PRELIMINARY AND DETAILED SITE INVESTIGATION – 771 Cudgen Road, Cudgen, NSW 2487.

PART 1 of 3

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

Date: 17 October 2018

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DOCUMENT CONTROL RECORD

OCTIEF Pty Ltd		Job No:	J8961
Telephone:	1800 628 433	File reference:	J8961
		Date of Issue:	17 October 2018
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Report Details:

Title:	Preliminary and Detailed Site Investigation – 771 Cudgen Road, Cudgen, NSW 2487
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Status:	Final
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Client:	TSA Management
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Revision History:

Issue No	Date	Issued by	Checked by	Distributed to	No. of Copies
Draft v1.0	17 August 2018	Matthew Conroy	Michelle Oliver	Sue Folliot	1 electronic
v2.0	6 September 2018	Matthew Conroy	Michelle Oliver	Sue Folliot	1 electronic
v3.0	2 October 2018	Matthew Conroy	Michelle Oliver	Sue Folliot	1 electronic
Final v4.0	17 October 2018	Matthew Conroy	Michelle Oliver	Sue Folliot	1 electronic

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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.

EXECUTIVE SUMMARY

OCTIEF was engaged by Health Infrastructure NSW to conduct a combined Preliminary Site Investigation (PSI) and Detailed Site Investigation of the property at 771 Cudgen Road, Cudgen, NSW Site Assessment (ESA) (Lot 102/DP870722), being the Project Site for the new Tweed Valley Hospital.

The objectives of the PSI and DSI were to:

- identify potential sources of contamination and determine potential contaminants of concern;
- identify areas of potential contamination;
- provide Health Infrastructure with high level confidence that site contamination characteristics are sufficiently understood to allow (if required) remedial planning and implementation;
- Provide sufficient confidence and reliance that there will be no foreseeable contamination issues which may affect redevelopment or suitability for the State Significant Development Application (concept proposal and stage 1 works).

As part of its engagement OCTIEF conducted a review of previous desktop assessments completed for the site, undertook a preliminary site inspection, prepared a sampling, analytical and quality plan (SAQP) and performed a field investigation that included the collection and analysis of soil, groundwater and surface water samples from locations across the site that would aid in establishing the contamination status of the site.

A summary of information gathered during the desktop investigation and initial site inspection is summarised below:

- Property owners indicated that they had owned the site since 2010, and site had been used for small scale farming of predominantly sweet potatoes during that time. No stock animals have been on site during the time of current ownership.
- Property owners indicated there was no record available of historical chemical/fertilizer use onsite.
- A small farm dump was located on the edge of the vegetated area in the northwest corner of the site. A visual inspection of the dump identified only inert building materials such as fencing posts, and paving bricks, however due to extensive coverage by vegetation the full extent of the dump could not be clearly determined.
- No ground staining to suggest potential soil contamination was identified onsite.
- Asbestos guttering in poor condition was noted along the western side of the site shed, with isolated fragments of ACM (Asbestos containing material) noted adjacent to the northwest corner of the shed.
- Chemical storage onsite was limited to 10L and 20L containers of pesticides/herbicides (Dimethoate, Serenade Prime and Banjo) and motor oil and bags of fertiliser.

- Above ground diesel storage tank (approx. 1000L) was noted adjacent to farm shed, tank appeared in reasonable condition.
- A farm dam was identified on the edge of the vegetated area in the northern portion of the site, it was noted that the pump associated with the storage dam was connected to mains power.
- A paddock of custard apple trees was identified in the north east corner of the property.

6 composite samples and one surface sample were collected during the initial preliminary site inspection and a total of 55 primary soil samples, and 6 QC samples (3 duplicate and 3 triplicate) were analysed from 50 sample locations completed across the site from 1st August 2018 to 3rd August 2018. Samples were selectively analysed for the Chemicals of Potential Concern (COPC) identified (Total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene, xylene (BTEX), Polycyclic Aromatic Hydrocarbons (PAHs), heavy metals, volatile organic compounds (VOCs), asbestos and organochlorine/organophosphorous (OC/OP) pesticides). A summary of analytical results is presented below:

- Asbestos Fibres (AF) and Fibrous Asbestos (FA) was detected at concentrations exceeding the residential guideline levels in sample HA1-0.1 collected from adjacent to the western side of the shed onsite.
- No heavy metals (Arsenic, Chromium, cadmium, copper, nickel, zinc, lead or mercury) were detected in any of the soil samples at concentrations exceeding the nominated health based investigation levels.
- Sample HA4-0.15 reported zinc concentrations exceeding the ecological investigation levels for residential land use and ecologically sensitive areas.
- Sample HA2-0.15 reported zinc concentrations exceeding the ecological investigation levels for ecologically sensitive areas.
- Composite sample HA17 reported zinc concentrations exceeding the adjusted ecological investigation levels (EILs) for ecologically sensitive areas.
- Analysis for zinc of the individual discrete samples used for the HA17 composite (HA17-1, HA17-2, HA17-3 and HA17-4) did not report any concentrations of zinc above the EIL guidelines.
- No heavy metals were detected in any of the other soil samples analysed at concentrations exceeding the Ecological investigation levels for residential land use.
- No TRH, BTEX or VOC compounds were detected in the soil samples submitted for analysis.
- None of the soil samples analysed reported OC or OP pesticide concentrations in excess of the nominated human health or ecological guideline levels.

As part of the investigation a groundwater sample was collected from the groundwater well installed as part of the geotechnical investigation at the site and water and sediment samples were collected form the onsite surface water storage dam.

- Copper concentration in the groundwater sample collected from groundwater well GW1 and surface water sample WS01 exceeded the Groundwater Investigation Level (GIL) for freshwater, and ANZAST, 2018 Freshwater 99% species protection Guidelines.
- Nickel in surface water sample WS01 exceeded the ANZAST 2018 Guidelines.

- Zinc concentrations in both the groundwater sample and two surface water samples from the storage dam onsite exceeded the freshwater GIL, and ANZAST. 2018 Guidelines.
- 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.

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Based on the scope of works carried out, the objectives outlined above and subject to the limitations set out in this report the following conclusions are made:

- No exceedances of relevant human health investigation levels for chemical contaminants were identified in the soil samples analysed. Exceedances of ecological assessment criteria are relatively minor and isolated, and the site is considered acceptable for use in the Project, from a chemical contamination perspective.

- ACM was identified in the area around the western side of the chemical storage/equipment shed, Soil results indicate Asbestos fines in the soil and the ACM identified on the surface was moderately degraded presenting a risk to human health if disturbed.

- Anthropogenic wastes were noted in a small farm dump in the north western corner of the site. Visual assessment and soil analytical testing indicate the material in this area is inert waste, however some portions of the dump could not be assessed during the PSI/DSI due to vegetation overgrowth.

- OCTIEF considers that the works undertaken at the site have sufficiently characterised the site to enable assessment as suitable for the SSD application subject to implementation of a Remediation Action Plan as recommended below.

Based on the investigations carried out and our current understanding of the Project, OCTIEF recommends that:

- A Remediation Action Plan (RAP) be developed for the area of asbestos impacted soil on the western side of the main site shed. The RAP should be prepared in accordance with SEPP 55 and relevant NSW guidelines and legislation and include appropriate protocols for removal and appropriate disposal of all remaining ACM associated with the main shed.

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ABBREVIATIONS

Abbreviation	Details
ACM	Asbestos Containing Material
AHD	Australian Height Datum
ANZECC	Australia and New Zealand Environment and Conservation Council
AST	Above ground storage tank
B(a)P	Benzo(a)pyrene
BGL	Below Ground Level
BTEX	Benzene, toluene, ethyl benzene and xylenes
COC	Chain of custody
CoPC	Chemical/Contaminant of Potential Concern
DQO	Data quality objectives
DQI	Data quality indicators
EIL	Ecological investigation level
EIS	Environmental Impact Statement
GIL	Groundwater investigation levels
HILs	Health-based soil investigation levels
HSLs	Health Screening Levels
LOR	Limit of reporting
mbgl	Metres below ground level
mg/kg	Milligrams per kilogram
mg/L	Milligrams per litre
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NSW EPA	New South Wales Environmental Protection Authority
NSW DEC	New South Wales Department of Environment and Conservation
NSW DECC	New South Wales Department of Environment and Climate Change
NSW OEH	New South Wales Office of Environment &Heritage
OH&S	Occupational health and safety
PAH	Polycyclic aromatic hydrocarbons
PID	Photo-ionisation detector
POEO	Protection of Environment Operations
QA/QC	Quality assurance/quality control
RAP	Remedial action plan
RPD	Relative percentage difference
SEPP	State Environmental Planning Policy
TEQ	Toxicity equivalent quotient
TPH	Total petroleum hydrocarbons
TRH	Total recoverable hydrocarbons
UCL	Upper confidence limit
VOC	Volatile organic compounds

1. INTRODUCTION

OCTIEF was engaged by NSW Health Infrastructure to conduct a combined Preliminary Site Investigation (PSI) and Detailed Site Investigation (DSI) of the property at 771 Cudgen Road, Cudgen, NSW (Lot 102/DP870722), being the Project Site for the new Tweed Valley Hospital.

1.1 OBJECTIVE

The objectives of the PSI and DSI were to:

- identify potential sources of contamination and determine potential contaminants of concern;
- identify areas of potential contamination;
- provide Health Infrastructure with high level confidence that site contamination characteristics are sufficiently understood to allow (if required) remedial planning and implementation;
- Provide sufficient confidence and reliance that there will be no foreseeable contamination issues which may affect redevelopment or suitability for the State Significant Development Application (concept proposal and stage 1 works) ;

1.2 SCOPE OF WORKS

The following scope of works was undertaken to achieve the stated objectives:

- Review of previous desktop investigations of site history to identify potential current and historical contaminating activities;
- Site inspection to validate results of the site history review and identify additional sources or evidence of potential contamination;
- Preparation of a Sample Analysis and Quality Plan (SAQP);
- Soil sampling program to assess Areas of Potential Environmental Concern (APECs) identified by the site history review and site inspection;
- Groundwater sampling of well installed as part of geotechnical site investigation works;
- Surface water and sediment sampling from the onsite storage dam;
- Submission of soil , water and sediment samples to a laboratory accredited by the National Association of Testing Authorities (NATA) for the proposed analysis of the Contaminates of Potential Concern (COPC) identified; and
- Preparation of a combined PSI and DSI report which includes the findings, conclusions and recommendations of the investigation.

1.3 TECHNICAL FRAMEWORK

The scope of works was completed in general accordance with the following technical framework:

- National Environment Protection Council (NEPC) 2013, *National Environment Protection*

(Assessment of Site Contamination) Measure (NEPM).

- NSW EPA 1997, Guidelines for Assessing Banana Plantation Sites.
- 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 OEH 2011. *Contaminated sites: Guidelines for Consultants Reporting on Contaminated sites*. New South Wales Office of Environment and Heritage, 2011.
- NSW Department Environment and Conservation 2005, Guidelines for Assessing former orchards and Market gardens;
- NSW State Environmental Planning Policy No. 55 – Remediation of Land;
- Standards Australia, 1999. AS4482.2 – 1999, Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil. Part 2: Volatile Substances;
- Standards Australia, 2005. AS4482.1 – 2005, Guide to the Sampling and Investigation of Potentially Contaminated Soil, Part 1, Non-Volatile and Semi-Volatile Compounds ; and
- Western Australia Department of Health, 2009, Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia

1.4 PROJECT OVERVIEW

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 Masterplan
- Tweed Valley Hospital Concept Proposal and design.

The 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:

- 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 (Project Application)

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

1.4.1 Concept Proposal and Stage 1 Early Works

This component (and EIS) seeks approval for a Concept Proposal of the Tweed Valley Hospital and Stage 1 early and enabling 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;

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.

Architectural plans for the Masterplan are attached at **Appendix D**.

1.4.2 Stage 2: Hospital Delivery - Main Works and Operation

Stage 2 (which will be subject to a separate application) 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.

1.4.3 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.

2. SITE DESCRIPTION

2.1 SITE IDENTIFICATION

The investigation area is located at 771 Cudgen Road, Cudgen, NSW 2487 (28º15'48"S, 153º34'02"E) and is described as Lot 102 /DP870722 as shown in **Figure 1, Appendix B.** The subject property lot covers an area of 23.23 Hectares (ha), with approximately 16 ha being used for agricultural production. The Project covering up to 65,000m^2 (6.5 ha) within the southern portion of the property (as shown in the design plan in Appendix D).

At the time of the investigation the site was unfenced, and no evidence of soil erosion was noted during the initial site inspection. The residential premises on the property was noted to be in good condition, while some evidence of general weathering /degradation (damaged guttering and corrosion of galvanised sheeting) was noted on the main and vehicle sheds (located approximately 50m North East of the residential premises).

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. Results of the searches are included in Appendix E.

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.

Approximately 1.75ha of the Site is zoned R1 General Residential but is currently undeveloped. This is split between a small sliver of land fronting Turnock Street on the eastern end of the agricultural area, and a larger undeveloped parcel of land in the north-eastern corner of the Site.

The remainder of the Site (approximately 5.4ha) is comprised of an area of mapped Coastal Wetlands under the Coastal Management State Environmental Planning Policy (CM SEPP) and is zoned Environmental Protection (Habitat) under the Tweed Local Environmental Plan (LEP) 2000, as it is a Deferred Matter in the Tweed LEP 2014. It is noted that a portion of the site requires re-zoning for the Project and a portion is proposed to become SP2-Infrastructure.

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:

- Residential house on the southern site boundary with access from Cudgen Road;
- Chemical storage / equipment shed on the southern property boundary to the east of the residential house,
- Cultivated paddocks covering approximately 16ha; and
- Undeveloped wetland in the northern/northwestern portion of the site;

Significant features are shown on **Figure 2, Appendix B**.

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; and
- West – Farmland and dense forest.

Surrounding land uses are shown on **Figure 2, Appendix B**.

3. ENVIRONMENTAL SETTING

3.1 CLIMATE

Being orientated on the coast, the temperature of Tweed Heads is moderated by off shore breezes during summer. On average, 51 days during the summer months are not interrupted by rain. The temperatures of Tweed Heads offer moderate year round climate, and a summary of temperature and rainfall data is shown in Table 3.1 below.

Table 3-1 Summary of Groundwater Database Bore Reports

Data	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg Daily Max (°C)	28.1	28.1	27.6	25.9	23.4	21.1	20.5	21.1	22.7	23.8	25.7	27.5
Avg Daily Min (°C)	21.8	21.7	20.7	18.5	15.5	12.6	11.6	12.1	14.5	16.6	18.8	20.8
Sum Rain Mean (mm)	194	266	262	159	147	127	87	68	55	116	117	142
Sum Rain Median (mm)	158	196	240	138	131	73	57	59	46	91	86	111
Sum Rain Days Mean	12	13	14	11	10	8	7	6	6	9	9	10

3.2 TOPOGRAPHY AND DRAINAGE

The site has a gradual slope leading towards the north side of the site. The NSW Six Maps indicates the cultivated area of the site has an elevation between 25m Australian Height Datum (AHD) to the south east and 8mAHD to the north. A copy of the topographic map is included in **Appendix E)**.

3.3 FLOOD INFORMATION

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 (Tweed maps, Section 14, 2018, included in Appendix E).

3.4 REGIONAL GEOLOGY AND SOILS

3.4.1 Regional Geology

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

3.4.2 Landscape and Soils

The Department of Land and water Conservation 1:100,000 Murwillumbah to Tweed Heads soil Landscape Series Sheet (9541 – 9561) defines the landscape of the surrounding area as a Residual Landscape of low undulating hills and rises on Tertiary Basalt plateau. The associated soils report of the Cudgen landscape define the soils as predominantly Krasnozems (red to brown, acid, strongly structured clay soils), with the Krasnozems of the Cudgen area described as red, self-mulching moderate plasticity clays with topsoil depths of 20 – 40cm and total soil depth of 1 -2m. A copy of the soil Landscape Series Map is included in Appendix E,

3.5 REGIONAL HYDROGEOLOGY

The Lamington Volcanics basalt is a fractured rock aquifer consisting of the Lamington Volcanics which overlies the rocks of the New England Fold Belt. Yields are moderate being up to 5 L/s however some bores may obtain yields of up to 10 l/s when associated with highly fractured areas (DPI Water, 2016).

Groundwater is typically recharged by infiltration of incident rainfall resulting in water with low concentrations of dissolved constituents.

A search of groundwater bores registered with the NSW Department of Primary Industries, Office of Water identified seven bores within a 500 m radius of the site's boundaries. Bore reports for bores provided by NSW Office of Water are provided in Appendix F and summarised in below Table 3-2.

Table 3-2 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

Registered No.	Date Registered	Standing Water Level (m BGL)	Aquifer geology	Distance from site	Use
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

The location of the registered bores are shown on a plan provided in Appendix F. The closest surface water bodies to the site are Wommin Bay approximately 1km to the north east of the site and Cudgen Creek, approximately 800m to the south east.

3.6 VEGETATION AND ENVIRONMENTAL VALUES

The following 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 – Coastal wetland;
- The northern part of the site is classified as Bushfire prone land with the middle of the site classed as a vegetation buffer;

A copy of the maps are provided in Appendix E.

3.7 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).

3.8 HERITAGE PLACES

A search of the NSW Office of Environment and Heritage (OEH), State Heritage map (www.environment.nsw.gov.au/heritageapp/heritagesearch.aspx) did not show any heritage sites within 500m of the site. A search of the Australian Heritage Database reported no listed heritage sites in Cudgen.

3.9 ACID SULFATE SOILS

The area is said to be located within an acid sulfate soil area (Tweed Heads Maps, 2018). Under Clause 7.1 of Council's Local Environment Plan 2014, development consent to undertake works is required on land shown as being Class 1, 2, 3, 4 or 5 on the Acid Sulfate Soil Planning Maps.

The majority of the site is listed as Class 5 which is defined as "Works within 500 metres of Class 1, 2, 3 or 4 land which are likely to lower the water table below 1 metre AHD in adjacent Class 1, 2, 3 or 4 land" . The northernmost point is listed as Class 2 - Works below the ground surface or Works by which the water table is likely to be lowered. The middle length of the site is listed as Class 3 - Works beyond 1 metre below the natural ground surface or Works by which the water table is likely to be lowered beyond 1 metre below the natural ground surface.

Based on the subsurface geology of the site and depth to groundwater in the area of the Project, a preliminary review of the site indicates the Project would not trigger the class 5 provisions and therefore an acid sulphate soil management plan or investigation is not considered to be required.

4. Site History

A review of the site history was undertaken to identify potential current and historical contaminating activities and comprised the following:

- Interviews with relevant staff/site owner;
- Review of historical environmental reports pertaining to the site;
- Review of historical aerial photographs;
- Review of historical title certificates;
- Review of publicly available local government records for the site;
- Review of information held by NSW State Library;
- Available local historical information; and
- Establishment of site settings based on a desktop review of publically available groundwater bore monitoring geology, hydrology, and hydrogeology information.

4.1 INTERVIEWS WITH SITE PERSONNEL

Anecdotal information was supplied by the site owner during the initial site inspection undertaken on 14 June 2018:

- Current owners purchased site in 2010;
- Predominantly used for sweet potato farming since purchase;
- Previous owner was historically growing sugar cane;
- No animals have been grazed on the property since the current owners have had the property.

4.2 CURRENT AND HISTORICAL TITLE SEARCH

A current and historical land title search was undertaken by OCTIEF. The results were provided to OCTIEF to identify historical site owners and associated potentially contaminating activities. Private individual owners of the site are generally considered to pose a low risk to potential land contamination. The certificates of title are included in **Appendix E**. Based on the title documentation, initial title for the land was issued in 1881 and 1889 to Henry Robert Gazala and William warner Julius, respectively. Title documents indicate that the land has remained privately owned and as of 2010, Duane John Joyce and Kerry Douglas Prichard have been joint tenants.

4.3 LOCAL COUNCIL RECORDS

Tweed Shire Council were contacted on regarding any relevant information about the subject property lot pertaining to hazardous chemicals notifications, and documented environmentally relevant activities. OCTIEF submitted a Contaminated Lands Search Request to council and received a response on 6 July stating that:

- A radial search by council revealed no known cattle dip sites within 200m of the subject property; and
- Data records reveal no known potentially contaminating activities on the subject site

Copies of documentation from the local council are provided in **Appendix E**.

4.4 NSW STATE LIBRARY SEARCH

An online search of the NSW State Library for records pertaining to the site was undertaken on 11 June 2018. Relevant information forthcoming from the search is summarised below:

- No relevant records regarding potential sources of land contamination were forthcoming from the search.

4.5 HISTORICAL AERIAL PHOTOGRAPH REVIEW

A review of available historical aerial photography was undertaken on OCTIEF. The aerial photographs were provided by (Tweed Shire Council and a review of the aerial photography from 1944, 1962, 1976, 1986 and 1995, was undertaken by OCTIEF along with a review of the google earth imagery from 2003. The purpose of the review was to gain an understanding of previous land uses both on site and on adjacent properties. The results of the aerial photography review are summarised in Table 4-1 and copies of the photographs are provided in **Appendix G**.

Table 4-1 Summary of Historical Aerial Photography Review

Date of Photograph	Site Specific Observation	Surrounding Land Observations
1944 – photo run 8 - no. 10647	The site is undeveloped, no structures or site clearing is visible.	The immediate surrounding area is also undeveloped, with no visible clearing or structures adjacent to the site, with the exception of Cudgen Rd running past the southern site boundary.
1962	The site has been cleared and is being utilised for agricultural use. The cleared area appears to match the current dimensions of the cropped area onsite. House and shed are visible on the site. No other structures can be identified.	Surrounding properties to the west and south have also been cleared and are being used for agricultural. The adjacent properties to the east are not visible due to the nature of the aerial photo.
1976	The site appears unchanged from the previous photo – cropping still visible in all cleared areas of the site.	Surrounding properties to the west and south appear unchanged and are still being used for agricultural. Residential development is visible to the east of the site.
1986	Some paddocks along western site boundary appear to no longer being actively cropped. Trees / plantation trees are visible on some of the paddocks on the northern side of the agricultural area onsite.	Surrounding properties to the west and south appear unchanged and are still being used for agricultural cropping. A temporary water storage dam is adjacent to the eastern site boundary.
1995	No evidence of active cropping is visible, some plantation trees still visible on the same paddock.	Surrounding properties to the west and south appear unchanged and are still being used for agricultural cropping. Further residential development is visible to the south east of the site.

Date of Photograph	Site Specific Observation	Surrounding Land Observations
2003, Google Earth.	Active cropping of the central paddocks onsite. Plantation trees on central northern paddock appear to have been removed	TAFE campus is now visible to the south east of the site.

Results of the historical aerial photograph review identified the following potentially contaminating activities:

- Ground disturbance on site and in neighbouring areas, associated with agricultural activities, has potential for soil contamination associated with poor pesticide storage and usage practices on the properties.

4.6 HISTORICAL ENVIRONMENTAL REPORTS

The search through the Tweed Shire Council provided no historical environmental reports for the site. A number of desktop investigations of the site 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 cleared part of site may have been subject to agrichemical applications. Generally broadacre agricultural land 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.

4.7 INITIAL SITE INSPECTION

A site inspection was undertaken on 14 June 2018 by a Suitably Qualified Environmental Scientist 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. A summary of information gathered during the initial site inspection and interview with site owners is summarised below and site photographs are provided in Appendix C.

- Property owners indicated that they had owned the site for approx. 30 years, and site had been used for small scale farming of predominantly sweet potatoes during that time. No stock animals have been on site during the time of current ownership.
- Property owners indicated there was no record available of historical chemical/fertilizer use onsite.
- A small farm dump was located on the edge of the vegetated area in the northwest corner of the site. A visual inspection of the dump identified only inert building materials such as fencing posts, and paving bricks, however due to extensive coverage by vegetation the full extent of the dump could not be clearly determined.
- No ground staining to suggest potential soil contamination was identified onsite.
- Asbestos guttering in poor condition was noted along the western side of the site shed, with isolated fragments of ACM (Asbestos containing material) noted adjacent to the northwest corner of the shed.
- Chemical storage onsite was limited to 10L and 20L containers of pesticides/herbicides (Dimethoate, Serenade Prime and Banjo) and motor oil and bags of fertiliser (photos in Appendix C).
- Above ground diesel storage tank (approx. 1000L) was noted adjacent to farm shed, tank appeared in reasonable condition.
- A farm dam was identified on the edge of the vegetated area in the northern portion of the site, it was noted that the pump associated with the storage dam runs on mains power.
- A paddock of custard apple trees was identified in the north east corner of the property.

4.8 SOIL SAMPLING

During the initial site inspection preliminary surface soil samples were collected by a suitably qualified environmental scientist from adjacent to the site shed and composite samples were collected from each of the main cultivated paddocks for analytical analysis. Soil sample locations are shown on **Figure 2, Appendix B**. The preliminary soil samples were submitted to a National Association of Testing Authorities (NATA) accredited laboratory for selected analysis of:

- Total Recoverable Hydrocarbons and BTEX compounds;
- Organochlorine and Organophosphorous pesticides; and
- Heavy metals (As, Cd, Cr, Cu, Ni, Pb, Zn and Hg) .

Analytical results were compared to the National Environment Protection Council (NEPM), 1999. National Environmental Protection (Assessment of Site Contamination) Measure (Amended 2013) health based and ecological guidelines for residential land use.

The surface soil sample collected from adjacent to the site shed reported zinc concentrations is excess of the nominated ecological investigation levels. No other samples analysed reported any concentrations of the chemicals of potential concern exceeding the nominated investigation levels. Tabulated analytical results for the initial surface samples are presented in Table 1 in Appendix A.

5. PRELIMINARY CONCEPTUAL SITE MODEL

Based upon the review of the desktop investigation and initial site inspection and soil sampling works, Octief developed an initial Conceptual Site Model (CSM). A summary of the CSM is presented below.

5.1 ELEMENTS OF A CONCEPTUAL SITE MODEL

The CSM identifies the potential sources of impact, contaminants of concern, transport mechanisms, exposure pathways and receptors. For a potential risk to be present at a site the following components are required:

- A source (e.g. primary sources leaking fuel tanks; secondary sources impacted soils/groundwater);
- A receptor (e.g. on-site worker, water body, environmentally sensitive area); and
- A transport mechanism between the source and receptor by which a contaminant might enter an organism (e.g. infiltration, vapour migration, groundwater migration).

If a source, a receptor and a transport mechanism are all present then a complete exposure pathway exists. The objective of the CSM is to identify any complete, incomplete and unknown exposure scenarios.

5.2 POTENTIAL SOURCES OF CONTAMINATION AND CONTAMINANTS OF CONCERN

The preliminary site investigation identified the following potential sources of contamination:

- 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;
- 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.

5.3 SENSITIVE RECEPTORS

Based on the results of the desktop assessment and potential risks associated with the identified contamination, the following potential receptors were identified:

- Site users;
- Future on-site maintenance/ construction workers; and
- Ecosystems of the wetland areas.

5.4 POTENTIAL TRANSPORT MECHANISMS AND EXPOSURE ROUTES

- Volatilisation and atmospheric dispersion from impacted soil;
- Dermal contact with impacted soils;
- Disturbance of asbestos impacted soils and fibre inhalation;
- Leaching from contaminated soils; and
- Surface water runoff .

6. Sample and Analysis Quality Plan

Following the completion of the Preliminary Site Investigation, OCTIEF prepared a Sampling Analysis and Quality Plan (SAQP) for a Detailed Site Investigation (DSI) at the site to assess the potentially complete exposure pathways identified during the PSI, further characterise the site in relation to suitability for the proposed rezoning and the Project, and identify any remediation /management requirements in relation to site contamination.

SAQP Proposed Sample Locations	SAQP Proposed Samples for analysis	SAQP Proposed Analysis	Sampling completed	Final sample Analysis	Rationale
Cultivated areas within Project footprint					
4 Samples per Hectare (Composite samples - 4 subsamples per composite)	28 plus QA/ QC	Heavy metals OC and OP Pesticides). Representative samples will be selected for pH and CEC analysis	26 hand Augers	Heavy Metals and , OC/OP Pesticides (26 primary samples plus QA/QC samples). pH and CEC (2 samples)	Proposed Hospital footprint up to 6.5 Ha at time of investigation, reduced total sample locations within footprint
Cultivated areas outside Project footprint					
2 Samples per Hectare (Composite samples - 4 subsamples per composite)	18 plus QA/QC	Heavy metals (As, Cd, Cr, Cu , Ni, Pb, Zn and Hg), OC and OP Pesticides	17 hand augers	Heavy Metals and OC/OP Pesticides (17 primary samples). pH and CEC (1 sample)	17 locations considered suitable based on site observations
Chemical storage shed					
4 Handaugers	8 plus QA/QC	Heavy metals (8) TRH, BTEXN, PAHs, OCPs, asbestos (4)	4 Handaugers	Heavy Metals – 5 samples TRH, BTEX – 3 samples PAH – 2 samples OC pesticides – 5 samples Asbestos – 3 samples pH and CEC - 2 sample	Assessment of potential soil impacts from storage and preparation of agricultural chemicals, fuels.

SAQP Proposed Sample Locations	SAQP Proposed Samples for analysis	SAQP Proposed Analysis	Sampling completed	Final sample Analysis	Rationale
Onsite Water Storage					
4 handaugers (dependant on access restrictions)	8 plus QA/QC	Heavy metals, OC and OP pesticides,	1 Handauger, 2 sediment samples, 2 Surface water samples	Heavy metals, OC and OP pesticides,	Restricted access to eastern and southern areas of dam. Surface water and sediment sampling undertaken for characterization
Farm Dump					
4 handaugers Proposed/ dependant on access restrictions	4 plus QA/QC	Heavy metals, TRH, BTEXN, PAHs, OCPs, asbestos	2 handaugers	Heavy metals, TRH, BTEXN, PAHs, OCPs	Sampling within farm dump and adjacent to north not feasible at time of sampling. Field observations indicated inert waste only, and no visual evidence of soil impacts noted – reduced analysis was deemed appropriate.

7. DATA QUALITY OBJECTIVES

Schedule B2 Appendix B of the NEPM (NPEC amended 2013) sets out the data quality objective (DQO) process and its purpose to ensure data collection activities are focussed on:

- Collecting appropriate information needed to make decisions; and
- Answering relevant questions leading up to such decisions.

The DQO process comprises seven steps, summarised 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.

Each step is disused in detail below with reference to addressing the data gaps discussed in Section 3.

7.1 STEP 1 – STATE THE PROBLEM

The identified and potential environmental and human health risks (on and off site) are not fully understood, as potential remains for 'hotspot' contamination to be present onsite in area of chemical storage, and broadacre contamination across cultivated areas. The buildings themselves contain hazardous materials and therefore the demolition process has the potential to impact the site.

7.2 STEP 2 – IDENTIFY THE DECISIONS

To resolve the problem stated in Section 7.1, the following decisions require consideration:

- Have all Potential Areas of Environmental Concern identified during the site inspection and historical investigations been adequately investigated?
- Have the chemical storage areas been adequately investigated?
- Have all potential exposure pathways been appropriately assessed?
- Do complete exposure pathways exist which are currently posing a risk to human health and the environment?
- Has a reasonable amount of soil sampling been undertaken to collect sufficient data in order to characterise the site?
- Is the data sufficient to compile a Remediation Action Plan?
- Are the conclusions and recommendations derived as a result of assessment work completed defendable?

7.3 STEP 3 – IDENTIFY INPUTS INTO THE DECISION

The inputs required to make the decisions listed in Section 7.2 are as follows:

- Targeted soil sampling in vicinity of the main site shed;
- Soil sampling program across the cultivated areas of the site
- Collection of groundwater samples from piezometers installed during geotechnical site works;
- Soil sampling data including: soil screening results, bore logs, tabulated concentrations of the COC compared against the adopted assessment criteria and a figure showing spatial distribution of the sample locations and exceedances;
- Updated CSM.

7.4 STEP 4 – DEFINE THE BOUNDARIES OF THE INVESTIGATION

The boundaries of the investigation include the subject property lot and the cleared areas of the property.

The temporal boundaries of the investigation are the proposed submission date of the EIS for the site.

7.5 STEP 5 – DEVELOP A DECISION RULE

The decision rules adopted for the decisions listed in Section 7.2 are as follows:

- If concentrations of the COPC are reported as >25% of the nominated investigation levels in composite samples collected, then sub-samples from each composite will be submitted for individual analysis.
- If concentrations of the COPC are reported above the adopted assessment criteria, then further assessment, management or remediation will be required;
- If the bounds (north, south east and west) of the soil contamination can be mapped without unknowns and all potentially impacted areas can be identified, then the contamination will be considered adequately delineated;
- If no data gaps are identified in the CSM then it will be considered that the potential exposure pathways have been adequately assessed and potential complete exposure pathways identified;

7.6 STEP 6 – SPECIFY LIMITS ON DECISION ERRORS

With respect to the decision rules presented in Section 7.5, decision errors would occur as a result of presenting concentrations of the COPC 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. Data quality is typically discussed in terms of precision, accuracy, representativeness, comparability and completeness. These are referred to as the PARCC parameters. The PARCC parameters and corresponding data quality indicators are provided in Table 7-1.

Table 7-1 Data Quality Indicators

Data quality indicator	Criteria
Precision	
Laboratory matrix duplicate relative percentage differences (RPDs) within criteria	Limits set by the laboratory: • Soil results <10 times the LOR: No Limit; • Soil results between 10-20 times the LOR: RPD must lie between 0-50%; • Soil results >20 times the LOR: RPD must lie between 0-30%.
Field duplicate RPDs within criteria	In accordance with AS4482.1 (2005), RPD results ≥50% will be considered to exceed the data quality objectives (DQO) of the assessment. However, based on industry best practice, RPD results will be discounted if both sample results used to calculate the RPD are below the laboratories limit of reporting (LOR) or less than 10 times the LOR.
Accuracy	
Matrix spike sample results reported with prescribed limits	Limits set by the laboratory: • Results to be between 70-130%.
Surrogate spike sample results reported with prescribed limits	Limits set by the laboratory: • Recoveries must lie between 50-150%.
Laboratory method blanks reported with prescribed limits	Concentrations of targeted parameters should be below the laboratory's limit of reporting (LOR).
All analysis NATA accredited	Analysis to be completed by a NATA accredited laboratory.
Representativeness	
Samples delivered to laboratory within sample holding times, chilled and with correct preservative	Target temp <4ºC. Samples to be submitted to the laboratory within the designated holding times. Different holding times exist for different parameters. Samples to meet the preservation requirements set by the laboratory.

Required number of field duplicates and sample blanks taken	Intra and inter laboratory duplicates are to be collected at a ratio of one duplicate pair per 20 samples. One rinse blank and field blank to be collected per day as required. One trip blank to be collected per cooler where analysis of volatile compounds is proposed .
Sample blanks reported results below detection limits	Concentrations of targeted parameters to be below the laboratory's limit of reporting (LOR).
Samples collected in accordance with regulatory and OCTIEF procedures	Samples to be collected in general accordance with OCTIEF's standard operating procedures (SOPs) which are based on applicable regulatory guidance and industry best practice.
Comparability	
Same standard operation procedures (SOPs) applied during each sampling event	The same SOPs to be adopted for each sampling event.
LORs below the adopted assessment criteria	The laboratory's LOR is to be below the adopted assessment criteria.
Qualified sampler	The sampler is to be a Suitably Qualified Person (SQP)
Same type of sample preservation and analysis techniques	The same type of sample preservation and analysis techniques are to be applied to all samples. This information is to be provided within laboratory reports.
Completeness	
All laboratory data reviewed and presented in the report (i.e. COCs, SRNs, COAs and QCRs)	All information provided by the laboratory is to be provided in the final report.
All sample results reported	All sample results are to be reported and discussed.
Sample blanks data reported	All sample blank data is to be reported.
Relative percent differences (RPDs) calculated	RPDs to be calculated for all sets of field duplicates.
Laboratory duplicates reported	All laboratory duplicate results are to be reported.
NATA stamp on reports	NATA stamps to be shown on all laboratory reports.

7.7 STEP 7 – OPTIMISE THE DESIGN FOR OBTAINING DATA

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

- Sampling to be undertaken by an appropriately experienced and qualified environmental scientist in accordance with OCTIEF's SOP which are based on relevant Australian Standards, guidance documents and industry best practice;
- Where sampling is to be undertaken for asbestos analysis, field works will be undertaken by a an appropriately experienced and qualified environmental scientist/licensed asbestos assessor in accordance with OCTIEFS's SOP; and

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

8. SAMPLING AND ANALYSIS PROGRAM

8.1 GENERAL

An OCTIEF Suitably Qualified Environmental Scientist was responsible for the completion of borehole logs, and collection of soil samples. Field works were conducted in general accordance with OCTIEF's procedures, which are based on applicable regulatory criteria and industry best practice.

8.2 SOIL SAMPLING – BOREHOLES

The aim of the soil sampling program will be to characterise soil chemical concentrations across the area of the Project and the current cultivated area of the site. The adopted soil sampling methodology is summarised in Table 8-1.

Table 8-1 Soil Sampling methodology

Task	Methodology
Soil sampling	Soil samples were collected in accordance with Australian Standards AS4482.1-2005 and AS4482.2-1999 and NEPM Guidelines (2013 revision).
Soil screening	Soil samples were field-screened for volatile organic compounds using a photo-ionisation detector (PID) that was calibrated daily to a known concentration of isobutylene calibration gas. A calibration certificate for the PID is provided. In Appendix J.
Soil logging	The soil lithology of each remedial excavation was logged in general accordance with Australian Standard 1726-1993.
Sample preservation	Soil samples were placed in laboratory supplied containers and stored in an iced cooler while on site and in transit to the laboratory. Samples were dispatched under standard chain-of-custody (CoC) documentation.
Decontamination procedures	Non-disposable sampling equipment (if used) was decontaminated using the triple washing technique. The triple washing technique is comprised of washing equipment with water, scrubbing with nitrate free detergent (Decon 90) and water, followed by a final rinse with demineralised water.
Field - Quality Control and Quality Assurance (QA/QC)	Field QA/QC included the collection of intra and inter laboratory duplicates, rinse blanks, field blanks and trip blanks. Laboratory duplicates were collected at a ratio of one duplicate pair per 20 samples and one trip blank per cooler. Rinse blanks were collected from sampling equipment that was being decontaminated and re-used. Field blanks were collected at a ratio of one field blank per day of sampling.
Sampling Locations and sample numbers	Sampling densities recommended in the NSW EPA Guidelines for assessing banana plantations and NSW Guidelines for Assessing Former Orchards and Market Gardens was considered appropriate for the cultivated areas of the site. For cultivated areas outside of the Project footprint, a reduced sampling density was considered appropriate to identify areas of broadacre contamination. Targeted sampling was undertaken in the vicinity of potential sources of contamination identified onsite. GPS locations of all soil samples was recorded at the time of sampling.

Task	Methodology
Excavation method and target depth	Samples across cultivated areas were collected using a hand auger, with a target depth of 0.15m, in accordance with NSW EPA guidance. Composite sampling was utilized in cultivated areas, with four separate samples collected in each location and composited in accordance with AS4482.2 . Samples targeting potential sources of contamination (chemical storage, farm dump) were collected using a hand auger, with final target depth of 1.0m. All samples collected from the targeted sample locations were collected as discrete samples to ensure suitability for analysis of volatile compounds.
Excavation abandonment	All hand augers were backfilled immediately following sampling.
Soil sample collection (non asbestos)	Soil samples were collected directly from the hand auger, or from the ground surface using nitrile gloves and placed in laboratory supplied jars. Care was taken to ensure there was no head space within the jars. Samples were collected in general accordance with Australian Standard AS 4482.1 – 2005 and AS 4482.2 – 1999. Soil samples (depending on location) were collected at the following depths: • surface (0-150 mm); • half a metre (400–600 mm); • one metre (900 – 1000mm) Composite samples from cultivated areas will be composited in accordance with Australian standards and NSW guidelines as outlined above.
Soil sample collection (asbestos)	Surface soil samples for asbestos analysis were collected from the vicinity of the main shed in accordance with methodologies described in the Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (WA DOH 2009) which inlcuded: • Collection of at least 10L of soil from each sampling location; • Non-cohesive soils: manually sieving the soil on-site through a 7mm sieve; • Collection of suspected ACM fragments which did not pass through the sieve/visually identified on the plastic; • Collection of at least 500 ml of wetted soil. Fragments of suspected ACM > 7 mm and soil were placed in laboratory supplied bags and given unique sample identification numbers. All sampling for asbestos analysis was undertaken by a appropriately experienced and qualified environmental scientist/licensed asbestos assessor

Task	Methodology
Analytical suite	Soil samples collected were selectively analysed for the following: • Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc). • Total recoverable hydrocarbons (TRH); • Volatile Organic Compounds • Polycyclic aromatic hydrocarbons (PAHs) • Organochlorine pesticides; • Organophosphorus pesticides; and • Asbestos Soil samples not selected for analysis were placed on hold with the laboratory.
Selected Laboratories	Primary soil samples and intra-laboratory duplicate soil samples were submitted to Eurofins Laboratory. Inter-laboratory duplicate samples were submitted to ALS Global Laboratories. Eurofins and ALS are accredited by the NATA for the proposed analytical tests. Primary asbestos samples and intra-laboratory duplicate asbestos samples were submitted to Octief Laboratory.

8.3 SOIL ASSESSMENT CRITERIA

To assess the potential human and environmental health risks posed by on-site soils, assessment criteria are required for the identified COPC. Selection of the appropriate assessment criteria is based on the current and future land use of the site, geology and identified potential receptors.

As the site is to be used for health services, as a conservative measure, health based guidelines for residential land use (sensitive receptors) have been adopted. In relation to environmental investigation levels, guidelines have been adopted in consideration of the Project, and the wetland area in the northern portion of the site, The adopted assessment criteria are summarised below.

- National Environment Protection Council (NEPM), 1999. National Environmental Protection (Assessment of Site Contamination) Measure (Amended 2013).
    - Health investigation Level A (HIL –A), residential with garden/accessible soil, also includes sensitive land use.
    - Health Screening Level A (HSL – A)- low to high density residential;
    - Ecological Investigation levels (EIL-A), urban, residential and public open space and areas of ecological significance.
    - Ecological screening levels (ESL –A), urban and residential and public open space; and areas of ecological significance.
    - Health Screening levels for Asbestos contamination in soil – Residential A.

The NEPM 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).

Composite samples will be initially assessed against adjusted site investigation levels in accordance with the procedure outlined in the relevant NSW EPA guidelines. The adopted assessment criteria values are shown in summary tables located at the end of this report. As composite samples were composited from 4 discrete samples, guideline values were divided by a factor of 4. For metals, to eliminate the potential for the adjusted guideline value to be below background concentrations, only the added contaminant limits (ACLs) were divided by 4.

Where applicable for metals, the site specific EIL's were calculated by adding an average background concentration (ABC) onsite to the ACLs outlined in Tables 1B(1) to 1B(3) of Schedule B1 (NEPM, 2013). ACLs have been determined utilizing pH, and Cation Exchange Capacity (CEC) from representative samples collected (Table 5 Appendix A). For the composite samples collected from the cultivated areas, the average CEC and pH from representative samples (HA8, HA20 and HA30 – Table 5 Appendix A were utilised). Based on site observations, for this investigation, the analytical results for hand auger HA5 were considered representative of average background concentrations (ABC) onsite.

An assessment of aesthetic issues will be undertaken as outlined in Schedule B(1) of the NEPM, which states that 'there are no specific numeric aesthetic guidelines, however site assessment requires balanced consideration of the quantity, type and distribution of foreign material or odours in relation to the specific land use and its sensitivity'.

General assessment considerations include:

- That chemically discoloured soils or large quantities of various types of inert refuse, particularly if unsightly, may cause ongoing concern to site users.
- The depth of the materials, including chemical residues, in relation to the final surface of the site.
- The need for, and practicality of, any long-term management of foreign material.

The NEPM notes that in some cases, documentation of the nature and distribution of the foreign material may be sufficient to address concerns relating to potential land use restrictions.

8.4 Groundwater Sampling Methodology

The aim of the groundwater sampling was to provide a preliminary characterisation of groundwater quality in the shallow weathered basalt groundwater bearing zone beneath the site. Groundwater sampling was not included in the initial SAQP, however was undertaken as part of this investigation due to concurrent geotechnical works undertaken at the site reported that groundwater had been intersected in one of the deep (approximately 17m) geotechnical borehole onsite.

- A 50mm class 18uPVC well was installed by the geotechnical driller to enable a groundwater sample to be undertaken.

Table 8-2 Groundwater Sampling Methodology

Task	Methodology
Groundwater monitoring well location	Groundwater monitoring well GW1 was associated with geotechnical assessment requirements and is located in the central portion of the site, within the Project footprint. The location of GW1 is shown on Figure 4.
Groundwater monitoring well development	Monitoring wells will be developed to remove drilling fines and aid in connectivity between the well and the surrounding aquifer. Well development included removing a minimum of five well volumes of water, until the turbidity of the water had decreased and physiochemical parameters had stabilised. Well development was undertaken using a dedicated bailer.
Groundwater sample collection	Monitoring well was purged and sampled in general accordance with Australian and New Zealand Standard 5667.11-1998. Due to the temporal constraints. The standard seven day period after development was waived, and the monitoring well was sampled the day after development. Prior to the collection of groundwater samples, the depth to standing water was gauged using an interface probe and the wells was purged. Due to the sampling timeframe, the monitoring well was purged twice (minimum of 5 x well volume each time) prior to the collection of a groundwater sample to ensure that water sampled was not water which had been sitting in the well for an extended period of time . The groundwater sample (and duplicate and triplicate samples) were collected using a dedicated disposal bailer and decanted into clean laboratory supplied containers.
Sample preservation	The groundwater sample (and associated duplicate and triplicate QC samples) were placed in laboratory supplied containers and stored in an iced cooler while on site and in transit to the laboratory. Samples were dispatched under standard chain-of-custody (CoC) documentation.
Decontamination procedures	Non disposable sampling equipment was decontaminated using the triple washing technique. The triple washing technique comprised washing equipment with water, scrubbing with nitrate free detergent (Decon 90) and water, followed by a final rinse with demineralised water provided by the laboratory.

Task	Methodology
Field – Quality Control and Quality Assurance (QA/QC)	Field QA/QC included the collection of intra and inter laboratory duplicates, trip blanks, field blanks and rinse blanks. Laboratory duplicates were collected at a ratio of one duplicate pair per 10 samples. Trip blanks were collected at a ratio of one trip blank per cooler. Rinse blanks were collected at a ratio of one sample per day of sampling. Field blanks were collected at the ratio of one field blank per day of sampling.
Selected Laboratories	Primary soil samples and intra-laboratory duplicate samples were submitted to Eurofins Laboratory. Inter-laboratory duplicate samples were submitted to ALS Laboratory. Eurofins and ALS are accredited by the NATA for the proposed analytical tests.

8.5 Surface Water Sampling

Samples were collected from the onsite storage dam utilised to capture surface water runoff, to characterise water quality. Two water samples were collected, and physiochemical parameters were also recorded using a YSI water quality meter (calibration certificate included in Appendix J . Surface water samples were collected in general accordance with Australian and New Zealand Standard 5667.6-1998 and the following methodology:

Table 8-3 Surface water sampling methodology

Task	Methodology
Number of sampling locations	The number of surface water sampling locations (two locations) was selected to obtain surface water samples from the vicinity of the extraction point and from the opposite end of the pond.
Surface water sample collection	Surface water samples were collected in accordance with Australian and New Zealand Standard 5667.6-1998. Samples were collected from a minimum of 0.3 m below the water's surface using a sampling pole and laboratory supplied containers.
Sample preservation	Surface water samples were placed in laboratory-supplied containers and stored in an iced cooler while on site and in transit to the laboratory. Samples were dispatched under standard chain-of-custody (CoC) documentation.
Analytical suite	Surface water samples were analysed for heavy metals (As, Cd, Cr, Cu, Pb, Ni, Zn and Hg), OC and OP pesticides, nitrogen and phosphorous. Two surface water samples from the onsite storage dam were submitted for laboratory analysis.

8.6 Groundwater and Surface Water Assessment Criteria

To assess groundwater and surface water conditions onsite, the samples collected were assessed against both human health and environmental guidelines. In accordance with the NEPM guidelines, site assessment criteria have been adopted in consideration of the risks from contaminated surface water and groundwater to potential receptors on and off site and potential effects on groundwater resources and receiving waters.

As the site is to be used for health services, as a conservative measure, health screening guidelines for residential land use (sensitive receptors) have been adopted. Registered groundwater bores within 100m of the site that are intersecting the same groundwater aquifer encountered during onsite are listed for domestic and irrigation use, and therefore groundwater results have also been compared against drinking water and irrigation guidelines.

Based on the presence of the wetland area in the north eastern portion of the site being considered an area of high ecological value, in accordance with the guidance provided in regards to implementation of the ANZG (2018) guidelines, 99% species protection default guideline values have been applied where they exist.

The adopted assessment criteria are summarised below.

- Australian and New Zealand guidelines for Fresh and Marine Water Quality (ANZAST, 2018)
    - Primary Industries - Irrigation
    - Freshwater 99% level of species Protection
- National Environment Protection Council (NEPM), 1999. National Environmental Protection (Assessment of Site Contamination) Measure (Amended 2013).
    - Groundwater Investigation Levels (Freshwater)
    - Groundwater Investigation Levels (Drinking water)

8.7 Sediment Sampling

Sediment samples were collected from the onsite storage dam utilised to capture surface water runoff. Two sediment samples were collected from the northern and southern sides of the dam. Surface sediment samples were collected in accordance with the following methodology:

Sediment Sampling methodology

Task	Methodology
Sediment sampling	Sediment samples were collected in accordance with Australian Standards AS4482.2-2005, the Handbook for Sediment Quality Assessment (CSIRO, 2005) and Collection and preservation of sediment (Qld Gov 2018)
Sample preservation	Soil samples were placed in laboratory supplied containers and stored in an iced cooler while on site and in transit to the laboratory. Samples were dispatched under standard chain-of-custody (CoC) documentation.
Decontamination procedures	Non-disposable sampling equipment was decontaminated using the triple washing technique. The triple washing technique is comprised of washing equipment with water, scrubbing with nitrate free detergent (Decon 90) and water, followed by a final rinse with demineralised water.
Selected Laboratories	Primary sediment samples were submitted to Eurofins Laboratory. Eurofins is accredited by the NATA for the proposed analytical tests.
Sample method and target depth	Samples were collected from the northern and southern sides of the storage dam using a stainless steel trowel and laboratory supplied sampling container, with a target depth of <0.10m.
Analytical suite	Sediment samples collected will be selectively analysed for the following: • Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc). • Organochlorine pesticides; • Organophosphorus pesticides; and • Nitrate

8.8 Sediment Assessment Criteria

Selection of the appropriate assessment criteria is based on the surrounding land use of the site, the adopted assessment criteria is summarised below. Guideline values have been applied in relation to the presence of the wetland area in the north eastern portion of the site being considered an area of high ecological value. It should be noted that while guidance advice (www.waterquality.gov.au/anz-guidelines/resources/key-concepts/level-of-protection) outlines no specific recommendation for high ecological value areas, it is recommended that the DGV's outlined in the 2018 Guidelines are utilised as protection levels for slightly to moderately disturbed ecosystems, and consequently the following guidelines have been adopted for this investigation: .

- Australian and New Zealand guidelines for Fresh and Marine Water Quality (ANZAST, 2018) – Default Sediment Quality Guidelines and High –Sediment Quality Guidelines.

9. QUALITY ASSURANCE / QUALITY CONTROL

The data validation process is used to assess the representativeness of analytical results and the effects of the sampling program on data quality. The quality assurance and quality control (QA/QC) methods adopted are based on requirements of Standards Australia, NEPM, and OCTIEF procedures.

Data quality is typically discussed in terms of precision, accuracy, representativeness, comparability and completeness. These are referred to as the PARCC parameters. The PARCC parameters are discussed in what follows as indicators of data quality. A summary of the conformance of the sampling program to the data quality objectives outlined in Section 7 are summarised in Table 9-1.

Table 9-1 Summary of QAQC Conformance

Data quality indicator	Within compliance	Comments
Precision		
Laboratory matrix duplicate relative percentage differences (RPDs) within criteria	No	Primary laboratory duplicate RPDs were within acceptable limits set by the laboratory, with the exception of Nickel for sample M18-AU09818 (31%).
Field duplicate RPDs within criteria	Yes	In accordance with AS4482.1 (2005), RPD results ≥50% were considered to exceed the data quality objectives (DQO) of the assessment. However, RPD results were discounted if both sample results used to calculate the RPD were below the laboratories limit of reporting (LOR) or less than 10 times the LOR. .
Accuracy		
Laboratory control spike sample recoveries reported with prescribed limits	Yes	Primary laboratory control spike sample concentrations were within laboratory's acceptable limits.
Matrix spike sample results reported with prescribed limits	Yes	Matrix spike sample concentrations were within the laboratory's acceptance limits
Surrogate spike sample results reported with prescribed limits	Yes	Primary laboratory surrogate spike recoveries were within the acceptable limits as set by the laboratory.
Laboratory method blanks reported with prescribed limits	Yes	Laboratory method blanks were reported within the prescribed limits as set by the laboratory.
All analyses NATA accredited	Yes	All analysis was undertaken by a NATA accredited laboratory.
Representativeness		
Samples delivered to laboratory within sample holding times, chilled and with correct preservative	Yes	All samples were delivered to the laboratory chilled and with the correct preservative, and all samples were extracted and analysed within the correct holding times.
Required number of field duplicates and sample blanks taken	Yes	The correct number of sample duplicates and sample blanks were collected and analysed.

Sample blanks reported results below detection limits	No	Rinsate samples from hand auger and groundwater bailer on 3/8/2018 reported dectectable concentrations of zinc. For hand auger rinsate, zinc concentration detected was 0.033mg/L, which is below the laboratory limit of reporting for soil samples (5mg/kg) and therefore not considered to affect the analytical results. For rinsate from the bailer, as the primary sample GW1 reported zinc concentration above the nominated investigation level, and no other groundwater samples were collected, analytical results are not considered to have been adversely affected. The other sample blanks analysed reported concentrations of all analytes below the laboratory's level of reporting (LOR).
Samples collected in accordance with regulatory and Octief procedures	Yes	Refer to the methodology section of this report.
Comparability		
Same standard operation procedures (SOPs) applied during each sampling event	Yes	The same sampling procedures were applied to each sampling event.
LORs below the adopted assessment criteria	Yes	Laboratory LORs were not reported above the adopted assessment criteria in all samples analysed.
Qualified sampler	Yes	Samples collected by an SQP.
Same type of sample preservation and analysis techniques	Yes	The same type of sample preservation and analysis technique was adopted.
Completeness		
All laboratory data reviewed and presented in this report (i.e. COCs, SRNs, COAs and QCRs)	Yes	All laboratory data represented in this report has been reviewed and provided.
All sample results reported	Yes	Refer to result summary tables at the end of this report.
All laboratory QA/QC data reviewed	Yes	Refer to result summary tables at the end of this report.
Relative percent differences (RPDs) calculated	Yes	Refer to result summary tables at the end of this report.
Samples analysed using NATA accredited methods	Yes	All laboratory analysis was undertaken by a laboratory accredited by NATA for the proposed analysis.

A review of the QA/QC results indicate the data quality objectives for this project have been satisfied to a level which is considered not to impact the conclusions of this investigation. Furthermore, it is considered that the data presented is suitable to meet the objectives of this report.

10. RESULTS

10.1 FIELD OBSERVATIONS

A summary of the soil profile encountered during field works in provided in Table 10-1. Borehole logs, for those hand augers which were continued to depths >0.15m are provided in Appendix H. Due to the presence of geotechnical drilling onsite during the sampling works (and the installation of a groundwater well as part of the geotechnical site works), the soil description outlined below incorporates a summary of site lithology from both environmental and geotechnical site investigations. A copy of the geotechnical bore log for the groundwater well is included in Appendix H.

Table 10-1 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 was 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.

10.1.1 Visual and Olfactory evidence of potential soil contamination

No fill material or hydrocarbon staining or odours were observed during handaugering for the environmental sampling. PID measurements ranged from 0.0 to 0.2 PPM which do not indicate the potential presence of volatile contaminants. Asbestos containing material (ACM) debris was noted on the soil surface around sampling location HA1, (refer photo in **Appendix C**) and a sample of the suspected ACM material was collected for analysis.

10.2 GROUNDWATER CONDITIONS

Groundwater was encountered in the geotechnical investigation borehole (BH1). On 3rd August, groundwater gauging and quality parameters (DO, EC, pH, redox, temp) were collected from the Geotechnical well installed. The location of the groundwater monitoring well in shown in **Figure 4, Appendix B**.

Table 10-2 Groundwater physical parameters

Borehole	D.O (mg/L)	E.C. (µs/cm)	pH	Eh(mv)	Temp(°C)	Volume purged (L)
GW1	5.27	178.0	6.03	-66.3	21.1	75

10.3 SURFACE WATER CONDITIONS

Water quality parameters (DO, EC, pH, redox, temp) were collected from the storage dam using a YSI quarto Plus water quality meter prior to the collection of the water samples. The location of the surface water samples are shown in Figure 4, Appendix B

Table 10-3 Storage Dam physical parameters

Location	D.O (mg/L)	pH	Eh(mv)	Temp(°C)
WS01	8.32	7.23	-137.2	21.6
WS02	7.23	7.22	-136.6	21.8

10.3.1 Visual and Olfactory evidence of potential water contamination

No visual or olfactory evidence of groundwater or surface water contamination was noted during sampling.

10.4 SOIL ANALYTICAL RESULTS

6 composite samples and one surface sample were collected during the initial preliminary site inspection, and a total of 55 primary soil samples, and 6 QC samples (3 duplicate and 3 triplicate) were analysed from 50 sample locations (composite sample locations targeted hand augers) completed across the site from 1 August to 3 August 2018 (Figure 3, Appendix B). Samples were selectively analysed for the COPC identified (TPH, BTEX, PAHs, heavy metals, volatile organic compounds, asbestos and OC/OP pesticides). Tabulated soil analytical results are presented in Tables 1-4 in Appendix A, and a copy of the certified laboratory results are included in Appendix I. A summary of soil analytical results is presented below:

- 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 shed onsite
- No heavy metals (As, Cr, Cd, Cu, Ni, Zn, Hg or Pb) were detected in any of the soil samples at concentrations exceeding the nominated health based investigation levels.
- The soil sample collected from next to the main shed as part of the initial site inspection (shed) and sample HA4-0.15 collected on 1 August 2018, reported zinc concentrations (1,600mg/kg and 530mg/kg), respectively, exceeding the ecological investigation levels for residential land use and ecologically sensitive areas.

- Soil sample HA2-0.15 collected from adjacent to the main shed reported zinc concentrations (270mg/kg), respectively, exceeding the ecological investigation levels for ecologically sensitive areas.
- Composite sample HA17 reported a zinc concentration (200mg/kg) exceeding the adjusted ecological investigation levels for ecologically sensitive areas, however analysis of the discrete samples HA17-1 to HA17-4 that comprised the composite reported zinc concentrations below the unadjusted ecological investigation levels for ecologically sensitive areas.
- No heavy metals were detected in any of the other soil samples analysed at concentrations exceeding the Ecological investigation levels for residential land use.
- No TRH, BTEX or VOC compounds were detected in any of the soil samples submitted for analysis;
- None of the soil samples analysed reported OC or OP pesticide concentrations in excess of the nominated human health or ecological guideline levels.

10.5 SEDIMENT ANALYTICAL RESULTS

Two sediment samples were collected from the southern and northern banks of the onsite storage dam. The results are tabulated in Table 6 in Appendix A, and laboratory results are presented in Appendix I.

- Copper and nickel concentrations exceed the low-sediment quality guidelines, but were below the high-SQG in sample SED1.
- No OC or OP pesticide compounds were detected in either sediment sample submitted for analysis.

10.6 GROUNDWATER AND SURFACE WATER ANALYTICAL RESULTS

A total of one groundwater (plus duplicate and triplicate sample) and two surface water samples were collected as part of the DSI works. The results are tabulated in Table 5 in Appendix A, and laboratory results are presented in Appendix I:

- Copper concentration in the groundwater sample collected from GW1 exceeded the GIL for freshwater and the ANZAST 2018 freshwater 99% species protection guidelines;
- Copper concentration in the surface water sample WS01 exceeded the ANZAST 2018 freshwater 99% species protection guidelines;
- Nickel concentration in the surface water sample WS01 exceeded the exceeded the GIL for freshwater and the ANZAST 2018 freshwater 99% species protection guidelines; and
- Zinc concentrations in both the groundwater sample and two surface water samples from the storage dam onsite exceeded the freshwater GIL and the ANZAST 2018 guidelines.

11. DISCUSSION

11.1 SOIL

Targeted soil sampling was undertaken in vicinity of the main site shed (HA1, HA2), vehicle shed (HA4), farm dump (HA6 and HA7) and dam pump house (HA5). Analytical results reported no concentrations above human health investigation levels, surface samples from the initial site inspection (shed sample 14/6 – 1600mg/kg) HA4-0.15 (530mg/kg) and HA2-0.15 reported concentrations of zinc above the ecological investigation levels. Weathered galvanised steel sheeting was noted on the main and vehicle sheds in the vicinity of these samples locations, and is considered a potential source of the elevated zinc concentrations.

HA17 was the only composite samples collected across the cultivated area on site, that reported concentrations above the nominated investigation levels with zinc (200mg/kg) exceeding the adjusted Ecological investigation level for areas of ecological significance. Additional analysis of each of the four discrete samples (HA17-1 to HA17-4) that comprised the composite sample HA17 was undertaken, and the discrete samples reported zinc concentrations below the ecological investigation levels.

11.2 ASBESTOS

Asbestos guttering on the western side of the chemical / equipment shed was noted to be in relatively poor condition, and other asbestos containing material (ACM) was observed on the western edge of the shed roof and small stockpiles containing ACM material were noted against the western wall of the shed. ACM fragments were also noted on the surface adjacent to the western side of the shed, and the material appeared somewhat degraded, and in this state poses a potential risk to human health if disturbed. The surface soil sample collected from this area (HA1-0-0.1m) reported concentrations of asbestos fines above the nominated investigation criteria.

No visible asbestos in surface soils should be present for residential and open space land use, and both the NEPM and workplace Health and Safety (WHS) regulations require removal of visible asbestos prior to any work activities that may disturb it. Any areas containing ACM require off-site disposal and would require appropriate classification in accordance with the Waste Classification Guidelines: Part 1 – Classifying waste (NSW EPA, 2014) prior to disposal off-site to an appropriately licenced facility.

11.3 WATER

The groundwater well installed onsite intersected a basalt aquifer with static groundwater level approximately 10.5m below ground surface (gauged during Geotechnical site works). 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 water samples collected from the storage dam onsite (WS01 and WS02) also reported zinc, nickel and copper (WS01) concentrations above the respective freshwater GILs and 99% species protection levels (ANZAST, 2018). These concentrations are considered typical of general runoff, and not indicative of any significant contamination to the surface water.

11.4 SEDIMENT

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.

12. REFINED CONCEPTUAL SITE MODEL

Following completion of the Detailed Site Investigation (DSI) works program, a summary of the residual site contamination and an updated Conceptual Site Model (CSM) for the site is presented below. The potential onsite sources that were identified in Section 5.2 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;
- Onsite Farm dump; and
- Onsite Surface water storage dam.

Based on the analytical results from the Detailed Site Investigation, a summary of potentially complete exposure pathways is presented below.

Table 12-1 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

13. CONCLUSIONS AND RECOMMENDATIONS

OCTIEF completed this PSI/DSI at the Project site in accordance with the process for assessment of site contamination described in the NEPM (NEPC 2013) on the basis of the approach described in the scope of works and SAQP.

The objectives of the PSI and DSI were to:

- identify potential sources of contamination and determine potential contaminants of concern;
- identify areas of potential contamination;
- provide Health Infrastructure with high level confidence that site contamination characteristics are sufficiently understood to allow (if required) remedial planning and implementation;
- Provide sufficient confidence and reliance that there will be no foreseeable contamination issues which may affect redevelopment or suitability for the State Significant Development Application (Concept Proposal and Stage 1 works) ;

Based on the scope of works carried out, the objectives outlined above and subject to the limitations set out in this report the following conclusions are made:

- No exceedances of relevant human health investigation levels for chemical contaminants were identified. Exceedances of ecological assessment criteria are relatively minor and isolated, and the site is considered acceptable for use in the Project, from a chemical contamination perspective.
- ACM was identified in the area around the western side of the chemical storage/equipment shed, Soil results indicate Asbestos fines in the soil and the ACM identified on the surface was moderately degraded presenting a potential risk to human health if disturbed.
- Anthropogenic wastes were noted in a small farm dump in the north western corner of the site, visual assessment and soil analytical testing indicate the material in this area is inert waste, however some portions of the dump could not be assessed during the PSI/DSI due to vegetation growth.
- OCTIEF considers that the works undertaken at the site have sufficiently characterised the site to enable assessment as suitable for the SSD application subject to implementation of a Remediation Action Plan as recommended below.

Based on the investigations carried out and our current understanding of the Project, OCTIEF recommends that:

- A Remediation Action Plan (RAP) be developed for the area of asbestos impacted soil on the western side of the main site shed. The RAP should be prepared in accordance with SEPP 55 and relevant NSW guidelines and legislation and include appropriate protocols for removal and appropriate disposal of all remaining ACM associated with the main shed.

14. REFERENCES

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APPENDIX A TABLES

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

OCTIEF

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

Notes

Results in yellow highlight and bold indicate an exceedance of the adopted health based assessment criteria - low to high density residential

Results iindicate an exceedance of the adopted ecological investigation criteria - Residential land use

Results iindicate an exceedance of the adopted ecological investigation criteria - Area of ecological significance

1 NEPM (1999) Schedule B1 Table 1A(3) - Health Screening Level A - low to high density residential (no degradation factor applied)
2 NEPM (1999) Schedule B1 Table 1A(1) - Health Investigation Level A, residential .
3 NEPM (1999) Schedule B1 Table 1B(6) - Ecological screening levels, urban and residential and public open space
4 NEPM (1999) Schedule B1 Table 1B(5) - Ecological Investigation levels, urban, residential and public open space (aged arsenic, fresh DDT, fresh naphthalene)
5 NEPM (1999) Schedule B1 Table 1B(6) - Ecological screening levels, Area of Ecological Significance
6 NEPM (1999) Schedule B1 Table 1B(5) - Ecological Investigation levels, Area of ecological significance (aged arsenic, fresh DDT, fresh naphthalene)
NL Not Limiting: NEPM (1999) Table 1A(3). When a soil vapour source concentration for a petroleum mixture can not exceed a level that would result in an exceedance of the maximum allowable vapour risk for a given scenario no HSL is provided and the HSL is shown as 'not limiting' or 'NL'.

EIL

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

Notes are provided at the end of the tables section

Table 2 - Soil analytical results

(results in mg/kg unless othwerwise stated)

OCTIEF

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

Notes

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

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

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

Table 4 - Soil analytical results - composite samples

J8961

(results in mg/kg unless otherwise stated)

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

Notes

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

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

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

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

Notes

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

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

Table 4 - Soil analytical results - composite samples

J8961

(results in mg/kg unless otherwise stated)

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

Notes

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

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

Notes are provided at the end of the tables section

Table 4 - Soil analytical results - composite samples

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(results in mg/kg unless otherwise stated)

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

Notes

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

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

Notes are provided at the end of the tables section

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

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

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

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

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

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

Notes
Values in ug/L unless otherwise specified

Results indicate an exceedance in the adopted assessment criteria

NL Not-Limiting

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

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

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

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

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

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

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

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

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

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

Notes
Values in ug/L unless otherwise specified

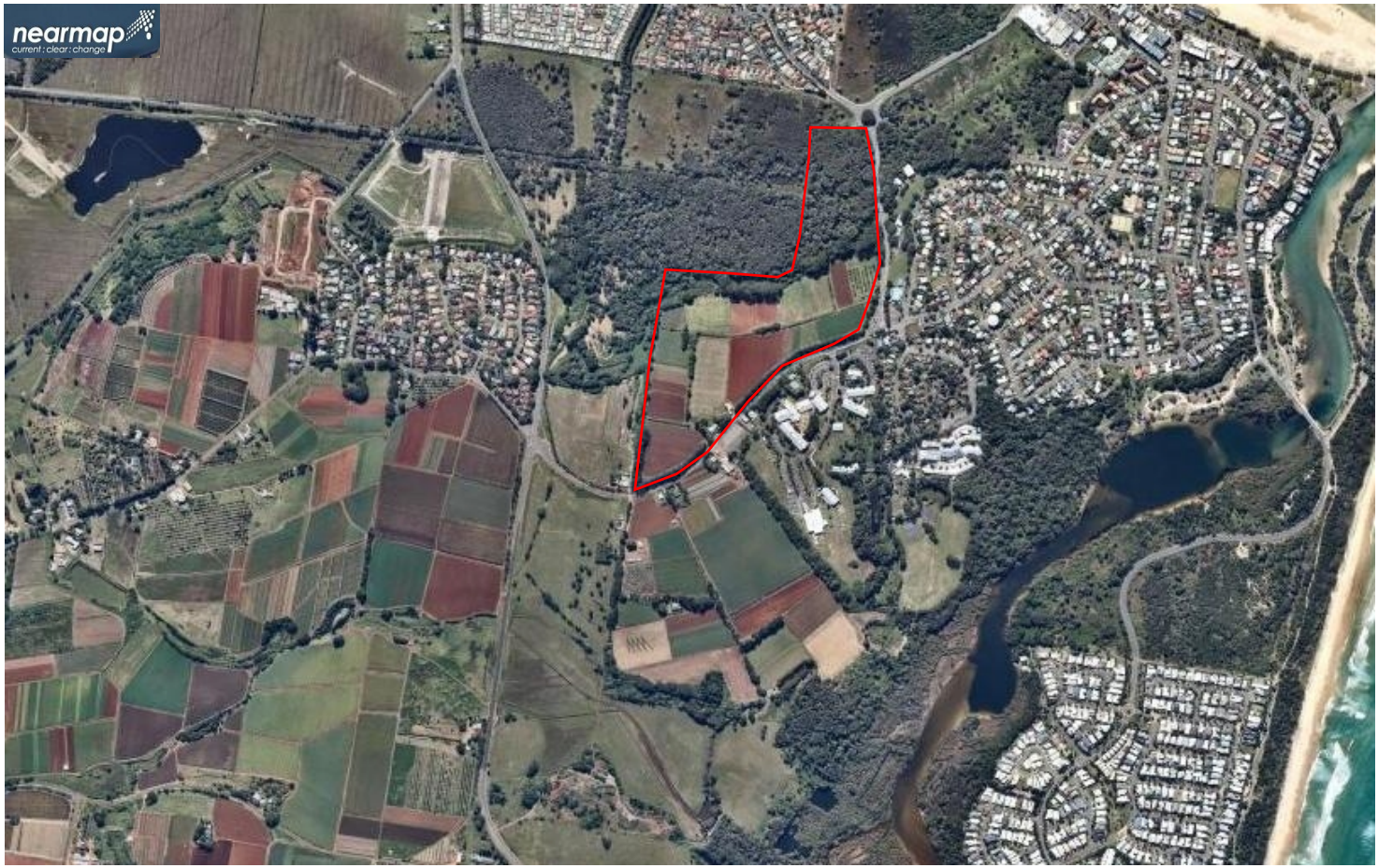
Results indicate an exceedance in the adopted assessment criteria

NL	Not-Limiting
1	NEPC (amended 2013) - National Environmental Protection (Assessment of Site Contamination) Measure 1999 - Table 1C Groundwater Investigation Levels - Freshwater ;
2	NEPC (amended 2013) - National Environmental Protection (Assessment of Site Contamination) Measure 1999 Table 1C Groundwater Investigation Levels - Drinking Water ;
3	ANZECC / ARMCANZ (2000) - Australian and New Zealand Guidelines for Fresh and Marine Water Quality - Irrigation and general water use guidelines
4	ANZAST(2018) - Australian and New Zealand Guidelines for Fresh and Marine Water Quality - High Conservation / ecological Value System

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

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

APPENDIX B FIGURES



LEGEND

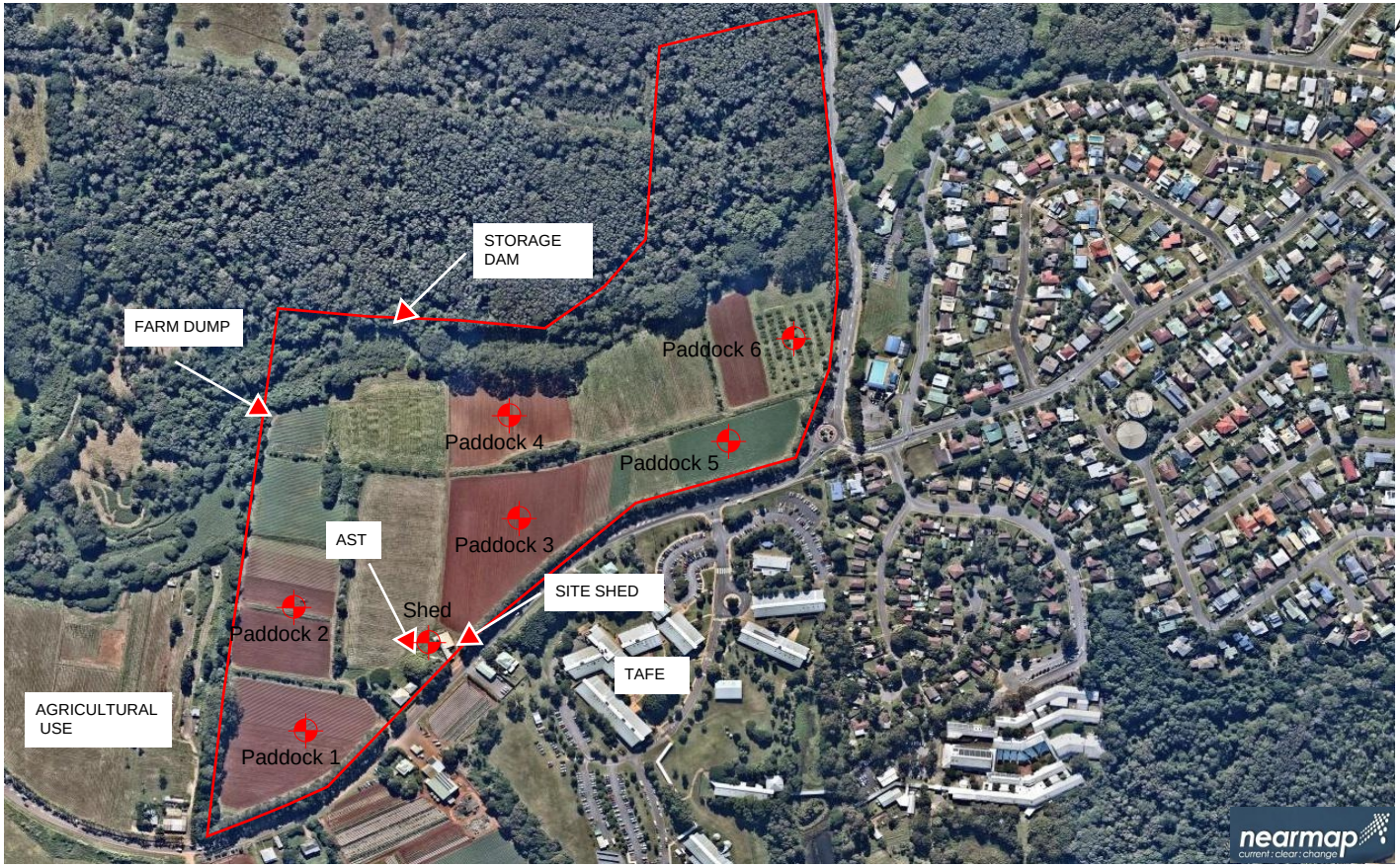
Site Boundary

0 125 250 375m

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

OCTIEF

CLIENT: Health Infrastructure NSW		DESIGNED:	DRAWN:
PROJECT TITLE: Tweed Hospital PSI/DSI		CHECKED:	No. SHEETS:
		SCALE:	DATE STARTED:
SITE ADDRESS: 771 Cudgen Road, Cudgen		JOB No: J8961	
DRAWING TITLE: Site Location		DRAWING No: 1	



LEGEND

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

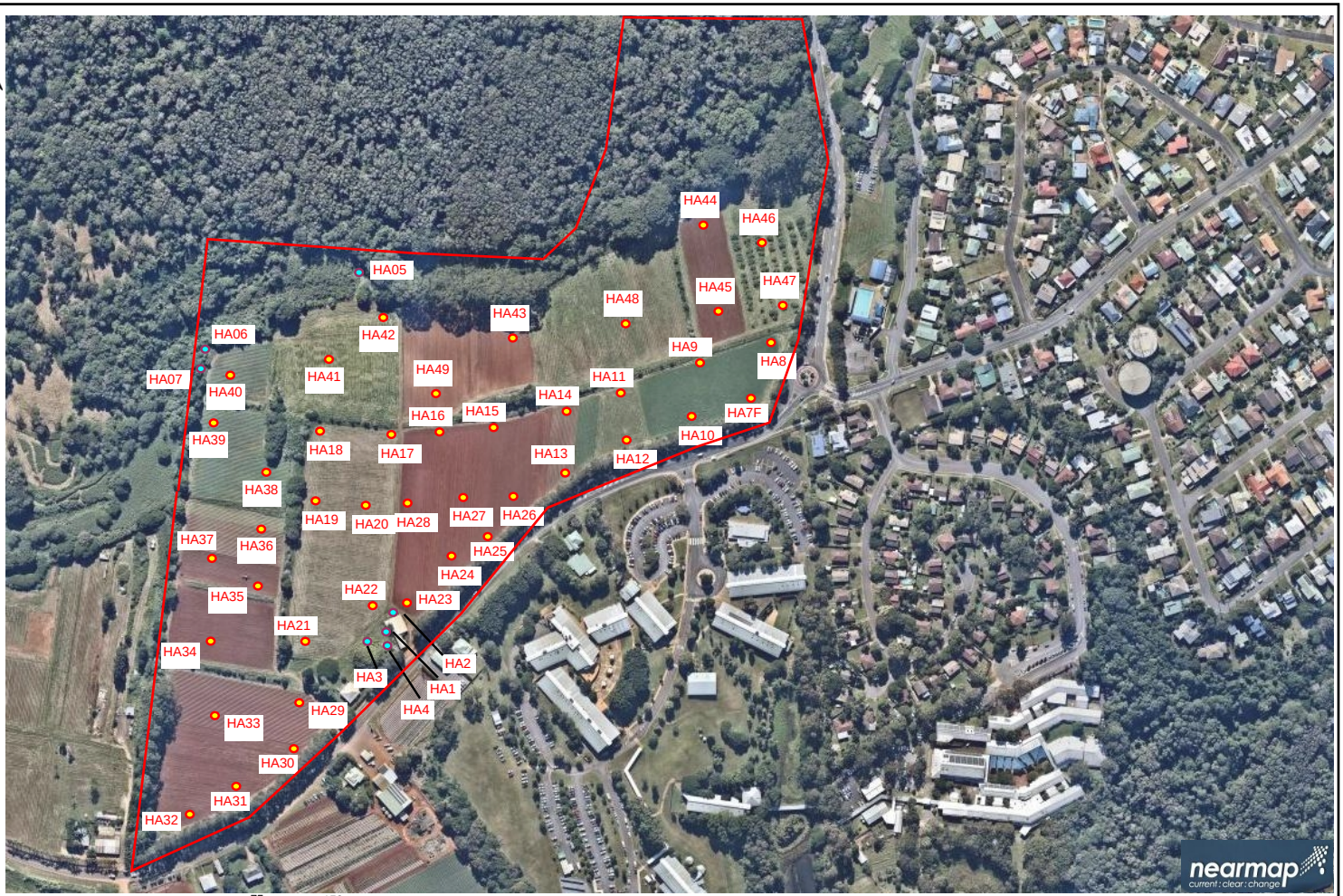
Site Boundary

0 75 150m

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

OCTIEF

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



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

OCTIEF

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

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

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

OCTIEF

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

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

0 75 150m

LEGEND

Monitoring well GW1

SED01 Sediment Sample

WS01 Surface Water Sample

Site Boundary

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

OCTIEF

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

APPENDIX C SITE PHOTOS

Photo 1 – looking east at the western side of the site shed building – asbestos sheeting visible on ground.

Photo 2 – Asbestos containing sheeting on roof of storage shed building.

Photo 3 : Rusted farm equipment on western side of site shed .

Photo 4: Asbestos sheeting fragments on ground near site shed .

Photo 6: Minor chemical storage area in vehicle shed adjacent to site shed.

Photo 7 : Vehicle Shed

Photo 8 : Fertilizer stored on eastern side of main site shed.

Photo 9 : looking south at the northern end of main site shed.

Photo 10 : Cement material and wooden pailings in site farm dump.

Photo 11 - Float devices near storage dam in vegetated area of site

Photo 12 – looking north at storage dam – pump house on right hand side of photo

Photo 13– Looking east along southern boundary of site.

Photo 14 – Above ground fuel tank

Photo 15 – Looking south across site at main site shed