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**

Phone **02 9276 1400**

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.

o 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.

REMEDIATION ACTION PLAN

TWEED VALLEY HOSPITAL SITE 771 CUDGEN ROAD, CUDGEN, NSW

Prepared For: NSW Health Infrastructure c/o – TSA Management

Date: 1 February 2019

OCTIEF PTY LTD
ABN: 82 163 772 478
Unit 34 53-57 Link Drive, Yatala, QLD 4207
Enquiries: 1300 138 366
Ph: 1800 OCTIEF (628 433)
corporate@octief.com.au
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DOCUMENT CONTROL RECORD

OCTIEF Pty Ltd		Job No:	J8961
Telephone:	1800 628 433	File reference:	J8961
		Date of Issue:	1 February 2019
Email:	corporate@octief.com.au	Project Manager:	Matthew Conroy

Report Details:

Title:	Remediation Action Plan – 771 Cudgen Road, Cudgen , NSW
Author(s):	Matthew Conroy B. Sc. Geology (Hons), MEIANZ
Reviewer:	Michelle Oliver *B.Sc. Geology & Environmental Systems, EIANZ*
Status:	Version 5
Approved for Release by:	Matthew Conroy B. Sc. Geology (Hons), MEIANZ
Client:	Health Infrastructure NSW c/o TSA Management

Revision History:

Issue No	Date	Issued by	Checked by	Distributed to	No. of Copies
V2	31 August 2018	Matthew Conroy	Michelle Oliver	TSA Management	1 electronic
V3	29 November 2018	Matthew Conroy	Michelle Oliver	TSA Management	1 electronic
V4	24 January 2019	Matthew Conroy	Michelle Oliver	TSA Management	1 electronic
V5	1 February 2019	Matthew Conroy	Michelle Oliver	TSA Management	1 electronic

DISCLAIMER

The management and staff of OCTIEF Pty Ltd has taken every care in compiling the information contained in their reports. As the interpretation of scientific data is often subject to professional judgement it is possible that errors may occur.

In consequence of the often subjective nature of the scientific interpretation of data, OCTIEF Pty Ltd does not guarantee the completeness or accuracy of the information provided and clients are advised that they should not rely entirely upon this information in their making of their commercial decision.

Any opinion, statement, representation or advice given by or on behalf of OCTIEF Pty Ltd is given in good faith on the basis that OCTIEF Pty Ltd, its servants, employees and agents are not subject to any liability whatsoever (whether by reason of lack of due care and attention or otherwise) and the Client releases and discharges OCTIEF Pty Ltd and its servants, agents or employees from all actions, suits, claims, demands, causes of action, costs and expenses, legal, equitable, under statute and otherwise, and all other liabilities of any nature (whether or not the parties were or could have been aware of them) which the Client may have; or but for this disclaimer, could or might have had, against OCTIEF Pty Ltd and its servants, agents or employees in any way related to the information provided or the circumstances recited in this disclaimer or allegations arising out of or in any way related to the information provided to the Client by OCTIEF Pty Ltd.

The information provided is for the benefit and use of the Client and cannot be relied upon by any third party. It has been prepared to meet the objectives of the client with reference to the future use of the Site, as understood by OCTIEF at the time of writing. Those objectives may not necessarily be the objectives desired by any other third party or any potential purchaser of the Site.

This report describes an assessment undertaken for the Site, on the basis of the proposed future land use. Should the future use of the Site change substantially, either through a change in site activities or through substantial redevelopment of the Site, then the findings of this assessment may not be applicable and reliance on them in that instance should not occur. In that instance, advice should be sought from OCTIEF on whether any further assessment or interpretation of existing data is required.

The nature of the assessment means that the findings are limited in their application and should not be considered as comprehensively addressing all potential environmental issues and risks.

Whilst we infer that the data was representative of soil conditions at the time of sampling, actual site conditions at and between the sampling locations may vary.

TABLE OF CONTENTS

LIST OF TABLES IN REPORT

APPENDICES

1. THE PROJECT

1.1 INTRODUCTION

OCTIEF Pty. Ltd. (OCTIEF) were engaged by TSA Management. on behalf of NSW Health Infrastructure (HI) to compile a Remediation Action Plan (RAP) for Lot 11 DP1246853 (the site), located at 771 Cudgen Road, Cudgen. The proposed Stage 1 Development Area for the Tweed Valley Hospital is located on the southern portion of the lot.

This RAP provides a summary of identified site contamination issues, and description of the proposed remediation and soil management programs, procedures and standards which are to be followed during the course of the preliminary works and redevelopment, to ensure the successful remediation of the site to a level suitable for the proposed land use (Hospital). This RAP has been developed in accordance with, and to meet the requirements of SEPP55 and the accompanying Department of Planning and Urban Development (DUAP) 1998 Guidelines.

1.2 BACKGROUND

A combined Stage1 and Stage 2 Environmental Site Assessment (Preliminary and Detailed Site Investigation) of the site was undertaken by OCTIEF in July 2018, in order to provide HI with confidence that the site contamination characteristics are sufficiently understood to determine the remediation required to make the site suitable for the final land use. The PSI/DSI concluded that the investigation works undertaken have sufficiently characterised the site to enable an assessment of its suitability for the proposed purpose (hospital with open space grounds), subject to implementation of a remediation action plan for the identified asbestos impacted soil.

This RAP should be read in conjunction with the PSI/DSI report.

1.3 PROPOSED DEVELOPMENT

An EIS has been prepared to accompany a State Significant Development Application for the Tweed Valley Hospital which will be assessed under Part 4 of the Environmental Planning and Assessment Act. The project has been established based on the following supporting documentation:

- Tweed Valley Hospital Business Case
- Tweed Valley Hospital Master Plan
- Tweed Valley Hospital Concept Proposal and design.

The Tweed Valley Hospital Project for which a staged approval is sought consists 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.

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) which will consist of:

- Preliminary works comprising two components:
  - CDC approval – Demolition of existing site infrastructure; and
  - REF approval – Construction of Sedimentation Basins and road way entries

- A concept development application and detailed proposal for Stage 1 (early and enabling works); and
- A second development application for Stage 2 works which will include detailed design, construction and operation of the Tweed Valley Hospital.

A detailed description of the proposed staging of the development is provided in the following sections.

1.3.1 Concept Proposal and Stage 1 Early Works

The Concept Proposal is informed by service planning to 2031/32 and has an expected gross floor area in the range 55,000m^2 to 65,000m^2. The hospital is expected to include (with more detail to be confirmed/provided at Stage 2) the following components/ services:

- A main entry and retail area
- Administration Services
- Ambulatory Services
- Acute and Sub-Acute in-patient units
- Paediatrics
- Intensive Care Unit
- Close Observation Unit
- Mental Health Services
- Maternity Unit
- Renal Dialysis
- Pathology
- Pharmacy
- Cancer Services including Day Oncology and Radiation Oncology
- Emergency Department
- Integrated Interventional Services
- Interventional Cardiology
- Medical Imaging
- Mortuary
- Back of house Services
- Car parking
- Future expansion areas;

Preliminary Works prior to commencement of Stage 1, consisting of :

- CDC approval – demolition of existing site infrastructure; and
- REF approval – Construction of sedimentation Basins and road way entries.

Stage 1 includes:

- Early and enabling works (for site clearance and preparation), generally comprising:

  - Construction Compound for Stage 1 Works;
  - Augmentation and connection of permanent services for the new facility (water, sewer, electricity, telecommunications);
  - General clearance of site vegetation within the footprint of construction works, including tree stumps;
  - Chipping of cleared vegetation (excluding weed species) to use on site for ground stabilisation/ erosion control, or off-site disposal (as required);
  - Bulk earthworks to establish the required site levels and create a stable landform in preparation for hospital construction;
  - Piling and associated works;
  - Rehabilitation and revegetation of part of the wetland area;
  - Construction of internal road ways for use during construction and in preparation for final road formations in Stage 2;
  - Retaining walls.

Plans for the preliminary works, and Concept design are attached at **Appendix C**. Further explanation of the Concept Proposal and an outline construction methodology for Stage 1 is provided at **Sections 3.7** and **3.8** respectively.

1.3.2 Stage 2: Hospital Delivery - Main Works and Operation

Stage 2 would include the detailed design, construction and operation of the Tweed Valley Hospital. Stage 2 will be subject to a separate application following Stage 1.

.

1.3.3 Subsequent Stages: Potential Future Expansion

Any subsequent stages would be subject to a separate application(s) as required and would be related to works for potential future expansion of the facility. Details of this are unknown at this stage and would be developed as required

1.4 PURPOSE

The purpose of this RAP is to provide a description of the proposed contamination remediation program, procedures and standards, which will be followed for remediation works to ensure the successful remediation of contamination at the site to render the site suitable for the proposed hospital land use and consequently the protection of the environment and human health. This RAP has been developed in accordance with, and to meet the requirements of SEPP55 and the accompanying DUAP 1998 Guidelines.

1.5 OBJECTIVES

The objectives of the RAP are to:

- Provide a framework for the remediation of soil impacts within the identified remedial areas;
- Provide validation requirements for the remediated areas;
- Provide a framework for the investigation of identified data gaps;
- Provide an outline for additional remediation/validation requirements in the event that the data gap investigation identifies contamination ;
- Establish the various safeguards required to complete remediation work in a safe and environmentally acceptable manner;
- Identify the necessary approvals and licences required by regulatory authorities in order to enable the remediation works to proceed; and
- Assist with asbestos regulatory compliance during soil disturbance activities.

1.6 SCOPE OF WORKS

The scope of works undertaken for this RAP consisted of:

- Review of existing data;
- Identification of areas of concern within the site requiring remediation;
- Outline the remediation strategy and remedial goals;
- Review and address (where relevant) comments received by DPI, EPA and the site auditor;
- Development of remediation procedures for remediation contractors to utilise in development of detailed work methods;
- Establishment of validation process;
- Identification of appropriate licence and approvals required to undertake remediation works;

2. SITE DESCRIPTION

2.1 SITE IDENTIFICATION

The investigation area is located at 771 Cudgen Road, Cudgen, NSW 2487 and is described as Lot 11 / DP1246853 (28º15'48"S, 153º34'02"E) as shown in **Figure 1, Appendix A.** The subject property lot covers an area of 19.38Ha, with approximately 16 Ha being used for agricultural production. The proposed hospital development covering 65,000m^2 (6.5 Ha) within the southern portion of the property (as shown in the design plan in Appendix C)

2.2 EPA CONTAMINATED SEARCH RESULTS

A search of the NSW Environmental Protection Agency (EPA) Contaminated land record was undertaken by OCTIEF. The search results (www.epa.nsw.gov.au/your-environment/contaminated-land/notification-policy/contaminated-sites-list) show that the property lot is not listed on the contaminated land record.

A search of the NSW Environmental Protection Agency (EPA) POEO Registry for Environmental Protection Licences, Notices and audits showed that there are no Environmental protection licences, notices or audits for the site.

2.3 ZONING

The current primary use of the Site is for agricultural production (approximately 16ha) and is zoned accordingly as RU1 Primary Production under the Tweed Local Environmental Plan (LEP) 2014.

0.446ha of the site is zoned R1 General Residential , while 0.267ha is zoned urban expansion (2c) and 0.04ha is listed as Agricultural Protection zone. The remaining 2.944Ha is zoned as an Environmental Protection (habitat) zone.

2.4 CURRENT AND PROPOSED FUTURE LAND USE

The current primary use of the Site is for agricultural production. The site was selected, and the proposed land use (Hospital) designed/assessed in response to a range of hospital related planning criteria. This included avoiding flood prone land, providing adequate bushfire protection, lower risk acid sulfate soils, and buildability without impacts to severe slopes or highly erodible land.

2.5 SITE LAYOUT AND SIGNIFICANT FEATURES

The subject property lot is irregular in shape and includes the following significant features:

- Former residential house on the southern site boundary with access from Cudgen Road (demolished December 2018);
- Former chemical storage / equipment shed on the southern property boundary to the east of the residential house, (demolished December 2018);
- Cultivated paddocks covering approximately 16Ha;
- Undeveloped wetland in the northern/northwestern portion of the site;

2.6 SURROUNDING LAND USE

The land use adjacent to the site is summarised as follows:

- North – Agricultural farm land to north west, undeveloped land;
- South – Open farmland and TAFE buildings (Education);
- East – Low/Medium density residential;
- West – Farmland and dense forest.

2.7 TOPOGRAPHY AND DRAINAGE

The site has a gradual slope leading towards the north side of the site. The NSW Six Maps indicates the investigation area has an elevation between 25mAHD to the south east and 8mAHD to the north.

2.8 FLOOD INFOMRATION

Based on the Tweed maps – Flood information Overlay Map, the investigation area is within a designated flood affected area only on the northern (currently undeveloped) side of the site.

2.9 GEOLOGY

The Tweed Heads 1:250,000 Geological map indicates that the underlying geology at the site is the Lamington Volcanics from the Tweed Range-Lamington Area. This is made up of basalt with members of rhyolite, trachyte, tuff, agglomerate, and conglomerate.

During the Stage 2 Detailed Site Investigation, the following subsurface conditions were encountered (Borehole locations provided on Figure 2, Appendix A):

Table 2-1 General Soil Description

Depth (m)	General Soil Description
0.0 - 0.15 m	Silty CLAY: red brown, traces to some fine gravel, medium plasticity, dry to damp.
0.15 – 1.0m (up to 3.6m) (1.0m - maximum depth of environmental sampling program)	Silty CLAY: red brown medium plasticity, damp to moist, firm, some fine to coarse gravel/ extremely weathered basalt fragments.
3.6 – 20.5	BASALT – zones ranging from fresh, vesicular dark grey very high strength basalt through to low strength , extremely weathered, clayey material.

2.10 HYDROGEOLOGY

A search of groundwater bores registered with the NSW Department of Primary Industries, Office of Water identified eight bores within a 500 m radius of the site's boundaries. Bore reports for bores provided by NSW Office of Water are provided and summarised in Table 2-2 below.

Table 2-2 Summary of Groundwater Database Bore Reports

Registered No.	Date Registered	Standing Water Level (m BGL)	Aquifer geology	Distance from site	Use
GW307808	No data available			450m NE	
GW304908	3/11/2004	3.00	0-5m – Sand grains (lithic)	475m NE	Domestic
GW065030	16/10/1989	12.00	0-15m – Clay 15-17m – Weathered rock 17-20m – Basalt 20-24m – Weathered Basalt 24-30m – Clay & Sandstone	100m South	Irrigation
GW047693	1/3/1980	N/A	0-4.57m – Soil 4.57-14.00m - Shale	100m South	Irrigation
GW047692	1/10/1980	N/A	0-1.2m – Soil 1.2-7.6m – Clay decomposed basalt 7.6-11.3m – Clay 11.3-21.3m – Basalt Layers	100m South	Irrigation
GW044188	1/1/1945	6.0m	0-4.57m – Soil 4.57-12.19m – Shale	100m South	Domestic
GW069108	7/3/1991	NA	0-10m – Clay 10-13m – Basalt 13-16m – Clay 16-21m – Basalt 21-33m – Clay 33-40m – Basalt 40-47m – Clay 47-54m - Granite	150m south west	Farming

Groundwater field parameters collected from during the Detailed Site Investigation recorded the following:

- Dissolved Oxygen – 5.27mg/L
- Electrical Conductivity - 178µs/cm indicating the groundwater is freshwater;
- pH – 6.03;
- Redox (Eh) - -66.3mV, within the range indicating oxidizing conditions.

2.11 VEGETATION AND ENVIRONMENTAL VALUES

The following EHP Environmental Reports were reviewed to assess the quality of existing environmental values and designated environmentally sensitive areas:

- The site has a stretch of tree preservation order (2004) - Koala Habitat Study Area for the northern side of the site;
- This same region and including the northernmost point is under the State Environmental Planning Policy (SEPP) coastal management – Coast wetland;
- The northern part of the site is classified as Bushfire prone land with the middle of the site classed as a vegetation buffer;

2.12 SENSITIVE ENVIRONMENTAL RECEPTORS

The following sensitive receptors were identified within a 200 m radius of the site:

- Education facility (TAFE) to the south of the site;
- The area is listed as having high ground water vulnerability (Tweed shire council, planning and flooding maps, 2018)

3. Contamination Summary

3.1 Previous Investigations

Desktop investigations have been undertaken for the site as part of the initial site selection process for the Tweed Valley Hospital. A review of the desktop investigation reports (HMC, 2017) and (Charter. 2018) identified the following:

- Broadacre intensive cropping across the elevated part of site may have been subject to agrichemical applications. Generally broadacre application meets investigation criteria for residential land use.
- 2-3 structures near Cudgen Road may have been used for storage/mixing of chemicals and storage of fuel. Small areas, may be hotspots requiring remediation.
- Further investigation in the form of detailed site inspection, additional site history and soil investigation is required prior to confirming site suitability, subject to final location of proposed development.

3.1.1 Preliminary and Detailed Site Investigation – (OCTIEF 2018)

An initial site inspection was undertaken on 14 June 2018 by a Suitably Qualified Person (SQP) to validate results of the site history review and identify additional sources or evidence of potential contamination. At the time of the site inspection, cultivation of sweet potatoes was being undertaken at the site, with some fields yet to be harvested. Based on the initial site inspection, the potentially contaminating activities were:

- Potential for the release of chemicals to the subsurface into the environment resulting from poor chemical storage or waste disposal practices;
- Potential for the release of chemicals to the subsurface into the environment resulting from poor agricultural practices;
- Asbestos building materials in onsite structures;
- Above ground diesel tank (AST);
- Onsite Farm dump; and
- Onsite surface water storage dam.

Chemicals of potential concern include:

- inorganic pesticides, e.g., arsenical and mercurial compounds
- organic pesticides, e.g., organochlorines (OCPs), organophosphates or (OPPs);
- volatile organic compounds;
- Hydrocarbon compounds (TRH. BTEX and PAH) associated with fuels and motor oils for machinery; and
- Asbestos (associated with degradation of building materials in onsite structures).

Other chemicals typically used in the agricultural environment (carbamates, synthetic pyrethroids, and growth regulators) have little or no residual activity i.e., they are highly biodegradable; and therefore are considered unlikely to cause soil contamination.

The Detailed Site Investigation (DSI) was completed in August 2018 by OCTIEF, the DSI focused on further assessment of potential sources identified. The main objectives of the DSI were to:

- To investigate potential contamination sources and chemicals of potential concern (CoPC) identified, and assess the risks posed by identified contamination (if present) to human health and the environment.
- Assess if further assessment or remediation measures are required.

The scope of works for the DSI included;

- Handaugering of 50 locations across the site. Locations in cultivated areas were undertaken to enable composite sampling to be completed, with four hand augers per location. The composite sample locations were evenly spaced across the cultivated areas of the site with 4 locations per hectare within the hospital development area and two locations per hectare for the remaining cultivated areas of the site. Targetted handaugers were also completed in the vicinity of the identified potential sources onsite (main shed, AST, farm dump, storage dam).
- Collection of a groundwater sample from the groundwater monitoring well installed as part of the Geotechnical site investigation works, and collection of surface water samples from the onsite storage dam. .
- Submitting soil and groundwater samples for laboratory analysis for the CoPC including heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), BTEX (benzene, toluene, ethylbenzene and xylene), TRH (total recoverable hydrocarbons), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), organophosphorous (OP) and organochlorine (OC) pesticides and asbestos.
- Preparation of a combined Preliminary and Detailed Site investigation report.

Based on the completed scope of works of the DSI, OCTIEF concluded the following;

- Sediment sample SED01 reported copper and nickel concentrations exceeding the low sediment quality guidelines (SQG) but below the high-SQG. The copper and nickel concentrations detected were comparable to the surface soil concentrations across the cultivated area of the site and are not considered indicative of any significant contamination in the dam sediments.
- Asbestos Fibres (AF) and Fibrous Asbestos (AF) was detected at concentrations exceeding the residential guideline levels in sample HA1-0.1 collected from adjacent to the western side of the main shed onsite.
- Zinc detected in the groundwater sample above the nominated investigation level is considered likely to be indicative of naturally occurring background concentrations in the groundwater.
- The surface soil sample collected adjacent to the main shed during the initial site inspection and sample HA4-0.15 collected during DSI reported zinc concentrations exceeding the ecological investigation levels for residential land use. These exceedances of the ecological assessment criteria are relatively minor and isolated, and not considered to affect suitability of the site for the proposed development.

3.1.2 Hazmat Assessment (Cavvanba Consulting Pty Ltd)

A hazardous material audit by Cavvanba Consulting Pty Ltd on 19th November of the residential premises and attached garage reported 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.

3.2 Refined Conceptual Site Model

A conceptual site model (CSM) has been refined for the site to identify the contamination sources at the site and provide an understanding of the pathways by which receptors at the site and surrounding areas may be exposed to contaminants.

The potential Source-Pathway-Receptor (SPR) linkages identified for the site, based on site information gathered during this investigation are presented in Table 3-1.

Table 3-1 Potential Complete Exposure Pathways

Potential Source	Pathway	Receptor	Pathway complete
Contaminated Soil	Surface water runoff	Ecological receptors	Unlikely – elevated zinc concentrations of limited lateral extent ,
	Atmospheric dispersion	Ecological receptors	Unlikely – elevated elevated zinc concentrations of limited lateral extent
	Leaching to groundwater	Ecological receptors	Unlikely – elevated zinc concentrations of limited lateral extent , and depth to groundwater is >10m with fresh to slightly weathered basalt overlying aquifer
Contaminated Groundwater	Lateral migration of groundwater	Ecological receptors of wetland	Unlikely – Groundwater concentrations likely to be indicative of natural background conditions and unlikely to be ecological risk
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.

3.3 Site Suitability

3.3.1 Chemical Contaminants

The site has been compared to “Tier 1” investigation or screening levels for land use settings equivalent to residential development, which is considered a conservative basis to assess the suitability of site materials for a hospital and associated grounds. No exceedances of health based criteria were identified during the PSI/DSI.

Environmental Investigation Level exceedances (zinc), are considered to be associated with the 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. It should be noted that the elevated zinc concentration was detected within the area of identified ACM impacted soil.

3.3.2 Asbestos

Asbestos has been detected in soil samples from the site, the ACM identified in its present state (bonded condition with some degradation and fibres in soil) presents risk to human health if disturbed, and remediation works are required in the area on the western side of the main site shed. No visible asbestos in surface soils should be present for residential and open space land use, and both the NEPM and WHS regulations require removal of visible asbestos prior to any work activities that may disturb it. Any ACM to be disposed off-site would require appropriate classification in accordance with the *Waste Classification Guidelines*: Part 1 – Classifying waste (EPA, 2014) prior to disposal to an appropriately licenced facility.

3.3.3 Unexpected Finds and Soil Management

The findings of the investigations to date are based on lines of evidence including historical site use, site observations and sampling and analysis from discrete locations. The site history indicates historical site use has been broadacre agricultural activities, and investigations do not indicate any significant disposal of waste has occurred. The small farm dump of inert waste identified is outside the proposed hospital development area, and it is unlikely that other such areas will be encountered during redevelopment of the site.

It is considered unlikely that unexpected contamination could be encountered during earthworks for redevelopment of the site, however the management requirements for unexpected finds are discussed further in Section 10.

3.3.4 Potential Data Gaps

Anecdotal information from Mr Brent Gibson 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 by Cavvanba Consulting on 29 January 2019 has identified a concrete slab of unknown origin immediately to the west of the former vehicle shed (shown on Figure 4). During the inspection, Cavvanba noted small quantities of liquids and wastes were present associated with the concrete slab, including brake pads, spark plugs, a blue powder (like copper), red/purple sand (appears like sand blasting grit), oil staining, and mechanical parts.

A data gap investigation has been included in this RAP to address the presence of the potential cattle dip, the details of which are outlined in sections 3.4.1, Section 7 and Section 10 below.

3.4 Extent of Remediation Required

ACM surface debris was noted along the western side of the main shed, and asbestos fines (AF) were detected at a concentration exceeding the health screening level of 0.001% w/w in sample HA1-0.1m . Based on the results of the detailed site investigation conducted by OCTIEF, remediation is required in the area adjacent to the western wall of the former main shed.

The WA DoH (2009) guidelines recommend the removal of an additional 1m laterally in all directions beyond the contaminated area. Based on site observations and sample locations the remediation area is shown in Figure 3 covering an area of approximately 230m^2 , which extends from 1m to the east of the western wall of the shed to 6m west of the north west corner and 2m west of the southwest corner.

In accordance with the WA DoH (2009) guidelines for assessment and remediation of asbestos contaminated soil the proposed excavation should be to a depth 30cm below the contaminated zone and consequently the remediation works will be to a depth of 0.4m.

3.4.1 Data Gap Investigation

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 indicative area anecdotally identified as containing a potential cattle dip (shown in Figure 4).

The data gap investigation must include the excavation and removal of the concrete slab described in section 3.3.4, with validation sampling immediately around the slab, and a series of testpits across the remaining indicative area shown in Figure 4 to enable identification of any former cattle dip structure. Due to the absence of any documentation regarding the location of the potential dip, testpitting across the identified area following the removal of surface infrastructure and concrete slabs is required to enable characterisation of the area.

4. Relevant Guidelines and Legislation

4.1 Preparation of the RAP

This RAP has been prepared with consideration of relevant guidelines and policy, as listed below. A summary of relevant aspects of these guidelines, Acts and regulations are provided in the following sections.

The remediation contractor shall be responsible for ensuring the remediation works are carried out in accordance with regulatory requirements.

4.2 National Environmental Protection (Assessment of Site Contamination) amendment Measure 2013

The National Environment Protection (Assessment of Site Contamination) Measure (referred to here as the NEPM) was produced by the federal National Environmental Protection Council (NEPC) in 1999 was revised and updated in 2013 by way of the National Environmental Protection (Assessment of site Contamination) Amendment Measure 2013. The amended NEPM is still referred to as the NEPM 1999. The NEPM provides a national framework for conducting assessments of contaminated sites in Australia.

The purpose of the NEPM is to *"establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, environmental auditors, landowners, developers and industry."*

The desired environmental outcome for the NEPM is to *"provide adequate protection of human health and the environment, where site contamination has occurred, through the development of an efficient and effective national approach to the assessment of site contamination".*

The NEPM addresses assessment of contamination, and does not provide specific guidance for remediation or management of risk.

The NEPM (2013) provides guidance relating to the assessment of known and suspected asbestos contamination in soil and addresses both friable and non-friable forms of asbestos. The health screening levels for asbestos in soil have been adopted from the Western Australian Department of Health (WA DoH) Guidelines for Remediation and Management of Asbestos Contaminated Sites in Western Australia (WA DoH 2009). The NEPM also refers to the WA DoH Guidelines for further information on risk assessment, remediation and management procedures.

4.3 State legislation and guidelines

The framework for this report has been developed in accordance with guidelines "made or approved" by the NSW EPA under Section 105 of the Contaminated Land Management Act, 1997.

These guidelines include the following:

- NSW Department of Environment & Climate Change (DECC) 2015, Contaminated Sites: Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997.
- NSW Office of Environment & Heritage (OEH) 2011, Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites.

- NSW DEC (2007) Guidelines for the Assessment and Management of Groundwater Contamination (the Groundwater Guidelines)
- NSW EPA 2017, Contaminated Land Management: Guidelines for NSW Site Auditor Scheme (3rd Edition).
- NSW EPA 1995, Contaminated Sites: Sampling Design Guidelines.

4.4 State Environment Planning Policy 55

SEPP55 introduces state wide planning controls for the remediation of contaminated land. Under the provisions of SEPP55, "*land must not be developed if it is unsuitable for a proposed use owing to contamination and must be remediated prior to development*". This Remediation Action Plan has been developed in accordance with, and to meet the requirements of SEPP55 and the accompanying DUAP 1998 Guidelines.

Under the requirements of the SEPP55, remediation is to be classified as either:

- Category 1– remediation work for which development consent is required; or
- Category 2 – remediation work not requiring development consent.

Category 1 remediation work, for which development consent is required includes:

- Work which is designated development under Schedule 3 of the Environmental Planning and Assessment (EP & A) Regulation or under a planning instrument.
- Work proposed on land identified as critical habitat under the Threatened Species Conservation Act 1995.
- Works where consideration of section 5A of the EP&A Act indicates that remediation work is likely to have a significant effect on threatened species, populations, ecological communities or their habitats.
- Works proposed in an area or zone identified in a planning instrument as being an area of environmental significance.
- Works proposed on any land in a manner that does not comply with a policy made under the contaminated land planning guidelines by the Council.

OCTIEF has not carried out a detailed planning assessment, however as far as the proposed remediation work outlined in this RAP is concerned, to the best of our knowledge none of the above apply to the proposed remediation works. On this basis the remediation work is considered to be Category 2.

If the remediation work is treated as category 2 remediation work, notice must be given to Council at least 30 days prior to the commencement of the work, in accordance with clause 16 of SEPP 55. Regardless of category, a notice of completion of the remediation work must be given to Council within 30 days after completion of the work, in accordance with clauses 17 and 18 of SEPP 55.

4.5 Work Health and Safety Act

All proposed remediation works for the Site (including asbestos work) should be completed in accordance with the *Work Health and Safety Act and Regulation* 2011. Asbestos works must also follow the guidelines of the *Safe Work Australia Code of Practice - How to Manage and Control Asbestos in*

the Workplace (December 2011), and the *Code of Practice – How to Safely Remove Asbestos* (December 2011).

HI has a legal obligation under the Work Health and Safety (National Uniform Legislation) Act 2011, (the WHS Act) and prescribed in the Work Health and Safety (National Uniform Legislation) Regulations 2012, to ensure the work health and safety of its workers, subcontractors and visitors.

Primary legislative requirements detailing obligations regarding the presence of asbestos on the Site are listed as follows:

- Work Health and Safety Act 2011(NSW)
- Work Health and Safety Regulations 2011 (NSW)
- How to Manage and Control Asbestos in the Workplace, 2011. Safe Work Australia (approved under Section 274 of the Work Health and Safety Act 2011 NSW)
- How to Safely Remove Asbestos, 2011. Safe Work Australia (approved under Section 274 of the Work Health and Safety Act 2011)

It is recommended that the remediation of the asbestos impacted materials on site be undertaken by an asbestos removalist contractor with a current friable asbestos removal licence (Class A).

WorkCover NSW must be notified five days before licensed asbestos removal work is commenced.

4.6 Protection of the Environment Operations Act 1997

The proposed remediation/management activities are not required to be licensed under the Protection of the Environment Operation Act 1997 since the works do not involve: treatment otherwise than by incineration and store more than 30,000 cubic metres of contaminated soil originating exclusively from the site, or disturb more than an aggregate area of 3 hectares of contaminated soil originating exclusively from the site.

The provisions of the POEO Act and Regulations will apply to offsite transport and disposal of soils. The regulatory provisions governing the management of waste generally apply to transport, treatment, disposal or receipt of waste, and hence only come into effect if the waste is removed from the site and/or received from another site.

5. Remediation Criteria

Remediation criteria are required to assess soil validation results against to ensure the impacted area has been successfully remediated to a level where the remedial goal has been met. The adopted remediation criteria are discussed below:

5.1 Asbestos

The NEPM (2013) provides guidance relating to the assessment of known and suspected asbestos contamination in soil and addresses both friable and non-friable forms of asbestos. The health screening levels for asbestos in soil have been adopted from the Western Australian Department of Health (WA DoH) Guidelines for Remediation and Management of Asbestos Contaminated Sites in Western Australia (WA DoH 2009). The NEPM also refers to the WA DoH Guidelines for further information on risk assessment, remediation and management procedures.

The NEPM guidance emphasises that the assessment and management of asbestos contamination should take into account the condition of the asbestos materials and the potential for damage and resulting release of asbestos fibres. Therefore, for the purposes of assessing the significance of asbestos in soil contamination, three terms are used as summarised below:

- Bonded asbestos containing material (Bonded ACM) – sound condition although possibly broken or fragmented and the asbestos is bound in a matrix such as cement or resin.
- Fibrous asbestos (FA) – friable asbestos materials such as severely weathered ACM and asbestos in the form of loose fibrous materials such as insulation.
- Asbestos fines (AF) – including free fibres of asbestos, small fibre bundles and also fragmented ACM that passes through a 7 mm x 7 mm sieve.

From a risk to human health perspective, FA and AF are considered to be equivalent to “friable” asbestos in Safe Work Australia (2011), which is defined therein as ‘material that is in a powder form or that can be crumbled, pulverised or reduced to a powder by hand pressure when dry, and contains asbestos’.

Bonded asbestos ACM in sound condition represents a low human health risk. However, both FA and AF materials have a significantly higher potential to generate, or be associated with, free asbestos fibres and may represent a significant human health risk if disturbed and fibres are made airborne. Table 5-1 summarises the land use setting and health screening levels for asbestos in soil that are considered the most appropriate for the site.

Table 5-1 Health Screening Levels for Asbestos contamination in soil

	Health Screening Level (w/w)			
Form of asbestos	Residential A[1]	Residential B[2]	Recreational C[3]	Commercial/ Industrial D4
Bonded ACM	0.01%	0.04%	0.02%	0.05%
FA and AF[5] (friable asbestos)	0.001%			
All forms of asbestos	No visible asbestos for surface soil			

6. REMEDIAL OPTIONS ASSESSMENT

The objective of the RAP is to document the processes required to address soil contamination to achieve the remediation goals. The remediation goals are to.

- Remediate the site to a level suitable for the for the proposed future land use (Hospital).;
- 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.

This Remediation Action Plan has been developed in accordance with, and to meet the requirements of SEPP55 and the accompanying DUAP 1998 Guidelines. The extent of remediation works required are outlined in Section 3.4.

6.1 Remedial Options

With regard to site remediation, the NSW EPA guidelines indicate that the preferred options for site remediation and management are (in descending order):

- 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 these options cannot be implemented, then the 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.

If remediation is likely to cause a greater adverse effect than would occur should the site be left undisturbed, then remediation should not proceed.

In relation to asbestos, the NEPM (Schedule B1 section 4.11) notes that remediation options which minimise soil disturbance and therefore public risk are preferred; and management of asbestos in situ is encouraged, which may include covering the contamination with uncontaminated fill or other protective or warning layers. However, Section 4.1 of Schedule B1 notes that this guidance is not applicable to asbestos materials which are wastes such as demolition materials present on the surface of the land. Section 4.3 also notes that if visible asbestos is present and it may be disturbed during work activities, it must be removed.

The WA DoH (2009) guidelines for the assessment, remediation and management of asbestos contaminated soil outline that main remediation options for asbestos contaminated soil can be broadly divided into management *in situ*, treatment on-site, and removal of the contaminated soil from the site.

6.2 Evaluation of remediation Options

Presented below is a brief overview of commonly used soil remediation technologies associated with the types of contamination identified onsite and/or the nature of the site. This is a preliminary evaluation only, from which appropriate options have been further assessed in Section 6.4 and 6.5

Table 6-1 Overview of Remediation Options

Remediation Method	Description	Applicability
Management of Exposure	Management of exposure risks can involve: - Precluding access to the Site (secure fencing and signage) to prevent or minimise access to affected areas and reduce the potential for exposure. This method requires a Site Management Plan to ensure the site remains secure and no migration of contamination has occurred. - Preventing exposure to contaminants by placing them in an area where they would not be expected to be subject to disturbance under reasonably foreseeable future land use.	Given the objectives of the remediation work is to allow the Site to be redeveloped, the option of precluding access to the site is not considered to be applicable, although it may be appropriate as an interim management measure. The option of selective placement of contaminated materials may be applicable to areas of the site where future disturbance would not be expected to occur. This management option is discussed further under onsite capping and containment, below.
Physical Separation	Physical separation (such as mechanical screening) to separate types or sizes of material enabling removal or concentration of contaminants.	While generally applicable to ACM contamination, Not considered applicable in cases where ACM has been identified to be highly weathered, or FA / AF asbestos contamination has been identified.

Excavation and Disposal	Excavation and offsite disposal to a NSW EPA approved landfill disposal site with appropriate environmental safeguards. The resulting excavation is generally backfilled (if required) using clean, validated fill materials. Disposal of contaminated material is permitted by the NSW EPA subject to the provisions of the POEO Act 1997. NSW EPA 2014 sets out the methodology for assessing and classifying solid wastes to be disposed to landfill.	This method is suitable for some contamination at the site where low volumes are expected or where policy prefers off- site disposal (such as ACM contamination).
On-site capping and containment	Capping involves the installation of a physical barrier to separate contaminated soil from infiltration and to provide a barrier to minimise human exposure. Containment involves the installation of a physical barrier around the contaminated area to prevent contaminants migrating away for the area. Thus, when used in combination, capping and containment essentially isolates the contaminated soil from the surrounding area. The inclusion of an effective low permeability capping system and appropriate surface water controls/management can be used to result in minimisation of groundwater generated within the cell. Capping and containment generally require long term management to prevent future exposure, in the form of a Site Management Plan.	Capping is a commonly used remedial strategy due to its effectiveness, simplicity and low overall cost. As noted in Section 6.1, the NEPM advocates in-situ management of asbestos contaminated soils (with the exception of asbestos materials which are wastes such as demolition materials present on the surface of the land), and hence this method is not recommended for the identified contamination

6.2.1 PREFERRED REMEDIAL OPTION

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 is the preferred strategy and consistent with regulatory requirements

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).

7. Remedial Strategy

The information presented in this section presents the remediation strategy and the procedures to address the presence of any soil contamination so the site can be made suitable from a contamination perspective. The section provides a description of the steps and procedures required to protect health, safety and the environment. It is expected that these will be supplemented by technical specifications for the remediation contractor who will prepare an appropriate detailed work plan based on the requirements of this RAP and the technical specifications.

7.1 Preliminaries

SEPP 55 provides state wide planning controls for the remediation of contaminated land. Under the provisions of SEPP 55, "*land must not be developed if it is suitable for a proposed use owning to contamination and must be remediated prior to development*".

Under the requirements of SEPP 55, remediation work is classified as either:

- Category 1: remediation work for which development consent is required; or
- Category 2: remediation work not requiring development consent.

Based on the information regarding site contamination, OCTIEF considers that the proposed remedial works are likely to be classified as Category 2 works and specific development consent is not required.

Prior to the establishment at the site, the Contractor is required to prepare a Detailed Work Plan incorporating the following documentation:

- Work Health and Safety Plan (WHSP)
- Asbestos Management Plan (AMP) – to be prepared in conjunction with the environmental consultant and reviewed by the site auditor.
- Emergency Response Procedures

It is the responsibility of the Contractor to prepare and/or obtain all appropriate documentation prior to the commencement of the works including plans, programmes, licences and certificates as appropriate. Following provision and approval of these documents, the Contractor will mobilise all necessary plant, equipment and amenities as required to complete the project in accordance with these requirements.

7.2 Site Establishment

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 shall delineate the work area. A temporary fence should be erected around any work areas where appropriate. Survey markers can be used to identify the extent of any remediation areas and should be verified with the Environmental Consultant.

Access to the work area will be determined by the Remediation Contractor. The site shall be accessible only to personnel inducted for work within the work area

7.3 Vegetation Clearance

Vegetation clearance will be subject to any requirements of the project approvals and design. In relation to site contamination, particular care shall be taken when clearing any vegetated areas to avoid disturbance and spreading of ACM. An appropriately trained “spotter” shall supervise all vegetation clearance to ensure these requirements are met.

7.4 Removal of ACM and validation of excavation

In relation to asbestos, the NEPM (Schedule B1 section 4.11) notes 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. Based on the findings of the PSI/DSI, removal of remaining ACM building materials from the main shed should also be undertaken in accordance with the requirements of the *Work Health and Safety Act and Regulation 2011.*

As outlined in Section 3.4, the asbestos impacted area extends along the former western wall of the main shed with surface ACM visually identified and AF identified in soil sample HA1-0.1 at levels exceeding the nominated health screening levels.

The WA DoH (2009) guidelines recommend the removal of an additional 1m laterally in all directions beyond the contaminated area. Based on site observations and sample locations the remediation area is shown in Figure 3 covering an area of approximately 230m^2 extending from 1m east of the former western wall of the shed to 6m west of the north west corner of the former shed and 2m west of the southwest corner.

The WA DoH (2009) guidelines recommend the boundaries of excavation works include an additional 30cm depth to account for uncertainty in the contamination delineation and removal process and therefore the below process should be undertaken for excavation and validation of ACM and asbestos impacted soils.

- Excavation of asbestos impacted area to minimum depth of 0.4m to ensure and allow visual clearance of base of excavation and validation sampling by suitably qualified persons 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.

Validation samples will be collected by a SQP in accordance with **Section 10** of this RAP over the area of remedial excavation. A breakdown of tasks associated with the validation is presented in **Table 7-1**.below . In the event that validation is required to be undertaken in sections to facilitate access for other site works, then the remediation contractor must ensure that no vehicle movement subsequently occurs between validated and unvalidated areas.

Table 7-1 – Validation Tasks

Step	Details
Conduct visual assessment of excavation during the remedial works .	Visual assessment should include observations to inform additional excavation required. Further details are provided in **Section 10.**.

Validation of the excavation	Validation samples should be collected from the walls and base of the excavation by the Environmental Consultant. Validation sampling should be completed in accordance with the procedures outlined in the validation plan in Section 10
Survey of the excavation area	The horizontal and vertical extent of the excavation should be surveyed upon completion.
Stockpiling of excavated material	Excavated soils should be temporarily stockpiled on site in a designated stockpile area prior to off-site disposal. Stockpiles should be placed on hardstand where available. If stockpiled material is placed on unsealed areas, the footprints of stockpile are required to validated once removed. Waste classification samples for off site disposal should be collected in accordance with the sampling procedure outlined in **Section 10**.
Off-site disposal of excavated material	Following the successful validation of the excavation and receipt of waste classification analytical data - excavated material should be disposed off-site to an appropriately licenced facility. Waste disposal documentation should be retained and presented in the validation report.

Asbestos fibre air monitoring will be undertaken during the excavation of asbestos impacted soils and any disturbance of the potentially asbestos impacted material.

7.5 Data Gap Investigation

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 indicative area anecdotally identified as containing a potential cattle dip (shown in Figure 4).

The data gap investigation must include the excavation and removal of the concrete slab described in section 3.3.4, with validation sampling immediately around the slab, and a series of testpits across the indicative area shown in Figure 4 to enable identification of any former cattle dip structure. Due to the absence of any documentation regarding the location of the potential dip, testpitting across the identified area following the removal of surface infrastructure and concrete slabs is required to enable characterisation of the area.

Samples from around the excavated concrete slab and from the testpits will be collected by a SQP in accordance with **Section 10**.

7.6 Transport of Material

Transportation of material shall be undertaken in accordance with the Detailed Work Plan.

- 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 Cl 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. KEY CONTACTS AND RESONSIBILITIES

8.1 ROLES and RESPONSIBILITIES

8.1.1 Principal

The Principal has responsibilities that include:

1. Ensuring guidelines and recommendations set out in this RAP are adhered to;
2. 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;
3. Completing sufficient stakeholder and community consultation where required; and
4. Maintaining a register of all relevant documentation pertaining to the remedial works.

8.1.2 Remediation Contractor

The remediation contractor has responsibilities that include:

1. Ensuring guidelines and recommendations set out in this RAP are adhered to;
2. 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.
3. Preparing a detailed work plan for implementing the works.
4. Undertaking material inspections and clearances in accordance with this RAP,
5. Preparing / obtaining and providing all relevant supporting documentation to the environmental consultant in relation to any remediation works carried out.

8.1.3 SQP/Licensed Asbestos Assessor

The Suitably Qualified Person (SQP)/ Licensed Asbestos Assessor will:

1. Provide direction and advice for the safe handling and removal of ACM and contaminated soil;
2. Inspect and approve control measures prior to soil disturbance activities;
3. Be responsible for the supervision of asbestos related site works (as required);
4. Conduct fibre air monitoring during soil disturbance;
5. Ensure remedial works are performed in accordance with this RAP, and other Government Legislative requirements relevant to asbestos and contaminated land including Codes of Practices and Guidance Notes;
6. Complete soil validation sampling and waste characterisation sampling as required;
7. Provide a remediation and validation report on completion of works.

8.1.4 All Site Personnel

Each employee (and/or sub-contractor where applicable) engaged to undertake site works shall be responsible for:

1. Operating within the requirements of this RAP;
2. Ensuring their PPE is effective and in sound working order;
3. Promoting safe work practices;
4. Adopting work practices that minimise disturbance of ACM and the creation of hazardous atmospheres;
5. Ensuring that all work is conducted in a safe and competent manner; and
6. Reporting incidences or potential hazards to the applicable responsible officer(s) before further works are carried out.

8.2 PUBLIC COMMUNICATION AND COMPLAINTS

Involvement and communication with site stakeholders is necessary to prevent undue concerns regarding management of site works and the associated risks. Consultation will address potential concerns that may be raised prior to or during site works that may include the following:

- Potential airborne asbestos fibre exposure;
- Potential odour, noise, vibration and dust generation;
- Traffic movement;
- Working hours;
- Treatment and management of asbestos containing materials and contaminated material; and
- Safety and security concerns.

It is anticipated that community consultation will be carried out by the Principal at their discretion (or a nominated representative during site works).

Any public concerns or complaints received by site personnel should be directed to the remediation contractor. A complaints register will be established by the contractor for site works. The register will comprise a system or protocol for the receipt, recording and response to community complaints, and methods for dealing with complaints. Complaints will be investigated and documented as a non-conformance (if justified) and appropriate corrective actions implemented in a timely manner.

9. DATA QUALITY OBJECTIVES

The Data Quality Objective (DQO) process will be applied to the remediation earth works and validation sampling as described below, to ensure that data collection activities are appropriate and achieve the stated objectives.

A process for establishing data quality objectives for an investigation site has been defined by Australian Standard AS4482.1 (1997) Guide to the Sampling and Investigation of Potentially Contaminated Soil - Parts 1 and 2 and DEC 2006. The DQO process involves seven steps as follows:

1. State the problem;
2. Identify the decision;
3. Identify the inputs into the decision;
4. Define the boundaries on the investigation;
5. Develop a decision rule;
6. Specify limits on decision errors; and
7. Optimise the design for obtaining data.

9.1 STEP 1 – STATE THE PROBLEM

Contamination has been identified at the site that may adversely impact the site's suitability for various uses and/or may have adverse impacts upon environmental receptors. Sources of contamination at the site have been identified to include:

- Poor storage / maintenance of ACM building materials; and
- Heavy metal (zinc) contamination of soil above ecological investigation levels associated with degradation of galvanised steel sheeting;

In its current state the area adjacent to the western side of the main shed is not suitable for the proposed development without remediation of ACM and asbestos contaminated soils. The demolition of the shed itself has the potential to cause the site to impacted by hazardous buildings materials (ACM guttering and loose ACM Sheeting), and remediation work should include removal of ACM materials from the main shed.

9.2 STEP 2 – IDENTIFY THE DECISIONS

The required remediation area has been defined as an area of approximately 230m^2 extending from 1m east of the former western wall of the shed to 6m west of the north west corner of the former shed and 2m west of the southwest corner (refer figure 3) . The excavation works of asbestos impacted area will extend to minimum depth of 0.4m to ensure and allow visual clearance of base of excavation and validation sampling by suitably qualified persons

The aim of the validation program 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 use (hospital).

The data gap investigation area shown in Figure 4, is an indicative area around the recently demolished site sheds and the identified concrete slab of unknown origin and is based on the available anecdotal information. The investigation will include excavation of the concrete slab and

associated sampling and the completion of testpits across the potential area of the cattle dip to enable adequate characterization of the area.

The aim of the data gap investigation is to collect sufficient data to verify if there is any contamination associated with a potential cattle dip in the area, and if contamination is identified, to enable the development of a suitable remediation plan.

These questions to be answered are the following:

- Has the extent of the identified impacts been adequately removed?
- In the event that un-forseen impacts are identified (i.e. unidentified contamination), is the proposed remedial plan adequate to manage this contamination?

9.3 STEP 3 – IDENTIFY INPUTS INTO THE DECISION

The validation program and data gap investigation has been designed to provide sufficient information to allow a sound scientific evaluation of the questions set out above. This will be achieved by comparing the soil results data to applicable guidelines to evaluate the potential for contamination to adversely impact upon human health and/or ecological receptors, and determine if remediation works have been completed to the extent necessary to achieve the remediation goal, or if the development of an additional remediation plan is required to remediate contamination associated with the potential cattle dip.

9.4 STEP 4 – DEFINE THE BOUNDARIES OF THE INVESTIGATION

The lateral boundaries of the site investigation included the subject property lot, the cleared areas of the property, and the extent of the Stage 1 Development Area.

The required remediation area has been defined as an area of approximately 230m^2 extending from 1m east of the former western wall of the main shed to 6m west of the north west corner of the former shed and 2m west of the southwest corner (refer figure 3). Excavation works in the remediation area will be 0.4m deep.

9.5 STEP 5 – DEVELOP A DECISION RULE

The decisions associated with accepting data in relation to soil sampling will be assessed with reference to the chosen guidelines (**Section 5**), which were established within the framework of guidelines made or approved by the NSW EPA.

- If the validation data are above the nominated guidelines, then additional remediation or risk assessment may be required.
- If the validation data indicates that the analysis is less than the nominated guidelines, then no further remediation or risk assessment is required

9.6 STEP 6 – SPECIFY LIMITS ON DECISION ERRORS

With respect to the decision rules, decision errors would occur as a result of presenting concentrations of the COC or other data which are not representative of site conditions. This may lead to non-contaminated land being remediated/managed as contaminated, contaminated land being considered suitable for use without remediation/management or incorrect management/remediation methods applied. Decision errors may be a result of the following:

- Execution of an incorrect sampling plan;
- Field sampling errors;
- Failure to identify preferential pathways;
- Not following QA/QC procedures;
- Use of non NATA accredited analytical techniques;
- Errors made by the analytical laboratories;
- Transcriptions errors in laboratory result summary tables;
- Applying incorrect methods for statistical analysis of results; and
- Adoption of assessment criteria which does not best represent the site's land use.

The limits on decision errors are best defined by establishing a framework for the assessment of data quality, including data quality indicators. The data quality assessment process will be used to assess the representativeness of analytical results and the effects of the sampling program on data quality.

9.7 STEP 7 – OPTIMISE THE DESIGN FOR OBTAINING DATA

The following will be undertaken to optimise the data collection process:

- Where sampling is to be undertaken for asbestos analysis, field works will be undertaken by a an appropriately experienced and qualified environmental scientist 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; and

Laboratory analysis is to be undertaken by a NATA accredited laboratory.

10. VALIDATION AND REPORTING

10.1 Validation Criteria

Section **4** details the relevant guidelines utilised in the development and selection of the validation criteria. All validation sampling and assessment should comply with the data quality objectives detailed in **Section 7.1**.

10.2 Soil Validation Plan

10.2.1 Remediation Area

The validation sampling frequency for the remediation area specified in Section 7.4 and analytical schedule is outlined in Table 10-1**, below** . Samples should be submitted to a NATA accredited laboratory for analysis for the CoPC. The results of the validation sampling should be compared against the remedial criteria specified in **Section 4.**

Table 10-1 **Validation Sampling**

Sample type	Required frequency	Anticipated number of samples [(a)]	Analytical schedule
Wall samples	Every 5 metres along each wall of the excavation.	fifteen wall samples (six from each of the eastern and western walls, one from the southern wall and two from the northern wall)	Asbestos
Base samples	A minimum of two samples per 100m^2 on base of the excavation.	Six base sample	Asbestos
Quality control samples	Duplicate samples (blind and split) should be collected at a combined rate of not less than 1 per 20 samples .	Two blind duplicate samples Two split duplicate sample	Asbestos

10.2.2 Sampling protocols and quality control procedures

Validation sampling for asbestos analysis should be undertaken in accordance with WA DoH (2009) and NEPM (2013) guidelines in particular:

- At least one 10 L sample from each sampling location;
- Sample screened manually on-site through a < 7 mm sieve or spread out for inspection on a contrasting colour material (recommended for FA);
- Identified ACM and FA collected and submitted to laboratory along with the soil sample (outlined below) to be weighed to calculate asbestos soil concentration.
- A wetted 500 ml soil sample from each location submitted for laboratory analysis.

All sampling should be conducted in strict accordance with accepted industry standards for quality control. This ensures that all samples are collected via a set of uniform, systematic methods. In particular:

- 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.
- Photographs of the excavation should be taken as part of the validation works.

The Environmental Consultant will undertake an independent visual assessment of the remedial excavations and stockpiles to provide an accurate log/description of their condition and provide a photographic record of the materials, and prepare / review the records of soil classification.

Copies of documentation (including details of source, quality and records of material movement) for the excavated material will be required to support the Environmental Consultant's assessment.

10.3 Data Gap Investigation

The sampling frequency for the data gap investigation specified in Section 3.4 and analysis frequency outlined below. Samples from the testpits should be submitted to a NATA accredited laboratory for analysis for heavy metals, while samples from the walls and floor of the slab excavation should be analysed for TPH/BTEX compounds, PAHs, heavy metals and asbestos based on the observations reported by Cavvanba Consulting during the inspection of the slab on 29 January. As a conservative measure the results of the sampling should be compared against the NEPM (2013) investigation criteria for human health and environmental receptors for residential land use.

Validation of Concrete slab excavation:

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

Characterisation testpits:

- Testpits are to be completed across the indicative area of the potential cattle dip (shown in Figure 4) at an equivalent density of 1 per 100m^2 to provide suitable characterisation to detect

any hotspots associated with a potential cattle dip. 3 samples per testpit should be collected for analysis in accordance with Australian Standards AS4482.2-1999 and NEPM Guidelines (2013).

10.4 Waste Classification

Waste classification is required prior to offsite disposal of material excavated. The recommended sampling density is a minimum rate of one sample per 25 m^2 (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.

Samples should be analysed for the following suite (as a minimum):

- Heavy metals (As, Cd, Cr, Cu, Ni, Hg, Pb, Zn).
- Asbestos.

Toxicity characterisation leaching procedure and analysis for selected analytes may be required for waste classification purposes.

10.5 Validation of imported fill

Based on the nature of proposed remediation works, there in not expected to be any requirement for importation of fill material for the remediation works. However in the event that material is imported to site, all material imported to the site as part of the remediation should be either virgin excavated natural material (VENM) or material for which a valid exemption exists (such as Excavated Natural Material (ENM)). Material which does not comply with this requirement will not be brought on to site. 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 the proposed backfill material is not pre-classified or certified as VENM or ENM, validation samples should be collected to confirm the suitability of the material for use on the site. In this instance, the Environmental Consultant will collect validation samples from imported materials at a minimum frequency of five validation samples per source or one 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 man made materials. Samples will be tested for the following suite of contaminants at a NATA accredited laboratory:

- Heavy metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn).
- Asbestos.
- TRH.
- BTEX.
- PAH;.
- Organochlorine pesticides (OCP).
- Polychlorinated biphenyls (PCBs).

10.6 Validation Reporting

The report will document 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 this RAP.

This report shall contain all relevant information and shall conform to:

- NSW EPA (2011*) Contaminated sites: guidelines for consultants reporting on contaminated sites*; and
- Department of Environment and Conservation NSW (2006) – *Contaminated sites: Guidelines for the NSW site auditor scheme (2nd edition).*

Following appropriate implementation of the remedial measures and associated activities documented in this RAP, and subject to validation by the Environmental Consultant, the site will be considered suitable for proposed hospital land use.

10.7 Contingency Plan

A contingency plan incorporating an “Unexpected Finds Protocol” (UFP) to be followed in the event of unexpected situations shall 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, and manage unexpected situations.

For asbestos contaminated soil remediation works If initial validation works do not remove all sufficient contamination, further excavation and off-site disposal may be required to meet site criteria.

For the data gap investigation, if elevated arsenic concentrations are detected from validation sampling around the slab or the testpits, then installation of groundwater wells will be required, and an addendum to the RAP will be prepared outlining the requirements for excavation, and offsite disposal of the impacted material,

10.7.1 Unexpected Finds Protocol

For all sites, a potential exists that wastes or contaminated soils exist through undetected hotspots or uncontrolled dumping. During the proposed site development works, all materials should be assessed for potential contamination. Indications of potential contamination can include soil, fill material or wastes which exhibit one or more of the following:

- 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 unexpected finding protocol (UFP) to be developed for the site works should include (but not be limited to) the following:

- 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.

11. Site Management Plan

11.1 Hazard Identification and Exposure Pathway

Based on the site assessment, the hazards which require management are:

- soil potentially contaminated with asbestos; and
- standard construction site hazards.

11.1.1 Exposure Pathway

Exposure pathways are limited to inhalation of asbestos fibres.

11.2 Interim Site Management

The site is currently fenced, and Tweed Coast Demolition & Excavations Pty Ltd have put the following control measures in place in order to reduce the risk and or exposure to human health:

- geofabric material was placed over the topsoil contaminated with ACM fragments; and
- ~ 200 mm of clean gravel was placed over top of the geofabric material.

The remediation schedule is yet to be finalised, and until commencement of remediation works the surrounding fence and geofabric material should be maintained in order to sustain the appropriate control measures for asbestos.

11.3 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 described in the above sections.

In particular, in addition to any statutory compliance required by the above-mentioned Acts and planning instruments, the contractor shall carry out the site works with all due care, 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.

11.3.1 Dust Control

Generation of dust must be kept to a minimum by the addition of adequate volumes of water or dust suppression product during all phases of soil disturbance. If the soil is dry, water must be added at the following stages to effectively minimise generation of airborne dust:

- Exposed areas of asbestos impacted soil;

- During soil excavation;
- During placement of soil/ACM into trucks; and
- If soil is placed in temporary stockpiles prior to loading on trucks.

Water applied to stockpiles must completed in a manner that does not generate runoff.

In addition, wind direction and wind strength should be considered during soil disturbance works. It may be necessary to suspend works during times of strong winds. Staff and plant should be situated upwind from excavation areas as much as practical.

11.3.2 Stormwater Management

Remediation works must comply with appropriate requirements for stormwater management on construction sites. This includes stockpiling excavated soil in a manner that shall prevent contamination from being transported off-site by stormwater. The Contractor must control surface water on site as follows:

- Diversion of clean stormwater runoff outside of any exposed contaminated areas so the water does not flow through the areas of impact;
- Control drainage at site by interception and redirecting clean runoff in a controlled manner.

Local Government approval must be sought prior to off-site discharge of any water suspected to be contaminated. Water collected in excavations in contact with contaminated soil must be sampled and analysed to determine a suitable disposal option.

11.3.3 Sediment Control

Sediment released to surface waters must be avoided by the use of sediment controls such as detention basins, diversion drains or silt fencing. Any silt or soil must not be released to stormwater outlets. Measures to limit the generation of sediment runoff from onsite soil stockpilers include:

- Covering of stockpiles to limit erosion; and
- Surround stockpiles by an appropriate sediment fence to limit the ability of soil to become mobile.

All trucks and machinery entering the work zones are to be inspected and cleaned as necessary prior to leaving the work zone to ensure soil is not leaving the site in an uncontrolled manner.

11.3.4 Remediation Schedule

The remediation schedule is yet to be finalised

11.3.5 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.

11.3.6 Long Term Management

A long term management plan is not considered likely to be required following completion of remediation works.

12. REFERENCES

NEPC 2013. National Environment Protection (Assessment of *Site Contamination) Measure 1999,* as amended by the National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1), National Environment Protection Council, May 2013.

NHMRC. 2011. Australian Drinking Water Guidelines (updated March 2015).
NSW DEC 2006. Contaminated sites: Guidelines for NSW site Auditor Scheme, (2nd Edition). New South Wales Department of Environment and Conservation, 2006.

NSW DEC 2007. Contaminated sites: Guidelines for the Assessment and Management of Groundwater Contamination. New South Wales Department of Environment and Conservation, 2007.

NSW EPA 2015. Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997. New South Wales Environment Protection Authority, 2015.

NSW EPA 1995. Contaminated sites: Sampling Design Guidelines. New South Wales Environment Protection Authority, 1995.

NSW DUAP & NSW EPA 1998, Managing land contamination: Planning guidelines, SEPP 55 – remediation of land, NSW Department of Urban Affairs and Planning and NSW Environment Protection Authority

NSW OEH 2011. Contaminated sites: Guidelines for Consultants Reporting on Contaminated sites. New South Wales Office of Environment and Heritage, 2011.

Western Australia Department of Health, 2009, Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia.

APPENDIX A FIGURES

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

APPENDIX B Analytical Results Tables

Site 8 - Soil analytical results

ANALYTE	Units	HIL A[1]	HSL A[2, 15]	ESL A[6, 15]	EIL A[5]	ESL Ecological Significance	EIL Ecological Signifcance [5]									
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
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		45		< 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			418		167	26	29	26		26	30	18	17	18
Copper	mg/kg	6000			240		261	81	88	45		70	16	71	35	22
Lead	mg/kg	300			1111		481	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			67		42	16	20	18		16	18	37	25	28
Zinc	mg/kg	7400			370		220	160	270	130		530	120	170	110	140
Organochlorine Pesticides																
4.4`-DDD[5]	mg/kg							< 0.05	< 0.05	< 0.05	< 0.05	< 0.05		< 0.05	< 0.05	< 0.05
4.4`-DDE[5]	mg/kg							0.08	0.08	0.07	< 0.05	0.35		< 0.05	< 0.05	< 0.05
4.4`-DDT[5]	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[6]	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[6]	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

X	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
1	NEPM (1999) Schedule

Notes are provided at the end of the tables section

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[1 #]	EIL A[2 #]	EIL - Ecologically significant[3 #]																								
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-Au09796	M18-Au09797	M18-Au09798	M18-Au09769		EB1819257001		M18-Au09799	M18-Au09800	M18-Au09801	M18-Au09802	M18-Au09803	M18-Au09804	M18-Au09805
Sample name						HA7F	HA8	HA9	HA10	HA11	HA12	HA13	HA14	HA15	HA16	HA17	HA18	HA20	HA19	QC3		QC3A		HA21	HA22	HA23	HA24	HA25	HA26	HA27
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	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	Duplicate of HA19	%RPD	Triplicate of HA19	%RPD	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	4.5	4.5	4.6	4.7	4.8	4.9	5.3	5	4.6	5.2	5.9	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	< 0.4	< 0.4	< 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	< 0.4
Chromium (Total)	5	mg/kg	25	118	50.5	14	14	18	15	16	17	22	19	20	26	27	22	23	17	21	18	16	5	20	26	26	30	28	21	31
Copper	5	mg/kg	1500	211	118.5	43	60	65	55	55	55	68	64	71	80	94	94	85	80	99	22	92	14	78	85	85	74	69	64	67
Lead	5	mg/kg	75	286	128	11	12	13	14	12	12	15	13	16	32	55	12	27	55	13	26	13	0	16	33	22	14	14	12	14
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	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	79.5	44.5	22	22	22	22	22	22	22	21	18	17	20	19	19	16	20	22	12	29	18	18	16	13	18	16	14
Zinc	5	mg/kg	1850	270	192.5	160	170	170	170	160	160	170	170	150	150	200	180	170	140	180	25	126	11	150	150	130	110	140	140	120
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	< 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[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	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[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	< 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	< 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	< 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	-	< 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	-	< 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	< 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	< 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	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[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	< 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	-	< 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	-	< 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	-	< 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	-	< 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	-	< 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	-	-	-	< 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	-	< 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	-	< 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	-	< 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	-	< 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	< 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		mg/kg	5			< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	-	-	-	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Vic EPA IWRG 621 OCP (Total)*		mg/kg				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 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	0.13	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	< 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		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	-	<0.05	-	< 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	< 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		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	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chlorpyrifos		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	< 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		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	-	<0.05	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Coumaphos		mg/kg				< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-	-	-	< 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	< 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		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	-	<0.05	-	< 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	< 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	< 0.2
Dichlorvos		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	-	<0.05	-	< 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	< 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	< 0.2
Disulfoton		mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
EPN		mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Ethion		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	-	<0.05	-	< 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	< 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		mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Fenitrothion		mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Fensulfothion		mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Fenthion		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	-	<0.05	-	< 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	< 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	< 0.2
Merphos		mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Methyl parathion		mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	<0.2	-	< 0.2	< 0.2	< 0.2	< 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	< 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		mg/kg				< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-	<0.2	-	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Naled		mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Omethoate		mg/kg				< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-	-	-	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Phorate		mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Pirimiphos-methyl		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	-	<0.05	-	< 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	< 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		mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Terbufos		mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Tetrachlorvinphos		mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Tokuthion		mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Trichloronate		mg/kg				< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	-	-	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2

Notes

X	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
1	NEPM (1999) Schedule B1 Table 1A(1) - Health Investigation Level A - low to high density residential
2	NEPM (1999) Schedule B1 Table 1B - Ecological Investigation levels, urban, residential and public open space
3	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

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[1 #]	EIL A[2 #]	EIL - Ecologically significant[3 #]														
Laboratory ID						M18-Au09806	M18-Au09807	M18-Au09808	M18-Au09809	M18-Au09810	M18-Au09811	M18-Au09812	M18-Au09813	M18-Au09772		EB1819257002		M18-Au09814	M18-Au09815	M18-Au09816
Sample name						HA28	HA29	HA30	HA31	HA32	HA33	HA34	HA35	QC6		QC6A		HA36	HA37	HA38
Sample Depth						0.15	0.15	0.15	0.15	0.15	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	Duplicate of HA35	%RPD	Triplicate of HA35	%RPD	3/08/18	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
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
Chromium (Total)	5	mg/kg	25	118	50.5	26	20	23	18	16	20	18	19	17	11	11	53	17	16	14
Copper	5	mg/kg	1500	211	118.5	70	63	52	39	34	60	41	34	33	3	29	15	34	55	42
Lead	5	mg/kg	75	286	128	24	15	12	12	8.8	14	10	12	12	0	9	28	11	12	16
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
Nickel	5	mg/kg	100	79.5	44.5	15	17	19	20	16	24	18	20	17	16	10	66	21	23	17
Zinc	5	mg/kg	1850	270	192.5	130	130	120	120	110	150	130	130	130	0	88	38	140	140	130
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	< 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	0.21	0.19	10	0.13	47	0.06	0.05	0.11
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	0.06	0.06	0	<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	-	< 0.05	< 0.05	< 0.05
Aldrin[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	< 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
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
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
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
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
Dieldrin[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	< 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
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
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
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
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
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
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
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
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
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
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
Toxaphene		mg/kg	5			< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	-	-	-	< 1	< 1	< 1
Vic EPA IWRG 621 OCP (Total)*		mg/kg				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.27	0.25	-	-	-	< 0.1	< 0.1	0.11
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	< 0.1	-	-	-	< 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	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2
Bolstar		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
Chlorfenvinphos		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
Chlorpyrifos		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
Chlorpyrifos-methyl		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
Coumaphos		mg/kg				< 2	< 2	< 2	< 2	< 2	< 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	< 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	< 0.2	< 0.2	-	<0.05	-	< 0.2	< 0.2	< 0.2
Diazinon		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
Dichlorvos		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
Dimethoate		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
Disulfoton		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
EPN		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
Ethion		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
Ethoprop		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
Ethyl parathion		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
Fenitrothion		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
Fensulfothion		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
Fenthion		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
Malathion		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
Merphos		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
Methyl parathion		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
Mevinphos		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
Monocrotophos		mg/kg				< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-	<0.2	-	< 2	< 2	< 2
Naled		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
Omethoate		mg/kg				< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	-	-	-	< 2	< 2	< 2
Phorate		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
Pirimiphos-methyl		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
Pyrazophos		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
Ronnel		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
Terbufos		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
Tetrachlorvinphos		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
Tokuthion		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
Trichloronate		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

Notes

x	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
1	NEPM (1999) Schedule B1 Table 1A(1) - Health Investigation Level A - low to high density residential
2	NEPM (1999) Schedule B1 Table 1B - Ecological Investigation levels, urban, residential and public open space
3	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

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)

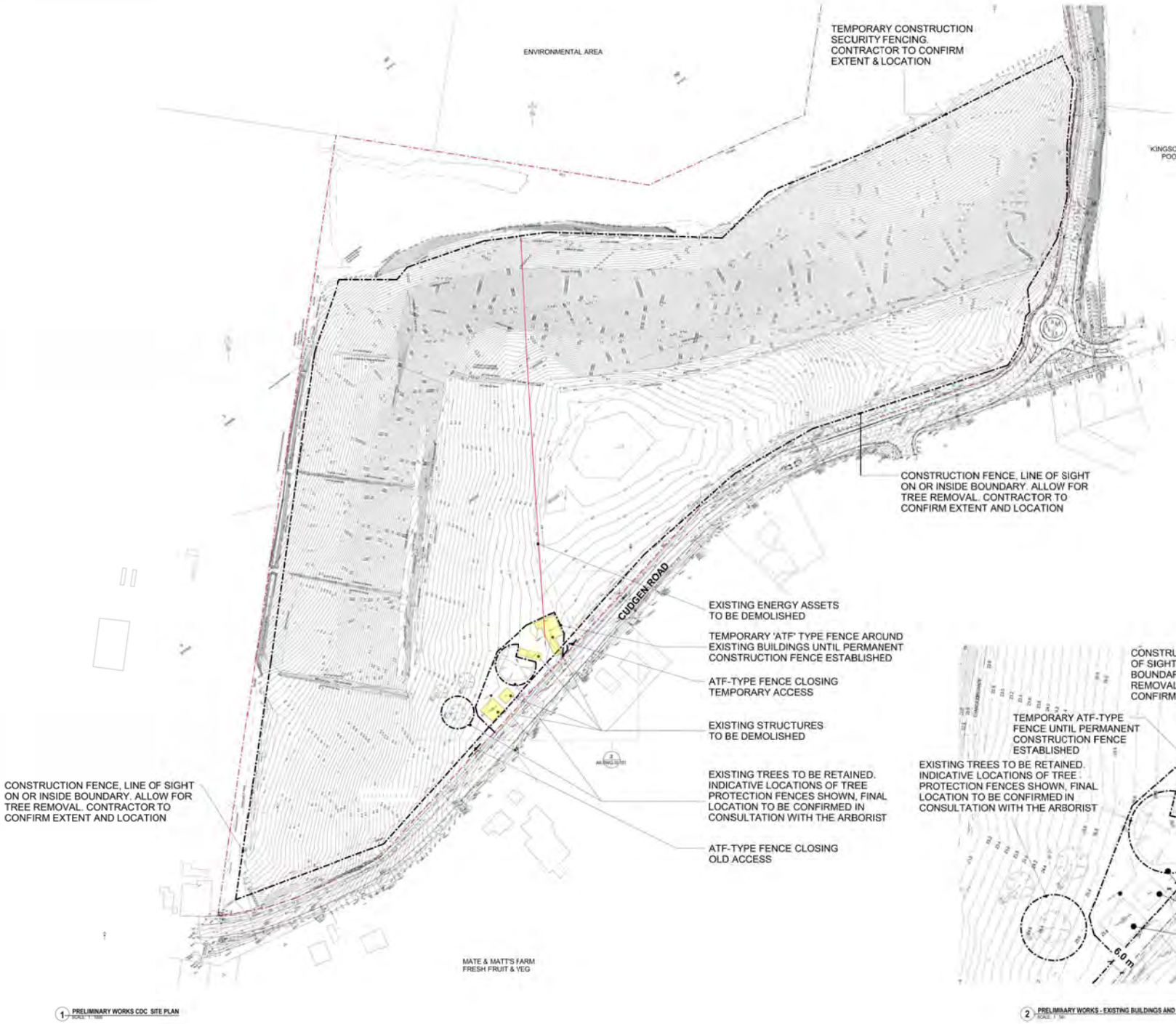
ANALYTE	LOR	Units	ASSESSMENT CRITERIA																	
			HIL A[1 #]	EIL A[2 #]	EIL - Ecologically significant[3 #]															
Laboratory ID						M18-Au09817	M18-Au09818	M18-Au09819	M18-Au09820	M18-Au09821	M18-Au09822	M18-Au09823	M18-Au09824	M18-Au09774		EB1819257003		M18-Au09825	M18-Au09826	M18-Au09827
Sample name						HA39	HA40	HA41	HA42	HA43	HA44	HA45	HA46	QC8		QC8A		HA47	HA48	HA49
Sample Depth						0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15					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	Duplicate of HA46	%RPD	Triplicate of HA46	%RPD	3/08/2018	3/08/2018	3/08/2018
Metals																				
Arsenic	2	mg/kg	25	25	10	7.6	6.2	9.5	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	< 0.4	< 0.4	< 0.4	-	1	-	< 0.4	< 0.4	< 0.4
Chromium (Total)	5	mg/kg	25	118	50.5	16	14	13	11	10	18	12	16	16	0	10	46	16	11	11
Copper	5	mg/kg	1500	211	118.5	42	35	34	38	49	38	55	66	72	8	74	11	86	77	58
Lead	5	mg/kg	75	286	128	12	8.6	13	12	10	8.5	9.8	12	11	8	9	28	13	11	14
Mercury	0.1	mg/kg	10	-	-	0.2	0.1	0.2	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	79.5	44.5	25	18	28	24	20	15	22	22	17	25	12	59	23	18	21
Zinc	5	mg/kg	1850	270	192.5	140	110	140	140	170	120	170	170	150	12	116	37	170	160	180
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
4.4`-DDE[S]	0.05	mg/kg				0.15	< 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`-DDT[S]	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	-	<0.2	-	< 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	-	< 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
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
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
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
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
DDT + DDE + DDD (Total)*	0.05	mg/kg	60			0.15	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-	<0.05	-	< 0.05	< 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
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
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
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
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
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
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
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
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
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
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
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
Toxaphene		mg/kg	5			< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	-	-	-	< 1	< 1	< 1
Vic EPA IWRG 621 OCP (Total)*		mg/kg				0.15	< 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)*		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
Organophosphorus Pesticides																				
Azinphos-methyl		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
Bolstar		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
Chlorfenvinphos		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
Chlorpyrifos		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
Chlorpyrifos-methyl		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
Coumaphos		mg/kg				< 2	< 2	< 2	< 2	< 2	< 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	< 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	< 0.2	< 0.2		<0.05		< 0.2	< 0.2	< 0.2
Diazinon		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
Dichlorvos		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
Dimethoate		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
Disulfoton		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
EPN		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
Ethion		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
Ethoprop		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
Ethyl parathion		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
Fenitrothion		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
Fensulfothion		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
Fenthion		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
Malathion		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
Merphos		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
Methyl parathion		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
Mevinphos		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
Monocrotophos		mg/kg				< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2		<0.2		< 2	< 2	< 2
Naled		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
Omethoate		mg/kg				< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2		-		< 2	< 2	< 2
Phorate		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
Pirimiphos-methyl		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
Pyrazophos		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
Ronnel		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
Terbufos		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
Tetrachlorvinphos		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
Tokuthion		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
Trichloronate		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

Notes

x	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
1	NEPM (1999) Schedule B1 Table 1A(1) - Health Investigation Level A - low to high density residential
2	NEPM (1999) Schedule B1 Table 1B - Ecological Investigation levels, urban, residential and public open space
3	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

Notes are provided at the end of the tables section

APPENDIX C Design Plan



1 PRELIMINARY WORKS CDC SITE PLAN
SCALE: 1 : 1000

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

N

LEGEND
SITE BOUNDARY
CONSTRUCTION FENCE

ISSUED FOR INFORMATION

STH BATESSMART

TSA MANAGEMENT

NSW Health Infrastructure | Health Northern NSW Local Health District

TWEED VALLEY HOSPITAL

PRELIMINARY WORKS CDC SITE PLAN

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

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'S 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.

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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

Remedial Action Plan Addendum – Residential house

771 Cudgen Road, Cudgen, NSW

January 2019, Ref. 18084 R02 V3

CAVVANBA
consulting

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Report Details

Report:

Remedial action plan addendum − Residential house

771 Cudgen Road,
Cudgen, NSW

Ref: 18084 R02 V3

for

Woollam Constructions Pty Ltd

Distribution:

Deliverables	Status	Date	Recipient
1	Original R02	20/12/2018	Tony Jackman Woollam Constructions
1	V2	08/01/2019	
	V3	24/01/2019	
1	Copy	24/01/2019	Cavvanba project file
1	Copy	24/01/2019	Cavvanba library

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Glen Chisnall
Environmental Scientist

Date: 24 January 2019

Ben Wackett
Principal Environmental Scientist

Date: 24 January 2019

Table of Contents

1.0 Introduction

Cavvanba Consulting (Cavvanba) was engaged by Woollam Constructions Pty Ltd to prepare a remedial action plan (RAP) for lead contamination in soil at a site located at 771 Cudgen Road, Cudgen NSW 2487.

This RAP should be read in full, including Section 1.4, *General limitations to environmental information.*

1.1 Background

The site consists of a farm shed, residential house and garage with farmland extending out into the western portion. Refer to Appendix A for a Photographic log and Figure 1 for an overview of the investigation boundary and features. It is understood that the previous owner had occupied the site for approximately 30 years and used it for agriculture.

As part of the new Tweed Valley Hospital development the residential house and garage are proposed to be demolished in order for preliminary works to continue at the site. OCTIEF conducted a preliminary and detailed investigation at the site in September 2018:

- OCTIEF (2018), *Preliminary and Detailed Site Investigation – 771 Cudgen Road, Cudgen, NSW 2487* (Ref. J8961).

The scope comprised of a soil and groundwater investigation which extended broadly over 771 Cudgen Road (Lot Lot 11, Deposited Plan 1246853). A total of 44 boreholes were advanced over the site, however it is noted that no soil sampling was conducted by OCTIEF within the current investigation area. A Figure from this report is included in Appendix B.

OCTIEF (2018) prepared a remediation action plan for asbestos contaminated soil associated with the farm shed, adjacent to the house:

- OCTIEF (2018) *Remediation action plan – Tweed Valley Hospital Site, 771 Cudgen Road, Cudgen NSW*. (Ref: J8961)

It should however be noted that the remedial area was outside the subject investigation area of this report.

Cavvanba conducted a contamination investigation at the site during November and December 2018, focussing on contaminants of lead and organochlorine pesticides (OCPs) associated with the residential house and garage:

- Cavvanba Consulting (2018), *Residential house – soil investigation report, 771 Cudgen Road, Cudgen, NSW* (Ref.: 18084 R01).

The investigation included the advancement of 22 test pits to maximum explored depths of 0.6 m. Following the investigation, lead contamination has successfully been delineated both vertically and laterally. The results are further discussed in Section 2.5.

Lead in soils is a common contaminated land issue with old buildings, and the EPA (2003) *Managing Lead Contamination in Home Maintenance, Renovation and Demolition Practices. A Guide for Councils* states that:

- there are over a million homes in NSW that were built before 1970 and are potentially contaminated with lead paint, dust and soil; and
- New Zealand research found soil lead levels of 16–28 ppm in homes built less than 10 years ago but 455– 16,858 ppm in homes built over 90 years ago.

1.2 Objectives

The objectives of the RAP are to:

- summarise background information and current conditions at the site;
- summarise the nature and extent of contamination at the site;

- summarise the results with respect to the proposed land use;
- describe the regulatory issues associated with the proposed remediation;
- describe the overall remedial strategy necessary to remove unacceptable risks to human health and the environment associated with the identified contaminants, as well as potential contingencies; and
- describe the remedial works to be conducted, including environmental management, occupational health and safety (OH&S), and site validation.

1.3 RAP Requirements

Office of Environment and Heritage (OEH) (2011) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*, describes that RAPs should:

- Set remediation goals that ensure the remediated site will be suitable for the proposed use and will pose no unacceptable risk to human health or to the environment.
- Document in detail all procedures and plans to be implemented to reduce risks to acceptable levels for the proposed site use.
- Establish the environmental safeguards required to complete the remediation in an environmentally acceptable manner.
- Identify and include proof of the necessary approvals and licenses required by regulatory authorities.

The information required by OEH (2011) in regard to RAPs, and where this information is addressed in this RAP, is shown in Table 1.1. Section 2 of the RAP summarises the site condition and previous investigation findings, and is based on the previous Cavvanba investigation.

Table 1.1: RAP requirements

Report requirement	Section
Discussion of the extent of remediation required.	4.0
Identification of regulatory compliance requirements such as licences and approvals.	5.0
Remediation goal.	6.1
Discussion of possible remedial options and how risk can be reduced.	6.2
Rationale for the selection of recommended remedial option.	6.3.1
Contingency plan if the selected remediation strategy fails.	6.4
Proposed testing to validate the site after remediation.	7.1
Interim site management plan (before remediation), including e.g. fencing, erection of warning signs, stormwater diversion.	8.2

Report requirement	Section
Site management plan (operation phase): - site stormwater management plan; - soil management plan; - noise control plan; - dust control plan, including wheel wash (where applicable); - odour control plan; and - occupational health and safety plan.	8.0
Remediation schedule.	8.4
Hours of operation.	8.5
Contingency plans to respond to site incidents, to obviate potential effects on surrounding environment and community.	8.7
Names and phone numbers of appropriate personnel to contact during remediation.	8.8
Community relations plans, where applicable.	n/a
Staged progress reporting, where appropriate.	n/a
Long-term site management plan.	8.9

1.4 Limitations

The findings of this report are based on the objectives and scope of work outlined above. Cavvanba performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental assessment profession. No warranties or guarantees, express or implied, are made. Subject to the scope of work, Cavvanba's assessment is limited strictly to identifying typical environmental conditions associated with the subject property, and does not include evaluation of any other issues. This report does not comment on any regulatory obligations based on the findings, for which a legal opinion should be sought. This report relates only to the objectives and scope of work stated, and does not relate to any other works undertaken for the Client.

The report and conclusions are based on the information obtained at the time of the assessment. Changes to the subsurface conditions may occur subsequent to the investigation described herein, through natural processes or through the intentional or accidental addition of contaminants, and these conditions may change with space and time.

The site history, and associated uses, areas of use, and potential contaminants, were determined based on the activities described in the scope of work. Additional site history information held by the Client, regulatory authorities, or in the public domain, which was not provided to Cavvanba or was not sourced by Cavvanba under the scope of work, may identify additional uses, areas of use and/or potential contaminants. The information sources referenced have been used to determine site history and desktop information regarding local subsurface conditions. While Cavvanba has used reasonable care to avoid reliance on data and information that is inaccurate or unsuitable, Cavvanba is not able to verify the accuracy or completeness of all information and data made available.

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. The absence of any identified hazardous or toxic materials on the subject property, should not be interpreted as a warranty or guarantee that such materials do not exist on the site. If additional certainty is required, additional site history or desktop studies, or environmental sampling and analysis, should be commissioned.

The results of this assessment are based upon site inspection and fieldwork conducted by Cavvanba personnel and information provided by the Client. All conclusions regarding the property area are the professional opinions of the Cavvanba personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, Cavvanba assumes no responsibility or liability for errors in any data obtained from regulatory agencies, information from sources outside of Cavvanba, or developments resulting from situations outside the scope of this project.

2.0 Site Setting

2.1 Site identification

The site location and investigation boundary are shown on Figure 1.

Owner:	Health Infrastructure NSW.
Street address:	771 Cudgen Road, Cudgen NSW 2487.
Property description:	Lot 11, Deposited Plan 1246853.
Investigation area (part of Lot 11 DP1246853):	Approximately 900 m^2 (consisting of the area surrounding the residential house and garage).
Co-ordinates:	Latitude: -28.265228 Longitude: 153.566395
Local government area:	Tweed Shire Council.
Elevation:	Approximately 27 m above AHD.
Landuse – existing:	Rural Residential/Agricultural.
Landuse – proposed:	Hospital.
Zoning – existing:	RU1 Primary Production.
Zoning – proposed:	SP2 Infrastructure (Hospital).

2.2 Surrounding Land Uses

The site is located in an area of mainly rural and recreational landuse, with the surrounding landuses identified as:

North:	Agricultural land use, followed by bushland.
East:	Cudgen Road followed by TAFE NSW Kingscliff.
West:	Agricultural land use.
South:	Cudgen Road followed by agricultural land use.

2.3 Topography

The site is relatively flat with a slight slope falling toward the south-west.

2.4 Geology and soils

2.4.1 Geology

Based on NSW Environment & Heritage Soil and Land Information (eSPADE, accessed 13 December 2018), the site lies on Lamington Volcanics—Tertiary basalt, consisting of rhyolite, trachyte, tuff, agglomerate, conglomerate.

The landscape consists of very low to low undulating hills and rises on the Cudgen Plateau and nearby basalt caps. Elevation is 30−40 m on the Cudgen Plateau.

The vegetation in the area is cleared closed-forest (rainforest). Most of this landscape is cultivated, but the original vegetation would have been be similar to that of the Limpinwood (li) or Green Pigeon (gp) soil landscapes.

2.4.2 Soils

Based on NSW Environment & Heritage Soil and Land Information (eSPADE, accessed 13 December 2018) the soil profile in the area consists of deep (>100 cm), well-drained red silty clay (Krasnozems). This soil profile is consistent with the observations made during the investigation of the house and garage.

2.5 Previous environmental investigation

Cavvanba conducted a soil investigation at the site during November and December 2018:
- Cavvanba Consulting (2018), *Residential house − soil investigation report, 771 Cudgen Road, Cudgen, NSW* (Ref.: 18084 R01).

The potential drip zone from the outer walls, underneath the house and garage slab were targeted for potential contamination of lead and/or OCPs.

2.5.1 Scope

The scope of work included:

- Review of previous environmental investigations OCTIEF (2018) report.
- Completion of a comprehensive site walkover and visual inspection for key features to identify potential areas of environmental concern on- and off-site.
- Advancement of 22 soil test pits using a hand auger in a staged investigation.
- Collect and analyse samples for potential contaminants of concern, which will assist in the classification of any material required for offsite disposal.
- Inclusion of the results and findings into a report.

The analytical results were compared to residential land use with minimal opportunities for soil access land use for human health screening (HIL A) and for urban residential and public open space environmental screening (EIL) and have been provided in Section 2.5.3.

2.5.2 Sampling conducted

Cavvanba's expectation of contamination based on similar sites is lead contamination from paint is generally limited to within 2 − 3 m of drip the zone, and within 0.5 m of the ground surface. At this site, the original house appeared to have been extended, therefore it was possible that lead would also be present beneath the building.

The sampling strategy included collection of samples at the following locations:
- within 1 m of existing perimeter on each side of the residential house and garage;
- step out locations at 2 m from the house and garage perimeter;
- samples beneath the house;
- samples beneath the garage slab; and
- samples at multiple depths at each location i.e. (0.1, 0.3 and 0.6 m below the ground surface).

Of those samples collected, the first stage of sample analysis selection was limited to:
- all samples beneath the house and garage slab;
- all samples within 1 m of the building perimeter i.e. on each side of the house and garage; and
- only samples at shallow depth (0.1 m).

Additional analysis was undertaken at step-out locations at greater depths that 0.1 m to delineate any criteria exceedances on an as needs basis. The sampling strategy completed was considered to meet the definition of a systematic approach, and meets the minimum sampling requirements in accordance with *Sampling Design Guidelines* (NSW EPA, 1995). Additionally, consideration was given to the Tweed Shire Council for Pre-Demolition Testing of organochlorine pesticides beneath structures and dwellings.

Table 2 below describes the rationale for the chosen sampling design and additional delineation sampling/analysis.

Table 2: Overall sampling design and rationale

Location/sample ID	Rationale
First stage of analysis	
TP01_0.1 to TP04_0.1	Targeting any potential sources of lead paint located underneath the residential house at the surface.
TP05_0.1 to TP10_0.1 & TP17_0.1 to TP19_0.1	Targeting the potential drip zone from the walls of the residential house and garage at the surface.
TP28_0.1, TP29_0.1, TP30_0.1	Targeting sub slab of garage.
TP11_0.1 to TP16_0.1	Samples taken to delineate any potential lead impact from the residential house.
Delineation sampling/analysis	
TP01_0.3, TP01_0.6, TP02_0.3, TP02_0.6, TP03_0.3, TP03_0.6, TP04_0.3	Further sampling/analysis conducted at 0.3 and 0.6 m below the ground surface; aiming to delineate the vertical extent of lead impact.

2.5.3 Analytical results

The results are summarised on the following page by contaminant. The analytical results have been compared to the screening criteria adopted for the site. The NEPM health investigation and screening levels for residential land use (HIL A) have been used along with the ecological investigation levels (EILs) for urban residential and public open space to ascertain the magnitude of impacts.

Table 2.1: Soil analytical summary

Analyte	Health criteria	Ecological criteria	Site data			
	HIL / HSL (mg/kg)	EIL/ESL (mg/kg)	No. samples analysed	Number of detects	Max' (mg/kg)	Meets screening criteria?
Metals						
Lead	300	1,100	27	27	1,600	No
Organochlorine pesticides						
DDT+DDE+DDD	240	180[1]	24	10	9.07	Yes
Aldrin and dieldrin	6	-[2]		7	1.18	Yes
Chlordane	50	-		4	4.10	Yes
Endosulfan	270	-		0	<0.05	Yes
Endrin	10	-		0	<0.05	Yes
Heptachlor	6	-		0	<0.05	Yes
HCB	10	-		0	<0.05	Yes
Methoxychlor	300	-		0	<0.2	Yes

Table notes:
1 – Criteria for DDT only.
2 – = No criteria available
3 – BOLD indicates exceedance of HILs criteria.
4 – Underscore indicates exceedances of EILs criteria.

The results are also summarised as eight samples exceeded HILs (Residential A) for lead collected from four locations (TP01, TP02, TP03 and TP06).

The maximum reported lead concentration of 1,600 mg/kg was reported at TP03_0.3 (located underneath the south-western corner of the residential house). This sample also exceeded the EILs (urban residential and open public space) criteria for lead.

All samples (excluding TP06_0.1) which exceeded the HILs were located underneath the residential house. OCPs were detected at 10 sample locations, concentrations were almost all an order of magnitude below the adopted criteria.

2.5.4 Discussion and recommendations

Discussion

Lead concentrations exceeding site criteria were present:
- underneath the former residential house in all four samples locations to 0.3 m depth;
- approximately 1 m from the eastern wall of the residential house, in the southern portion associated with TP06 to 0.1 m depth; and
- extending to 0.6 m depth at TP02 which still had reported concentrations of 324 mg/kg which marginally exceeds site criteria.

Based on the trends of decreasing lead concentrations with depth at TP02, it is anticipated that exceedances of residential criteria will not extend below 0.7 m below ground surface:
- TP02_0.1 = 1,070 mg/kg;
- TP02_0.3 = 838 mg/kg; and
- TP02_0.6 = 324 mg/kg.

Validation samples will be collected to confirm that lead contamination does not exceed these depths following remediation and has been further discussed in Section 7.1 of this report.

Recommendations

Based on the concentrations detected underneath the former residential house and ~1 m from the eastern wall, remediation and/or management is required.

A remedial action plan should be prepared for the former residential house which should consider:
- off-site disposal; and/or
- on-site management/capping including long term management.

2.6 Overarching RAP

OCTIEF was engaged by TSA management on behalf of NSW Health Infrastructure to compile a remediation action plan for Lot 11 DP 1246853 (the site) located at 771 Cudgen Road, Cudgen NSW:

– OCTIEF (2018) *Remediation action plan – Tweed Valley Hospital Site, 771 Cudgen Road, Cudgen NSW*. (Ref: J8961)

The OCTIEF RAP outlined remediation works which are considered category 2. The scope included excavation and disposal of asbestos contaminated soil to the south of the farm shed which is located nearby the house. Given the remediation strategy is similar for both the shed and house, this RAP supports the OCTIEF RAP.

3.0 Remediation criteria

The remediation area is to be made suitable for residential soil land use.

3.1 Soil

It should be noted that the proposed use of the site is a public hospital. For conservative purposes for lead in soil, the appropriate criterion is 300 mg/kg. This is sourced from Column 1 (residential with garden/accessible soil) health-based investigation levels from NEPM (2013).

ASC NEPM 2013 states that the NEPM HILs are not protective of construction workers, and site specific risk should be taken into consideration: (Schedule B7: Guideline on health-based investigation levels – Section 3.1) *The HILs are therefore considered to be protective of exposures to other receptor populations; however, the HILs do not specifically address short-duration exposures that may occur during construction and maintenance of a site (including intrusive works). These exposures should be addressed on a site-specific basis.*

Considering the above description and the following points, residential criteria is an appropriately conservative criteria for handing the site over for construction purposes without the need for further site specific risk assessment:
- the use of residential criteria is also consistent with the OCTIEF investigation documents;
- the potential area of lead impacted soil typically presents a small volume which can be feasibly removed from the site;
- the high level of public interest, and desire for conservative criteria to be implemented;
- the development was to be staged separately between demolition and construction, and the contaminated land investigation and potential remediation was expected to be undertaken prior to construction; and
- there are proposed construction works and the HILs for commercial/industrial landuse were not developed to be specifically protective of the risks to construction workers.

Developments in management of lead contaminated soils

In December 2013, the U.S. Environmental Protection Agency released a technical and policy guidance document by the Technical Review Workgroup for Lead (TRW) entitled *Technical Review Workgroup Recommendations Regarding Gardening and Reducing Exposure to Lead-Contaminated Soils* (OSWER 9200.2-142). The primary exposure risks identified four pathways of lead exposure, being:
- direct ingestion of produce (i.e. within vegetables);
- ingestion of lead in soil on produce (i.e. soil on vegetables);
- incidental ingestion of soil while gardening; and
- incidental ingestion of soil tracked into residence.

The following table outlines the best management practices reported by the TRW.

Table 1. TRW Lead Committee Recommended Best Management Practices for Gardening in Lead Contaminated Areas

Soil-Lead Concentration (ppm)	Category	Recommendation: Gardening Practices	Recommendation: Choosing Plants[a]
<100	Low risk	• No specific remedial action needed. • Wash hands, produce, clothes (good gardening and housekeeping practices).	• No restrictions of crop types.
>100–400[b] ⋯→ 400–1200	Potential risk	• Increasing use of good gardening and housekeeping practices as described in Table 3. • Relocate garden to lower risk garden areas. • Increasing use of soil amendments (*e.g.*, compost, clean fill), barriers (*e.g.*, mulch), and other remedial measures (see Table 3) up to and including raised beds and containers. • Ensure gardeners wear gloves and use tools to reduce soil contact and ingestion.	• Decrease planting of root vegetables or relocate root crop planting to lower risk areas. • Increase use of soil amendments and barriers to reduce soil deposition onto leafy vegetables. • Increase planting of fruiting vegetables, vegetables that grow on vines, and fruit trees.
>1200	High risk	• All of the above good gardening and housekeeping practices. • Raised beds, soil containers, soil replacement (*i.e.*, excavate contaminated soil and replace with soil containing low lead concentrations) are strongly recommended.[c] • Consider finding other locations for garden. • Restrict child access to only established safe areas. • Restrict all gardening by or for children in contaminated soils.	• Select plants with shallow roots for raised beds or areas with replacement soil to ensure that roots do not reach contaminated soil that is left in place, if any, otherwise, no restrictions.

The guidance provided is consistent with the NEPM. Based on the advice in the TRW best practice document, the concentrations present on-site are high risk and require management.

3.2 Waste

Material to be transported to another site is subject to the waste requirements of the POEO Act, i.e. the waste guidelines are relevant.

NSW EPA (2014) *Waste Classification Guidelines Part 1: Classifying waste,* states that "waste contaminated with lead (including lead paint waste) from residential premises or educational or child care institutions" are pre-classified as 'general solid waste (non-putrescible). Therefore, if soil material requires off-site disposal it will be classified as general solid waste.

The concentrations of other contaminants, namely OCPs do not change the classification.

3.3 Imported fill

Any soil imported to the site must be obtained from reputable suppliers and must comprise virgin excavated natural material (VENM).

Any material to be transported to another site is subject to the waste requirements of the POEO Act, i.e. the waste guidelines are relevant.

4.0 Extent of remediation required

4.1 Media

This remedial action plan is limited to soil only.

4.2 Potential contaminants of concern

Potential contaminants of concern associated with the site are limited to lead only.

4.3 Lateral and vertical extent

Based on presence of lead paint inside the residential house, it is assumed that this is the source of elevated lead concentrations in soil.

Lead exceeding 300 mg/kg has been detected. Based on the results of the previous investigation conducted by Cavvanba, contamination is estimated to be approximately 132 m^3 of soil, surrounding the house as shown on Figure 2 and Figure 3, which is within:

- the edge of the former residential house to the north, south, west;
- approximately 2 m the east of the former residential house − in the southern portion; and
- 0.7 m depth in all directions.

5.0 Regulatory requirements

Regulatory aspects relating to the remediation of this site are summarised below.

5.1 SEPP 55

The planning approach to the remediation of contaminated land is legislated in *State Environmental Planning Policy No 55—Remediation of Land* which requires certain considerations of when consent is required to undertake remediation works. The SEPP classifies remediation as either:

- Category 1 − remediation work for which development consent is required; or
- Category 2 − remediation work not requiring development consent.

Whilst Category 2 remediation may not require consent, all relevant conditions described in the SEPP must be considered, and notice must be given to the consent authority and local council 30 days prior to the commencement of the work. It is understood that Tweed Shire Council was notified of remedial works on 5 December 2018.

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. This report is provided to meet the requirements of SEPP 55 and Department of Planning and Urban Affairs (1998) *Planning Guidelines SEPP 55 − Remediation of Land*.

5.2 Environmentally Hazardous Chemicals act 1985

The Environmentally Hazardous Chemicals Act (1985) has been taken into consideration and is relevant to the remedial phase of the project. Section 4.14 in the order describes scheduled chemical wastes:

> *scheduled chemical wastes means any liquid or solid waste that contains one or more of the chemicals listed in Schedule A to this chemical control order where the total concentration of those chemicals is more than two milligrams per kilogram.*

The impacted soil is considered to be a scheduled chemical waste as reported concentrations of OCPs were more than two milligrams per kilogram. However, no requirements are applicable for transportation of the material as OCP concentrations were reported below 50 milligrams per kilogram. Section 22 of the order (Conveying scheduled chemical waste) describes the following:

> *A person must not convey scheduled chemical wastes in or on a vehicle, where the total concentration of the chemicals listed in Schedule A is 50 milligrams per kilogram or more, unless accompanying the vehicle there is personnel:*
> - *trained in methods of containing spilled scheduled chemical wastes; and*
> - *provided with appropriate personal protective equipment, clean-up material and equipment to deal with any spill.*

5.3 POEO Act 1997

The requirements of the *Protection of the Environment Operations (POEO) Act* 1997, and associated schedules and regulations, are relevant to the remedial phase of the project. The objectives of the Act include to protect, restore and enhance the quality of the environment in New South Wales, having regard to the need to maintain ecologically sustainable development.

The Act includes requirements not to pollute waters, to prevent or minimise air pollution, to maintain and operate plant in a proper and efficient condition/manner and to deal with materials in a proper and efficient manner to minimise noise impacts, and to minimise and manage wastes. The Act also requires notification to the EPA when a pollution incident occurs that causes or threatens material harm to the environment.

The POEO Act is relevant for disposal of wastes, importation of backfill materials, and excavation validation and reporting.

5.4 CLM Act

The Contaminated Land Management (CLM) Act 1997 enables the EPA to respond to contamination that is significant enough to warrant regulation to protect humans or the environment. The *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (June 2009) outline a decision-making process for reporting contamination to the EPA.

5.5 Environmental Planning & Assessment (EP&A) Act 1979

The Environmental Planning & Assessment (EP&A) Act enables the consent authority to consider the suitability of the site for the development, which includes whether the site is contaminated.

The site is mapped as having no known occurrence of acid sulphate soils (ASS). Based on this, a preliminary acid sulphate investigation is not required.

6.0 Remedial actions

6.1 Remediation goal

The remediation goal for the site is to:
- render the site suitable for the intended land use (for conservative purposes, residential with garden/accessible soils;
- 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.

6.2 Remedial options

NEPM, 2013 outlines a remediation hierarchy in the Assessment of Site Contamination Policy Framework (Attachment A, page 8 and 9).

> *(16) Attainment of environmental outcome*
>
> *In general, to achieve the desired environmental outcome, the process of the assessment of site contamination should be placed within the context of the broader site assessment and management process. In particular, in assessing the contamination, the site assessor and others should take into account the preferred hierarchy of options for site clean-up and/or management which is outlined as follows:*
>
> - *on-site treatment of the contamination so that it is destroyed, or the associated risk is reduced to an acceptable level; and*
> - *off-site treatment of excavated soil, so that the contamination is destroyed or the associated risk is reduced to an acceptable level, after which soil is returned to the site; or*
>
> *If the above are not practicable,*
> - *consolidation and isolation of the soil on site by containment with a properly designed barrier; and*
> - *removal of contaminated material to an approved site or facility, followed, where necessary, by replacement with appropriate material;*
>
> *or,*
> - *Where the assessment indicates remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy.*

In assessing the remedial options available for the site, the following have been considered:
- the types and form of the contaminants present;
- the land use proposed for the remediation area;
- available proven remediation methods/technologies; and
- regulatory requirements.

Based on this, a range of remedial options has been considered, comprising:
1. no action;
2. treatment of the impacted material;
3. removal and offsite disposal of the impacted material.

A brief review of the remedial options is summarised below.

6.2.1 No action

Contamination has been detected at the site which requires remediation and/or management and as the site is to be redeveloped, the 'no action' option is not considered to be appropriate.

6.2.2 Stabilisation/treatment

Stabilisation generally requires the excavation and either on-site or off-site treatment and/or disposal, and is essentially a remediation technology that reduces the mobility of contaminants, either by chemically altering or binding it (USEPA 1994). It is most applicable to inorganic (metal) contamination.

Immobilisation requires additional investigation, testing and verification, and at this stage is not considered appropriate.

6.2.3 Removal

Removal of contaminants involves physically digging up the contaminated material and off-site disposal of these materials. Contaminants can be effectively 'chased-out' based on the investigation results and current understanding. It is relatively time efficient and low-tech, however the removal requires some form of reinstatement and disruption, and can be costly for large volumes requiring off-site disposal.

The previous investigation delineated the impact vertically and laterally as described in Section 2.5.4 and determined that approximately 132 m^3 of soil required disposal off-site, depending on the level of certainty required. Considering the concentrations of lead and the volume of waste present, removal is considered appropriate. Two remedial options for removal have provided as Figure 1 and Figure 2:

- The Figure 1 strategy is to excavate and remove 0.7 m of soil across the entire remediation area; and
- The Figure 2 strategy is to remove 0.4 m of soil in the shallower contaminated areas (TP01, TP03, TP04, TP06) and to remove 0.7 m of soil in the vicinity of TP02 where contamination extended beyond 0.4 m depth.

6.2.4 Capping and containment

Capping

This primarily involves isolating the contaminated area with barriers and covering it so that it cannot be disturbed during normal site activities associated with the proposed landuse. The contamination therefore cannot generate dust, or come into contact with site occupiers. This option is generally applicable where the contamination is buried at depth, or will be buried at depth, where a layer of clean fill covers the impacted area. Capping also minimises disturbance, and infiltration of surface waters, therefore minimising the potential for migration of contaminants.

This option requires the placement of a geo-textile marker layer or similar to avoid disturbance, and requires ongoing management and notification on the Section 149 certificate.

Due to contamination being present at the ground surface, and the requirement for ongoing management this is considered to be an inappropriate strategy for the site.

In-situ

Containment technologies include both surface capping to impede direct contact (USEPA 1994), and construction of purpose built cells. ANZECC (1999) outlines design

requirements for onsite containment of contaminated soils, and includes contingencies for accumulation of vapours, potential for groundwater contamination, infiltration etc. The option of designing and constructing a cell onsite is not considered a feasible option, and would require ongoing management and notification on the Council 149 certificate.

Ex-situ

Ex-situ containment involves excavation and re-placement of the soil in a suitable place, which may include a specially designed cell offsite. This option, when compared to disposal to landfill is not economical.

6.3 Remedial strategy

The remedial strategy of off-site disposal is considered to meet the remedial requirements and be acceptable for the proposed development. The lead remediation area is outlined on Figure 2 and Figure 3.

Table 6.1: Summary remedial and management strategy

Aspect	Specific remedial or management strategy
Lead in soil	A lead in soil management area (which exceeds the site criteria) has been outlined on Figure 2 and Figure 3, and is to be excavated and disposed of off-site.
Off-site disposal	Off-site disposal of soil is proposed. Pre-classified as general solid waste as lead contamination is associated with lead paint from a residential premises.
Validation	Validation sampling for lead will be required, following the removal of impacted soil. This needs to be completed by a suitably qualified contaminated land environmental consultant. Further information is provided in Section 7.0.
Imported fill	If back filling is required, imported VENM may be required to bring the site back to grade, which will need to be evaluated in line with the guidance provided in Section 3.3.
Interim measures	Refer to Section 8.2, below.
Long term management	No long term management will be required, following the excavation and off-site disposal works.

6.3.1 Appropriateness of remedial strategy

For this site and scenario, the remedial strategy to excavate and remove ~ 132 m^3 of lead contaminated soil is the most appropriate based on the following:

- the duration of remedial works;
- the level of reported lead concentrations (> 500% of site criteria);
- minimal disturbance of the property; and
- long-term management or notification is considered unnecessary.

6.4 Remediation contingency

Remediation contingencies are limited to further excavation and disposal being required if the initial validation results exceed the site criteria.

7.0 Remediation validation and monitoring

7.1 Validation works

A validation report must be prepared following the works which is in accordance with:
- EPA (1995) *Contaminated Sites - Sampling Design Guidelines*; and
- NSW OEH (2011) *Guidelines for consultants reporting on contaminated sites*.

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).

The report will provide a clear conclusion stating whether or not the RAP has been satisfied and a conclusion regarding the site suitability for its existing or proposed future use.

7.2 Imported fill

VENM is described in the NSW EPA 2014 waste guidelines as natural material (e.g. clay, gravel, sand, soil or rock fines):
- that has been excavated or quarried from areas that are not contaminated with manufactured chemicals or process residues, as a result of industrial, commercial, mining or agricultural activities; and
- that does not contain sulphidic ores or soils, and includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved for the time by a notice published in the NSW Government Gazette.

To validate imported fill, one sample per 100m^3 will be collected and analysed for potential contaminants of concern (PCOCs) as per NSW EPA *Technical Note: Investigation of Service Station Sites* (2014), namely metals (arsenic, cadmium, chromium, copper, lead, mercury and zinc), TRH, BTEXN, organochloride pesticides (OCPs) and polychlorinated biphenyls (PCBs). Visual observation for asbestos must also be conducted.

8.0 Site Management Plan

Specific controls and strategies for environmental protection during remediation forms part of the requirements of the RAP.

8.1 Hazard identification and exposure pathways

8.1.1 Hazards

Based on the site assessment, the hazards which require management are:
- soil potentially contaminated with lead; and
- standard construction site hazards.

8.1.2 Exposure

Exposure is likely only when the soil is exposed. This may occur if:
- the grass is removed or killed; or
- following earth works, bare soil is exposed.

Based on the proposed remedial strategy, potential environmental impacts are considered to relate to movement of soils through erosion or disturbance, and movement of dust.

Potential human health exposure relates to:
- dermal (skin) contact with soil or dust; and/or
- inhalation of soil or dust; and/or
- ingestion of soil or dust.

Controlling the above exposure pathways will effectively minimise the risks to workers or occupants in relation to the contaminated soil.

8.2 Interim (before remediation)

The residential house has recently been demolished and the resultant footprint is currently uncontrolled, with the exception of being fenced for security purposes. It is expected that the remediation works will be undertaken imminently, however in the circumstance that remediation is delayed, the following interim measures 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 is 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 are considered appropriate for a period of up to 12 months if the site is undisturbed and maintained.

8.3 Site management (remediation phase)

The remedial program should be undertaken with due regard to legislative requirements and any relevant environment planning instruments that apply to the site described in the above sections.

In particular, in addition to any statutory compliance required by the above-mentioned Acts and planning instruments, the contractor shall carry out the site works with all due care, 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:

1. Maintain erosion and sediment controls to prevent offsite migration of impacted soils.

2. 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 surfacewater), cover work areas if required, or stop work if wind sufficient to generate dust.

3. During excavation works, use methods which minimise manual handling of soils.

4. Minimise the movement of soil via personnel and machinery tracking soil out of the lead in soil remediation area.

5. 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.

6. Given ingestion is a primary exposure pathway, all workers must wash their hands and faces before eating.

8.4 Remediation schedule

The remediation schedule is yet to be defined.

8.5 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.

8.6 Unexpected finds

As for all sites, a potential exists that wastes or contaminated soils exist through undetected hotspots or uncontrolled dumping. During the site works, all materials should be assessed for potential contamination. Indications of contamination include, but are not limited to, soils, fills or wastes which exhibit:
- staining or discolouration; and/or
- odours; and/or
- waste materials such as ash or slag; and/or
- construction or demolition wastes (brick, concrete, tile, timber, steel, carpet, etc.); and/or
- asbestos cement sheeting or pipe pieces or fragments; and/or
- bottles, chemical containers, broken glass, plastic, etc.; and/or
- white goods, garbage, etc.

An unexpected finding protocol (UFP) for the site works includes, the following:
- 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, this should include the involvement of an appropriately qualified environmental consultant, specialising in contaminated land.

The UFP should be integrated with the site-specific emergency response plan. If the unexpected findings present an immediate hazard, then the emergency response plan should take precedence over the UFP

8.7 Contingency plans

The purpose of the contingency plan is to identify unexpected situations that could occur during the remediation works, and specify procedures that can be implemented to manage such situations and prevent adverse impacts to the environment and human health, and manage unexpected situations. Contingency plans for the remedial works include:

- If initial validation works do not remove all sufficient contamination, further excavation and off-site disposal may be required to meet site criteria.

- Dust emissions are to be confined within the site boundary. The following dust control procedures may be employed to comply with this requirement:
  - minimisation of work areas;
  - erection of dust screens around the perimeter of the site or dust generating activities;
  - use of water sprays across the site to suppress dust (but not to generate runoff);
  - covering of all stockpiles of soil or other materials likely to generate dust or odours; and
  - changing or modifying work practices based on climatic conditions.

8.8 Contact details

The following contact details are to be provided:

Contact	Name	Details
The Tweed Hospital, Powell St & Florence Street, Tweed Heads NSW 2485	Nearest Medical Assistance	(07) 5536 1133
Emergency	-	000
Client	Tony Jackman Woollam Constructions Pty Ltd	0408 464 648
EPA	Pollution Hotline	(02) 9995 5000
Cavvanba Consulting Pty Ltd 1/66 Centennial Circuit, Byron Bay NSW 2481 ABN: 37 929 679 095	Ben Wackett Ross Nicolson Rob McLelland	0428 606 064 0488 225 692 02 6685 7811
Cavvanba Field Scientist	Glen Chisnall	0499 401 092

8.9 Long term management plan

A long-term management plan is not considered likely to be required following remediation works.

9.0 References

Consultant reports

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Figures

Figure 1: Site Location 18084 R02

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 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

Tables

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

Appendix A

Photographic log

Photograph 1.
View east of investigation area, garage to the left and the residential house on the right. All photographs taken on 30 November; 11 and 12 December 2018.

Photograph 2.
View of TP02; located underneath the south-western section of the former residential house. Anthropogenic materials consisting of plastic and glass scattered around the test pit location.

Photograph 3.
View of test pit location TP04; located underneath southeast portion of the house, in the southeast portion.

Photograph 4.
Test pit location TP06, located ~ 1 m from the eastern wall of the former residential house.

Photograph 5.
View of test pit location TP14, sampled ~ 5 m to the south of the residential house. Anthropogenic inclusions of glass and tiles were identified within this location.

Photograph 6.
View over garage slab. Test pit locations TP28 and TP30 visible in foreground followed by demolition waste from the former residential house.

Appendix B

OCTIEF (2018) *Preliminary and detailed site investigation – 771 Cudgen Road, Cudgen, NSW 2487* Figure 3 DSI sampling locations

REV	DESCRIPTION	DATE	MT	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

Remedial Action Plan Addendum – Farm Shed

771 Cudgen Road, Cudgen, NSW

January 2019, Ref. 18084 R04 V2

CAVVANBA
consulting

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Report Details

Report:

Remedial action plan addendum − Farm Shed
771 Cudgen Road,
Cudgen, NSW

Ref: 18084 R04 V2

for

Woollam Constructions Pty Ltd

Distribution:

Deliverables	Status	Date	Recipient
1	Original R04	16/01/2019	Tony Jackman, Woollam Constructions Pty Ltd
1	V2	24/01/2019	
1	Copy	24/01/2019	Cavvanba project file
1	Copy	24/01/2019	Cavvanba library

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Glen Chisnall
Environmental Scientist

Date: 24 January 2019

Ben Wackett
Principal Environmental Scientist

Date: 24 January 2019

Table of Contents

1.0 Introduction

Cavvanba Consulting (Cavvanba) was engaged by Woollam Constructions Pty Ltd (Woollam) to prepare a remedial action plan (RAP) for asbestos contamination in soil at a site located at 771 Cudgen Road, Cudgen NSW 2487.

This RAP should be read in full, including Section 1.5, *General limitations to environmental information.*

1.1 Professional experience

Cavvanba is a specialist contaminated land consultancy and is suitably qualified to conduct the works. Cavvanba employees hold certified environmental practitioner (CEnvP) qualifications, which are nationally recognised competencies.

Cavvanba is a full member of the Australian Contaminated Land Consultants Association (ACLCA) in NSW and Queensland. ACLCA is an association that "represents the major environmental consulting firms involved in the assessment and management of contaminated sites in Australia".

Ben Wackett is a WorkCover NSW licensed asbestos assessor (LAA 000132), and an associate member of the Australian Institute of Occupational Hygienists (AIOH). Ben is also a NSW EPA accredited Site Auditor, under the *Contaminated Land Management Act 1997.*

Ben is a member of the Environmental Institute of Australia and New Zealand (EIANZ).

1.2 Background

The site consists of a farm shed, residential house and garage with farmland extending out into the western portion. Refer to Figure 1 for an overview of the investigation boundary and features. It is understood that the previous owner had occupied the site for approximately 30 years, and used it for agriculture.

As part of the new Tweed Valley Hospital development the residential house and garage are proposed to be demolished in order for preliminary works to continue at the site. OCTIEF conducted a preliminary and detailed investigation at the site in September 2018:

- OCTIEF (2018), *Preliminary and Detailed Site Investigation – 771 Cudgen Road, Cudgen, NSW 2487* (Ref. J8961).

The scope comprised of a soil and groundwater investigation which extended broadly over 771 Cudgen Road (Lot Lot 11, Deposited Plan 1246853). A total of 44 boreholes were advanced over the site, however it is noted that only two of these boreholes are relevant to the investigation area of this report (HA1 and HA2).

OCTIEF (2018) prepared a remediation action plan for asbestos contaminated soil associated with the farm shed, adjacent to the house:

- OCTIEF (2018) *Remediation action plan – Tweed Valley Hospital Site, 771 Cudgen Road, Cudgen NSW* (Ref: J8961).

Cavvanba conducted a contamination investigation at the site during November and December 2018, focussing on contaminants of asbestos, lead and organochlorine pesticides (OCPs) associated with the farm shed:

- Cavvanba Consulting (2019), *Soil investigation report – Farm shed, 771 Cudgen Road, Cudgen, NSW* (Ref.: 18084 R03).

The investigation included the advancement of 21 test pits to maximum explored depths of 0.3 m. Delineation of ACM in soil has not been completely achieved for the farm shed.

Investigation beyond the immediate perimeter hasn't been undertaken at TP32 due to presence of an access road. The results are further discussed in Section 2.5.

1.3 Objectives

The objectives of the RAP are to:

- summarise background information and current conditions at the site;
- summarise the nature and extent of contamination at the site;
- summarise the results with respect to the proposed land use;
- describe the regulatory issues associated with the proposed remediation;
- describe the overall remedial strategy necessary to remove unacceptable risks to human health and the environment associated with the identified contaminants, as well as potential contingencies; and
- describe the remedial works to be conducted, including environmental management, occupational health and safety (OH&S), and site validation.

1.4 RAP Requirements

Office of Environment and Heritage (OEH) (2011) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*, describes that RAPs should:

- Set remediation goals that ensure the remediated site will be suitable for the proposed use and will pose no unacceptable risk to human health or to the environment.
- Document in detail all procedures and plans to be implemented to reduce risks to acceptable levels for the proposed site use.
- Establish the environmental safeguards required to complete the remediation in an environmentally acceptable manner.
- Identify and include proof of the necessary approvals and licenses required by regulatory authorities.

The information required by OEH (2011) in regard to RAPs, and where this information is addressed in this RAP, is shown in Table 1.1. Section 2 of the RAP summarises the site condition and previous investigation findings, and is based on the previous Cavvanba investigation.

Table 1.1: RAP requirements

Report requirement	Section
Discussion of the extent of remediation required.	4.0
Identification of regulatory compliance requirements such as licences and approvals.	5.0
Remediation goal.	6.1
Discussion of possible remedial options and how risk can be reduced.	6.2
Rationale for the selection of recommended remedial option.	6.3.1
Contingency plan if the selected remediation strategy fails.	6.4
Proposed testing to validate the site after remediation.	7.1

Report requirement	Section
Interim site management plan (before remediation), including e.g. fencing, erection of warning signs, stormwater diversion.	8.2
Site management plan (operation phase): - site stormwater management plan; - soil management plan; - noise control plan; - dust control plan, including wheel wash (where applicable); - odour control plan; and - occupational health and safety plan.	8.0
Remediation schedule.	8.4
Hours of operation.	8.5
Contingency plans to respond to site incidents, to obviate potential effects on surrounding environment and community.	8.7
Names and phone numbers of appropriate personnel to contact during remediation.	8.8
Community relations plans, where applicable.	n/a
Staged progress reporting, where appropriate.	n/a
Long-term site management plan.	8.9

1.5 Limitations

The findings of this report are based on the objectives and scope of work outlined above. Cavvanba performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental assessment profession. No warranties or guarantees, express or implied, are made. Subject to the scope of work, Cavvanba's assessment is limited strictly to identifying typical environmental conditions associated with the subject property, and does not include evaluation of any other issues. This report does not comment on any regulatory obligations based on the findings, for which a legal opinion should be sought. This report relates only to the objectives and scope of work stated, and does not relate to any other works undertaken for the Client.

The report and conclusions are based on the information obtained at the time of the assessment. Changes to the subsurface conditions may occur subsequent to the investigation described herein, through natural processes or through the intentional or accidental addition of contaminants, and these conditions may change with space and time.

The site history, and associated uses, areas of use, and potential contaminants, were determined based on the activities described in the scope of work. Additional site history information held by the Client, regulatory authorities, or in the public domain, which was not provided to Cavvanba or was not sourced by Cavvanba under the scope of work, may identify additional uses, areas of use and/or potential contaminants. The information sources referenced have been used to determine site history and desktop information regarding local subsurface conditions. While Cavvanba has used reasonable care to avoid reliance on data and information that is inaccurate or unsuitable, Cavvanba is not able to verify the accuracy or completeness of all information and data made available.

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. The absence of any identified hazardous or toxic materials on the subject property, should not be interpreted as a

warranty or guarantee that such materials do not exist on the site. If additional certainty is required, additional site history or desktop studies, or environmental sampling and analysis, should be commissioned.

The results of this assessment are based upon site inspection and fieldwork conducted by Cavvanba personnel and information provided by the Client. All conclusions regarding the property area are the professional opinions of the Cavvanba personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, Cavvanba assumes no responsibility or liability for errors in any data obtained from regulatory agencies, information from sources outside of Cavvanba, or developments resulting from situations outside the scope of this project.

2.0 Site Setting

2.1 Site identification

The site location and investigation boundary are shown on Figure 1.

Owner:	Health Infrastructure NSW.
Street address:	771 Cudgen Road, Cudgen NSW 2487.
Property description:	Lot 11 Deposited Plan (DP) 1246853.
Investigation area (part of Lot 11 DP1246853):	Approximately 750 m^2 (consisting of the area surrounding the residential house and garage).
Co-ordinates:	Latitude: -28.265041651 Longitude: 153.566689951.
Local government area:	Tweed Shire Council.
Elevation:	Approximately 27 m above AHD.
Landuse – existing:	Rural Residential/Agricultural.
Landuse – proposed:	Hospital.
Zoning – existing:	RU1 Primary Production.
Zoning – proposed:	SP2 Infrastructure (Hospital).

2.2 Surrounding Land Uses

The site is located in an area of mainly rural and recreational landuse, with the surrounding landuses identified as:

North:	Agricultural land use, followed by bushland.
East:	Cudgen Road followed by TAFE NSW Kingscliff.
West:	Agricultural land use.
South:	Cudgen Road followed by agricultural land use.

2.3 Surrounding environment

The site is situated at approximately 27 m AHD. Cudgen Creek is located approximately 500 m to the south-east of the site.

These environments are considered to be sensitive receptors, the aquatic ecosystem and dependent species would be potential environmental receptors. Recreational users of the creek would be potential human receptors, including both primary (e.g. swimming) and secondary (e.g. boating) contact.

2.4 Topography

The site is relatively flat with a slight slope falling toward the south-west.

2.5 Geology and soils

2.5.1 Geology

Based on NSW Environment & Heritage Soil and Land Information (eSPADE, accessed 13 December 2018), the site lies on Lamington Volcanics—Tertiary basalt, consisting of rhyolite, trachyte, tuff, agglomerate, conglomerate.

The landscape consists of very low to low undulating hills and rises on the Cudgen Plateau and nearby basalt caps. Elevation is 30−40 m on the Cudgen Plateau.

The vegetation in the area is cleared closed-forest (rainforest). Most of this landscape is cultivated, but the original vegetation would have been be similar to that of the Limpinwood (li) or Green Pigeon (gp) soil landscapes.

2.5.2 Soils

Based on NSW Environment & Heritage Soil and Land Information (eSPADE, accessed 10 January 2019) the soil profile in the area consists of deep (>100 cm), well-drained red silty clay (Krasnozems). This soil profile is consistent with the observations made during the investigation of the house and garage.

2.6 Previous environmental investigation

Cavvanba conducted a soil investigation at the site during November and December 2018:

- Cavvanba Consulting (2018), *Soil investigation report − Farm shed, 771 Cudgen Road, Cudgen, NSW* (Ref.: 18084 R03).

The potential sources of contamination were identified to be associated with lead paint, underneath the farm shed slab and areas where ACM fragments had been previously identified. These areas were targeted for potential contamination of asbestos, lead and/or OCPs.

2.6.1 Scope

The scope of work included:

- Review of a previous environmental investigation (OCTIEF, 2018).
- Completion of a comprehensive site walkover and visual inspection for key features to identify potential areas of environmental concern on- and off-site.
- Advancement of 21 soil test pits using a hand auger in a staged investigation.
- Collect and analyse samples for potential contaminants of concern, which will assist in the classification of any material required for offsite disposal.
- Inclusion of the results and findings into a report.

The analytical results were compared to residential land use with minimal opportunities for soil access land use for human health screening (HIL A), urban residential and public open space environmental screening (EIL), and site-specific asbestos criteria and have been provided in Section 2.5.3.

2.6.2 Sampling conducted

The assessment of asbestos impact was undertaken by targeted test pit locations positioned around the farm shed perimeter. A total of 21 test pits were advanced around

the perimeter and beneath the concrete slab which may represent potential sources of contamination. Cavvanba's expectation of contamination based on similar sites, is that asbestos fibres in soil are usually associated with nearby fragments of ACM from buildings.

Therefore, the sampling strategy included collection of samples at the following locations:
- within 1 m of the existing perimeter on each side of the farm shed;
- eight samples beneath the farm shed concrete slab; and
- samples at 0.1 m and 0.3 m at each location.

Initial sample analysis selection was based on a minimum:
- beneath farm shed concrete slab;
- within 1 m of building perimeter i.e. on each side of the farm shed; and
- samples at shallow depth (0.1 m).

Additional analysis was undertaken at greater depths (0.3 m) to delineate any criteria exceedances in the shallow samples. The sampling strategy completed was considered to meet the definition of a systematic approach and meets the minimum sampling requirements in accordance with *Sampling Design Guidelines* (NSW EPA, 1995). Additionally, consideration was given to the Tweed Shire Council for Pre-Demolition Testing of organochlorine pesticides beneath structures and dwellings.

Table 2.1 below describes the rationale for the chosen sampling design and additional delineation sampling/analysis.

Table 2.1: Overall sampling design and rationale

Location/sample ID	Rationale
First stage of analysis	
TP20_0.1 to TP27_0.1	Targeting sub slab of farm shed.
TP31_0.1 to TP43_0.1	Targeting any potential sources of lead paint and or asbestos fibres in soil located around the farm shed.
Delineation sampling/analysis	
TP32_0.3	Further sampling/analysis conducted at 0.3 below the ground surface; aiming to delineate the vertical extent of asbestos fibres.

2.6.3 Analytical results

The results are summarised in Table 2.2 on the following page. The analytical results have been compared to the screening criteria adopted for the site. The NEPM health investigation and screening levels for residential land use (HIL A) have been used along with the ecological investigation levels (EILs) for urban residential and public open space to ascertain the magnitude of impacts.

Table 2.2: Soil analytical summary

Analyte	Health criteria	Ecological criteria	Site data			
	HIL / HSL (mg/kg)	EIL/ESL (mg/kg)	No. samples analysed	Number of detects	Max' (mg/kg) Detected (Yes/No)	Meets screening criteria?
Metals						
Lead	300	1,100	13	13	44	Yes
Organochlorine pesticides						
DDT+DDE+DDD	240	180[1]	21	1	0.27	Yes
Aldrin and dieldrin	6	-[2]		7	1.18	Yes
Chlordane	50	-		0	<0.05	Yes
Endosulfan	270	-		1	0.89	Yes
Endrin	10	-		0	<0.05	Yes
Heptachlor	6	-		0	<0.05	Yes
HCB	10	-	21	0	<0.05	Yes
Methoxychlor	300	-		0	<0.2	Yes
Asbestos in soil						
Asbestos	Detect	-	14	2	Detect	No

Table notes:
1 * Criteria for DDT only.
2 – No criteria available.
3 – BOLD indicates exceedance of HILs/site-specific asbestos criteria.
4 – Underscore indicates exceedances of EILs criteria.

The results are summarised below:
- two samples (TP32_0.1 and TP33_0.1) had detections of asbestos fibres in soil which exceeds the site-specific asbestos criteria. No asbestos was detected in soil at TP32 at 0.3 m depth, suggesting the impact was limited to shallow depths;
- all sample concentrations of lead were below residential criteria; and
- while OCPs were detected at three sample locations, concentrations were below the adopted criteria. The maximum sum of OCPs is 1.25 mg/kg.

2.6.4 Discussion and recommendations

Following this soil investigation and the previous investigation (OCTIEF, 2018), asbestos contamination is believed 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 below the ground surface.

The nature of asbestos contamination is considered to be ACM in soil. Whilst is it recognised that asbestos fibres have been detected in laboratory analysed soil samples, the presence of fibres is expected to be the ACM, rather than a friable asbestos source such as pipe lagging or loose insulation. The condition of the ACM as observed by Cavvanba, did not appear to be highly weathered or pulverised. The detection of fibres in soil associated with ACM therefore does not represent an elevated risk of generating airborne fibres, and the material should otherwise be treated as bonded asbestos.

Investigation beyond the immediate perimeter hasn't been undertaken at TP32 due to presence of an access road. Determination of the extent in this area will be undertaken during the proposed remediation.

2.7 Recommendations

Based on the detection of asbestos fibres and observation of ACM in the soil around the former farm shed, remediation and/or management is required.

A remedial action plan for asbestos in soil should be prepared for the farm shed investigation area which should consider:

- off-site disposal; and/or
- on-site management/capping including long term management.

Based on the uneven distribution of visual observations of ACM fragments around the apron of the shed, a conservative approach should be adopted, and the ultimate extent of remediation should be based on field observations.

Validation samples will be collected following the completion of remediation.

2.8 Overarching RAP

OCTIEF was engaged by TSA management on behalf of NSW Health Infrastructure to compile a remediation action plan for Lot 11 DP 1246853 (the site) located at 771 Cudgen Road, Cudgen NSW:

– OCTIEF (2018) *Remediation action plan – Tweed Valley Hospital Site, 771 Cudgen Road, Cudgen NSW*. (Ref: J8961)

The OCTIEF RAP outlined remediation works which are considered Category 2. The scope included excavation and disposal of asbestos contaminated soil to the west of the farm shed. Given the remediation strategy is similar, this RAP supports the OCTIEF RAP.

3.0 Remediation criteria

The remediation area is to be made suitable for residential soil land use.

3.1 Asbestos in soil

It should be noted that the proposed use of the site is a public hospital. Cavvanba has therefore adopted site-specific investigation screening criteria. The screening criteria is a combination of no visual observations of ACM as well as non-detects of asbestos fibres in soil.

ASC NEPM 2013 states that the NEPM HILs are not protective of construction workers, and site specific risk should be taken into consideration: (Schedule B7: Guideline on health-based investigation levels – Section 3.1) *The HILs are therefore considered to be protective of exposures to other receptor populations; however, the HILs do not specifically address short-duration exposures that may occur during construction and maintenance of a site (including intrusive works). These exposures should be addressed on a site-specific basis.* Based on this, elimination of asbestos was seen as a more appropriate criteria for handing the site over from the demolition stage to the construction stage. This also takes into consideration the following points:

- the small area of asbestos present is likely to be limited and can be feasibly removed from the site;
- there are inherent and unavoidable uncertainties associated with the uneven distribution of ACM found on these types of sites, therefore a conservative approach has been adopted;
- there is a high level of public interest in this site, and eliminating asbestos issues for construction workers is considered appropriate, rather than to conveying risk to future workers by relying on criteria thresholds of asbestos concentrations in soil; and
- there are proposed construction works and the HILs for commercial/industrial landuse were not developed to be specifically protective of construction workers.

3.2 Waste

All soil material must be classified for disposal in accordance with the current NSW Environment Protection Authority (EPA) *Waste Classification Guidelines* (2014).

Off-site disposal may also consider interstate disposal to Queensland, with the appropriate approvals for contaminated soil and/or regulated wastes.

The soil data provided in the following report can be used for waste classification purposes in conjunction with additional sampling of soil to be disposed of off-site:

- Cavvanba Consulting (2018), *Soil Investigation Report – Farm shed, 771 Cudgen Road, NSW* (Ref.: 18084 R03).

The waste must be taken to a facility licenced to receive that waste.

3.3 Imported fill

Any soil imported to the site must be obtained from reputable suppliers and must comprise virgin excavated natural material (VENM).

Any material to be transported to another site is subject to the waste requirements of the POEO Act, i.e. the waste guidelines are relevant.

4.0 Extent of remediation required

4.1 Media

This remedial action plan is limited to soil only.

4.2 Potential contaminants of concern

Potential contaminants of concern associated with the site are limited to asbestos only.

The nature of asbestos contamination is considered to be ACM in soil. Whilst is it recognised that asbestos fibres have been detected in laboratory analysed soil samples, the presence of fibres is expected to be the ACM, rather than a friable asbestos source such as pipe lagging or loose insulation. The condition of the ACM as observed by Cavvanba, did not appear to be highly weathered or pulverised. The detection of fibres in soil associated with ACM therefore does not represent an elevated risk of generating airborne fibres, and the material should otherwise be treated as bonded asbestos.

4.3 Lateral and vertical extent

Delineation of ACM in soil has not been completely achieved for the farm shed and has been based on observations made in the field, soil analytical results, and conservative assumptions based on proximity to the building and a typical uneven distribution of ACM. Investigation beyond the immediate perimeter was not undertaken beyond TP32 due to presence of an access road.

Determination of the extent in this area will be undertaken during the proposed remediation. The ultimate extent of remediation will be established based on field observations of the presence of ACM fragments during the proposed remediation. Where undisturbed natural soil is encountered, this will be considered unlikely to be impacted with ACM, and represent the preliminary extent of excavations prior to validation.

5.0 Regulatory requirements

Regulatory aspects relating to the remediation of this site are summarised below.

5.1 SEPP 55

The planning approach to the remediation of contaminated land is legislated in *State Environmental Planning Policy No 55—Remediation of Land* which requires certain considerations of when consent is required to undertake remediation works. The SEPP classifies remediation as either:

- Category 1 − remediation work for which development consent is required; or
- Category 2 − remediation work not requiring development consent.

Whilst Category 2 remediation may not require consent, all relevant conditions described in the SEPP must be considered, and notice must be given to the consent authority and local council 30 days prior to the commencement of the work. It is understood that Tweed Shire Council was notified of remedial works on 5 December 2018.

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. This report is provided to meet the requirements of SEPP 55 and Department of Planning and Urban Affairs (1998) *Planning Guidelines SEPP 55 − Remediation of Land*.

5.2 Environmentally Hazardous Chemicals act 1985

The Environmentally Hazardous Chemicals Act (1985) has been taken into consideration and is relevant to the remedial phase of the project. Section 4.14 in the order describes scheduled chemical wastes:

> *scheduled chemical wastes means any liquid or solid waste that contains one or more of the chemicals listed in Schedule A to this chemical control order where the total concentration of those chemicals is more than two milligrams per kilogram.*

The impacted soil is not considered to be a scheduled chemical waste as maximum reported concentrations of OCPs were 1.25 mg/kg, which is less than 2 mg/kg.

5.3 POEO Act 1997

The requirements of the *Protection of the Environment Operations (POEO) Act* 1997, and associated schedules and regulations, are relevant to the remedial phase of the project. The objectives of the Act include to protect, restore and enhance the quality of the environment in New South Wales, having regard to the need to maintain ecologically sustainable development.

The Act includes requirements not to pollute waters, to prevent or minimise air pollution, to maintain and operate plant in a proper and efficient condition/manner and to deal with materials in a proper and efficient manner to minimise noise impacts, and to minimise and manage wastes. The Act also requires notification to the EPA when a pollution incident occurs that causes or threatens material harm to the environment.

The POEO Act is relevant for disposal of wastes, importation of backfill materials, and excavation validation and reporting.

5.4 CLM Act

The Contaminated Land Management (CLM) Act 1997 enables the EPA to respond to contamination that is significant enough to warrant regulation to protect humans or the environment. The *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (June 2009) outline a decision-making process for reporting contamination to the EPA.

5.5 Environmental Planning & Assessment (EP&A) Act 1979

The Environmental Planning & Assessment (EP&A) Act enables the consent authority to consider the suitability of the site for the development, which includes whether the site is contaminated.

The site is mapped as having no known occurrence of acid sulphate soils (ASS). Based on this, a preliminary acid sulphate investigation is not considered necessary.

6.0 Remedial actions

6.1 Remediation goal

The remediation goal for the site is to:
- render the site suitable for the intended land use (for conservative purposes, residential with garden/accessible soils;
- 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.

6.2 Remedial options

NEPM, 2013 outlines a remediation hierarchy in the Assessment of Site Contamination Policy Framework (Attachment A, page 8 and 9).

> *(16) Attainment of environmental outcome*
>
> *In general, to achieve the desired environmental outcome, the process of the assessment of site contamination should be placed within the context of the broader site assessment and management process. In particular, in assessing the contamination, the site assessor and others should take into account the preferred hierarchy of options for site clean-up and/or management which is outlined as follows:*
>
> - *on-site treatment of the contamination so that it is destroyed, or the associated risk is reduced to an acceptable level; and*
> - *off-site treatment of excavated soil, so that the contamination is destroyed or the associated risk is reduced to an acceptable level, after which soil is returned to the site; or*
>
> *If the above are not practicable,*
> - *consolidation and isolation of the soil on site by containment with a properly designed barrier; and*
> - *removal of contaminated material to an approved site or facility, followed, where necessary, by replacement with appropriate material;*
>
> *or,*
> - *Where the assessment indicates remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy.*

In assessing the remedial options available for the site, the following have been considered:
- the types and form of the contaminants present;
- the land use proposed for the remediation area;
- available proven remediation methods/technologies; and
- regulatory requirements.

Based on this, a range of remedial options has been considered, comprising:
1. no action;
2. treatment of the impacted material;
3. removal and offsite disposal of the impacted material.

A brief review of the remedial options is summarised on the following page.

6.2.1 No action

Contamination has been detected at the site which requires remediation and/or management and as the site is to be redeveloped, the 'no action' option is not considered to be appropriate.

6.2.2 Stabilisation/treatment

Stabilisation generally requires the excavation and either on-site or off-site treatment and/or disposal, and is essentially a remediation technology that reduces the mobility of contaminants, either by chemically altering or binding it (USEPA 1994). It is most applicable to inorganic (metal) contamination.

Immobilisation requires additional investigation, testing and verification, and at this stage is not considered appropriate.

6.2.3 Removal

Removal of contaminants involves physically digging up the contaminated material and off-site disposal of these materials. Contaminants can be effectively 'chased-out' based on the investigation results and current understanding. It is relatively time efficient and low-tech, however the removal requires some form of reinstatement and disruption, and can be costly for large volumes requiring off-site disposal.

Removal of ACM fragments by handpicking is not considered to be appropriate due to the detection of associated asbestos fibres in soil.

Delineation of ACM in soil has not been achieved for the farm shed. Investigation beyond the immediate perimeter hasn't been undertaken at TP32 due to presence of an access road. The lateral and vertical extent has however been estimated based on the laboratory results, field observations of ACM and typically irregular distribution of ACM. Approximately 100 m^3 of soil required disposal off-site, depending on the level of certainty required. Considering the detections of asbestos and the volume of waste present, removal is considered appropriate.

A remedial plan for removal has been provided as Figure 2. As a conservative measure, the strategy is to excavate and remove 0.3 m of soil across the entire remediation area.

6.2.4 Capping and containment

Capping

This primarily involves isolating the contaminated area with barriers and covering it so that it cannot be disturbed during normal site activities associated with the proposed landuse. The contamination therefore cannot generate dust, or come into contact with site occupiers. This option is generally applicable where the contamination is buried at depth, or will be buried at depth, where a layer of clean fill covers the impacted area. Capping also minimises disturbance, and infiltration of surface waters, therefore minimising the potential for migration of contaminants.

This option requires the placement of a geo-textile marker layer or similar to avoid disturbance, and requires ongoing management and notification on the Section 10.7 certificate.

The long term management also requires that its implementation is legally enforceable, and requires all stakeholders to agree. Given the relatively small volume of waste, and available resources for removal, this option is not considered to be appropriate.

In-situ

Containment technologies include both surface capping to impede direct contact (USEPA 1994), and construction of purpose built cells. ANZECC (1999) outlines design requirements for onsite containment of contaminated soils, and includes contingencies for accumulation of vapours, potential for groundwater contamination, infiltration etc. The option of designing and constructing a cell onsite is not considered a feasible option, and would require ongoing management and notification on the Council 10.7 certificate.

Ex-situ

Ex-situ containment involves excavation and re-placement of the soil in a suitable place, which may include a specially designed cell offsite. This option, when compared to disposal to landfill is not economical.

6.3 Remedial strategy

The remedial strategy of off-site disposal is considered to meet the remedial requirements and be acceptable for the proposed development. The asbestos remediation area is outlined in Figure 2.

Table 6.1: Summary remedial and management strategy

Aspect	Specific remedial or management strategy
Asbestos in soil	An asbestos in soil management area has been outlined in Figure 2 and is to be excavated and disposed of off-site.
Off-site disposal	Off-site disposal of soil is proposed. Asbestos has been detected in soil. A waste classification letter will need to be provided to the receiving landfill facility prior to disposal. Off-site disposal may include inter-juristictional transport and consignments. All necessary approvals and documented evidence of appropriate licences regarding disposal should be obtained prior to movement of asbestos contaminated soil.
Validation	Validation sampling for asbestos will be required, following the removal of impacted soil. This needs to be completed by a suitably qualified contaminated land environmental consultant. Further information is provided in Section 7.0.
Imported fill	If back filling is required, imported VENM may be required to bring the site back to grade, which will need to be evaluated in line with the guidance provided in Section 3.3.
Interim measures	Refer to Section 8.2.
Long term management	No long term management will be required, following the excavation and off-site disposal works.

6.3.1 Appropriateness of remedial strategy

For this site and scenario, the remedial strategy to excavate and remove up to 100 m^3 of asbestos contaminated soil is the most appropriate based on the following:

- the duration of remedial works;
- the volume of soil required for off-site disposal;
- minimal disturbance of the property; and
- long-term management or notification is considered unnecessary.

6.4 Remediation contingency

Remediation contingencies are limited to further excavation and disposal being required if the initial validation results have detections of asbestos.

7.0 Remediation validation and monitoring

7.1 Validation works

A validation report must be prepared following the works which is in accordance with:
- EPA (1995) *Contaminated Sites - Sampling Design Guidelines*;
- NSW OEH (2011) *Guidelines for consultants reporting on contaminated sites;*
- Western Australia Department of Health (WA DOH) (2009) *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*.

Validation sampling will be undertaken in accordance with WA DOH, and a quantitative assessment of asbestos in soil conducted. Based on an excavation area of approximately 200 m^2 the following will be required:
- 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;
- 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).

The report will provide a clear conclusion stating whether or not the RAP has been satisfied and a conclusion regarding the site suitability for its existing or proposed future use.

7.2 Imported fill

VENM is described in the waste guidelines as natural material (e.g. clay, gravel, sand, soil or rock fines):

- *that has been excavated or quarried from areas that are not contaminated with manufactured chemicals or process residues, as a result of industrial, commercial, mining or agricultural activities; and*
- *that does not contain sulphidic ores or soils, and includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved for the time by a notice published in the NSW Government Gazette.*

Any material to be transported to another site is subject to the waste requirements of the POEO Act, i.e. the waste guidelines are relevant.

To validate imported fill, one sample per 25 m^3 will be collected and analysed for potential contaminants of concern (PCOCs) as per NSW EPA *Technical Note: Investigation of Service Station Sites* (2014), namely metals (arsenic, cadmium, chromium, copper, lead, mercury and zinc), TRH, BTEXN, organochloride pesticides (OCPs) and polychlorinated biphenyls (PCBs). Visual observation for asbestos must also be conducted.

8.0 Site Management Plan

Specific controls and strategies for environmental protection during remediation forms part of the requirements of the RAP.

8.1 Hazard identification and exposure pathways

8.1.1 Hazards

Based on the site assessment, the hazards which require management are:
- soil potentially contaminated with asbestos; and
- standard construction site hazards.

8.1.2 Exposure

Exposure pathways are limited to inhalation of asbestos fibres.

8.2 Interim (before remediation)

The site is currently fenced, and Tweed Coast Demolition & Excavations Pty Ltd have put the following control measures in place in order to reduce the risk and or exposure to human health:
- geofabric material was placed over the topsoil contaminated with ACM fragments; and
- ~ 200 mm of clean gravel was placed over top of the geofabric material.

It is expected that the remediation works will be undertaken imminently, however in the circumstance that remediation is delayed, the surrounding fence and geofabric material should be maintained in order to sustain the appropriate control measures for asbestos.

8.3 Site management (remediation phase)

The remedial program should be undertaken with due regard to legislative requirements and any relevant environment planning instruments that apply to the site described in the above sections.

In particular, in addition to any statutory compliance required by the above-mentioned Acts and planning instruments, the contractor shall carry out the site works with all due care, 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:

1. Maintain erosion and sediment controls to prevent offsite migration of impacted soils.

2. 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 surfacewater), cover work areas if required, or stop work if wind sufficient to generate dust.

3. During excavation works, use methods which minimise manual handling of soils.

4. Minimise the movement of soil via personnel and machinery tracking soil out of the asbestos in soil remediation area.

5. 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.

6. Given ingestion is a primary exposure pathway, all workers must wash their hands and faces before eating.

8.4 Remediation schedule

The remediation schedule is yet to be defined.

8.5 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.

8.6 Unexpected finds

As for all sites, a potential exists that wastes or contaminated soils exist through undetected hotspots or uncontrolled dumping. During the site works, all materials should be assessed for potential contamination. Indications of contamination include, but are not limited to, soils, fills or wastes which exhibit:
- staining or discolouration; and/or
- odours; and/or
- waste materials such as ash or slag; and/or
- construction or demolition wastes (brick, concrete, tile, timber, steel, carpet, etc.); and/or
- asbestos cement sheeting or pipe pieces or fragments; and/or
- bottles, chemical containers, broken glass, plastic, etc.; and/or
- white goods, garbage, etc.

An unexpected finding protocol (UFP) for the site works includes, the following:
- 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.

The UFP should be integrated with the site-specific emergency response plan. If the unexpected findings present an immediate hazard, then the emergency response plan should take precedence over the UFP

8.7 Contingency plans

The purpose of the contingency plan is to identify unexpected situations that could occur during the remediation works, and specify procedures that can be implemented to manage such situations and prevent adverse impacts to the environment and human health, and manage unexpected situations.

Contingency plans for the remedial works include:

- If initial validation works do not remove all sufficient contamination, further excavation and off-site disposal may be required to meet site criteria.

- Dust emissions are to be confined within the site boundary. The following dust control procedures may be employed to comply with this requirement:
  - minimisation of work areas;
  - erection of dust screens around the perimeter of the site or dust generating activities;
  - use of water sprays across the site to suppress dust (but not to generate runoff);
  - covering of all stockpiles of soil or other materials likely to generate dust or odours; and
  - changing or modifying work practices based on climatic conditions.

8.8 Contact details

The following contact details are to be provided:

Contact	Name	Details
The Tweed Hospital, Powell St & Florence Street, Tweed Heads NSW 2485	Nearest Medical Assistance	(07) 5536 1133
Emergency	-	000
Client	Tony Jackman Woollam Constructions Pty Ltd	0408 464 648
EPA	Pollution Hotline	(02) 9995 5000
Cavvanba Consulting Pty Ltd 1/66 Centennial Circuit, Byron Bay NSW 2481 ABN: 37 929 679 095	Ben Wackett Ross Nicolson Rob McLelland	0428 606 064 0488 225 692 02 6685 7811
Cavvanba Field Scientist	Glen Chisnall	0499 401 092

8.9 Long term management plan

A long-term management plan is not considered likely to be required following remediation works.

9.0 References

Consultant reports

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NEPC (1999) *National Environment Protection (Assessment of Site Contamination) Measure, Schedule A and Schedules B(1)-B(10), amended April 2013*. National Environment Protection Council, Adelaide.

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NSW Agricultural/CMPS&F (1996) *Guidelines for the Assessment and Clean Up of Cattle Tick Dip Sites for Residential Purposes*. NSW Agricultural and CMPS&F Environmental, Canberra.

Figures

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

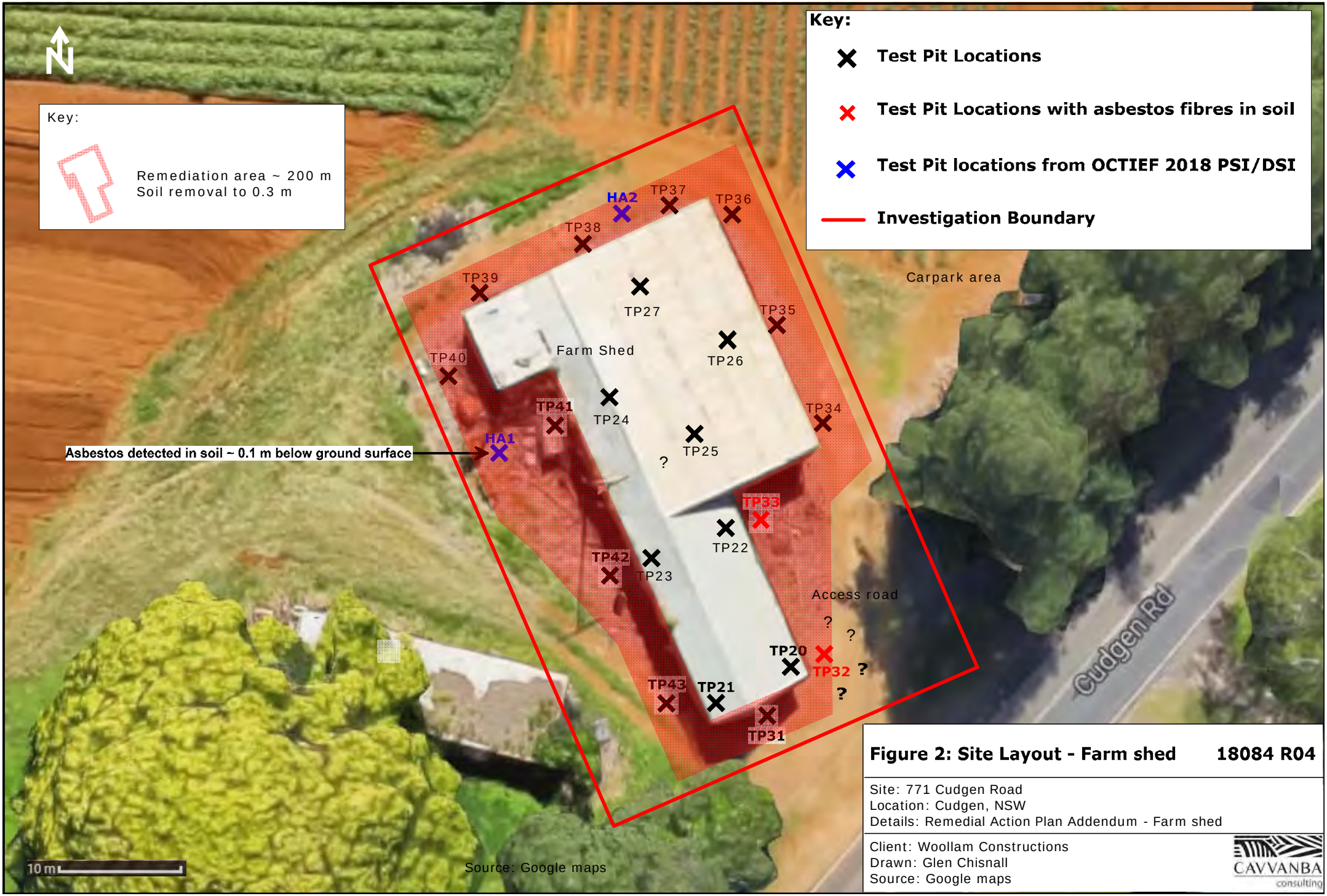

Figure 2: Site Layout - Farm shed **18084 R04**

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

Tables

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