequate for the purpose of assessing asbestos contamination status within the investigation area. The auditor further notes that the RAP addendum prepared by the consultant (Cavvanba 2019d) included appropriate validation sampling requirements in accordance with WA/DoH 2009/ NEPC 2013.
	Sediment sampling methodology	Sediment samples to be collected using a methodology consistent with AS4482.2-2005.	The assessment of sediments was not originally included in the SAQP (OCTIEF 2018a). Sediment samples were collected from the storage dam using a decontaminated stainless-steel trowel, from a depth of approximately 0.10 m. Sediment samples were placed immediately in laboratory supplied sample jars and transported to the primary laboratory for analysis. The auditor considers that the sediment sampling conducted is considered adequate for the purposes of the investigation.
	Groundwater sampling locations	Groundwater sampling locations to assess areas of concern, allow for lateral delineation of contamination and assess the groundwater flow direction.	The assessment of groundwater was not included within the investigative scope for the DSI. However, a monitoring well was installed during the geotechnical investigation. GW1 was installed within a cultivated area in the center of the site. In the absence of additional monitoring wells (minimum three), the groundwater flow direction beneath the site could not be calculated. However, the auditor considers that in light of the absence of identified leachable soil impacts at the site (only asbestos impacts identified), and the absence of contamination identified in the groundwater sample collected from GW1, further characterization of groundwater beneath the site is not considered necessary.
Representativeness	Groundwater well construction	Wells to be constructed in accordance with the current version of the Minimum Constructions Requirements for Water Bores in Australia and screened to target the likely contaminated portion of the water column.	GW1 was constructed during the geotechnical investigation, reportedly using 50 mm diameter Class 18 PVC. The standing water level on the geotechnical was recorded at 11.2 m bgs. No other construction details were available. The auditor considers that since information is not available to confirm that the monitoring well was appropriately installed, the data obtained from the well should be considered indicative only.
	Groundwater sampling methodology	Groundwater samples to be collected approximately 7 days after well installation and development. Groundwater samples	Although the geotechnical well was not installed by OCTIEF, they report that following installation, the monitoring well was purged of at least five well volumes, until the turbidity of the water had decreased, and physiochemical parameters had stabilized. Purging was undertaken using a dedicated

Parameter	DQIs	Requirement	Auditor Assessment
		to be collected using low flow methods (where it can be demonstrated that this is appropriate), or by purging at least 3 well volumes, until field parameters have adequately stabilised.	Teflon disposable bailer. The elapsed time between well development and sampling is not specified in the report. GW1 was purged and sampled using a dedicated disposable bailer, in accordance with the requirements of AS/NZS 5667.11-1998. The auditor notes that the consultant report did not indicate that the sample obtained for metals analyses was filtered prior to analyses, hence, the metals data in groundwater should not be considered representative of actual concentrations.
	Surface water sampling methodology	Surface water samples should be collected in accordance with the requirements of AS/NZS 5667.6-1998.	The collection of surface water samples was not originally included in the SAQP. Samples were collected from 0.3 m beneath the water's surface using a sampling pole and laboratory supplied containers. Samples were then transported to the primary laboratory under chain of custody protocols for the scheduled analysis. OCTIEF report that the sampling was conducted in accordance with the requirements of AS/NZS 5667.6-1998. The auditor considers that the surface water sampling method adopted by the consultant was generally appropriate. The auditor notes that field records were not provided for the sampling conducted but considers this to be a relatively minor non-conformance.
	Soil, sediment groundwater and surface water sampling containers	Soil samples to be collected into laboratory supplied, clean unpreserved Teflon lined jars. Groundwater samples to be collected into laboratory supplied, clean and appropriately preserved sampling containers.	The consultant (OCTIEF 2018b) reported that soil and sediment samples were immediately placed in laboratory supplied samples jars which were sealed tight and placed on ice for transport to the analytical laboratories. The consultant (Cavvanba 2019a and 2019c) reported that all soil samples were collected into laboratory supplied glass jars and placed directly into chilled eskies and transported to the laboratory under chain of custody documentation Bulk soil samples (500 g) collected for analysis of asbestos during the (OCTIEF 2018b) sampling works were collected in plastic zip-lock bags accordance with the WA DoH 2009 sampling protocols. The consultant (OCTIEF 2018b) reported groundwater and surface samples were immediately placed into appropriately preserved containers provided by the laboratory. Based on the information provided, the auditor considers that the soil data are of a suitable quality but the groundwater and surface water data should be considered indicative only.
Representativeness	Soil and groundwater sampling equipment decontamination	Soil sampling equipment to be decontamination between sampling locations or between sampling depths; and monitoring well locations where significant	The consultant (OCTIEF 2018b) reported that decontamination of non-disposable sampling equipment was undertaken during the works. This included washing the equipment using phosphate free detergent, followed by rinsing with potable water, followed by rinsing with distilled water between sampling locations. The consultant (Cavvanba 2019a and 2019c) reported that decontamination procedures to prevent cross contamination between samples included use of

Parameter	DQIs	Requirement	Auditor Assessment
		contamination is encountered.	dedicated sampling equipment, otherwise decontamination of the sampling equipment between each sampling location (using DECON 90). Groundwater sampling was conducted using a dedicated disposable bailer. The auditor considers the sampling methods employed by the consultants during the investigation works are unlikely to have resulted in significant cross-contamination between sample locations and a review of the available analytical data does not indicate that this has occurred.
	Soil sample contamination screening	Soil samples to be screened for contamination via visual / olfactory observations and photo-ionisation detector (PID) measurement.	As part of the investigation works (OCTIEF 2018b) the consultant provided bore logs detailing observations of material types; visual and olfactory observations; sample depths; and soil moisture / water observations, where present. Soil samples were also screened in the field using a PID during the field investigation. During subsequent investigations (Cavvanba 2019a and 2019c) the consultant did not provide test pit logs, however, included a summary of sample descriptions including relevant observations.
	Sample storage and transport	Samples to be placed in an insulated container and chilled. Samples to be transported to laboratory under chain of custody conditions.	All soil samples were transported in ice-cooled chests under chain of custody conditions, to laboratories that were NATA accredited for the analysis performed.
Representativeness	Laboratory sample receipt advice	No damaged containers. No samples submitted in containers which have not been chilled. No samples to be submitted without sufficient times to comply with recommended holding times.	Laboratory sample receipt advice provided by the nominated laboratories confirmed that all samples were received in suitable condition. Review of laboratory sample receipt advice provided in Cavvanba (2019c) identified that the sample temperature on receipt was between 18.9 and 21.1 °C. The auditor notes that there is a potential for volatilisation to have occurred in these samples. However, with consideration to the analysed contaminants of concern, this is a non-conformance not considered to affect the outcome of this audit.
	Holding times	Samples to be extracted and analysed within recommended holding times.	A review of the consultant's COC documentation and laboratory reports indicates that all samples were extracted and analysed within their holding times for all analyses undertaken.
	Analytical Method	Samples to be analysed using NATA accredited methodology.	Laboratories used during OCTIEF (2018b) included: Eurofins (primary) and ALS (secondary). Laboratories used during Cavvanba (2019a) and Cavvanba (2019c) included: ALS (primary) and Envirolab (secondary). Laboratory certificates indicate that the laboratories were NATA accredited.

Parameter	DQIs	Requirement	Auditor Assessment
Complete-ness	Sampling, analysis and quality plan completeness	100 % of sampling, analysis and quality plan to be implemented.	Minor deviations from the audit approved SAQP were noted in the DSI, including: • number of soil samples within the cultivated area within the hospital footprint reduced from 28 to 26 based on a revised understanding of the size of the proposed footprint; • number of soil samples within cultivated areas of the site, outside the proposed hospital footprint reduced from 18 to 17 locations based on site observations during fieldwork; • number of sediment samples reduced based on access restrictions; and • reduced number of sampling locations within farm dump area due to access constraints and field observations indicating the presence of inert waste only. The auditor considers that the sampling undertaken was adequate to assess the contamination status of soil and sediments at the site. GW1 was constructed during the geotechnical investigation, reportedly using 50 mm diameter Class 18 PVC. The standing water level on the geotechnical was recorded at 11.2 m bgs. No other construction details were available. Based on the depth to groundwater and the absence of significant soil contamination identified at the site, further groundwater characterization is not considered to be required. An SAQP relating to additional Cavvanba (2019a and 2019c) investigations was not prepared for auditor review. Review of these reports was undertaken by the auditor on 25th January 2019, indicating the suitability of the reports with no further investigation works required with the exception of validation works on completion of site remediation.
	Field documentation	All relevant field documentation to be collated including sampling logs and calibration records.	Calibration certificates were provided for the PID and water quality monitor utilized during investigations (OCTIEF 2018b). The consultant (OCTIEF 2018b) provided logs and relevant site plans showing the locations of all sampling locations. The auditor notes that field records were not provided for the surface water and groundwater sampling conducted, further indicating that the groundwater and surface water data should be considered indicative only. The consultant (Cavvanba 2019a and 2019c) did not provide test pit logs, however, provided a summary of sample descriptions including relevant observations.
	Laboratory documentation	All relevant laboratory documentation to be collated, including chain of custody records, sample receipt advice and analytical reports.	The consultant provided all relevant COC documentation; laboratory sample receipt advice; and full laboratory certificates in the reports, with the exception of the QA/QC compliance assessment report for EB1819257. As relevant quality information is readily available in the QC report for this work order, the auditor considers the absence of this piece of documentation

Parameter	DQIs	Requirement	Auditor Assessment
			to be a relatively minor non-conformance, and not to impact on overall confidence in the data.
	Critical sample validity	All critical sample data to be valid.	The auditor considers that the data is considered reliable for the purpose of the investigation.
	Sampling, analysis and quality approach	Adequately comparable sampling, analysis and quality approach to be used throughout the project.	All sampling works during OCTIEF (2018b), including the soil, and groundwater investigation were undertaken by consistent field staff at OCTIEF. The soil sampling works during Cavvanba 2019a and 2019c, were undertaken by consistent field staff at Cavvanba. The auditor considers that the data obtained during the investigation works is comparable, as consistent sampling methods and consistent field staff were employed throughout the works. All laboratory analysis was undertaken by NATA accredited laboratories.
	Sampler	Samplers used throughout the project to have sufficient experience.	

5.1 Audit Findings

The quality assurance/quality control measures employed by the consultants (OCTIEF 2018b, Cavvanba 2019a and Cavvanba 2019c) were checked and found, overall, to generally adequately comply with the requirements outlined in OEH 2011, NEPC 2013 and EPA 2017.

A number of data quality issues were identified in relation to the groundwater and surface water investigation completed at the site (OCTIEF 2018b), specifically relating to the absence of filtering of samples for prior to metals analyses. As such, the auditor considers the groundwater and surface water data collected during the investigation to be indicative only and not suitable for comparison against the assessment criteria nominated by the consultant in **Section 6**.

The laboratory QA/QC results have been reviewed and the results indicate that the analytical laboratories were achieving adequate levels of precision and accuracy. As such, the sampling, analytical and quality protocols undertaken by the consultant were considered to be adequately reliable for the purpose of assessing the contamination status of the site; and is reliable and useable for the purpose of this audit.

6. Assessment Criteria

6.1 Soil Criteria

As the site is to be used for health services (i.e. Tweed Valley Hospital), guidelines for residential land use (sensitive receptors) were adopted by the consultant (OCTIEF 2018b).

The consultant (OCTIEF 2018b) adopted the following soil assessment criteria sourced from National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013 (NEPC 2013):

- Health Investigation Levels: HIL A – residential with garden / accessible soil (home grown produce < 10 % fruit and vegetable intake, no poultry), and includes children's day care centres, preschools and primary schools.
- Health Screening Levels: HSL A/B – residential, low to high density, for assessment of vapour inhalation risk, clay soils.
- Health screening levels for asbestos is soil: Residential A – garden/accessible soil also includes children's day care centres, preschools and primary schools (0.01% w/w for bonded ACM; for friable asbestos (FA) and asbestos fines (AF), where quantifiable, a screening level of 0.001 % w/w; and no visible asbestos on the ground surface).
- Ecological Investigation Levels: EIL- urban residential areas and public open space.
- Ecological Investigation Levels: EIL- areas of ecological significance.
- Ecological Screening Levels: ESL – urban residential and public open space; fine-grained soils.
- Ecological Screening Levels: ESL – areas of ecological significance; fine-grained soils.

In relation to ecological receptors, assessment criteria were selected based on the presence of the wetland area in the northern portion of the site being considered as an area of high ecological value. The consultant (OTIEF 2018b) has calculated site-specific EILs for the site.

The consultant (OCTIEF 2018b) also considered aesthetic issues, in accordance with the NEPC 2013.

During subsequent soil investigations, the consultant (Cavvanba 2019a and 2019c) adopted assessment criteria consistent with the HIL A and site specific EILs derived in OCTIEF (2018b.)

6.2 Groundwater and Surface Water Criteria

The consultant noted that registered groundwater bores exist within 100 m of the site which are used for domestic and irrigation purposes, and therefore the consultant (OCTIEF 2018b) has compared groundwater and surface water results to drinking water and irrigation guideline values.

The consultant (OCTIEF 2018b) adopted surface water/groundwater assessment criteria sourced from NEPC 2013 and Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZAST 2018).

The criteria adopted from ANZAST 2018 are as follows:

- Freshwater – 99% level of species protection.
- Primary Industries – Irrigation (ANZECC/ARMCANZ 2000).

The criteria adopted from NEPC 2013 are as follows:

- Groundwater Investigation Levels – Freshwater.
- Groundwater Investigation Levels – Drinking Water.

6.3 Sediment Criteria

The consultant (OCTIEF 2018b) adopted the following assessment criteria from ANZAST 2018:

- Toxicant Default Guideline Values (DGV) for Sediment Quality.
- Guideline Value – High.

6.4 Audit Findings

The soil, groundwater, surface water and sediment criteria adopted by the consultants (OCTIEF 2018b, Cavvanba 2019a and Cavvanba 2019c) have been checked against, and were generally consistent with, criteria endorsed by the EPA appropriate for the proposed land use and potential ecological receptors relevant to the site.

As part of the OCTIEF (2018b) assessment, composite soil samples comprising four discrete samples were collected, and as such, the consultant (OCTIEF 2018b) divided relevant assessment criteria by a factor of four. To eliminate the potential for the adjusted guideline value to be below background concentrations, only the added contaminant limits (ACLs) were divided by four. The auditor considers that the modification of soil assessment criteria for assessment of composite samples was appropriate.

The auditor notes that the consultant (OCTIEF 2018b) adopted NEPC 2013 groundwater investigation levels for freshwater which represent the values for slightly-moderate disturbed ecosystems, adopted from the superseded ANZECC/ARMCANZ 2000 guidelines. However, the auditor notes that the consultant also adopted the more sensitive 99% freshwater criteria from current ANZAST 2018 guidelines, and as such, the application of both guidelines is considered not to affect the interpretation of data.

The consultant (OCTIEF 2018b) did not provide adequate explanation as to what soil physical and chemical values were utilised in the calculation of site-specific EILs. For completeness, the auditor has calculated appropriate EILs and compared to those utilised in OCTIEF (2018b) and subsequently in Cavvanba (2019a) and (2019c).

The following soil parameters were utilised for calculation of the Added Contaminant Limits (ACL) for site-specific EIL derivation:

- mean pH value calculated from five analysed soil samples: pH 7.52 (utilised 7.5 in calculations);
- mean CEC value calculated from five analysed soil samples: 9.22 cmol/kg (utilised CEC value of 5 rather than 10 in calculations as three of the five samples exhibited CEC values <10); and
- clay content of ≥10% utilised in calculations as soils were consistently described as clay, indicating a clay content of >40%.

The consultant (OCTIEF 2018b) considered HA-0.15 to represent background conditions, and therefore the following values were adopted as Ambient Background Concentrations (ABC):

- chromium (total): 18 mg/kg;
- copper: 71 mg/kg;
- lead: 11 mg/kg;
- nickel: 37 mg/kg; and
- zinc: 170 mg/kg.

Table 6.1: Site Specific EILs Calculated by the Auditor

Metal	ABC (mg/kg)	ACL (mg/kg) Areas of Ecological Significance	ACL (mg/kg) Urban Residential and POS	EIL (mg/kg) Areas of Ecological Significance	EIL (mg/kg) Urban Residential and POS
Chromium (total)	18	130	400	148	418
Copper	71	190	560	261	631
Lead	11	470	1 100	481	1 111
Nickel	37	5	30	42	67
Zinc	170	50	230	220	400

Table 6.2: Site Specific EILs Calculated by the Consultant

Metal	Auditor Calculated EIL (mg/kg) Areas of Ecological Significance	Consultant Calculated EIL (mg/kg) Areas of Ecological Significance	Auditor Calculated EIL (mg/kg) Urban Residential and POS	Consultant Calculated EIL (mg/kg) Urban Residential and POS
Chromium (total)	148	150	418	420
Copper	261	260	631	650
Lead	481	480	1 111	1 100
Nickel	42	70	67	200
Zinc	220	220	400	400

With the exception of the consultant's calculated urban residential/POS EIL for nickel, the consultant's EILs are generally consistent with the EILs calculated by the auditor. The discrepancy has not affected the interpretation of the data as no concentration of nickel identified exceeded the more sensitive 'areas of ecological significance' value.

The consultant (OCTIEF 2018b) adopted ANZG 2018 upper guideline values (GV-high) for investigation of sediments. In accordance with guidance provided in ANZG 2018, the auditor notes that GV-high values should only be used as an indicator of potential high-level toxicity problems and not as a guideline value to ensure protection of ecosystems. However, the consultant also adopted the appropriate ANZG 2018 toxicant DGVs for the assessment of sediments, and as such, the application of both guidelines values is considered not to affect the interpretation of data.

Overall, the auditor considers that the soil, groundwater, surface water and sediment criteria adopted by the consultants were appropriate for assessing the contamination status of the site.

7. Site Investigation Results

7.1 Field Observations

A summary of observations made during the field investigations OCTIEF conducted in 2018 are summarised below.

- The general soil profile encountered across the site during the environmental and geotechnical investigations was described as red brown silty clay with fine gravel to a depth of 0.15m underlain by red brown silty clay including fine to coarse gravel and extremely weathered basalt fragments to maximum depth of 3.6 m bgs, further underlain by zones of high strength basalt and highly weathered clayey material.
- No fill materials, staining or odours were observed during hand auguring undertaken for the environmental investigation.
- PID measurements ranged from 0.0 to 0.2 ppm, consistent with laboratory results which did not identify volatile contamination of soils.
- Asbestos Containing Material (ACM) was observed on the soil surface in the vicinity of sampling location HA1, which was subsequently sampled for laboratory analysis.
- Groundwater was encountered during the geotechnical investigations at depths greater than 10 m bgs.
- A summary of groundwater quality parameters measured at GW1 in August 2018 is provided as follows:
    - pH measured at 6.03;
    - EC measured at 178 µS/cm, indicative of freshwater conditions;
    - Redox measured at -66.3 mV; and
    - Dissolved oxygen measured at 5.27 mg/L.
- A summary of surface water quality parameters measured within the storage dam during August 2018 is provided as follows:
    - pH ranged from 7.22 to 7.23;
    - Redox ranged from -136.6 mV to -137.2; and
    - Dissolved oxygen ranged from 7.23 to 8.32 mg/L.

A summary of observations made during the subsequent soil investigations (Cavvanba 2019a and Cavvanba 2019c) are summarised below.

- Grass surface was observed to be in good condition around the edges of the residential building and farm shed with no visible staining or contamination identified.
- Potential lead paint was identified inside the residential building.
- ACM fragments were observed along the north eastern edge of the farm shed and at sample location TP32 on ground surface.

7.2 Soil Analytical Results

7.2.1 PSI/DSI (OCTIEF 2018b)

A detailed soil investigation was undertaken by OCTIEF (OCTIEF 2018b). The consultant (OCTIEF 2018b) provided summary tables (**Appendix E**) in addition to detailed laboratory reports and chain of custody documentation.

A summary of the soil analytical results, in comparison to the adopted soil investigation levels (as provided in **Section 6.1**) is provided in **Table 7.1**, as follows.

Table 7.1: Summary of Soil Analytical Results (mg/kg) (OCTIEF 2018b)

Substance	Minimum concentration	Maximum concentration	Exceedance of Assessment Criteria
Metals			
Arsenic	3.7	24	No exceedance
Cadmium	< 0.4	2.6	No exceedance
Chromium (Total)	10	31	No exceedance
Copper	16	99	No exceedance
Lead	8.5	74	No exceedance
Mercury	< 0.1	0.4	No exceedance
Nickel	10	37	No exceedance
Zinc	110	1 600	'Shed' (1 600 mg/kg) and HA4-0.15 (530 mg/kg) exceeded EILs for areas of ecological significance (220 mg/kg) and urban residential/POS (400 mg/kg). HA2-0.15 (270 mg/kg) and HA17-0.15 (200 mg/kg) exceeded EIL for areas of ecological significance.
Volatile Organic Compounds (VOCs)			
Benzene	< 0.1	< 0.1	No exceedance
Toluene	< 0.1	< 0.1	No exceedance
Ethylbenzene	< 0.1	< 0.1	No exceedance
Total Xylenes	< 0.3	< 0.3	No exceedance
1.1.1.2-Tetrachloroethane	< 0.5	< 0.5	No exceedance
Bromobenzene	< 0.5	< 0.5	No exceedance
Carbon Tetrachloride	< 0.5	< 0.5	No exceedance
Chloroform	< 0.5	< 0.5	No exceedance
Total Recoverable Hydrocarbons (TRH)			
TRH C_6-C_{10} (F1)	< 20	< 20	No exceedance
TRH C_6-C_{10} Fraction	< 20	< 20	No exceedance
TRH > C_{10}-C_{16} Fraction	< 50	< 50	No exceedance
TRH > C_{10}-C_{16} (F2)	< 50	< 50	No exceedance
TRH > C_{16}-C_{34} (F3)	< 100	180	No exceedance
TRH > C_{34}-C_{40} (F4)	< 100	< 100	No exceedance
Polycyclic Aromatic Hydrocarbons (PAHs)			
Benzo(a)pyrene (BaP)	< 0.5	< 0.5	No exceedance
Anthracene	< 0.5	< 0.5	No exceedance
Pyrene	< 0.5	< 0.5	No exceedance
Naphthalene	< 0.5	< 0.5	No exceedance
Chrysene	< 0.5	< 0.5	No exceedance
Total PAHs	< 0.5	< 0.5	No exceedance
Organochlorine Pesticides (OCPs)			
DDE+DDD+DDT	< 0.05	0.56	No exceedance
Aldrin + Dieldrin	< 0.05	< 0.05	No exceedance
Heptachlor	< 0.05	< 0.05	No exceedance
Endrin	< 0.05	< 0.05	No exceedance
Methoxychlor	< 0.05	< 0.05	No exceedance
Organophosphorus Pesticides (OPPs)			
Chlorpyriphos	< 0.2	< 0.2	No exceedance
Diazinon	< 0.2	< 0.2	No exceedance
Fenthion	< 0.2	< 0.2	No exceedance
Ronnel	< 0.2	< 0.2	No exceedance
Trichloronate	< 0.2	< 0.2	No exceedance
Asbestos in Soil			
AF/FA (2 – 7 mm)	< 0.001%	0.021%	Exceedance to HSL A at HA1-0-0.1 (0.021%)
AF/FA (<2 mm)	< 0.001%	0.010%	Exceedance to HSL A at HA1-0-0.1 (0.010%)

7.2.2 Residential Building Soil Investigation (Cavvanba 2019a)

A soil investigation of the residential building and attached garage was undertaken by the consultant (Cavvanba 2019a). The consultant (Cavvanba 2019a) provided summary tables (**Appendix E**) in addition to detailed laboratory reports and chain of custody documentation.

A summary of the soil analytical results, in comparison to the adopted soil investigation levels (as provided in **Section 6.1**) is provided in **Table 7.2**, as follows.

Table 7.2: Summary of Soil Analytical Results (mg/kg) (Cavvanba 2019a)

Substance	Minimum concentration	Maximum concentration	Exceedance of Assessment Criteria
Metals			
Lead	15	1600	Exceedance at TP01_0.1 (1090 mg/kg) and TP01_0.3 (1600 mg/kg), TP02_0.1 (1070 mg/kg) to HIL A (300 mg/kg) and EIL urban residential and open space (1100 mg/kg). Exceedance at TP02_0.3 (838 mg/kg), TP02_0.6 (324 mg/kg), TP03_0.1 (502 mg/kg), TP03_0.3 (416 mg/kg), TP04_0.1 (324 mg/kg), TP06_0.1 (317 mg/kg) to HIL A (300 mg/kg).
Organochlorine Pesticides (OCPs)			
DDE+DDD+DDT	< 0.05	9.07	No exceedance
Aldrin + Dieldrin	< 0.05	1.18	No exceedance
Heptachlor	< 0.05	< 0.05	No exceedance
Endrin	< 0.05	< 0.05	No exceedance
Methoxychlor	< 0.05	< 0.05	No exceedance

7.3 Farm Shed Soil Investigation (Cavvanba 2019c)

A soil investigation of the Farm Shed was undertaken by the consultant (Cavvanba 2019c) following temporary site management works as summarised below:

- Asbestos guttering was removed by a licenced asbestos removalist without disturbing the existing ACM in the soil adjacent to the shed.
- A protective layer of geofabric and gravel (approximately 200 mm thick) was placed around the apron of the shed to facilitate demolition and removal without cross contamination of ACM in soil.
- Following demolition, the gravel was partially removed, and care was taken to not disturb the underlying geofabric. The partially removed gravel was re-use onsite, and the geofabric and residual gravel remained in-situ as a temporary protective cover.

The consultant (Cavvanba 2019a) provided summary tables (**Appendix E**) in addition to detailed laboratory reports and chain of custody documentation.

A summary of the soil analytical results, in comparison to the adopted soil investigation levels (as provided in **Section 6.1**) is provided in **Table 7.3**, as follows.

Table 7.3: Summary of Soil Analytical Results (mg/kg) (Cavvanba 2019c)

Substance	Minimum concentration	Maximum concentration	Exceedance of Assessment Criteria
Metals			
Lead	7	63	No exceedance
Organochlorine Pesticides (OCPs)			
DDE+DDD+DDT	< 0.05	0.27	No exceedance
Aldrin + Dieldrin	< 0.05	0.56	No exceedance
Heptachlor	< 0.05	< 0.05	No exceedance
Endrin	< 0.05	< 0.05	No exceedance
Methoxychlor	< 0.05	< 0.05	No exceedance
Asbestos in Soil			

Substance	Minimum concentration	Maximum concentration	Exceedance of Assessment Criteria
Asbestos Detected	No	Yes	Chrysotile and crocidolite asbestos detected above reporting limit of 0.1 g/kg at TP32_0.1. Crocidolite asbestos detected below reporting limit of 0.1 g/kg at TP33_0.1.

7.4 Groundwater Analytical Results

One monitoring well (GW1) installed for geotechnical purposes was sampled by the consultant (OCTIEF 2018b) during August 2018.

The consultant provided summary tables (**Appendix E**) in addition to detailed laboratory reports and chain of custody documentation.

A summary of the groundwater analytical results, in comparison to the adopted groundwater investigation levels (as provided in **Section 6.2**) is provided in **Table 7.4**, as follows.

Table 7.4: Summary of Groundwater Analytical Results (mg/L)

Substance	Minimum concentration	Maximum concentration	Exceedance of Assessment Criteria
Metals			
Arsenic	< 0.001	< 0.001	No exceedance
Cadmium	< 0.0002	< 0.0002	No exceedance
Chromium	< 0.001	< 0.001	No exceedance
Copper	0.001*	0.002	Copper in GW01 (0.002 mg/L) exceeded 99% freshwater DGV.
Lead	< 0.001	< 0.001	No exceedance
Mercury	< 0.0001	< 0.0001	No exceedance
Nickel	< 0.001	0.001*	No exceedance
Zinc	0.018*	0.02	Zinc in GW01 (0.02 mg/L) exceeded 99% freshwater DGV.
Organochlorine Pesticides (OCPs)			
DDE+DDD+DDT	< 0.0001	< 0.0001	No exceedance
Aldrin + Dieldrin	< 0.0001	< 0.0001	No exceedance
Heptachlor	< 0.0001	< 0.0001	No exceedance
Endrin	< 0.0001	< 0.0001	No exceedance
Methoxychlor	< 0.0001	< 0.0001	No exceedance
Organophosphorus Pesticides (OPPs)			
Chlorpyriphos	< 0.02	< 0.02	No exceedance
Diazinon	< 0.002	< 0.002	No exceedance
Fenthion	< 0.002	< 0.002	No exceedance
Ronnel	< 0.002	< 0.002	No exceedance
Trichloronate	< 0.002	< 0.002	No exceedance

*duplicate sample value

7.5 Surface Water Analytical Results

Two surface water samples (WS01 and WS02) were collected by the consultant (OCTIEF 2018b) from the onsite storage dam during August 2018.

The consultant provided summary tables (**Appendix E**) in addition to detailed laboratory reports and chain of custody documentation.

A summary of the surface water analytical results, in comparison to the adopted investigation levels (as provided in **Section 6.2**) is provided in **Table 7.5**, as follows.

Table 7.5: Summary of Surface Water Analytical Results (mg/L)

Substance	Minimum concentration	Maximum concentration	Exceedance of Assessment Criteria
Metals			
Arsenic	< 0.001	0.001	No exceedance
Cadmium	< 0.0002	< 0.0002	No exceedance

Substance	Minimum concentration	Maximum concentration	Exceedance of Assessment Criteria
Chromium	< 0.001	< 0.001	No exceedance
Copper	< 0.001	0.012	Copper in WS01 (0.012 mg/L) exceeded 99% Freshwater DGV.
Lead	< 0.001	< 0.001	No exceedance
Mercury	< 0.0001	< 0.0001	No exceedance
Nickel	0.002	0.017	Nickel in WS01 (0.017 mg/L) 99% Freshwater DGV.
Zinc	0.01	0.077	Zinc in WS01 (0.077 mg/L) and WS02 (0.01 mg/L) exceeded 99% Freshwater DGV.
Organochlorine Pesticides (OCPs)			
DDE+DDD+DDT	< 0.0001	< 0.0001	No exceedance
Aldrin + Dieldrin	< 0.0001	< 0.0001	No exceedance
Heptachlor	< 0.0001	< 0.0001	No exceedance
Endrin	< 0.0001	< 0.0001	No exceedance
Methoxychlor	< 0.0001	< 0.0001	No exceedance
Organophosphorus Pesticides (OPPs)			
Chlorpyriphos	< 0.02	< 0.02	No exceedance
Diazinon	< 0.002	< 0.002	No exceedance
Fenthion	< 0.002	< 0.002	No exceedance
Ronnel	< 0.002	< 0.002	No exceedance
Trichloronate	< 0.002	< 0.002	No exceedance

7.6 Sediment Analytical Results

Two sediment samples (SED01 and SED02) were collected by the consultant (OCTIEF 2018b) from the onsite storage dam during August 2018.

The consultant did not tabulate the results but provided detailed laboratory reports and chain of custody documentation.

A summary of the sediment analytical results, in comparison to the adopted investigation levels (as provided in **Section 6.3**) is provided in **Table 7.6**, as follows.

Table 7.6: Summary of Sediment Analytical Results (mg/kg)

Substance	Minimum concentration	Maximum concentration	Exceedance of Assessment Criteria
Metals			
Arsenic	< 2	4.7	No exceedance
Cadmium	< 1	< 1	No exceedance
Chromium	< 5	19	No exceedance
Copper	< 5	82	Copper in SED01 (82 mg/kg) exceeded DGV (65 mg/kg)
Lead	< 5	10	No exceedance
Mercury	< 0.1	0.1	No exceedance
Nickel	< 5	28	Nickel in SED01 (28 mg/kg) exceeded DGV (21 mg/kg)
Zinc	< 5	120	No exceedance
Alkali Metals			
Potassium	640	1 000	-
Nutrients			
Nitrate + Nitrite (as N)	< 5	< 5	-
Total Kjeldahl Nitrogen (as N)	2 900	3 700	-
Total Nitrogen (as N)	2 900	3 700	-
Phosphorous	1 300	1 800	-
Organochlorine Pesticides (OCPs)			
DDE+DDD+DDT	< 0.05	< 0.05	No exceedance
Aldrin + Dieldrin	< 0.05	< 0.05	No exceedance
Lindane	< 0.05	< 0.05	No exceedance
Endrin	< 0.05	< 0.05	No exceedance

Substance	Minimum concentration	Maximum concentration	Exceedance of Assessment Criteria
Organophosphorus Pesticides (OPPs)			
Chlorpyriphos	< 0.2	< 0.2	-
Diazinon	< 0.2	< 0.2	-
Fenthion	< 0.2	< 0.2	-
Ronnel	< 0.2	< 0.2	-
Trichloronate	< 0.2	< 0.2	-

7.7 Farm Dump Area Assessment

As reported in OCTIEF (2018b), a small farm dump was located on the on the edge of the vegetated area in the northwest corner of the site. A visual inspection of the area identified only inert building materials such as fencing posts, and paving bricks, however due to extensive coverage by vegetation the full extent of the dump could not be clearly determined at the time. An asbestos clearance report (Cavvanba 2018b) was subsequently issued for the farm dump area based on sampling/analysis of fibrous cement sheets and visual clearance undertaken at the farm dump by a Licensed Asbestos Assessor (LAA) in December 2018.

7.8 Consultant's Interpretations and Conclusions

The consultant (OCTIEF 2018b) provided the following discussion of results, conclusions and recommendations:

- Targeted soil sampling was undertaken in vicinity of the main site shed (HA1, HA2), vehicle shed (HA4), farm dump (HA6 and HA7) and dam pump house (HA5). Analytical results reported no concentrations above human health assessment criteria. Samples HA4-0.15 (530 mg/kg) and HA2-0.15 (270 mg/kg) reported concentrations of zinc above the ecological assessment criteria, as did the shed surface sample (1 600 mg/kg) conducted during preliminary sampling in June 2018. Weathered galvanised steel sheeting was noted on the main and vehicle sheds in the vicinity of these samples locations and was considered a likely potential source of the elevated zinc concentrations.
- HA17 was the only composite sample collected across the cultivated area on site that reported concentrations above the adopted assessment criteria. The concentration of zinc (200mg/kg) exceeded the adjusted EIL for areas of ecological significance. Additional analysis of each of the four discrete samples (HA17-1 to HA17-4) that comprised the composite sample HA17 was undertaken, and the discrete samples reported zinc concentrations below EIL.
- Asbestos guttering on the western side of the chemical / equipment shed was noted to be in relatively poor condition, and other asbestos containing material (ACM) was observed on the western edge of the shed roof and against the western wall of the shed. ACM fragments were also noted on the surface adjacent to the western side of the shed, and the material appeared somewhat degraded. The surface soil sample collected from this area (HA1-0-0.1m) reported concentrations of asbestos fines above the adopted assessment criteria. No visible asbestos in surface soils should be present for residential and open space land use, and both the NEPM and workplace Health and Safety (WHS) regulations require removal of visible asbestos prior to any work activities that may disturb it. Any areas containing ACM impacts requiring off-site disposal would require appropriate classification in accordance with the Waste Classification Guidelines: Part 1 - Classifying waste (NSW EPA, 2014) prior to disposal offsite to an appropriately licenced facility.
- Anthropogenic wastes were noted in a small farm dump in the north western corner of the site, visual assessment and soil analytical testing indicate the material in this area is inert waste, however some portions of the dump could not be assessed during the PSI/DSI due to vegetation growth.

- The groundwater well installed onsite intersected a basalt aquifer with static groundwater level approximately 10.5m below ground surface (gauged during geotechnical site works). Minor concentrations of zinc and copper detected in the groundwater sample above the adopted assessment criteria were considered likely to be indicative of naturally occurring background concentrations in the regional groundwater.
- The surface water samples collected from the storage dam onsite (WS01 and WS02) reported zinc, nickel and copper (WS01) concentrations above the respective freshwater GILs and 99% species protection levels (ANZAST 2018). These concentrations were considered typical of general runoff, and not to be indicative of any significant contamination to the surface water.
- Sediment sample SED01 reported arsenic, copper and nickel concentrations exceeding the default sediment guideline values (DGV). The concentrations identified were comparable to the surface soil concentrations across the cultivated area of the site and were not considered to be indicative of any significant contamination in the dam sediments.

The consultant (OCTIEF 2018b) concluded that a Remediation Action Plan (RAP) be developed for the area of asbestos impacted soil on the western side of the main site shed, in accordance with SEPP 55 and relevant NSW guidelines and legislation and include appropriate protocols for removal and appropriate disposal of all remaining ACM associated with the main shed

The consultant (Cavvanba 2019a) concluded that lead concentrations exceeding SAC were present underneath the residential building in all four samples locations to 0.3 m bgs; approximately 1 m from the eastern wall of the residential building, in the southern portion associated with TP06 to 0.1 m bgs; and extending to 0.6 m bgs at TP02. Based on decreasing lead concentrations with depth observed at TP02, the consultant noted that exceedances of SAC will not extend below 0.7 m bgs. The consultant recommended that remediation and/or management is required based on the concentrations of lead detected in the vicinity of the residence.

The consultant (Cavvanba 2019c) concluded that asbestos contamination was identified assumed to be limited to approximately 1 m from the north-eastern wall of the farm shed; approximately 3 m from the south-western wall of the farm shed; and no deeper than 0.3 m bgs. The consultant noted that delineation of ACM in soil has not been completely achieved for the farm shed as investigation beyond the immediate perimeter adjacent to TP32 was not undertaken due to presence of an access road. The consultant recommended that remediation and/or management is required Based on the detection of asbestos fibres and observation of ACM in the soil around the former farm shed

7.9 Audit Findings

The consultants (OCTIEF 2018b, Cavvanba 2019a and Cavvanba 2019c) provided tables and a summary of results that were generally accurate and complete.

Relevant site plans provided by the consultants (OCTIEF 2018b, Cavvanba 2019a and Cavvanba 2019c) adequately identified the sampling locations relevant to the main site features such as boundaries and street frontage and have been produced to scale. Site plans produced by the consultants are included in **Appendix D**.

The laboratory procedures were generally appropriate for the identified potential contaminants of concern and the adopted site assessment criteria against which the results were compared.

The consultant's (OCTIEF 2018b) concluded that the minor concentrations of zinc identified in excess of EILs are likely to be associated with degradation of the galvanised steel noted in the vicinity of the sample locations (sheds), and that the area of impact is relatively minor and isolated. The consultant stated that the site was considered suitable for the proposed use from a chemical contamination perspective. The auditor concurs that remediation of isolated ecological exceedances was not warranted, however, notes that subsequent soil investigations at the site (Cavvanba 2019a and

Cavvanba 2019c) identified lead impact in soil in the vicinity of residential building, in exceedance of adopted human health criteria. The results were incorporated into consideration of the proposed remedial strategy outlined in the RAP addendum (Cavvanba 2019b), as discussed in **Section 8**, and is considered appropriate for the purposes of this audit.

The auditor concurs with the consultant's (OCTIEF 2018b) conclusion that the identified ACM and concentrations of asbestos fines/fibrous asbestos identified are likely to be associated with the degradation of asbestos containing materials associated with the various sheds. The results were incorporated into consideration of the proposed remedial strategy outlined in the RAP (OCTIEF 2019), as discussed in **Section 8,** and are considered appropriate for the purposes of this audit.

Further, the soil investigation undertaken by Cavvanba (2019c) identified additional asbestos impacts to the southeast of the farm shed. The auditor notes that the Cavvanba (2019c) asbestos investigation was limited and did not comprise 500 mL samples in conformance with NEPC 2013/ WA DoH 2009 requirements. Further, asbestos impact was not laterally delineated due to the presence of an access road beyond TP32 and only one sample was analysed at depth of 0.3 m bgs to delineate the extent of vertical impact. Investigation results from both OCTIEF (2018b) and Cavvanba (2019c) including limitations of these assessments were incorporated into consideration of the updated indicative remedial extent outlined in the RAP addendum (Cavvanba 2019d), as discussed in **Section 8**, and is considered appropriate for the purposes of this audit.

A comprehensive groundwater assessment was not undertaken at the site, and only one monitoring well, installed for geotechnical purposes, was sampled as part of the investigation. In the absence of construction details for GW01, the sample results can only be considered as broadly indicative of groundwater quality in the vicinity of the site. However, in light of the depth to groundwater (>10 m bgs) and the absence of significant onsite soil impacts, the auditor considers that more detailed assessment of groundwater is not required.

The consultant (OCTIEF 2018b) concluded that the minor concentrations of copper and zinc identified as exceeding 99% protection level freshwater guidelines are likely to be reflective of regional aquifer conditions, rather than indicative of groundwater contamination beneath the site. The auditor notes that groundwater samples collected by the consultant (OCTIEF 2018b) were not appropriately filtered in the field prior to heavy metals analysis as required under the guidelines. Due to the data quality issues identified above, the auditor considers the groundwater data obtained from the investigation to be indicative only and not suitable quality for comparison against the nominated criteria. However, considering the risk-based factors outlined in NEPC (2013) in relation to consideration of groundwater impacts, and the absence of significant soil impacts at the site to date, the auditor is satisfied that broader groundwater investigations are not warranted at this stage.

The minor concentrations of copper and nickel identified in sediment sample SED01 as exceeding DGV were considered by the consultant (OCTIEF 2018b) to be consistent with the concentrations of these metals identified in surface soils at the site, and therefore not to be indicative of contamination of storage dam sediments. The auditor concurs with this conclusion.

The consultant (OCTIEF 2018b) reported that concentrations of zinc, nickel and copper identified in sample WS01 as exceeding freshwater 99% species protection levels, were considered typical of general runoff to the onsite storage dam, and not to be indicative of any significant contamination to the surface water. The auditor notes that surface water samples were not filtered by the consultant prior to analysis for heavy metals and as such, is not suitable for comparison against the nominated criteria. In the absence of significant soil impacts at the site, the auditor considers the surface water quality to be representative of general runoff conditions.

The consultants reported that the site investigation reports (OCTIEF 2018b, Cavvanba 2019a and Cavvanba 2019c) have been prepared to meet the requirements of the *State Environmental Planning*

Policy No 55 – Remediation of Land (SEPP 55) and the accompanying *Managing Contaminated Land: Planning Guidelines* (DUAP 1998). The auditor is satisfied that the requirements of SEPP 55 and DUAP 1998 have been adequately addressed in the site investigation reports (OCTIEF 2018b, Cavvanba 2019a and Cavvanba 2019c).

The conclusions reached by the consultants in relation to contamination issues are considered appropriate and meet the requirements of the site audit. Overall, the consultant reports (OCTIEF 2018b, Cavvanba 2019a and Cavvanba 2019c) is considered to have obtained and reported results in a manner which enables conclusions to be drawn regarding the need for remediation (as discussed in **Section 8**) and therefore meets the requirements of the site audit.

8. Remediation and Validation Requirements

8.1 Remediation Objective

The consultant reported that the objective of the RAP (OCTIEF 2019) is to document the processes required to address soil contamination to achieve the remediation goals which include:

- Remediate the site to a level suitable for the for the proposed future land use (i.e. hospital use);
- Remove any unacceptable risk to human health and environment associated with contaminated material; and
- Ensure protection of the remediation team, surrounding community and the environment throughout the remediation works.

8.2 Site Contamination Status

ACM surface debris was noted along the western side of the main shed, and asbestos fines (AF) were detected at HA1-0.1m at the time of OCTIEF (2018b). Based on the OCTIEF (2018b) investigation and subsequent Cavvanba (2019c) investigation, asbestos impacts were identified in soils surrounding the farm shed, which requires remediation. Additionally, as identified during the Cavvanba (2019b) investigation, lead impacted soils were identified in the vicinity of the residence, which requires remediation.

8.3 Potential Data Gaps

The consultant (OCTIEF 2019) reported that anecdotal information has indicated the potential for a cattle dip being present onsite in the vicinity of the recently demolished main shed. Inspection of the area following demolition of the main shed and vehicle shed and clearance of surface debris in the area has identified a concrete slab of unknown origin immediately to the west of the former vehicle shed (refer to consultant's figures provided in **Appendix D**). Additionally, as documented in Cavvanba (2019e), an unexpected find comprising comprising a concrete pit, concrete ramp, concrete drip pad and infilled pit and wastes including brake pads, spark plugs, a blue powder, red/purple sand, oil staining, and mechanical parts has been discovered at the site on 29 January 2019 (**Appendix B**). The consultant (OCTIEF 2019) reported that the data gap will be addressed as part of the remediation works.

8.4 Remediation Options

The consultant (OCTIEF 2019) undertook an appraisal of remediation/management options. In accordance with NEPC 2013, the consultant (OCTIEF 2018b) summarised the preferred hierarchy of options for site remediation/management as follows:

- On-site treatment of contamination so that the contaminant(s) are either destroyed or the associated hazard is reduced to an acceptable level; then
- Off-site treatment of contamination so that the contaminant(s) are either destroyed or the associated hazard is reduced to an acceptable level, after which the formerly contaminated material is returned to the site.

If the above cannot be implemented, other options that should be considered include:

- Removal of contaminated material to an approved site or facility (such as a landfill), followed, where necessary by the reinstatement of formed excavations using clean fill; then
- Consolidation and isolation of the contaminated material on-site by containing the contaminated material within a properly designed barrier.

The consultant (OCTIEF 2019) also noted that if remediation is likely to cause a greater adverse effect than would occur should the site be left undisturbed, then remediation should not proceed.

8.5 Preferred Remediation Approach

The consultant (OCTIEF 2019) reported that to meet the remedial goal of remediating the site to a level suitable for the proposed land use (hospital) the adopted remedial method is excavation and offsite disposal.

Physical removal and disposal of asbestos-containing materials that may be disturbed by the site works was the preferred strategy and considered consistent with regulatory requirements. The consultant (OCTIEF 2019) also noted that the preferred remedial option would include the removal of hazardous building materials by an appropriately licenced asbestos removalist in accordance with the requirements of the Work Health and Safety Act and Regulation 2011 and the Code of Practice – How to Safely Remove Asbestos (December 2011).

Following completion of additional investigations in January 2019, the following RAP addenda were prepared by the consultant (Cavvanba) and presented for auditor review:

- Following identification of lead impacted soil in the vicinity of the residence as documented in Cavvanba (2019a), a RAP addendum (Cavvanba 2019b) was prepared.
- Following identification of additional asbestos impacts in the vicinity of the farm shed as documented in Cavvanba (2019c), a RAP addendum (Cavvanba 2019d) was prepared.

With consideration to the site remediation objectives established in the RAP (OCTIEF 2019), the RAP addenda (Cavvanba 2019b and Cavvanba 2019d) identified the preferred remediation strategy for lead/ asbestos impacted soils as excavation and off-site disposal.

8.6 Remediation Activities

8.6.1 Work Plans, Approvals and Licenses

The consultant (OCTIEF 2019) reported that the proposed remediation works were likely classified as Category 2 remediation works under the provisions of SEPP 55, and as such, notice must be given to Council at least 30 days prior to the commencement of the work. At the time of development of the subsequent RAP addenda, the consultant (Cavvanba 2019b and Cavvanba 2019d) reported that the Tweed Shire Council was understood to have been notified of remedial works on 5 December 2018, however a copy of the remediation notice was not made available in the reports.

Prior to establishment at the site for remedial works, the consultant (OCTIEF 2019) reported that a detailed work plan should be prepared by the Remediation Contractor, incorporating the following documentation:

- Work Health and Safety Plan (WHSP);
- Asbestos Management Plan (AMP); and
- Emergency Response Procedures.

8.6.2 Site Establishment

As reported in the RAP (OCTIEF 2019), prior to site establishment, all staff involved in the proposed works must be aware of and provided with all relevant documents necessary for the commencement of work.

Prior to any work commencing, the Remediation Contractor should delineate the work area, with a temporary fence to be erected around any work areas where appropriate. Survey markers used to identify the extent of any remediation areas should be verified with the Environmental Consultant. Access to the work area will be determined by the Remediation Contractor and the site access should be restricted to personnel inducted for work within the work area.

8.6.3 Vegetation Clearance

The consultant (OCTIEF 2019) reported that vegetation clearance will be subject to any requirements of the project approvals and design. With regard to site contamination care should be taken when clearing any vegetated areas to avoid disturbance and spreading of ACM and an appropriately trained "spotter" shall supervise all vegetation clearance to ensure these requirements are met.

8.6.4 Excavation of Asbestos Impacted Soil Surrounding the Farm Shed

The consultant (OCTIEF 2019) reported that asbestos materials which are present on the land surface and are included in wastes such as demolition materials, must be removed prior to disturbance during proposed site work activities. Removal of remaining ACM building materials from the main shed was also required to be undertaken in accordance with the requirements of the Work Health and Safety Act and Regulation 2011.

The indicative remediation area for asbestos impacted soils was identified in the RAP (OCTIEF 2019), however, with consideration to results reported during both OCTIEF (2018b) and Cavvanba (2019c) investigations, the indicative remediation extent was revised in the subsequent RAP addendum (Cavvanba 2019d). The lateral extent of remediation is shown on the consultant's (Cavvanba 2019d) figures provided in **Appendix D**. The updated lateral remediation extent comprised an approximate area of 200 m^2, and a vertical extent of 0.3 m bgs.

As discussed in **Section 7**, the extent of ACM impacted soil was not delineated completely, and as such, the consultant (Cavvanba 2019d) reported that the final remediation extent will be determined during the remediation works, based on the field observations and presence of ACM fragments

8.6.5 Excavation of Lead Impacted Soils Surrounding the Residence

The indicative remediation area for lead impacted soils was identified in the RAP addendum (Cavvanba 2019b). The lateral extent of remediation is shown on the consultant's figures provided in **Appendix D**. The consultant (Cavvanba 2019b) presented two remediation excavation options removal of lead impacted soils as follows:

- Option 1 - Excavate and remove soils across the entire remediation area comprising an approximate area of 220 m^2 to a depth of 0.7 m bgs.
- Option 2 - Excavate and remove soils in shallow contaminated areas (TP01, TP03, TP04, TP06) to a depth of 0.4 m bgs, followed by excavation in the vicinity of TP02 to a depth of 0.7 m bgs.

8.6.6 Data Gap Investigation

The consultant (OCTIEF 2019) reported that, as part of the remediation works of the identified asbestos impacted area, a data gap investigation in accordance with the relevant guidelines and with oversight of the site auditor must be undertaken in the area anecdotally identified as containing a potential cattle dip and the unexpected find documented in Cavvanba (2019e). The consultant further stated that the data gap investigation should include the excavation and removal of the concrete slab, with validation sampling immediately around the slab, and a series of test pits across the remaining area to enable identification of any former cattle dip structure.

Due to the absence of any documentation regarding the location of the potential dip, test pitting across the identified area following the removal of surface infrastructure and concrete slabs was required to enable characterisation of the area. The consultant (OCTIEF 2019) noted that test pits will be undertaken at an equivalent density of 1 per 100 m^2.

8.6.7 Transport of Material

The consultant (OCTIEF 2019) reported that transportation of material shall be undertaken in accordance with the detailed work plan to be prepared by the remediation contractor and comprise the following minimum requirements:

- All material movements, including on-site movements, shall be recorded on a material tracking plan documenting material source, type, description, volume, destination, reference to testing results, approval for movement and date(s) of movement. A register setting out this information shall be established as part of the CQA plan.
- Wastes shall only be removed off-site after the material has been classified and written approval has been received for the disposal of the contaminated soil at the nominated treatment or disposal site, or evidence of appropriate recycling (in accordance with regulatory requirements and relevant codes of practice) has been provided.
- All asbestos debris and contaminated PPE should be doubled bagged prior to transportation to an appropriately licensed landfill that can accept asbestos waste. Management of asbestos waste is to be undertaken in accordance with Clause 42 of the POEO (Waste) Regulation 2005.
- Waste tracking shall be undertaken in accordance with EPA requirements (specifically Cl 49 of the POEO (Waste) Regulation 2005) and include evidence of instructions, load registers/records (source, classification, volume, date and time, vehicle details etc), weigh bridge dockets.

8.7 Key Contacts and Responsibilities

The consultant (OCTIEF 2019) identified key roles and responsibilities for remediation works as summarised below:

- The Principal has responsibilities that include: ensuring guidelines and recommendations set out in the RAP are adhered to; management of company systems to ensure suitably qualified contractors and consultants are engaged to carry out the proposed works and to ensure the necessary safety standards are being maintained; completing sufficient stakeholder and community consultation where required; and maintaining a register of all relevant documentation pertaining to the remedial works.
- The Remediation Contractor has responsibilities that include: ensuring guidelines and recommendations set out in the RAP are adhered to; required civil works (i.e., remediation or associated works), including all measures required to protect worker and public health and the environment during the works; preparing a detailed work plan for implementing the works; undertaking material inspections and clearances in accordance with the RAP, preparing / obtaining and providing all relevant supporting documentation to the environmental consultant in relation to any remediation works carried out.
- The Suitably Qualified Person (SQP)/ Licensed Asbestos Assessor will: provide direction and advice for the safe handling and removal of ACM and contaminated soil; inspect and approve control measures prior to soil disturbance activities; be responsible for the supervision of asbestos related site works (as required); conduct fibre air monitoring during soil disturbance; ensure remedial works are performed in accordance with the RAP, and other Government Legislative requirements relevant to asbestos and contaminated land including Codes of Practices and Guidance Notes; complete soil validation sampling and waste characterisation sampling as required; provide a remediation and validation report on completion of works.

- All Site Personnel shall be responsible for: operating within the requirements of the RAP; ensuring their PPE is effective and in sound working order; promoting safe work practices; adopting work practices that minimise disturbance of ACM and the creation of hazardous atmospheres; ensuring that all work is conducted in a safe and competent manner; and reporting incidences or potential hazards to the applicable responsible officer(s) before further works are carried out.

The consultant (OCTIEF 2019) also stated that community consultation will be carried out by the Principal at their discretion. A complaints register will be established to document public concerns or complaints received.

8.8 Validation Plan

The consultant (OCTIEF 2019) reported that the aim of the validation program is to is to collect sufficient data to verify that the remediation has been carried out satisfactorily to achieve the remediation goal of rendering the site suitable for the proposed hospital land use.

8.8.1 Validation Acceptance Criteria

The consultants (OCTIEF 2019) reported that in accordance with NEPC (2013), that HSLs for asbestos contamination in soil relating to Residential A land use are adopted as most appropriate for the proposed use of the site as a hospital, as summarised below:

- Bonded ACM – 0.01%;
- FA and AF (friable asbestos) – 0.001%; and
- No visible asbestos for surface soils.

The auditor notes that Cavvanba (2019d) proposed site-specific investigation screening criteria, including a combination of no visual observations of ACM as well as non-detects of asbestos fibres in soil.

Additionally, validation criteria for lead was proposed in the subsequent RAP addendum (Cavvanba 2019b) consistent with NEPC (2013) Residential A land use (300 mg/kg).

8.8.2 Validation Sampling and Analysis

8.8.2.1 Asbestos

The consultant (OCTIEF 2019) reported that soil validation sampling following asbestos remediation works will include: one sample per 5m along each wall of the excavation; and a minimum of two samples per 100 m^2 on the base of the excavation.

The auditor notes that different requirements for asbestos validation sampling were included in the RAP addendum (Cavvanba 2019d). Based on an approximate remediation area of 200 m^2 and in accordance with guidance provided in WA DoH (2009) the following validation sampling requirements were provided:

- At least 1 sample from each wall per 5 m length of strata of interest (or per 1 m depth), additional discretionary samples if necessary; and
- Floor should be visually inspected and if suspect may need to be sampled at twice the minimum density outlined in NSW EPA Sampling Design Guidelines (1995). I.e. a minimum of ten locations will be required (ten locations for less than 0.05 hectares).

8.8.2.2 Lead

The RAP addendum (Cavvanba 2019b) provided validation sampling requirements relating to remediation of lead impacted soils. Based on an excavation area of approximately 220 m^2, a

minimum of five locations will be required in accordance with NSW EPA Sampling Design Guidelines (five locations for less than 0.05 hectares).

8.8.2.3 Data Gap Investigation

The consultant (OCTIEF 2019) reported that validation of the concrete slab excavation will be completed as follows:

- 1 sample per 5 linear metres along each wall of excavation.
- 1 sample per 5 linear metres along base of excavation.

The consultant (OCTIEF 2019) stated that samples from the walls and floor of the blab excavation will be analysed for heavy metals, TRH/BTEX, PAH and asbestos based on the observations made in Cavvanba (2019e).

The consultant further reported that characterisation test pits will be completed at an equivalent density of 1 per 100 m^2 with three samples to be collected per test pit, with analysis for heavy metals.

The consultant reported that data gap investigation results will be assessed against NEPC (2013) investigation criteria for human health and environmental receptors relating to residential land use, consistent with the proposed use of the site as a hospital.

8.8.3 Validation Quality Assurance and Quality Control

The RAP (OCTIEF 2019) outlined field QA/QC procedures to be adopted as part of validation sampling including:

- Collection of blind and split duplicate samples at a combined rate of not less than 1 per 20 samples;
- All sampling equipment shall be thoroughly decontaminated, using phosphate free detergent and deionised water rinse between sampling events;
- All field equipment should be calibrated in accordance with documented requirements;
- Samples should be collected in suitable containers, as provided by the project analytical laboratories;
- All soil samples collected should be transported to the testing laboratory under strict chain of custody documentation; and
- Photographs of the excavation should be taken as part of the validation works.

Additionally, the consultant (OCTIEF 2019) stated that samples should be submitted to a NATA accredited laboratory for the analysis of COPCs.

8.9 Waste Classification

Waste classification is required prior to offsite disposal of material excavated. The consultant (OCTIEF 2019) stated that the recommended sampling density is 1 sample per 25 m^3 (based on the sampling density for in-situ classification detailed in the NSW EPA excavated natural material guidelines. All waste classification is to be undertaken in accordance with NSW EPA (2014) *Waste Classification Guidelines Part 1: Classifying Waste*. Waste disposal is to be undertaken in accordance with applicable legislation and any specific council requirements.

Soil samples shall be analysed for Heavy metals and asbestos as a minimum, with TCLP analysis to be undertaken if required for the purpose of waste classification.

8.10 Validation of Imported Fill Material

As reported in the RAP (OCTIEF 2019), material imported to site (if required) must be virgin excavated natural material (VENM) or material for which a valid exemption exists (such as Excavated Natural Material (ENM)).

The Environmental Consultant will carry out an inspection and a review of site history for each identified source of VENM. The nature of the imported material will be recorded (including photographs) at the source so it can be verified on site. The Contractor will need to provide tracking details of imported material.

In the event that material is not pre-classified or certified as VENM or ENM, validation samples are required to be collected to confirm the suitability of the material for use on the site. In this instance, the RAP (OCTIEF 2019) stated that the Environmental Consultant will collect validation samples from imported materials at a minimum frequency of five validation samples per source or 1 per 100 m^3, whichever is the higher. In addition, the imported soil must be inspected and verified as being free from deleterious materials, for example, rubbish and other anthropogenic materials. Samples will be tested for the following suite of contaminants at a NATA accredited laboratory including heavy metals, asbestos, TRH, BTEX, PAH, Organochlorine pesticides (OCP) and Polychlorinated biphenyls (PCBs).

8.11 Validation Report

A Validation Report will be prepared by the Environmental Consultant documenting the remediation and validation program activities including the final methodologies adopted and an evaluation of the results against the remedial goals demonstrating compliance with the conditions of the RAP.

The consultant (OCTIEF 2019) stated that following appropriate implementation of the remedial measures and associated activities documented in the RAP, and subject to validation by the Environmental Consultant, the site will be considered suitable for proposed hospital land use.

8.12 Contingency Plan

As reported in the RAP (OCTIEF 2019), a contingency plan incorporating an Unexpected Finds Protocol (UFP) to be followed in the event of unexpected situations must be prepared by the Contractor and form part of the Detailed Work Plan.

The Contractor will be required to follow the contingency plan if unexpected situations are encountered during the remediation works. The contingency plan should outline procedures that can be implemented to manage such situations and prevent adverse impacts to the environment and human health.

In relation to the data gap investigation, the consultant (OCTIEF 2019) reported that, if elevated arsenic concentrations are detected from validation sampling around the slab or the test pits, then installation of groundwater wells will be required, and a RAP addendum will be prepared outlining the requirements for excavation and offsite disposal of the impacted material.

8.12.1 Unexpected Finds Protocol

The consultant (OCTIEF 2019) reported that all materials should be assessed for potential contamination during the proposed site development works for indications of potential contamination including:

- staining or discolouration;
- odours;
- waste materials such as ash or slag;
- construction or demolition wastes (brick, concrete, tile, timber, steel, carpet, etc.);

- asbestos cement sheeting or pipe pieces or fragments;
- bottles, chemical containers, broken glass, plastic, etc.; and/or
- white goods, garbage, etc.

The RAP (OCTIEF 2019) outlined the following minimum provisions to be included in the contingency plan, in the event of an unexpected find:

- immediately stop work in the area of concern;
- contact the site manager or their designated authority;
- erect temporary barricading to prevent access, and warning signs as required;
- provide cover or suitable suppressant if odorous;
- provide erosion and sediment control measures as required; and
- contact appropriate organisations to provide specialist advice/support.

8.13 Site Management Plan

The RAP (OCTIEF 2019) and subsequent Cavvanba (2019d) RAP addendum provided a site management plan relating to the proposed asbestos remediation works. The Cavvanba (2019b) RAP addendum provided a site management plan relating to remediation of lead impacted soils. Specific controls and strategies provided by the consultant (Cavvanba 2019b and 2019d) for environmental protection during remediation is summarised below.

8.13.1 Hazard Identification and Exposure Pathways

Based on completed site investigations, hazards that require management include:

- Soil potentially contaminated with asbestos;
- Soil potentially contaminated with lead; and
- Standard construction site hazards.

Exposure pathways for asbestos contamination is limited to inhalation of fibres. Exposure pathways relating to lead contaminated soil include dermal (skin) contact, inhalation and/or ingestion of soil or dust.

8.13.2 Interim Site Management

As reported in Cavvanba (2019c), it is understood that the farm shed was demolished prior to undertaking the soil investigation. The consultant (Cavvanba 2019d) reported that the site was fenced at the time of preparation of the RAP addendum in January 2019, with a geofabric material placed over the topsoil contaminated with ACM fragments overlain by approximately 200 mm of clean gravel as control measures to reduce the risk and or exposure to human health.

The consultant (Cavvanba 2019d) further reported that the surrounding fence and geofabric material should be maintained in order to sustain the appropriate control measures for asbestos until remediation works commence at the site.

The consultant (Cavvanba 2019b) reported that the residential building had been demolished at the time of preparation of the RAP addendum in January 2019. The consultant stated that the resultant footprint is currently uncontrolled, with the exception of being fenced for security purposes. If remediation activities are delayed on site, the consultant provided the following interim measures that are required in order to maintain the current minimal exposure scenario:

- Implement erosion and sediment controls which are adequate to ensure no soil leaves the remediation area via runoff or air. It was recommended that these measures are designed

and implemented by an appropriately qualified specialist in erosion and sediment control. These measures may include covering with a geofabric, or other free draining, rot proof cover with high tensile strength, and redirection of any surface water which may accumulate or traverse the remediation area.

- The interim measures were considered appropriate for a period of up to 12 months if the site was undisturbed and maintained.

8.13.3 Site Management (Remediation Works)

The remedial program should be undertaken with due regard to legislative requirements and any relevant environment planning instruments that apply to the site. In addition to any statutory compliance requirements the contractor shall carry out the site works to ensure that the following conditions are complied with, as far as practicable:

- Wind-borne dust is minimised;
- No water containing any suspended matter or contaminants is to be allowed to leave the confines of the site in such a manner that it could pollute any nearby waterway;
- Material from exposed, surfaces is not to be tracked onto other areas of the site by personnel or equipment; and
- Noise levels at the site boundary are to comply with the Council requirements.

The contractor will ensure that each employee or sub-contractor employed by the contractor is familiarised with the requirements of the RAP by the site manager/supervisor.

Specific environmental requirements relating to the remediation works include:

- Maintain erosion and sediment controls to prevent offsite migration of impacted soils.
- Use appropriate methods to control the generation of dust, e.g. limit extent of works at any one time, use water sprays to keep soils moist (but not enough to generate surface water), cover work areas if required, or stop work if wind sufficient to generate dust.
- During excavation works, use methods which minimise manual handling of soils.
- Minimise the movement of soil via personnel and machinery tracking soil out of the lead/asbestos in soil remediation area.
- Ensure all personnel whom are coming into contact with potentially contaminated soils are wearing appropriate personal protective equipment (PPE), such as gloves, long sleeves shirt, long pants and the like.
- Given ingestion is a primary exposure pathway, all workers must wash their hands and faces before eating.

8.13.4 Hours of Operation

Remediation works must comply with the development application, including:

- Monday to Saturday from 7.00 am to 5.00 pm;
- No work to be carried out on Sundays or Public Holidays; and
- The proponent is responsible to instruction and control subcontractors regarding hours of work.

8.14 Consultants Conclusions

Overall, the consultant (OCTIEF 2019) concluded that following appropriate implementation of the remedial measures and associated activities documented in the RAP, and subject to validation by the

Environmental Consultant, the site will be considered suitable for proposed hospital land use. The auditor notes that addenda to the RAP (Cavvanba 2019a and Cavvanba 2019b) were subsequently prepared to support the RAP.

8.15 Audit Findings

The consultant's nominated remediation objectives were appropriate and consistent with the proposed use of the site.

The consultant (OCTIEF 2019) considered a wide range of remediation and management options including management of exposure, physical separation, excavation and disposal and onsite capping and containment. With consideration to the nature and extent of soil of the identified soil contamination, the auditor accepts the preferred remediation approach to be consistent with relevant NSW EPA guidance. The auditor notes that the subsequent RAP addenda (Cavvanba 2019b and Cavvanba 2019d) supported the remediation approach nominated in the RAP. The auditor is also satisfied that the requirements of SEPP 55 and DUAP 1998 have been adequately addressed in the RAP (OCTIEF 2019) and RAP addenda (Cavvanba 2019b and Cavvanba 2019d).

The RAP (OCTIEF 2019) and the Cavvanba (2019d) RAP addendum have identified different remedial extents for the proposed remediation of ACM impacted soils in the vicinity of the farm shed. The auditor notes that the RAP addendum (Cavvanba 2019d) has taken all site investigation data available to date relating to asbestos contamination as documented in OCTIEF (2018b) and Cavvanba (2019c). As such the auditor accepts the indicative remediation extent identified in Cavvanba (2019d), as required to be adopted during site remediation. Further, the auditor notes that the extent of asbestos impacted soils was not adequately delineated in Cavvanba (2019c). As such the remedial extent proposed in the RAP addendum (Cavvanba 2019d) is considered indicative only, and the final lateral/vertical extent of remediation is subject to field observations and validation sampling required to demonstrate that successful remediation and validation has been achieved.

The consultant (OCTIEF 2019) proposed a data gap investigation to be undertaken as part of the site remediation works with consideration to anecdotal information on a potential cattle dip located at the site. The proposed sampling and validation approach is considered generally appropriate to address the anecdotal information regarding the cattle dip as well as the unexpected find as documented in Cavvanba (2019e). Should contamination arising from a potential cattle dip be identified during the data gap investigation, a RAP addendum must be prepared to document the processes required to address soil/groundwater contamination to achieve the established site remediation goals and be provided to the auditor for review and endorsement.

The proposed validation approaches provided by the consultants (OCTIEF 2019, Cavvanba 2019b and Cavvanba 2019d) are considered generally appropriate and in accordance with relevant guidelines. However, the auditor notes that differing validation sampling and analysis programs and validation criteria have been nominated in the RAP (OCTIEF 2019) and subsequent RAP addendum (Cavvanba 2019d). As such, a validation SAQP should be prepared for auditor review prior to commencement of site remediation in order to resolve any discrepancies and provide a clear process for validating the site.

The site management provisions appear to broadly control the potential impacts associated with the proposed remediation works, and appear adequately protective of both the remediation workforce and the surrounding environment (including the neighbouring community). The auditor also notes that the following documents should be prepared during the site redevelopment works, consistent with the RAP (OCTIEF 2019):

- Work Health and Safety Plan (WHSP);
- Asbestos Management Plan (AMP); and
- Emergency Response Procedures.

The consultant nominated a contingency plan in the RAP (OCTIEF 2019) which suitably outlined the procedures for the identification and management of unexpected issues or events. In the event that contamination arising from a potential cattle dip is identified during the data gap soil investigation, an additional groundwater investigation including installation of new monitoring wells will be required to address potential contamination migration issues.

The adopted remediation approach presented in the RAP (OCTIEF 2019) and subsequent RAP addenda (Cavvanba 2019b and Cavvanba 2019c) was checked by the auditor and found to be:

- Technically feasible;
- Environmentally justifiable given the nature and extent of the identified contamination; and
- consistent with relevant laws, policies and guidelines, since the works are proposed to be undertaken in a manner which are unlikely to result in any relevant regulatory measures being breached.

Prior to the commencement of site remediation works, the consultant will be required to prepare a Validation SAQP, Work Health and Safety Plan (WHSP), Asbestos Management Plan (AMP) and Emergency Response Procedures. These documents will require review and endorsement by the auditor prior to the commencement of any remediation works.

The auditor notes that all waste classification of soils will be required in accordance with NSW EPA (2014) *Waste Classification Guidelines Part 1: Classifying Waste*, prior to removal of any soils from the site. The auditor notes that differing requirements for imported materials was nominated in the RAP and subsequent RAP addenda. The validation requirements for imported materials should be identified in the validation SAQP required to be produced prior to commencement of site remediation works. The auditor notes that the requirements for off-site disposal of waste material and importation of materials is in accordance with the requirements of NSW EPA (2017).

The validation criteria nominated by the consultants (OCTIEF 2019, Cavvanba 2019b and Cavvanba 2019d) relating to remediation of lead and asbestos impacts is considered suitable, however, the auditor notes that the validation criteria for unexpected finds including aesthetic considerations should be included in the validation SAQP.

Upon successful completion of the remediation and validation activities, the consultant (OCTIEF 2019) stated a validation report will be prepared. The auditor notes the report will need to be prepared in accordance with the requirements of OEH 2011 and EPA 2017 and other relevant endorsed EPA guidelines. The validation report must be reviewed and accepted by a site auditor, with a site audit statement (SAS) supported by a site audit report (SAR), to be issued certifying site suitability for the proposed use.

The remediation strategy proposed for the site is considered appropriate for the site given the identified contamination issues, and able to make the site suitable for the proposed uses, subject to the following:

- Validation SAQP, Work Health and Safety Plan (WHSP), Asbestos Management Plan (AMP) and Emergency Response Procedures must be reviewed and accepted by site auditor prior to commencement of remediation works;
- The validation report must be reviewed and accepted by a site auditor following completion of site remediation/validation and prior to occupation of the site; and
- A site audit statement (SAS) supported by a site audit report (SAR), must be issued by the site auditor confirming site suitability for the proposed use.

9. Evaluation of Land Use Suitability

In assessing the suitability of a site for an existing or proposed land use in an urban context, the decision process for assessing urban redevelopment sites should be followed (Page 46 and 47, EPA 2017), as discussed in the following sections.

This audit was undertaken with the objective of independently reviewing the site investigation reports (OCTIEF 2018b, Cavvanba 2019a and Cavvanba 2019c), RAP (OCTIEF 2019) and subsequent RAP addenda (Cavvanba 2019b and Cavvanba 2019d) to determine if the land can be made suitable for the proposed landuse as a hospital, by the implementation of the processes outlined in the RAP and RAP addenda.

9.1 Reporting in Accordance with EPA Requirements

The documents provided by the consultant have been checked against, and meet the requirements of, OEH 2011. As such, the reporting of the site investigation process and the proposed remediation and validation process is considered to be appropriate and meets the requirements of this audit.

9.2 Aesthetics Have Been Addressed

As part of the investigation works, the consultant (OCTIEF 2018b) completed an assessment of contaminant odours, soil discolouration, anthropogenic material and/or presence of asbestos during the soil sampling. As such, aesthetic issues are considered to have been adequately addressed.

9.3 Soils Have Been Assessed Against the Appropriate Investigation Levels

The chemical criteria adopted by the consultants (OCTIEF 2018b, Cavvanba 2019a and Cavvanba 2019c) have been checked against, and are consistent with, appropriate criteria endorsed by the EPA for the proposed uses. As such the soils are considered to have been assessed against appropriate investigation levels.

The consultant's (Cavvanba 2019c) asbestos analysis was limited to presence/absence and did not meet the requirements of NEPC 2013/ WA DoH 2009. The auditor notes that the analysis is considered adequate for the purpose of characterising the contamination status and considers that appropriate validation criteria have been nominated in the RAP (OCTIEF 2019) consistent with NEPC 2013/ WA DoH 2009 health screening levels for asbestos contamination in soil.

9.4 Groundwater has been assessed against appropriate investigation levels

The groundwater investigation criteria adopted by the consultant (OCTIEF 2018b) have been checked against and are generally consistent with, appropriate criteria endorsed by the EPA. However, it is noted that due to the identified groundwater sampling methodologies, the groundwater data obtained is considered to be indicative only.

9.5 Background Soil Concentrations Have Been Adequately Addressed

During the site investigation works, the consultant sampled in natural formations, providing a clear indication and representation of local natural soil profiles. The chemical concentrations in underlying natural soils were below the appropriate soil criteria. As such, background soil concentrations are considered to have been adequately addressed.

9.6 All Impacts of Chemical Mixtures Have Been Assessed

No issues relating to chemical mixtures in relation to the identified contaminants of concern were identified by the consultant. Hence, there was no requirement to give any further consideration to the impact of chemical mixtures.

9.7 Any potential ecological risks have been assessed

The consultant (OCTIEF 2018b) identified potential ecological risks relating to identified contamination issues. Minor concentrations of zinc were reported exceeding ecological criteria, considered likely to be associated with weathering and degradation of farm equipment stored between the main storage and vehicle sheds onsite. Exceedances were relatively minor and considered sufficiently isolated as to not present an unacceptable risk to human health or the environment.

As such, the requirements of the site audit in relation to potential ecological risks have been met.

9.8 Site Management Strategy is Appropriate

In accordance with the requirements of EPA 2017, the site management strategy outlined in the RAP (OCTIEF 2019) and subsequent RAP addenda (Cavvanba 2019b and Cavvanba 2019d) is considered to be:

- technically feasible;
- environmentally justifiable; and
- consistent with relevant laws, policies and guidelines.

On this basis, the auditor accepts that the proposed remediation strategy is appropriate and, if implemented appropriately, will make the site suitable for the proposed use, i.e, hospital.

9.9 Contaminant Migration (Actual or Potential) Has Been Addressed

The consultant addressed both the potential and actual migration of the identified contaminants of concern through an assessment of soil and groundwater at the site.

Based on the investigations completed to date at the site and in the absence of significant soil contamination issues being identified, the auditor accepts that no further groundwater investigation is required at this stage.

Should contamination issues arising from the potential cattle dip be identified during the proposed data gap investigation, the consultant included a groundwater investigation as a contingency scenario as part of development of the RAP (OCTIEF 2019).

As such, the requirements of the site audit in relation to consideration of contaminant migration have been met.

10. Audit Summary Opinion

On the basis of the findings of the site audit, and subject to the limitations in **Section 11**, the following summary opinions are provided:

- The site investigations and proposed remediation and validation works are considered to have met the requirements of the Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme (3rd Edition) (EPA 2017).
- The site investigation activities identified lead and asbestos in soil which require remediation under the proposed land use as a hospital.
- An assessment of groundwater conditions was undertaken by consultant (OCTIEF 2018b). However, due to a number of data quality issues identified by the auditor, the groundwater data are considered to be indicative only and not suitable for comparison against the nominated criteria. In consideration of risk-based factors outlined in NEPC 2013, the auditor is satisfied that there is no evidence of potential migration of contaminants from the site which is likely to result in any unacceptable risks to surrounding human or ecological receptors.
- Should contamination arising from a potential cattle dip be identified during the proposed data gap investigation, a RAP addendum must be prepared and be provided to the auditor for review and endorsement to document the processes required to address soil/groundwater contamination and to achieve the established site remediation goals.
- The RAP (OCTIEF 2019) and subsequent RAP addenda (Cavvanba 2019b and Cavvanba 2019d) prepared for the site addressed the identified contamination issues; with the remediation approach documented in the RAP and RAP addenda checked by the auditor and found to be: technically feasible; environmentally justifiable given the nature and extent of the identified contamination; and consistent with relevant laws, policies and guidelines.
- The auditor is satisfied that the requirements of SEPP 55 and DUAP 1998 have been adequately addressed in the site investigation reports, RAP and subsequent RAP addenda.
- The auditor notes that the remediation and validation procedures outlined in the RAP and RAP addenda are considered appropriate to make the site suitable for the proposed uses, subject to the following requirements:
    - A Validation Sampling Analysis and Quality Plan, Work Health and Safety Plan (WHSP), Asbestos Management Plan (AMP) and Emergency Response Procedures for the site must be reviewed and accepted by site auditor prior to commencement of remediation works;
    - The validation report must be reviewed and accepted by a site auditor following successful completion of site remediation/validation and prior to occupation of the site; and
    - A site audit statement (SAS) supported by a site audit report (SAR) confirming site suitability for the proposed use must be issued by the site auditor following successful completion of site remediation/validation and prior to occupation of the site.

11. Limitations

This audit was conducted with a reasonable level of scrutiny, care and diligence on behalf of the client for the purposes outlined in the Contaminated Land Management Act 1997. The data used to support the conclusions reached in this audit were obtained by other consultants and the limitations which apply to the consultant's report(s) apply equally to this audit report.

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 analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were 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 audit 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, JBS&G and the Site Auditor reserve the right to review the report in the context of the additional information, subject to meeting relevant guideline requirements imposed by the EPA.

Appendix A Guidelines made or approved by the EPA

Guidelines made or approved by the EPA (s.105 CLM Act 1997)

Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia (ANZG 2018)

Australian Drinking Water Guidelines, National Health and Medical Research Council and Agriculture and Resource Management Council of Australia and New Zealand, 2011 (NHMRC/NRMMC 2011)

Composite Sampling, Lock, W. H., National Environmental Health Forum Monographs, Soil Series No.3, 1996, SA Health Commission, (NEHF 1996)

Contaminated Sites: Sampling Design Guidelines, NSW EPA, 1995 (EPA 1995)

Contaminated Sites: Guidelines for the Vertical Mixing of Soil on Former Broad-Acre Agricultural Land, NSW EPA, 1995 (EPA 1995b)

Contaminated Sites: 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)

Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites, NSW EPA, 1997 (EPA 1997, reprinted and updated 2011)

Contaminated Sites: Guidelines for Assessing Banana Plantation Sites, NSW EPA, 1997 (EPA 1997b)

Contaminated Sites: Guidelines for Assessing Former Orchards and Market Gardens, NSW EPA, 2005 (EPA 2005)

Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme (3rd Edition), NSW EPA, 2017 (EPA 2017)

Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination, NSW EPA, March 2007 (EPA 2007)

Contaminated Sites: Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997, NSW EPA, June 2009 (EPA 2009)

Environmental Health Risk Assessment: Guidelines for assessing human health risks from environmental hazards, Department of Health and Ageing and EnHealth Council, Commonwealth of Australia, June 2002 (EnHealth 2002)

National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013, National Environment Protection Council (NEPC 2013)

Appendix B Audit Correspondence

Penelope King

From: Andrew Lau
Sent: Friday, 10 August 2018 12:22 PM
To: Jacqueline Hawkins (Health Infrastructure); Penelope King; Andrew Lau
Cc: Sue Folliott
Subject: RE: Soil Sampling SAQP

Hi Jackie,

I've reviewed the revised SAQP and additional comments/responses provided in the email trail below and am satisfied that the audit comments have been addressed.

I have no further comments on the SAQP and am satisfied that it is appropriate for the purpose of the investigations.

Kind regards,
Andrew

Andrew Lau | Managing Director, Accredited Auditor | JBS&G
Sydney | Melbourne | Adelaide | Perth | Brisbane | Canberra | Darwin | Wollongong
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---

From: Jacqueline Hawkins (Health Infrastructure) <Jacqueline.Hawkins@health.nsw.gov.au>
Sent: Friday, 10 August 2018 12:52 PM
To: Andrew Lau <ALau@jbsg.com.au>
Cc: Sue Folliott <sfolliott@tsamanagement.com.au>
Subject: FW: Soil Sampling SAQP

Good afternoon Andrew

Please find attached updated SAQP following your feedback and CV of Matthew Conroy. Please confirm suitability.

Cheers
Jackie

Jackie Hawkins
Project Director | **Health Infrastructure**
0407 624 953| jacqueline.hawkins@health.nsw.gov.au
Level 14, 77 Pacific Highway, North Sydney NSW 2060 | PO Box 1060, North Sydney NSW 2059

From: Sue Folliott [mailto:sfolliott@tsamanagement.com.au]
Sent: Friday, 10 August 2018 12:46 PM
To: Jacqueline Hawkins (Health Infrastructure) <Jacqueline.Hawkins@health.nsw.gov.au>
Subject: FW: Soil Sampling SAQP

As requested – I haven't reviewed as yet

SUE FOLLIOTT
Senior Project Manager
TSA MANAGEMENT
Level 15, Brisbane Club Tower
241 Adelaide Street | Brisbane QLD 4000
T: 02 9276 1400 | **M:** 0456 963 944
W: tsamanagement.com.au | **E:** sfolliott@tsamanagement.com.au

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From: Matthew Conroy <Matthew.Conroy@octief.com.au>
Sent: Friday, 10 August 2018 11:57 AM
To: Sue Folliott <sfolliott@tsamanagement.com.au>
Subject: RE: Soil Sampling SAQP

Hi Sue,

Please find attached the revised SAQP, addressing comments below , some of these comments did not directly relate to the SAQP itself , and responses to these are shown below .

Regards

Matthew Conroy
Principal Environmental Scientist

OCTIEF

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From: Sue Folliott
Sent: Wednesday, 1 August 2018 8:53 AM
To: 'Matthew Conroy' <Matthew.Conroy@octief.com.au>
Subject: RE: Soil Sampling SAQP

Hi Matt,

Apologies for the delay in getting this back to you as I was in meetings all afternoon yesterday.

Please see comments below:

- Please ensure large diameter hand auger (>150mm) is used where samples are being analysed for asbestos, as per relevant guidelines.
- Confirm that >150mm diameter was used
- It may already be the case, but please ensure all samples analysed for volatile compounds are discrete samples and not composite samples, otherwise the data will be invalid.
- Addressed in revised SAQP
- Please ensure GPS co-ordinates are obtained for all sampling locations so that any areas of proposed remediation are able to be accurately recorded and documented in the Remedial Action Plan.
- Addressed in revised SAQP
-
- Please provide evidence that the report reviewer is appropriately qualified and experienced and that the person undertaking the fieldworks is a competent person in relation to asbestos investigations, as per relevant guidance.
- Propose to have report reviewed by certified CEnvP Site contamination specialist . I was onsite for the field works and have attached my short CV as evidence of competence.
- It's unclear whether composite data are to be compared directly against the or against the criteria divided by the number of composite samples as per relevant guidance. Please clarify.
- Addressed in revised SAQP

- Depending on what is identified in the soil investigations, an assessment of contamination migration via groundwater may be required, consistent with relevant guidance and also based on the `high' vulnerability of groundwater identified in the previous report.

-
- As per comment – dependant on what is identified in soil samples . Groundwater sample was collected from one well completed by Geotech at the time of the site works completed.
- The previous report makes mention of additional site historical review being required. Please ensure that the historical information presented in the assessment report meets relevant EPA reporting guidance.
- Octief have completed additional site historical review – will be included in report
- In the absence of a detailed inventory of chemicals stored in the shed(s), please consider the inclusion of a broader VOC suite instead of BTEX (only) for those targeted samples submitted for analyses.
- Addressed in revised SAQP
-
- The assessment report prepared at the end of the investigations should follow relevant reporting guidelines.
- Report will be in accordance with reporting guidelines

If you have any queries, happy to pass them on.

Given we may have restricted access after Friday, are you able to continue to liaise with Leigh to see how you can both meet your priorities?

If you can confirm what day and time you will be onsite so I can let the auditor know?

Thanks
Sue

SUE FOLLIOTT
Senior Project Manager
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From: Matthew Conroy <Matthew.Conroy@octief.com.au>
Sent: Monday, 30 July 2018 3:02 PM
To: Sue Folliott <sfolliott@tsamanagement.com.au>
Subject: Soil Sampling SAQP

Hi Sue,
As discussed, please find attached the Sample Analysis Quality Plan (SAQP).

Regards

Matthew Conroy
Principal Environmental Scientist
OCTIEF

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From: Sue Folliott <sfolliott@tsamanagement.com.au>
Sent: Friday, 27 July 2018 5:08 PM
To: Matthew Conroy <Matthew.Conroy@octief.com.au>
Cc: leigh bexley <lbexley@morrisongeo.com.au>
Subject: RE: Groundwater well Installation and sampling

Hi Matt,
No problem. Talk then
Kind regards
Sue

SUE FOLLIOTT
Senior Project Manager
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241 Adelaide Street | Brisbane QLD 4000
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From: Matthew Conroy <Matthew.Conroy@octief.com.au>
Sent: Friday, 27 July 2018 5:02 PM
To: Sue Folliott <sfolliott@tsamanagement.com.au>
Subject: Groundwater well Installation and sampling

Hi Sue,

As discussed, I have been liaising with Leigh regarding the groundwater wells/piezometers to be installed as part of the geotechnical drilling works. Based on those discussions , Morrisons are proposing to install 2 deep piezometers in the area beneath the future hospital buildings, and two shallow (`3m perched seepage water piezometers only) in the areas of the future hospital carparks. These piezometers will be installed to a standard suitable for environmental sampling if groundwater is present in the wells . It should be noted that it is not known if seepage / perched water is present beneath the site in those areas and consequently the perched water wells may remain dry.

In addition to the above, while the drill rig is onsite, I would like to install a groundwater well on the northern boundary of the cultivated area onsite (near the proposed permeability test holes shown on the geotech drilling location plan. However this would represent an additional borehole on top of what is currently being proposed for the geotech works, and as such could extend the drilling program. I will give you a call to discuss this on Monday.

Regards

Matthew Conroy
Principal Environmental Scientist
OCTIEF

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MAIL TYPE	MAIL NUMBER	REFERENCE NUMBER
General Correspondence	JBS&G-GCOR-000002	TSA-GCOR-000575

Re: Welcome to the Tweed Valley Project

From	Ms Penelope King - JBS&G Australia Pty Ltd
To	Susan Folliott - TSA Management
Cc	Mr Andrew Lau - JBS&G Australia Pty Ltd
Sent	Friday, 2 November 2018

MESSAGE

Hi Sue,

Thanks for providing the revised DSI for review. The revised report broadly satisfies the original auditor comments, and Andrew considers that the additional minor comments which have not been addressed by the consultant will not impact preparation of the SAR.

Andrew requests that the consultant please now proceed to develop a Remedial Action Plan (RAP) to address the contamination identified. It would be appreciated if you are able to let us know when we might receive this document for review to assist us in scheduling appropriate resources.

Don't hesitate to contact Andrew or me should you have any queries.

Kind Regards,
Penelope King
0402 601 151

From: S Folliott
Sent: 30/10/2018 12:22:33 PM AEDT (GMT +11:00)
To: Penelope King
Cc: Andrew Lau
Mail Number: TSA-GCOR-000881
Subject: Re: Welcome to the Tweed Valley Project

Please find attached final contamination report - apologies for not sending through earlier as my understanding was that all comments raised below had been addressed
Report split into three as per DPE requirements for the EIS submission
Kind regards
Sue

From: P King
Sent: 14/09/2018 10:57:18 AM AEST (GMT +10:00)
To: Susan Folliott

Cc: Andrew Lau
Mail Number: JBS&G-GCOR-000001
Subject: Re: Welcome to the Tweed Valley Project

Hi Sue,

Thanks for providing the Tweed Valley DSI for review. On behalf of Andrew Lau, please find below comments regarding the report.

Site Description

- Please provide geographic coordinates for the site.
- Limited information has been provided pertaining to site condition. Additional information should be provided in the revised report (in accordance with the NSW OEH reporting guidelines), including:
  - conditions at site boundary (such as type and condition of fencing, soil stability and erosion);
  - conditions of on-site buildings, roads and other infrastructure; and
  - condition of site surface (e.g. areas of hard stand, condition etc).
- Please provide information relating to both regional and site-specific soil conditions.
- Based on available desktop sources, please provide additional information pertaining to the site-specific and regional hydrogeological setting of the site (e.g. background water quality).
- Please provide a summary of climate information based on Bureau of Meteorology statistics.
- Please identify the nearest surface water body, and potential discharge location for groundwater.
- Hydrogeology – the standing water levels reported in the summary table (in some instances e.g. GW044188) are the approximate water bearing zones, rather than the SWLs as they are provided in the bore search information.

Site History

- Section 4.7 indicates that the property has been owned by the current owners for approximately 30 years, whereas Sections 4.1 and 4.2 state that the current owners purchased the site in 2010. Please confirm which is correct.
- Please include the results of regulatory searches (such as NSW EPA records CLM register and POEO register) and WorkCover dangerous goods records) in the revised report.
- In the revised report, please include a review of heritage information sourced from the Australian Heritage Database and the NSW Heritage Database.

Figures

- Please label relevant features (such as road names, surface water bodies and sensitive receptors) on the site location figure.
- Soil analytical results identified as exceeding adopted assessment criteria should be shown on a figure.

Sampling and Analysis Quality Plan

- Section 6 should specifically reference the SAQP, and include a summary of proposed (as per the auditor reviewed SAQP) versus completed works, with justification for deviations from the SAQP

(e.g. collection of groundwater and surface samples; collection of soils from 50 rather than the proposed 58 locations etc). This should include information pertaining to how many samples (and what type) were collected from each area of environmental concern, and what COPCs the samples were analysed for.

Quality Assurance/Quality Control

- Table 9-1 incorrectly states that all lab duplicate RPDs were within acceptable limits as set by the lab. Work order 611312-S – RPD for nickel was outside the acceptable range.
- Please provide the Sample Receipt Notifications (SRNs) for all laboratory work orders.
- Please provide the quality control reports for work order EB1819257.
- Please provide all relevant bore logs. Only the geotechnical logs and a limited number of environmental logs (HA1, HA2, HA4, HA5 and HA7) have been provided. The coordinates of the investigation locations should be provided on the logs.
- Please provide a calibration certificate for the PID.
- Can any construction details be provided for geotechnical well BH1, from which groundwater sample GW1 was obtained?
- Please provide field records for groundwater well development and sampling activities.
- The rationale provided in Table 9-1 for the identification of zinc in the rinsate collected from the hand auger of being of no significance requires further consideration, as concentrations of zinc were identified in soil samples (not all <LOR as stated).
- Please provide justification for soil triplicate samples (inter-laboratory duplicates) being collected at less than the required frequency (only QC6A and QC8A are included in the tables).
- Please include discussion of RPDs (for soil and groundwater) which did not fall within the nominated acceptable range.
- Section 7.2 – inputs to the decision should include the site inspection and results of historical investigations.

Adopted Assessment Criteria

- Please provide justification for the adoption of the groundwater assessment criteria selected with reference to potential sensitive receptors.
- ANZAST 2018 is incorrectly referenced as ANZECC and ARMCANZ 2018.
- Please provide justification for the adoption of the sediment quality guidelines selected for comparison of samples collected from the farm dam.
- Please document the calculation of site-specific EILs, including tabulation of the laboratory data used (pH, CEC etc).
- Table 1 – analytical results have been compared to HIL-B rather than HIL-A criteria.
- Table 1 – only the ESL values for fine grain soils in urban residential/POS have been applied (ESLs for areas of ecological significance have not).
- Table 1 – it is unclear how the site specific EILs have been calculated, and only the values for urban/residential POS have been applied (ESLs for areas of ecological significance have not).
- Table 2 – ESLs for areas of ecological significance, fine grained soils – the incorrect guideline value for total xylenes has been applied (45 mg/kg rather than 1.6 mg/kg).

- Table 2 – it is unclear how the EILs have been calculated; and it appears that only the urban residential/POS values have been used, rather than both the urban residential/POS and areas of ecological significance values.

Results

- Please update analytical data tables with consideration of the comments regarding adopted assessment criteria, above.
- HA2-0.15 (from main shed) zinc concentration 270 mg/kg exceeds EIL for ecologically significant areas, but has not been highlighted. Is there are reason for this omission? Please check data tables to ensure this has not occurred for other samples and analytes.

Conclusions and Recommendations

As remediation is required/recommended (which the auditor agrees with), the site cannot currently be considered suitable for the proposed development, and the commentary in the conclusions around site suitability must reflect this, as per relevant EPA guidance.

- As the farm dump area has not been fully assessed due to the presence of vegetation, provision for further investigation and/or management of this area should be included in the RAP. Aesthetic factors associated with the farm dump should also be considered.

Don't hesitate to contact Andrew or me should you have any queries.

Kind Regards,
Penelope King
0402 601 151

From: S Folliott
Sent: 10/09/2018 1:56:40 PM AEST (GMT +10:00)
To: Penelope King
Cc: Sagar Mukherjee
Mail Number: TSA-GCOR-000575
Subject: Welcome to the Tweed Valley Project

Kind regards
Sue

Sahani Gunatunge

From: Christine Louie
Sent: Wednesday, 23 January 2019 3:34 PM
To: Sue Folliott
Cc: Andrew Lau; Sahani Gunatunge
Subject: RE: Tweed Valley Hospital Reports

Hi Sue,

Please see below the Auditor's review of the Octief and Cavvanba reports for the Tweed Valley Hospital site.

The following report has been reviewed by the Auditor:

- *Remediation Action Plan, Tweed Valley Hospital Site 771 Cudgen Road, Cudgen, NSW*. Ref: Version 3 J8961, 28 November 2018. (Octief Pty Ltd 2018).

Review of the Remediation Action Plan (RAP) has been undertaken against the requirements of NSW OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites* and the NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Measure 1999*, and the following comments are made:

a) Section 2.1 Site Description – please confirm the lot ID and site boundary for the site. SIX Maps shows 771 Cudgen Road Cudgen as being Lot 11 DP 1246853 and the lot boundary aligning with the concept design plan provided in Appendix C of the RAP.
b) Section 2.3 Zoning – please amend this section and subsequent sections as relevant based on any changes to the site boundary (see Section 2.1 comments).
c) Section 2.5 Site Layout and Significant Features – this section should be updated to include the shed demolition documented in Cavvanba (2019a).
d) Section 4 Relevant Guidelines and Legislation – the consultant should discuss and demonstrate that the relevant requirements of SEPP 55 and Department of Planning and Urban Affairs (1998) Planning *Guidelines SEPP 55 – Remediation of Land* are met.
e) Section 4.3 State Legislation and Guidelines – the Guidelines for Consultants Reporting on Contaminated Sites (OEH 2011) and Guidelines for NSW Site Auditor Scheme (2nd edition) (NSW DEC 2007) have been updated. Please amend the references.
f) Section 6 Remedial Options Assessment – this section evaluates various remedial options without having clearly identified the remediation goals in the RAP. While the extent of site contamination has been discussed in Section 3.3 Site Suitability, the extent of the area requiring remediation has not been clearly defined. Please define the remediation area and goals prior to assessment of appropriate remediation options, noting that vertical mixing and soil washing are not relevant remediation options. Reference should be made to WA DoH (2009) for additional guidance on remediation and management of asbestos.
g) Section 6.2.1 Preferred Remedial Option – please define the remedial goal (see above comment).
h) Section 7.1 Preliminaries – the AMP should be prepared in conjunction with the environmental consultant and reviewed by the Site Auditor.
i) Section 7.4 Removal of ACM and Validation of Excavation – please define the extent of the remediation area (see earlier comment). WA DoH (2009) recommends the removal of an extra 1m in all directions beyond the contaminated area and an additional 30 cm depth – a minimum excavation depth of 0.2m does not meet WA DoH guidance. It is noted that Figure 3 shows an 'indicative remediation area' on an aerial photograph that has not been discussed in the text of the RAP. Remediation and validation of asbestos impacted areas should be undertaken by a suitably qualified person as defined in WA DoH (2009) i.e '*environmental consultants supervised by a lead consultant with appropriate asbestos credentials and a minimum of 3 years continuous experience with asbestos contamination and relevant tertiary qualifications*'.

j) Section 9 Data Quality Objectives – without clear identification of the remediation extent and goal, the DQOs have therefore not been properly defined for the proposed site remediation works. Please review and amend. Refer to NEPM Schedule B2 for guidance on the DQO process.
k) Section 10.2 Soil Validation Plan – as the remediation extent has not been clearly defined, it is unclear whether the nominated number of validation samples are sufficient. Further detail on the soil sampling process for asbestos is required.
l) Section 10.4 Validation of Imported Fill – for any non pre-classified or non-certified VENM/ENM imported to site, the minimum sampling frequency requirement should be the greater of, five samples per source or 1 sample per 100 m^3.
m) Section 10.6 Unexpected Finds Protocol – an outline of a contingency plan or unexpected finds protocol should be provided including but not limited to encountering increased asbestos contamination.
n) Other details required in a RAP as per NSW OEH (2011) including site management plans and remediation schedule have not been included. Please amend the RAP.

The following report has been reviewed by the Auditor:

- *Soil Investigation Report – Farm Shed 771 Cudgen Road, Cudgen, NSW*. Ref: 18084 R03, January 2019. (Cavvanba Consulting Pty Ltd 2019a).

Review of the Soil Investigation Report has been undertaken against the requirements of NSW OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites* and the NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Measure 1999*, and the following comments are made:

a) Section 1.4 Scope of Work - the consultant should discuss and demonstrate that the relevant requirements of SEPP 55 and Department of Planning and Urban Affairs (1998) Planning *Guidelines SEPP 55 – Remediation of Land* are met.
b) Section 9.1 Asbestos is Soil Discussion - the assessment of asbestos impact was undertaken via targeted testpit locations rather than grid-based with the maximum depth of investigation of 0.3 m at one location only. Analysis was also limited to presence/absence only with no quantification of asbestos fibres from 500 mL soil sampling in accordance with the requirements of WA DoH (2009). The extent of asbestos impact as discussed in this section can therefore not be considered to be delineated with the limited assessment.

The following report has been reviewed by the Auditor:

- *Remediation Action Plan Addendum – Farm Shed 771 Cudgen Road, Cudgen, NSW*. Ref: 18084 R04, January 2019. (Cavvanba Consulting Pty Ltd 2019b).

Review of the Remediation Action Plan (RAP) has been undertaken against the requirements of NSW OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites* and the NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Measure 1999*, and the following comments are made:

a) Section 1.2 Background – refer comments on Cavvanba (2019a) and delineation of asbestos impact.
b) Section 2.6 Previous Investigation – refer comments on Cavvanba (2019a) and amend as appropriate.
c) Section 3 Remediation Criteria – the rationale for the adopted remediation criteria for the remediation area should address the appropriateness of the criteria for the proposed land use for the site as a hospital.
d) Section 3.2 Waste – soil data from Cavvanba (2019a) may be used for waste classification in conjunction with additional sampling of soil to be disposed of off-site.
e) Section 4.3 Lateral and Vertical Extent – the extent of asbestos impact was not clearly delineated in Cavaanba (2019a). Refer comments on Cavvanba (2019a) and amend remediation extent accordingly.
f) Section 5 Regulatory Requirements - the consultant should discuss and demonstrate that the relevant requirements of SEPP 55 and Department of Planning and Urban Affairs (1998) Planning *Guidelines SEPP 55 – Remediation of Land* are met.
g) Section 6.2.3 Removal – refer to previous comments on delineation of asbestos impact and amend accordingly.

h) Section 7.1 Validation Works – validation sampling of the excavated area should be in accordance with WA DoH (2009) i.e. at least 1 sample from each wall per 5 m length with the floor sampled at twice the minimum density as required. Sampling and analytical requirements should be provided.

The following report has been reviewed by the Auditor:

- *Soil Investigation Report – Residential House 771 Cudgen Road, Cudgen, NSW*. Ref: 18084 R01, December 2018. (Cavvanba Consulting Pty Ltd 2018a).

Review of the Soil Investigation Report has been undertaken against the requirements of NSW OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites* and the NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Measure 1999*, and the following comments are made:

a) Section 1.4 Scope of Work - the consultant should discuss and demonstrate that the relevant requirements of SEPP 55 and Department of Planning and Urban Affairs (1998) Planning *Guidelines SEPP 55 – Remediation of Land* are met.
a) Section 5.1 Contaminants of Concern – was asbestos considered as a contaminant for the residence? The presence of anthropogenic materials underneath the residence and demolition waste from a previous residence are potential sources of asbestos.
b) Section 5.3 Relevant Soil Environmental Criteria – please provide the rationale for the adopted assessment criteria.
c) Section 9.1 Lead – the extent of the area (horizontally and vertically) impacted by lead and requiring remediation is not clear.

The following report has been reviewed by the Auditor:

- *Remediation Action Plan Addendum – Residential House 771 Cudgen Road, Cudgen, NSW*. Ref: 18084 R02, December 2018b. (Cavvanba Consulting Pty Ltd 2018b).

Review of the Remediation Action Plan (RAP) has been undertaken against the requirements of NSW OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites* and the NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Measure 1999*, and the following comments are made:

a) Section 2.5.4 Discussion and Recommendations – Refer to comments on extent of lead impact (Cavvanba 2018a) and amend accordingly.
b) Section 5 Regulatory Requirements - the consultant should discuss and demonstrate that the relevant requirements of SEPP 55 and Department of Planning and Urban Affairs (1998) Planning *Guidelines SEPP 55 – Remediation of Land* are met.
c) Section 8.6 Unexpected Finds – based on the anthropogenic materials present underneath the residence, the management of unexpected finds should include provision for involvement of the environmental consultant to determine the appropriate course of action.

Regards,
Christine

Christine Louie | Principal | JBS&G
Sydney | Melbourne | Adelaide | Perth | Brisbane | Canberra | Darwin | Wollongong
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MAIL TYPE	MAIL NUMBER	REFERENCE NUMBER
General Correspondence	JBS&G-GCOR-000005	TSA-GCOR-001679

Re: PRIVILEGED AND CONFIDENTIAL:Cavvanba reports

From	Mr Andrew Lau - JBS&G Australia Pty Ltd
To	Susan Folliott - TSA Management
Cc (6)	Mr Simon Waterworth - GeoLINK
	Mr Jacob Sickinger - GeoLINK
	Ms Jacqueline Hawkins - Health Infrastructure
	Ms Penelope King - JBS&G Australia Pty Ltd
	Alyssa Muche - TSA Management
	Alison Tham - TSA Management
Sent	Friday, 25 January 2019

MESSAGE

Sue,
I have reviewed the revisions/responses and am satisfied that my previous audit comments have been addressed. I have no further comments on these reports.
Andrew

Andrew Lau | Managing Director, Accredited Auditor | JBS&G
Sydney | Melbourne | Adelaide | Perth | Brisbane
Level 1, 50 Margaret Street Sydney NSW 2000
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Contaminated Land | Groundwater Remediation | Auditing and Compliance | Assessments and Approvals | Occupational Hygiene and Monitoring

From: S Folliott
Sent: 24/01/2019 10:50:03 PM AEDT (GMT +11:00)
To: Andrew Lau
Cc: Jacob Sickinger, Simon Waterworth, Jacqueline Hawkins, Penelope King, Alyssa Muche, Alison Tham
Mail Number: TSA-GCOR-001679
Subject: PRIVILEGED AND CONFIDENTIAL:Cavvanba reports

Hi Andrew,
Please find attached updated Cavvanba reports for your review and comment.
Octief to follow.
Can you please advise if there are any further updates required or if these are accepted for inclusion with the Submission Report.
Kind regards
Sue

From: Ben Wackett <ben@cavvanba.com>
Sent: Friday, 1 February 2019 9:17 AM
To: Tony Jackman <Tony.Jackman@woollamconstructions.com.au>
Cc: Rob McLelland <rob@cavvanba.com>; Glen Chisnall <glen@cavvanba.com>
Subject: FW: 771 Cudgen Creek Road, Unexpected find

Hi Tony,

As discussed, appropriate interim measures for this area would include:

- Fencing to restrict access
- Make the pit safe. i.e. cover the void.
- Tidy the area. The red sands (appears like sand blasting garnet sands), and blue powder (like copper), and any other wastes such as the brake pads, spark plugs, mechanical parts should be collected and placed into containers to avoid exposure/spills.
- Unlike the former residential house, I do not recommend covering the area with geofabric or gravel. The area appears to be relatively stable, with topsoil, leaf litter, tree cover, and minimal slope. Significant erosion and dust generation is unlikely to occur. As a precaution, some sediment controls may be appropriate, such as sediment fencing.
- The area should otherwise remain undisturbed until the investigation can take place. Field observations are critical to successful investigation, and location of structures and surface staining are primary considerations.

Regards

Ben Wackett
Principal Environmental Scientist – Contaminated Land

NSW Site Auditor
QLD Contaminated Land Auditor
Licensed Asbestos Assessor

Cavvanba Consulting Pty Ltd

T (02) 6685 7811 I F (02) 6685 5083 I M 0488 225 692 I www.cavvanba.com
1/66 Centennial Circuit I PO Box 2191 I Byron Bay NSW 2481

When sending large electronic reports and/or files, you can also use Cavvanba Consulting's secure internet-based file delivery system located at Cavvanba Consulting DropBox. In "subject", please include client and site name.

From: Ben Wackett <ben@cavvanba.com>
Sent: Tuesday, 29 January 2019 4:51 PM
To: 'Tony Jackman' <Tony.Jackman@woollamconstructions.com.au>
Cc: Rob McLelland <rob@cavvanba.com>; Glen Chisnall <glen@cavvanba.com>
Subject: 771 Cudgen Creek Road, Unexpected find

Hi Tony,

As discussed, the purpose of this email is to provide some recommendations regarding the unexpected find I inspected today (29/01/19).

- Located between the former farm shed and the former residential house
- Concrete structures, including a pit, a ramp, a concrete drip pad, and an infilled pit.
- Small quantities of liquids and wastes are present. Including brake pads, spark plugs, a blue powder, red/purple sand, oil staining, and mechanical parts.

It is possible that the structure is a former dip, based on the drip pad which leads to a potential infilled race. However, its construction and layout does not appear to be consistent with a typical cattle tick dip constructed/decommissioned by Dept Agriculture. It is therefore possible it is a private dip, and therefore unlikely to have been recorded.

The wastes are currently accessible, and exposed to rainfall, runoff and wind erosion.

It is recommended that the area is fenced and controlled to prevent disturbance and erosion until a determination can be made regarding its nature. It is recommended that sampling of soil is undertaken for a range of potential contaminants.

Happy to discuss.

Ben Wackett
Principal Environmental Scientist – Contaminated Land

NSW Site Auditor
QLD Contaminated Land Auditor
Licensed Asbestos Assessor

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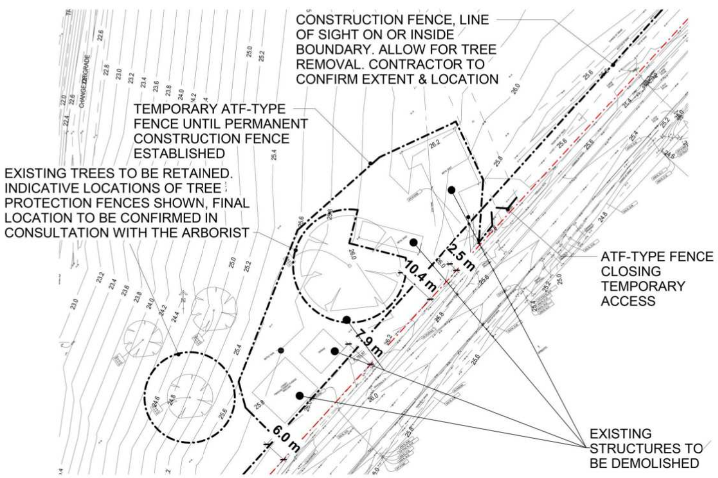
Appendix C Site Plans

1 PRELIMINARY WORKS CDC SITE PLAN
SCALE 1 : 1000



2 PRELIMINARY WORKS - EXISTING BUILDINGS AND TREES DETAILS
SCALE 1 : 500

KEY PLAN

N

REV	DESCRIPTION	DRN	DATE
1	ISSUED FOR INFORMATION	SH	31/10/2018
2	ISSUED FOR INFORMATION	SH	02/11/2018

LEGEND
SITE BOUNDARY
CONSTRUCTION FENCE

DIMENSIONS
USE FIGURED DIMENSIONS, DO NOT SCALE. CONTRACTORS MUST VERIFY ALL DIMENSIONS ON THE SITE BEFORE COMMENCING ANY WORK OR MAKING ANY SHOP DRAWING WHICH MUST BE SUBMITTED AND REVIEWED BEFORE MANUFACTURE.

FIXTURES, FITTINGS & EQUIPMENT SPECIFICATIONS
SUBSTITUTE FF&E EQUIPMENT SPECIFICATIONS
THE FIT-OUT DESIGN AND DOCUMENTATION HAS BEEN COMPLETED ON THE BASIS OF FF&E AND EQUIPMENT ADVISED TO THIS OFFICE AT THE TIME OF BRIEFING THE DESIGN. THE DESIGN PROVISIONS FOR FF&E AND EQUIPMENT INCORPORATES SPATIAL ALLOCATIONS, SERVICING, LOADING AND ACCESS CLEARANCES AND WHERE APPROPRIATE SERVICES REQUIREMENTS, HAVING DUE REGARD FOR SURROUNDING FIXTURES AND FITTINGS. IT SHOULD BE NOTED THAT SUBSTITUTE FF&E OR EQUIPMENT WITH ALTERNATE SPECIFICATIONS SHOULD NOT BE PROCURED PRIOR TO VALIDATING THOSE SPECIFICATIONS AGAINST THE ITEM CONTROL SCHEDULE AND DESIGN PROVISIONS IN THE MODEL. THIS OFFICE ACCEPTS NO RESPONSIBILITY FOR THE PROCUREMENT OF SUBSTITUTE FF&E AND EQUIPMENT WHICH HAS NOT BEEN REVIEWED AND VALIDATED AGAINST THE ORIGINAL DESIGN PROVISIONS.

SERVICE POINTS DISCLAIMER
THE SERVICE POINTS IDENTIFIED ON THESE DRAWINGS HAVE BEEN OVERLAYED FROM THE BUILDING SERVICES ENGINEERING MODEL, AND ARE PROVIDED FOR INFORMATION AND SET-OUT PURPOSES ONLY. WE HAVE BEEN ADVISED BY THE SERVICES ENGINEERS THAT THE POINTS REPRESENTED ON THESE DRAWINGS ARE CORRECT AT THE TIME OF PUBLICATION. THIS OFFICE DOES NOT WARRANT THE ACCURACY OF THIS DATA. REFER TO THE BUILDING SERVICES ENGINEERING DOCUMENTATION FOR THE INSTALLATION OF THE SERVICES POINTS, AND THE INTERFACE BETWEEN THE SERVICES POINTS AND THE RESPECTIVE ENGINEERING SYSTEMS.

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PROJECT MANAGER
TSA MANAGEMENT

CLIENT
NSW GOVERNMENT | Health Infrastructure | Health Northern NSW Local Health District

PROJECT
TWEED VALLEY HOSPITAL

DRAWING TITLE
PRELIMINARY WORKS CDC SITE PLAN

SCALE	DATE	DRAWN BY	CHECKED
As indicated@A0	2/11/18	SH	AB

PROJECT No.	DRAWING No.	REVISION
10363.00	AR-DWG-10-101	2

NOTES

LANDSCAPE INDICATIVE ONLY - REFER LANDSCAPE ZONAL PLAN L-MP-12

LEGEND

- SITE BOUNDARY
- MAXIMUM PLANNING ENVELOPE
- TREE TRUNK LINE
- APZ OFFSETS
- PROBABLE MAXIMUM FLOOD LEVEL
- INDICATIVE BUILDING ENTRIES

N

DIMENSIONS

USE FIGURED DIMENSIONS, DO NOT SCALE. CONTRACTORS MUST VERIFY ALL DIMENSIONS ON THE SITE BEFORE COMMENCING ANY WORK OR MAKING ANY SHOP DRAWING WHICH MUST BE SUBMITTED AND REVIEWED BEFORE MANUFACTURE.

FIXTURES, FITTINGS & EQUIPMENT SPECIFICATIONS

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SERVICE POINTS DISCLAIMER

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email natalie@sth.com.au

PROJECT MANAGER

TSA MANAGEMENT

CLIENT

NSW GOVERNMENT Health Infrastructure | Health Northern NSW Local Health District

PROJECT

TWEED VALLEY HOSPITAL
771 Cudgen Road, Cudgen

DRAWING TITLE

MASTERPLAN
CONCEPT PLAN

SCALE	DATE	DRAWN BY	CHECKED
1:2500 @ A3	19/09/2018	CE	MH

PROJECT No	DRAWING No	REVISION
10363	AR-SKE-10-006	04

Appendix D Consultant's Figures

LEGEND

Site Boundary

0 125 250 375m

REV	DESCRIPTION	DATE	INT	APP
1		04/7/2018	MO	RJ

OCTIEF

CLIENT: Health Infrastructure NSW

PROJECT TITLE: Tweed Hospital PSI/DSI

SITE ADDRESS: 771 Cudgen Road, Cudgen

DRAWING TITLE: Site Location

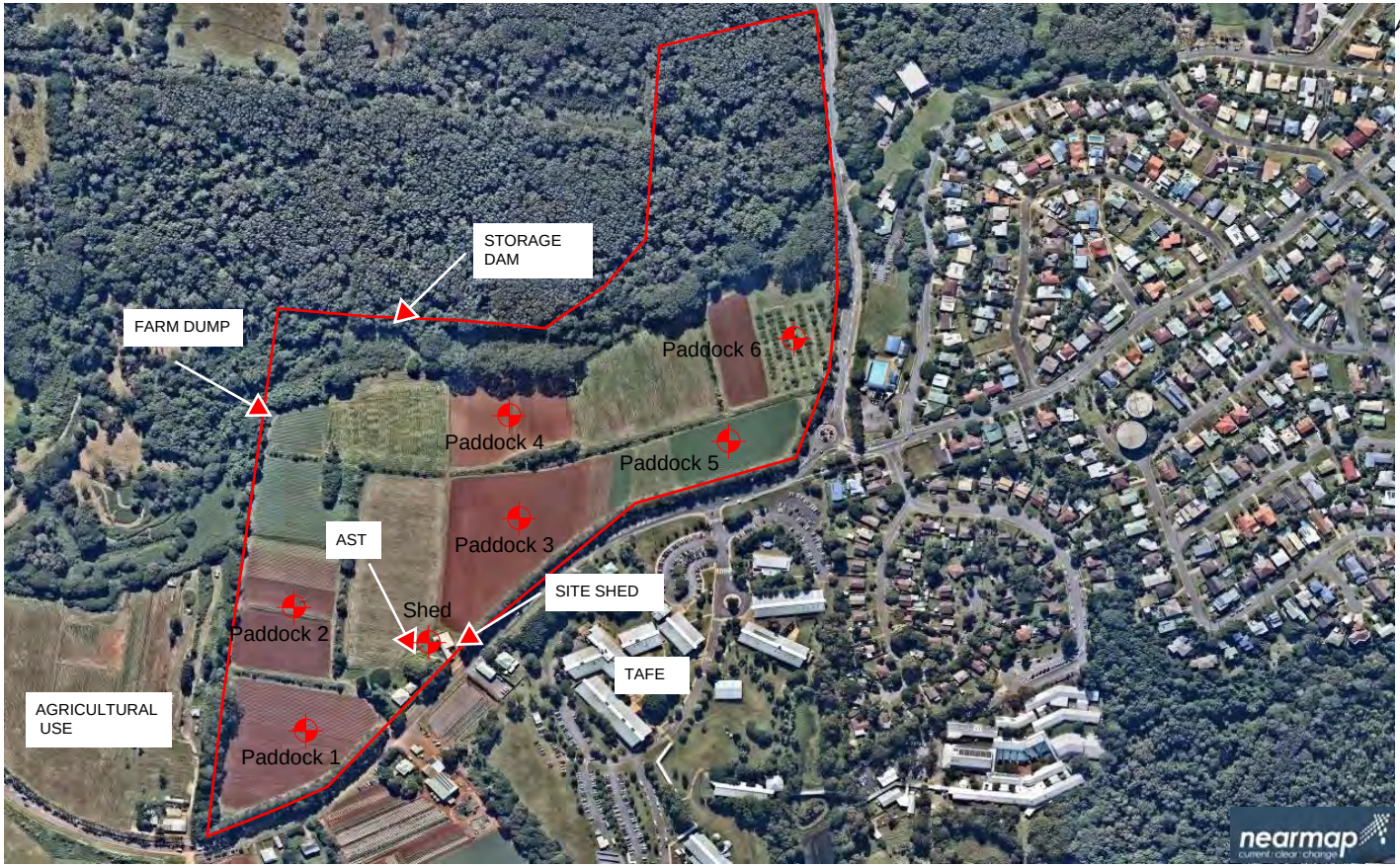
DESIGNED: | DRAWN:

CHECKED: | No. SHEETS:

SCALE: | DATE STARTED:

JOB No: J8961

DRAWING No: 1



LEGEND

Sampling locations - PSI
Site Inspection (14/6/2018)

Site Boundary

0 75 150m

REV	DESCRIPTION	DATE	INT	APP
1		04/4/2016	MO	RJ

OCTIEF

CLIENT:	Health Infrastructure NSW
PROJECT TITLE:	Tweed Hospital PSI/DSI
SITE ADDRESS:	771 Cudgen Road, Cudgen
DRAWING TITLE:	Areas of Potential Environmental Concern
DESIGNED:	
DRAWN:	
CHECKED:	
No. SHEETS:	
SCALE:	
DATE STARTED:	
JOB No:	J8961
DRAWING No:	2

REV	DESCRIPTION	DATE	INT	APP
1		04/4/2016	MO	RJ

OCTIEF

CLIENT:	Health Infrastructure NSW
PROJECT TITLE:	Tweed Hospital PSI/DSI
SITE ADDRESS:	771 Cudgen Road, Cudgen
DRAWING TITLE:	DSI Sampling Locations
DESIGNED:	
DRAWN:	
CHECKED:	
No. SHEETS:	
SCALE:	
DATE STARTED:	
JOB No:	J8961
DRAWING No:	3

REV	DESCRIPTION	DATE	INT	APP
1		04/4/2016	MO	RJ

OCTIEF

CLIENT:	Health Infrastructure NSW
PROJECT TITLE:	Tweed Hospital PSI/DSI
SITE ADDRESS:	771 Cudgen Road, Cudgen
DRAWING TITLE:	Sample locations exceeding investigation guidelines

DESIGNED:	DRAWN:
CHECKED:	No. SHEETS:
SCALE:	DATE STARTED:
JOB No:	J8961
DRAWING No:	4

0 75 150m

LEGEND

Monitoring well GW1

SED01 Sediment Sample

WS01 Surface Water Sample

Site Boundary

REV	DESCRIPTION	DATE	INT	APP
1		04/4/2016	MO	RJ

OCTIEF

CLIENT:	Health Infrastructure NSW
PROJECT TITLE:	Tweed Hospital PSI/DSI
SITE ADDRESS:	771 Cudgen Road, Cudgen
DRAWING TITLE:	Groundwater and Surface Water Samples
DESIGNED:	
DRAWN:	
CHECKED:	
No. SHEETS:	
SCALE:	
DATE STARTED:	
JOB No:	J8961
DRAWING No:	5

LEGEND

REV	DESCRIPTION	DATE	INT	APP
1		04/4/2016	MO	RJ

OCTIEF

CLIENT:	Health Infrastructure NSW
PROJECT TITLE:	Tweed Hospital - RAP
SITE ADDRESS:	771 Cudgen Road, Cudgen
DRAWING TITLE:	Site Location

DESIGNED:	DRAWN:
CHECKED:	No. SHEETS:
SCALE:	DATE STARTED:
JOB No:	J8961
DRAWING No:	1

REV	DESCRIPTION	DATE	INT	APP
1		04/4/2016	MO	RJ

OCTIEF

CLIENT:	Health Infrastructure NSW
PROJECT TITLE:	Tweed Hospital RAP
SITE ADDRESS:	771 Cudgen Road, Cudgen
DRAWING TITLE:	DSI Sampling Locations

DESIGNED:	DRAWN:
CHECKED:	No. SHEETS:
SCALE:	DATE STARTED:
JOB No:	J8961
DRAWING No:	2

REV	DESCRIPTION	DATE	INT	APP
1		04/4/2016	MO	RJ

OCTIEF

CLIENT:	Health Infrastructure NSW
PROJECT TITLE:	Tweed Hospital RAP
SITE ADDRESS:	771 Cudgen Road, Cudgen
DRAWING TITLE:	Remediation Area

DESIGNED:	DRAWN:
CHECKED:	No. SHEETS:
SCALE:	DATE STARTED:
JOB No:	J8961
DRAWING No:	3

REV	DESCRIPTION	DATE	INT	APP
1		04/4/2016	MO	RJ

OCTIEF

CLIENT:	Health Infrastructure NSW
PROJECT TITLE:	Tweed Hospital RAP
SITE ADDRESS:	771 Cudgen Road, Cudgen
DRAWING TITLE:	Indicative Data Gap Investigation Area

DESIGNED:	DRAWN:
CHECKED:	No. SHEETS:
SCALE:	DATE STARTED:
JOB No:	J8961
DRAWING No:	4

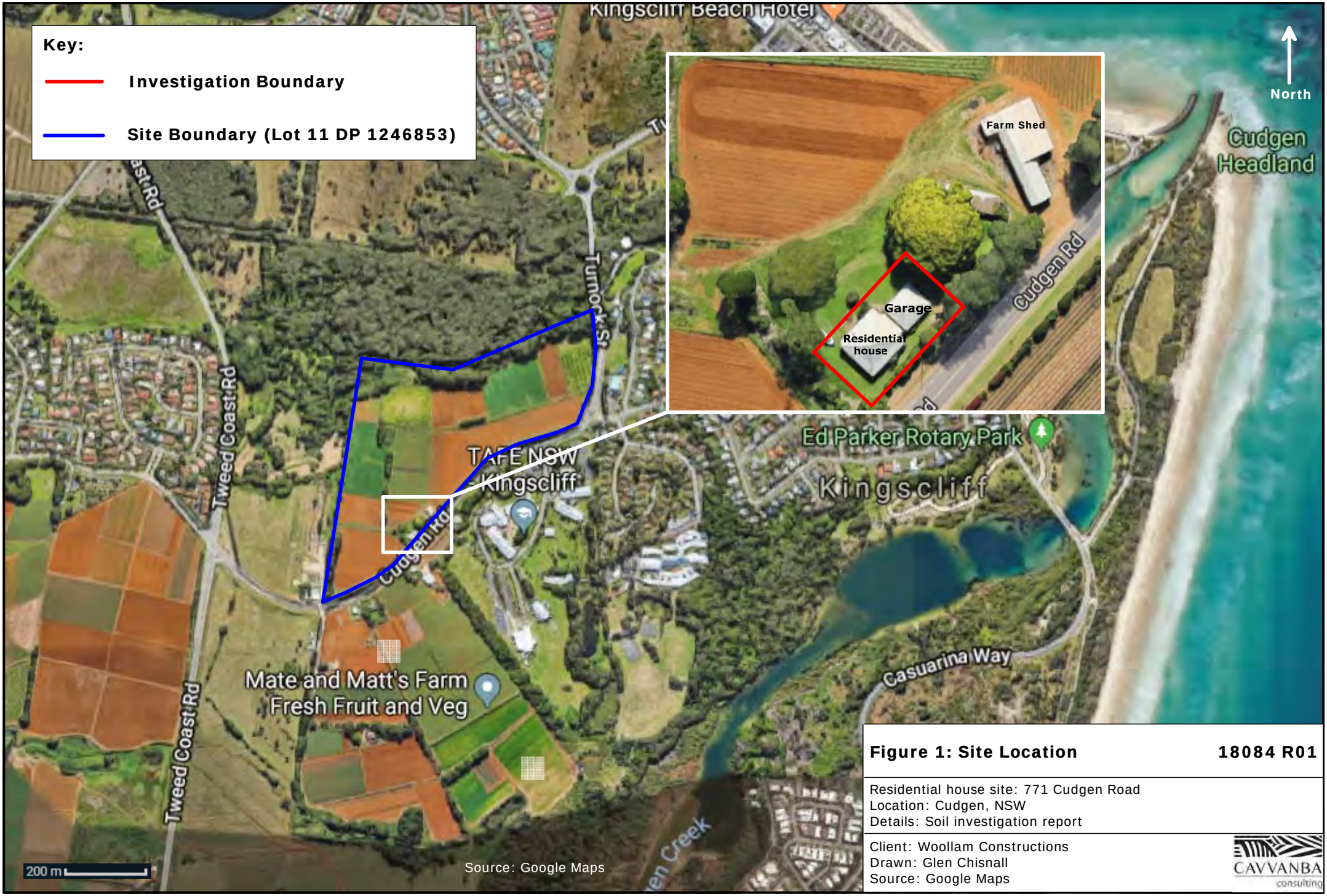


Figure 1: Site Location **18084 R01**

Residential house site: 771 Cudgen Road
Location: Cudgen, NSW
Details: Soil investigation report

Client: Woollam Constructions
Drawn: Glen Chisnall
Source: Google Maps

CAVVANBA consulting

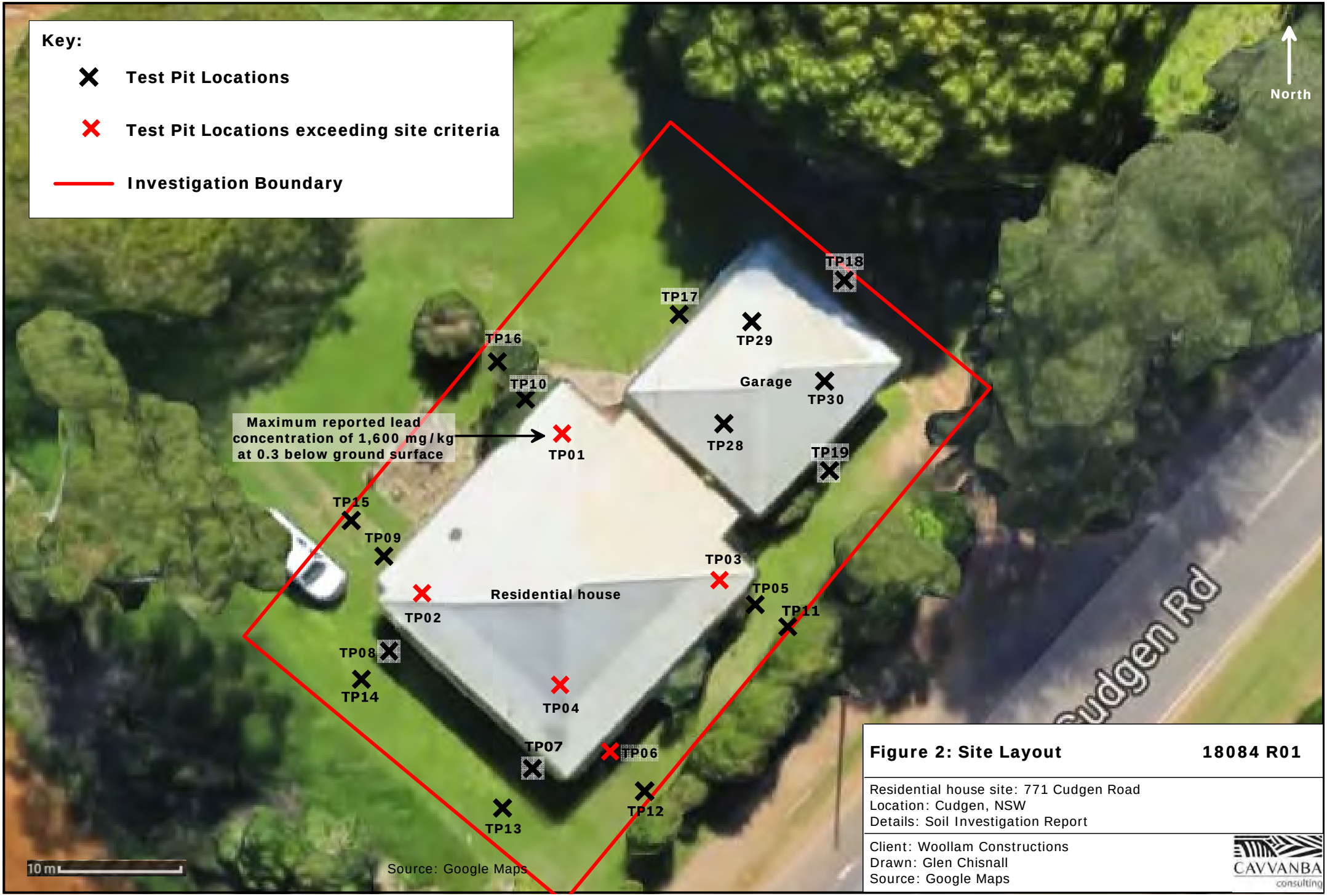


Figure 2: Site Layout **18084 R01**

Residential house site: 771 Cudgen Road
Location: Cudgen, NSW
Details: Soil Investigation Report

Client: Woollam Constructions
Drawn: Glen Chisnall
Source: Google Maps

CAVVANBA consulting

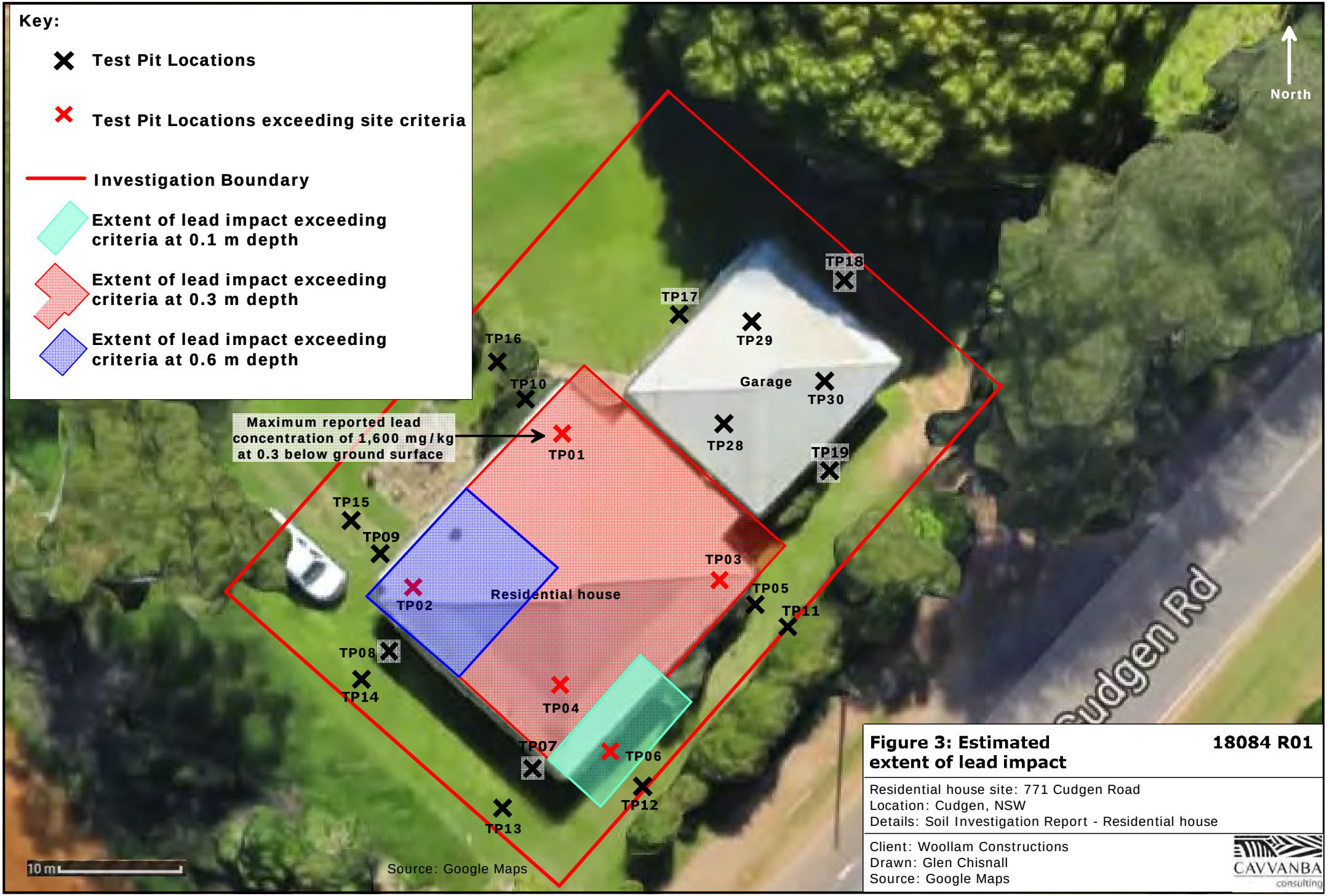


Figure 3: Estimated extent of lead impact **18084 R01**

Residential house site: 771 Cudgen Road
Location: Cudgen, NSW
Details: Soil Investigation Report - Residential house

Client: Woollam Constructions
Drawn: Glen Chisnall
Source: Google Maps

CAVVANBA consulting

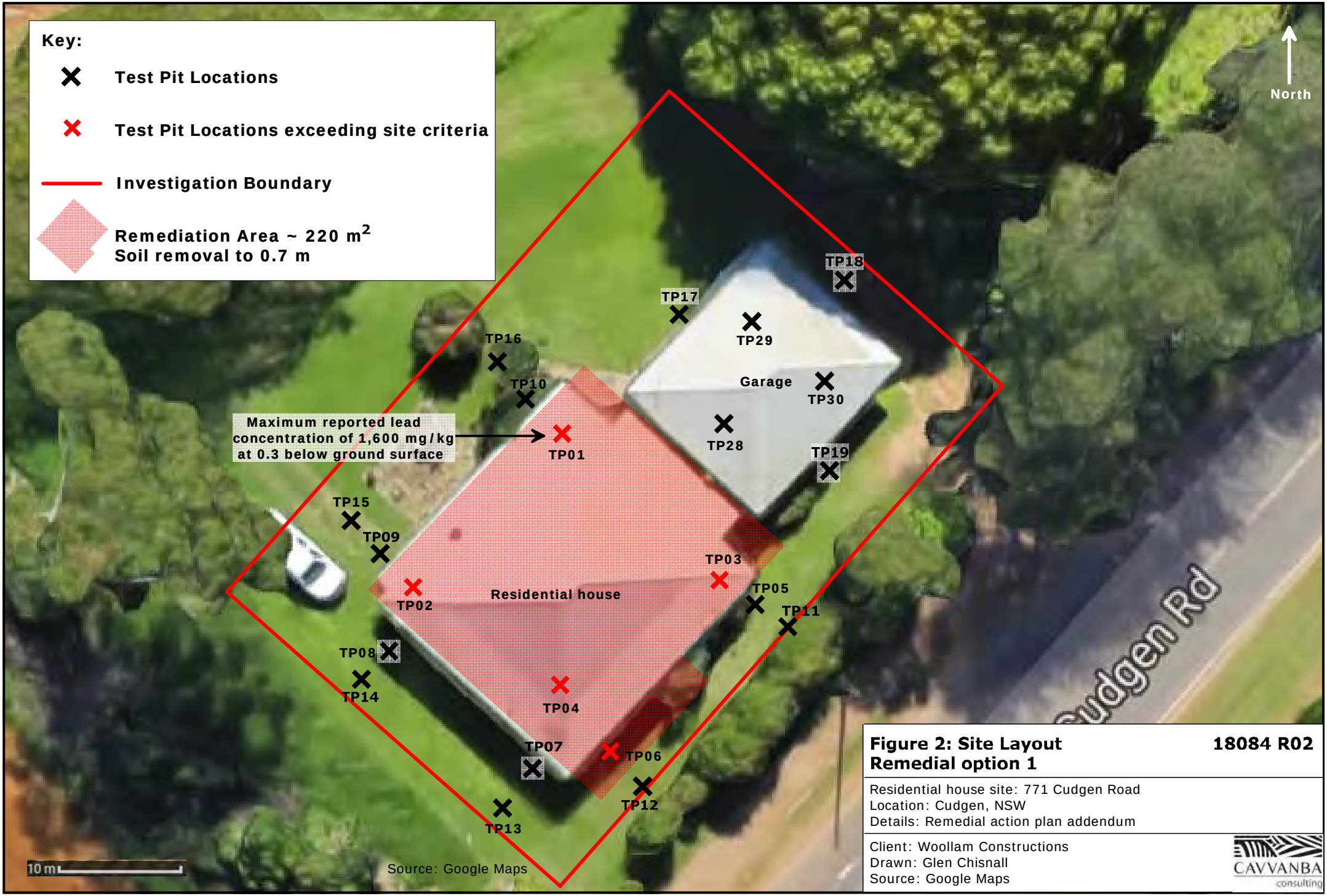


Figure 2: Site Layout **18084 R02**
Remedial option 1

Residential house site: 771 Cudgen Road
Location: Cudgen, NSW
Details: Remedial action plan addendum

Client: Woollam Constructions
Drawn: Glen Chisnall
Source: Google Maps

CAVVANBA consulting

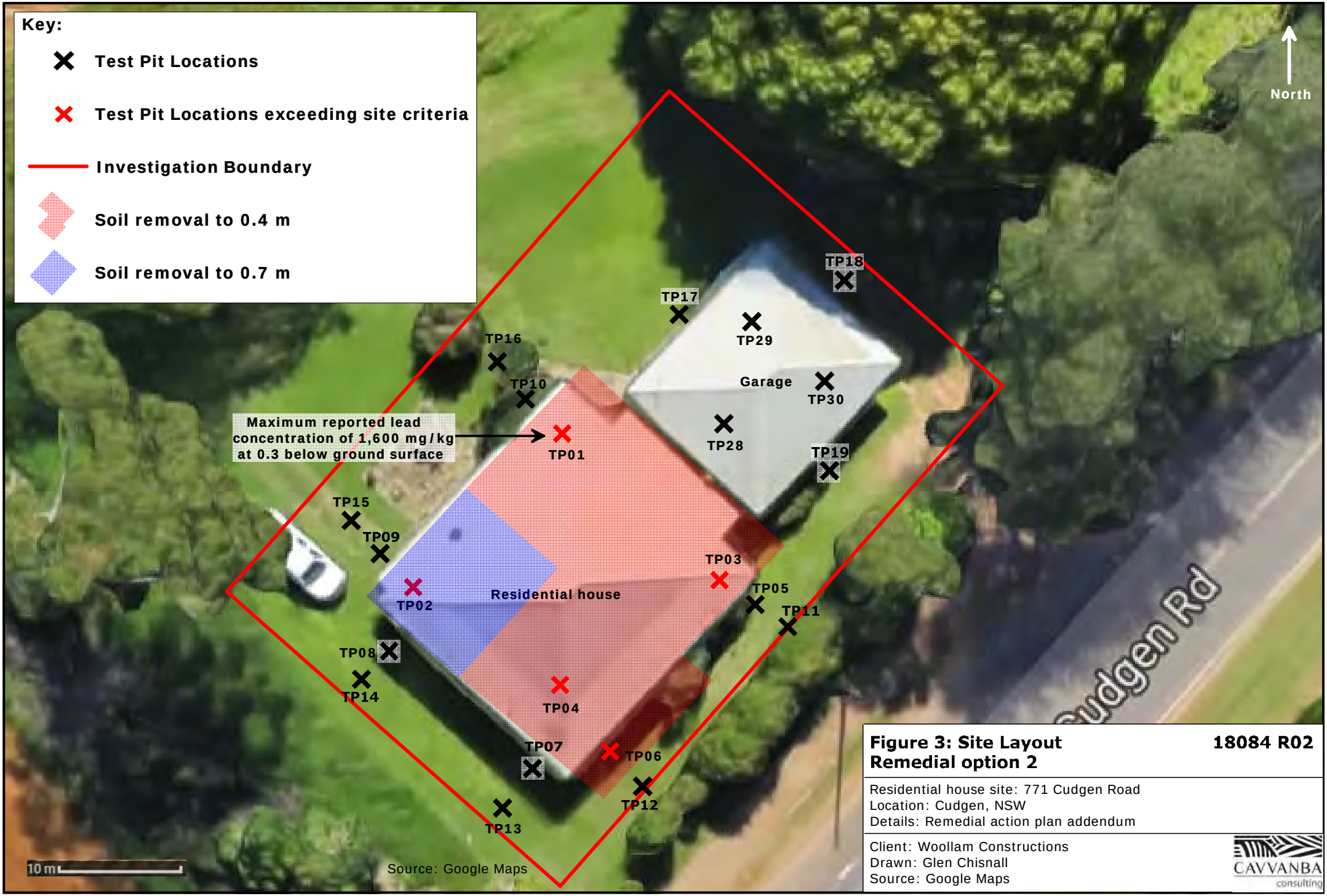


Figure 3: Site Layout **18084 R02**
Remedial option 2

Residential house site: 771 Cudgen Road
Location: Cudgen, NSW
Details: Remedial action plan addendum

Client: Woollam Constructions
Drawn: Glen Chisnall
Source: Google Maps

CAVVANBA consulting

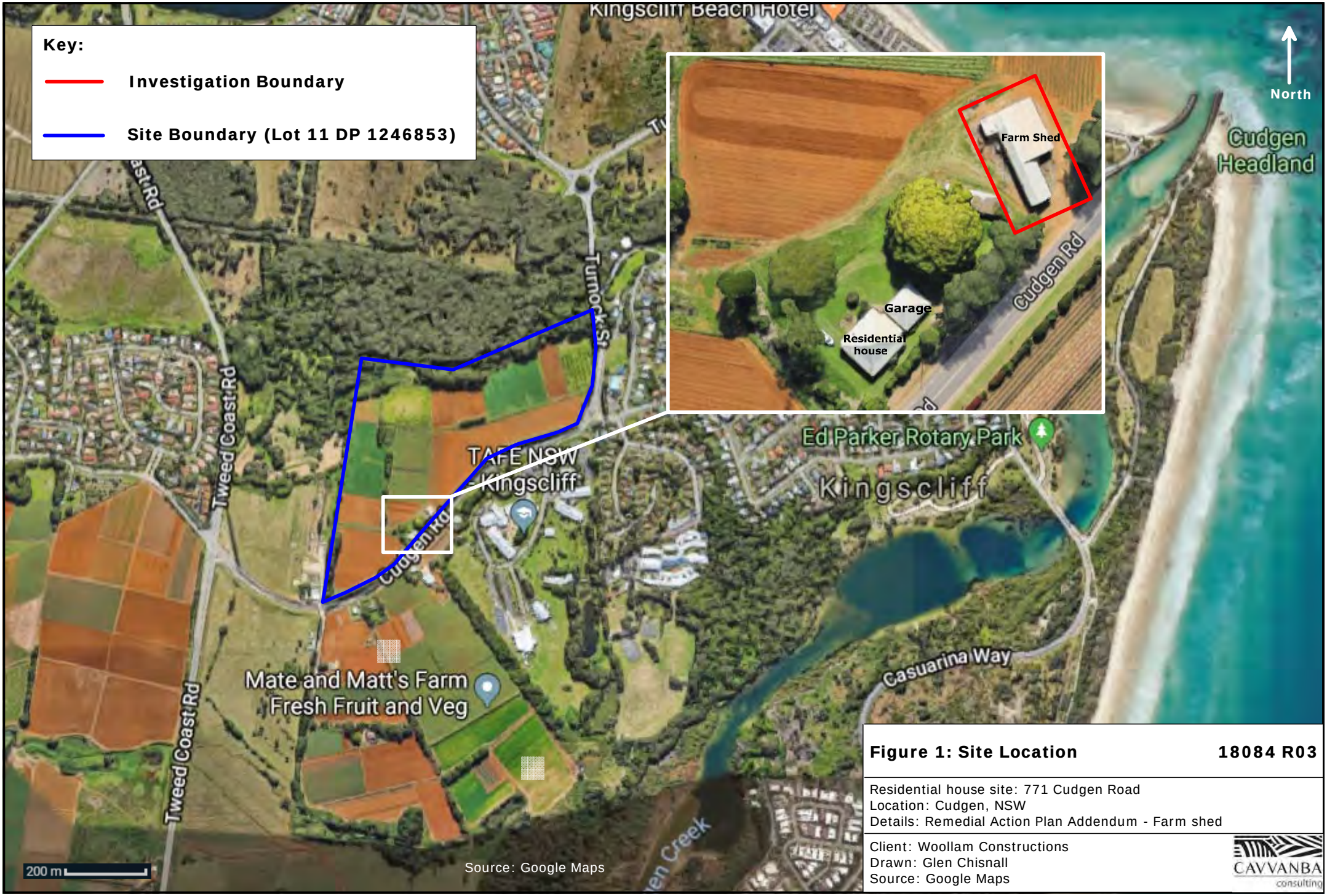


Figure 1: Site Location **18084 R03**

Residential house site: 771 Cudgen Road
Location: Cudgen, NSW
Details: Remedial Action Plan Addendum - Farm shed

Client: Woollam Constructions
Drawn: Glen Chisnall
Source: Google Maps

CAVVANBA consulting

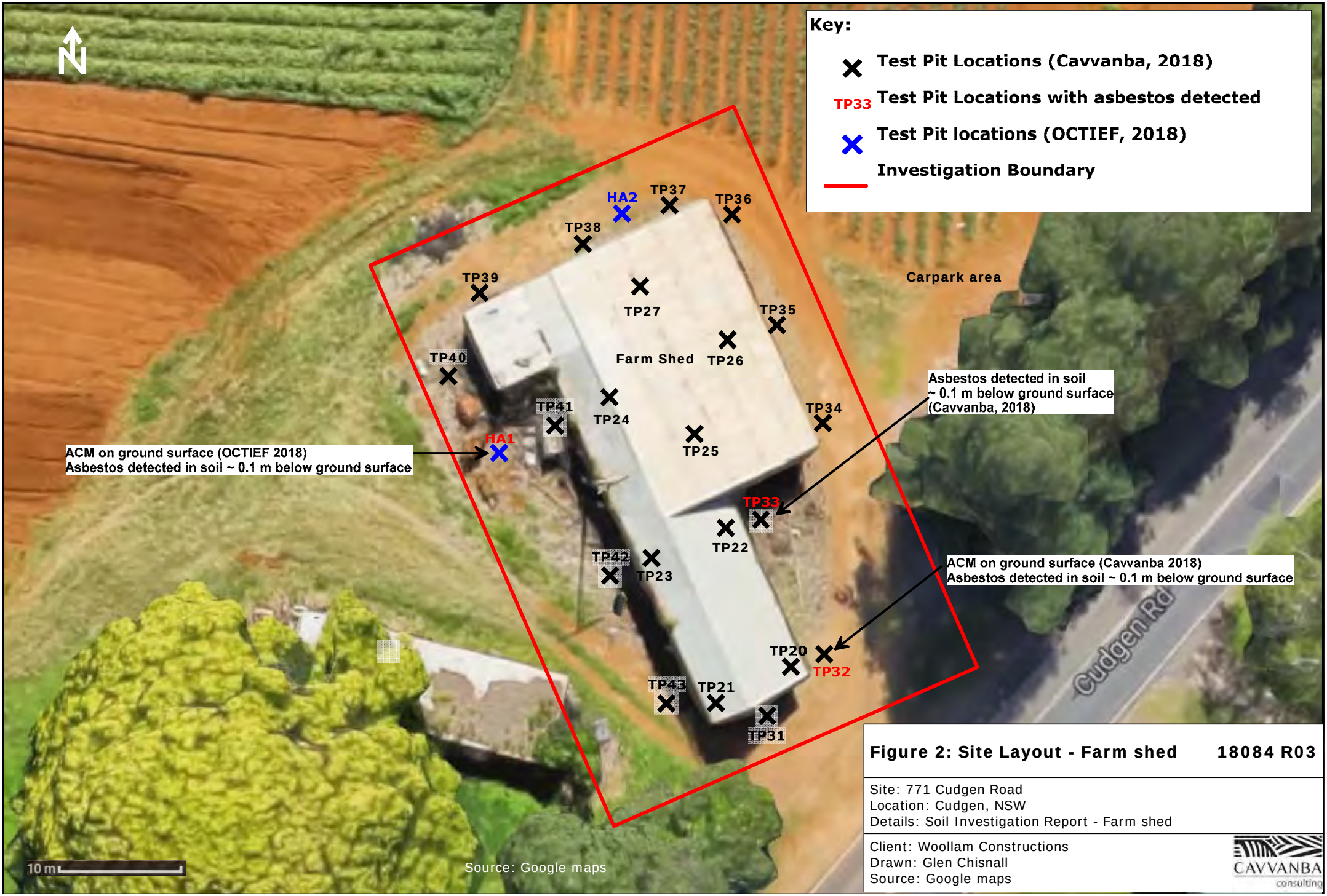


Figure 2: Site Layout - Farm shed **18084 R03**

Site: 771 Cudgen Road
Location: Cudgen, NSW
Details: Soil Investigation Report - Farm shed

Client: Woollam Constructions
Drawn: Glen Chisnall
Source: Google maps

CAVVANBA consulting

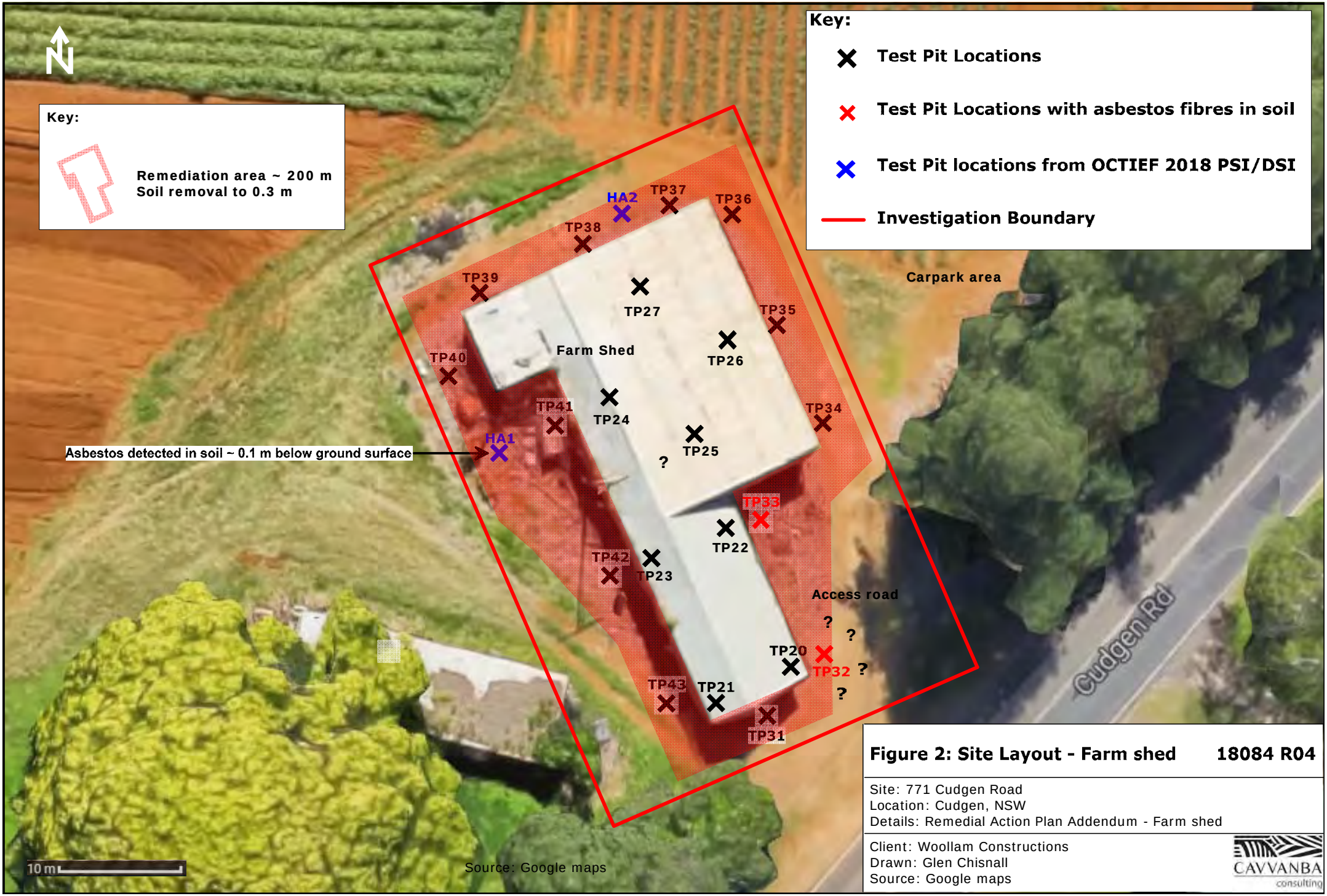


Figure 2: Site Layout - Farm shed **18084 R04**

Site: 771 Cudgen Road
Location: Cudgen, NSW
Details: Remedial Action Plan Addendum - Farm shed

Client: Woollam Constructions
Drawn: Glen Chisnall
Source: Google maps

CAVVANBA consulting

Appendix E Consultant's Summary Results Tables

Table 1 - Soil analytical results - Site Inspection - 14 June 2018
J8196
771 Cudgen Road, Cudgen

OCTIEF

ANALYTE	Units	ASSESSMENT CRITERIA																
		HIL A (1)	HSL A (2)	ESL A (3)	EIL A(4)	ESL (5)	EIL(6)											
Sample name								Paddock 1	Paddock 2	Paddock 3	Paddock 4	Paddock 5	Paddock 6	QA1	Shed	Rinsate	Trip Blank
Sample date								14/06/18	14/06/18	14/06/18	14/06/18	14/06/18	14/06/18	14/06/18	14/06/18	14/06/18	14/06/18
Soil																		
BTEX																		
Benzene	mg/kg		0.7	65		10		-	-	-	-	-	-	-	< 0.1	< 0.001	< 0.001
Ethylbenzene	mg/kg		NL	125		40		-	-	-	-	-	-	-	< 0.1	< 0.001	< 0.001
meta- & para-Xylene	mg/kg							-	-	-	-	-	-	-	< 0.2	< 0.002	< 0.002
ortho-Xylene	mg/kg							-	-	-	-	-	-	-	< 0.1	< 0.001	< 0.001
Toluene	mg/kg		480	105		65		-	-	-	-	-	-	-	< 0.1	< 0.001	< 0.001
Total Xylenes	mg/kg		110	45		1.6		-	-	-	-	-	-	-	< 0.3	< 0.003	< 0.003
Metals																		
Arsenic	mg/kg	100			100		40	4.4	5.3	5.5	6.5	4.3	4	5.9	11	< 0.001	-
Cadmium	mg/kg	20						< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	2.6	< 0.0002	-
Chromium (Total)	mg/kg	100			420		150	19	15	30	13	14	12	28	30	< 0.001	-
Copper	mg/kg	6000			650		260	57	39	66	33	49	51	68	64	< 0.001	-
Lead	mg/kg	300			1100		480	17	10	20	9.2	12	10	19	74	< 0.001	-
Mercury	mg/kg	40						0.2	0.2	0.1	0.1	0.1	0.2	0.1	< 0.1	< 0.0001	-
Nickel	mg/kg	400			200		70	19	20	17	21	21	22	17	18	< 0.001	-
Zinc	mg/kg	7400			400		220	140	130	120	110	160	160	120	1600	< 0.005	-
Organochlorine Pesticides																		
4.4`-DDD[5]	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
4.4`-DDE[5]	mg/kg							< 0.05	0.09	0.1	0.16	0.05	< 0.05	0.13	< 0.05	< 0.0001	-
4.4`-DDT[5]	mg/kg				180		3	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
a-BHC	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
Aldrin[6]	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
Aldrin and Dieldrin (Total)	mg/kg	6						< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
b-BHC	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
Chlordanes - Total	mg/kg	50						< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.001	-
d-BHC	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
DDT + DDE + DDD (Total)*	mg/kg	240						< 0.05	0.09	0.1	0.16	0.05	< 0.05	0.13	< 0.05	< 0.0001	-
Dieldrin[6]	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
Endosulfan I	mg/kg	270						< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
Endosulfan II	mg/kg	270						< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
Endosulfan sulphate	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
Endrin	mg/kg	10						< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
Endrin aldehyde	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
Endrin ketone	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
g-BHC (Lindane)	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
Heptachlor	mg/kg	6						< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
Heptachlor epoxide	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
Hexachlorobenzene	mg/kg	10						< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
Methoxychlor	mg/kg	300						< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.0001	-
Toxaphene	mg/kg	20						< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 0.01	-
Vic EPA IWRG 621 OCP (Total)*	mg/kg							< 0.1	< 0.1	0.1	0.16	< 0.1	< 0.1	0.13	< 0.1	< 0.001	-
Vic EPA IWRG 621 Other OCP (Total)*	mg/kg							< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.001	-
Organophosphorus Pesticides																		-
Azinphos-methyl	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Bolstar	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Chlorfenvinphos	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Chlorpyrifos	mg/kg	106						< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.02	-
Chlorpyrifos-methyl	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Coumaphos	mg/kg							< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 0.02	-
Demeton-O	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Demeton-S	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.02	-
Diazinon	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Dichlorvos	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Dimethoate	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Disulfoton	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
EPN	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Ethion	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Ethoprop	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Ethyl parathion	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Fenitrothion	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Fensulfothion	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Fenthion	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Malathion	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Merphos	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Methyl parathion	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Mevinphos	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Monocrotophos	mg/kg							< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 0.002	-
Naled	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Omethoate	mg/kg							< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 0.002	-
Phorate	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Pirimiphos-methyl	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.02	-
Pyrazophos	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Ronnel	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Terbufos	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Tetrachlorvinphos	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Tokuthion	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
Trichloronate	mg/kg							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.002	-
TRH - 2013 NEPM Fractions																		
Naphthalene	mg/kg		5		170	25		-	-	-	-	-	-	-	< 0.5	< 0.01	< 0.01
TRH >C10-C16	mg/kg			120				-	-	-	-	-	-	-	< 50	< 0.05	
TRH >C10-C16 less Naphthalene (F2)	mg/kg		280					-	-	-	-	-	-	-	< 50	< 0.05	
TRH >C16-C34	mg/kg			1300		-		-	-	-	-	-	-	-	180	< 0.1	
TRH >C34-C40	mg/kg			5600		-		-	-	-	-	-	-	-	< 100	< 0.1	
TRH C6-C10	mg/kg			180		125		-	-	-	-	-	-	-	< 20	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1)	mg/kg		50			-		-	-	-	-	-	-	-	< 20	< 0.02	< 0.02

Notes

	Results in yellow highlight and bold indicate an exceedance of the adopted health based assessment criteria - low to high density residential
	Results iindicate an exceedance of the adopted ecological investigation criteria - Residential land use
	Results iindicate an exceedance of the adopted ecological investigation criteria - Area of ecological significance
1	NEPM (1999) Schedule B1 Table 1A(3) - Health Screening Level A - low to high density residential (no degradation factor applied)
2	NEPM (1999) Schedule B1 Table 1A(1) - Health Investigation Level A, residential .
3	NEPM (1999) Schedule B1 Table 1B(6) - Ecological screening levels, urban and residential and public open space
4	NEPM (1999) Schedule B1 Table 1B(5) - Ecological Investigation levels, urban, residential and public open space (aged arsenic, fresh DDT, fresh naphthalene)
5	NEPM (1999) Schedule B1 Table 1B(6) - Ecological screening levels, Area of Ecological Significance
6	NEPM (1999) Schedule B1 Table 1B(5) - Ecological Investigation levels, Area of ecological significance (aged arsenic, fresh DDT, fresh naphthalene)
NL	Not Limiting: NEPM (1999) Table 1A(3). When a soil vapour source concentration for a petroleum mixture can not exceed a level that would result in an exceedance of the maximum allowable vapour risk for a given scenario no HSL is provided and the HSL is shown as 'not limiting' or 'NL'.
EIL	Where applicable for metals, the site specific EIL's were calculated by adding an average background concentration (ABC) onsite to the ACLs outlined in Tables 1B(1) to 1B(3) of Schedule B1 (NEPM, 2013). ACLs have been determined utilizing pH, and Cation Exchange Capacity (CEC) from representative samples collected (Table 5 Appendix A). Based on site observations, for this investigation, the analytical results for hand auger HA5 were considered representative of average background concentrations (ABC) onsite

Notes are provided at the end of the tables section

Table 2 - Soil analytical results

(results in mg/kg unless othwerwise stated)

OCTIEF

ANALYTE	Units	INVESTIGATION GUIDELINES													
		HIL A (1)	HSL A (2)	ESL A (3)	EIL A (4)	ESL (5)	EIL (6)								
Laboratory ID								M18-Au09777	M18-Au09778	M18-Au09779	M18-Au09780	M18-Au09781		M18-Au09782	M18-Au09783	M18-Au09784
Sample name								HA1-0.15	HA2-0.15	HA2-0.5	HA3-0.15	HA4-0.15	HA4-0.5	HA5-0.15	HA6-0.15	HA7-0.5
Sample Depth								0.15	0.15	0.5	0.15	0.15	0.5	0.15	0.15	0.5
Sample date								1/08/18	1/08/18	1/08/18	1/08/18	1/08/18	1/08/18	1/08/18	1/08/18	1/08/18
Location								Main Shed	Main shed	Main shed	former AST	Vehcile shed	Vehcile shed	Adjacent to pump house	Farm Dump	Farm Dump
Soil																
BTEX																
Benzene	mg/kg		0.7	65		10		< 0.1	-	< 0.1	< 0.1	-	-	< 0.1	< 0.1	< 0.1
Ethylbenzene	mg/kg		NL	125		40		< 0.1	-	< 0.1	< 0.1	-	-	< 0.1	< 0.1	< 0.1
meta- & para-Xylene	mg/kg							< 0.2	-	< 0.2	< 0.2	-	-	< 0.2	< 0.2	< 0.2
ortho-Xylene	mg/kg							< 0.1	-	< 0.1	< 0.1	-	-	< 0.1	< 0.1	< 0.1
Toluene	mg/kg		480	105		65		< 0.1	-	< 0.1	< 0.1	-	-	< 0.1	< 0.1	< 0.1
Total Xylenes	mg/kg		110	45		1.6		< 0.3	-	< 0.3	< 0.3	-	-	< 0.3	< 0.3	< 0.3
Metals																
Arsenic	mg/kg	100			100		40	21	7.1	5.6	-	24	5.1	7.2	6.2	8.6
Cadmium	mg/kg	20						< 0.4	0.5	< 0.4	-	0.8	< 0.4	< 0.4	< 0.4	< 0.4
Chromium (Total)	mg/kg	100			420		150	26	29	26	-	26	30	18	17	18
Copper	mg/kg	6000			650		260	81	88	45	-	70	16	71	35	22
Lead	mg/kg	300			1100		480	23	63	23	-	18	13	11	9.8	11
Mercury	mg/kg	40						0.2	0.4	0.2	-	0.2	0.2	0.1	0.2	0.2
Nickel	mg/kg	400			200		70	16	20	18	-	16	18	37	25	28
Zinc	mg/kg	7400			400		220	160	270	130	-	530	120	170	110	140
Organochlorine Pesticides																
4.4'-DDD	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05
4.4'-DDE	mg/kg							0.08	0.08	0.07	< 0.05	0.35	-	< 0.05	< 0.05	< 0.05
4.4'-DDT	mg/kg				180		3	< 0.05	< 0.05	< 0.05	< 0.05	0.21	-	< 0.05	< 0.05	< 0.05
a-BHC	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05
Aldrin	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05
Aldrin and Dieldrin (Total)	mg/kg	6						< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05
b-BHC	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05
Chlordanes - Total	mg/kg	50						< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1
d-BHC	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05
DDT + DDE + DDD (Total)*	mg/kg	240			180		3	0.08	0.08	0.07	< 0.05	0.56	-	< 0.05	< 0.05	< 0.05
Dieldrin	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05
Endosulfan I	mg/kg	270						< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05
Endosulfan II	mg/kg	270						< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05
Endosulfan sulphate	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05
Endrin	mg/kg	10						< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05
Endrin aldehyde	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05
Endrin ketone	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05
g-BHC (Lindane)	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05
Heptachlor	mg/kg	6						< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05
Heptachlor epoxide	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05
Hexachlorobenzene	mg/kg	10						< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05
Methoxychlor	mg/kg	300						< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05
Toxaphene	mg/kg	20						< 1	< 1	< 1	< 1	< 1	-	< 1	< 1	< 1
Vic EPA IWRG 621 OCP (Total)*	mg/kg							< 0.1	< 0.1	< 0.1	< 0.1	0.56	-	< 0.1	< 0.1	< 0.1
Vic EPA IWRG 621 Other OCP (Total)*	mg/kg							< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1
Organophosphorus Pesticides																
Azinphos-methyl	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Bolstar	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Chlorfenvinphos	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Chlorpyrifos	mg/kg	106						< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Chlorpyrifos-methyl	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Coumaphos	mg/kg							< 2	< 2	*	< 2	< 2	-	< 2	< 2	< 2
Demeton-O	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Demeton-S	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Diazinon	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Dichlorvos	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Dimethoate	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Disulfoton	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
EPN	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Ethion	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Ethoprop	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Ethyl parathion	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Fenitrothion	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Fensulfothion	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Fenthion	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Malathion	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Merphos	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Methyl parathion	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Mevinphos	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Monocrotophos	mg/kg							< 2	< 2	*	< 2	< 2	-	< 2	< 2	< 2
Naled	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Omethoate	mg/kg							< 2	< 2	*	< 2	< 2	-	< 2	< 2	< 2
Phorate	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Pirimiphos-methyl	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Pyrazophos	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Ronnel	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Terbufos	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Tetrachlorvinphos	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Tokuthion	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Trichloronate	mg/kg							< 0.2	< 0.2	*	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2
Polycyclic Aromatic Hydrocarbons																
Acenaphthene	mg/kg							< 0.5		< 0.5				< 0.5	< 0.5	< 0.5
Acenaphthylene	mg/kg							< 0.5		< 0.5				< 0.5	< 0.5	< 0.5
Anthracene	mg/kg							< 0.5		< 0.5				< 0.5	< 0.5	< 0.5
Benz(a)anthracene	mg/kg							< 0.5		< 0.5				< 0.5	< 0.5	< 0.5
Benzo(a)pyrene	mg/kg							< 0.5		< 0.5				< 0.5	< 0.5	< 0.5
Benzo(a)pyrene TEQ (lower bound) *	mg/kg	3						< 0.5		< 0.5				< 0.5	< 0.5	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	mg/kg	3						0.6		0.6				0.6	0.6	0.6
Benzo(a)pyrene TEQ (upper bound) *	mg/kg	3						1.2		1.2				1.2	1.2	1.2
Benzo(b&j)fluoranthene	mg/kg							< 0.5		< 0.5				< 0.5	< 0.5	< 0.5
Benzo(g.h.i)perylene	mg/kg							< 0.5		< 0.5				< 0.5	< 0.5	< 0.5
Benzo(k)fluoranthene	mg/kg							< 0.5		< 0.5				< 0.5	< 0.5	< 0.5
Chrysene	mg/kg							< 0.5		< 0.5				< 0.5	< 0.5	< 0.5
Dibenz(a.h)anthracene	mg/kg							< 0.5		< 0.5				< 0.5	< 0.5	< 0.5
Fluoranthene	mg/kg							< 0.5		< 0.5				< 0.5	< 0.5	< 0.5
Fluorene	mg/kg							< 0.5		< 0.5				< 0.5	< 0.5	< 0.5
Indeno(1.2.3-cd)pyrene	mg/kg							< 0.5		< 0.5				< 0.5	< 0.5	< 0.5
Naphthalene	mg/kg							< 0.5		< 0.5				< 0.5	< 0.5	< 0.5
Phenanthrene	mg/kg							< 0.5		< 0.5				< 0.5	< 0.5	< 0.5
Pyrene	mg/kg							< 0.5		< 0.5				< 0.5	< 0.5	< 0.5
Total PAH*	mg/kg	300						< 0.5		< 0.5				< 0.5	< 0.5	< 0.5
Volatile Organics																
1.1.1.2-Tetrachloroethane	mg/kg							< 0.5		< 0.5		< 0.5				
1.1.1-Trichloroethane	mg/kg							< 0.5		< 0.5		< 0.5				
1.1.2.2-Tetrachloroethane	mg/kg							< 0.5		< 0.5		< 0.5				
1.1.2-Trichloroethane	mg/kg							< 0.5		< 0.5		< 0.5				
1.1-Dichloroethane	mg/kg							< 0.5		< 0.5		< 0.5				
1.1-Dichloroethene	mg/kg							< 0.5		< 0.5		< 0.5				
1.2.3-Trichloropropane	mg/kg							< 0.5		< 0.5		< 0.5				
1.2.4-Trimethylbenzene	mg/kg							< 0.5		< 0.5		< 0.5				
1.2-Dibromoethane	mg/kg							< 0.5		< 0.5		< 0.5				
1.2-Dichlorobenzene	mg/kg							< 0.5		< 0.5		< 0.5				
1.2-Dichloroethane	mg/kg							< 0.5		< 0.5		< 0.5				
1.2-Dichloropropane	mg/kg							< 0.5		< 0.5		< 0.5				
1.3.5-Trimethylbenzene	mg/kg							< 0.5		< 0.5		< 0.5				
1.3-Dichlorobenzene	mg/kg							< 0.5		< 0.5		< 0.5				
1.3-Dichloropropane	mg/kg							< 0.5		< 0.5		< 0.5				
1.4-Dichlorobenzene	mg/kg							< 0.5		< 0.5		< 0.5				
2-Butanone (MEK)	mg/kg							< 0.5		< 0.5		< 0.5				
2-Propanone (Acetone)	mg/kg							< 0.5		< 0.5		< 0.5				
4-Chlorotoluene	mg/kg							< 0.5		< 0.5		< 0.5				
4-Methyl-2-pentanone (MIBK)	mg/kg							< 0.5		< 0.5		< 0.5				
Allyl chloride	mg/kg							< 0.5		< 0.5		< 0.5				
Benzene	mg/kg							< 0.1		< 0.1		< 0.1				
Bromobenzene	mg/kg							< 0.5		< 0.5		< 0.5				
Bromochloromethane	mg/kg							< 0.5		< 0.5		< 0.5				
Bromodichloromethane	mg/kg							< 0.5		< 0.5		< 0.5				
Bromoform	mg/kg							< 0.5		< 0.5		< 0.5				
Bromomethane	mg/kg							< 0.5		< 0.5		< 0.5				
Carbon disulfide	mg/kg							< 0.5		< 0.5		< 0.5				
Carbon Tetrachloride	mg/kg							< 0.5		< 0.5		< 0.5				
Chlorobenzene	mg/kg							< 0.5		< 0.5		< 0.5				
Chloroethane	mg/kg							< 0.5		< 0.5		< 0.5				
Chloroform	mg/kg							< 0.5		< 0.5		< 0.5				
Chloromethane	mg/kg							< 0.5		< 0.5		< 0.5				
cis-1.2-Dichloroethene	mg/kg							< 0.5		< 0.5		< 0.5				
cis-1.3-Dichloropropene	mg/kg							< 0.5		< 0.5		< 0.5				
Dibromochloromethane	mg/kg							< 0.5		< 0.5		< 0.5				
Dibromomethane	mg/kg							< 0.5		< 0.5		< 0.5				
Dichlorodifluoromethane	mg/kg							< 0.5		< 0.5		< 0.5				
Ethylbenzene	mg/kg							< 0.1		< 0.1		< 0.1				
Iodomethane	mg/kg							< 0.5		< 0.5		< 0.5				
Isopropyl benzene (Cumene)	mg/kg							< 0.5		< 0.5		< 0.5				
m&p-Xylenes	mg/kg							< 0.2		< 0.2		< 0.2				
Methylene Chloride	mg/kg							< 0.5		< 0.5		< 0.5				
o-Xylene	mg/kg							< 0.1		< 0.1		< 0.1				
Styrene	mg/kg							< 0.5		< 0.5		< 0.5				
Tetrachloroethene	mg/kg							< 0.5		< 0.5		< 0.5				
Toluene	mg/kg							< 0.1		< 0.1		< 0.1				
Total MAH*	mg/kg							< 0.5		< 0.5		< 0.5				
trans-1.2-Dichloroethene	mg/kg							< 0.5		< 0.5		< 0.5				
trans-1.3-Dichloropropene	mg/kg							< 0.5		< 0.5		< 0.5				
Trichloroethene	mg/kg							< 0.5		< 0.5		< 0.5				
Trichlorofluoromethane	mg/kg							< 0.5		< 0.5		< 0.5				
Vic EPA IWRG 621 CHC (Total)*	mg/kg							< 0.5		< 0.5		< 0.5				
Vic EPA IWRG 621 Other CHC (Total)*	mg/kg							< 0.5		< 0.5		< 0.5				
Vinyl chloride	mg/kg							< 0.5		< 0.5		< 0.5				
Xylenes - Total	mg/kg							< 0.3		< 0.3		< 0.3				
TRH - 2013 NEPM Fractions																
Naphthalene	mg/kg		5		170			< 0.5		< 0.5	< 0.5			< 0.5	< 0.5	< 0.5
TRH >C10-C16	mg/kg			120		25		< 50		< 50	< 50			< 50	< 50	< 50
TRH >C10-C16 less Naphthalene (F2)	mg/kg		280					< 50		< 50	< 50			< 50	< 50	< 50
TRH C10-C40(total)	mg/kg							< 100		< 100	< 100			< 100	< 100	< 100
TRH >C16-C34	mg/kg			1300		-		< 100		< 100	< 100			< 100	< 100	< 100
TRH >C34-C40	mg/kg			5600		-		< 100		< 100	< 100			< 100	< 100	< 100
TRH C6-C10	mg/kg			180		125		< 20		< 20	< 20			< 20	< 20	< 20
TRH C6-C10 less BTEX (F1)	mg/kg		50			-		< 20		< 20	< 20			< 20	< 20	< 20

Notes

	Results in yellow highlight and bold indicate an exceedance of the adopted health based assessment criteria - low to high density residential
	Results iindicate an exceedance of the adopted ecological investigation criteria - Residential land use
	Results iindicate an exceedance of the adopted ecological investigation criteria - Area of ecological significance
1	NEPM (1999) Schedule B1 Table 1A(3) - Health Screening Level A - low to high density residential (no degradation factor applied)
2	NEPM (1999) Schedule B1 Table 1A(1) - Health Investigation Level A, residential .
3	NEPM (1999) Schedule B1 Table 1B(6) - Ecological screening levels, urban and residential and public open space
4	NEPM (1999) Schedule B1 Table 1B(5) - Ecological Investigation levels, urban, residential and public open space (aged arsenic, fresh DDT, fresh naphthalene)
5	NEPM (1999) Schedule B1 Table 1B(6) - Ecological screening levels, Area of Ecological Significance
6	NEPM (1999) Schedule B1 Table 1B(5) - Ecological Investigation levels, Area of ecological significance (aged arsenic, fresh DDT, fresh naphthalene)
NL	Not Limiting: NEPM (1999) Table 1A(3). When a soil vapour source concentration for a petroleum mixture can not exceed a level that would result in an exceedance of the maximum allowable vapour risk for a given scenario no HSL is provided and the HSL is shown as 'not limiting' or 'NL'.
EIL	Where applicable for metals, the site specific EIL's were calculated by adding an average background concentration (ABC) onsite to the ACLs outlined in Tables 1B(1) to 1B(3) of Schedule B1 (NEPM, 2013). ACLs have been determined utilizing pH, and Cation Exchange Capacity (CEC) from representative samples collected (Table 5 Appendix A). Based on site observations, for this investigation, the analytical results for hand auger HA5 were considered representative of average background concentrations (ABC) onsite

Table 3 - Results of sample examination using polarised light microscopy (PLM) including Dispersion Staining

Qualitative Results (NATA)							Quantitative Results (non NATA)					
AS 4964 – 2004 Identification of Asbestos in Bulk Samples							National Environment Protection (Assessment of Site Contamination) Measure (2013)					
								AF / FA (2 - 7mm)		AF / FA (<2mm)		
Sample ID	Sample Location	Sample Description	Approx. Sample Weight (dry) (g)	Asbestos Detected	Fibre Type Detected	Trace Asbestos Detected	Approx. Sample Weight (dry) (kg)	Weight of AF/FA (g)	AF/FA (as 100% Asbestos in AF/FA) (%)	Sub-sample Weight (g)	Weight of AF/FA (g)	AF / FA (as 100% asbestos in AF/FA)
HA 1 - 0 - 0.1	-	Soil	530	Yes	CHR-ORG	No	0.53	0.111	0.021	102.00	0.0100	0.010
HA 2 - 0 - 0.1	-	Soil	402	No	NAD-ORG	No	0.402	0.000	<0.001	105.00	0.0000	<0.001
HA 7 - 0 - 0.1	-	Soil	254	No	NAD-ORG	No	0.254	0.000	<0.001	102.00	0.0000	<0.001
HA 4 - 0 - 0.1	-	Soil	322	No	NAD-ORG	No	0.322	0.000	<0.001	100.00	0.0000	<0.001

Table 4 - Soil analytical results - composite samples

J8961

(results in mg/kg unless otherwise stated)

ANALYTE	LOR	Units	ASSESSMENT CRITERIA																
			HIL A [##]	EIL A	EIL - Ecologically significant Area														
Laboratory ID						M18-Au09785	M18-Au09786	M18-Au09787	M18-Au09788	M18-Au09789	M18-Au09790	M18-Au09791	M18-Au09792	M18-Au09793	M18-Au09794	M18-Au09795	M18-Au28028	M18-Au28029	M18-Au28030	M18-Au28031
Sample name						HA7F	HA8	HA9	HA10	HA11	HA12	HA13	HA14	HA15	HA16	HA17	HA17-1	HA17-12	HA17-3	HA17-4
Sample Depth						0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Sample date						2/08/18	2/08/18	2/08/18	2/08/18	2/08/18	2/08/18	2/08/18	2/08/18	2/08/18	2/08/18	2/08/18	2/08/18	2/08/18	2/08/18	2/08/18
Metals																				
Arsenic	2	mg/kg	25	25	10	4.5	4.5	4.6	4.7	4.8	4.9	5.3	5	4.6	5.2	5.9	-	-	-	-
Cadmium	1	mg/kg	5	-	-	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	-	-	-	-
Chromium (Total)	5	mg/kg	25	120	50	14	14	18	15	16	17	22	19	20	26	27	-	-	-	-
Copper	5	mg/kg	1500	211	120	43	60	65	55	55	55	68	64	71	80	94	-	-	-	-
Lead	5	mg/kg	75	290	130	11	12	13	14	12	12	15	13	16	32	55	-	-	-	-
Mercury	0.1	mg/kg	10	-	-	0.1	0.2	0.1	0.2	0.2	0.2	0.1	0.2	0.1	0.1	0.2	-	-	-	-
Nickel	5	mg/kg	100	80	50	22	22	22	22	22	22	22	21	18	17	20	-	-	-	-
Zinc	5	mg/kg	1850	270	190	160	170	170	170	160	160	170	170	150	150	200	200	210	230	210
Organochlorine Pesticides																				
4,4`-DDD[5]	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
4,4`-DDE[5]	0.05	mg/kg				< 0.05	< 0.05	< 0.05	0.06	< 0.05	< 0.05	< 0.05	0.08	0.05	0.06	0.05	-	-	-	-
4,4`-DDT[5]	0.05	mg/kg		45	0.75	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
a-BHC	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
Aldrin[6]	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
Aldrin and Dieldrin (Total)	0.05	mg/kg	1.5			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
b-BHC	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
Chlordanes - Total	0.05	mg/kg	12.5			< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-	-
d-BHC	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
DDT + DDE + DDD (Total)*	0.05	mg/kg	60			< 0.05	< 0.05	< 0.05	0.06	< 0.05	< 0.05	< 0.05	0.08	0.05	0.06	0.05	-	-	-	-
Dieldrin[6]	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
Endosulfan I	0.05	mg/kg	67.5			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
Endosulfan II	0.05	mg/kg	67.5			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
Endosulfan sulphate	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
Endrin	0.05	mg/kg	2.5			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
Endrin aldehyde	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
Endrin ketone	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
g-BHC (Lindane)	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
Heptachlor	0.05	mg/kg	1.5			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
Heptachlor epoxide	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
Hexachlorobenzene	0.05	mg/kg	2.5			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
Methoxychlor	0.05	mg/kg	75			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	-
Toxaphene	1	mg/kg	5			< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	-	-	-	-
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-	-
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-	-
Organophosphorus Pesticides																				
Azinphos-methyl	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Bolstar	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Chlorfenvinphos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Chlorpyrifos	0.2	mg/kg	26.5			< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Chlorpyrifos-methyl	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Coumaphos	0.2	mg/kg				< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-	-	-	-
Demeton-O	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Demeton-S	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Diazinon	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Dichlorvos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Dimethoate	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Disulfoton	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
EPN	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Ethion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Ethoprop	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Ethyl parathion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Fenitrothion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Fensulfothion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Fenthion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Malathion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Merphos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Methyl parathion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Mevinphos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Monocrotophos	0.2	mg/kg				< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-	-	-	-
Naled	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Omethoate	0.2	mg/kg				< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-	-	-	-
Phorate	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Pirimiphos-methyl	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Pyrazophos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Ronnel	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Terbufos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Tetrachlorvinphos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Tokuthion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-
Trichloronate	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	-

Notes

	Results in yellow highlight and bold indicate an exceedance of the adopted health based assessment criteria -
	Results in green highlight and bold indicate an exceedance of the adopted ecological based assessment criteria for residential land use
	Results in green highlight and bold indicate an exceedance of the adopted ecological based assessment criteria for Ecologically significant Area
HIL A	NEPM (1999) Schedule B1 Table 1A(1) - Health Investigation Level A - low to high density residential
EIL A	NEPM (1999) Schedule B1 Table 1B - Ecological Investigation levels, urban, residential and public open space
EIL Ecologically Significant	NEPM (1999) Schedule B1 Table 1B - Ecological Investigation levels, Areas of Ecological Significance
##	Composite samples - relevant HIL/EIL has been divided by the the number of samples that formed the composite i.e. default HIL / added contaminant limit has been divided by 4. Ikt should be noted that the reduced guideline does not apply to discrete samples HA17-1 to HA17-4

Where applicable for metals, the site specific EIL's were calculated by adding an average background concentration (ABC) onsite to the ACLs outlined in Tables 1B(1) to 1B(3) of Schedule B1 (NEPM, 2013). ACLs have been determined utilizing pH, and Cation Exchange Capacity (CEC) from representative samples collected (Table 5 Appendix A). Based on site observations, for this investigation, the analytical results for hand auger HA5 were considered representative of average background concentrations (ABC) onsite

Table 4 - Soil analytical results - composite samples
J8961
(results in mg/kg unless otherwise stated)

ANALYTE	LOR	Units	ASSESSMENT CRITERIA																	
			HIL A [##]	EIL A	EIL - Ecologically significant Area															
Laboratory ID						M18-Au09796	M18-Au09797	M18-Au09798	M18-Au09769		EB1819257001		M18-Au09799	M18-Au09800	M18-Au09801	M18-Au09802	M18-Au09803	M18-Au09804	M18-Au09805	
Sample name						HA18	HA20	HA19	QC3		QC3A		HA21	HA22	HA23	HA24	HA25	HA26	HA27	
Sample Depth						0.15	0.15	0.15	Duplicate of HA19	%RPD	Triplicate of HA19	%RPD	0.15	0.15	0.15	0.15	0.15	0.15	0.15	
Sample date						2/08/18	2/08/18	2/08/18					2/08/18	3/08/18	3/08/18	3/08/18	3/08/18	3/08/18	3/08/18	
Metals																				
Arsenic	2	mg/kg	25	25	10	5.8	5.5	4.1	5.3	27	7	53	11	5.4	5.1	5.1	5.6	5	5.8	
Cadmium	1	mg/kg	5	-	-	< 0.4	< 0.4	< 0.4	< 0.4	-	2	-	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	
Chromium (Total)	5	mg/kg	25	120	50	22	23	17	21	18	16	5	20	26	26	30	28	21	31	
Copper	5	mg/kg	1500	211	120	94	85	80	99	22	92	14	78	85	85	74	69	64	67	
Lead	5	mg/kg	75	290	130	27	55	13	17	26	13	0	16	33	22	14	14	12	14	
Mercury	0.1	mg/kg	10	-	-	0.2	0.2	0.2	0.2	-	0.2	0	0.2	0.2	0.1	0.1	0.1	0.2	< 0.1	
Nickel	5	mg/kg	100	80	50	19	19	16	20	22	12	29	18	18	16	13	18	16	14	
Zinc	5	mg/kg	1850	270	190	180	170	140	180	25	126	11	150	150	130	110	140	140	120	
Organochlorine Pesticides																				
4,4'-DDD[S]	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
4,4'-DDE[S]	0.05	mg/kg				0.08	0.06	< 0.05	0.09	-	0.08	-	0.05	0.08	0.09	0.13	0.1	0.07	0.1	
4,4'-DDT[S]	0.05	mg/kg		45	0.75	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.2	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
a-BHC	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Aldrin[S]	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	--	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Aldrin and Dieldrin (Total)	0.05	mg/kg	1.5			< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
b-BHC	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Chlordanes - Total	0.05	mg/kg	12.5			< 0.1	< 0.1	< 0.1	< 0.1	-	<0.05	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
d-BHC	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
DDT + DDE + DDD (Total)*	0.05	mg/kg	60			0.08	0.06	< 0.05	0.09	-	0.08	-	0.05	0.08	0.09	0.13	0.1	0.07	0.1	
Dieldrin[S]	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Endosulfan I	0.05	mg/kg	67.5			< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Endosulfan II	0.05	mg/kg	67.5			< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Endosulfan sulphate	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Endrin	0.05	mg/kg	2.5			< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Endrin aldehyde	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Endrin ketone	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
g-BHC (Lindane)	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Heptachlor	0.05	mg/kg	1.5			< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Heptachlor epoxide	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Hexachlorobenzene	0.05	mg/kg	2.5			< 0.05	< 0.05	< 0.05	< 0.05		<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Methoxychlor	0.05	mg/kg	75			< 0.05	< 0.05	< 0.05	< 0.05	-	<0.2	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Toxaphene	1	mg/kg	5			< 1	< 1	< 1	< 1		-	-	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg				< 0.1	< 0.1	< 0.1	< 0.1		-	-	< 0.1	< 0.1	< 0.1	0.13	0.1	< 0.1	0.1	
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg				< 0.1	< 0.1	< 0.1	< 0.1		-	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
Organophosphorus Pesticides																				
Azinphos-methyl	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Bolstar	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Chlorfenvinphos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Chlorpyrifos	0.2	mg/kg	26.5			< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Chlorpyrifos-methyl	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Coumaphos	0.2	mg/kg				< 2	< 2	< 2	< 2	-	-	-	< 2	< 2	< 2	< 2	< 2	< 2	< 2	
Demeton-O	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Demeton-S	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Diazinon	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Dichlorvos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Dimethoate	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Disulfoton	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
EPN	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Ethion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Ethoprop	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Ethyl parathion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Fenitrothion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Fensulfothion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Fenthion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Malathion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Merphos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Methyl parathion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	<0.2	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Mevinphos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Monocrotophos	0.2	mg/kg				< 2	< 2	< 2	< 2	-	<0.2	-	< 2	< 2	< 2	< 2	< 2	< 2	< 2	
Naled	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Omethoate	0.2	mg/kg				< 2	< 2	< 2	< 2	-	-	-	< 2	< 2	< 2	< 2	< 2	< 2	< 2	
Phorate	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Pirimiphos-methyl	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Pyrazophos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Ronnel	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Terbufos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	-		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Tetrachlorvinphos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	-		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Tokuthion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	-		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	
Trichloronate	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	-	-		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	

Notes

	Results in yellow highlight and bold indicate an exceedance of the adopted health based assessment criteria -
	Results in green highlight and bold indicate an exceedance of the adopted ecological based assessment criteria for residential land use
	Results in green highlight and bold indicate an exceedance of the adopted ecological based assessment criteria for Ecologically significant Area
HIL A	NEPM (1999) Schedule B1 Table 1A(1) - Health Investigation Level A - low to high density residential
EIL A	NEPM (1999) Schedule B1 Table 1B - Ecological Investigation levels, urban, residential and public open space
EIL Ecologically Significant	NEPM (1999) Schedule B1 Table 1B - Ecological Investigation levels, Areas of Ecological Significance
##	Composite samples - relevant HIL/EIL has been divided by the the number of samples that formed the composite i.e. default HIL / added contaminant limit has been divided by 4. Ikt should be noted that the reduced guideline does not apply to discrete samples HA17-1 to HA17-4

Where applicable for metals, the site specific EIL's were calculated by adding an average background concentration (ABC) onsite to the ACLs outlined in Tables 1B(1) to 1B(3) of Schedule B1 (NEPM, 2013). ACLs have been determined utilizing pH, and Cation Exchange Capacity (CEC) from representative samples collected (Table 5 Appendix A). Based on site observations, for this investigation, the analytical results for hand auger HA5 were considered representative of average background concentrations (ABC) onsite

Table 4 - Soil analytical results - composite samples
J8961
(results in mg/kg unless otherwise stated)

OCTIEF

ANALYTE	LOR	Units	ASSESSMENT CRITERIA																			
			HIL A [##]	EIL A	EIL - Ecologically significant Area																	
Laboratory ID						M18-Au09806	M18-Au09807	M18-Au09808	M18-Au09809	M18-Au09810	M18-Au09811	M18-Au09812	M18-Au09813	M18-Au09772		E81819257002		M18-Au09814	M18-Au09815	M18-Au09816	M18-Au09817	M18-Au09818	M18-Au09819
Sample name						HA28	HA29	HA30	HA31	HA32	HA33	HA34	HA35	QC6		QC6A		HA36	HA37	HA38	HA39	HA40	HA41
Sample Depth						0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	Duplicate of HA35	%RPD	Triplicate of HA35	%RPD	0.15	0.15	0.15	0.15	0.15	0.15
Sample date						3/08/18	3/08/18	3/08/18	3/08/18	3/08/18	3/08/18	3/08/18	3/08/18					3/08/18	3/08/2018	3/08/2018	3/08/2018	3/08/2018	3/08/2018
Metals																							
Arsenic	2	mg/kg	25	25	10	5.4	4.2	4.7	5.4	4.3	5.5	4.7	5.7	4.9	15	6	5	4.4	4.9	5.5	7.6	6.2	9.5
Cadmium	1	mg/kg	5	-	-	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	-	2	-	**< 0.4**	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Chromium (Total)	5	mg/kg	25	120	50	26	20	23	18	16	20	18	19	17	11	11	53	17	16	14	16	14	13
Copper	5	mg/kg	1500	211	120	70	63	52	39	34	60	41	34	33	3	29	15	34	55	42	42	35	34
Lead	5	mg/kg	75	290	130	24	15	12	12	8.8	14	10	12	12	0	9	28	11	12	16	12	8.6	13
Mercury	0.1	mg/kg	10	-	-	0.1	0.2	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0	0.2	0	0.2	0.2	0.2	0.2	0.1	0.2
Nickel	5	mg/kg	100	80	50	15	17	19	20	16	24	18	20	17	16	10	66	21	23	17	25	18	28
Zinc	5	mg/kg	1850	270	190	130	130	120	120	110	150	130	130	130	0	88	38	140	140	130	140	110	140
Organochlorine Pesticides																							
4,4`-DDD[S]	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05		< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
4,4`-DDE[S]	0.05	mg/kg				0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.21	0.19	10	0.13	47	0.06	0.05	0.11	0.15	< 0.05	< 0.05
4,4`-DDT[S]	0.05	mg/kg		45	0.75	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.06	0.06	0	<0.2	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
a-BHC	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aldrin[S]	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aldrin and Dieldrin (Total)	0.05	mg/kg	1.5			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
b-BHC	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chlordanes - Total	0.05	mg/kg	12.5			< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	<0.05	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
d-BHC	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	60			0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.27	0.25	10	0.13	**70**	0.06	0.05	0.11	0.15	< 0.05	< 0.05
Dieldrin[S]	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Endosulfan I	0.05	mg/kg	67.5			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Endosulfan II	0.05	mg/kg	67.5			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Endosulfan sulphate	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Endrin	0.05	mg/kg	2.5			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Endrin aldehyde	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Endrin ketone	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
g-BHC (Lindane)	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Heptachlor	0.05	mg/kg	1.5			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Heptachlor epoxide	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Hexachlorobenzene	0.05	mg/kg	2.5			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Methoxychlor	0.05	mg/kg	75			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.2	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Toxaphene	1	mg/kg	5			< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	-	-	-	< 1	< 1	< 1	< 1	< 1	< 1
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.27	0.25	-	-	-	< 0.1	< 0.1	0.11	0.15	< 0.1	< 0.1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
															-		-						
Organophosphorus Pesticides															-		-						
Azinphos-methyl	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Bolstar	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chlorfenvinphos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chlorpyrifos	0.2	mg/kg	26.5			< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chlorpyrifos-methyl	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Coumaphos	0.2	mg/kg				< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-	-	-	< 2	< 2	< 2	< 2	< 2	< 2
Demeton-O	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Demeton-S	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Diazinon	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Dichlorvos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Dimethoate	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Disulfoton	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
EPN	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Ethion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Ethoprop	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Ethyl parathion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Fenitrothion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Fensulfothion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Fenthion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Malathion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Merphos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Methyl parathion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	<0.2	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Mevinphos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Monocrotophos	0.2	mg/kg				< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-	<0.2	-	< 2	< 2	< 2	< 2	< 2	< 2
Naled	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Omethoate	0.2	mg/kg				< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-	-	-	< 2	< 2	< 2	< 2	< 2	< 2
Phorate	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Pirimiphos-methyl	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Pyrazophos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Ronnel	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Terbufos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Tetrachlorvinphos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Tokuthion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Trichloronate	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

Notes

	Results in yellow highlight and bold indicate an exceedance of the adopted health based assessment criteria -
	Results in green highlight and bold indicate an exceedance of the adopted ecological based assessment criteria for residential land use
	Results in green highlight and bold indicate an exceedance of the adopted ecological based assessment criteria for Ecologically significant Area
HIL A	NEPM (1999) Schedule B1 Table 1A(1) - Health Investigation Level A - low to high density residential
EIL A	NEPM (1999) Schedule B1 Table 1B - Ecological Investigation levels, urban, residential and public open space
EIL Ecologically Significant	NEPM (1999) Schedule B1 Table 1B - Ecological Investigation levels, Areas of Ecological Significance
##	Composite samples - relevant HIL/EIL has been divided by the the number of samples that formed the composite i.e. default HIL / added contaminant limit has been divided by 4. Ikt should be noted that the reduced guideline does not apply to discrete samples HA17-1 to HA17-4

Where applicable for metals, the site specific EIL's were calculated by adding an average background concentration (ABC) onsite to the ACLs outlined in Tables 1B(1) to 1B(3) of Schedule B1 (NEPM, 2013). ACLs have been determined utilizing pH, and Cation Exchange Capacity (CEC) from representative samples collected (Table 5 Appendix A). Based on site observations, for this investigation, the analytical results for hand auger HAS were considered representative of average background concentrations (ABC) onsite

Notes are provided at the end of the tables section

Table 4 - Soil analytical results - composite samples

J8961

(results in mg/kg unless otherwise stated)

ANALYTE	LOR	Units	ASSESSMENT CRITERIA																
			HIL A [##]	EIL A	EIL - Ecologically significant Area														
Laboratory ID						M18-Au09820	M18-Au09821	M18-Au09822	M18-Au09823	M18-Au09824	M18-Au09774		EB1819257003		M18-Au09825	M18-Au09826	M18-Au09827		
Sample name						HA42	HA43	HA44	HA45	HA46	QC8		QC8A		HA47	HA48	HA49		
Sample Depth						0.15	0.15	0.15	0.15	0.15	Duplicate of HA46	%RPD	Triplicate of HA46	%RPD	0.15	0.15	0.15		
Sample date						3/08/2018	3/08/2018	3/08/2018	3/08/2018	3/08/2018					3/08/2018	3/08/2018	3/08/2018		
Metals																			
Arsenic	2	mg/kg	25	25	10	6.9	4.2	3.7	4.4	4.5	3.9	14	6	28	4.8	4.2	4.9		
Cadmium	1	mg/kg	5	-	-	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	-	1	-	< 0.4	< 0.4	< 0.4		
Chromium (Total)	5	mg/kg	25	120	50	11	10	18	12	16	16	0	10	46	16	11	11		
Copper	5	mg/kg	1500	211	120	38	49	38	55	66	72	8	74	11	86	77	58		
Lead	5	mg/kg	75	290	130	12	10	8.5	9.8	12	11	8	9	28	13	11	14		
Mercury	0.1	mg/kg	10	-	-	0.1	0.1	0.2	0.2	0.2	0.2	0	0.2	0	0.2	0.2	0.2		
Nickel	5	mg/kg	100	80	50	24	20	15	22	22	17	25	12	59	23	18	21		
Zinc	5	mg/kg	1850	270	190	140	170	120	170	170	150	12	116	37	170	160	180		
Organochlorine Pesticides																			
4,4`-DDD[5]	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05		
4,4`-DDE[5]	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05		
4,4`-DDT[5]	0.05	mg/kg		45	0.75	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.2	-	< 0.05	< 0.05	< 0.05		
a-BHC	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05		
Aldrin[6]	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05		
Aldrin and Dieldrin (Total)	0.05	mg/kg	1.5			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05		
b-BHC	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05		
Chlordanes - Total	0.05	mg/kg	12.5			< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	<0.05	-	< 0.1	< 0.1	< 0.1		
d-BHC	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05		
DDT + DDE + DDD (Total)*	0.05	mg/kg	60			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05		
Dieldrin[6]	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05		
Endosulfan I	0.05	mg/kg	67.5			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05		
Endosulfan II	0.05	mg/kg	67.5			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05		
Endosulfan sulphate	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05		
Endrin	0.05	mg/kg	2.5			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05		
Endrin aldehyde	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05		
Endrin ketone	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	-	-	< 0.05	< 0.05	< 0.05		
g-BHC (Lindane)	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05		
Heptachlor	0.05	mg/kg	1.5			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05		
Heptachlor epoxide	0.05	mg/kg				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05		
Hexachlorobenzene	0.05	mg/kg	2.5			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 0.05	< 0.05		
Methoxychlor	0.05	mg/kg	75			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.2	-	< 0.05	< 0.05	< 0.05		
Toxaphene	1	mg/kg	5			< 1	< 1	< 1	< 1	< 1	< 1	-	-	-	< 1	< 1	< 1		
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-	< 0.1	< 0.1	< 0.1		
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-	< 0.1	< 0.1	< 0.1		
Organophosphorus Pesticides																			
Azinphos-methyl	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		<0.05		< 0.2	< 0.2	< 0.2		
Bolstar	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		-		< 0.2	< 0.2	< 0.2		
Chlorfenvinphos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		<0.05		< 0.2	< 0.2	< 0.2		
Chlorpyrifos	0.2	mg/kg	26.5			< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		<0.05		< 0.2	< 0.2	< 0.2		
Chlorpyrifos-methyl	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		<0.05		< 0.2	< 0.2	< 0.2		
Coumaphos	0.2	mg/kg				< 2	< 2	< 2	< 2	< 2	< 2		-		< 2	< 2	< 2		
Demeton-O	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		-		< 0.2	< 0.2	< 0.2		
Demeton-S	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		<0.05		< 0.2	< 0.2	< 0.2		
Diazinon	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		<0.05		< 0.2	< 0.2	< 0.2		
Dichlorvos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		<0.05		< 0.2	< 0.2	< 0.2		
Dimethoate	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		<0.05		< 0.2	< 0.2	< 0.2		
Disulfoton	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		-		< 0.2	< 0.2	< 0.2		
EPN	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		-		< 0.2	< 0.2	< 0.2		
Ethion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		<0.05		< 0.2	< 0.2	< 0.2		
Ethoprop	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		-		< 0.2	< 0.2	< 0.2		
Ethyl parathion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		-		< 0.2	< 0.2	< 0.2		
Fenitrothion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		-		< 0.2	< 0.2	< 0.2		
Fensulfothion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		-		< 0.2	< 0.2	< 0.2		
Fenthion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		<0.05		< 0.2	< 0.2	< 0.2		
Malathion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		<0.05		< 0.2	< 0.2	< 0.2		
Merphos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		-		< 0.2	< 0.2	< 0.2		
Methyl parathion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		<0.2		< 0.2	< 0.2	< 0.2		
Mevinphos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		-		< 0.2	< 0.2	< 0.2		
Monocrotophos	0.2	mg/kg				< 2	< 2	< 2	< 2	< 2	< 2		<0.2		< 2	< 2	< 2		
Naled	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		-		< 0.2	< 0.2	< 0.2		
Omethoate	0.2	mg/kg				< 2	< 2	< 2	< 2	< 2	< 2		-		< 2	< 2	< 2		
Phorate	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		-		< 0.2	< 0.2	< 0.2		
Pirimiphos-methyl	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		<0.05		< 0.2	< 0.2	< 0.2		
Pyrazophos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		-		< 0.2	< 0.2	< 0.2		
Ronnel	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		-		< 0.2	< 0.2	< 0.2		
Terbufos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		-		< 0.2	< 0.2	< 0.2		
Tetrachlorvinphos	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		-		< 0.2	< 0.2	< 0.2		
Tokuthion	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		-		< 0.2	< 0.2	< 0.2		
Trichloronate	0.2	mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2		-		< 0.2	< 0.2	< 0.2		

Notes

	Results in yellow highlight and bold indicate an exceedance of the adopted health based assessment criteria -
	Results in green highlight and bold indicate an exceedance of the adopted ecological based assessment criteria for residential land use
	Results in green highlight and bold indicate an exceedance of the adopted ecological based assessment criteria for Ecologically significant Area
HIL A	NEPM (1999) Schedule B1 Table 1A(1) - Health Investigation Level A - low to high density residential
EIL A	NEPM (1999) Schedule B1 Table 1B - Ecological Investigation levels, urban, residential and public open space
EIL Ecologically Significant	NEPM (1999) Schedule B1 Table 1B - Ecological Investigation levels, Areas of Ecological Significance
##	Composite samples - relevant HIL/EIL has been divided by the the number of samples that formed the composite i.e. default HIL / added contaminant limit has been divided by 4. Ikt should be noted that the reduced guideline does not apply to discrete samples HA17-1 to HA17-4

Where applicable for metals, the site specific EIL's were calculated by adding an average background concentration (ABC) onsite to the ACLs outlined in Tables 1B(1) to 1B(3) of Schedule B1 (NEPM, 2013). ACLs have been determined utilizing pH, and Cation Exchange Capacity (CEC) from representative samples collected (Table 5 Appendix A). Based on site observations, for this investigation, the analytical results for hand auger HA5 were considered representative of average background concentrations (ABC) onsite

Notes are provided at the end of the tables section

Table 5
Groundwater, Surface water and QC sample analytical Results
Tweed Valley Hospital
J8961

SAMPLE ID							GW1	INTRA		INTER		WS01	WS02	QC1
SAMPLE DATE							3/08/2018	3/08/2018		3/08/2018		3/08/2018	3/08/2018	1/08/2018
TWEED HOSPITAL CUDGEN RD (J8961)			NEPM (2013)		ANZECC (2000) /	ANZAST (2018)	M18-Au09761	M18-Au09762				M18-Au09764	M18-Au09765	M18-Au09767
	LOR	Units	GIL - Fresh water (1)	GIL - Drinking water (2)	Irrigation STV (3)	99% Species Protection level - Freshwater (4)		Duplicate of GW1	%RPD	Triplicate of GW1	%RPD	Storage dam	Storage dam	Trip Blank
% Moisture														
Nitrate & Nitrite (as N)		mg/L					9.6	9.7				0.56	0.23	
Phosphate total (as P)							0.36	0.13				0.06	0.06	
Phosphorus		mg/L			0.8-12									
Total Kjeldahl Nitrogen (as N)		mg/L					0.2	< 0.5				0.5	0.3	
Total Nitrogen (as N)		mg/L			25-125		9.8	9.7				1.1	0.53	
Alkali Metals														
Potassium														
BTEX														
Benzene	0.001	mg/L		0.001										< 0.001
Ethylbenzene	0.001	mg/L		0.3										< 0.001
m&p-Xylenes	0.002	mg/L		-										< 0.002
o-Xylene	0.001	mg/L		-										< 0.001
Toluene	0.001	mg/L		0.8										< 0.001
Xylenes - Total	0.003	mg/L		0.6										< 0.003
Heavy Metals														
Arsenic	0.001	mg/L	0.024	0.01	2	0.001	< 0.001	< 0.001	-	<0.001	-	0.001	< 0.001	
Cadmium	0.0002	mg/L	0.0002	0.002	0.05	0.00006	< 0.0002	< 0.0002	-	<0.0001	-	< 0.0002	< 0.0002	
Chromium	0.001	mg/L	0.001	0.05	1		< 0.001	< 0.001	-	<0.001	-	< 0.001	< 0.001	
Copper	0.001	mg/L	0.0014	2	5	0.001	0.002	0.001	66	0.001	66	0.012	< 0.001	
Lead	0.001	mg/L	0.0034	0.01	5	0.001	< 0.001	< 0.001	-	<0.001	-	< 0.001	< 0.001	
Mercury	0.0001	mg/L	0.00006	0.001	0.002	0.00006	< 0.0001	< 0.0001	-	<0.0001	-	< 0.0001	< 0.0001	
Nickel	0.001	mg/L	0.011	0.02	2	0.008	< 0.001	0.001	-	0.001	-	0.017	0.002	
Zinc	0.005	mg/L	0.008		5	0.0024	0.02	0.018	5	0.018	0	0.077	0.01	
Organochlorine Pesticides														
4.4'-DDD	0.0001	mg/L					< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
4.4'-DDE	0.0001	mg/L					< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
4.4'-DDT	0.0001	mg/L	0.00006	0.009		0.000006	< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
a-BHC	0.0001	mg/L					< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
Aldrin	0.0001	mg/L					< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
Aldrin and Dieldrin (Total)*	0.0001	mg/L					< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
b-BHC	0.0001	mg/L					< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
Chlordanes - Total	0.0001	mg/L	0.00003	0.002		0.00003	< 0.001	< 0.001		0.0005		< 0.001	< 0.001	
d-BHC	0.0001	mg/L					< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
DDT + DDE + DDD (Total)*	0.0001	mg/L					< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
Dieldrin	0.0001	mg/L					< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
Endosulfan I	0.0001	mg/L	0.00003	0.02		0.00003	< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
Endosulfan II	0.0001	mg/L	0.00003				< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
Endosulfan sulphate	0.0001	mg/L					< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
Endrin	0.0001	mg/L	0.00001			0.00001	< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
Endrin aldehyde	0.0001	mg/L					< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
Endrin ketone	0.0001	mg/L					< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
g-BHC (Lindane)	0.0001	mg/L	0.0002	0.01		0.00007	< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
Heptachlor	0.0001	mg/L	0.00001			0.00001	< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
Heptachlor epoxide	0.0001	mg/L					< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
Hexachlorobenzene	0.0001	mg/L					< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
Methoxychlor	0.0001	mg/L					< 0.0001	< 0.0001		0.0005		< 0.0001	< 0.0001	
Toxaphene	0.01	mg/L				0.0001	< 0.01	< 0.01		0.0005		< 0.01	< 0.01	
Vic EPA IWRG 621 OCP (Total)*	0.001	mg/L					< 0.001	< 0.001		0.0005		< 0.001	< 0.001	
Vic EPA IWRG 621 Other OCP (Total)*	0.001	mg/L					< 0.001	< 0.001		0.0005		< 0.001	< 0.001	
Organophosphorus Pesticides														
Azinphos-methyl	0.002	mg/L				0.00001	< 0.002	< 0.002				< 0.002	< 0.002	
Bolstar	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Chlorfenvinphos	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Chlorpyrifos	0.02	mg/L				0.00000004	< 0.02	< 0.02				< 0.02	< 0.02	
Chlorpyrifos-methyl	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Coumaphos	0.002	mg/L					< 0.02	< 0.02				< 0.02	< 0.02	
Demeton-O	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Demeton-S	0.002	mg/L					< 0.02	< 0.02				< 0.02	< 0.02	
Diazinon	0.002	mg/L	0.00001				< 0.002	< 0.002				< 0.002	< 0.002	
Dichlorvos	0.002	mg/L				0.00000003	< 0.002	< 0.002				< 0.002	< 0.002	
Dimethoate	0.002	mg/L	0.0015			0.0001	< 0.002	< 0.002				< 0.002	< 0.002	
Disulfoton	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
EPN	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Ethion	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Ethoprop	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Ethyl parathion	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Fenitrothion	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Fensulfothion	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	

Table 5
Groundwater, Surface water and QC sample analytical Results
Tweed Valley Hospital
J8961

SAMPLE ID							GW1	INTRA		INTER		WS01	WS02	QC1
SAMPLE DATE							3/08/2018	3/08/2018		3/08/2018		3/08/2018	3/08/2018	1/08/2018
TWEED HOSPITAL CUDGEN RD (J8961)			NEPM (2013)		ANZECC (2000) /	ANZAST (2018)	M18-Au09761	M18-Au09762				M18-Au09764	M18-Au09765	M18-Au09767
	LOR	Units	GIL - Fresh water (1)	GIL - Drinking water (2)	Irrigation STV (3)	99% Species Protection level - Freshwater (4)		Duplicate of GW1	%RPD	Triplicate of GW1	%RPD	Storage dam	Storage dam	Trip Blank
Fenthion	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Malathion	0.002	mg/L				0.000002	< 0.002	< 0.002				< 0.002	< 0.002	
Merphos	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Methyl parathion	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Mevinphos	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Monocrotophos	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Naled	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Omethoate	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Phorate	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Pirimiphos-methyl	0.002	mg/L					< 0.02	< 0.02				< 0.02	< 0.02	
Pyrazophos	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Ronnel	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Terbufos	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Tetrachlorvinphos	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Tokuthion	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	
Trichloronate	0.002	mg/L					< 0.002	< 0.002				< 0.002	< 0.002	

Table 5
Groundwater, Surface water and QC sample analytical Results
Tweed Valley Hospital
J8961

SAMPLE ID							GW1	INTRA		INTER		WS01	WS02	QC1
SAMPLE DATE							3/08/2018	3/08/2018		3/08/2018		3/08/2018	3/08/2018	1/08/2018
TWEED HOSPITAL CUDGEN RD (J8961)			NEPM (2013)		ANZECC (2000) /	ANZAST (2018)	M18-Au09761	M18-Au09762				M18-Au09764	M18-Au09765	M18-Au09767
	LOR	Units	GIL - Fresh water (1)	GIL - Drinking water (2)	Irrigation STV (3)	99% Species Protection level - Freshwater (4)		Duplicate of GW1	%RPD	Triplicate of GW1	%RPD	Storage dam	Storage dam	Trip Blank
Polycyclic Aromatic Hydrocarbons														
Acenaphthene	0.001	mg/L												
Acenaphthylene	0.001	mg/L												
Anthracene	0.001	mg/L												
Benz(a)anthracene	0.001	mg/L												
Benzo(a)pyrene	0.001	mg/L												
Benzo(a)pyrene TEQ (lower bound) *	0.001	mg/L												
Benzo(a)pyrene TEQ (medium bound) *	0.001	mg/L												
Benzo(a)pyrene TEQ (upper bound) *	0.001	mg/L												
Benzo(b&j)fluoranthene	0.001	mg/L												
Benzo(g.h.i)perylene	0.001	mg/L												
Benzo(k)fluoranthene	0.001	mg/L												
Chrysene	0.001	mg/L												
Dibenz(a.h)anthracene	0.001	mg/L												
Fluoranthene	0.001	mg/L												
Fluorene	0.001	mg/L												
Indeno(1.2.3-cd)pyrene	0.001	mg/L												
Naphthalene	0.001	mg/L	0.016	-		0.0025								
Phenanthrene	0.001	mg/L												
Pyrene	0.001	mg/L												
Total PAH*	0.001	mg/L												
Total Recoverable Hydrocarbons - 2013 NEPM Fractions														
Naphthalene	0.01	mg/L	0.016			0.0025								< 0.01
TRH >C10-C16	0.05	mg/L												
TRH >C10-C16 less Naphthalene (F2)	0.05	mg/L												
TRH >C10-C40 (total)*	0.1	mg/L												
TRH >C16-C34	0.1	mg/L												
TRH >C34-C40	0.1	mg/L												
TRH C6-C10	0.02	mg/L												< 0.02
TRH C6-C10 less BTEX (F1)	0.02	mg/L												< 0.02
		mg/L												

Notes
Values in ug/L unless otherwise specified

Results indicate an exceedance in the adopted assessment criteria

NL Not-Limiting

1 NEPC (amended 2013) - National Environmental Protection (Assessment of Site Contamination) Measure 1999 - Table 1C Groundwater Investigation Levels - Freshwater ;

2 NEPC (amended 2013) - National Environmental Protection (Assessment of Site Contamination) Measure 1999 Table 1C Groundwater Investigation Levels - Drinking Water ;

3 ANZECC / ARMCANZ (2000) - Australian and New Zealand Guidelines for Fresh and Marine Water Quality - Irrigation and general water use guidelines

4 ANZAST(2018) - Australian and New Zealand Guidelines for Fresh and Marine Water Quality - High Conservation / ecological Value System

Table 5
Groundwater, Surface water and QC sample analytical Results
Tweed Valley Hospital
J8961

SAMPLE ID							QC2	QC4	QC5	QC7	QC9	QC10	QC11	
SAMPLE DATE							1/08/2018	1/08/2018	2/08/2018	2/08/2018	3/08/2018	3/08/2018		
TWEED HOSPITAL CUDGEN RD (J8961)			NEPM (2013)		ANZECC (2000) /	ANZAST (2018)	M18-Au09768	M18-Au09770	M18-Au09771	M18-Au09773	M18-Au09775	M18-Au09776		
	LOR	Units	GIL - Fresh water (1)	GIL - Drinking water (2)	Irrigation STV (3)	99% Species Protection level - Freshwater (4)	Rinsate Blank - Hand auger	Field Blank	Rinsate Blank - Hand auger	Field Blank	Rinsate Blank - Bailer	Rinsate Blank - Hand auger	Rinsate Blank - Hand auger	
% Moisture														
Nitrate & Nitrite (as N)		mg/L												
Phosphate total (as P)														
Phosphorus		mg/L			0.8-12									
Total Kjeldahl Nitrogen (as N)		mg/L												
Total Nitrogen (as N)		mg/L			25-125									
Alkali Metals														
Potassium														
BTEX														
Benzene	0.001	mg/L		0.001			< 0.001	< 0.001						
Ethylbenzene	0.001	mg/L		0.3			< 0.001	< 0.001						
m&p-Xylenes	0.002	mg/L		-			< 0.002	< 0.002						
o-Xylene	0.001	mg/L		-			< 0.001	< 0.001						
Toluene	0.001	mg/L		0.8			< 0.001	< 0.001						
Xylenes - Total	0.003	mg/L		0.6			< 0.003	< 0.003						
Heavy Metals														
Arsenic	0.001	mg/L	0.024	0.01	2	0.001	*	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	
Cadmium	0.0002	mg/L	0.0002	0.002	0.05	0.00006	*	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	
Chromium	0.001	mg/L	0.001	0.05	1		*	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	
Copper	0.001	mg/L	0.0014	2	5	0.001	*	< 0.001	< 0.001	< 0.001	0.001	0.001	< 0.001	
Lead	0.001	mg/L	0.0034	0.01	5	0.001	*	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	
Mercury	0.0001	mg/L	0.00006	0.001	0.002	0.00006	*	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	
Nickel	0.001	mg/L	0.011	0.02	2	0.008	*	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	
Zinc	0.005	mg/L	0.008		5	0.0024	*	< 0.005	< 0.005	< 0.005	0.005	0.033	< 0.005	
Organochlorine Pesticides														
4.4'-DDD	0.0001	mg/L					< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
4.4'-DDE	0.0001	mg/L					< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
4.4'-DDT	0.0001	mg/L	0.00006	0.009		0.000006	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
a-BHC	0.0001	mg/L					< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
Aldrin	0.0001	mg/L					< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
Aldrin and Dieldrin (Total)*	0.0001	mg/L					< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
b-BHC	0.0001	mg/L					< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
Chlordanes - Total	0.0001	mg/L	0.00003	0.002		0.00003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0005	
d-BHC	0.0001	mg/L					< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
DDT + DDE + DDD (Total)*	0.0001	mg/L					< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
Dieldrin	0.0001	mg/L					< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
Endosulfan I	0.0001	mg/L	0.00003	0.02		0.00003	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
Endosulfan II	0.0001	mg/L	0.00003				< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
Endosulfan sulphate	0.0001	mg/L					< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
Endrin	0.0001	mg/L	0.00001			0.00001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
Endrin aldehyde	0.0001	mg/L					< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
Endrin ketone	0.0001	mg/L					< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
g-BHC (Lindane)	0.0001	mg/L	0.0002	0.01		0.00007	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
Heptachlor	0.0001	mg/L	0.00001			0.00001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
Heptachlor epoxide	0.0001	mg/L					< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
Hexachlorobenzene	0.0001	mg/L					< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
Methoxychlor	0.0001	mg/L					< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	
Toxaphene	0.01	mg/L				0.0001	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.0005	
Vic EPA IWRG 621 OCP (Total)*	0.001	mg/L					< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0005	
Vic EPA IWRG 621 Other OCP (Total)*	0.001	mg/L					< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0005	
Organophosphorus Pesticides														
Azinphos-methyl	0.002	mg/L				0.00001	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Bolstar	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Chlorfenvinphos	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Chlorpyrifos	0.02	mg/L				0.00000004	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	
Chlorpyrifos-methyl	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Coumaphos	0.002	mg/L					< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	
Demeton-O	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Demeton-S	0.002	mg/L					< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	
Diazinon	0.002	mg/L	0.00001				< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Dichlorvos	0.002	mg/L				0.00000003	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Dimethoate	0.002	mg/L	0.0015			0.0001	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Disulfoton	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
EPN	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Ethion	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Ethoprop	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Ethyl parathion	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Fenitrothion	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Fensulfothion	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	

Table 5
Groundwater, Surface water and QC sample analytical Results
Tweed Valley Hospital
J8961

SAMPLE ID							QC2	QC4	QC5	QC7	QC9	QC10	QC11	
SAMPLE DATE							1/08/2018	1/08/2018	2/08/2018	2/08/2018	3/08/2018	3/08/2018		
TWEED HOSPITAL CUDGEN RD (J8961)			NEPM (2013)		ANZECC (2000) /	ANZAST (2018)	M18-Au09768	M18-Au09770	M18-Au09771	M18-Au09773	M18-Au09775	M18-Au09776		
	LOR	Units	GIL - Fresh water (1)	GIL - Drinking water (2)	Irrigation STV (3)	99% Species Protection level - Freshwater (4)	Rinsate Blank - Hand auger	Field Blank	Rinsate Blank - Hand auger	Field Blank	Rinsate Blank - Bailer	Rinsate Blank - Hand auger	Rinsate Blank - Hand auger	
Fenthion	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Malathion	0.002	mg/L				0.000002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Merphos	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Methyl parathion	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Mevinphos	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Monocrotophos	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Naled	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Omethoate	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Phorate	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Pirimiphos-methyl	0.002	mg/L					< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	
Pyrazophos	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Ronnel	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Terbufos	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Tetrachlorvinphos	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Tokuthion	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	
Trichloronate	0.002	mg/L					< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	

Table 5
Groundwater, Surface water and QC sample analytical Results
Tweed Valley Hospital
J8961

SAMPLE ID							QC2	QC4	QC5	QC7	QC9	QC10	QC11	
SAMPLE DATE							1/08/2018	1/08/2018	2/08/2018	2/08/2018	3/08/2018	3/08/2018		
TWEED HOSPITAL CUDGEN RD (J8961)			NEPM (2013)		ANZECC (2000) /	ANZAST (2018)	M18-Au09768	M18-Au09770	M18-Au09771	M18-Au09773	M18-Au09775	M18-Au09776		
	LOR	Units	GIL - Fresh water (1)	GIL - Drinking water (2)	Irrigation STV (3)	99% Species Protection level - Freshwater (4)	Rinsate Blank - Hand auger	Field Blank	Rinsate Blank - Hand auger	Field Blank	Rinsate Blank - Bailer	Rinsate Blank - Hand auger	Rinsate Blank - Hand auger	
Polycyclic Aromatic Hydrocarbons														
Acenaphthene	0.001	mg/L					< 0.001	< 0.001						
Acenaphthylene	0.001	mg/L					< 0.001	< 0.001						
Anthracene	0.001	mg/L					< 0.001	< 0.001						
Benz(a)anthracene	0.001	mg/L					< 0.001	< 0.001						
Benzo(a)pyrene	0.001	mg/L					< 0.001	< 0.001						
Benzo(a)pyrene TEQ (lower bound) *	0.001	mg/L												
Benzo(a)pyrene TEQ (medium bound) *	0.001	mg/L												
Benzo(a)pyrene TEQ (upper bound) *	0.001	mg/L												
Benzo(b&j)fluoranthene	0.001	mg/L					< 0.001	< 0.001						
Benzo(g.h.i)perylene	0.001	mg/L					< 0.001	< 0.001						
Benzo(k)fluoranthene	0.001	mg/L					< 0.001	< 0.001						
Chrysene	0.001	mg/L					< 0.001	< 0.001						
Dibenz(a.h)anthracene	0.001	mg/L					< 0.001	< 0.001						
Fluoranthene	0.001	mg/L					< 0.001	< 0.001						
Fluorene	0.001	mg/L					< 0.001	< 0.001						
Indeno(1.2.3-cd)pyrene	0.001	mg/L					< 0.001	< 0.001						
Naphthalene	0.001	mg/L	0.016	-		0.0025	< 0.001	< 0.001						
Phenanthrene	0.001	mg/L					< 0.001	< 0.001						
Pyrene	0.001	mg/L					< 0.001	< 0.001						
Total PAH*	0.001	mg/L					< 0.001	< 0.001						
Total Recoverable Hydrocarbons - 2013 NEPM Fractions														
Naphthalene	0.01	mg/L	0.016			0.0025	< 0.01	< 0.01						
TRH >C10-C16	0.05	mg/L					< 0.05	< 0.05						
TRH >C10-C16 less Naphthalene (F2)	0.05	mg/L					< 0.05	< 0.05						
TRH >C10-C40 (total)*	0.1	mg/L					< 0.1	< 0.1						
TRH >C16-C34	0.1	mg/L					< 0.1	< 0.1						
TRH >C34-C40	0.1	mg/L					< 0.1	< 0.1						
TRH C6-C10	0.02	mg/L					< 0.02	< 0.02						
TRH C6-C10 less BTEX (F1)	0.02	mg/L					< 0.02	< 0.02						
		mg/L												

Notes
Values in ug/L unless otherwise specified

Results indicate an exceedance in the adopted assessment criteria

NL Not-Limiting

1 NEPC (amended 2013) - National Environmental Protection (Assessment of Site Contamination) Measure 1999 - Table 1C Groundwater Investigation Levels - Freshwater ;

2 NEPC (amended 2013) - National Environmental Protection (Assessment of Site Contamination) Measure 1999 Table 1C Groundwater Investigation Levels - Drinking Water ;

3 ANZECC / ARMCANZ (2000) - Australian and New Zealand Guidelines for Fresh and Marine Water Quality - Irrigation and general water use guidelines

4 ANZAST(2018) - Australian and New Zealand Guidelines for Fresh and Marine Water Quality - High Conservation / ecological Value System

Table 7
pH and CEC
Soil Analytical Results
Tweed Valley Hospital DSi/PSI
J8961

OCTIEFQLD	HA1-0.15	HA1-0.5	HA8-1	HA20-1	HA30-1
SAMPLE DATE	1/08/2018	1/08/2018	2/08/2018	1/08/2018	3/08/2018
TWEED HOSPITAL CUDGER RD (J8961)	M18-Au14538	M18-Au14539	M18-Au14540	M18-Au14541	M18-Au14542
% Moisture	19	27	30	19	17
Conductivity (1:5 aqueous extract at 25Â°C as	21	14	28	29	61
pH (1:5 Aqueous extract at 25Â°C as rec.)	5.8	8.2	8.1	7.8	7.7
Cation Exchange Capacity					
Cation Exchange Capacity	5.9	5.8	15	12	7.4

Table 1: Sample Description and Analytical Summary

Sample	Depth (m)	Date sampled	Description	Lead	OCPs
Soil - Test Pits					
Residential house					
TP01	0.1	30/11/18	Reworked natural: Dark brown to red silty clay. Slightly moist with low plasticity. Anthropogenic inclusions of glass and tiles.	•	•
TP01	0.3	30/11/18	Reworked natural: Dark brown to red silty clay. Slightly moist with low plasticity. Anthropogenic inclusions of glass and tiles.	•	•
TP01	0.6	12/12/18	Dark brown to red silty clay. Slightly moist with low plasticity.	•	
TP02	0.1	30/11/18	Reworked natural: Dark brown to red silty clay. Slightly moist with low plasticity. Anthropogenic inclusions of glass and tiles.	•	•
TP02	0.3	30/11/18	Reworked natural: Dark brown to red silty clay. Slightly moist with low plasticity. Anthropogenic inclusions of glass and tiles.	•	
TP02	0.6	12/12/18	Dark brown to red silty clay. Slightly moist with low plasticity.	•	
TP03	0.1	30/11/18	Reworked natural: Dark brown to red silty clay. Slightly moist with low plasticity. Anthropogenic inclusions of glass and tiles.	•	•
TP03	0.3	30/11/18	Reworked natural: Dark brown to red silty clay. Slightly moist with low plasticity. Anthropogenic inclusions of glass and tiles.	•	•
TP03	0.6	12/12/18	Dark brown to red silty clay. Slightly moist with low plasticity.	•	
TP04	0.1	30/11/18	Reworked natural: Dark brown to red silty clay. Slightly moist with low plasticity. Anthropogenic inclusions of glass and tiles.	•	•
TP04	0.3	30/11/18	Reworked natural: Dark brown to red silty clay. Slightly moist with low plasticity. Anthropogenic inclusions of glass and tiles.	•	
TP05	0.1	30/11/18	Dark brown to red silty clay. Slightly moist with low plasticity.	•	•
TP06	0.1	30/11/18	Dark brown to red silty clay. Slightly moist with low plasticity.	•	•

Table 1: Sample Description and Analytical Summary

Sample	Depth (m)	Date sampled	Description	Lead	OCPs
TP06	0.3	12/12/18	Dark brown to red silty clay. Slightly moist with low plasticity.	•	
TP07	0.1	30/11/18	Dark brown to red silty clay. Slightly moist with low plasticity.	•	•
TP08	0.1	30/11/18	Dark brown to red silty clay. Slightly moist with low plasticity.	•	•
TP09	0.1	30/11/18	Dark brown to red silty clay. Slightly moist with low plasticity.	•	•
TP10	0.1	30/11/18	Dark brown to red silty clay. Slightly moist with low plasticity.	•	•
TP11	0.1	30/11/18	Dark brown to red silty clay. Slightly moist with low plasticity.	•	•
TP12	0.1	30/11/18	Dark brown to red silty clay. Slightly moist with low plasticity.	•	•
TP13	0.1	30/11/18	Reworked natural: Dark brown to red silty clay. Slightly moist with low plasticity. Anthropogenic inclusions of glass and tiles.	•	•
TP14	0.1	30/11/18	Reworked natural: Dark brown to red silty clay. Slightly moist with low plasticity. Anthropogenic inclusions of glass and tiles.	•	•
TP15	0.1	30/11/18	Dark brown to red silty clay. Slightly moist with low plasticity.	•	•
TP16	0.1	30/11/18	Dark brown to red silty clay. Slightly moist with low plasticity.	•	•
TP17	0.1	30/11/18	Dark brown to red silty clay. Slightly moist with low plasticity.	•	•
TP18	0.1	30/11/18	Dark brown to red silty clay. Slightly moist with low plasticity.	•	•
TP19	0.1	30/11/18	Dark brown to red silty clay. Slightly moist with low plasticity.	•	•
Underneath garage slab					
TP28	0.1	11/12/18	Dark brown to red silty clay. Slightly moist with low plasticity.		•
TP29	0.1	11/12/18	Dark brown to red silty clay. Slightly moist with low plasticity.		•
TP30	0.1	11/12/18	Dark brown to red silty clay. Slightly moist with low plasticity.		•

Table 2: Soil Analytical Summary, OCPs and Lead

Sample	Depth (m)	Heptachlor	Total Chlordane (sum)	Endrin	Endosulfan (sum)	Methoxychlor	Sum of Aldrin + Dieldrin	Sum of DDD + DDE + DDT	Hexachlorobenzene (HCB)	Sum of OCPs	Lead
LORs		*0.05*	*0.05*	*0.05*	*0.05*	*0.2*	*0.05*	*0.05*	*0.05*	-	*0.1*
Analytical - Test pits											
Residential House											
TP01	0.1	nd	4.1	nd	nd	nd	0.77	3.58	nd	8.45	**1,090**
TP01	0.3	nd	2.06	nd	nd	nd	1.18	9.07	nd	12.31	**1,600**
TP01	0.6	-	-	-	-	-	-	-	-	-	144
TP02	0.1	nd	0.16	nd	nd	nd	0.14	0.06	nd	0.36	**1,070**
TP02	0.3	-	-	-	-	-	-	-	-	-	**838**
TP02	0.6	-	-	-	-	-	-	-	-	-	**324**
TP03	0.1	nd	nd	nd	nd	nd	0.88	1.09	nd	1.97	**502**
TP03	0.3	nd	nd	nd	nd	nd	0.34	0.25	nd	0.59	**416**
TP03	0.6	-	-	-	-	-	-	-	-	-	15
TP04	0.1	nd	0.14	nd	nd	nd	0.29	0.08	nd	0.51	**324**
TP04	0.3	-	-	-	-	-	-	-	-	-	252
TP05	0.1	nd	nd	nd	nd	nd	nd	0.83	nd	0.83	155
TP06	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	**317**
TP06	0.3	-	-	-	-	-	-	-	-	-	162
TP07	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	64.6
TP08	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	60.9
TP09	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	161
TP10	0.1	nd	nd	nd	nd	nd	0.23	0.07	nd	0.3	119
TP11	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	32.2
TP12	0.1	nd	nd	nd	nd	nd	nd	0.1	nd	0.1	195
TP13	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	34
TP14	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	54.8
TP15	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	72.4
TP16	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	134
TP17	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	76.5
TP18	0.1	nd	nd	nd	nd	nd	nd	0.07	nd	0.07	27
TP19	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	31.6

Table 2: Soil Analytical Summary, OCPs and Lead

Sample	Depth (m)	Heptachlor	Total Chlordane (sum)	Endrin	Endosulfan (sum)	Methoxychlor	Sum of Aldrin + Dieldrin	Sum of DDD + DDE + DDT	Hexachlorobenzene (HCB)	Sum of OCPs	Lead
LORs		*0.05*	*0.05*	*0.05*	*0.05*	*0.2*	*0.05*	*0.05*	*0.05*	-	*0.1*
Underneath garage slab											
TP28	0.1	nd	nd	nd	nd	nd	5.18	nd	nd	5.18	-
TP29	0.1	nd	nd	nd	nd	nd	5.19	0.1	nd	5.29	-
TP30	0.1	nd	nd	nd	nd	nd	10.6	nd	nd	10.6	-
Statistics											
Samples analysed		21	21	21	21	21	21	21	21	21	27
Detects		0	4	0	0	0	7	10	0	10	27
% detect		0%	19%	0%	0%	0%	33%	48%	0%	48%	100%
Maximum		<0.05	4.10	<0.05	<0.05	<0.05	1.18	9.07	<0.05	12	**1,600**
Mean		<0.05	0.31	<0.05	<0.05	<0.05	0.18	0.72	<0.05	1.21	306
Median		<0.05	1.11	<0.05	<0.05	<0.05	0.34	0.18	<0.05	0.55	155
Minimum		<0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	15
Criteria											
HILs- Residential A		6	50	10	270	300	6	240	10	-	**300**
EILs - Urban residential and public open space		-	-	-	-	-	-	180 (DDT only)	-	-	1,100

Table 3: Soil Analytical Summary, Quality Control (mg/kg)

Analyte	LOR mg/kg	TP09_0.1	QS01	**RPD**	TP09_0.1	QS02	**RPD**
Type	-	*Primary*	*Duplicate*	*%*	*Primary*	*Inter-laboratory Duplicate*	*%*
Date	-	30/11/18	30/11/18	-	30/11/18	30/11/18	-
Media	*Soil*	*Soil*	*Soil*	-	*Soil*	*Soil*	-
Heavy metals							
Lead	5	161	167	4	161	140	14
Organochlorine Pesticides (OCPs)							
Heptachlor	0.05	nd	nd	-	nd	nd	-
Total Chlordane (sum)	0.05	nd	nd	-	nd	nd	-
Endrin	0.05	nd	nd	-	nd	nd	-
Endosulfan (sum)	0.05	nd	nd	-	nd	nd	-
Methoxychlor	0.2	nd	nd	-	nd	nd	-
Sum of Aldrin + Dieldrin	0.05	nd	0.88	-	nd	nd	-
Sum of DDD + DDE + DDT	0.05	nd	0.11	-	nd	nd	-
Hexachlorobenzene (HCB)	0.05	nd	nd	-	nd	nd	-
Sum of OCPs	-	nd	0.99	-	nd	nd	-
Data Quality Indicator		-	-	*<50%*	-	-	*<50%*

See tables notes at end of section

Table 3: Soil Analytical Summary, Quality Control (mg/kg)

Analyte	LOR mg/kg	TP07_0.1	QS03	**RPD**	TP07_0.1	QS04	**RPD**
Type	-	*Primary*	*Duplicate*	*%*	*Primary*	*Inter-laboratory Duplicate*	*%*
Date	-	30/11/18	30/11/18	-	30/11/18	30/11/18	-
Media	*Soil*	*Soil*	*Soil*	-	*Soil*	*Soil*	-
Heavy metals							
Lead	5	64.6	61.9	4	64.6	57	13
Organochlorine Pesticides (OCPs)							
Heptachlor	0.05	nd	nd	-	nd	nd	-
Total Chlordane (sum)	0.05	nd	nd	-	nd	nd	-
Endrin	0.05	nd	nd	-	nd	nd	-
Endosulfan (sum)	0.05	nd	nd	-	nd	nd	-
Methoxychlor	0.2	nd	nd	-	nd	nd	-
Sum of Aldrin + Dieldrin	0.05	nd	nd	-	nd	nd	-
Sum of DDD + DDE + DDT	0.05	nd	nd	-	nd	nd	-
Hexachlorobenzene (HCB)	0.05	nd	nd	-	nd	nd	-
Sum of OCPs	-	nd	nd	-	nd	nd	
Data Quality Indicator		-	-	*<50%*	-	-	*<50%*

See tables notes at end of section

Table 3: Soil Analytical Summary, Quality Control (mg/kg)

Analyte	LOR mg/kg	TP03_0.6	QS03	**RPD**	TP03_0.6	QS06	**RPD**
Type	-	*Primary*	*Duplicate*	*%*	*Primary*	*Inter-laboratory Duplicate*	*%*
Date	-	12/12/18	12/12/18	-	12/12/18	12/12/18	-
Media	*Soil*	*Soil*	*Soil*	-	*Soil*	*Soil*	-
Heavy metals							
Lead	5	15	26	**54**	15	6	**86**
Organochlorine Pesticides (OCPs)							
Heptachlor	0.05	-	-	-	-	-	**-**
Total Chlordane (sum)	0.05	-	-	-	-	-	**-**
Endrin	0.05	-	-	-	-	-	**-**
Endosulfan (sum)	0.05	-	-	-	-	-	**-**
Methoxychlor	0.2	-	-	-	-	-	**-**
Sum of Aldrin + Dieldrin	0.05	-	-	-	-	-	**-**
Sum of DDD + DDE + DDT	0.05	-	-	-	-	-	**-**
Hexachlorobenzene (HCB)	0.05	-	-	-	-	-	-
Sum of OCPs	-	-	-	-	-	-	
Data Quality Indicator		-	-	***<50%***	-	-	***<50%***

See tables notes at end of section

Soil Analytical Summary Table Notes

LOR denotes limit of reporting (standard LOR unless otherwise shown)

PBILs denotes phytotoxicity based investigation levels

nd denotes not detected above the LOR

NL denotes non-limiting

- denotes not analysed/not available

Bold - Exceeds landuse criteria

^ denotes raised LOR

TRH C6-C10 F1 = TRH C6-C10 minus BTEX compounds

*analyte list shown on laboratory report

1. Methyl mercury / inorganic mercury
2. Netherlands protection of terrestrial organisms/ Netherlands human health based and human health and ecologically based protection level.
3. Criteria for phenol

Table 1: Sample Description and Analytical Summary

Sample	Depth (m)	Date sampled	Description	OCPs	Lead	Asbestos
Soil - Test Pits						
Cavvanba, 2018: Underneath farm shed slab						
TP20	0.1	11/12/18	Dark brown to red silty CLAY. Slightly moist with low plasticity.	•		
TP21	0.1	11/12/18	Dark brown to red silty CLAY. Slightly moist with low plasticity.	•		
TP22	0.1	11/12/18	Dark brown to red silty CLAY. Slightly moist with low plasticity.	•		
TP23	0.1	11/12/18	Dark brown to red silty CLAY. Slightly moist with low plasticity.	•		
TP24	0.1	11/12/18	Dark brown to red silty CLAY. Slightly moist with low plasticity.	•		
TP25	0.1	11/12/18	Dark brown to red silty CLAY. Slightly moist with low plasticity.	•		
TP26	0.1	11/12/18	Dark brown to red silty CLAY. Slightly moist with low plasticity.	•		
TP27	0.1	11/12/18	Dark brown to red silty CLAY. Slightly moist with low plasticity.	•		
OCTIEF, 2018: Around farm shed						
HA1	0.15	01/08/18	Silty CLAY: red brown, traces to some fine gravel, medium plasticity, dry to damp. Inclusion of ACM fragments.	•	•	•
HA2	0.15	01/08/18	Silty CLAY: red brown, traces to some fine gravel, medium plasticity, dry to damp.	•	•	•
HA2	0.5	01/08/18	Silty CLAY: red brown, traces to some fine gravel, medium plasticity, dry to damp.	•	•	•

Table 1: Sample Description and Analytical Summary

Sample	Depth (m)	Date sampled	Description	OCPs	Lead	Asbestos
Cavvanba, 2018: Around farm shed						
TP31	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP32	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity. Inclusions of ACM fragments.	•	•	•
TP32	0.3	14/12/18	Natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.			•
TP33	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP34	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP35	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP36	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP37	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP38	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP39	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP40	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP41	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP42	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP43	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity. Inclusions of plastic and nails.	•	•	•

Table 2: Soil Analytical Summary, OCPs and Lead

Sample	Depth (m)	OCPs									Metals
		Heptachlor	Total Chlordane (sum)	Endrin	Endosulfan (sum)	Methoxychlor	Sum of Aldrin + Dieldrin	Sum of DDD + DDE + DDT	Hexachlorobenzene (HCB)	Sum of OCPs	Lead
LORs		*0.05*	*0.05*	*0.05*	*0.05*	*0.2*	*0.05*	*0.05*	*0.05*	-	*0.1*
Analytical - Test pits											
Cavvanba, 2018: Underneath farm shed slab											
TP20	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	-
TP21	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	-
TP22	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	-
TP23	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	-
TP24	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	-
TP25	0.1	nd	nd	nd	nd	nd	0.56	nd	nd	nd	-
TP26	0.1	nd	nd	nd	nd	nd	0.19	nd	nd	0.19	-
TP27	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	-
OCTIEF, 2018: Around farm shed											
HA1	0.15	nd	nd	nd	nd	nd	nd	0.08	nd	0.08	23
HA2	0.15	nd	nd	nd	nd	nd	nd	0.08	nd	0.08	63
HA2	0.5	nd	nd	nd	nd	nd	nd	0.07	nd	0.07	23
Cavvanba 2018: Around farm shed											
TP31	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	33.8
TP32	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	39.1
TP33	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	34.7
TP34	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	38.2
TP35	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	26.4
TP36	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	20
TP37	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	7.3
TP38	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	9.8
TP39	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	20.6
TP40	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	32
TP41	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	13.8

Table 2: Soil Analytical Summary, OCPs and Lead

Sample	Depth (m)	OCPs									Metals
		Heptachlor	Total Chlordane (sum)	Endrin	Endosulfan (sum)	Methoxychlor	Sum of Aldrin + Dieldrin	Sum of DDD + DDE + DDT	Hexachlorobenzene (HCB)	Sum of OCPs	Lead
LORs		*0.05*	*0.05*	*0.05*	*0.05*	*0.2*	*0.05*	*0.05*	*0.05*	-	*0.1*
TP42	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	23
TP43	0.1	nd	nd	nd	0.89	nd	0.09	0.27	nd	1.25	43.8
Statistics											
Samples analysed		21	21	21	21	21	21	21	21	21	13
Detects		0	0	0	1	0	3	4	0	5	16
% detect		0%	0%	0%	5%	0%	14%	19%	0%	24%	123%
Maximum		<0.05	<0.05	<0.05	0.89	<0.05	0.56	0.27	<0.05	1	63
Mean		<0.05	<0.05	<0.05	0.04	<0.05	0.04	0.02	<0.05	0.08	34.73
Median		<0.05	<0.05	<0.05	0.89	<0.05	0.19	0.08	<0.05	0.08	24.70
Minimum		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	7
Criteria											
HILs- Residential A		6	50	10	270	300	6	240	10	-	300
EILs - Urban residential and public open space		-	-	-	-	-	-	180 (DDT only)	-	-	1,100

Table 3: Soil Analytical Summary, Asbestos in soil

Sample	Depth (m)	Date	Asbestos detected in soil
LORs			-
Analytical - Asbestos			
OCTIEF, 2018: Around Farm Shed			
HA1	0.0 - 0.1	1/08/2018	**Yes**
HA2	0.0 - 0.1	1/08/2018	No
Cavvanba, 2018: Around Farm Shed			
TP31	0.1	14/12/2018	No
TP32	0.1	14/12/2018	**Yes**
TP32	0.3	14/12/2018	No
TP33	0.1	14/12/2018	**Yes***
TP34	0.1	14/12/2018	No
TP35	0.1	14/12/2018	No
TP36	0.1	14/12/2018	No
TP37	0.1	14/12/2018	No
TP38	0.1	14/12/2018	No
TP39	0.1	14/12/2018	No
TP40	0.1	14/12/2018	No
TP41	0.1	14/12/2018	No
TP42	0.1	14/12/2018	No
TP43	0.1	14/12/2018	No
Criteria			
Site specific criteria**			**Yes**

*** -** Asbestos material was detected and positively identified at concentrations estimated to be below 0.1g/kg. No asbestos found at the reporting limit of 0.1g/kg, by polarised light microscopy including dispersion staining.

** - Site specific investigation screening criteria.

See table notes at end of section

Table 4: Soil Analytical Summary, Quality Control (mg/kg)

Analyte	LOR mg/kg	TP39_0.1	QS07	**RPD**	TP39_0.1	QS08	**RPD**
Type	-	*Primary*	*Duplicate*	*%*	*Primary*	*Inter-laboratory Duplicate*	*%*
Date	-	14/12/18	14/12/18	-	14/12/18	14/12/18	-
Media	*Soil*	*Soil*	*Soil*	-	*Soil*	*Soil*	-
Heavy metals							
Lead	5	11.1	13	12	11.1	16	36
Organochlorine Pesticides (OCPs)							
Heptachlor	0.05	nd	nd	-	nd	nd	-
Total Chlordane (sum)	0.05	nd	nd	-	nd	nd	-
Endrin	0.05	nd	nd	-	nd	nd	-
Endosulfan (sum)	0.05	nd	nd	-	nd	nd	-
Methoxychlor	0.2	nd	nd	-	nd	nd	-
Sum of Aldrin + Dieldrin	0.05	nd	nd	-	nd	nd	-
Sum of DDD + DDE + DDT	0.05	nd	nd	-	nd	nd	-
Hexachlorobenzene (HCB)	0.05	nd	nd	-	nd	nd	-
Sum of OCPs	-	nd	nd	-	nd	nd	-
Data Quality Indicator		-	-	*<50%*	-	-	*<50%*

See tables notes at end of section

Soil Analytical Summary Table Notes

LOR denotes limit of reporting (standard LOR unless otherwise shown)

PBILs denotes phytotoxicity based investigation levels

nd denotes not detected above the LOR

NL denotes non-limiting

- denotes not analysed/not available

Bold - Exceeds landuse criteria

^ denotes raised LOR

TRH C6-C10 F1 = TRH C6-C10 minus BTEX compounds

*analyte list shown on laboratory report

1. Methyl mercury / inorganic mercury
2. Netherlands protection of terrestrial organisms/ Netherlands human health based and human health and ecologically based protection level.
3. Criteria for phenol

Appendix F Regulatory Search Results

Search results

Your search for:LGA: Tweed Shire Council

Matched 11 notices relating to 4 sites.

Search Again

Refine Search

Suburb	Address	Site Name	Notices related to this site
BYANGUM	Old Lismore ROAD	Dip 5022 Oakbank	2 former
MURWILLUMBAH	182 Tweed Valley WAY	Puma Murwillumbah (formerly Matilda)	1 current
TERRANORA	Federation DRIVE	Dip 4766 Lamberts	3 former
TWEED HEADS	60 Pacific HIGHWAY	Former Mobil Quix Service Station	5 former

Page 1 of 1

23 January 2019

Search results

Your search for: **General Search** with the following criteria

Suburb - Cudgen

returned 10 results

Export to excel 1 of 1 Pages Search Again

Number	Name	Location	Type	Status	Issued date
12385	GALES-KINGSCLIFF PTY LIMITED	Altona Drive, CUDGEN, NSW 2487	POEO licence	Issued	18 Nov 2005
1096630	GALES-KINGSCLIFF PTY LIMITED	Altona Drive, CUDGEN, NSW 2487	s.58 Licence Variation	Issued	08 Jan 2009
1509651	GALES-KINGSCLIFF PTY LIMITED	Altona Drive, CUDGEN, NSW 2487	s.58 Licence Variation	Issued	11 Dec 2012
11453	HANSON CONSTRUCTION MATERIALS PTY LTD	CRESENT STREET, CUDGEN, NSW 2487	POEO licence	Issued	27 Jul 2001
4686	SOUTH EAST EXCAVATIONS PTY. LIMITED	LOT 71 LOADERS ROAD, CUDGEN, NSW 2487	POEO licence	Surrendered	11 Jul 2000
1010166	SOUTH EAST EXCAVATIONS PTY. LIMITED	LOT 71 LOADERS ROAD, CUDGEN, NSW 2487	s.58 Licence Variation	Issued	22 Aug 2002
1044842	SOUTH EAST EXCAVATIONS PTY. LIMITED	LOT 71 LOADERS ROAD, CUDGEN, NSW 2487	s.58 Licence Variation	Issued	24 Feb 2005
1045391	SOUTH EAST EXCAVATIONS PTY. LIMITED	LOT 71 LOADERS ROAD, CUDGEN, NSW 2487	s.58 Licence Variation	Issued	14 Mar 2005
1051066	SOUTH EAST EXCAVATIONS PTY. LIMITED	LOT 71 LOADERS ROAD, CUDGEN, NSW 2487	s.58 Licence Variation	Issued	21 Sep 2005
1053870	SOUTH EAST EXCAVATIONS PTY. LIMITED	LOT 71 LOADERS ROAD, CUDGEN, NSW 2487	s.58 Licence Variation	Issued	25 Nov 2005

23 January 2019

List of NSW Contaminated Sites Notified to EPA as of 12 December 2018

Background

A strategy to systematically assess, prioritise and respond to notifications under Section 60 of the *Contaminated Land Management Act 1997* (CLM Act) has been developed by the EPA. This strategy acknowledges the EPA's obligations to make information available to the public under *Government Information (Public Access) Act 2009*.

When a site is notified to the EPA, it may be accompanied by detailed site reports where the owner has been proactive in addressing the contamination and its source. However, often there is minimal information on the nature or extent of the contamination.

For some notifications, the information indicates the contamination is securely immobilised within the site, such as under a building or carpark, and is not currently causing any offsite consequences to the community or environment. Such sites would still need to be cleaned up, but this could be done in conjunction with any subsequent building or redevelopment of the land. These sites may not require intervention under the CLM Act, but could be dealt with through the planning and development consent process.

Where indications are that contamination is significant enough to warrant regulation having regard to the matters in section 12 of the CLM Act, the EPA may apply the regulatory provisions of the CLM Act to have the appropriate person (for example, the responsible polluter and/or landowner) investigate and remediate the site.

Where the EPA reasonably suspects that a pollution incident is occurring (or has occurred) at a premise, the EPA, as the appropriate regulatory authority, may choose to regulate the incident and any resulting contamination under the POEO Act by ordering the occupier or the owner to carry out certain actions.

As such, the sites notified to the EPA and presented in the following table are at various stages of the assessment and/or remediation process. Understanding the nature of the underlying contamination, its implications and implementing a remediation program where required, can take a considerable period of time. The tables provide an indication, in relation to each nominated site, as to the management status of that particular site. Further detailed information may be available from the EPA or the responsible landowner.

The following questions and answers may assist those interested in this issue:

Frequently asked questions

What is the difference between the "List of NSW Contaminated Sites Notified to the EPA" and the "Contaminated Land: Record of Notices"?

A site will be on the Contaminated Land: Record of Notices only if the EPA has issued a regulatory notice in relation to the site under the *Contaminated Land Management Act 1997*.

The sites appearing on this "List of NSW contaminated sites notified to the EPA" indicate that the notifiers consider that the sites are contaminated and warrant reporting to the EPA. However, the contamination may or may not be significant enough to warrant regulation by the EPA. The EPA needs to review and, if necessary, obtain more information before it can make a determination as to whether the site warrants regulation.

Why my site appears on the list?

Your site appears on the list because of one or more of the following reasons:

- The site owner and/or the person partly or fully responsible for causing the contamination notified to the EPA about the contamination under Section 60 of the *Contaminated Land Management Act 1997*. In other words, the site owner or the "polluter" believes the site is contaminated.
- The EPA has been notified via other means and is satisfied that the site is or was contaminated.

Does the list contain all contaminated sites in NSW?

No. The list only contains contaminated sites that the EPA is aware of, with regard to its regulatory role under the CLM Act. An absence of a site from the list does not necessarily imply the site is not contaminated.

The EPA relies upon responsible parties to notify contaminated sites.

How are these notified contaminated sites managed by the EPA?

There are different ways that the EPA manages these notified contaminated sites. First, an initial assessment is carried out by the EPA. At the completion of the initial assessment, the EPA may take one or more than one of the following management approaches:

- The contamination warrants the EPA's direct regulatory intervention either under the *Contaminated Land Management Act 1997* or the *Protection of the Environment Operations Act 1997* (POEO Act), or both. Information about current or past regulatory action on this site can be found on EPA website.
- The contamination with respect to the current use or approved use of the site, as defined under the *Contaminated Land Management Act 1997,* is not significant enough that it warrants EPA regulation.
- The contamination does not require EPA regulation and can be managed by a planning approval process.
- The contamination is related to an operational Underground Petroleum Storage System, such as a service station or fuel depot. The contamination may be managed under the POEO Act and the Protection of the Environment Operation (Underground Petroleum Storage Systems) Regulation 2014.
- The contamination is being managed under a specifically tailored program operated by another agency (for example t
- he Department of Industry and Investment's *Derelict Mines Program*).

I am the owner of a site that appears on the list. What should I do?

First of all, you should ensure the current use of the site is compatible with the site contamination. Secondly, if the site is the subject of EPA regulation, make sure you comply with the regulatory requirements, and you have considered your obligations to notify other parties who may be affected.

If you have any concerns, contact us and we may be able to offer you general advice, or direct you to accredited professionals who can assist with specific issues.

I am a prospective buyer of a site that appears on the list. What should I do?

You should seek advice from the vendor to put the contamination issue into perspective. You may need to seek independent expert advice.

The information provided in the list is meant to be indicative only, and a starting point for your own assessment. Site contamination as a legacy of past site uses is not uncommon, particularly in an urbanised environment. If the contamination on a site is properly remediated or managed, it may not materially impact upon the intended future use of the site. However, each site needs to be considered in context.

List of NSW Contaminated Sites Notified to the EPA

Disclaimer

The EPA has taken all reasonable care to ensure that the information in the list of contaminated sites notified to the EPA (the list) is complete and correct. The EPA does not, however, warrant or represent that the list is free from errors or omissions or that it is exhaustive.

The EPA may, without notice, change any or all of the information in the list at any time.

You should obtain independent advice before you make any decision based on the information in the list.

The list is made available on the understanding that the EPA, its servants and agents, to the extent permitted by law, accept no responsibility for any damage, cost, loss or expense incurred by you as a result of:

1. any information in the list; or
2. any error, omission or misrepresentation in the list; or
3. any malfunction or failure to function of the list;
4. without limiting (2) or (3) above, any delay, failure or error in recording, displaying or updating information.

Site Status	Explanation
Under assessment	The contamination is being assessed by the EPA to determine whether regulation is required. The EPA may require further information to complete the assessment. For example, the completion of management actions regulated under the planning process or *Protection of the Environment Operations Act 1997*. Alternatively, the EPA may require information via a notice issued under s77 of the *Contaminated Land Management Act 1997* or issue a Preliminary Investigation Order.
Regulation under CLM Act not required	The EPA has completed an assessment of the contamination and decided that regulation under the *Contaminated Land Management Act 1997* is not required.
Regulation being	The EPA has completed an assessment of the contamination and decided

finalised	that the contamination is significant enough to warrant regulation under the *Contaminated Land Management Act 1997*. A regulatory approach is being finalised.
Contamination currently regulated under CLM Act	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation under the *Contaminated Land Management Act 1997* (CLM Act). Management of the contamination is regulated by the EPA under the CLM Act. Regulatory notices are available on the EPA's Contaminated Land Public Record.
Contamination currently regulated under POEO Act	Contamination is currently regulated under the *Protection of the Environment Operations Act 1997* (POEO Act). The EPA as *the appropriate regulatory authority* reasonably suspects that a pollution incident is occurring/ has occurred and that it requires regulation under the POEO Act. The EPA may use environment protection notices, such as clean up notices, to require clean up action to be taken. Such regulatory notices are available on the POEO public register.
Contamination being managed via the planning process (EP&A Act)	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation. The contamination of this site is managed by the consent authority under the *Environmental Planning and Assessment Act 1979* (EP&A Act) planning approval process, with EPA involvement as necessary to ensure significant contamination is adequately addressed. The consent authority is typically a local council or the Department of Planning and Environment.
Contamination formerly regulated under the CLM Act	The EPA has determined that the contamination is no longer significant enough to warrant regulation under the *Contaminated Land Management Act 1997* (CLM Act). The contamination was addressed under the CLM Act.
Contamination formerly regulated under the POEO Act	The EPA has determined that the contamination is no longer significant enough to warrant regulation. The contamination was addressed under the *Protection of the Environment Operations Act 1997* (POEO Act).
Contamination was addressed via the planning process	The EPA has determined that the contamination is no longer significant enough to warrant regulation. The contamination was addressed by the appropriate consent authority via the planning process under the

(EP&A Act)	*Environmental Planning and Assessment Act 1979* (EP&A Act).
Ongoing maintenance required to manage residual contamination (CLM Act)	The EPA has determined that ongoing maintenance, under the *Contaminated Land Management Act 1997* (CLM Act), is required to manage the residual contamination. Regulatory notices under the CLM Act are available on the EPA's Contaminated Land Public Record.

Suburb	SiteName	Address	ContaminationActivityType	ManagementClass	Latitude	Longitude
CORRIMAL	Woolworths Petrol - Corrimal	275-277 Princes HIGHWAY	Service Station	Under assessment	-34.37527426	150.8962637
CORRIMAL	7-Eleven Corrimal	138-146 Princes HIGHWAY	Service Station	Regulation under CLM Act not required	-34.36986923	150.8978271
COWRA	Landmark Fertiliser Storage Facility	Corner Young Road & Waratah STREET	Chemical Industry	Regulation under CLM Act not required	-33.84321832	148.6722578
COWRA	Lowes Petroleum (former BP Cowra Depot)	12 Campbell STREET	Other Petroleum	Regulation under CLM Act not required	-33.83803706	148.6977873
COWRA	Former Gasworks	30 Brougham STREET	Gasworks	Contamination currently regulated under CLM Act	-33.8389659	148.6963482
COWRA	Shell Depot	34 Brougham STREET	Other Petroleum	Contamination formerly regulated under the CLM Act	-33.83932421	148.6976295
CRANGAN BAY	Big T Road House.	555 and 565 Pacific HIGHWAY	Service Station	Contamination currently regulated under CLM Act	-33.17326538	151.6083864
CREMORNE	Shell Coles Express Service Station	225 Military ROAD	Service Station	Regulation under CLM Act not required	-33.83063306	151.226223
CRESTWOOD	Former Caltex Depot Queanbeyan	36 Kendall (Cnr Stephens Rd) AVENUE	Other Petroleum	Regulation under CLM Act not required	-35.34615546	149.207807
CRESTWOOD	Former BP Queanbeyan	64 Uriarra ROAD	Service Station	Regulation under CLM Act not required	-35.34646177	149.2246263
CRONULLA	Breen Holdings	Bate Bay ROAD	Other Industry	Regulation under CLM Act not required	-34.03861737	151.1614114
CROWS NEST	Caltex Service Station	111-121 Falcon STREET	Service Station	Regulation under CLM Act not required	-33.82868236	151.2060317
CROYDON	Caltex Service Station	404-410 Liverpool ROAD	Service Station	Regulation under CLM Act not required	-33.88853994	151.115879
CROYDON	BP Ashfield	584 Parramatta ROAD	Service Station	Regulation under CLM Act not required	-33.87399409	151.1267296
CROYDON PARK	Mobil Service Station	334 Georges River ROAD	Service Station	Regulation under CLM Act not required	-33.89771626	151.0999194
CULCAIRN	Caltex Service Station	2883 Olympic HIGHWAY	Service Station	Regulation under CLM Act not required	-35.67441635	147.0356845
CULLEN BULLEN	Baal Bone Colliery	Castlereagh HIGHWAY	Other Industry	Regulation under CLM Act not required	-33.27193875	150.0587194
CUNDLETOWN	Caltex Service Station (1 Manning River Drive)	Old Pacific HIGHWAY	Service Station	Regulation under CLM Act not required	-31.89329598	152.5068225
CURL CURL	John Fisher Park	Corner Harbord and Abbott ROADS	Landfill	Regulation under CLM Act not required	-33.76352692	151.2798462
DACEYVILLE	Astrolabe Park	Cook AVENUE	Landfill	Under assessment	-33.92963704	151.221773
DAPTO	RailCorp Dapto	(Rear of property) 12-14 Hamilton STREET	Other Industry	Regulation under CLM Act not required	-34.50045405	150.787353
DARLINGHURST	Proposed Retail Unit	139-155 Palmer STREET	Unclassified	Regulation under CLM Act not required	-33.87504688	151.2168106
DARLINGHURST	Cross City Tunnel	Riley Street and William STREET	Service Station	Contamination was addressed via the planning process (EP&A Act)	-33.87424636	151.2158305
DARLINGHURST	18-28 Neild Avenue, Darlinghurst	18-28 Neild AVENUE	Landfill	Regulation under CLM Act not required	-33.87876581	151.2276546
DEE WHY	United Dee Why	1 The Strand STREET	Service Station	Regulation being finalised	-33.75569207	151.2959451

Search Results

1 result found.

Cudgen Burial Ground Chinderah Rd	Chinderah, NSW, Australia	(Registered) Register of the National Estate (Non-statutory archive)

Report Produced: Wed Jan 23 12:11:43 2019

Search for NSW heritage

Return to search page where you can refine/broaden your search.

Statutory listed items

Information and items listed in the State Heritage Inventory come from a number of sources. This means that there may be several entries for the same heritage item in the database. For clarity, the search results have been divided into three sections.

- **Section 1** - contains Aboriginal Places declared by the **Minister for the Environment** under the National Parks and Wildlife Act. This information is provided by the Heritage Division.
- **Section 2** - contains heritage items listed by the **Heritage Council of NSW** under the NSW Heritage Act. This includes listing on the State Heritage Register, an Interim Heritage Order or protected under section 136 of the NSW Heritage Act. This information is provided by the Heritage Division.
- **Section 3** - contains items listed by **local councils** on Local Environmental Plans under the Environmental Planning and Assessment Act, 1979 and **State government agencies** under s.170 of the Heritage Act. This information is provided by local councils and State government agencies.

Section 1. Aboriginal Places listed under the National Parks and Wildlife Act.

Your search did not return any matching results.

Section 2. Items listed under the NSW Heritage Act.

Your search did not return any matching results.

Section 3. Items listed by Local Government and State Agencies.

Your search returned 3 records.

Item name ▲	Address	Suburb	LGA	Information source
Cudgen Sugar Mill Remains	Tweed Coast Road	Cudgen	Tweed	LGOV
Dry Stone Walls	463 and 501 Cudgen Road	Cudgen	Tweed	LGOV
War Memorial Cenotaph and Public School Rolls	11 Collier Street	Cudgen	Tweed	LGOV

There was a total of 3 records matching your search criteria.

Key:
LGA = Local Government Area
GAZ= NSW Government Gazette (statutory listings prior to 1997), HGA = Heritage Grant Application, HS = Heritage Study, LGOV = Local Government, SGOV = State Government Agency.
Note: While the Heritage Division seeks to keep the Inventory up to date, it is reliant on State agencies and local councils to provide their data. Always check with the relevant State agency or local council for the most up-to-date information.

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