Palmer Street Development: Stage 1
Waipa District Council
03-Dec-2015

DRAFT

Environmental Contamination Report

Detailed Site Investigation (DSI)

D R A F T

Environmental Contamination Report

Detailed Site Investigation (DSI)

Client: Waipa District Council

Co No.: N/A

Prepared by

AECOM New Zealand Limited
8 Mahuhu Crescent, Auckland 1010, PO Box 4241, Auckland 1140, New Zealand
T +64 9 967 9200 F +64 9 967 9201 www.aecom.com

03-Dec-2015

Job No.: 60343891

AECOM in Australia and New Zealand is certified to the latest version of ISO9001, ISO14001, AS/NZS4801 and OHSAS18001.

D R A F T

Quality Information

Document Environmental Contamination Report

Ref 60343891

Date 03-Dec-2015

Prepared by Susie Humphrey and Lorraine Hamilton

Reviewed by Anthony Kirk

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
B	23-Nov-2015	Revised Draft for Client Review	Emma Trembath Principal Environmental Scientist	

D R A F T

Table of Contents

D R A F T

Executive Summary

AECOM New Zealand Limited (AECOM) have been engaged by Waipa District Council (WDC) to assess the site and advise on the repair of the buildings and infrastructure where required, and the constraints for new development. As part of this assessment, a contamination assessment (detailed site investigation [DSI]) has been completed.

Preliminary Site Investigation

The results of the limited preliminary site investigation (PSI) indicate the Site has historically been utilised for uncontrolled fill activities. A gully that traversed in a south-west to north-east direction across the Site was infilled prior to the construction of pensioner housing between the 1950s and 1970s.

Activities of potential concern include:

- Fill activities – a previous site investigation indicated that the majority of the Site is underlain by uncontrolled fill that included general refuse.
- Potential asbestos containing material (ACM) associated with historic building materials and structures.
- Potential lead-based paint associated with historic buildings.

Based on results of the PSI the potential contaminants of concern identified for the site include trace elements, hydrocarbons, semi-volatile organic compounds (SVOCs), volatile organic compounds (VOCs), and ACM.

Detailed Site Investigation

Based on the results of the limited PSI, the DSI focused on the characterisation of soil, groundwater, fill leachate and fill gas as potential sources of contamination at the Site.

Fill Gas

The fill gas survey comprised a fill gas walkover survey and targeted spiking survey. The walkover survey focussed on the identification of potential areas of concern as well as potential migration pathways. Methane was not detected in the crawl space of houses, but was identified at low concentrations at two external locations.

The targeted fill gas spiking survey, undertaken at five locations across the Site, recorded only low methane concentrations. The presence of damaged services present at various locations across the site does however provide a potential pathway for gas migration and accumulation. Although ongoing gas generation is expected to be limited, there is potential for historically generated gas to have accumulated within services.

Soil Investigation

The soil investigation identified a soil cover layer of sandy silt, with thickness ranging between 0.15 and 1.2 m. No visual evidence of contamination of this cover material in the form of small pieces of plastic etc., was noted during site works, however, solvent odours were recorded during the advancement of monitoring well MW04. Refuse underlying this material includes glass, paper, bricks, rope, metal, rood, rubber, plastic, ash, and evidence of burnt refuse.

The findings of soil sample analysis were as follows:

- Two soil samples recorded exceedances of the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health Soil Contaminant Standards (NES SCS) for lead (adopting a residential land-use with 10% produce ingestion) at boreholes HA04 and HA10.
- Numerous soil samples recorded exceedances of the Waikato Regional Background Ranges for cadmium, lead and zinc.
- One composite sample (composite of HA09, HA10, HA11, HA12) returned polycyclic aromatic hydrocarbons (PAH) concentrations above the laboratory detection limit (LDL). PAH in soil from one of these borehole locations could potentially exceed the adopted acceptance criteria.

Given the residential land-use, a soil source with exceedances of the NESS CS for lead introduces the potential for human contact along the produce ingestion and direct soil contact (dermal and ingestion) pathways. It is therefore conservatively considered that there is potential for residents to be exposed to elevated lead concentrations.

D R A F T

Groundwater and Leachate Investigation

The groundwater and leachate investigation comprised the advancement of three groundwater monitoring wells and one leachate monitoring well. Three groundwater monitoring wells are located on the margins of the closed fill and screened in natural ground beneath the refuse. A fourth monitoring well, located centrally within the site in an area interpreted to be the former gully that traversed the site. This well is screened within the refuse for the purposes of characterising leachate. The findings of the groundwater investigation are as follows:

- SWLs were measured at depths between 1.97 (MW01) and 4.64 (MW03) m btoc.
- Interpreted groundwater flow is interpreted to be in a north-easterly direction towards the Mangaohoi Stream, and is inferred to be in close hydraulic connection with the fill.
- Leachate demonstrates relative low concentrations of dissolved solids and contaminants, having low total nitrogen indicative of an absence of putrescible organic matter. Of the parameters tested, only boron exceeded the adopted Australian and New Zealand Environment Conservation Council (ANZECC) criteria for freshwater.
- Whilst the influence of leachate is apparent in groundwater immediately down-gradient of the fill, this influence is considered minor. Significant attenuation is expected to mitigate potential risks to the receiving environment.
- Groundwater as a potable water supply resource is not expected to be adversely effected by the discharge of leachate.

Contamination of groundwater by leachate is not considered significant enough to introduce any potential exposure pathways by which contaminants could affect human health or the environment.

Conclusion

The PSI indicates that the refuse materials underlying the site present a source from which contaminants may exist. The DSI confirms that heavy metals are present in shallow soils at the site, including within the capping material; methane gases are present at detectable concentrations in two outdoor locations; and fill leachate generated within the fill contains low concentrations of dissolved solids and contaminants, indicating an absence of putrescible organic matter within the fill materials.

Due to low concentrations of contaminants and attenuation effects, leachate is not considered to present a risk to the surrounding environment, receiving surface water environment or potable groundwater in the area.

The refuse underlying the Site has relatively low potential to generate fill gas or fill leachate to the extent that it would present significant risk to human health or the environment. However, there remains potential for historically generated fill gas to have accumulated in underground services, which may present a risk pathway if the gases were to migrate into the dwellings in the future.

The refuse materials are separated from Site users by cover materials (soils) which limits the potential for direct contact. However, soils used for fill cover contain concentrations of trace elements, including cadmium, lead and zinc, elevated above the regional background. In the case of lead, concentrations have been identified in excess of the criteria of protection of human health. Whilst risk associated with the presence of such elevated concentrations may be mitigated to some extent by the nature of the site use (low produce consumption), it is conservatively considered that there is potential for this exposure to present a risk to human health via dermal contact, ingestion and produce ingestion.

An assessment of the resource consent requirements and remediation / mitigation options for the Site are presented in the AECOM report titled ‘Engineering and Environmental Assessment – Interpretation and Recommendations’, dated 3 December 2015.

D R A F T

1.0 Introduction and Purpose

1.1 Introduction

The Waipa District Council (WDC) own pensioner housing located on a collection of sites bounded by Palmer, Vaile and Roche Streets in Te Awamutu (herein referred to as the Site); **Figure A1** in **Appendix A** illustrates the Site location. The site was filled with uncontrolled fill prior to and during the construction of the pensioner housing between the 1950's and 1970's. There is visible evidence of the ground surface settling and damage occurring to some of the buildings.

AECOM New Zealand Limited (AECOM) have been engaged by WDC (Contract No: 27-14-57, dated 4 March 2015) to assess the site and advise on the repair of the buildings and infrastructure where required, and the constraints for new development. As part of this assessment, a contamination assessment (detailed site investigation [DSI]) has been completed. This report outlines the findings of the DSI.

1.2 Purpose

An environmental assessment was undertaken by Geo and Hydro – K8 Limited (Geo and Hydro)titled "Detailed Site Investigation Te Awamutu Retirement Village, Palmer Street", dated 16th July 2013. The investigation combined a ground penetrating radar (GPR) survey with an intrusive test pitting exercise and identified that the site is underlain by waste, associated with the fill activities at the property. Contamination was identified in soils across, with lead the primary contaminant of concern. Geo and Hydro suggested some remedial options and made the following recommendations:

- If full removal of waste is not considered in the near future, undertake an assessment of the risk related to fill gas and vapour emissions.
- Undertake an investigation of potential pathways for fill gas and vapour migration into buildings at the site.
- Eliminate the risk of small buried objects by completing an electromagnetic induction survey.
- Explore future use and re-build options with current landowner.

It is considered that the nature of potential contaminant conditions at the site were not fully characterised by this initial investigation, with Identified information gaps including:

- The potential risk presented by any fill gas to current and future site users.
- The potential for shallow soil materials in the vicinity of existing units to have been impacted by historical land-use activities including heavy metals and asbestos containing materials (ACM).
- The risk presented by any fill leachate on groundwater quality on and off the Site.

This current contamination assessment has been completed in order refine the characterisation of site conditions and to further inform recommendations, with respect to the management of potential human health and environmental risks at the Site.

The environmental investigation was completed in conjunction with the geotechnical investigation of the site.

D R A F T

2.0 Preliminary Site Investigation

2.1 Site Setting

The Site comprises 10 adjoining properties located on or between Palmer, Roche and Vaile Streets, Te Awamutu, with a small reserve located centrally within the site.

Table 1 presents a summary of Site details and **Table 2** summarises land use activities surrounding the Site.

Table 1 Summary of Site Details

Item	Description
Site Addresses	75 – 96 Palmer Street, Te Awamutu. 337 and part of 387 Roche Street, Te Awamutu.
Legal Descriptions	Part Allot 85 VILL OF Te Awamutu and Allots 87, 88, 89, 90, 91, 93, 95, 97, 99 VILL OF Te Awamutu.
Current Site Owner	Waipa District Council.
Regulating Authorities	Local: Waipa District Council. Regional: Waikato Regional Council.
Operative Zoning and Planning Overlays	Residential Zone.
Site Area	9190 m^2 or 0.919 ha.
Approximate Site Elevation (m AOD)	59 m.

Table 2 Summary of Surrounding Landuse Activities

Direction From Site	
North-west	Residential land-use: A retirement housing complex and Roche Street, beyond which are residential properties.
North-east	Reserve zone beyond which is commercial land-use: Vaile Street, a reserve and a historic building (49 - Little Theatre, originally a school built in 1877), beyond which is the Te Awamutu Public Library and Museum building complex.
South-west	Residential land-use: Palmer Street beyond which are residential properties.
South-east	Residential land-use: Brady Street beyond which are residential properties.

2.1.1 Environmental Setting

Table 3 presents a summary of the environmental setting at the Site.

Table 3 Summary of Environmental Conditions

Item	Description
Topography and surface condition	Overall the area in which the Site is located slopes in an easterly direction, towards the corner of Vaile and Palmer Street. There is also a slope from the southern section of Palmer Street towards the Site. The Site itself is relatively flat with a very gentle downward gradient towards the north-east boundary. The ground surface at the Site is approximately 50 % grassed and 50 % residential housing footprints. There are some footpaths and driveways, which are concreted.
Geology	The Site is underlain by Pleistocene period alluvial sediments of the Tauranga Group, Walton Subgroup. This comprises pumiceous alluvium and colluvium dominated by primary and reworked, non-welded ignimbrite, (Edbrook, 2005).
Hydrogeology	Waikato Regional Council (WRC) bore records indicate that there are 14 bores within a 1 km radius of the Site. The WRC bore search documentation is presented in **Appendix B.** - There are three bores utilised for domestic and stock watering purposes. Their depths

D R A F T

Item	Description
	range between 63 m and 144 m below ground; with these located 650 m and 700 m north-east, and 870 m south-east of the Site. - Eight shallow bores (under 10 m depth) are located at a Mobil service station located approximately 420 m north-east of the Site. There are utilised for groundwater monitoring purposes. These bore locations are estimated to be down-gradient of the Site. - One bore, with a depth of 10 m, is utilised for groundwater monitoring purposes. This is located 380 m east of the Site. - Two bores have no information on their use. One is located 525 m north-east of the Site, and has no details on location. Groundwater was encountered at four monitoring wells installed at the Site on 20 May 2015, with groundwater levels ranging between 1.97 m to 4.64 m below top of casing (m bTOC). Note that the top of casing is approximately flushed with the ground. Locally, shallow groundwater is interpreted to flow in an easterly to north-easterly direction towards the Mangaohoi Stream. The land use surrounding the Site is predominantly residential and water supply to the area is provided by reticulated supply. Based on the information above, it is considered unlikely that shallow groundwater is utilised for potable supply in the vicinity of the Site.
Sensitive Ecological Receptors	The Mangaohoi Stream, the nearest surface water body, is located approximately 610 m north-east of the Site. Two unnamed watercourses are located approximately 860 m west and 870 m south of the Site.
Underground Services	As part of a geotechnical investigation by AECOM, the location of underground services was surveyed by Underground Service Locators Limited. Radio wands, ground penetrating radar and CCTV were used to identify the locations of services within the site, where practical access could be gained. A number of underground services transect the Site. Locations of the underground services are presented in **Figure A2** in **Appendix A**. **Water supply** – Water supply pipes are present along Brady Street and Palmer Street (along the footpaths / site perimeter), with connections to the residential properties from Palmer Street. All water services are understood to have been originally laid in 20mm diameter copper pipe. More recent maintenance and modifications to the network has seen the use of using polyethylene pipe (PE). **Wastewater** – Wastewater lines run along Palmer, Roche and part of Vaile Streets (in road corridors), with connections from to the residential properties from Palmer and Vaile Streets. A separate sewer line also transects the site from Vaile Street, in a westerly direction towards Roche Street. The WDC sewer network within the Site is a mixture of concrete and earthenware construction and is understood to be approximately 40 years old. Most of the sewer lines extending through the site are expected to be in a serviceable condition, however, with some defects, likely due to settlement at the site, And root intrusion at a number of joints. **Stormwater** – A stormwater line extends eastwards from Roche street to a manhole in the centre of the Site. From here various connections transect the Site to the residential properties. The main stormwater pipelines through the site are concrete. Individual stormwater service connections are earthenware. Most of the stormwater system is in a serviceable condition, but some displacement defects are inferred. The earthenware stormwater connections are showing signs of settlement through joint deflection, displacement and in some instances collapse.

2.2 Historical Site Information

2.2.1 Summary of Historical Aerial Photographs

Historical aerial photographs were obtained through the WRC's archives and also WDC. A summary of historical aerial photography is presented in **Table 4**. The historical aerial photographs indicate that the Site started being developed for residential housing in the 1950's.

D R A F T

Table 4 Summary of Historical Aerial Photographs

Year & Historical Photograph	Review
1944	
 Source: Waikato Regional Council	The Site is undeveloped and grassed. A gully traverses the Site in a south-west to north-east direction; a small watercourse is potentially present here. Residential landuse development is evident in the areas adjacent to the Site. Vacant or undeveloped land is noted to the south-west and north-east is partially vacant.
1957	
 Source: Waikato Regional Council	Some pensioner houses have been constructed on the southern portion of the Site. The gully is now less visible. The previously undeveloped areas to the south-west of the Site have been developed for residential landuse.

D R A F T

Year & Historical Photograph	Review
1979	
 Source: Waikato Regional Council	The Site has been fully and the pensioner housing footprint is positioned as it is presently. Surrounding landuse development is similar in extent to the 1957 aerial photograph.
1992	
 Source: Waikato Regional Council	The Site and surrounding area is as it is presently.

D R A F T

Year & Historical Photograph	Review
2006	
 Source: Waipa District Council	Current Site layout.

2.2.2 Review of Council Information

Waikato Regional Council

Resource Consent Search

WRC records indicate that there has been a single Resource Consent lodged for the Site and within the immediate vicinity of the Site:

This relates to the monitoring wells installed at the Site as part of this investigation. No other resource consents are issued by WRC for activities within the vicinity of the site.

The WRC resource consent search documentation is presented in **Appendix B**.

Land Use Information Register Search

WRC Land Use Information Register records indicate that there are 13 potentially contaminated sites within 200 m of the Site. These properties have been classified as 'verified' and 'unverified' hazardous activities and industries list (HAIL) land-uses and no sampling or reporting exist for the sites.

The WRC Land Use Information Register search documentation is presented in **Appendix B**.

2.2.3 Historical Environmental Assessments

An environmental assessment was undertaken at the Site by Geo and Hydro, with the report titled Detailed Site Investigation Te Awamutu Retirement Village, Palmer Street and dated 16th July 2013 (provided in **Appendix D**). The investigation comprised of the use of GPR and test pitting to determine the extent of the area of fill on the site and the amount of soil capping/cover present over the refuse. The study area for this previous assessment included land on the opposite side of Vaile Street (referred to as 'the little theatre') and the property on the corner of Roche and Brady Streets (nursing home), which were not part of the current investigation. Soil samples were collected and analysed using a selection of X-Ray Fluorescence (XRF) and laboratory testing. A summary of the investigation outcomes is detailed below:

- The Site history section detailed the following:
    - The Site has been owned by local councils since the 1940's.

- The report quoted that “people in the area remember the site being very boggy”.
- The 1963 aerial photograph illustrated the presence of various stockpiles across the Site, and some infilling of the gully has been completed.
- The report stated that “large diameter holes have been drilled north-east of the three new buildings,(houses located in the southern section of the Site) and that these could have been intended as storm water soak holes”.

- The investigation identified that the majority of this site is underlain by buried waste material. The waste was the result of general disposal of municipal and commercial waste prior to and during the construction of the pensioner housing (between the 1950’s and 1970’s).
- The report stated that waste material is covered with an overburden soil capping which varies in depth from approximately 1 to 2.5 m across this site; and that the waste material depth varies from around 3 to 5 m in depth. The waste materials appear to extend across Brady Street to the south-west of the Site and investigated area.
- Contamination was identified in soil throughout the Site with shallower “brown” waste containing lower concentrations of contamination compared to the areas of “black waste” located beneath the brown waste.
- Comparison of soil analytical results against soil quality criteria outlined in the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES Soil), indicates that the primary contaminant of concern for the Site is lead. Zinc was also identified as a contaminant of concern for the site as the majority of samples exceeded the Australian National Environment Protection (Assessment of Site Contamination) Measure (NEPM) guideline value.
- The following remedial options were presented for the site:
  - Assessment and evaluation of the risk. If deemed acceptable leave all waste in place, build any new buildings on piles, and top up soil levels around the buildings periodically.
  - Remove the waste with contaminant levels which exceed NES Soil quality standards applicable to the land-use scenario at the site (currently ‘residential’, however this could become ‘high density residential’ or even ‘commercial’ in the future).
  - Remove all waste and therefore all current and potential “risks and unknowns”.
- The following recommendations were presented:
  - If full removal of waste is not considered in the near future, an assessment of the risk related to fill gas and vapour emissions was advised.
  - Undertake an investigation of potential pathways for fill gas and vapour migration into buildings at the Site.
  - Eliminate the risk of small buried objects at the Site by completing an electromagnetic induction survey.
  - Explore future use and re-build options with current landowner.

2.3 Areas of Potential Concern

The review of the historical Site information identified the following areas of potential concern at the Site, summarised in **Table 5**.

Table 5 Areas of Potential Concern

Area of Site	Environmental Condition	Potential HAIL Activity	Contaminants of Potential Concern
In Entire Site	Prior to the 1970’s, filling activities were conducted at the Site. A gully traversing in a south-west to north-east direction was infilled.	- Category G3 – Fill sites. - Category G5 – Waste disposal to land (excluding where biosolids have been used as soil conditioners).	- Heavy metals. - Hydrocarbons. - Semi volatile organic compounds (SVOCs). - Volatile organic compounds (VOCs). - Nutrients.

D R A F T

Area of Site	Environmental Condition	Potential HAIL Activity	Contaminants of Potential Concern
			- Asbestos Containing Materials (ACM). - Fill gas (methane).
Buildings on Site	Given the age of the buildings at the Site, building materials may contain ACM.	- Category E1 – Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorating condition.	- ACM.
	Given the age of the buildings at the Site, paints used on buildings may contain lead.	- Category I – Any other land that has been subject to intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment.	- Trace elements.

2.4 PSI Summary and Conclusions

The findings of the limited preliminary site investigation (PSI) suggest the Site has historically been utilised for fill activities, with building activities potentially including the use of hazardous materials (lead based paint and ACM). A gully that traversed in a south-west to north-east direction across the Site was infilled prior to the construction of pensioner housing. The contaminants of potential concern for the Site have been identified as trace elements, hydrocarbons, SVOCs, VOCs, nutrients, ACM, and fill gas.

Potential contaminants of concern relating to the building activities identified during the PSI, if present, would be expected to be present in surface soils. Whereas, the distribution of potential contaminants of concern related to the fill activities, if present, may be more extensive and present throughout the soil profile and in groundwater. Fill gas, if generated in sufficient concentrations and volumes, may potentially present a risk to occupiers of the buildings and underground infrastructure maintenance workers.

D R A F T

3.0 Detailed Site Investigation

3.1 Investigation Rationale

To DSI methodology was developed to allow refinement of the site characterisation and assessment of potential risks identified within the PSI. In this regard the DSI focussed on:

1) Determination of the extent and depth of uncontrolled fill cover and waste materials.
2) Characterisation of contaminant concentrations in soils, including surface soils.
3) Determination of the fill leachate and groundwater depth, likely flow direction and potential environmental receptors to groundwater flow.
4) Characterisation of fill leachate (if any) and groundwater quality.
5) Measurement of near surface fill gas concentrations.

3.2 Investigation Methodology

3.2.1 Fill Gas Investigation

AECOM completed a walkover survey on 21 April 2015. The walkover survey was completed using a calibrated GA5000 portable fill gas analyser which recorded instantaneous measurements of methane close to the ground surface (under 5 cm). The walkover survey focussed on the identification of potential areas of concern regarding fill gas accumulation as well as potential migration pathways, including:

- Building foundations / cavity spaces.
- Seals of manholes and drains.
- Surface depressions or areas of surface water ponding.
- Surface cracks.
- Distressed vegetation or areas of grass cover die-back.

Based on the results of the walkover survey, a targeted fill gas spiking survey was completed at five temporary locations across the Site. Using a small diameter hand auger, a hole was driven through the uncontrolled fill capping material and with a Gas-Rover instrument, methane concentrations were measured from within the refuse layer. These locations were combined with the hand auger boreholes described in Section 3.2.2.

Fill gas survey locations are shown in **Figure A3** in **Appendix A**. The fill gas survey photographs are presented in **Appendix G**.

3.2.2 Soil Investigation

On 21 April 2015 and 10 September 2015, AECOM advanced a total of 22 hand auger boreholes within the current capping layer near existing foundation piles to a depth of between 0.3 and 1.2 m below ground level (m bgl) (HA01 through HA22). The boreholes were advanced through the capping layer and were terminated when they were advanced into refuse materials. Soil samples were collected for laboratory analysis from within the capping layer. Soil samples were collected into laboratory supplied containers. Samples were stored and submitted in a chilled state to Hill Laboratories, under standard AECOM chain of custody.

Selected discrete soil samples collected on 21 April 2015 were submitted for trace elements (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) and asbestos in soil. Three composite soil samples (composite of four samples for screening purposes) were also submitted for SVOCs. The discrete soil samples collected on 10 September 2015 were analysed for lead only.

Investigation locations are shown in **Figure A3** in **Appendix A**. Soil laboratory analysis results are presented in **Appendix C**, with soil borelogs presented in **Appendix E**.

D R A F T

3.2.3 Groundwater and Leachate Investigation

On 22 April 2015, AECOM oversaw the advancement of soil bores and installation of three groundwater monitoring wells (MW01 through MW03) by drilling contractors, DCN Drilling Limited (DCN).The groundwater monitoring wells are located on the margins of the closed fill and are screened in natural ground beneath the refuse.

On 11 May 2015, AECOM oversaw the advancement of a single borehole and installation of a monitoring well by DCN (MW04). The monitoring well is located in the centre of the site and screened at the base of the refuse materials, with water sampled from this well considered representative of fill leachate.

Monitoring well locations are shown in **Figure A3** in **Appendix A**.

The soil cores were logged by an AECOM geologist, but no soil samples were collected for analysis. The monitoring wells comprise 50 mm PVC machine slotted screen and casing. The monitoring wells were completed at the surface with flush mounted covers. **Table 6** summarises the monitoring well installations.

Table 6 Summary of the Groundwater Monitoring Well Installations

Location	Depth of Fill Refuse/Fill Encountered (m bgl)	Groundwater Monitoring Well Screening (m bgl)	Depth to Groundwater * (m bTOC)	Soil Type Targeted with Screen	Monitoring Well Positioning Rationale
MW01	0.91 – 1.3	1.6 – 4.5	1.97	Underlying natural soil beneath refuse.	Down-gradient (groundwater).
MW02	0.5 – 1.8	4.0 – 7.0	4.16	Underlying natural soil beneath refuse.	Up-gradient (groundwater).
MW03	-	4.0 – 7.0	4.64	Natural soil.	Up-gradient (groundwater).
MW04	2.0 – 6.2	3.9 – 6.9	3.58	Refuse.	Centre of fill (leachate).

Notes: m bTOC: meters below top of casing, * Water levels measured on 20th May 2015.

A water level survey and a groundwater monitoring event was completed on 20 May 2015. The water samples were collected into laboratory supplied containers and submitted to Hill Laboratories for analysis. Quality assurance and quality control (QA/QC) samples included the analysis of a duplicate groundwater sample.

The following laboratory analysis was completed:

- Groundwater:
  - Dissolved trace elements (arsenic cadmium, chromium, copper, lead, nickel and zinc).
  - Nutrient suite (total kjeldahl nitrogen [TKN], nitrate-N, nitrite-N, nitrate and nitrite-N, total nitrogen, total ammoniacal-N).
  - Electrical conductivity (EC).
  - pH.
- Leachate:
  - Dissolved trace elements (as listed above).
  - Nutrient suite (as listed above).
  - SVOCs.
  - VOCs.
  - EC.
  - pH.
  - Major anions and cations (chloride, calcium, magnesium, potassium, sodium, sulphate, total anions and total cations).

Groundwater and leachate laboratory analysis results are presented in **Appendix C**.

D R A F T

3.3 Investigation Results

3.3.1 Summary of Field Observations

Soil

The following observations were noted during the advancement of hand auger boreholes and machine boreholes:

- Fill cover materials comprised silts, sandy silts and silty sands, with this ranging in thickness from 0.15 m to 1.2 m. **Table 7** presents a summary of observed capping material thickness.
- Refuse, encountered below the cover materials, was present in a silt, sandy silt and sand fill matrix. Refuse was encountered identified to a depth of 6.2 m bgl centrally within the site, with this inferred to be within the former gully that traversed the site.
- Natural soil underlying the refuse comprised predominately of sandy and silty clay.
- No visual evidence of contamination was noted within the fill cover soils i.e., no soil staining was noted. (refer to Section 0 for observations).
- The maximum PID reading for VOCs, recorded during the soil investigation field works, was 28 parts per million (ppm) (borehole HA04). This result not considered to be significant in the context of the wider fill investigation.
- Copies of borelogs are provided in **Appendix E**.

Groundwater and Leachate

The following observations were noted during the monitoring event:

- Non aqueous phase liquid were not detected in any monitoring well.
- PID readings of VOCs in the well headspace ranged between 4 and 4.3 ppm, with this considered to be indicative of moisture effects on the monitoring equipment.
- The standing water levels (SWL) were measured at depths between 1.97 (MW01) and 4.64 (MW03) m btoc. Groundwater and leachate elevation data is presented in **Table 8**.

The piezometric contour plan based on the May 2015 data is presented in **Figure A4** in **Appendix A**, with groundwater interpreted to flow in an easterly to north-easterly direction, towards the Mangaohoi Stream. No significant vertical hydraulic gradients were noted between leachate and the surrounding groundwater, suggesting that groundwater is in close hydraulic connection with the fill. Approximately 0.6 m of leachate is inferred to be present within the fill, in the former location of the gully.

Table 7 Summary of depth of capping material thickness

Borehole Location	Depth Fill Refuse / Fill Material Encountered (m bgl)
HA-01	0.62
HA-02	0.30
HA-03	0.55
HA-04	0.45
HA-05	0.50
HA-06	0.45
HA-07	0.45
HA-08	0.54
HA-09	0.50
HA-10	0.35

D R A F T

Borehole Location	Depth Fill Refuse / Fill Material Encountered (m bgl)
HA-11	0.9
HA-12	0.75
HA-13	0.25
HA-14	No refuse observed
HA-15	0.15
HA-16	0.2
HA-17	0.2
HA-18	0.5
HA-19	0.35
HA-20	0.5
HA-21	0.3
HA-22	0.3
MW01	0.90 – 1.30
MW02	0.60 – 2.0
MW03	No refuse observed
MW04	1.2– 6.2

Table 8 Summary of Groundwater Elevation Data

Well ID	Date	Total Well Depth	TOC Elevation	SWL	Groundwater Elevation
		(m btoc)	(m RL*)	(m btoc)	(m RL)
MW01	20-May-15	4.36	85.33	1.97	83.36
MW02	20-May-15	6.80	88.77	4.16	84.61
MW03	20-May-15	6.88	89.22	4.64	84.58
MW04	20-May-15	6.80	88.05	3.58	84.47

Notes: SWL=standing water level (prior to purging), RL=relative Level, m=metres, btoc=below top of casing, and m RL* = monitoring wells were surveyed by CKL on 20-05-15.

D R A F T

3.3.2 Fill Gas Surveys

Walkover Survey

A summary of the fill gas walkover survey is presented in **Table 9** and the fill gas survey photographs are presented in **Appendix G**. The two locations identified in the table are the only methane readings measured above background concentrations during the fill gas survey. The recorded concentrations are considered to be negligible.

Table 9 Fill Gas Walkover Survey Results

Location ID	Sample Location / Area Description	Methane (ppm)	Photograph Reference	Comments
M01	Reading obtained near a concrete pad.	8	1	Very low reading. Dead grass area near concrete path, some cracking in ground surface.
M02	In vegetable garden next to house.	43	-	Some dead grass along the edge of the garden.

Notes: PPM = parts per million.

Targeted Gas Spiking

Targeted gas spiking was completed in the two locations identified during the fill gas walkover survey to have elevated methane readings (above background readings); three other locations were also included. As with the walkover survey results, the recorded concentrations are considered to be negligible.

Table 10 Targeted Gas Spiking Survey

Location ID	Sample Location / Area Description	Methane (ppm)	Photograph Reference	Comments
P-M01 / HA-12	Reading obtained near a concrete pad and a near concrete path.	8	1	Dead grass area, some cracking in ground surface.
P-M02 / HA-11	Vegetable garden next to house – near outdoor garden hoses.	18	-	Moist ground, potentially higher readings.
P-M03 / HA-09	Near ivy fencing.	0	2	Dead grass area.
P-M04 / HA07	In garden area, next to house.	13	3	Bare ground, close to cracking in house foundations.
P-M05 / HA04	Vegetable garden.	48	4	-

Notes: PPM = parts per million.

3.3.3 Adopted Acceptance Criteria

The acceptance criteria for the investigation has been adopted in accordance with the hierarchy defined by Ministry for the Environment (MfE) Contaminated Land Management Guidelines No.2 (MfE, 2002).

Soil

Soil quality criteria for a residential landuse scenario have been adopted, in view of the current land-use. The adopted soil quality includes:

1) Resource Management Act (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations, 2011. NES soil contaminant standards for a residential (10% produce) landuse. Hereinafter referred to as the **NES SCS**.

2) MfE Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE, 1999, revised 2011). Tier 1 soil acceptance criteria for a residential landuse scenario; sandy silt and silty clay soil types; encountered at depths of less than 1 m bgl and groundwater depth of 2 m. Hereinafter referred to as the **MfE Tier 1 Guidelines (soil)**.

3) Taylor, M and Kim, N., 2009. Dealumination as a mechanism for increased acid recoverable aluminium in Waikato mineral soils. Australian Journal of Soil Research, 47, 828 - 838. Table 1. Hereinafter referred to as the **Regional Background Ranges**.

Groundwater

1) MfE Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE, 1999, revised 2011), Tier 1 Groundwater acceptance criteria, Route specific – Inhalation Pathway - residential landuse. Based on the environmental setting along with groundwater observations made in the field, analytical results have been compared against route specific, indoor inhalation pathway for residential land uses – sandy soil types for groundwater at 2 m depth. Hereinafter referred to as the **MfE Tier 1 Guidelines (groundwater)**.

2) Australian and New Zealand Environment Conservation Council (ANZECC, 2000) Australian and New Zealand guidelines for fresh and marine water quality for the protection of 80 % of fresh water species. Hereinafter referred to as the **ANZECC Guidelines**.

3) Ministry of Health (2005, revised 2008), Drinking Water Standards for New Zealand. Hereinafter referred to as the **Drinking Water Standards**.

3.3.4 Summary of Laboratory Results

3.3.4.1 Soil

Tabulated soil analytical results are presented in **Tables C1** (Inorganic Compounds), **C2** (Organic Compounds) and **C3** (Asbestos) in **Appendix C**. In summary:

Inorganic Compounds (Metals)

- A total of 18 soil samples were analysed for a suite of eight metals including arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc.
- A further 14 soil samples were analysed for lead only.
- Two recorded exceedances of the NES SCS were measured:
  - Lead concentrations (210 mg/kg guideline criteria) in soil samples from boreholes HA04 (0.1 m bgl; 2,900 mg/kg) and HA10 (0.3 m bgl; 220 mg/kg).
- There were numerous recorded exceedances of the Regional Background Ranges:
  - Cadmium concentrations in soil samples from six boreholes. Cadmium concentrations that exceeded background ranged between 0.34 and 0.46 mg/kg.
  - Lead concentrations in soil samples from 22 boreholes. Lead concentrations that exceeded background ranged between 33 and 2,900 mg/kg.
  - Zinc concentrations in soil samples from all 11 boreholes. Zinc concentrations that exceeded background ranged between 66 and 500 mg/kg.

Organic Compounds

- A total of three composite soil samples were analysed for SVOCs.
- SVOC results for two composite soil samples returned concentrations below the laboratory detection level (LDL).
- One composite sample returned polycyclic aromatic hydrocarbons concentrations above the LDL, however, measured concentrations did not exceed the adopted guideline criteria.

Asbestos

- Asbestos was not identified in any of the six discrete soil samples collected.

3.3.4.2 Groundwater and Leachate

A total of three groundwater (monitoring wells MW01 to MW03) and one leachate (monitoring well MW04) samples were collected in May 2015. The groundwater samples were analysed for a suite of leachate indicator analytes and dissolved trace elements. The leachate samples were analysed for a more extensive leachate indicator suite of dissolved metals, SVOCs and VOCs. Tabulated groundwater and leachate analytical results are presented in **Tables C4** (Detections Only) and **C5** (Complete) in **Appendix C**. In summary:

D R A F T

Leachate

- There was one recorded exceedance of the ANZECC Guidelines:
  - The boron concentration (1.45 mg/L) measured in marginally exceeded the adopted ANZECC freshwater criteria (1.3 mg/L).
- There were two recorded exceedances of the Drinking Water Standards:
  - The boron concentration (1.45 mg/L) marginally exceeded the potable water criteria (1.4 mg/L).
  - The manganese concentration (1.36 mg/L exceeded the potable water criteria (0.4 mg/L).
- All SVOC and VOC results returned concentrations below the LDL.
- With regard to other indicators of leachate, the following was noted:
  - The concentrations of all parameters were significantly lower than those expected for an operational typical municipal fill leachate[1]
  - Nitrogen species were limited to ammoniacal-N and organic-N, with an absence of oxidised inorganic nitrogen (nitrate-N or Nitrite-N).
  - Major anions and cations were dominated by calcium-carbonate.

Groundwater

- All groundwater samples returned concentrations below the adopted acceptance criteria.
- Concentrations of nitrogen species, an indicator of the influence of fill leachate, were lowest in the inferred up-gradient monitoring well MW03 (total-N of 1.3 mg/L) with this considered to be reflective of the local background concentration. Measured nitrogen species concentrations were greatest in the down-gradient monitoring well MW01 (total-N of 5.2 mg/L). At this location, the dominant forms of nitrogen were organic-N and oxidised inorganic-N (nitrate and nitrite).
- Electrical conductivity in groundwater samples were markedly lower than that of leachate, suggesting a lower dissolved solids content.
- The concentration of boron in the down gradient monitoring well MW01 were lower than that measured in leachate (0.08 mg/L compared to 1.45 mg/L) and below the adopted water quality criteria.

3.3.5 Quality Assurance and Quality Control

A duplicate leachate sample (monitoring well MW04) was collected for quality assurance and quality control (QAQC) purposes. The calculated relative percentage difference (RPD) for metals detected in the primary sample (MW04 GAA 463) and duplicate sample (QC100 GAA 464) are presented in **Table 11**.

Table 11 Relative Percentage Difference

Analyte	Primary Sample (mg/L)	Duplicate Sample (mg/L)	Relative Percentage Difference (%)
Arsenic (filtered)	0.0017	0.0021	21
Cadmium (filtered)	0.00005	0.00005	0
Chromium (filtered)	0.0005	0.0005	0
Copper (filtered)	0.0005	0.0005	0
Lead (filtered)	0.00018	0.00011	48
Nickel (filtered)	0.0009	0.0015	50
Zinc (filtered)	0.026	0.027	4

1 Centre for Advanced Engineering, University of Canterbury Christchurch New Zealand (2000). Landfill Guidelines – Towards Sustainable Waste Management in New Zealand.

D R A F T

The RPD results show a degree of variation between some samples, however, as all results were close to the LDL this is not considered to be significant. These results indicate satisfactory QAQC for the quality objectives of this report.

The laboratory results and chain of custody documentation is presented in **Appendix F**.

D R A F T

4.0 Discussion

4.1 Summary of Results

The results of fill gas, soil, leachate and groundwater quality sampling at the Site have identified the following:

- Four out of five gas spiking locations recorded low methane concentrations.
- The greater majority of field observations noted no visual evidence of contamination i.e., no soil staining, in the capping or natural soil material. A solvent odour was observed in soil at monitoring well MW04, no other odours were noted.
- Numerous soil samples collected from across the Site recorded exceedances of the Regional Background Ranges for cadmium, lead and zinc.
- Only two soil samples recorded exceedances of the NES SCS for lead. Delineation sampling completed as part of a second mobilisation did not record any exceedances of the NES SCS for lead.
- Only boron was measured in leachate at a concentration in exceedance of the ANZECC Guidelines.
- Concentrations of leachate indicators in groundwater at the Site boundary, including nitrogen species and boron, were below the adopted criteria.

Taking the above into consideration, the following conclusions can be drawn:

1) Leachate does not demonstrate a significant influence of the waste materials, with correspondingly low influence of the down-gradient groundwater quality.

4.2 Conceptual Site Model and Risk Assessment

From the environmental setting and findings of the DSI a conceptual site model (CSM) has been developed to describe the potential contaminant sources, pathways for exposure, and potential human and environmental receptors. The CSM has been used to assess the potential risk to human health and the environment posed by residual contaminant conditions at the Site. The following sections describes the CSM and associated risk assessment.

Fill Gas

Fill gas is derived by the action of microorganisms within the uncontrolled fill.

Fill gas whilst present at the Site, has only been recorded at low concentrations in discrete locations. Recorded values to date are considered negligible and does not currently present a risk to Site occupiers.

Where fill gas does occur at the Site, any potential risk to human health is related to air displacement in a confined space (where fill gas can act as an asphyxiate) and/or the potential for explosions where high concentrations of methane accumulate. The general lack of putrescible matter within the fill limits the potential for ongoing generation of fill gas at significant pressures and concentrations. In addition, methane was not detected in the crawl spaces of houses, indicating fill gas is not accumulating beneath the houses. As such, it is considered that potential risks to site occupiers associated with future fill gas generation is also low.

However, where services intersect refuse materials, potential does exist for longer term accumulation of fill gas, potentially associated with historical gas generation. In the absence of detailed surveying of the underground infrastructure the potential risks to infrastructure maintenance workers has not been characterised.

Soil Contaminant Conditions

The uncontrolled fill has been covered with re-worked soil comprising sandy-clayey-silt material, which is intended to provide a separation between site users and occupiers and the underlying refuse.

Whilst there was no visual evidence of contamination, the concentrations of metals and presence of organic contaminants indicates that the soils are impacted to some degree. It is unclear whether this is the result of mixing with refuse during placement, a function of historic use of lead based paints on the buildings, or entrained in the cover material from an external source prior to placement i.e. it was brought onto the site as impacted soil.

Potential exposure to contaminants in shallow soil are cumulative via the following exposure pathways; dermal contact with soil, soil ingestion, and produce ingestion. As most surfaces at the Site are unsealed and as small sections of the Site are used for gardening activities, it is considered that the abovementioned exposure pathways are potentially complete for the Site. However, given the relative absence of elevated contaminant concentrations in shallow soil materials, and the potential to further reduce the overall exposure pathway through appropriate hygiene practices, the risk to site users and occupiers is low.

Groundwater and Leachate Contaminant Conditions

Leachate within the fill is expected to be generated from:

- Rainwater infiltration through the unsealed areas of the Site.
- Inflow of groundwater to the former gully from hydraulically up-gradient areas.
- Leakage of stormwater and wastewater from damaged underground infrastructure.

Leachate within the fill, has been identified at a depth of between 2 and 4 m bgl, and is interpreted to flow in an easterly to north-easterly direction, towards the Mangaohoi Stream. The apparent consistency in measured levels of leachate in refuse and the surrounding groundwater table suggests that groundwater is in direct hydraulic connection with the fill. However, flow along the former gully is expected to occur preferentially, as waste material is likely to have a higher permeability than the surrounding natural clayey soil; which is estimated to have a hydraulic conductivity in the order of 3×10^{-8} m/s to 3×10^{-9}m/s (estimated from the AECOM geotechnical investigation CPT data[2]).

Leachate characterised through the sampling of monitoring well MW04, demonstrates proportionally elevated concentrations of calcium, carbonate and boron, consistent with the dissolution of ash. The lack of high nitrogen concentrations, particularly ammoniacal-N, suggests that the fill comprises limited putrescible matter. Whilst reducing conditions are evident, with the presence of ammoniacal-N and elevated manganese, the leaching of waste material appears to result in only trace level contaminants. The leachate chemistry is consistent with a waste that had historically been burnt, (as indicated by the PSI) removing the majority of organic matter and producing ash, with extensive leaching over time removing the greater proportion of soluble contaminants. Notably, with the exception of boron and manganese, the concentrations of contaminants measured in the leachate are within the water quality criteria for potable water supply.

The down-gradient groundwater quality, as indicated by groundwater sampled from monitoring well MW01, demonstrates the influence of the fill leachate, with a minor increase in total nitrogen relative to the background groundwater quality. The apparent attenuation of contaminants is also demonstrated through the microbial oxidation of ammoniacal-N to the less toxic inorganic form of nitrate. Further attenuation is expected with migration of groundwater away from the Site, with it considered highly unlikely that the influence of fill leachate would be detectable in surface water receptors to groundwater flow; inferred to be approximately 600 m down-gradient of the Site. As such, potential risks to the environment associated with leachate discharging from the Site are expected to be minimal.

The leachate discharge is also not expected to adversely influence groundwater as a resource, or pose a potential risk to human health where groundwater is used for potable water supply, because:

- Contaminant concentrations identified in the fill leachate and the immediately down-gradient groundwater are low and generally within the water quality requirements for potable water.
- Water supplies in the vicinity of the site are reticulated, with the nearest bore located 380 m east (across-gradient) of the Site.
- Shallow groundwater is not used as a viable potable supply in the area owing to the low potential yields and poor security to anthropogenic effects (shallow unconfined aquifer).

[2] AECOM (2015). Engineering and Environmental Investigations – Factual Report, Appendix D.

D R A F T

5.0 Summary

AECOM have been engaged by WDC to assess contaminant conditions at the Site, advise on the repair of the buildings and infrastructure where required, and the potential constraints for future development. The following is a summary of the findings of the investigation completed by AECOM:

- The Site has historically been utilised for uncontrolled fill activities. A gully that traversed in a south-west to north-east direction across the Site was infilled prior to the construction of pensioner housing between the 1950s and 1970s. Other activities of potential concern for the Site include:
    - Potential ACM associated with historic building materials and structures.
    - Potential lead-based paint associated with historic buildings.
- The fill gas survey comprised a fill gas walkover survey and targeted spiking survey.
    - The walkover survey focussed on the identification of potential areas of concern as well as potential migration pathways. Methane was not detected in the crawl space of houses, but was identified at low concentrations at two external locations.
    - The targeted fill gas spiking survey, undertaken at five locations across the Site, recorded only low methane concentrations. The presence of damaged services present at various locations across the site does however provide a potential pathway for gas migration and accumulation. Although ongoing gas generation is expected to be limited, there is potential for historically generated gas to have accumulated within services.
- The soil investigation identified a fill cover layer of sandy silt, with thickness ranging between 0.15 and 1.2 m. No visual evidence of contamination of this cover material was noted during site works. However, a solvent odour was recorded during the advancement of monitoring well MW04. Refuse underlying this material includes glass, paper, bricks, rope, metal, rood, rubber, plastic, ash, and evidence of burnt refuse.

  The findings of soil sample analysis were as follows:
    - Numerous soil samples which recorded exceedances of the Regional Background Ranges for cadmium, lead and zinc.
    - Two soil samples recorded exceedances of the NES SCS for lead (adopting a residential land-use with 10% produce ingestion) at boreholes HA04 and HA10.
    - One composite sample (composite of HA09, HA10, HA11, HA12) returned polycyclic aromatic hydrocarbons (PAH) concentrations above the LDL. PAH in soil from one of these borehole locations could potentially exceed the adopted acceptance criteria.
- The groundwater and leachate investigation comprised the advancement of three groundwater monitoring wells and one leachate monitoring well. Three groundwater monitoring wells are located on the margins of the closed fill and screened in natural ground beneath the refuse. A fourth monitoring well was advanced in the centre of the Site and screened within refuse materials. The findings of the groundwater investigation are as follows:
    - SWLs were measured at depths between 1.97 (MW01) and 4.64 (MW03) m btoc.
    - Interpreted groundwater flow is interpreted to be in a north-easterly direction towards the Mangaohoi Stream, and is inferred to be in close hydraulic connection with the fill.
    - Leachate demonstrates relative low concentrations of dissolved solids and contaminants, having low total nitrogen indicative of an absence of putrescible organic matter. Of the parameters tested, only boron exceeded the adopted ANZECC criteria for freshwater.

Based on the results of the AECOM investigation, a CSM and risk assessment has been completed for the Site:

- Fill gas whilst present at the Site, has only been recorded at low concentrations in discrete locations. Recorded values to date are considered negligible and do not currently present a risk to Site occupiers. Furthermore, given the general lack of putrescible matter within the fill the potential for future fill gas generation is also low. However, where services intersect refuse materials, potential does exist for longer term accumulation of fill gas, potentially associated with historical gas generation. In the absence of detailed

surveying of underground infrastructure the potential risks to infrastructure maintenance workers has not been characterised.

- The fill has been covered with re-worked soil comprising sandy-clayey-silt material, which is intended to provide a separation between site users and occupiers and the underlying refuse. The concentrations of metals and presence of organic contaminants indicates that the soils are impacted to some degree. Potential exposure to contaminants in shallow soil are cumulative via the following exposure pathways; dermal contact, soil ingestion, and produce ingestion pathways. However, given the relative absence of elevated contaminant concentrations in shallow soil materials, and the potential to further reduce the exposure pathway through appropriate hygiene practices, the overall risk to site users and occupiers is low.
- Leachate within the fill flows in an easterly to north-easterly direction, towards the Mangaohoi Stream. Results indicate that groundwater is in direct hydraulic connection with the fill. Whilst the influence of leachate is apparent in groundwater immediately down-gradient of the fill, this influence is considered minor. Significant attenuation is expected to mitigate potential risks to the receiving environment. Overall, groundwater as a potable water supply resource is not expected to be adversely effected by the discharge of leachate.

D R A F T

6.0 References

AECOM, 2015. Engineering and Environmental Investigations – Factual Report. Appendix D.

AECOM, 2015. Engineering and Environmental Assessment – Interpretation and Recommendations.

Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, 2000. Australian and New Zealand guidelines for fresh and marine water quality, Volume 1, The Guidelines. Chapters 1-7.

Centre for Advanced Engineering, University of Canterbury Christchurch New Zealand, 2000. Landfill Guidelines – Towards Sustainable Waste Management in New Zealand.

Edbrook, S.W. (compiler), Institute of Geological and Nuclear Sciences, 2005. Geology of the Waikato Area, 1:250 000 Geological Map 4 Waikato.

Environment Agency, 2004. Guidance on the management of landfill gas. LFTGN 03 Landfill Directive, Appendix E

Geo and Hydro – K8 Limited, 16 July 2013. Detailed Site Investigation Te Awamutu Retirement Village, Palmer Street.

Ministry for the Environment, 1999, updated 2011. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand.

Ministry for the Environment, 2001. Contaminated Land Management Guidelines No. 1. Reporting on Contaminated Sites in New Zealand. Revised 2011.

Ministry for the Environment, 2003. Contaminated Land Management Guidelines No. 2. Hierarchy and Application in New Zealand of Environmental Guideline Values. Revised 2011.

Ministry for the Environment, 2004. Contaminated Land Management Guidelines No. 5. Site Investigation and Analysis of Soils. Revised 2011.

Ministry for the Environment, 2011. Resource Management Act (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations, 2011.

Ministry for the Environment, 2012. User's Guide, National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health.

Ministry of Health, 2005, revised 2008. Drinking Water Standards for New Zealand.

Taylor, M and Kim, N., 2009. Dealumination as a mechanism for increased acid recoverable aluminium in Waikato mineral soils. Australian Journal of Soil Research, 47, 828 - 838.

Waikato Regional Council, 2014. Waikato Regional Maps – Groundwater.

http://giswrcmaps.waikatoregion.govt.nz/WRCMaps/Full.aspx?variant=Groundwater.

D R A F T

7.0 Limitations

The information contained in this document was produced by AECOM New Zealand Limited for the sole use of Waipa District Council (the Client).

AECOM has used its reasonable endeavours to ensure that this document is based on information that was current as of the date of the document. AECOM's findings represent its reasonable judgments within the time and budget context of its commission and utilising the information available to it at the time.

AECOM has relied on information provided by the Client and by third parties (Information Providers) to produce this document and arrive at its conclusions. AECOM has not verified information provided by the Information Providers (unless specifically noted otherwise) and we assume no responsibility and make no representations with respect to the adequacy, accuracy or completeness of such information. No responsibility is assumed for inaccuracies in reporting by the Information Providers including, without limitation, by the Client's employees or representatives or for inaccuracies in any other data source whether provided in writing or orally used in preparing or presenting the document.

Neither AECOM nor its parent corporation, or its affiliates (a) makes any warranty, expressed or implied, with respect to the use of any information or methods disclosed in this document or (b) assumes any liability with respect to the use of any information or methods disclosed in this document.

Subject to AECOM's obligations to its client and any authorised third parties under their contract:

- Any other recipient of this document, by their acceptance or use of this document, releases AECOM, its parent corporation and its and their affiliates from any liability for direct, indirect, consequential or special loss or damage whether arising in contract, warranty, express or implied, tort or otherwise, and irrespective of fault, negligence and strict liability.
- AECOM undertakes no duty to, nor accepts any responsibility to, any other party who may use or rely upon this document unless otherwise agreed to by AECOM in writing (including, without limitation, in the form of a reliance letter) herein or in a separate document.
- Any other party who is entitled to rely on this document may do so only on the document in its entirety and not on any excerpt or summary. Entitlement to rely upon this document is conditional upon the entitled party accepting full responsibility and not holding AECOM liable in any way for any impacts on the development of the Site arising from changes in "external" factors such as changes in government policy or changes in the owner's policy affecting the operation of the project.

This document may include "forward-looking statements". These statements relate to AECOM's expectations, beliefs, intentions or strategies regarding the future. These statements may be identified by the use of words like "anticipate," "believe," "estimate," "expect," "intend," "may," "plan," "project," "will," "should," "seek," and similar expressions. The forward-looking statements reflect AECOM's views and assumptions with respect to future events as of the date of this document and are subject to future conditions, and other risks and uncertainties, including but not limited to economic and political conditions and sovereign risk. Circumstances and events will occur following the date on which such information was obtained that are beyond AECOM's control or knowledge and which may affect the findings or projections contained in this document. We may not be held responsible for such circumstances or events and specifically disclaim any responsibility therefore.

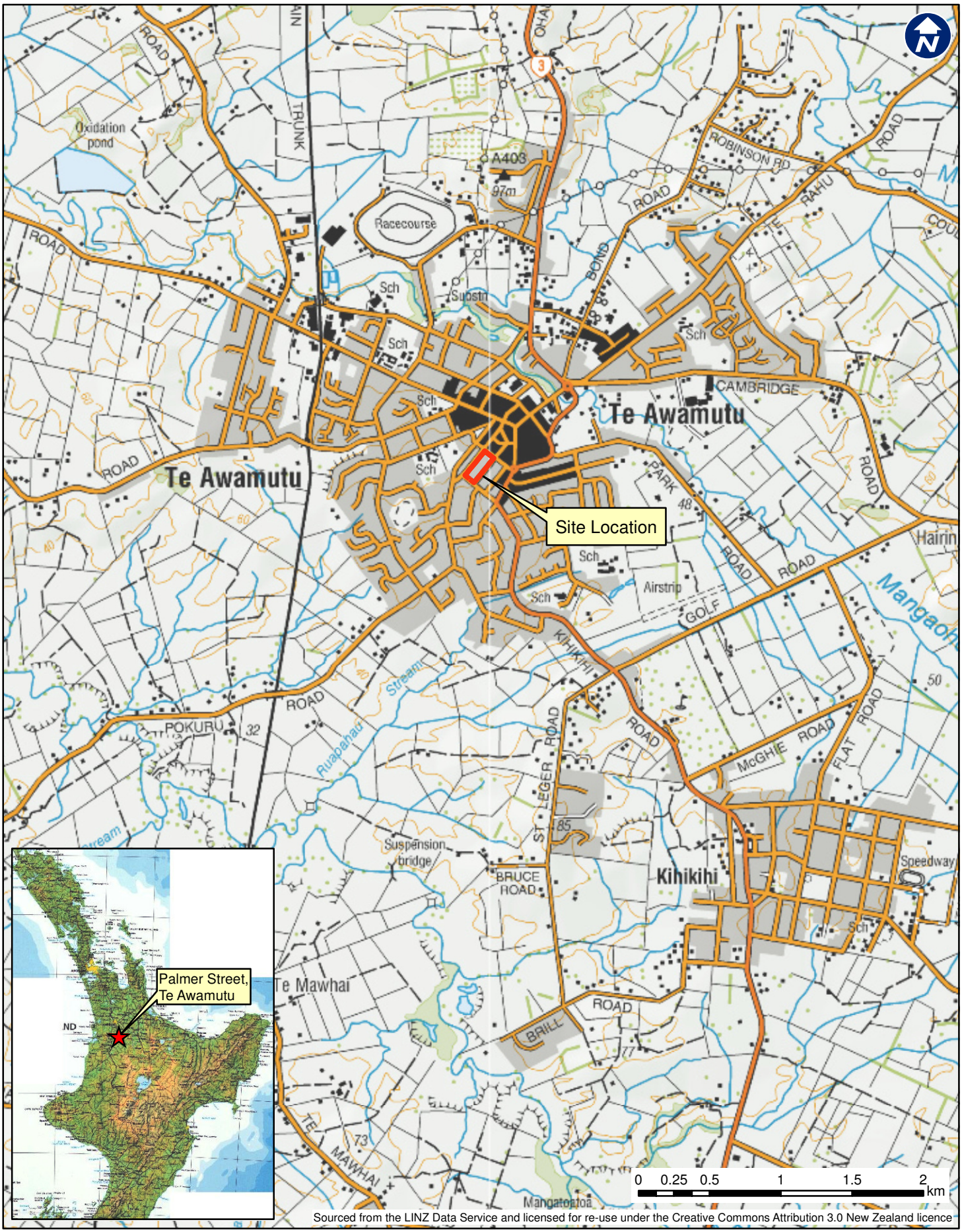
No section or element of this document may be removed, reproduced, electronically stored or transmitted in any form by parties other than those for whom the document has been prepared without the written permission of AECOM. All sections in this document must be viewed in the context of the entire document including, without limitation, any assumptions made and disclaimers provided. No section in this document may be excised from the body of the document without AECOM's prior written consent.

From a technical perspective, the subsurface environment at any Site may present substantial uncertainty. It is a heterogeneous, complex environment, in which small subsurface features or changes in geologic conditions can have substantial impacts on water, vapour and chemical movement. Uncertainties may also affect source characterisation, assessment of chemical fate and transport in the environment, assessment of exposure risks and health effects, and remedial action performance.

D R A F T

Appendix A

Figures



6/10/2015 2:14:19 p.m.

\\nzham1fp001.au.aecomnet.com\projects\603X\60343891\4. Tech work Area\4.99 GIS\02_Maps\Site_Location.mxd

Approved	LH	Date	6/10/2015
Designed	SS	Drawn	SS
Checked	LH		

Project: **Palmer Street Development: Detailed Site Investigation**

Title: **Site Location Plan**

Scale: 1:35,000 (A4 size)

Status: DRAFT | Rev. A | Map No. **FIGURE A1** | Job No. 60343891

Rev.	By	App.	Description	Date

Client: Waipa DISTRICT COUNCIL

Map features depicted in terms of NZTM projection.

Data Sources:
NZ Topographical Features - LINZ NZ National Topo Dataset 2014
Cadastral Boundaries - LINZ NZ Cadastral Dataset 2014

AECOM

06 Oct 2015 14:18

PDF File Name - \\nzham1fp001.au.aecomnet.com\projects\60X\60343891\4. Tech work Area\4.99 GIS\02_Maps\Underground_Services.mxd

Rev.	By	App.	Description	Date

Notes:

Printed	6/10/2015 2:18:25 p.m.		
Approved	HL	Date	6/10/2015
Designed	SS	Checked	HL
Drawn	SS		

Map features depicted in terms of NZTM projection.

Data Sources:
NZ Topographical Features – LINZ NZ National Topo Dataset 2014
Cadastral Boundaries – LINZ NZ Cadastral Dataset 2014

AECOM

Waipa DISTRICT COUNCIL

Project: **Palmer Street Development: Detailed Site Investigation**

Title: **Underground Services Site Plan**

Scale: 1:700 (A3 size) 5 2.5 0 5 10 15 20 m

Status: Draft | Map No. **Figure A2** | Job No. 60343891 | Rev. **A**

30 Oct 2015 12:19

RESIDENTIAL

ROCHE ST

RETIREMENT HOME

MW02

MW04

RESERVE ZONING

VAILE ST

HA05

HA03

HA02

HA22

HA04

HA01

MW01

HA18

HA07

HA06

HA17

HA15

HA13

HA12

MW03

BRADY ST

HA10

HA09

HA08

HA14

HA16

HA11

HA19

HA20

HA21

PALMER ST

RESIDENTIAL

Legend

Groundwater Monitoring Well

Hand Auger

\\nzham1fp001.au.aecomnet.com\projects\603X\60343891\4. Tech work Area\4.99 GIS\02_Maps\Site_Layout.mxd PDF File Name -

Rev.	By	App.	Description	Date

Notes:

Printed	30/10/2015 12:19:31 p.m.		
Approved	HL	Date	30/10/2015
Designed	SS	Checked	HL
Drawn	SS		

Map features depicted in terms of NZTM projection.

Data Sources:
NZ Topographical Features – LINZ NZ National Topo Dataset 2014
Cadastral Boundaries – LINZ NZ Cadastral Dataset 2014

AECOM

Waipa DISTRICT COUNCIL

Project: **Palmer Street Development: Detailed Site Investigation**

Title: **Site Layout Plan**

Scale: 1:700 (A3 size) 5 2.5 0 5 10 15 20 m

Status: Draft | Map No. **Figure A3** | Job No. 60343891 | Rev. **A**

12 Oct 2015 09:16

\\nzham1fp001.au.aecomnet.com\projects\603X\60343891\4. Tech work Area\4.99 GIS\02_Maps\Piezometric_surface.mxd PDF File Name -

RESIDENTIAL

ROCHE ST

RETIREMENT HOME

RESERVE ZONING

VAILE ST

BRADY ST

PALMER ST

RESIDENTIAL

MW01 83.36

MW02 84.61

MW03 84.58

MW04 84.47

HA01 HA02 HA03 HA04 HA05 HA06 HA07 HA08 HA09 HA10 HA11 HA12 HA13 HA14 HA15 HA16 HA17 HA18 HA19 HA20 HA21 HA22

84.5 84.0 83.5

Legend

- Groundwater Monitoring Well
- Hand Auger
- Piezometric Contour
- Interpreted Groundwater Flow Direction

Rev.	By	App.	Description	Date

Notes:

Printed	30/10/2015 12:21:45 p.m.		
Approved	HL	Date	30/10/2015
Designed	SS	Checked	HL
Drawn	SS		

Map features depicted in terms of NZTM projection.

Data Sources:
NZ Topographical Features – LINZ NZ National Topo Dataset 2014
Cadastral Boundaries – LINZ NZ Cadastral Dataset 2014

AECOM

Waipa DISTRICT COUNCIL

Project: **Palmer Street Development: Detailed Site Investigation**

Title: **Interpreted Piezometric Contour Plan**

Scale: 1:700 (A3 size) 5 2.5 0 5 10 15 20 m

Status: Draft | Map No. **Figure A4** | Job No. 60343891 | Rev. **A**

D R A F T

Appendix B

Waikato Regional Council Information

Waikato regional maps - Google Chrome

giswrcmaps.waikatoregion.govt.nz/WRCMaps/Full.aspx?variant=Groundwater

Tools | Measurements | Selection | WRC Info

Groundwater

Map Content

Layers | Categories

- Groundwater
  - Bore (depth): Less than 25.0m
  - Bore Label 25m
  - Bore (depth): 25.1 - 50.0m
  - Bore Label 50m
  - Bore (depth): 50.1 - 75.00
  - Bore Label 75m
  - Bore (depth): 75.1 -100.0m
  - Bore Label 100m
  - Bore (depth): Over 100.0m
  - Bore Label Over 100m
  - Bore (depth): Unknown
  - Bore Label: Unknown
  - All Bores
- Consents
  - All Consents
  - Land Use - Bore/well
- Base layers
- Images
- Google Maps

0 400 800 m

Waikato regional maps - Google Chrome

giswrcmaps.waikatoregion.govt.nz/WRCMaps/Full.aspx?variant=Groundwater

Tools | Measurements | Selection | WRC Info

Groundwater

Map Content

Layers | Categories

- Groundwater
  - Bore (depth): Less than 25.0m
  - Bore Label 25m
  - Bore (depth): 25.1 - 50.0m
  - Bore Label 50m
  - Bore (depth): 50.1 - 75.00
  - Bore Label 75m
  - Bore (depth): 75.1 -100.0m
  - Bore Label 100m
  - Bore (depth): Over 100.0m
  - Bore Label Over 100m
  - Bore (depth): Unknown
  - Bore Label: Unknown
  - All Bores
- Consents
  - All Consents
  - Land Use - Bore/well
- Base layers
- Images
- Google Maps

0 400 800 m

Waikato regional maps - Google Chrome

giswrcmaps.waikatoregion.govt.nz/WRCMaps/Full.aspx?variant=Groundwater

Tools | Measurements | Selection | WRC Info

Groundwater

Map Content

Layers | Categories

- Groundwater
  - Bore (depth): Less than 25.0m
  - Bore Label 25m
  - Bore (depth): 25.1 - 50.0m
  - Bore Label 50m
  - Bore (depth): 50.1 - 75.00
  - Bore Label 75m
  - Bore (depth): 75.1 -100.0m
  - Bore Label 100m
  - Bore (depth): Over 100.0m
  - Bore Label Over 100m
  - Bore (depth): Unknown
  - Bore Label: Unknown
  - All Bores
- Consents
  - All Consents
  - Land Use - Bore/well
- Base layers
- Images
- Google Maps

0 400 800 m

Bore Report

Construction Details

Bore Id: 72_5344
Driller: Brown Bros Ltd
Date Completed: 6/04/2011
Map Reference: S15:145-517
Easting/Northing: 2714523, 6351746
Observed WQ:
Casing: PVC
Bore Depth: 10 m
Casing Depth: 3.6 m
Screen Interval: 3.6 to 9.5 m
Purpose:
Comments:

Accuracy:
Geothermal: Unknown
Screen: PVC
Bore Diameter: 100 mm
Casing Diameter: 50 mm
Slot Size:

Sample Results

Sample	Date	Parameter	Result	Detection Limit
107588	19/04/2011 10:00:00 a.m.	1,1,1,2-Tetrachloroethane Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,1,1-Trichloroethane Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,1,2,2-Tetrachloroethane Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,1,2-Trichloroethane Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,1,2-Trichlorotrifluoroethane(Freon113) Purge & Trap, GC-MS FS analysis.	<.004 g/m³	0.004
107588	19/04/2011 10:00:00 a.m.	1,1-Dichloroethane Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,1-Dichloroethene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,1-Dichloropropene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,2,3-Trichlorobenzene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,2,3-Trichloropropane Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,2,4-Trichlorobenzene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,2,4-Trimethylbenzene Purge & Trap, GC-MS FS analysis.	.066 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,2-Dibromo-3-chloropropane Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,2-Dibromoethane(ethylene dibromideEDB) Purge & Trap, GC-MS FS analysis.	<.0004 g/m³	0.0004
107588	19/04/2011 10:00:00 a.m.	1,2-Dichlorobenzene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,2-Dichloroethane Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,2-Dichloropropane Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,3,5-Trichlorobenzene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,3,5-Trimethylbenzene Purge & Trap, GC-MS FS analysis.	.0156 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,3-Dichlorobenzene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,3-Dichloropropane Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	1,4-Dichlorobenzene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	2,2-Dichloropropane Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005

107588	19/04/2011 10:00:00 a.m.	2-Butanone (MEK) Purge & Trap, GC-MS FS analysis.	<.005 g/m³	0.005
107588	19/04/2011 10:00:00 a.m.	2-Chlorotoluene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	4-Bromofluorobenzene Purge & Trap, GC-MS FS analysis.	102 %	1
107588	19/04/2011 10:00:00 a.m.	4-Chlorotoluene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	4-Isopropyltoluene (p-Cymene) Purge & Trap, GC-MS FS analysis.	.0007 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	4-Methylpentan-2-one (MIBK) Purge & Trap, GC-MS FS analysis.	<.005 g/m³	0.005
107588	19/04/2011 10:00:00 a.m.	Acenaphthene Solid Phase Extraction, Gas chromotography, mass spec detection, SIM	<.000008 g/m³	0.000008
107588	19/04/2011 10:00:00 a.m.	Acenaphthylene Solid Phase Extraction, Gas chromotography, mass spec detection, SIM	<.000008 g/m³	0.000008
107588	19/04/2011 10:00:00 a.m.	Acetone Purge & Trap, GC-MS FS analysis.	<.05 g/m³	0.05
107588	19/04/2011 10:00:00 a.m.	Anthracene Solid Phase Extraction, Gas chromotography, mass spec detection, SIM	<.000008 g/m³	0.000008
107588	19/04/2011 10:00:00 a.m.	Benzene Purge & Trap, GC-MS FS analysis.	.003 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Benzo[a]anthracene Solid Phase Extraction, Gas chromotography, mass spec detection, SIM	<.000008 g/m³	0.000008
107588	19/04/2011 10:00:00 a.m.	Benzo[a]pyrene (BAP) Solid Phase Extraction, Gas chromotography, mass spec detection, SIM	<.000008 g/m³	0.000008
107588	19/04/2011 10:00:00 a.m.	Benzo[b]fluoranthene Benzo[j]fluoranthene Solid Phase Extraction, Gas chromotography, mass spec detection, SIM	<.000008 g/m³	0.000008
107588	19/04/2011 10:00:00 a.m.	Benzo[g,h,i] perylene Solid Phase Extraction, Gas chromotography, mass spec detection, SIM	<.000008 g/m³	0.000008
107588	19/04/2011 10:00:00 a.m.	Benzo[k] fluoranthene Solid Phase Extraction, Gas chromotography, mass spec detection, SIM	<.000008 g/m³	0.000008
107588	19/04/2011 10:00:00 a.m.	Bromobenzene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Bromodichloromethane Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Bromoform (tribromomethane) Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Bromomethane Purge & Trap, GC-MS FS analysis.	<.002 g/m³	0.002
107588	19/04/2011 10:00:00 a.m.	Carbon disulphide Purge & Trap, GC-MS FS analysis.	<.005 g/m³	0.005
107588	19/04/2011 10:00:00 a.m.	Carbon tetrachloride Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Chlorobenzene (monochlorobenzene) Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Chloroethane Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Chloroform (Trichloromethane) Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Chloromethane Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Chrysene Solid Phase Extraction, Gas chromotography, mass spec detection, SIM	<.000008 g/m³	0.000008
107588	19/04/2011 10:00:00 a.m.	Dibenzo[a,h]anthracene Solid Phase Extraction, Gas chromotography, mass spec detection, SIM	<.000008 g/m³	0.000008
107588	19/04/2011 10:00:00 a.m.	Dibromochloromethane Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Dibromomethane Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Dichlorodifluoromethane Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Dichloromethane (methylene chloride) Purge & Trap, GC-MS FS analysis.	<.01 g/m³	0.01

107588	19/04/2011 10:00:00 a.m.	Ethylbenzene Purge & Trap, GC-MS FS analysis.	.0025 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Fluoranthene Solid Phase Extraction, Gas chromotography, mass spec detection, SIM	<.000008 g/m³	0.000008
107588	19/04/2011 10:00:00 a.m.	Fluorene Solid Phase Extraction, Gas chromotography, mass spec detection, SIM	.000141 g/m³	0.0001
107588	19/04/2011 10:00:00 a.m.	Hexachlorobutadiene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Indeno(1,2,3-c,d)pyrene Solid Phase Extraction, Gas chromotography, mass spec detection, SIM	<.000008 g/m³	0.000008
107588	19/04/2011 10:00:00 a.m.	Isopropylbenzene (Cumene) Purge & Trap, GC-MS FS analysis.	.0074 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Methyl tert-butylether (MTBE) Purge & Trap, GC-MS FS analysis.	<.005 g/m³	0.005
107588	19/04/2011 10:00:00 a.m.	Naphthalene Gas chromotography, mass spec detection, SIM	.039 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Napthalene Solid Phase Extraction, Gas chromotography, mass spec detection, SIM	.039 g/m³	0.0001
107588	19/04/2011 10:00:00 a.m.	Phenanthrene Solid Phase Extraction, Gas chromotography, mass spec detection, SIM	.000026 g/m³	0.000008
107588	19/04/2011 10:00:00 a.m.	Pyrene Solid Phase Extraction, Gas chromotography, mass spec detection, SIM	.00001 g/m³	0.000008
107588	19/04/2011 10:00:00 a.m.	Styrene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Tetrachloroethene (tetrachloroethylene) Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Toluene Purge & Trap, GC-MS FS analysis.	<.001 g/m³	0.001
107588	19/04/2011 10:00:00 a.m.	Toluene-d8 Purge & Trap, GC-MS FS analysis.	100 % Recovery	1
107588	19/04/2011 10:00:00 a.m.	Total Hydrocarbons C10-C14 Sovent extraction, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines.	.5 g/m³	0.2
107588	19/04/2011 10:00:00 a.m.	Total Hydrocarbons C15-C36 Sovent extraction, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines.	1.5 g/m³	0.4
107588	19/04/2011 10:00:00 a.m.	Total Hydrocarbons C7-C36 Sovent extraction, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines.	2.1 g/m³	0.7
107588	19/04/2011 10:00:00 a.m.	Total Hydrocarbons C7-C9 Sovent extraction, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines.	.11 g/m³	0.1
107588	19/04/2011 10:00:00 a.m.	Trichloroethene (trichloroethylene) Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Trichlorofluoromethane Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	Vinyl chloride Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	cis-1,2-Dichloroethene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	cis-1,3-Dichloropropene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	m&p-Xylene Purge & Trap, GC-MS FS analysis.	.031 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	n-Butylbenzene Purge & Trap, GC-MS FS analysis.	.0011 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	n-Propylbenzene Purge & Trap, GC-MS FS analysis.	.0154 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	o-Xylene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	sec-Butylbenzene Purge & Trap, GC-MS FS analysis.	.0009 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	tert-Butylbenzene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	trans-1,2-Dichloroethene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005
107588	19/04/2011 10:00:00 a.m.	trans-1,3-Dichloropropene Purge & Trap, GC-MS FS analysis.	<.0005 g/m³	0.0005

Sample Comments

Sample 107588: Sample taken by Ken Read, Opus International Consultants. Analysed by Hill Laboratories.

Stratigraphic Log

Depth (m)	Primary Lithology	Secondary Lithology	Description
0 - 0.14	Sands		grey orange nedium coarse sand, minor fine gravel, angular, saturated, loose, non plastic
0.14 - 0.3	Sands		Grey brown mottled fine-coarse sand, dry-moist, loose, non plastic
0.3 - 0.5	Silt		Brown/grey bedded silt, moist, soft-firm, slightly plastic
0.5 - 1.68	Sands		Grey fine sand, some medium coarse gravel, saturated, loose, non plastic
1.68 - 2.05	Sands	Silt	Brown silty fine-coarse sand, saturated, loose, non plastic
2.05 - 2.9	Silt		Brown organic silt, wet, soft, slightly plastic
2.9 - 3.4	Sands		Light brownish yellow dilatent fine sand, saturated, loose, non plastic
3.4 - 3.6	Silt		Organic silt, brown, wet, soft, slightly plastic
3.6 - 3.8	Silt		Light brown silt, saturated, very soft, slightly plastic
3.8 - 3.93	Clay	Silt	grey silty clay, minor coarse pumice sand, saturated, very soft, slightly moderately plastic
3.93 - 5.3	Silt		Greenish grey orange mottled silt, minor fine sand, moist, firm, slightly moderately plastic
5.3 - 6	Silt		No mottles, minor fine pumice, wet saturated, very soft
6 - 7.5	Sands	Silt	Yellow silty fine coarse sand, minor fine gravel, saturated, loose, non plastic
7.5 - 7.85	Sands		Yellow sand, minor silt and fine gravel, saturated, loose, non plastic
7.85 - 8.2	Sands		Medium dense
8.2 - 9.4	Sands		orange fine-coarse sand, some fine-coarse pumice gravel, saturated, medium dense, non plastic
9.4 - 10	Sands		Becoming pinkish orange

Bore Report

Construction Details

Bore Id: 72_5332
Driller: Brown Bros Ltd
Date Completed: 8/12/2009
Map Reference: S15:144-523
Easting/Northing: 2714452, 6352384
Accuracy:
Observed WQ:
Geothermal: N
Casing: PVC
Screen: PVC
Bore Depth: 10 m
Bore Diameter: 100 mm
Casing Depth: 2.8 m
Casing Diameter: 50 mm
Screen Interval: 2.8 to 10 m
Slot Size:
Purpose:
Comments: Water level = 5.10 08/12/09.
Well back filled 0 - 2.8 bentonite, 2.8 - 15.0 Walton park sand.

Stratigraphic Log

Depth (m)	Primary Lithology	Secondary Lithology	Description
0 - 0.1	Silt	Clay	Silt some clay, minor coarse sand dark brown
0.1 - 0.95	Silt	Clay	Light yellowish brown clayey silt, soft dry to moist slightly to moderately plastic
0.95 - 2.06	Clay	Silt	Light yellowish brown silty clay trace of fine sand, soft to firm moist moderatly plastic
2.06 - 2.2	Sands	Silt	Silty sand fine to coarse homogeneous, loose moist wet poorly graded

2.2 - 2.5	Silt		Light brown homogeneous silt. Firm moist to firm slightly plastic
2.5 - 5.4	Clay	Silt	Brown clay some silt homogeneous, soft to firm, moist, moderately to highly plastic
5.4 - 5.66	Clay	Gravels	Clay some fine gravels and silt, minor sand, light brown mottled orange speckled black. Soft to firm, wet slightly plastic. Gravel fine subrounded highly weathered black, uniformly graded
5.66 - 6.1	Silt	Clay	Light yellow brown silt some clay, mottled red and grey, homogeneous, siff wet slightly plastic sensitive. gravel 5.8 - 5.9 gravel fine to medium angular highly weathered
6.1 - 7	Silt	Sands	Grey mottled red sandy silt some clay homogeneous. Soft to firm wet to saturated slightly plastic
7 - 7.6	Silt	Clay	Silt some clay and gravel, grey mottled red homogeneous, stiff wet slightly plastic, sensitive.Gravel fine angular, highly weathered.
7.6 - 8	Sands	Silt	Brown grey sand minor silt, homogeneous. Loose saturated poorly sorted
8 - 8.1	Silt		Light yellowish grey silt, wet slightly plastic
8.1 - 8.5	Silt		Silt brown bedding sub horizontal laminated
8.5 - 8.7	Silt		Silt saturated
8.7 - 8.85	Sands		Some fine sand
8.85 - 10.24	Sands		Fine to medium sand, minor silt, grey homogeneous, dense wet poorly sorted
10.24 - 11.66	Sands	Pumice	Sand fine to coarse bedding sub horizontal laminated
11.66 - 12.1	Silt		Organic silt dark brown homogeneous.Stiff moist slightly plastic moderatly sensitive
12.1 - 12.8	Sands		Fine to coarse sand some silt green homogeneous. Dense wet poorly graded, sand mainly fine
12.8 - 13	Sands		Sand saturated
13 - 13.64	Sands	Gravels	Fine to coarse gravely sand green speckled white homogeneous, dense wet poorly graded, sand , coarse.
13.64 - 15	Sands	Gravels	Gravel fine to coarse sand light green speckled white homogeneous. Very dense poorly gradded. Gravel fine sub rounded. Fresh to slightly weathered (completely weathered ignimbrite)

Bore Report

Construction Details

Bore Id: 72_4632
Driller: Barham United Welldrillers Ltd
Date Completed: 9/11/1999
Map Reference: S15:146-525
Easting/Northing: 2714600, 6352500
Accuracy:
Observed WQ: Good
Geothermal: N
Casing: Steel
Screen:
Bore Depth: 63 m
Bore Diameter: 100 mm
Casing Depth: 54 m
Casing Diameter: 100 mm
Screen Interval:
Slot Size:
Purpose: Consent Current: Construct a well for domestic & stock watering purposes

Comments: Driller comment: WQ good.

Sample Results

Sample	Date	Parameter	Result	Detection Limit

102861	9/11/1999 12:00:00 p.m.	Bore Pumping Rate Bore Pumping Rate as determined by the flow test method. Used by Located	.52371 m³/d
102861	9/11/1999 12:00:00 p.m.	Static Bore Water Level The static bore or well water level as determined by the flow test method. Used by Located	6.5 m

Stratigraphic Log

Depth (m)	Primary Lithology	Secondary Lithology	Description
0 - 1	Soil		Topsoil
1 - 12	Clay		Clay
12 - 55	Pumice	Sands	Brown pumices, sands and gravels
55 - 60	Pumice		Yellow pumices
60 - 63	Pumice	Clay	Pink pumices and clay

Bore Report

Construction Details

Bore Id: 72_5650
Driller: J Jones Ltd
Date Completed:
Map Reference: S15:145-515
Easting/Northing: 2714500, 6351500
Accuracy:
Observed WQ:
Geothermal: Unknown
Casing:
Screen:
Bore Depth:
Bore Diameter:
Casing Depth:
Casing Diameter:
Screen Interval:
Slot Size:
Purpose:
Comments: Arapuni Road, Dairy number 3989, next to concrete tank

Bore depth: Ido min
Casing depth: 32.5
Casing diameter: 100mm

Pumping test

SWL: 28m
Drawdown: 1.9m
Duration of pumping: 4 hours

Water quality is good

Stratigraphic Log

Depth (m)	Primary Lithology	Secondary Lithology	Description
0 - 3	Clay		Brown Clay
3 - 16	Clay		Clay and odd rhyolitic boulder
16 - 24	Clay		Clay and odd rhyolitic boulder
24 - 33	Rhyolite		Rhyolitic green
33 - 46	Rhyolite		Rhyolitic brown and grey
46 - 47	Organics		
47 - 65	Sands		Rhyolitic sands
65 - 66	Clay		Fawn clay

Bore Report

Construction Details

Bore Id: 70_1122
Driller: Pattle Delamore Partners Limited
Date Completed: 18/03/1996
Map Reference: S15:145-523
Easting/Northing: 2714500, 6352300
Accuracy: +/- 6 m
Observed WQ:
Geothermal: Unknown
Casing:
Screen:
Bore Depth: 5 m
Bore Diameter:
Casing Depth: 1 m
Casing Diameter:
Screen Interval: 1 to 5 m
Slot Size:
Purpose:

Comments: Well Location: 133 Arawata Street, Te Awamutu \ Driller: Pattle Delamore \ Owner: Craik Motors \ Permit No: 3112

Stratigraphic Log

Depth (m)	Primary Lithology	Secondary Lithology	Description
0 - 0.2	Gravels		
0.2 - 1	Sands		medium coarse brown grey loose slightly sandy silty
1 - 4.5	Sands	Silt	orange to brown loose slightly sandy silty
4.5 - 5	Sands	Silt	orange mottled slightly clayey/claybound

Bore Report

Construction Details

Bore Id: 70_1127
Driller: Pattle Delamore Partners Limited
Date Completed: 18/03/1996
Map Reference: S15:145-523
Easting/Northing: 2714500, 6352300 **Accuracy:** +/- 6 m
Observed WQ: Unknown **Geothermal:** Unknown
Casing: **Screen:**
Bore Depth: 7.5 m **Bore Diameter:**
Casing Depth: 2.4 m **Casing Diameter:**
Screen Interval: 2.4 to 7.5 m **Slot Size:**
Purpose:
Comments: Well Location: 133 Arawata Street, Te Awamutu \ Driller: Pattle Delamore \ Owner: Craik Motors \ Permit No: 3112 \ General Remarks: Static water level at drilling 5.63m

Sample Results

Sample	Date	Parameter	Result	Detection Limit
64084	19/03/1996	Static Bore Water Level The static bore or well water level as determined by the flow test method. Used by Located	5.63 m	

Stratigraphic Log

Depth (m)	Primary Lithology	Secondary Lithology	Description
0 - 0.2	Gravels		
0.2 - 1.5	Sands		fine with slightly silty brown to grey loose
1.5 - 6	Silt		slightly fine sandy brown compacted
6 - 7.5	Silt	Sands	grey green orange white soft

Bore Report

Construction Details

Bore Id: 70_1128
Driller: Pattle Delamore Partners Limited
Date Completed: 18/03/1996
Map Reference: S15:145-523
Easting/Northing: 2714500, 6352300 **Accuracy:** +/- 6 m
Observed WQ: Unknown **Geothermal:** Unknown
Casing: **Screen:**
Bore Depth: 7.5 m **Bore Diameter:**
Casing Depth: 2.4 m **Casing Diameter:**
Screen Interval: 2.4 to 7.5 m **Slot Size:**
Purpose:
Comments: Well Location: 133 Arawata Street, Te Awamutu \ Driller: Pattle Delamore \ Owner: Craik Motors \ Permit No: 3112 \ General Remarks: Static water level at drilling 5.65

Sample Results

Sample	Date	Parameter	Result	Detection Limit
64085	19/03/1996	Static Bore Water Level The static bore or well water level as determined by the flow test method. Used by Located	5.65 m	

Stratigraphic Log

Depth (m)	Primary Lithology	Secondary Lithology	Description
0 - 0.2	Gravels		
0.2 - 1.5	Silt	Sands	brown loose
1.5 - 5.5	Silt		brown slightly fine sandy compacted
5.5 - 7.5	Silt	Sands	fine sandy green grey soft

Bore Report

Construction Details

Bore Id: 70_1129
Driller: Pattle Delamore Partners Limited
Date Completed: 18/03/1996
Map Reference: S15:145-523
Easting/Northing: 2714500, 6352300 **Accuracy:** +/- 6 m
Observed WQ: Unknown **Geothermal:** Unknown
Casing: **Screen:**
Bore Depth: 7.5 m **Bore Diameter:**
Casing Depth: 2.4 m **Casing Diameter:**
Screen Interval: 2.4 to 7.5 m **Slot Size:**
Purpose:
Comments: Well Location: 133 Arawata Street, Te Awamutu\ \ Driller: Pattle Delamore \ Owner: Craik Motors \ Permit No: 3112 \ General Remarks: static water level 5.79m at drilling

Sample Results

Sample	Date	Parameter	Result	Detection Limit
64086	19/01/1996	Static Bore Water Level The static bore or well water level as determined by the flow test method. Used by Located	5.79 m	

Stratigraphic Log

Depth (m)	Primary Lithology	Secondary Lithology	Description
0 - 0.2	Gravels		
0.2 - 2	Sands		brown loose silty
2 - 5.5	Silt		slightly clayey/claybound brown slightly sandy compacted
5.5 - 6	Silt		brown mottled soft slightly sandy
6 - 7.5	Sands		fine orange to white soft silty

Bore Report

Construction Details

Bore Id: 70_1130
Driller: Pattle Delamore Partners Limited
Date Completed: 18/03/1996
Map Reference: S15:145-523
Easting/Northing: 2714500, 6352300 **Accuracy:** +/- 6 m
Observed WQ: Unknown **Geothermal:** Unknown
Casing: **Screen:**
Bore Depth: 7 m **Bore Diameter:**
Casing Depth: 2 m **Casing Diameter:**
Screen Interval: 2 to 7 m **Slot Size:**
Purpose:
Comments: Well Location: 133 Arawata Street, Te Awamutu \ Driller: pattle Delamore \ Owner: Craik Motors \ Permit No: 3112 \ General Remarks: Static water level at drilling 5.71m

Sample Results

Sample	Date	Parameter	Result	Detection Limit
64087	19/03/1996	Static Bore Water Level The static bore or well water level as determined by the flow test method. Used by Located	5.71 m	

Stratigraphic Log

Depth (m)	Primary Lithology	Secondary Lithology	Description

0 - 0.2	Gravels		
0.2 - 1	Sands	brown loose silty	
1 - 4	Silt	brown slightly clayey/claybound compacted	
4 - 5	Silt	orange mottled slightly sandy compacted	
5 - 7	Silt	orange brown with black Streaked sandy	

Bore Report

Construction Details

Bore Id: 70_1131
Driller: Pattle Delamore Partners Limited
Date Completed: 18/03/1996
Map Reference: S15:145-523
Easting/Northing: 2714500, 6352300 **Accuracy:** +/- 6 m
Observed WQ: Unknown **Geothermal:** Unknown
Casing: **Screen:**
Bore Depth: 7 m **Bore Diameter:**
Casing Depth: 2 m **Casing Diameter:**
Screen Interval: 2 to 7 m **Slot Size:**
Purpose:
Comments: Well Location: 133 Arawata Street, Te Awamutu \ Driller: Pattle Delamore \ Owner: Craik Motors \ Permit No: 3112 \ General Remarks: Static water level 4.81m

Sample Results

Sample	Date	Parameter	Result	Detection Limit
64088	19/03/1996	Static Bore Water Level The static bore or well water level as determined by the flow test method. Used by Located	4.81 m	

Stratigraphic Log

Depth (m)	Primary Lithology	Secondary Lithology	Description
0 - 0.2	Gravels		
0.2 - 2	Silt		brown loose sandy
2 - 4	Silt		slightly clayey/claybound brown compacted
4 - 5.5	Silt		orange mottled
5.5 - 7	Sands		orange to white soft silty

Bore Report

Construction Details

Bore Id: 70_1132
Driller: Pattle Delamore Partners Limited
Date Completed: 18/03/1996
Map Reference: S15:145-523
Easting/Northing: 2714500, 6352300 **Accuracy:** +/- 6 m
Observed WQ: Unknown **Geothermal:** Unknown
Casing: **Screen:**
Bore Depth: 7 m **Bore Diameter:**
Casing Depth: 2 m **Casing Diameter:**
Screen Interval: 2 to 7 m **Slot Size:**
Purpose:
Comments: Well Location: 133 Arawata Street, Te Awamutu \ Driller: Pattle Delamore \ Owner: Craik Motors \ Permit No: 3112 \ General Remarks: Static water level 5.79m

Sample Results

Sample	Date	Parameter	Result	Detection Limit
64089	19/03/1996	Static Bore Water Level The static bore or well water level as determined by the flow test method. Used by Located	5.79 m	

Stratigraphic Log

Depth (m)	Primary Lithology	Secondary Lithology	Description
0 - 0.2	Gravels		
0.2 - 2.5	Silt		brown loose sandy

2.5 - 4	Silt	slightly clayey/claybound brown compacted
4 - 4.5	Silt	orange to black mottled compacted
4.5 - 7	Sands	orange to white soft silty

Bore Report

Construction Details

Bore Id: 70_1133
Driller: Pattle Delamore Partners Limited
Date Completed: 18/03/1996
Map Reference: S15:145-523
Easting/Northing: 2714500, 6352300 **Accuracy:** +/- 6 m
Observed WQ: Unknown **Geothermal:** Unknown
Casing: **Screen:**
Bore Depth: 7 m **Bore Diameter:**
Casing Depth: 2 m **Casing Diameter:**
Screen Interval: 2 to 7 m **Slot Size:**
Purpose:
Comments: Well Location: 133 Arawata Street, Te Awamutu \ Driller: Pattle Delamore \ Owner: Craik Motors \ Permit No: 3112 \ General Remarks: Static water level 5.3m

Sample Results

Sample	Date	Parameter	Result	Detection Limit
64090	19/03/1996	Static Bore Water Level The static bore or well water level as determined by the flow test method. Used by Located	5.3 m	

Stratigraphic Log

Depth (m)	Primary Lithology	Secondary Lithology	Description
0 - 0.2	Gravels		
0.2 - 3.7	Silt		brown slightly clayey/claybound loose to compacted sandy
3.7 - 4.5	Silt		slightly clayey/claybound sandy orange mottled with black Streaked
4.5 - 6.7	Silt		orange compacted to soft sandy
6.7 - 7	Silt		white to yellow mottled compacted

Bore Report

Construction Details

Bore Id: 70_1172
Driller: J Jones Ltd
Date Completed: 3/03/1998
Map Reference: S15:145-515
Easting/Northing: 2714500, 6351500 **Accuracy:** +/- 6 m
Observed WQ: Good **Geothermal:** Unknown
Casing: **Screen:**
Bore Depth: 66 m **Bore Diameter:** 100 mm
Casing Depth: 32.5 m **Casing Diameter:**
Screen Interval: **Slot Size:**
Purpose:
Comments: Well Location: Arapuni Road, Dairy number 3989 \ Map Ref: S15:145-515 \ Driller: J Jones \ Owner: J Roigard \ Permit No: 3894 \ Depth of Casing: 32.5 m \ General Remarks: water quality good \ WL Date: 28 m (980303). Bore for domestic & stock purposes.

Sample Results

Sample	Date	Parameter	Result	Detection Limit
63719	5/03/1998	Bore Drawdown (max) Maximum Bore drawdown as determined by the flow test method. Used by Located	1.9 m	
63719	5/03/1998	Bore Pumping Rate Bore Pumping Rate as determined by the flow test method. Used by Located	26.1864 m^3/d	

63719	5/03/1998	Pumping Test Duration Bore or Well Pump Test Duration as determined by the flow test method. Used by Located	4 h
63719	5/03/1998	Static Bore Water Level The static bore or well water level as determined by the flow test method. Used by Located	28 m

Stratigraphic Log

Depth (m)	Primary Lithology	Secondary Lithology	Description
0 - 3	Clay		brown
3 - 16	Clay		rhyolitic
16 - 24	Clay		rhyolitic
24 - 33	Rhyolite		green
33 - 46	Rhyolite		brown grey
46 - 47			clayey/claybound
47 - 65	Sands		rhyolitic
65 - 66	Clay		brown

Bore Report

Construction Details

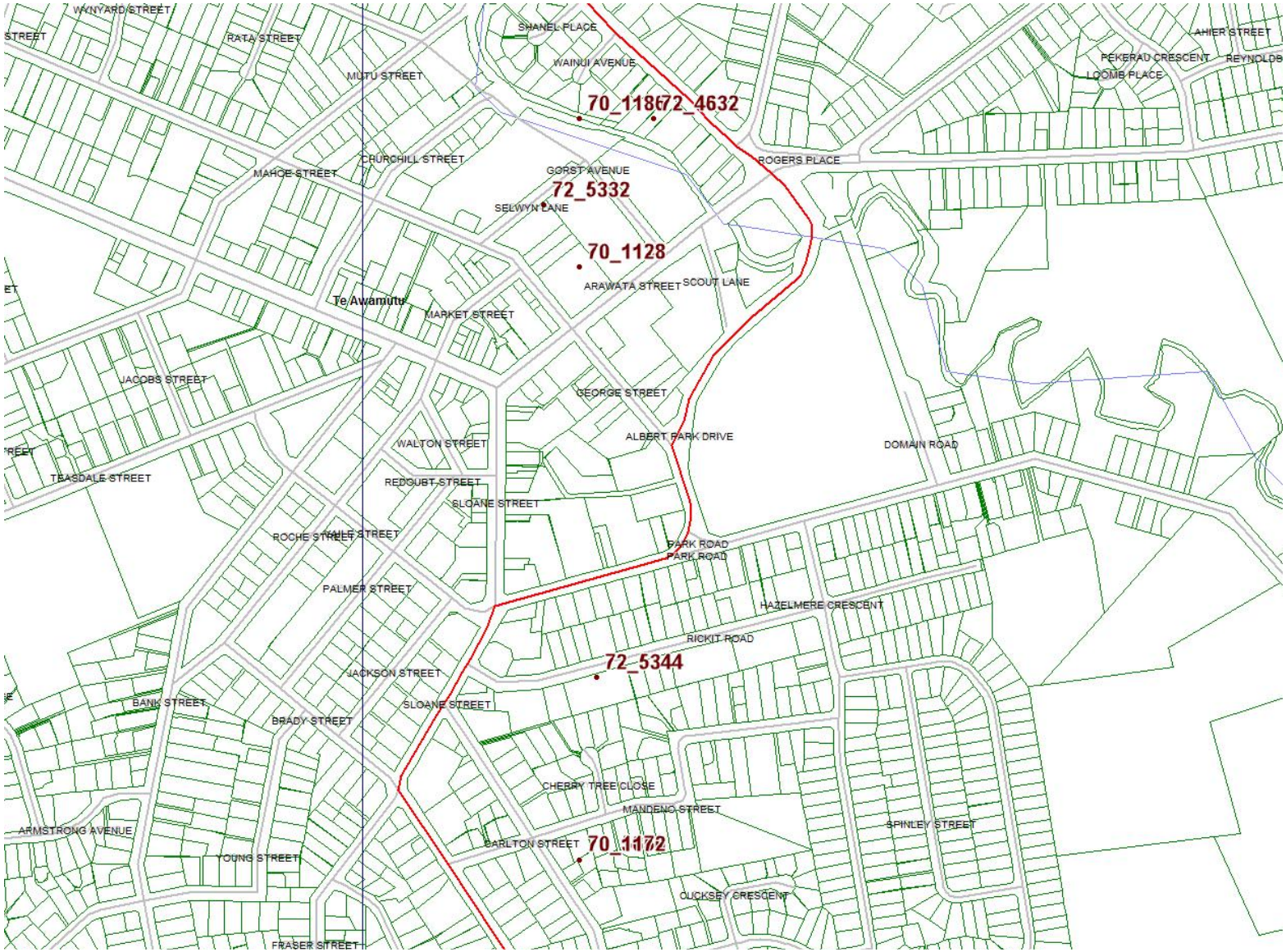
Bore Id: 70_1186
Driller: Benton & Son Ltd
Date Completed: 1/08/1998
Map Reference: S15:145-525
Easting/Northing: 2714500, 6352500
Accuracy: +/- 6 m
Observed WQ: Good
Geothermal: Unknown
Casing:
Screen:
Bore Depth: 143.8 m
Bore Diameter: 144 mm
Casing Depth: 47.2 m
Casing Diameter:
Screen Interval:
Slot Size:
Purpose:
Comments: Well Location: 93 Duncan Road, RD4 Te Awamutu \ Driller: Benton and Son \ Owner: Mike Graham \ Permit No: 3775 \ Depth of Casing: 47.2 m \ WL Date: 64.6 m.Bore for domestic stock purposes.

Sample Results

Sample	Date	Parameter	Result	Detection Limit
63819	1/08/1998	Bore Drawdown (max) Maximum Bore drawdown as determined by the flow test method. Used by Located	10.3 m	
63819	1/08/1998	Bore Pumping Rate Bore Pumping Rate as determined by the flow test method. Used by Located	129.6 m^3/d	
63819	1/08/1998	Pumping Test Duration Bore or Well Pump Test Duration as determined by the flow test method. Used by Located	2 h	
63819	1/08/1998	Static Bore Water Level The static bore or well water level as determined by the flow test method. Used by Located	64.6 m	

Stratigraphic Log

Depth (m)	Primary Lithology	Secondary Lithology	Description
0 - 21.3	Clay		brown
21.3 - 22.4	Rhyolite		soft brown
22.4 - 31.5	Clay		brown
31.5 - 34.1	Sands		soft grey
34.1 - 59.4			firm
59.4 - 87.1	Rhyolite		brown
87.1 - 96	Ash		black
96 - 143.8	Rhyolite		brown grey


WINYARD STREET
STREET
RATA STREET
MUTU STREET
SHANEL PLACE
WAINUI AVENUE
AHIER STREET
PEKERAU CRESCENT
REYNOLDS
LOOMB PLACE
70_1186
72_4632
CHURCHILL STREET
MAHOE STREET
GORST AVENUE
ROGERS PLACE
72_5332
SELWYN LANE
70_1128
ARAWATA STREET
SCOUT LANE
Te Awamutu
MARKET STREET
JACOBS STREET
GEORGE STREET
ALBERT PARK DRIVE
DOMAIN ROAD
WALTON STREET
TEASDALE STREET
REDOUBT STREET
SLOANE STREET
ROCHE STREET
WALE STREET
PARK ROAD
PARK ROAD
PALMER STREET
HAZELMERE CRESCENT
RICKIT ROAD
72_5344
JACKSON STREET
BANK STREET
SLOANE STREET
BRADY STREET
CHERRY TREE CLOSE
MANDENO STREET
ARMSTRONG AVENUE
SPINLEY STREET
CARLTON STREET
70_1172
YOUNG STREET
DUCKSEY CRESCENT
FRASER STREET

Humphrey, Sussanna

From: Debbie Dewar <Debbie.Dewar@waikatoregion.govt.nz>
Sent: Tuesday, 9 June 2015 2:50 p.m.
To: Humphrey, Sussanna
Subject: RE: Resource Consents Search: Palmer Street, Te Awamutu

Dear Susie,

Thank you for your enquiry regarding information the Waikato Regional Council may hold relating to potential contamination at the properties indicated below:

Property A: 114 Palmer Street, Te Awamutu: ALOT 87 VILF TE AWAMUTU ALOT 89 VILF TE AWAMUTU ALOT 91 VILF TE AWAMUTU ALOT 93 VILF TE AWAMUTU ALOT 95 VILF TE AWAMUTU ALOT 97 VILF TE AWAMUTU ALOT 99 VILF TE AWAMUTU Pt ALOT 85 VILF TE AWAMUTU (VRN 04482/272/00) – LUI02770

Property B: 287/2 Roche Street, Te Awamutu: ALOT 92 VILF FLAT 2 DPS 36667 (VRN 04482/268/00B)

Property C: 387 Roche Street, Te Awamutu: ALOT 82 VILF TE AWAMUTU ALOT 84 VILF TE AWAMUTU ALOT 86 VILF TE AWAMUTU ALOT 88 VILF TE AWAMUTU ALOT 90 VILF TE AWAMUTU LOT 2 DPS 20361 (VRN 04482/263/00)

Background: The Waikato Regional Council maintains a register of properties known to be contaminated on the basis of chemical measurements, or potentially contaminated on the basis of past land use. This register (called the Land Use Information Register) is still under development and should not be regarded as comprehensive.

The 'potentially contaminated' category is gradually being compiled with reference to past or present land uses that have a greater than average chance of causing contamination, as outlined in the Ministry for the Environment's Hazardous Activities and Industries List (HAIL): http://www.mfe.govt.nz/issues/managing-environmental-risks/contaminated-land/is-land-contaminated/hazardous-activities-industries-list.pdf.

Property A: I can confirm that this property does currently appear on the Land Use Information Register, with a classification of 'Unverified HAIL'. The property is listed due to past land use activity as a landfill. The known trading names for the site are Waipa District Council closed landfill and Te Awamutu Borough Council. We do not have any specific information or reports regarding the presence or otherwise of hazardous substances in the soil at the property .

Property B: I can confirm that this property does not currently appear on the Land Use Information Register.

Property C: I can confirm that this property does not currently appear on the Land Use Information Register.

Other properties identified as on the Land Use Information Register within 200 m of the subject sites:

Pirongia Bowling Club Incorporated: 0 Teasdale Street, Te Awamutu: LOT 6 DP 1182 Pt LOT 5 DP 1182 Pt LOT 7 DP 1182 Pt LOT 8 DP 1182 (VRN 04482/174/00) – LUI07274

I can confirm that this property does currently appear on the Land Use Information Register, with a classification of 'Verified HAIL – No sampling'. The property is listed due to past and current land use as a bowling club, which may have utilised persistent pesticides. We do not have any specific information or reports regarding the presence or otherwise of hazardous substances in the soil at the property.

McEntee Hire: 0 and 60 Vaile Street, Te Awamutu: LOT 1 DP 325706 ALOT 111 VILF TE AWAMUTU (VRN 04492/195/02 and 04492/195/01) – LUI07333

I can confirm that this property does appear on the Land Use Information Register with a classification of 'Verified HAIL- no sampling'. The property is listed because of its confirmed past and present land use for 'Storage tanks or drums for fuel'. We do not have any specific information or reports regarding the presence or otherwise of hazardous substances in the soil at the property; although there is record of a diesel spill occurring at the property in November 2011.

Te Awamutu Gracelands Trust: 48 Teasdale Street, Te Awamutu: LOT 2 DP 409057 Pt LOT 1 DP 26343 Pt SEC 69 Teasdale SETT (VRN 04492/148/02) - LUI02945

I can confirm that this property does currently appear on the Land Use Information Register, with a classification of 'Unverified HAIL'. The property is listed because of its past land use for a motor vehicle workshop and for storage tanks or drums for fuel, chemicals or liquid waste associated with Ebbett Motors Limited. We have a note on file that Waipa District Council notes that underground tanks have been removed from the site. We do not have any specific information or reports regarding the presence or otherwise of hazardous substances in the soil at the property.

Paper Plus: 263 Alexandra Street, Te Awamutu: LOT 1 DP 27264 LOT 1 DP 409057 LOT 2 DP 27264 (VRN 04492/148/01) – LUI02976

I can confirm that this property does currently appear on the Land Use Information Register, with a classification of 'Verified HAIL – No sampling'. The property is listed due to past land use as a motor vehicle workshop (Kirks Garage (Te Awamutu) Ltd). We do not have any specific information or reports regarding the presence or otherwise of hazardous substances in the soil at the property.

Waipa Car Painters Ltd: 494 Sloane Street, Te Awamutu: LOT 2 DPS 14730 (VRN 04492/211/00) – LUI02901

I can confirm that this property does currently appear on the Land Use Information Register, with a classification of 'Verified HAIL – No sampling'. The property is listed due to past land use as a motor vehicle workshop. We do not have any specific information or reports regarding the presence or otherwise of hazardous substances in the soil at the property.

Te Awamutu Telephone Exchange: 5 Walton Street, Te Awamutu: SEC 2 SO 58127 (VRN 04492/192/00)

I can confirm that this property does currently appear on the Land Use Information Register, with a classification of 'Verified HAIL – No Sampling'. The property is listed for past land use activity for storage tanks or drums for fuel, chemicals or liquid waste. A note on file indicates while the property was occupied by Transfield that the site has had bulk fuel storage. We do not have any specific information or reports regarding the presence or otherwise of hazardous substances in the soil at the property.

Rickett and Sons: 54 Slone Street and 9 Walton Street, Te Awamutu: ALOT 163 VILF TE AWAMUTU Pt ALOT 158 VILF TE AWAMUTU PT ALOT 159 VILF TE AWAMUTU PT ALOT 160 VILF TE AWAMUTU and ALOT 164 VILF (VRN 04492/191/00 and 04492/190/01) – LUI00178

I can confirm that this property does currently appear on the Land Use Information Register, with a classification of 'Verified HAIL – No sampling'. The property is listed due to past land use for 'wood treatment or preservation or bulk storage of treated timber'. We do not have any specific information or reports regarding the presence or otherwise of hazardous substances in the soil at the property.

Hawley & Cooper Ltd: 144 Slone Street, Te Awamutu: LOT 1 DPS 68412 (VRN 04492/196/02) – LUI02876

I can confirm that this property does currently appear on the Land Use Information Register, with a classification of 'Verified HAIL – No sampling'. The property is listed due to past land use as a motor vehicle workshop. We do not have any specific information or reports regarding the presence or otherwise of hazardous substances in the soil at the property.

Warner Reg 1970 Limited: 154 Slone Street, Te Awamutu: LOT 1 DPS 61898 (VRN 04492/200/00) – LUI02902

I can confirm that this property does currently appear on the Land Use Information Register, with a classification of 'Verified HAIL – No sampling'. The property is listed due to past land use as a motor vehicle workshop. We do not have any specific information or reports regarding the presence or otherwise of hazardous substances in the soil at the property.

Browne Roy Car Painters Ltd: 181 Slone Street, Te Awamutu: LOT 1 DPS 13463 LOT 2 DP 13167 PT LOT 1 DP 13167 Pt LOT 1 DP 17648 (VRN 04492/126/00) – LUI02867

I can confirm that this property does currently appear on the Land Use Information Register, with a classification of 'Verified HAIL – No sampling'. The property is listed due to past land use as a motor vehicle workshop. We do not have any specific information or reports regarding the presence or otherwise of hazardous substances in the soil at the property.

D Bain & Sons Ltd: 121 Sloane Street, Te Awamutu: LOT 2 DPS 17098 Pt LOT 6 DP 10408 Pt LOT 8 DP 10408 (VRN 04492/124/00) – LUI02943

I can confirm that this property does currently appear on the Land Use Information Register, with a classification of 'Verified HAIL – No sampling'. The property is listed due to past land use as a motor vehicle workshop. We do not have any specific information or reports regarding the presence or otherwise of hazardous substances in the soil at the property.

Te Awamutu Service Station Ltd: 105 Sloane Street, Te Awamutu: LOT 2 DP 24125 Pt LOT 8 DP 10408 (VRN 04492/123/00) – LUI03024

I can confirm that this property does currently appear on the Land Use Information Register, with a classification of 'Unverified HAIL'. The property is listed due to past land use as a service station. We do not have any specific information or reports regarding the presence or otherwise of hazardous substances in the soil at the property.

Sincerity Drycleaners: 97 Sloane Street, Te Awamutu: LOT 2 DPS 24499 (VRN 04492/122/00) – LUI02830

I can confirm that this property does currently appear on the Land Use Information Register, with a classification of 'Verified HAIL – No sampling'. The property is listed due to current and past land use as a drycleaners. We do not have any specific information or reports regarding the presence or otherwise of hazardous substances in the soil at the property.

District Councils: Our records are not integrated with those of territorial authorities, so it would also be worth contacting the Waipa District Council to complete your audit of Council records if you have not already done so. In general, information about known contaminated land will be included on a property LIM produced by the territorial authority.

Rural Land Considerations: Examples of sites that are "more likely than not" to have soil contamination (HAIL sites) include timber treatment activities, service stations and/or petroleum storage, panel beaters, spray painters, etc. Whilst pastoral farming is not included on this list, typical farming activities of horticulture, sheep dipping, chemical storage, petroleum storage and workshops are; but are more difficult to identify and may not be as well represented on the Land Use Information Register. Therefore, individuals interested in pastoral land may be interested in completing further investigations in accordance with Ministry for the Environment Guidelines prior to land purchase and/or development.

Additional Information: Please also note that significant use of lead-based paint on buildings can, in some cases, pose a contamination risk; the use of lead-based paint is not recorded on the Land Use Information Register. Likewise, the long term, frequent use of superphosphate fertilisers can potentially result in elevated levels of cadmium on some properties.

Please feel free to contact me if you have any further queries, or would like to discuss the matter further.

Kind regards,

Debbie Dewar | Scientist- Contaminated Land | Science and Strategy Directorate
Waikato Regional Council
P: +64 7 859 0549
F: +64 7 859 0998
Private Bag 3038, Waikato Mail Centre, Hamilton 3240

AUTH135267.01.01 | Well drilling

Land Use Consent | Land - well Status: **Current**

Holder: Waipa District Council

General Information Edit

IRIS ID: AUTH135267.01.01 **Primary Industry/Purpose:** Water supply - municipal/community **Officer Responsible:** Ruth Hutchinson
Authorisation Type: Resource Consent **Secondary Industry/Purpose:** **Authorisation Exercised:** Yes
Activity Type: Land Use Consent **Expected Lifetime:** Limited
Activity Subtype: Land - well **Granted Duration:** 6 **Previous Authorisation:**
Commencement Date: 14/04/2015 **Duration Type:** Months **Application Activity:** Well drilling
Expiry Date: 13/10/2015
Lapse Date:

Authorisation Name
Well drilling

Authorisation Description
construct 4 wells for groundwater monitoring purposes

Monitoring Notes

Status History Add

Status	Date/Time	Created By	
Current	14/04/2015 09:13	Ruth Hutchinson	Edit

Linked Authorisation Holders/Agents Show All Add

Linked Item	Linked As	From	To	
Waipa District Council	Authorisation Holder	14/04/2015		Edit

Name and Address for Service Edit

Waipa District Council Private Bag 2402, Te Awamutu 3840

Linked Locations Show All Add

Linked Item	IRIS ID	Linked As	From	To	
175 Vaile Street Te Awamutu	LOC188578	Authorisation Location	14/04/2015		Edit
Bore - 135267 | Authorised extent	LOC188599	Authorisation Location	14/04/2015		Edit

Related Applications

Regional Plans/Rules/Objectives Add

Plan	Rule/Objective	Rule/Objective Description	
Waikato Regional Plan	3.8.4.7 - Controlled Activity Rule - Drilling Below the Water Table		Edit

Other Identifiers Add

Other Links Show All Add

Humphrey, Sussanna

From:	Sharron Peek <Sharron.Peek@waikatoregion.govt.nz>
Sent:	Wednesday, 10 June 2015 10:40 a.m.
To:	Humphrey, Sussanna
Subject:	RE: Resource Consents Search: Palmer Street, Te Awamutu
Attachments:	AUTH135267.01.01.pdf

Hi Sussanna

As at today's date there is only the one consent in that area in our database as described below;

- AUTH135267.01.01 – Construct 4 wells for groundwater monitoring purposes – due to expire 13/10/15.

Regards

Sharron Peek | Information and Advisory | Resource Use Group
Waikato Regional Council
P: 0800 800 402
Private Bag 3038, Waikato Mail Centre, Hamilton 3240
Please consider the environment before printing this email

D R A F T

Appendix C

Results

Table C1
Soil Analytical Results - Metals
Palmer Street - Palmer St Development
Waipa District Council

AECOM

							Metals							
							Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
							mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
MfE NES contaminants in soil (Residential 10% Produce)							**20**	**3**		**10,000**	**210**	**310**		
Waikato Background Ranges							1 - 25	0.03 - 0.3	1 - 150	4 - 55	3 - 32	-	0.56 - 21	11 - 58
Sample Location	**Sample Depth (m bgl)**	**Field ID**	**Lab Sample Number**	**Date Sampled**	**Guideline Soil Type**	**PID Reading (ppm)**								
HA01	0.15	PHA01 0.15m	1416847_1	21-Apr-15	Sandy SILT	0.0	6	0.19	14	42	93	0.24	6	84
HA02	0.1	PHA02 0.1m	1416847_3	21-Apr-15	Sandy SILT	8.0	12	0.37	12	24	26	<0.1	5	112
	0.4	PHA02 0.4m	1416847_4	21-Apr-15	Silty CLAY	0.0	9	0.39	12	26	35	0.15	5	92
HA03	0.2	PHA03 0.2m	1416847_5	21-Apr-15	Silty CLAY	9.6	9	0.29	13	36	53	0.19	7	99
	0.45	PHA03 0.45m	1416847_6	21-Apr-15	Silty CLAY	0.0	10	0.3	14	41	67	0.14	11	220
HA04	0.1	PHA04 0.1m	1416847_7	21-Apr-15	Silty CLAY	28.0	14	0.46	15	50	**2900**	0.1	8	156
HA05	0.1	PHA05 0.1m	1416847_9	21-Apr-15	Sandy SILT	17.0	6	0.11	13	27	35	0.16	5	73
	0.45	PHA 05 0.45m	1416847_10	21-Apr-15	Silty CLAY	0.0	5	0.1	11	24	32	<0.1	4	66
HA06	0.1	PHA06 0.1m	1416847_11	21-Apr-15	Sandy SILT	0.1	11	0.41	14	46	96	0.2	8	168
HA07	0.1	PHA07 0.1m	1416847_13	21-Apr-15	Sandy SILT	2.0	6	0.22	13	37	50	0.18	7	96
	0.4	PHA07 0.4m	1416847_14	21-Apr-15	Sandy SILT	0.0	7	0.34	14	35	69	0.13	8	140
HA08	0.1	PHA08 0.1m	1416847_15	21-Apr-15	Sandy SILT	0.0	8	0.27	13	24	23	<0.1	6	77
HA09	0.2	PHA09 0.2m	1416847_17	21-Apr-15	Sandy SILT	0.0	8	0.23	13	31	60	0.14	6	107
	0.45	PHA09 0.45m	1416847_18	21-Apr-15	Sandy SILT	0.0	13	0.4	15	58	114	0.31	13	500
HA10	0.3	PHA10 0.3m	1416847_19	21-Apr-15	Silty CLAY	0.0	9	0.39	17	61	**220**	0.3	13	320
HA11	0.2	PHA11 0.2m	1416847_20	21-Apr-15	Sandy SILT	6.0	3	<0.1	15	50	27	0.3	6	45
HA12	0.1	PHA12 0.1m	1416847_22	21-Apr-15	Sandy SILT	0.0	8	0.28	12	37	33	0.23	7	74
	0.6	PHA12 0.6m	1416847_23	21-Apr-15	Sandy SILT	0.0	8	0.23	15	43	37	0.29	9	90
HA13	0.05	SAB151	1474279.1	10-Jun-15	SILT	7.4	-	-	-	-	112	-	-	-
	0.5	SAB152	1474279.2	10-Jun-15	SILT	6.9	-	-	-	-	34	-	-	-
HA14	0.05	SAB153	1474279.3	10-Jun-15	SILT	6.7	-	-	-	-	57	-	-	-
	0.05	SAB154	1474279.4	10-Jun-15	SILT	6.7	-	-	-	-	61	-	-	-
HA15	0.05	SAB155	1474279.5	10-Jun-15	Gravelly SILT	7.1	-	-	-	-	101	-	-	-
HA16	0.05	SAB156	1474279.6	10-Jun-15	SILT	8.2	-	-	-	-	133	-	-	-
HA17	0.05	SAB157	1474279.7	10-Jun-15	SILT	8.5	-	-	-	-	36	-	-	-
HA18	0.05	SAB158	1474279.8	10-Jun-15	SILT	3.5	-	-	-	-	60	-	-	-
	0.4	SAB159	1474279.9	10-Jun-15	SILT	2.4	-	-	-	-	85	-	-	-
HA19	0.05	SAB160	1474279.10	10-Jun-15	SILT	4.5	-	-	-	-	54	-	-	-
	0.05	SAB161	1474279.11	10-Jun-15	SILT	4.5	-	-	-	-	54	-	-	-
HA20	0.05	SAB162	1474279.12	10-Jun-15	SILT	4.6	-	-	-	-	89	-	-	-
HA21	0.05	SAB164	1474279.14	10-Jun-15	SILT	5.5	-	-	-	-	41	-	-	-
HA22	0.05	SAB163	1474279.13	10-Jun-15	SILT	7.4	-	-	-	-	39	-	-	-

Table C1
Soil Analytical Results - Metals
Palmer Street - Palmer St Development
Waipa District Council

						Metals							
						Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
MfE NES contaminants in soil (Residential 10% Produce)						**20**	**3**		**10,000**	**210**	**310**		
Waikato Background Ranges						1 - 25	0.03 - 0.3	1 - 150	4 - 55	3 - 32	-	0.56 - 21	11 - 58
Sample Location	**Sample Depth (m bgl)**	**Field ID**	**Lab Sample Number**	**Date Sampled**	**Guideline Soil Type**	**PID Reading (ppm)**							

Notes

Bold Result exceeds NES guideline criteria for Residential (10% produce)
Shaded Result exceeds Waikato Background Ranges

MfE NES: Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.
MfE NES Soil screening criteria. Criteria taken from table B2 (inorganic substances) of the NES 2011.

Waikato Background Ranges: Taylor, M and Kim, N. (2009). *Dealumination as a mechanism for increased acid recoverable aluminium in Waikato mineral soils. Australian Journal of Soil Research, 47, 828 - 838.* Values taken from Table 1 (Waikato Regional Background Ranges).

Table C2
Soil Analytical Results - Organics
Palmer Street - Palmer St Development
Waipa District Council

					Sample Location	Composite of PHA01 0.15m, PHA02 0.1m, PHA03 0.2m & PHA04 0.1m	Composite of PHA05 0.1m, PHA06 0.1m, PHA07 0.1m & PHA08 0.1m	Composite of PHA09 0.2m, PHA10 0.3m, PHA11 0.2m & PHA12 0.1m
					Sample Depth (m bgl)			
					Date Sampled	23/04/2015	23/04/2015	23/04/2015
					AECOM Sample Number	Composite 1	Composite 2	Composite 3
					Laboratory Sample Number	1416847_36	1416847_37	1416847_38
					Guideline Soil Type	Sandy SILT	Sandy SILT	Sandy SILT
			MfE 1999 Protection of Groundwater GW 2m, Sandy SILT	MfE 1999, Tier I All Pathways Residential, Sandy SILT	MfE NES contaminants in soil (Residential 10% Produce)			
Chem_Group	**ChemName**	**output unit**	0-1m	0-1m				
Organochlorine Pesticides (OC)	Aldrin	mg/kg				<1.6	<1.5	<1.7
	Dieldrin	mg/kg			2.6	<1.6	<1.5	<1.7
	a-BHC	mg/kg				<1.6	<1.5	<1.7
	b-BHC	mg/kg				<1.6	<1.5	<1.7
	d-BHC	mg/kg				<1.6	<1.5	<1.7
	g-BHC (Lindane)	mg/kg				<1.6	<1.5	<1.7
	DDD	mg/kg				<1.6	<1.5	<1.7
	DDE	mg/kg				<1.6	<1.5	<1.7
	DDT	mg/kg			70	<4	<3	<4
	Endosulfan 1	mg/kg				<4	<3	<4
	Endosulfan 2	mg/kg				<4	<3	<4
	Endosulfan sulfate	mg/kg				<4	<3	<4
	Endrin	mg/kg				<4	<3	<4
	Endrin ketone	mg/kg				<4	<3	<4
	Heptachlor	mg/kg				<1.6	<1.5	<1.7
	Heptachlor epoxide	mg/kg				<1.6	<1.5	<1.7
	Hexachlorobenzene (HCB)	mg/kg				<1.6	<1.5	<1.7
Anilines and Benzidines	3,3-Dichlorobenzidine	mg/kg				<8	<8	<9
	Carbazole	mg/kg				<1.6	<1.5	<1.7
	Dibenzofuran	mg/kg				<1.6	<1.5	<1.7
Chlorinated Hydrocarbons	Hexachlorocyclopentadiene	mg/kg				<8	<8	<9
	Hexachloroethane	mg/kg				<4	<3	<4
Haloethers	4-Bromophenyl phenyl ether	mg/kg				<1.6	<1.5	<1.7
	4-Chlorophenyl phenyl ether	mg/kg				<1.6	<1.5	<1.7
	Bis(2-chloroethoxy) methane	mg/kg				<1.6	<1.5	<1.7
	Bis(2-chloroethyl) ether	mg/kg				<1.6	<1.5	<1.7
	Bis(2-chloroisopropyl)ether	mg/kg				<1.6	<1.5	<1.7
Halogenated Aliphatic Compounds	Hexachlorobutadiene	mg/kg				<4	<3	<4
Halogenated Aromatic Compounds	1,2,4-Trichlorobenzene	mg/kg				<1.6	<1.5	<1.7
	1,2-Dichlorobenzene	mg/kg				<4	<3	<4
	1,3-Dichlorobenzene	mg/kg				<4	<3	<4
	1,4-Dichlorobenzene	mg/kg				<4	<3	<4
Miscellaneous Compounds	Benzyl alcohol	mg/kg				<16	<15	<17
Nitroaromatics and Ketones	2,4-Dinitrotoluene	mg/kg				<4	<3	<4
	2,6-Dinitrotoluene	mg/kg				<4	<3	<4
	Isophorone	mg/kg				<1.6	<1.5	<1.7
	Nitrobenzene	mg/kg				<1.6	<1.5	<1.7
Nitrosamines	n-Nitrosodiphenylamine	mg/kg				<4	<3	<4
	N-Nitrosodipropylamine	mg/kg				<4	<3	<4
Phenolic Compounds	Phenol	mg/kg				<4	<3	<4
	2-Chlorophenol	mg/kg				<1.6	<1.5	<1.7
	2-Methylphenol (o-Cresol)	mg/kg				<1.6	<1.5	<1.7
	3&4-Methylphenol (m&p-Cresol)	mg/kg				<4	<3	<4
	2-Nitrophenol	mg/kg				<5	<5	<5
	2,4-Dichlorophenol	mg/kg				<1.6	<1.5	<1.7
	2,4-Dimethylphenol	mg/kg				<3	<3	<3
	4-Chloro-3-methylphenol	mg/kg				<5	<5	<5
	2,4,6-Trichlorophenol	mg/kg				<4	<3	<4
	2,4,5-Trichlorophenol	mg/kg				<4	<3	<4
	Pentachlorophenol	mg/kg				<40	<30	<40
Phthalate Esters	Butyl benzyl phthalate	mg/kg				<4	<3	<4
	Diethyl phthalate	mg/kg				<4	<3	<4
	Dimethyl phthalate	mg/kg				<4	<3	<4
	Di-n-butyl phthalate	mg/kg				<4	<3	<4
	Di-n-octyl phthalate	mg/kg				<4	<3	<4
	Bis(2-ethylhexyl)phthalate	mg/kg				<7	<6	<7
Polynuclear Aromatic Hydrocarbons	Naphthalene	mg/kg	0.28	63 v		<0.8	<0.8	<0.9
	2-Methylnaphthalene	mg/kg				<0.8	<0.8	<0.9
	2-Chloronaphthalene	mg/kg				<0.8	<0.8	<0.9
	Acenaphthylene	mg/kg				<0.8	<0.8	<0.9
	Acenaphthene	mg/kg				<0.8	<0.8	<0.9
	Anthracene	mg/kg				<0.8	<0.8	<0.9
	Fluorene	mg/kg				<0.8	<0.8	<0.9
	Phenanthrene	mg/kg				<0.8	<0.8	3.1
	Fluoranthene	mg/kg				<0.8	<0.8	3.9
	Benz(a)anthracene	mg/kg				<0.8	<0.8	1.3
	Benzo(k)fluoranthene	mg/kg				<1.6	<1.5	<1.7
	Benzo(a)pyrene	mg/kg				<1.6	<1.5	<1.7
	Benzo(a)pyrene eq.	mg/kg	(5.7)	0.27	10	<3.54	<3.40	3.9
	Chrysene	mg/kg				<0.8	<0.8	1.3
	Pyrene	mg/kg	7.9	(1600) p		<0.8	<0.8	3.3
	Benzo(g,h,i)perylene	mg/kg				<1.6	<1.5	<1.7
	Dibenz(a,h)anthracene	mg/kg				<1.6	<1.5	<1.7
	Indeno(1,2,3-cd)pyrene	mg/kg				<1.6	<1.5	<1.7
Un-assigned	Di(2-ethylhexyl)adipate	mg/kg				<1.6	<1.5	<1.7

Notes

MfE 1999: Ministry for the Environment 1999, updated 2011. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand.
MfE 1999 Tier I All Pathways Residential: All Pathways soil screening criteria taken from tables 4.10 and 4.13 of the MfE 1999 Guidelines.
MfE 1999 Protection of Groundwater: Soil screening criteria taken from table 4.20 of the MfE 1999 Guidelines.

Brackets indicate that guideline values exceed the threshold likely to correspond to formation of residual separate phase hydrocarbons.
The following notes indicate the limiting pathway for each criterion: v - Volatilisation, s - Soil Ingestion, d - Dermal, p - Produce, m - Maintenance/Excavation, x - PAH surrogate
NA indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in the soil matrix. Some aesthetic impact may be noted.

MfE NES: Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.
MfE NES Soil screening criteria. Criteria taken from table B3 (organic substances) of the NES 2011.
Benzo(a)pyrene eq: the equivalent BaP concentration is calculated as the sum of each of the detected concentrations of nine carcinogenic PAHs (benzo(a)anthracene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene and indeno(1,2,3-cd) pyrene), multiplied by their respective potency equivalency factors (See Table 44 of the MfE 2011 Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health). Where a result is below detection limits it is treated as a value of equal to the detection limit for the purpose of the calculations. If all results are below detection the total equivalent value is reported as below detection. Where some of the results are above detection limits, the total has conservatively been reported as above detection.
Please note that the NES acceptance criteria supersede the guideline values given in the MfE 1999 Guidelines.

D R A F T

Appendix C Results

Soil Investigation Analytical Results

Table C1 Soil Analytical Results – Metals

Table C2 Soil Analytical Results – Organics

Table C3 Soil Analytical Results - Asbestos

Sample Location	Sample Depth (m bgl)	Field ID	Lab Sample Number	Date Sampled	Asbestos Presence / Absence
HA03	0.2	PHA 03_asb 0.2m	1416847.26	21-Apr-15	Asbestos NOT detected.
HA05	0.1	PHA 05_asb 0.1m	1416847.28	21-Apr-15	Asbestos NOT detected.
HA07	0.1	PHA 07_asb 0.1m	1416847.30	21-Apr-15	Asbestos NOT detected.
HA09	0.2	PHA 09_asb 0.2m	1416847.32	21-Apr-15	Asbestos NOT detected.
HA11	0.2	PHA 11_asb 0.2m	1416847.34	21-Apr-15	Asbestos NOT detected.
HA12	0.1	PHA 12_asb 0.1m	1416847.35	21-Apr-15	Asbestos NOT detected.

Groundwater and Leachate Investigation Analytical Results

Table C4 Groundwater Analytical Results – Detections Only

Table C5 Groundwater Analytical Results – All Results

Table C4
GroundwaterAnalytical Results - Detects Only
Palmer Street - Palmer St Development
Waipa District Council

					Bulk Organics		Alkalinity		Major Ions								Metals							
					Biological Oxygen Demand	Chemical Oxygen Demand	Total Alkalinity as CaCO3	Hardness as CaCO3	Chloride	Calcium	Magnesium	Potassium	Sodium	Sulphate (as SO4-)	Total Anions	Total Cations	Aluminium (Filtered)	Arsenic (Filtered)	Boron (Filtered)	Cobalt (Filtered)	Lead (Filtered)	Manganese (Filtered)	Nickel (Filtered)	Zinc (Filtered)
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
ANZECC 2000 - Maintenance of Ecosystems Freshwater 80%																	0.15		1.3		0.0094	3.6	0.017	0.031
MfE 1999 Indoor Inhalation(GW) Commercial /Industrial (GW at 2m)																								
NZDWS																		**0.01**	**1.4**		**0.01**	**0.4**	**0.08**	
Sample Location	**Date Sampled**	**Lab Sample Number**	**AECOM Sample Number**	**Sample Type**																				
MW01	20/05/2015	1428804_1	MW01 GAA 461	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.082	-	0.00014	-	-	0.0059
MW02	20/05/2015	1428804_2	MW02 GAA 462	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.006
MW03	20/05/2015	1428804_5	MW03 GAA 465	Normal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0095
MW04	20/05/2015	1428804_3	MW04 GAA 463	Normal	2	114	175	110	15.6	33	6.8	7.9	11.3	1.1	4	3.3	0.079	0.0017	**1.45**	0.0021	0.00018	**1.36**	0.0009	0.026
		1428804_4	QC100 GAA 464	Field_Duplicate	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0021	-	-	0.00011	-	0.0015	0.027

Notes
MfE 1999 Guidelines: Ministry for the Environment 1999, updated 2011. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand.
MfE 1999 Inhalation (Groundwater) - Route Specific Groundwater Acceptance Criteria - Inhalation Pathway. Values for Residential / Agricultural land use taken from table 5.9 of the MfE 1999 Guidelines

S: Calculated water criteria exceeds solubility limit for pure compound in water.
Values in brackets exceed solubility limit for compound in water when present as part of a typical gasoline mixture.

ANZECC 2000: Australia and New Zealand Environmental and Conservation Council 2000: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Revised 2009)
NZDWS 2008: Ministry of Health 2005 (Revised 2008), Drinking Water Standards for New Zealand. Values taken from Tables 2.2 and 2.3.

Table C4
GroundwaterAnalytical Results - Detects Only
Palmer Street - Palmer St Development
Waipa District Council

					Nutrients					Physico-Chemical Parameters	
					Nitrate (as N)	Total Kjeldahl Nitrogen	Nitrate & Nitrite (as N) (Filtered)	Total Nitrogen	Total Ammoniacal-N (Filtered)	Electrical conductivity (lab)	pH (Lab)
					mg/L	mg/L	mg/L	mg/L	g/m3	mS/m	pH Units
ANZECC 2000 - Maintenance of Ecosystems Freshwater 80%											
MfE 1999 Indoor Inhalation(GW) Commercial /Industrial (GW at 2m)											
NZDWS					**50**						
Sample Location	**Date Sampled**	**Lab Sample Number**	**AECOM Sample Number**	**Sample Type**							
MW01	20/05/2015	1428804_1	MW01 GAA 461	Normal	1.68	3.5	1.68	5.2	-	8.5	5.9
MW02	20/05/2015	1428804_2	MW02 GAA 462	Normal	0.51	0.76	0.51	1.28	-	9.4	6.7
MW03	20/05/2015	1428804_5	MW03 GAA 465	Normal	2.3	0.51	2.3	2.8	-	8.6	5.9
MW04	20/05/2015	1428804_3	MW04 GAA 463	Normal	-	9.4	-	9.4	5.3	42.7	6.4
		1428804_4	QC100 GAA 464	Field_Duplicate	-	-	-	-	-	-	-

Notes
MfE 1999 Guidelines: Ministry for the Environment 1999, updated 2011. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated
MfE 1999 Inhalation (Groundwater) - Route Specific Groundwater Acceptance Criteria - Inhalation Pathway. Values for Residential / Agricultural land us

S: Calculated water criteria exceeds solubility limit for pure compound in water.
Values in brackets exceed solubility limit for compound in water when present as part of a typical gasoline mixture.

ANZECC 2000: Australia and New Zealand Environmental and Conservation Council 2000: Australian and New Zealand Guidelines for Fresh and Marine W
NZDWS 2008: Ministry of Health 2005 (Revised 2008), Drinking Water Standards for New Zealand. Values taken from Tables 2.2 and 2.3.

Table C5
Groundwater Analytical Results - All Data
Palmer Street
Waipa District Council

			ANZECC 2000 - Maintenance of Ecosystems Freshwater 80%	MfE 1999, Inhalation(GW) Residential/Agricultural, Indoor(4m) Sandy SILT	NZDWS	Sample Location	MW01	MW02	MW03	MW04	
						Date Sampled	20/05/2015	20/05/2015	20/05/2015	20/05/2015	
						Lab Sample Number	1428804_1	1428804_2	1428804_5	1428804_3	1428804_4
						AECOM Sample Number	MW01 GAA 461	MW02 GAA 462	MW03 GAA 465	MW04 GAA 463	QC100 GAA 464
						Sample Type	Normal	Normal	Normal	Normal	Field_D
Bulk Organics											
Biological Oxygen Demand	mg/L						-	-	-	2	-
Chemical Oxygen Demand	mg/L						-	-	-	114	-
Organochlorine Pesticides (OC)											
Aldrin	mg/L				0.00004		-	-	-	<0.0005	-
Dieldrin	mg/L				0.00004		-	-	-	<0.0005	-
a-BHC	mg/L						-	-	-	<0.0005	-
b-BHC	mg/L						-	-	-	<0.0005	-
d-BHC	mg/L						-	-	-	<0.0005	-
g-BHC (Lindane)	mg/L		0.001		0.002		-	-	-	<0.0005	-
DDD	mg/L						-	-	-	<0.0005	-
DDE	mg/L						-	-	-	<0.0005	-
DDT	mg/L		0.00004		0.001		-	-	-	<0.0010	-
Endosulfan 1	mg/L						-	-	-	<0.0010	-
Endosulfan 2	mg/L						-	-	-	<0.0010	-
Endosulfan sulfate	mg/L						-	-	-	<0.0010	-
Endrin	mg/L		0.00006		0.001		-	-	-	<0.0010	-
Endrin ketone	mg/L						-	-	-	<0.0010	-
Heptachlor	mg/L		0.0007				-	-	-	<0.0005	-
Heptachlor epoxide	mg/L						-	-	-	<0.0005	-
Hexachlorobenzene (HCB)	mg/L						-	-	-	<0.0005	-
Alkalinity											
Total Alkalinity as CaCO3	mg/L						-	-	-	175	-
Hardness as CaCO3	mg/L						-	-	-	110	-
Anilines and Benzidines											
3,3-Dichlorobenzidine	mg/L						-	-	-	<0.0030	-
Carbazole	mg/L						-	-	-	<0.0005	-
Dibenzofuran	mg/L						-	-	-	<0.0005	-
Chlorinated Hydrocarbons											
1,2-Dichloroethene [cis]	mg/L				0.06		-	-	-	<0.0005	-
1,2-Dichloroethene [trans]	mg/L				0.06		-	-	-	<0.0005	-
Hexachloroethane	mg/L		0.5				-	-	-	<0.0010	-
Fumigants											
1,2-Dibromoethane (EDB)	mg/L				0.0004		-	-	-	<0.0004	-
1,2-Dichloropropane	mg/L				0.05		-	-	-	<0.0005	-
cis-1,3-Dichloropropene	mg/L						-	-	-	<0.0005	-
trans-1,3-Dichloropropene	mg/L						-	-	-	<0.0005	-
Haloethers											
4-Bromophenyl phenyl ether	mg/L						-	-	-	<0.0005	-
4-Chlorophenyl phenyl ether	mg/L						-	-	-	<0.0005	-
Bis(2-chloroethoxy) methane	mg/L						-	-	-	<0.0005	-
Bis(2-chloroethyl) ether	mg/L						-	-	-	<0.0005	-
Bis(2-chloroisopropyl)ether	mg/L						-	-	-	<0.0005	-
Halogenated Aliphatic Compounds											
1,1,1-Trichloroethane	mg/L						-	-	-	<0.0005	-
1,1-Dichloroethane	mg/L						-	-	-	<0.0005	-
1,1-Dichloroethene	mg/L						-	-	-	<0.0005	-
1,2-Dichloroethane	mg/L				0.03		-	-	-	<0.0005	-
Bromomethane	mg/L						-	-	-	<0.0020	-
Carbon Tetrachloride	mg/L				0.005		-	-	-	<0.0005	-
Chloroethane	mg/L						-	-	-	<0.0005	-
Dichlorodifluoromethane	mg/L						-	-	-	<0.0005	-
Dichloromethane	mg/L				0.02		-	-	-	<0.0100	-
Hexachlorobutadiene	mg/L				0.0007		-	-	-	<0.0005	-
Tetrachloroethene	mg/L				0.05		-	-	-	<0.0005	-
Trichloroethene	mg/L				0.02		-	-	-	<0.0005	-
Trichlorofluoromethane	mg/L						-	-	-	<0.0005	-
Vinyl chloride	mg/L				0.0003		-	-	-	<0.0005	-
Freon 113	mg/L						-	-	-	<0.0040	-
1,1,1,2-Tetrachloroethane	mg/L						-	-	-	<0.0005	-
1,1,2,2-Tetrachloroethane	mg/L						-	-	-	<0.0005	-
1,1,2-Trichloroethane	mg/L		8.4				-	-	-	<0.0005	-
1,1-Dichloropropene	mg/L						-	-	-	<0.0005	-
1,2,3-Trichloropropane	mg/L						-	-	-	<0.0005	-
1,2-Dibromo-3-chloropropane	mg/L				0.001		-	-	-	<0.0005	-
1,3-Dichloropropane	mg/L						-	-	-	<0.0005	-
Chloromethane	mg/L						-	-	-	<0.0005	-
Dibromomethane	mg/L						-	-	-	<0.0005	-
Halogenated Aromatic Compounds											
Chlorobenzene	mg/L						-	-	-	<0.0005	-
1,2,3-Trichlorobenzene	mg/L		0.03				-	-	-	<0.0005	-
1,2,4-Trichlorobenzene	mg/L		0.3				-	-	-	<0.0005	-
1,2-Dichlorobenzene	mg/L		0.27		1.5		-	-	-	<0.0005	-
1,3-Dichlorobenzene	mg/L		0.52				-	-	-	<0.0005	-
1,4-Dichlorobenzene	mg/L		0.1		0.4		-	-	-	<0.0005	-
2-Chlorotoluene	mg/L						-	-	-	<0.0005	-
4-Chlorotoluene	mg/L						-	-	-	<0.0005	-
Bromobenzene	mg/L						-	-	-	<0.0005	-
1,3,5-Trichlorobenzene	mg/L						-	-	-	<0.0005	-
Major Ions											
Chloride	mg/L						-	-	-	15.6	-
Calcium	mg/L						-	-	-	33	-
Magnesium	mg/L						-	-	-	6.8	-
Potassium	mg/L						-	-	-	7.9	-
Sodium	mg/L						-	-	-	11.3	-
Sulphate (as SO4-)	mg/L						-	-	-	1.1	-
Total Anions	meq/L						-	-	-	4	-
Total Cations	meq/L						-	-	-	3.3	-
Metals											
Aluminium (Filtered)	mg/L		0.15				-	-	-	0.079	-
Arsenic (Filtered)	mg/L				0.01		<0.001	<0.001	<0.001	0.0017	0.0021
Boron (Filtered)	mg/L		1.3		1.4		0.082	-	-	1.45	-
Cadmium (Filtered)	mg/L		0.0008		0.004		<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Chromium (Filtered)	mg/L				0.05		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt (Filtered)	mg/L						-	-	-	0.0021	-
Copper (Filtered)	mg/L		0.0025		2		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Table C5
Groundwater Analytical Results - All Data
Palmer Street
Waipa District Council

			ANZECC 2000 - Maintenance of Ecosystems Freshwater 80%	MfE 1999, Inhalation(GW) Residential/Agricultural, Indoor(4m) Sandy SILT	NZDWS	Sample Location	MW01	MW02	MW03	MW04	
						Date Sampled	20/05/2015	20/05/2015	20/05/2015	20/05/2015	
						Lab Sample Number	1428804_1	1428804_2	1428804_5	1428804_3	1428804_4
						AECOM Sample Number	MW01 GAA 461	MW02 GAA 462	MW03 GAA 465	MW04 GAA 463	QC100 GAA 464
						Sample Type	Normal	Normal	Normal	Normal	Field_D
Lead (Filtered)	mg/L		0.0094		0.01		0.00014	<0.0001	<0.0001	0.00018	0.00011
Manganese (Filtered)	mg/L		3.6		0.4		-	-	-	1.36	-
Nickel (Filtered)	mg/L		0.017		0.08		<0.0005	<0.0005	<0.0005	0.0009	0.0015
Zinc (Filtered)	mg/L		0.031				0.0059	0.006	0.0095	0.026	0.027
Miscellaneous Compounds											
Benzyl alcohol	mg/L						-	-	-	<0.0005	-
Monocyclic Aromatic Hydrocarbons											
Benzene	mg/L		2	3.5	0.01		-	-	-	<0.0005	-
Toluene	mg/L			(150)	0.8		-	-	-	<0.001	-
Ethylbenzene	mg/L			(36)	0.3		-	-	-	<0.0005	-
m&p-Xylene	mg/L						-	-	-	<0.0005	-
o-Xylene	mg/L		0.64				-	-	-	<0.0005	-
Total Xylenes	mg/L			S	0.6		-	-	-	<0.0010	-
1,2,4-trimethylbenzene	mg/L						-	-	-	<0.0005	-
Isopropylbenzene	mg/L						-	-	-	<0.0005	-
Styrene	mg/L				0.03		-	-	-	<0.0005	-
n-butylbenzene	mg/L						-	-	-	<0.0005	-
n-propylbenzene	mg/L						-	-	-	<0.0005	-
p-isopropyltoluene	mg/L						-	-	-	<0.0005	-
sec-butylbenzene	mg/L						-	-	-	<0.0005	-
tert-butylbenzene	mg/L						-	-	-	<0.0005	-
1,3,5-trimethylbenzene	mg/L						-	-	-	<0.0005	-
Nitroaromatics and Ketones											
2,4-Dinitrotoluene	mg/L		0.25				-	-	-	<0.0010	-
2,6-Dinitrotoluene	mg/L						-	-	-	<0.0010	-
Isophorone	mg/L						-	-	-	<0.0005	-
Nitrobenzene	mg/L		1.3				-	-	-	<0.0005	-
Nitrosamines											
n-Nitrosodiphenylamine	mg/L						-	-	-	<0.0010	-
N-Nitrosodipropylamine	mg/L						-	-	-	<0.0010	-
Nutrients											
Nitrate (as N)	mg/L				50		1.68	0.51	2.3	<0.02	-
Nitrite (as N) (Filtered)	mg/L				0.2		<0.002	<0.002	<0.002	<0.02	-
Total Kjeldahl Nitrogen	mg/L						3.5	0.76	0.51	9.4	-
Nitrate & Nitrite (as N) (Filtered)	mg/L						1.68	0.51	2.3	<0.02	-
Total Nitrogen	mg/L						5.2	1.28	2.8	9.4	-
Total Ammoniacal-N (Filtered)	mg/L						<0.01	<0.01	<0.01	5.3	-
Oxygenated Compounds											
2-Propanone (Acetone)	mg/L						-	-	-	<0.0500	-
2-Butanone (MEK)	mg/L						-	-	-	<0.0005	-
4-Methyl-2-pentanone (MIBK)	mg/L						-	-	-	<0.0005	-
Methyltertbutylether (MTBE)	mg/L						-	-	-	<0.0005	-
Phenolic Compounds											
Phenol	mg/L		1.2				-	-	-	<0.0010	-
2-Chlorophenol	mg/L		0.87				-	-	-	<0.0005	-
2-Methylphenol (o-Cresol)	mg/L						-	-	-	<0.0005	-
3&4-Methylphenol (m&p-Cresol)	mg/L						-	-	-	<0.0010	-
2-Nitrophenol	mg/L						-	-	-	<0.0010	-
2,4-Dichlorophenol	mg/L		0.27				-	-	-	<0.0005	-
2,4-Dimethylphenol	mg/L						-	-	-	<0.0005	-
4-Chloro-3-methylphenol	mg/L						-	-	-	<0.0010	-
2,4,6-Trichlorophenol	mg/L		0.095		0.2		-	-	-	<0.0010	-
2,4,5-Trichlorophenol	mg/L						-	-	-	<0.0010	-
Pentachlorophenol	mg/L		0.027		0.009		-	-	-	<0.0100	-
Phthalate Esters											
Butyl benzyl phthalate	mg/L						-	-	-	<0.0010	-
Diethyl phthalate	mg/L		1.3				-	-	-	<0.0010	-
Dimethyl phthalate	mg/L		5.1				-	-	-	<0.0010	-
Di-n-butyl phthalate	mg/L		0.0646				-	-	-	<0.0010	-
Di-n-octyl phthalate	mg/L						-	-	-	<0.0010	-
Bis(2-ethylhexyl)phthalate	mg/L						-	-	-	<0.0030	-
Physico-Chemical Parameters											
Electrical conductivity (lab)	mS/m						8.5	9.4	8.6	42.7	-
pH (Lab)	pH Units						5.9	6.7	5.9	6.4	-
Polynuclear Aromatic Hydrocarbons											
Naphthalene	mg/L		0.085	S			-	-	-	<0.0003	-
2-Methylnaphthalene	mg/L						-	-	-	<0.0003	-
2-Chloronaphthalene	mg/L						-	-	-	<0.0003	-
Acenaphthylene	mg/L						-	-	-	<0.0003	-
Acenaphthene	mg/L						-	-	-	<0.0003	-
Anthracene	mg/L						-	-	-	<0.0003	-
Fluorene	mg/L						-	-	-	<0.0003	-
Phenanthrene	mg/L						-	-	-	<0.0003	-
Fluoranthene	mg/L						-	-	-	<0.0003	-
Benz(a)anthracene	mg/L						-	-	-	<0.0003	-
Benzo(k)fluoranthene	mg/L						-	-	-	<0.0005	-
Benzo(a)pyrene	mg/L			S	0.0007		-	-	-	<0.0005	-
Chrysene	mg/L						-	-	-	<0.0003	-
Pyrene	mg/L			S			-	-	-	<0.0003	-
Benzo(g,h,i)perylene	mg/L						-	-	-	<0.0005	-
Dibenz(a,h)anthracene	mg/L						-	-	-	<0.0005	-
Indeno(1,2,3-cd)pyrene	mg/L						-	-	-	<0.0005	-
Benzo(b+j)fluoranthene	mg/L						-	-	-	<0.0005	-
Sulfonated Compounds											
Carbon disulfide	mg/L						-	-	-	<0.0500	-
Trihalomethanes											
Bromodichloromethane	mg/L						-	-	-	<0.0005	-
Bromoform	mg/L				0.1		-	-	-	<0.0005	-
Chloroform	mg/L				0.4		-	-	-	<0.0005	-
Dibromochloromethane	mg/L						-	-	-	<0.0005	-
Surrogates											
4-Bromofluorobenzene	%						-	-	-	96	-
Toluene-D8	%						-	-	-	93	-
Un-assigned											
Di(2-ethylhexyl)adipate	mg/L						-	-	-	<0.0100	-

Notes

MfE 1999 Guidelines: Ministry for the Environment 1999, updated 2011. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand.
MfE 1999 Inhalation (Groundwater) - Route Specific Groundwater Acceptance Criteria - Inhalation Pathway. Values for Residential / Agricultural land use taken from table 5.9 of the MfE 1999 Guidelines

S: Calculated water criteria exceeds solubility limit for pure compound in water.
Values in brackets exceed solubility limit for compound in water when present as part of a typical gasoline mixture.

NZDWS 2008: Ministry of Health 2005 (Revised 2008), Drinking Water Standards for New Zealand. Values taken from Tables 2.2 and 2.3.

D R A F T

Appendix D

Geo and Hydro – K8 Limited (2013) Environmental Report

Geo & Hydro – K8 Ltd

: 32 Keirunga Road
Havelock North 4130
: 06 875 8588
: 021 1171148
: www.benkeet.com
: ben@benkeet.com

Russell Easton Ltd
P.O. Box 248
Te Awamutu

Project:	TAPS-Ret
Location:	Palmer Street, Te Awamutu
Ref.:	TAPS-Ret DSI
Version:	v1.3
Date:	16 July 2013

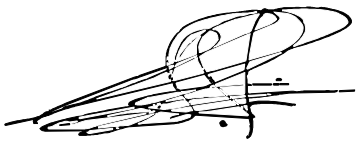
Subject: Detailed site investigation Te Awamutu Retirement Village, Palmer Street.

Dear Russell,

EXECUTIVE SUMMARY

A detailed site investigation has been carried out of the subsurface of the retirement village and surroundings located in Palmer Street, Te Awamutu. Using ground penetrating radar, excavations and on-site and laboratory analysis the significant quantities of waste has been identified as contaminated material with concentrations exceeding both residential and commercial soil quality values as set out in the National Environmental Standard (NES) for contaminated soil to protect Human Health. A number of options to deal with this waste are discussed and a future course of action is recommended.

Regards,



Drs. Ben Keet FRSC, MRSNZ
Senior Contaminated Land Auditor

Disclaimer

This report describes the site investigation, process, data collected and interpretation of data obtained from this work. Its conclusions are only valid for the purpose for which it was requested. The report is valid only when it is in original form and must only be reproduced in its entirety.
While every care has been taken in the compilation of this report, to the extent that its conclusions are based on the analysis of the data made available by your organisation or by a third party, no responsibility or liability is accepted for consequences arising from either errors or omission in that data, or for parts of the site not analysed, or from factors or data which were not made available to Geo & Hydro – K8 Ltd., or which Geo & Hydro – K8 Ltd could not ascertain by reasonable inquiry in the ordinary course of investigation. Anyone who relies on this report other than Mr. Russell Easton and Waipa District Council does so at his/her own risk.

Table of Contents

Document quality control

Project manager: Drs. Ben Keet
Report author: Drs. Ben Keet

Document history and status

Revision	Date issued	Reviewed by	Approved by	Date approval	Revision type
V1.1	4 June 2013	R. Gillett			
V1.2	8 June 2013	M. Hoekstra	B. Keet		
V1.2	8 June 2013	R. Easton	B. Keet		

Distribution of copies

Revision	Format	Quantity	Issued to
V1.2	pdf	1	Mr. Russel Easton
V1.3	pdf	1	Mr. Russel Easton

File name: report taps-ret dsi v. 3.docx

Last saved: 16/07/2013 12:58:03 p.m.

Location

The location of the retirement village on the property 152 – 296 Palmer Street, (entrance community Centre of Roche Street) in Te Awamutu is shown below. The survey extents over Vaile Street and includes the Little Theatre located in an old relocated school house.

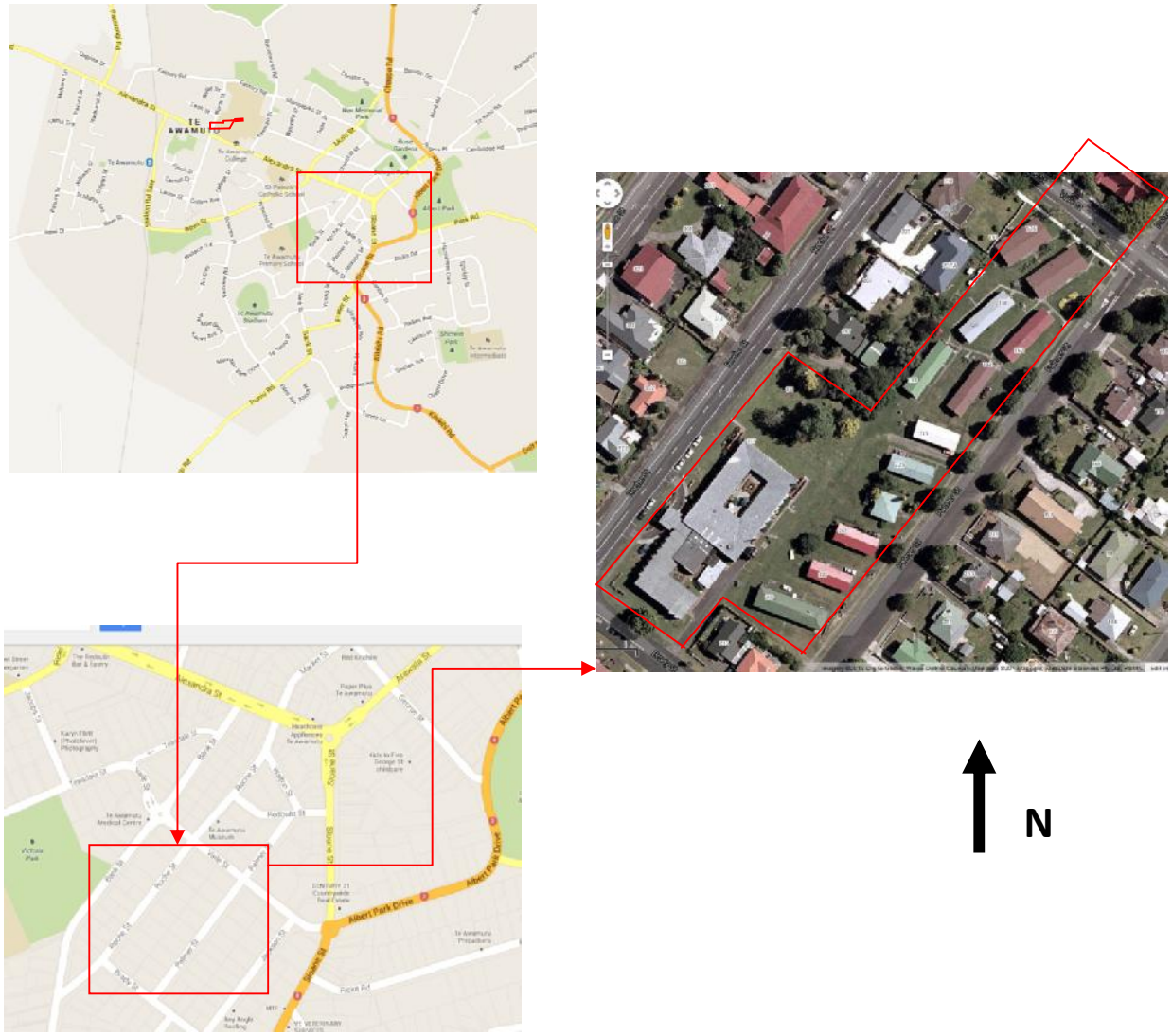


Figure 1 Overview map of Te Awamutu.

Figure 2 Detail of location overview showing approximate location on the property and at the top right the Google Maps with the property boundary sketched in.

A more detailed location plan is provided on the next page.

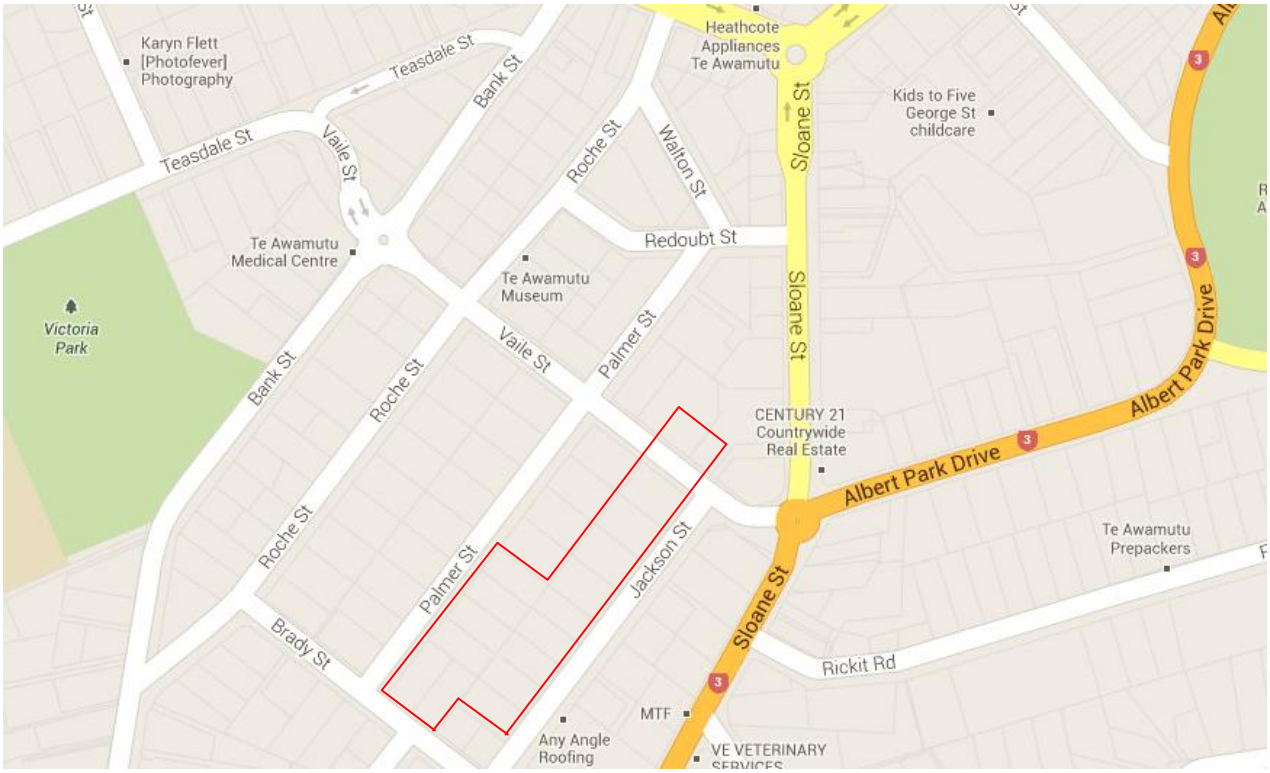


Figure 3 Detailed location plan showing the boundary of the retirement village. Note the Little Theatre building across Vaile Street is strictly not part of the retirement complex, however has the same owner.

Investigation process

Subsidence of the soil in the retirement village has long been a problem. The village is build in the 70-ies in a valley (see aerial photographs below) which was filled to create the building sites. There has been a suspicion of poor practices of filling this site with non compacted or even putrefying wastes. However there had never been an investigation. Clearly just digging some holes at random will not provide a site-wide overview.

Ground Penetration Radar (GPR) was selected for its continuous recording of disturbances in the underground along lines run over the surface. It is basically an 'ultra sound' scan of the soil to a depth of about 6 meters. Unfortunately penetration is less in wet soil and in wet clay soils as water absorbs the energy from the radar.

A plan was developed to use the GPR to find anomalies and to use an excavator to have a look what these are. Anomalies means: any disturbance of the naturally layered soil. This could be a pile of waste, a car body, but also a sewer pipe or a buried piece of steel.

From the excavated material samples can be taken and analysed to determine the potential health implications and disposal options of the material encountered.

In this manner the GPR allows targeting the areas which are 'different' and these areas can be physically investigated to see what that 'different' means. This is fed back into the interpretation to come up with a plan showing the total area affected by the buried materials, and what these are.

History

The property is currently owned by Waipa Council and historically by other councils since at least the 40-ies. It is a natural valley and during the 50-ies the site had some residential buildings on the higher ground at the northern end of the site surrounding the small creek.

The earliest aerial photograph available is from 1944. The front of the property is in use for cropping while the back (proposed lot 2) appears in grassland. At the of these land uses we see a truck or small shed. (Photo from NZAM).

Figure 4 Situation in 1944 (Photo from NZAM). Three residential properties at northern end of the block. The red line indicates the very approximate site boundary. Clear signs of water running diagonally through this section can be seen. Older people in the area remember the site being a very boggy place.

Figure 5 Situation in 1963 (Photo from NZAM). The first 3 retirement homes have been build. All over the site there appear to be stockpiles of materials. Large diameter holes have been drilled north east of the three new buildings. These could have been intended as storm water soak holes. The top NE section seems a natural depression (indicated by the green oval)

A very unclear photograph from 1972 shows all retirement homes had been build and their layout remains the same until today.

By 17 January 2006 (Photo ref. Google Earth) the situation has not changed since 1970-ies.
– Note Google History provides photographs of 2007 – 2010, however these do not add value as noting has changed while the photos are less sharp.

Figure 6 Situation in 2006 Note the community centre (SW corner) is located on a significantly raised area, especially in the NW corner. The building is on a pile foundation and all around the building the ground is subsiding.

Ground Penetrating Radar (section written by Martin King B.Sc., C.Eng, MIPENZ)

Introduction

For some years now the lawns and ground surface around the Pensioner Units off Palmer Street Te Awamutu have been showing signs of subsidence. This has caused concern and some buildings have sustained minor damage. In some cases the entrance steps up to the units have had to be extended in order to reach the receding ground level.

Objective

The Waipa District Council required a non-intrusive subsurface investigation of the lawns and ground surrounding the pensioner units. This investigation was to determine if there was any evidence of buried waste and/or other materials/reasons that might be the cause of the local ground subsidence. In the first instance the objective was to carry out a geophysical survey, in this case Ground Penetrating Radar (GPR). Following examination and analysis of the GPR data collected, this survey was to be followed by on-site physical excavations to confirm the GPR survey findings.

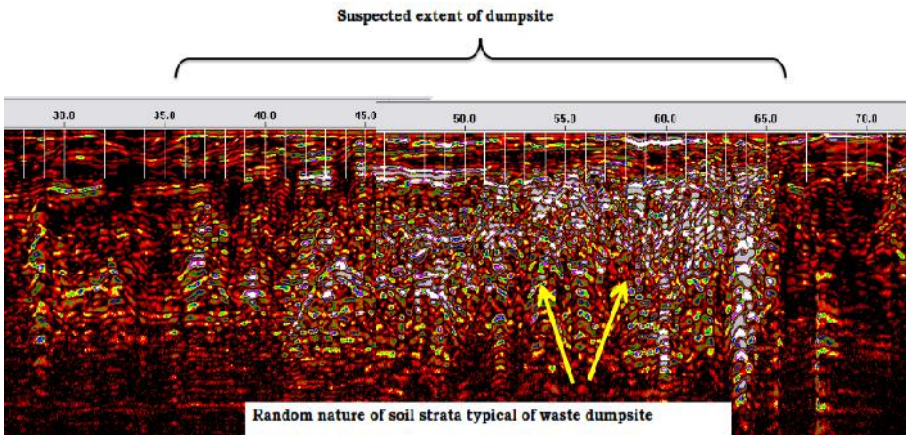
Methodology

Geophysical methods are used extensively in New Zealand and overseas to carry out non-intrusive subsurface surveys to investigate a wide range of situations, including locating and plotting of subsurface voids, steel reinforcing in concrete slips, fault lines, subsidence, contaminated areas and many other investigations.

Figure 7 GPR set-up with direct PC readout unit on front of quad

There are a wide range of geophysical methods that can be employed depending upon the objective/target and information required. For this particular project, a state-of-the-art GSSI manufactured SIR20 digital radar system together with a low frequency (200MHz) antenna, for deep penetration, was used to investigate the subsurface at this site.

GPR scans were taken in a systematic way to cover as much of the grounds as possible. Survey lines have been set out, aiming for straight lines where possible to allow accurate position plotting. In total 27 lines have been set out and GPR data has been recorded over these lines. An example from line 27 is presented below.



On the left more regular layering of soil can be seen, while on the right all segments are highly disconnected, indicating randomly placed fill. More radargrams are provided in the appendix.

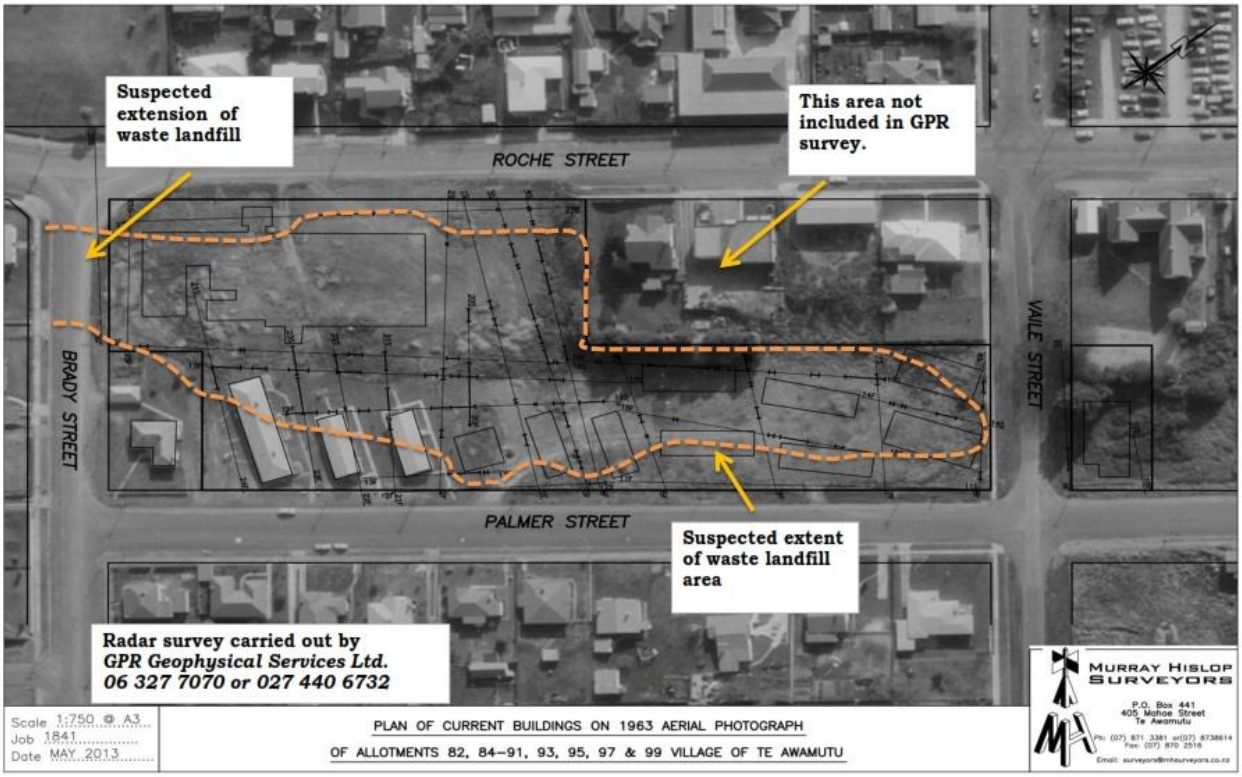
Results

The GPR data revealed that the majority of each GPR scan route indicated disturbed soil strata. This is synonymous with previous excavation and also wide ranging types of buried material, including metals, plastics, rubber, bottles and other domestic rubbish.

It is not possible, due to the variegated nature of waste material, to determine the accurate depth to bottom of waste material. In some cases the increased soil electrical conductivity of decomposing material will attenuate and inhibit a GPR signal which significantly reduces maximum GPR penetration. This can be clearly seen in some sections of the radargrams presented in the appendix.

The findings are thus:

1. The majority of this site appears to be underlain by buried waste material. The estimated extent of the dump site, based on GPR data, has been indicated on the site layout drawing below (see more detail in Appendix A).



2. The waste material is covered with an overburden soil capping which appears to vary in depth from around1.0 m to 2.5.m across this site. The waste material depth appears to vary from around 3.0m to 5.0m.

3. The property in the North-west section of this site was not included in this survey and the waste dumpsite may extend under this area as well.

4. The waste dumpsite appears to extend across Brady Street in the south western section of this site and investigated area.

5. The waste dumpsite appears to extend under the nursing home building.

Sampling the anomalies

An excavator was used to sample the soil. The excavated material was laid on geo-textile to avoid contaminated material being left behind on the surface after the investigation (see photo below).

Figure 8 Sampling the anomalies found in the radargrams

All excavations showed a similar pattern, with waste free soil over the first 1 – 2 meters below the surface, after which the material rapidly changes to consisting almost entirely out of waste.

The waste appears in two distinct typed, which are characterised by colour.

Brown waste, as can be seen on the left, appears to contain a lot of earthy component derived from composted materials in a generally aerobic environment (i.e. above average groundwater table).

Black waste is more fragmented, has far more open pore space and far more individual waste items like glass bottles. Both types of waste can have a large portion of bigger waste pieces, like car axels iron sheeting etc. (see above.).

The black waste, especially when located above the water table, seems to have been burned. This has practice has been observed in other excavated landfills and is likely associated with reducing volume as well as limiting the smell from the waste dump.

The effect is that the residual waste is low on compostable materials, however, due to burning of painted wood very much enriched with the paint pigments and other residues, mainly lead. Lead is therefore the main contaminant found throughout the site.

On the left, an example of black waste with blown waste on top. This pit was dug on radar line no. 2 at 66 – 68 meters from the start of the line.

Below an example of black waste directly below the earth cover material (pit located at 33 – 36 m on radar line no. 2)

This type of black waste is very 'particle rich' as can be seen in the picture below.

This waste can extend quite deep. The pit shown in bottom right extends to 5.8 meters (pit 2/ 33-36, located at the corner of the community centre building).

At the edges of the fill areas the ‘waste’ can be confused with the natural peaty soil common in bogs. On line 24 two pits were dug close together at the SE corner of the site to verify this. On the top is the pit at 23 – 30 m on line 24, showing mainly natural black soil overlain with a brown earth fill. The layer is only about 1 meter thick and contains hardly any waste (3 bottles were found). On the bottom is the pit dug 5 meters to the east (pit 2-33/35) which shows the black soil layer has wedged out and is no longer present.

Current Soil Standards

From 1 January 2012 the National Environmental Standard for contaminated soil has come into force. For example this standard requires soil on land to be used for residential purposes to have arsenic concentrations of 20 mg/kg or below (see soil quality table below).

Table 2: Summary of soil contaminant values for inorganic substances (mg/kg)

	Arsenic	Boron[1]	Cadmium (pH 5)[2]	Chromium[1]		Copper[1]	Inorganic lead	Inorganic mercury compounds[3]
				III	VI			
Rural residential / lifestyle block 25% produce	17[4]	NL	0.8	NL	290	NL	160	200
Residential 10% produce	20	NL	3	NL	460	NL	210	310
High-density residential	45	NL	230	NL	1,500	NL	500	1,000
Recreational	80	NL	400	NL	2,700	NL	880	1,800
Commercial / industrial outdoor worker / maintenance	70	NL	1,300	NL	6,300	NL	3,300	4,200

1 SCVs for boron, chromium III and copper are much greater than the soil concentration at which plant health will be affected. Plant and other environmental effects may need to be considered separately.

2 Default value is for pH 5. See Appendix 1 of the *Methodology Report*[22] for SCVs at other soil pH values.

3 The inorganic mercury SCV does not apply to elemental (pure) mercury.

4 Derived value replaced with 99th percertile of national dataset of background concentrations as described in the *Methodology Report*.

Note: NL = No Limit. Derived value exceeds 10,000 mg/kg.

Table 3: Summary of soil contaminant values for organic compounds (mg/kg unless shown otherwise)

Scenario	BaP[1] (mg/kg)	DDT (mg/kg)	Dieldrin[2] (mg/kg)	PCP[3] (mg/kg)	Dioxin (µg/kg TEQ)[4]	
					TCDD	Dioxin-like PCBs[5]
Rural residential / lifestyle block 25% produce	6	45	1.1	55	0.12	0.09
Residential 10% produce	10	70	2.6	55	0.15	0.12
High-density residential	24	240	45	110	0.35	0.33
Recreational	40	400	70	150	0.60	0.52
Commercial / industrial outdoor worker / maintenance	35	1,000	160	360	1.4	1.2

Based on the past use the following remarks can be made concerning these 12 priority contaminants:

Priority Contaminant	Common use	Expected Y / N	Reason	Samples needed?
Arsenic	Related to CCA wood and ashes, sheep dipping, orchard sprays applied 1900 – 1970	Yes	Waste disposal and burning of CCA wood is likely on site.	Yes
Boron	Timber treatment	No	No such activity	No
Cadmium	Residue from Super phosphate fertiliser	No	Not likely	No
Chromium	Electroplating, pigments, treated timber	Yes	Possible, however if present mostly related to wood (ash) - see As	XRF only
Copper	Foot rot bath, organic spray, treated wood	Yes	No limit for SQC in NES	No
Lead	Lead based paint Orchard sprays, (glass) house paints	Yes	Lead paint in wood ash and batteries will be predominant source	Yes
Mercury	Old pesticides (sheep), industrial, thermometer	Yes	Unlikely to be found (possibly as vapour)	No
BaP (poly aromatic hydrocarbons)	Residue from Creosote, waste engine oil and burning of waste	Yes	Related to burning or waste	Yes
DDT	Insecticide of the 1950-1960-ies.	Yes	Used extensively from 50 to 70, the time of waste filling	Yes
Dieldrin	More related to sheep dips.	No	No such activity	No
PCP	Fungicide, anti sap-staining agent in timber industry	No	No such activity	No
Dioxins	Related to PCP, or formed during low temperature incineration of plastics	No	Possible, but analyse only if PAH are high	No

Soil analysis Screening

The excavated waste has been analysed on-site to get an impression of the types of contaminants present. Analysis has been done using a handheld X-Ray Fluorescence analyser capable of analysing 20 heavy metals simultaneously in 20 seconds with lab-grade precision down to 10 parts per million.

The main difference with lab analysis is that in a laboratory the soil gets sieved first and all particles over 2 mm removed. Then a 2 gram subsample is analysed by acid extraction and the extract injected into the analyser. XRF analyses do not need extraction into a liquid and hence no sieving is required. This does mean larger pieces get analysed which the lab misses, however it also creates a larger variability of results. In this project this is good, as it provides insight into the range of concentrations that exist within the fill. An example is provided below for a sample from a pit on line 4 at 23.5 – 29 m (pictured on the above right).

Sample No.	Ti	Cr	Co	Ni	Cu	Zn	As	Pb	Analysis	Date
	mg/kg d.w.									
pit 4 -23.5-29	548	45	390	22	52	104	7	337	on-site	15-May
pit 4 -23.5-29	96	114	197	15	88	219	3	609	on-site	15-May
pit 4 -23.5-29	2090	169	442	41	14	99	9	57	on-site	15-May
pit 4 -23.5-29	150	32	16	5381	10964	195	5	13	on-site	15-May
pit 4 -23.5-29	150	103	219	199	261722	2782	85	389	on-site	15-May
pit 4 -23.5-29	1122	13	157	11	25	83	8	51	on-site	15-May
pit 4 -23.5-29	530	24	167	13	22	139	24	106	on-site	15-May
pit 4 -23.5-29	3475	81	981	21	31	444	15	686	on-site	15-May

Going over the metals, we see a large variation in Titanium. Around 1000 is natural soil, higher may indicate some paint pigments are added, lower means less natural soil present. The latter can be seen when we jump to Nickel and Copper (Cu) which are high when Ti is low indicating corrosion products of some alloy make up the volume rather than soil. Note 261722 mg/kg copper is 26% copper, with added oxygen copper oxide will make up most of the 'soil' volume in this sample. Chromium and Cobalt are used to detect waste oil and the first also treated wood residues. Zinc (and copper) is benign to people, but highly toxic to the environment, especially in the water phase (rivers etc.). Of main concern on this site is the health of people, for which arsenic and lead (the last two in the list) are indicative. For arsenic the NES soil quality value is 20 mg/kg arsenic and it is 210 mg/kg for lead. Both values are exceeded in many of the analysis results.

Although sieving is not necessary for XRF analysis it does provide a better overall average of the soil (or waste materials). In addition samples are often analysed multiple times, at different locations in the same sample bag, as the XRF only 'sees' 6 mm^2 of the sample to a maximum depth of 20 mm.

In the following table we see the results of the same waste pit (4-23.5/26) however now as a sieved sample in a bag.

Sample No.	Ti	Cr	Co	Ni	Cu	Zn	As	Pb	Analysis	Date
	mg/kg d.w.									
Hole 4-23.5-29	953	48	311	37	192	351	8	686	lab bag	24-May
Hole 4-23.5-29	193	98	132	11	20	222	10	242	lab bag	24-May
Hole 4-23.5-29	594	38	175	25	50	164	10	588	lab bag	24-May
Hole 4-23.5-29	195	21	163	18	41	175	8	137	lab bag	24-May
Hole 4-23.5-29	966	68	62	19	35	109	9	135	lab bag	24-May
Hole 4-23.5-29	548	60	173	49	28	128	10	278	lab bag	24-May
Hole 4-23.5-29	710	51	113	26	19	120	15	251	lab bag	24-May
Hole 4-23.5-29	163	61	75	23	43	1400	2	1032	lab bag	24-May
Hole 4-23.5-29	150	102	168	18	5	762	3	717	lab bag	24-May
Hole 4-23.5-29	266	70	142	22	5	74	3	214	lab bag	24-May
Hole 4-23.5-29	150	29	91	30	3	19	4	13	lab bag	24-May
Hole 4-23.5-29	507	37	346	27	35	367	8	793	lab bag	24-May
Hole 4-23.5-29	635	59	33	24	10	65	6	107	lab bag	23-May
Hole 4-23.5-29	12690	109	208	28	17	146	10	914	lab bag	23-May
Hole 4-23.5-29	10280	79	309	40	37	229	10	520	lab bag	23-May

We see the results are much more averaged out, with the exception of the last 2 analysis where clearly the analyses 'saw' a piece of timber or paint flake of modern paint as titanium is high. Overall lead exceeds the SQV of the NES in 80% of the analysis while arsenic is below the SQC in all analysis.

This sample is characteristic for 'brown waste'. The concentrations are not extreme and well below those set for commercial sites ($SQV_{commercial}$ for As and Pb is 70 and 3300 mg/kg resp.).

Different is the black waste. Below is an example of this material from the hole dug in line 2 at 33 – 36 meters (the deep hole pictured above).

Sample No.	Ti	Cr	Co	Ni	Cu	Zn	As	Pb	Analysis	Date
	mg/kg d.w.									
2 33 36 /1	1752	13	403	10	5	345	27	202	lab bag	24-May
2 33 36 /1	1206	16	244	19	26	201	3	303	lab bag	24-May
2 33 36 /1	262	107	171	20	66	708	35	514	lab bag	24-May
2 33 36 /1	1808	799	231	30	63	1828	93	692	lab bag	24-May
2 33 36 /1	856	35	194	31	99	126	4	115	lab bag	24-May
2 33 36 /1	1118	100	167	18	8	102	22	93	lab bag	24-May
2 33 36 /1	728	59	237	25	74	618	4	1403	lab bag	24-May
2 33 36 /1	150	199	57	27	15	2515	26	401	lab bag	24-May
2 33 36 /1	1216	109	172	22	23	1574	77	770	lab bag	24-May
2 33 36 /1	1290	130	282	89	12	391	255	1941	lab bag	24-May
2 33 36 /1	710	46	207	89	5	140	39	127	lab bag	24-May
2 33 36 /1	745	33	324	17	30	91	13	60	lab bag	24-May
2-33-36/1	150	70	120	15	5	419	8	399	lab bag	23-May
2-33-36/1	5554	44	222	22	14	459	8	1481	lab bag	23-May
2-33-36/1	308	95	73	40	10	213	5	138	lab bag	23-May

We see a lot more cobalt and chromium (more waste oil / car parts types of waste), much higher levels of zinc, arsenic and lead, with arsenic well above commercial SQVs.

All XRF analyses are presented in the appendix.

Laboratory analysis

With such a wide variety of concentrations it is hard to justify many laboratory analyses, so a few have been selected to confirm the range of concentrations found. Below are the results for heavy metal analysis. The results corroborate the XRF analysis very well with lead being the principal metal of concern, followed by arsenic. Cadmium, an element poorly analysed by XRF and likely related to metal and engine oil related wastes as well as paint is found to exceed residential SQCs in 1 out of the 7 samples, similar to arsenic. Lead exceeds the residential SQVs in all samples.

Sample Type: Soil						
Sample Name:		TEAWA-RET-Pit 4 -23.5-29	TEAWA-RET-Pit 3 56 50	TEAWA-RET-Pit 2 66 68	TEAWA-RET-Pit 2 33 36 /1	TEAWA-RET-Pit 2 33 36 /2
Lab Number:		1140355.1	1140355.2	1140355.3	1140355.4	1140355.5
Individual Tests						
Dry Matter	g/100g as rcvd	50	67	61	59	67
Moisture*	g/100g as rcvd	50	33	39	41	33
Total Recoverable Arsenic	mg/kg dry wt	8	16	17	8	22
Total Recoverable Cadmium	mg/kg dry wt	0.81	2.9	0.71	0.85	1.02
Total Recoverable Chromium	mg/kg dry wt	15	23	27	23	35
Total Recoverable Lead	mg/kg dry wt	2,100	540	230	880	470
Total Recoverable Zinc	mg/kg dry wt	540	2,700	350	1,090	710
Sample Name:		TEAWA-RET-Pit 24 24 30 black	TEAWA-RET-Pit 24 24 30 brown	TEAWA-RET-Pit 4 -23.5-29	TEAWA-RET-Pit 2 33 36 /1	TEAWA-RET-Pit 24 24 30 black
Lab Number:		1140355.6	1140355.7	1140355.8	1140355.9	1140355.10
Individual Tests						
Dry Matter	g/100g as rcvd	60	65	-	-	-
Moisture*	g/100g as rcvd	40	35	-	-	-
Total Recoverable Arsenic	mg/kg dry wt	9	10	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	6.7	1.68	-	-	-
Total Recoverable Chromium	mg/kg dry wt	27	33	-	-	-
Total Recoverable Lead	mg/kg dry wt	740	320	-	-	-
Total Recoverable Zinc	mg/kg dry wt	4,000	850	-	-	-

Four samples have been analysed for organochlorine pesticides (OCPs) which include DDT and its derivates, Dieldrin etc. None of these exceed the residential guideline. The full laboratory report is appended to this report.

Also four samples have been analysed for poly aromatic hydrocarbons (PAHs). These relate to soot, and other products of low temperature combustion. The sample with the highest concentrations in taken from pit 2-33/36 (the deep pit pictured above).

To see if the PAHs exceed the SQV of the NES they have to be combined and corrected for their individual toxicity using the toxicity equivalent factor (TEF) to arrive at the BAP Toxicity Equivalent (BAP teq.) as is done below.

Chemical TEF	factor	2-33/36	BAP teq (mg/kg).
benzo(a)pyrene	1	2.1	2.1
benzo(a)anthracene	0.1	1.82	0.2
benzo(b)fluoranthene	0.1	2	0.2
benzo(k)fluoranthene	0.1	1.7	0.2
chrysene	0.01	2	0.0
dibenz(a,h)anthracene	1	0.35	0.4
indeno(123-cd)pyrene	0.1	1.25	0.1
total			3.1

The BAP teq for residential soil is 55 mg/kg. The most PAH containing sample has a BAP teq of 3.1 mg/kg, less than 6 % of the SQV. Although 4 samples is not a large quantity of samples for a site with a large variety of wastes, it is a clear indication that PAHs are not a major issue in this waste.

Interpretation of Results

The waste underlying the site is mainly contaminated with heavy metals. The site average, calculated from all XRF analysis undertaken in the waste is presented below.

Site AVERAGE	Ti	Cr	Co	Ni	Cu	Zn	As	Pb
	mg/kg d.w.							
	1428	76	208	88	1747	1509	40	1387
Residential SQV							20	210
High density res SQV							45	500
Commercial SQV							70	3300

The site meets the high density residential SQV for arsenic and cadmium (see discussion below). However for lead the property meets currently only the commercial SQV's.

Arsenic and Lead

Arsenic is often the result of old sprays, however also can result from burning of apple bins or fence posts (treated wood) and spreading of ashes or the disposal of saw dust of treated wood. Lead is often the result of old orchard sprays and the burning wood which was painted with lead-based paints.

Analyses for arsenic show generally acceptable levels for residential site use (20 mg/kg), with small but distinct hotspots where the arsenic concentration is significantly higher.

Lead is generally found at concentrations above residential level (210 mg/kg). However is generally below the commercial SQV of 3300 mg/kg.

Most arsenic and cadmium and many of the lead analysis are below the NES SQV for high density residential site use.

The laboratory corroboration analysis show good correlation with the XRF analysis.

Copper and zinc

Copper and zinc are analysed as they often indicate some past activity. Copper and zinc may result from:

Copper	a result of (organic) sprays and residues of other fungicides and anti-foot-rot baths
Zinc	a residue from modern pesticides as well as the result of corrosion of galvanised farm implements, fence lines, galvanised steel sheeting on sheds, anti-foot-rot baths etc.

In this case we see significantly elevated zinc and copper levels in many of the samples. This can have multiple reasons, like some zinc paint residues, corroding / burned old car tires and the disposal of galvanised sheeting, or old fence wire. Most samples exceed the NEPM ecological values by a factor 10 – 100. Clearly caution has to be taken to avoid site run-off to get to open water where it can do serious harm to the ecosystems. Fortunately humans are quite insensitive to copper and zinc and therefore they are not a priority pollutants in the NES (NL = 'no limit').

Cadmium

Cadmium is often a residue of super phosphate from the time that New Zealand imported phosphate rock high in cadmium and other heavy metals (pre-2000). The concentrations of Cadmium, Fluorine and Uranium in the post 2000 imported rock phosphate are somewhat lower. The XRF analyser is not sensitive to cadmium and the NES limits are very low (0.8 mg/kg for rural residential properties and 3 mg/kg for residential properties). Therefore a laboratory analysis for this metal is included. All samples tested by the lab show results below the SQV set out in the NES for residential site use (see laboratory report in the appendix).

∑DDT and OCPs

DDT is the generic name for a group of DDT-like pesticides which are produced together as well as breaking down producing into other DDT like chemicals (DDT → DDD → DDE) with half-life ranging from 5 to 30 years[1].

The limit for the sum of all DDT-like chemicals combined is set by the NES at 45 mg/. For this property the analysis results show a very low concentration.

PAHs

Poly Aromatic Hydrocarbons occur naturally and near open fires. They are often found in soot in chimneys and in waste engine oil. Their toxicity is compound dependent with the most toxic (and carcinogenic) being Benzo-a- pyrene (BAP). The toxicity of the PAH group is expressed in BAP equivalent toxicity. The sample which contains the highest concentration of PAHs has a BAP teq of only 3.1 mg/kg. For residential soil 55 mg/kg is the SQV. Although the PAH concentration will vary a lot over the site depending what was burned and where, it is safe to assume that on average most of the materials will meet residential guideline levels.

[1] http://www.atsdr.cdc.gov/toxprofiles/tp35.pdf

Other considerations

Non priority contaminants

The property has been in use as retirement village for over 50 years. Property maintenance is mainly by lawn mowing and individual residents have their own gardens. Even if 'modern' organo-phosphate or -nitrate pesticides and herbicides were used, with half life values of days to weeks the concentration in the soil will drop to non detectable levels quickly. Moreover the NES considers these chemicals of lesser importance in relation to human health. Combining this with the rapid breakdown and therefore low concentrations we conclude that analysis for these compounds will not add value to this report.

Reasons to use lower guideline levels

Lower guideline levels than those listed in the NES are applicable when the site is located in or near sensitive receptors. This occurs when water or sediment run-off is expected to enter water bodies such as rivers, lakes or estuaries.

Although the property has a small creek running to the south of it, this is separated from the property by at least 20 m of land owned by the neighbours. Mainly Copper and Zinc would affect the eco-systems in the stream; however these sediments would carry the average concentration found on the property, rather than the concentration from one particular site. Using the Ecological threshold levels used NEPM table 5-A; we find:

(All concentrations in mg/kg d.w.)	Zn	Cu
Ecological threshold levels used NEPM table 5-A;	200	100
Average levels found on this site (all XRF analysis combined)	1509	1747

The average concentrations of both Zinc and Copper are well above the Ecological threshold levels and therefore every attempt has to be made to contain run-off of these metals to open water and other the eco-systems.

Current risks and Potential Risks

Current risks are limited to the presence of buried waste and take two forms:

- Direct contact with the waste, due to digging / gardening at places where the cover layer may be thin and exposure to the heavy metals in the waste.

- Inhalation of gasses and vapours produced by and emitted from the waste. The waste is after all a 'landfill' and landfills are notorious for generating landfill gasses. The most dangerous one is carbon monoxide, however also methane can be toxic and explosive in sufficient concentrations. No sign (smell) of hydrogen sulphide was found during excavations; however relative few excavations were carried out.

Potential risks relate to:

- The presence of drums of chemicals, which have not yet fully corroded, but when they do may migrate to the surface, create vapours or migrate off site and/or to groundwater.

- Presence of large hollow spaces (like car bodies), which may collapse when fully corroded or when other waste around it becomes unstable causing sudden subsidence.

Conclusion

Combining the GPR survey with the physical inspection by excavation has shown the site to be mainly underlain by waste. The waste is the result of general co-disposal of municipal and commercial wastes during the period prior to building the retirement village.

Contamination is present throughout the waste with areas with 'brown' waste having significantly lower concentrations compared to the areas with 'black waste'.

The main contaminant is lead for human health reasons, with for ecological reasons zinc being a close second.

At present the inhabitants are shielded from the contaminants by a layer of clean soil. However the thickness is quite variable with thicknesses of 0.3 – 1.5 meter being observed during this investigation.

Remedial Options

To devise remedial options is outside the scope of the current brief; however a few suggestions and ideas generated during the investigation project are in order of potential costs:

1. Assess and evaluate the risks and if acceptable leave all waste in place. Built any new buildings on piles and keep topping up the soil around the buildings from time to time.
2. Remove the waste with contaminant levels over the SQC applicable to the site (at current use 'residential', however this could become 'high density residential' or even 'commercial' under a new site construction scenario.
3. Remove all waste and thereby all current and potential risks and unknowns. This allows the full potential of this property to be realised without limitations.
4. Other variations of partial remediation may be possible.

Recommendations

If full removal of waste is not considered in the near future, an assessment of the risk related to landfill gasses and vapours emitted from the waste is advised.

Investigate potential pathways of gasses and vapours into the buildings.

Eliminate risk of small buried objects by carrying out an electromagnetic induction survey.

Explore future use and re-built options with current landowner.

Compliance and Guidelines used:

This assessment complies with the "Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011" Ref No. 2011/361, downloaded 8/7/2012 from http://www.legislation.govt.nz/regulation/public/2011/0361/latest/DLM4052228.html?search=ts_regulation_contaminants_resel&p=1&sr=1

The work carried out for this soil assessment complies with the guidelines set out in (last downloaded 8 July 2012): http://www.mfe.govt.nz/publications/rma/users-guide-nes-for-assessing-managing-contaminants-in-soil/guide-nes-for-assessing-managing-contaminants-in-soil.pdf

With technical specifications contained in (last downloaded 8 July 2012):

- Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils (Revised 2011): http://www.mfe.govt.nz/publications/hazardous/contaminated-land-mgmt-guidelines/guideline-1.pdf
- Contaminated Land Management Guidelines No. 1 - Reporting on Contaminated Sites in New Zealand (Revised 2011) http://www.mfe.govt.nz/publications/hazardous/contaminated-land-mgmt-guidelines-no5/guideline-5.pdf
- For the Ecological threshold levels used NEPM table 5-A: http://esdat.net/Environmental%20Standards/Australia/NEPM%20Tables.pdf

Appendices:

A The use of an X-ray fluorescence (XRF) Analyser
B Detailed site plan, Annotated radargrams and Laboratory analysis report

Appendix A: The use of X-ray fluorescence (XRF) Analyser.

Comparison with Laboratory Results

Field XRF analysis yields 'wet weight' a (w.w.) result, i.e. the sample is 'diluted' with water. Laboratory results and guideline standards are given as dry weight (d.w) also called dry matter (dm) concentrations. The results from XRF analysis therefore have to be corrected by the percentage soil moisture in order to be compared with the guideline values and laboratory results. The soil moisture content of the samples nearest to those analysed in the lab is used. All results in the report are corrected for soil moisture (as the laboratory does) and are given in mg/kg d.w.

A difference between laboratory results and those obtained from XRF analysis is that the XRF analyses a small *surface area* of the sample, whereas a *small volume* of the sample will be extracted for laboratory analysis (2 gram). Sample heterogeneity is accounted for with the XRF analysis by analysing the sample on more separate positions (different places on the sample bags) and if needed determining an average concentration. In the laboratory the sample is mechanically mixed and sieved (2 mm) before the sub-sample is taken. For example, larger paint flakes are omitted in laboratory analysis, but the XRF results would be higher if the flakes are close to the surface in the sample. At the other hand the XRF results are moderated by paint resin reducing the fluorescence of the metal molecules, which in turn reduces the concentration read on the instrument.

Finally compaction of the sample is important as the more soil grains are present in front of the XRF window, the higher the concentration read. Using the XRF on-site in an in situ mode care has been taken to analyse soil which was either not yet excavated or when measuring on the mix pile selecting a spot inside the wheel tracks to gain consistent readings. When analysing soil in bags or in the field care has been taken to compress each bag or sample before analysis to obtain similar compaction for each bag / sample analysed. As this is certainly not 95% compaction everywhere in the bag, some variability can be expected.

International Use of XRF

The United Stated Environmental Protection Agency has produced a number of guidelines and method statements for the use of XRF devices. In the USA, portable XRF devices are used in the field for initial site characterisation and the identification of contamination patterns, as well as to make informed decisions on sample selection for further analysis. Method Statement 6200 has been published by the EPA under the Resource Conservation and Recovery Act (RCRA) to provide guidance and regulation for field-portable XRF analysis (www.epa.gov). In the absence of NZ guidance, this document is considered during the current project.

Appendix B Questions raised and answers to these

Taken from emails send 8 July 2012

Some questions that did arise that I would ask for your comment on are:

a- No reference in the report has been made to the "Little Theatre" site - across road Vaile/Palmer Streets. This was part of the extended area requested by Council. I advised Council it was part of the original drainage system

in the southern part of the section, and probably of similar finding to the pensioner unit site across the road.

I attach the Geotech report that provides bore holes 1-4 relating to the site to assist your comment.

[Ben Keet] This question has been discussed with Martin King and he has reviewed the radargrams in that area. Our answer is that in the radargrams 9 and 10 (see attached) there is certainly not the strong response from landfill/waste material found elsewhere on the site. Along the Church, in radargram no. 9, the clay layers are clearly seen (see last page in appendix C). The disturbance at the footpath is most likely due to some service duct / piping which doesn't extent past the church as it is not visible on radargram no. 10, however there is some disturbance, however this is too little to give it the certainty of a classification 'landfill / waste'. At the location of the footpath and further towards the middle of the crossing is where the centre of the old valley was and this area will have been very wet and peaty. The occasional brick and piece of concrete / rubbish may have been present when it was finally covered over. These items would be too small and too similar to their surrounding to be picked up in isolation. From the radargrams we wouldn't class the footpath area as an extension of the landfill, however the landfill may well extend across the road (crossing) into the hire place yard. This is outside the surveyed area. So to conclude: it looks like the church itself is not build on waste, but rather on clay / peat. If there is waste past the crossing it may just be starting at the footpath and continue on into the road area. This, however, is very speculative.

b- I was questioned about the issues of lead levels and the hot spots of arsenic being higher than the residential SQV, and with the existing pensioners on site and now that Council are made aware

1/ do we see any current immediate action to be undertaken especially now you have seen the site ie: gardens.

[Ben Keet] this investigation has focussed on the question:"Is there waste below the buildings and if so what is the extent and does it contain contamination". It hasn't really focussed on the health related aspects of garden soil and consequently no sampling of these was undertaken. Based on assumptions two lines of thought can be pursued:

1. ***At the on hand, based on the history of the site, it seems logical to assume the cover material placed over the fill provides adequate separation. The (garden) topsoil was most likely placed after the buildings were build and has no relationship with the waste below the fill layer.***

2. ***At the other hand the piles of the buildings may not have been driven, but drilled, which would have brought up some of the waste which then during the building process would have dispersed around the buildings and finally be mixed into the garden soil, creating a current contaminant issue with concentrations of lead and/or arsenic over NES SQVs.***

I have no knowledge of how the construction of the foundation might have been carried out in the 70-ies. Diving seems logical, however the waste contains sufficient large 'junk' that drilling may have been needed. In view of this I would give option 1 60% chance and option 2 40% chance.

2/ the issue raised about inhalation of gases and vapour (carbon monoxide and methane) especially with the open spaces under piled timber floors is seen as a potential hazard that has not been confirmed or

denied in the report. This is a current issue raised in need of an answer even though it could be mitigated under a new construction I think we need urgent advise on this please.

[Ben Keet] In my view, now we have confirmed the presence of a significant body of waste – mainly originating from domestic sources and thus originally containing putrefiable materials which can generate landfill gasses, the detection of landfill gasses should be considered. It is not a big task. Using a calibrated landfill gas monitor the subfloor space of all units, the recreation building and theatre can be surveyed in 1 day including taking some readings from inside the waste by means of soil probes. I think this is recommendable.

[Ben Keet] I'm surprised the council hasn't pursued the point made about the potentially buried drums (and cars). Not only could further corrosion in the future make the ground unstable, leading to accidents, if not just to inconvenience by having to fill holes all the time. But more importantly any buried drum may contain (volatile) chemicals that at present have not been found. The information I have about drum location is that it can be done relatively fast (1 day) and with a near 95% chance of identifying any piece of steel that has a horizontal surface the size of a 60 liter drum. I would consider this worthwhile.

c- Not such a pressing issue revealed but one of concern is the levels of zinc and copper on the site. I am aware that this is a NZ wide problem, but I have no experience on how to treat and Council want information about this site and how it can be dealt with and potential costs.

[Ben Keet] The zinc and copper levels in the waste would only cause problems when they are also mobile, i.e. when they are transported off-site to waterways by means of groundwater transport; which due to the presence of the main drain through this old valley can enter the storm water system which acts as a short cut to open water. The simplest way to defuse this problem is by taking a few water samples in downstream locations like near the corner of Palmer and Vale Streets. The Geotech rig can drill such holes (say 3 holes) in a short space of time. Care needs to be taken to filter the sampled water before analysis to avoid false high readings.

I currently have no intention to excavate the site due to cost and would see that we are in this case taking the problem from one site to another.

[Ben Keet] I agree with the non-excavation strategy. However 'the other' location would of course be a geo-engineered and fully lined landfill with leachate control. This would improve the situation both on-site and in relation to the final resting place of the waste significantly. However at current economic climate I can see the cost are possibly not be justified and as long as the risk is minimal – by quantifying the risks as identified above and finding they are low or absent – the waste is better left untouched.

I also ask, is the problem on this site any worse than the stormwater running off galvanised iron roofs, etc. to waterways via storm water drains.

[Ben Keet] This is a very hard question and in terms of risk assessment an invalid one – like stating the smoking creates a 1000 times higher risk to health then living on a site of a former landfill. The comparison also opens a can of worms in terms of dilution: Should we allow any contamination as long as it is diluted adequately? I suggest to steer away from such arguments.

Regards, Ben Keet

Ph 021 117 1148

Next pages: Appendix C Detailed site plan, Annotated radargrams and Laboratory analysis report

.

All XRF analysis results - corrected for soil moisture at uniform level of 40%

Sample No.	Ti	Cr	Co	Ni	Cu	Zn	As	Pb	Analysis	Date
	mg/kg d.w.									
pit 4 -23.5-29	548	45	390	22	52	104	7	337	on-site	15-May
pit 4 -23.5-29	96	114	197	15	88	219	3	609	on-site	15-May
pit 4 -23.5-29	2090	169	442	41	14	99	9	57	on-site	15-May
pit 4 -23.5-29	150	32	16	5381	10964	195	5	13	on-site	15-May
pit 4 -23.5-29	150	103	219	199	261722	2782	85	389	on-site	15-May
pit 4 -23.5-29	1122	13	157	11	25	83	8	51	on-site	15-May
pit 4 -23.5-29	530	24	167	13	22	139	24	106	on-site	15-May
pit 4 -23.5-29	3475	81	981	21	31	444	15	686	on-site	15-May
pit 4 -23.5-29	1033	32	236	32	10	95	5	123	on-site	15-May

Sample No.	Ti	Cr	Co	Ni	Cu	Zn	As	Pb	Analysis	Date
	mg/kg d.w.									
Hole 4-23.5-29	953	48	311	37	192	351	8	686	lab bag	24-May
Hole 4-23.5-29	193	98	132	11	20	222	10	242	lab bag	24-May
Hole 4-23.5-29	594	38	175	25	50	164	10	588	lab bag	24-May
Hole 4-23.5-29	195	21	163	18	41	175	8	137	lab bag	24-May
Hole 4-23.5-29	966	68	62	19	35	109	9	135	lab bag	24-May
Hole 4-23.5-29	548	60	173	49	28	128	10	278	lab bag	24-May
Hole 4-23.5-29	710	51	113	26	19	120	15	251	lab bag	24-May
Hole 4-23.5-29	163	61	75	23	43	1400	2	1032	lab bag	24-May
Hole 4-23.5-29	150	102	168	18	5	762	3	717	lab bag	24-May
Hole 4-23.5-29	266	70	142	22	5	74	3	214	lab bag	24-May
Hole 4-23.5-29	150	29	91	30	3	19	4	13	lab bag	24-May
Hole 4-23.5-29	507	37	346	27	35	367	8	793	lab bag	24-May
Hole 4-23.5-29	635	59	33	24	10	65	6	107	lab bag	23-May
Hole 4-23.5-29	12690	109	208	28	17	146	10	914	lab bag	23-May
Hole 4-23.5-29	10280	79	309	40	37	229	10	520	lab bag	23-May
pit3 -46 -50	1737	39	305	23	15	115	9	139	on-site	15-May
pit3 -46 -50	876	97	79	22	15	247	11	104	on-site	15-May
pit3 -46 -50	1858	53	121	20	69	929	7	250	on-site	15-May
pit3 -46 -50	1701	11	104	25	35	656	28	276	on-site	15-May
pit3 -46 -50	1331	30	225	27	16	1155	1	277	on-site	15-May
pit3 -46 -50	1085	47	327	13	36	197	6	79	on-site	15-May
3 46 50	308	21	453	89	59	1340	8	233	lab bag	24-May
3 46 50	830	55	230	31	48	2368	14	322	lab bag	24-May
3 46 50	1654	30	159	25	39	530	21	167	lab bag	24-May
3 46 50	1763	155	258	35	31	626	16	220	lab bag	24-May
3 46 50	1663	26	335	21	53	643	9	425	lab bag	24-May
3 46 50	1613	32	119	29	54	678	29	159	lab bag	24-May

3 46 50	1171	44	238	20	19	610	10	114	lab bag	24-May
3 46 50	335	10	241	30	19	305	11	217	lab bag	24-May
3 46 50	915	17	152	29	40	327	12	106	lab bag	24-May
3 46 50	1691	18	250	40	18	135	4	66	lab bag	24-May
3 46 50	1243	37	195	22	21	391	7	82	lab bag	24-May
3 46 50	1161	105	179	36	20	142	8	68	lab bag	23-May
3 46 50	14283	62	302	89	123	1905	7	196	lab bag	23-May
3 46 50	2798	27	166	30	45	1456	7	239	lab bag	23-May
hole 2 65-70	150	46	67	4082	1405	173	12	166	on-site	15-May
hole 2 65-70	1778	107	227	16	5	100	6	26	on-site	15-May
hole 2 65-70	240	1303	1002	89	147	74	21	110	on-site	15-May
hole 2 65-70	809	60	72	18	8	33	9	12	on-site	15-May
hole 2 65-70	150	67	158	27	9	51	6	15	on-site	15-May
hole 2 65-70	366	44	211	21	14	87	6	46	on-site	15-May
hole 2 65-70	150	199	40	77	174	160346	4411	195539	on-site	15-May
hole 2 65-70	1520	29	187	89	10	84	14	44	on-site	15-May
hole 2 65-70	1497	30	139	26	10	88	8	45	on-site	15-May
hole 2 65-70	150	199	855	89	31	176	7	331	on-site	15-May
hole 2 65-70	977	224	723	12	167	293	30	286	on-site	15-May
hole 2 65-70	232	55	164	25	10	127	9	32	on-site	15-May
hole 2 65-70	792	57	104	38	8	53	10	11	on-site	15-May
2 66 68	1628	35	328	40	36	157	16	85	lab bag	24-May
2 66 68	909	35	126	31	14	150	9	44	lab bag	24-May
2 66 68	1569	61	317	38	25	726	2	213	lab bag	24-May
2 66 68	150	13	107	14	9	54	7	17	lab bag	24-May
2 66 68	1805	65	13	17	18	118	21	63	lab bag	24-May
2 66 68	1766	116	223	34	13	142	12	79	lab bag	24-May
2 66 68	660	52	89	22	27	78	5	37	lab bag	24-May
2 66 68	906	38	502	12	11	309	11	75	lab bag	24-May
2 66 68	845	111	284	29	19	88	13	52	lab bag	24-May
2 66 68	819	50	214	23	27	372	7	56	lab bag	24-May
2 66 68	903	61	278	18	6	314	6	70	lab bag	24-May
2 66 68	745	61	232	18	44	217	9	114	lab bag	24-May
2 66 68	631	58	34	13	11	121	5	74	lab bag	23-May
2 66 68	13704	56	99	21	19	68	9	80	lab bag	23-May
2 66 68	160	21	90	20	25	117	14	49	lab bag	23-May
hole 2 33-36	1077	36	282	23	5	148	5	129	on-site	15-May
hole 2 33-36	376	28	81	15	20	171	5	84	on-site	15-May
hole 2 33-36	662	31	95	24	8	94	3	81	on-site	15-May
hole 2 33-36	424	56	288	26	27	139	10	77	on-site	15-May
hole 2 33-36	2050	69	161	89	15	98	5	59	on-site	15-May
hole 2 33-36	1127	51	376	89	17	75	6	41	on-site	15-May
hole 2 33-36	2115	94	247	46	15	140	6	47	on-site	15-May

hole 2 33-36	409	63	105	19	15	180	13	170	on-site	15-May
hole 2 33-36	150	18	81	26	10	80	10	58	on-site	15-May
hole 2 33-36	547	65	243	22	10	292	33	201	on-site	15-May
hole 2 33-36	274	27	370	28	5	361	5	182	on-site	15-May
hole 2 33-36	150	147	388	27	45	234	9	88	on-site	15-May
hole 2 33-36	513	1013	361	26	10	175	4	32	on-site	15-May
hole 2 33-36	531	54	188	30	17	187	9	121	on-site	15-May
hole 2 33-36	1068	13	290	28	20	105	6	88	on-site	15-May

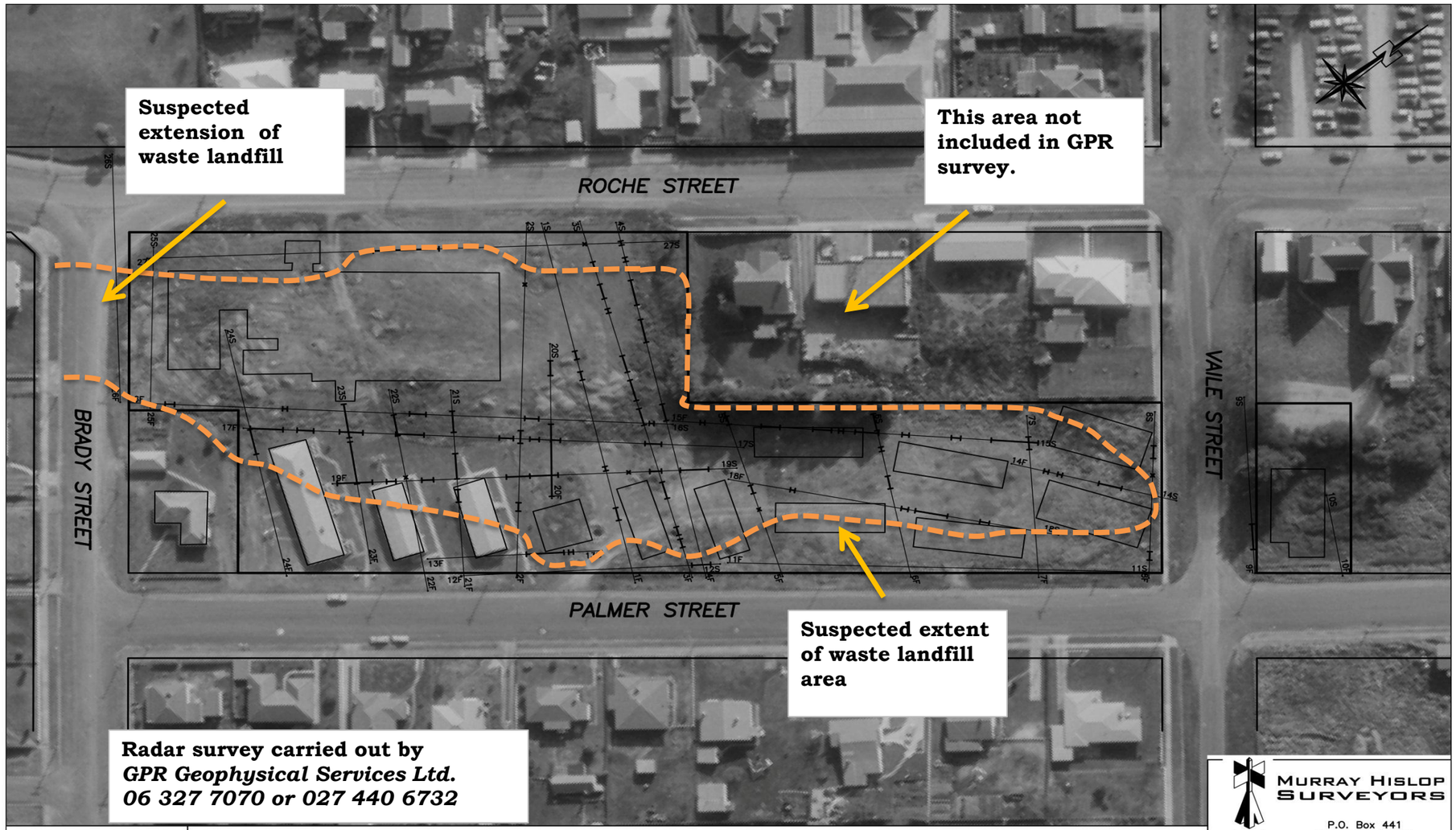
Sample No.	Ti	Cr	Co	Ni	Cu	Zn	As	Pb	Analysis	Date
	mg/kg d.w.									
2 33 36 /1	1752	13	403	10	5	345	27	202	lab bag	24-May
2 33 36 /1	1206	16	244	19	26	201	3	303	lab bag	24-May
2 33 36 /1	262	107	171	20	66	708	35	514	lab bag	24-May
2 33 36 /1	1808	799	231	30	63	1828	93	692	lab bag	24-May
2 33 36 /1	856	35	194	31	99	126	4	115	lab bag	24-May
2 33 36 /1	1118	100	167	18	8	102	22	93	lab bag	24-May
2 33 36 /1	728	59	237	25	74	618	4	1403	lab bag	24-May
2 33 36 /1	150	199	57	27	15	2515	26	401	lab bag	24-May
2 33 36 /1	1216	109	172	22	23	1574	77	770	lab bag	24-May
2 33 36 /1	1290	130	282	89	12	391	255	1941	lab bag	24-May
2 33 36 /1	710	46	207	89	5	140	39	127	lab bag	24-May
2 33 36 /1	745	33	324	17	30	91	13	60	lab bag	24-May
2-33-36/1	150	70	120	15	5	419	8	399	lab bag	23-May
2-33-36/1	5554	44	222	22	14	459	8	1481	lab bag	23-May
2-33-36/1	308	95	73	40	10	213	5	138	lab bag	23-May
2 33 36 /2	2606	69	66	35	17	315	67	172	lab bag	24-May
2 33 36 /2	1154	43	236	13	18	142	6	176	lab bag	24-May
2 33 36 /2	1962	43	189	37	25	255	16	149	lab bag	24-May
2 33 36 /2	944	63	129	41	22	229	5	136	lab bag	24-May
2 33 36 /2	1463	110	307	32	36	331	16	45	lab bag	24-May
2 33 36 /2	1328	55	181	12	42	157	6	65	lab bag	24-May
2 33 36 /2	506	64	111	11	107	147	10	138	lab bag	24-May
2 33 36 /2	1896	50	86	27	80	331	8	178	lab bag	24-May
2 33 36 /2	916	28	316	23	29	1095	4	176	lab bag	24-May
2 33 36 /2	911	14	287	28	40	379	8	235	lab bag	24-May
2 33 36 /2	812	106	38	37	14	163	10	76	lab bag	24-May
2 33 36 /2	641	50	137	120	20	149	21	62	lab bag	24-May
2-33-36/2	604	27	145	89	8	116	9	63	lab bag	23-May
2-33-36/2	911	33	192	13	17	856	6	91	lab bag	23-May
2-33-36/2	15805	29	126	15	33	172	15	65	lab bag	23-May
24 24 30 black	936	106	72	40	13	2386	4	211	lab bag	24-May

24 24 30 black	800	60	177	17	88	1084	9	168	lab bag	24-May
24 24 30 black	150	93	107	89	93	1541	33	274	lab bag	24-May
24 24 30 black	1096	16	236	11	117	1160	10	183	lab bag	24-May
24 24 30 black	150	104	60	24	82	1539	9	151	lab bag	24-May
24 24 30 black	829	23	174	33	37	2120	15	133	lab bag	24-May
24 24 30 black	1354	50	30	30	53	2838	9	167	lab bag	24-May
24 24 30 black	150	40	141	15	26	357	10	51	lab bag	24-May
24 24 30 black	1123	39	57	34	34	1493	23	115	lab bag	24-May
24 24 30 black	208	60	275	16	120	587	5	143	lab bag	24-May
24 24 30 black	755	42	130	14	47	621	12	151	lab bag	24-May
24 24 30 black	1292	56	151	28	62	2191	6	410	lab bag	24-May
24/24/30 black	1644	48	132	22	125	5255	8	1884	lab bag	23-May
24/24/30 black	496	44	284	29	6	203	6	48	lab bag	23-May
24/24/30 black	10590	23	180	19	61	1784	4	360	lab bag	23-May
hole 24 24-30	2805	67	217	44	291	464	14	573	on-site	15-May
hole 24 24-30	1385	60	122	31	34	342	8	66	on-site	15-May
hole 24 24-30	502	23	138	11	88	47	13	33	on-site	15-May
hole 24 24-30	726	63	13	39	12	110	4	52	on-site	15-May
hole 24 24-30	1752	24	124	16	5	532	4	44	on-site	15-May
hole 24 24-30	958	66	10	26	110	361	23	293	on-site	15-May
hole 24 24-30	473	11	68	12	11	406	6	110	on-site	15-May
hole 24 24-30	964	57	195	20	17	85	4	102	on-site	15-May
hole 24 24-30	807	110	155	18	10	160	9	47	on-site	15-May
hole 24 24-30	839	117	59	21	5	121	12	47	on-site	15-May
hole 24 24-30	1257	15	19	27	9	67	9	46	on-site	15-May
hole 24 24-30	938	46	63	25	9	102	7	34	on-site	15-May
24 24 30 brown	1525	48	258	34	38	522	6	398	lab bag	24-May
24 24 30 brown	4062	66	123	41	91	299	10	146	lab bag	24-May
24 24 30 brown	168	78	171	24	18	174	10	140	lab bag	24-May
24 24 30 brown	2306	19	189	31	26	242	20	195	lab bag	24-May
24 24 30 brown	1236	35	239	30	7	117	5	68	lab bag	24-May
24 24 30 brown	1408	18	45	12	26	145	4	82	lab bag	24-May
24 24 30 brown	1700	26	131	29	16	107	7	46	lab bag	24-May
24 24 30 brown	577	21	213	24	5	127	8	27	lab bag	24-May
24 24 30 brown	1083	60	49	16	17	95	5	47	lab bag	24-May
24 24 30 brown	247	99	225	17	43	123	5	185	lab bag	24-May
24 24 30 brown	1945	64	142	28	29	169	35	135	lab bag	24-May
24 24 30 brown	1105	21	273	30	10	179	9	124	lab bag	24-May
24/24/30 brown	725	56	75	28	10	97	9	48	lab bag	23-May
24/24/30 brown	1901	18	299	89	10	61	4	58	lab bag	23-May
24/24/30 brown	1466	62	283	25	40	966	16	213	lab bag	23-May

Sample No.	Ti	Cr	Co	Ni	Cu	Zn	As	Pb		Date
pit3 -39-44	1059	85	336	26	50	402	44	394	on-site	15-May
pit3 -39-44	147	171	648	21	77	972	47	388	on-site	15-May
pit3 -39-44	1363	24	765	89	210	1224	3	292	on-site	15-May
pit3 -39-44	1514	55	170	43	37	326	8	247	on-site	15-May
pit3 -39-44	2062	28	661	89	41	1198	7	275	on-site	15-May
pit3 -39-44	150	26	62	16	13165	12281	3	853	on-site	15-May
pit3 -39-44	150	55	37	21	12	60	6	63	on-site	15-May
drill hole 10	407	35	17	19	10	317	7	99	on-site	15-May
drill hole 10	657	26	251	14	142	318	19	108	on-site	15-May

Site AVERAGE	Ti	Cr	Co	Ni	Cu	Zn	As	Pb
	mg/kg d.w.							
	1428	76	208	88	1747	1509	40	1387
Residential SQV							20	210
High density res SQV							45	500
Commercial SQV							70	3300

APPENDIX A
GEOPHYSICAL SURVEY - TE AWAMUTU
PENSIONER UNITS GROUNDS
PALMER STREET
May-13



Scale 1:750 @ A3
Job 1841
Date MAY 2013

PLAN OF CURRENT BUILDINGS ON 1963 AERIAL PHOTOGRAPH

OF ALLOTMENTS 82, 84–91, 93, 95, 97 & 99 VILLAGE OF TE AWAMUTU

MURRAY HISLOP SURVEYORS

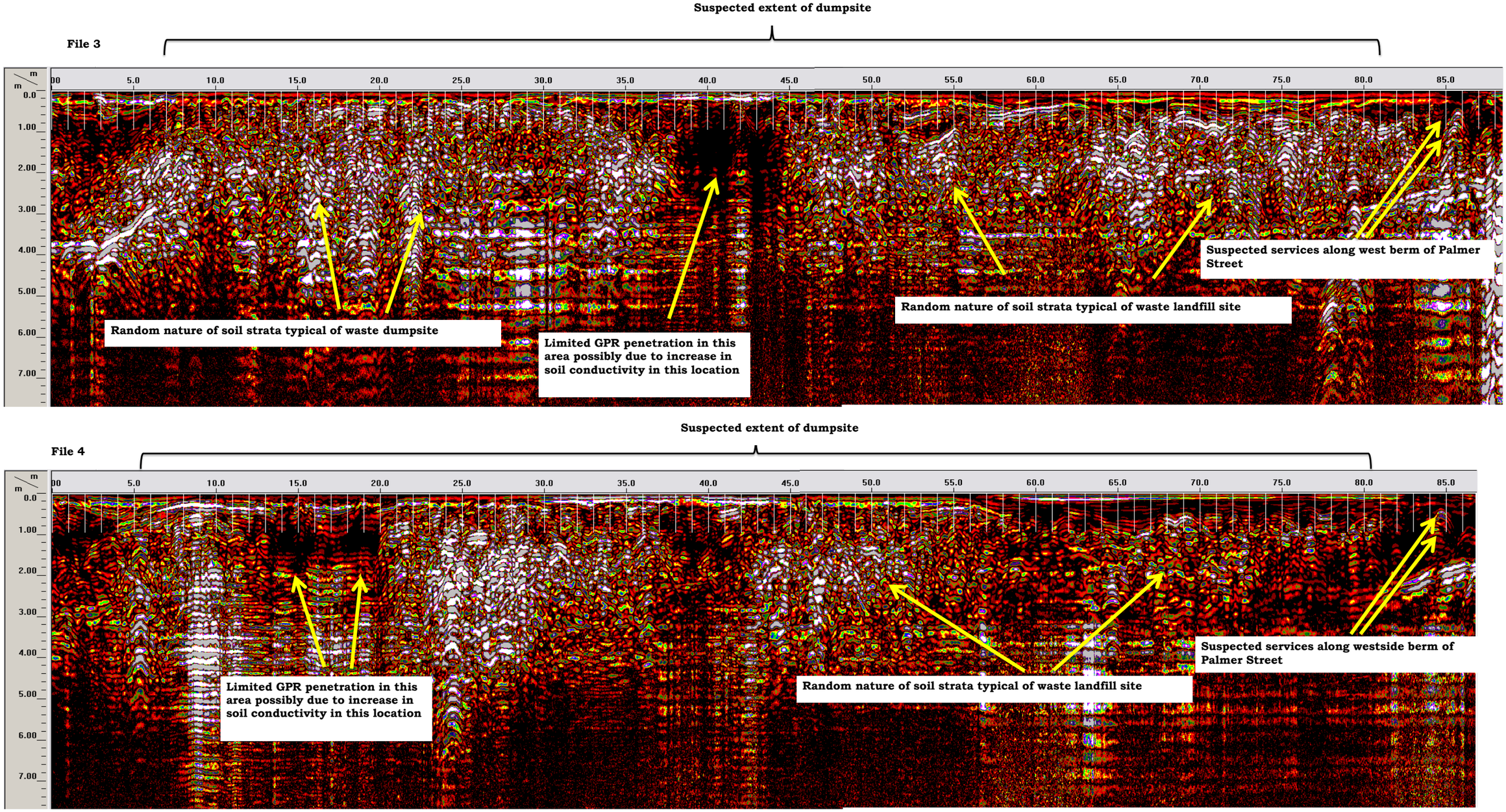
P.O. Box 441
405 Mahoe Street
Te Awamutu

Ph: (07) 871 3381 or(07) 8738614
Fax: (07) 870 2516

Email: surveyors@mhsurveyors.co.nz

APPENDIX B
GEOPHYSICAL SURVEY - TE AWAMUTU
PENSIONER UNITS GROUNDS
PALMER STREET
May-13
Sheet 1 of 2

File 3



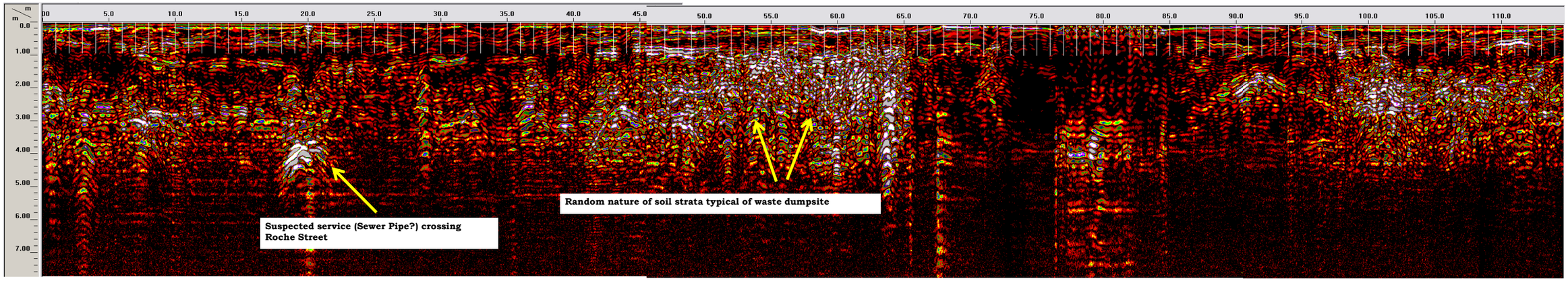
File 4

APPENDIX B
GEOPHYSICAL SURVEY - TE AWAMUTU
PENSIONER UNITS GROUNDS
PALMER STREET
May-13
Sheet 2 of 2

File 27

Suspected extent of dumpsite

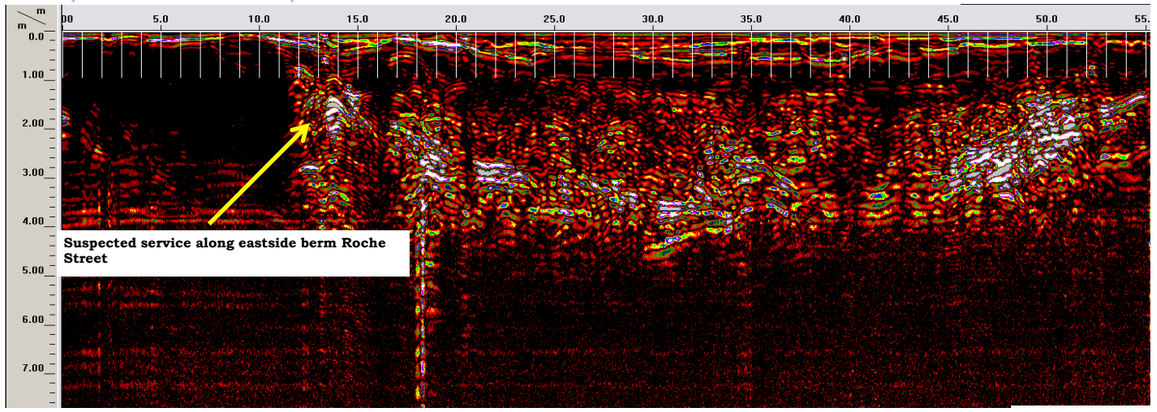
Suspected extent of dumpsite



Roche Street reserve

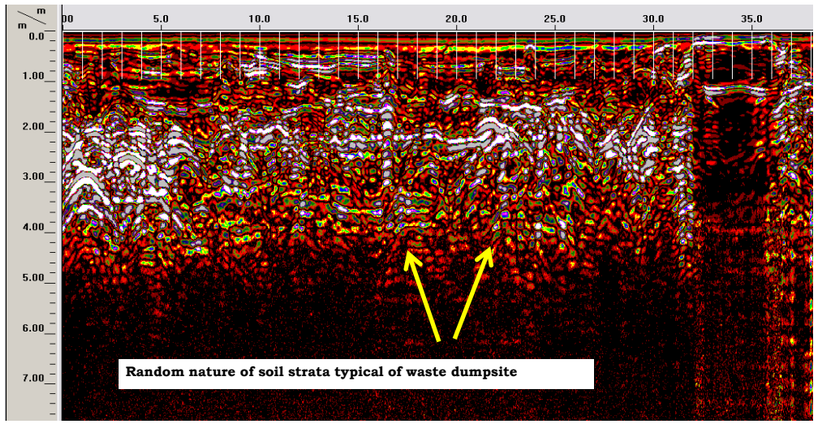
File 26

Suspected extent of dumpsite



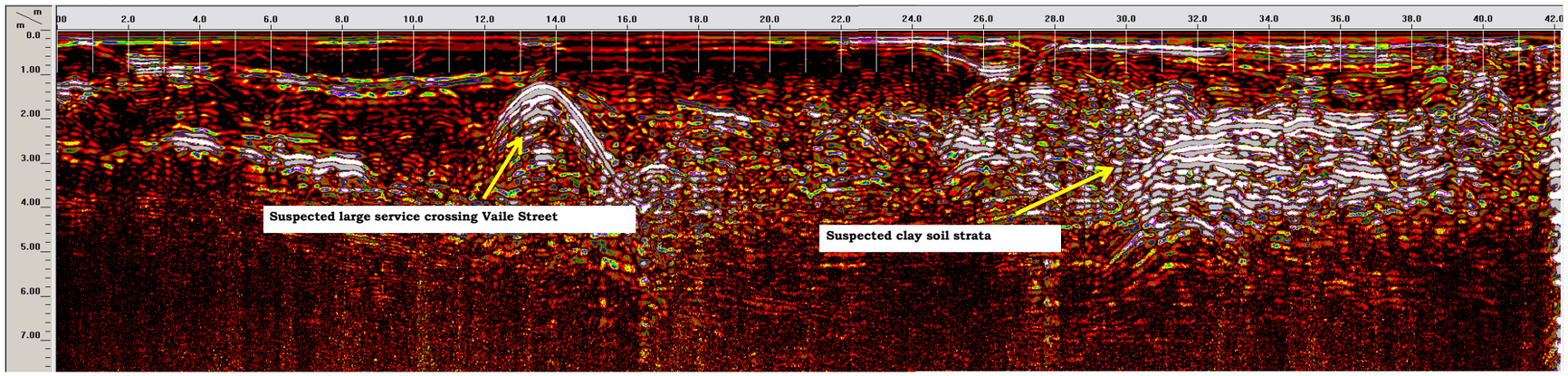
File 25

Suspected extent of dumpsite

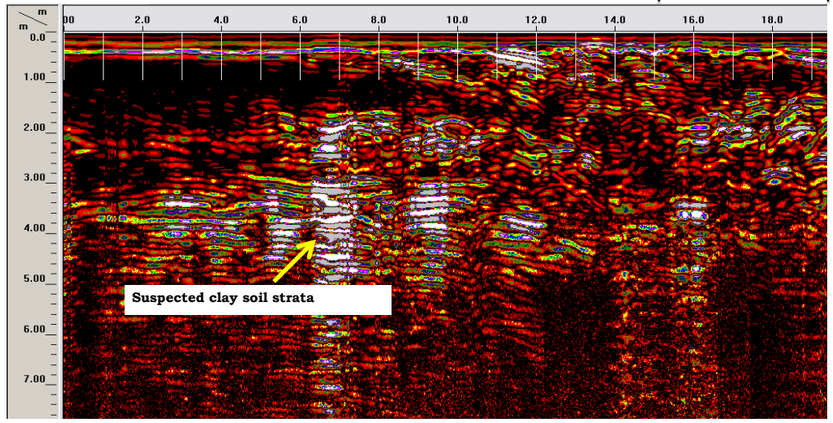


APPENDIX B Rev1
GEOPHYSICAL SURVEY - TE AWAMUTU
SUPPLEMENTARY ADDITIONAL RADARGRAM FOR CONSIDERATION
PENSIONER UNITS GROUNDS
PALMER STREET
May-13
Sheet 3 of 3

File 9



File 10



Hill Laboratories
BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
Hamilton 3240, New Zealand

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	Geo & Hydro Ltd	**Lab No:**	1140355	SPv1
Contact:	Dr B Keet	**Date Registered:**	29-May-2013	
	C/- Geo & Hydro Ltd	**Date Reported:**	07-Jun-2013	
	32 Keirunga Road	**Quote No:**	55307	
	HAVELOCK NORTH 4130	**Order No:**		
		Client Reference:	TEAWA - Ret	
		Submitted By:	Dr B Keet	

Sample Type: Soil

		Sample Name:	TEAWA-RET-Pit 4 -23.5-29	TEAWA-RET-Pit 3 56 50	TEAWA-RET-Pit 2 66 68	TEAWA-RET-Pit 2 33 36 /1	TEAWA-RET-Pit 2 33 36 /2
		Lab Number:	1140355.1	1140355.2	1140355.3	1140355.4	1140355.5
Individual Tests							
Dry Matter	g/100g as rcvd		50	67	61	59	67
Moisture*	g/100g as rcvd		50	33	39	41	33
Total Recoverable Arsenic	mg/kg dry wt		8	16	17	8	22
Total Recoverable Cadmium	mg/kg dry wt		0.81	2.9	0.71	0.85	1.02
Total Recoverable Chromium	mg/kg dry wt		15	23	27	23	35
Total Recoverable Lead	mg/kg dry wt		2,100	540	230	880	470
Total Recoverable Zinc	mg/kg dry wt		540	2,700	350	1,090	710

		Sample Name:	TEAWA-RET-Pit 24 24 30 black	TEAWA-RET-Pit 24 24 30 brown	TEAWA-RET-Pit 4 -23.5-29	TEAWA-RET-Pit 2 33 36 /1	TEAWA-RET-Pit 24 24 30 black
		Lab Number:	1140355.6	1140355.7	1140355.8	1140355.9	1140355.10
Individual Tests							
Dry Matter	g/100g as rcvd		60	65	-	-	-
Moisture*	g/100g as rcvd		40	35	-	-	-
Total Recoverable Arsenic	mg/kg dry wt		9	10	-	-	-
Total Recoverable Cadmium	mg/kg dry wt		6.7	1.68	-	-	-
Total Recoverable Chromium	mg/kg dry wt		27	33	-	-	-
Total Recoverable Lead	mg/kg dry wt		740	320	-	-	-
Total Recoverable Zinc	mg/kg dry wt		4,000	850	-	-	-
Organochlorine Pesticides Screening in Soil							
Aldrin	mg/kg dry wt		-	-	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt		-	-	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt		-	-	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt		-	-	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt		-	-	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt		-	-	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt		-	-	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt		-	-	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt		-	-	< 0.010	0.014	< 0.010
4,4'-DDD	mg/kg dry wt		-	-	< 0.010	0.110	< 0.010
2,4'-DDE	mg/kg dry wt		-	-	< 0.010	0.010	< 0.010
4,4'-DDE	mg/kg dry wt		-	-	< 0.010	0.086	0.026
2,4'-DDT	mg/kg dry wt		-	-	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt		-	-	< 0.010	< 0.010	0.016
Dieldrin	mg/kg dry wt		-	-	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt		-	-	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt		-	-	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt		-	-	< 0.010	< 0.010	< 0.010

Sample Type: Soil						
Sample Name:		TEAWA-RET-Pit 24 24 30 black	TEAWA-RET-Pit 24 24 30 brown	TEAWA-RET-Pit 4 -23.5-29	TEAWA-RET-Pit 2 33 36 /1	TEAWA-RET-Pit 24 24 30 black
Lab Number:		1140355.6	1140355.7	1140355.8	1140355.9	1140355.10
Organochlorine Pesticides Screening in Soil						
Endrin	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Endrin Aldehyde	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	-	-	< 0.010	< 0.010	< 0.010

Sample Name:		TEAWA-RET-Pit 24 24 30 brown	TEAWA-RET-Pit 4-23.5-29	TEAWA-RET-Pit 2 33 36 /1	TEAWA-RET-Pit 24 24 30 black	TEAWA-RET-Pit 24 24 30 brown
Lab Number:		1140355.11	1140355.12	1140355.13	1140355.14	1140355.15
Individual Tests						
Dry Matter	g/100g as rcvd	-	56	57	61	67
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	-	-	-	-
alpha-BHC	mg/kg dry wt	< 0.010	-	-	-	-
beta-BHC	mg/kg dry wt	< 0.010	-	-	-	-
delta-BHC	mg/kg dry wt	< 0.010	-	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	-	-	-	-
cis-Chlordane	mg/kg dry wt	< 0.010	-	-	-	-
trans-Chlordane	mg/kg dry wt	< 0.010	-	-	-	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	-	-	-	-
2,4'-DDD	mg/kg dry wt	< 0.010	-	-	-	-
4,4'-DDD	mg/kg dry wt	0.014	-	-	-	-
2,4'-DDE	mg/kg dry wt	< 0.010	-	-	-	-
4,4'-DDE	mg/kg dry wt	0.023	-	-	-	-
2,4'-DDT	mg/kg dry wt	< 0.010	-	-	-	-
4,4'-DDT	mg/kg dry wt	0.018	-	-	-	-
Dieldrin	mg/kg dry wt	< 0.010	-	-	-	-
Endosulfan I	mg/kg dry wt	< 0.010	-	-	-	-
Endosulfan II	mg/kg dry wt	< 0.010	-	-	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.010	-	-	-	-
Endrin	mg/kg dry wt	< 0.010	-	-	-	-
Endrin Aldehyde	mg/kg dry wt	< 0.010	-	-	-	-
Endrin ketone	mg/kg dry wt	< 0.010	-	-	-	-
Heptachlor	mg/kg dry wt	< 0.010	-	-	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.010	-	-	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.010	-	-	-	-
Methoxychlor	mg/kg dry wt	< 0.010	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	-	< 0.05	0.24	< 0.04	< 0.04
Acenaphthylene	mg/kg dry wt	-	< 0.05	< 0.05	0.05	< 0.04
Anthracene	mg/kg dry wt	-	< 0.05	0.40	< 0.04	< 0.04
Benzo[a]anthracene	mg/kg dry wt	-	0.17	1.82	0.35	0.16
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	0.26	2.1	0.50	0.23
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	0.49	3.7	0.84	0.40
Benzo[g,h,i]perylene	mg/kg dry wt	-	0.25	1.52	0.47	0.22
Benzo[k]fluoranthene	mg/kg dry wt	-	0.19	1.39	0.28	0.16
Chrysene	mg/kg dry wt	-	0.25	2.0	0.46	0.22
Dibenzo[a,h]anthracene	mg/kg dry wt	-	0.05	0.35	0.09	0.05
Fluoranthene	mg/kg dry wt	-	0.47	5.2	0.73	0.41
Fluorene	mg/kg dry wt	-	< 0.05	0.19	< 0.04	< 0.04
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	0.17	1.25	0.33	0.15
Naphthalene	mg/kg dry wt	-	< 0.3	< 0.3	< 0.18	< 0.17

Sample Type: Soil						
Sample Name:		TEAWA-RET-Pit 24 24 30 brown	TEAWA-RET-Pit 4-23.5-29	TEAWA-RET-Pit 2 33 36 /1	TEAWA-RET-Pit 24 24 30 black	TEAWA-RET-Pit 24 24 30 brown
Lab Number:		1140355.11	1140355.12	1140355.13	1140355.14	1140355.15
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Phenanthrene	mg/kg dry wt	-	0.29	3.6	0.25	0.18
Pyrene	mg/kg dry wt	-	0.59	5.2	1.02	0.52

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Samples**
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-7
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082).. Tested on dried sample	-	8-11
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	-	12-15
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	1-7, 12-15
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-7
Moisture*	Calculated from (100 - Dry Matter %). DM performed at 103°C for 18hr.	0.10 g/100g as rcvd	1-7
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-7
Total Recoverable Cadmium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.10 mg/kg dry wt	1-7
Total Recoverable Chromium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-7
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.4 mg/kg dry wt	1-7
Total Recoverable Zinc	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	4 mg/kg dry wt	1-7

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Carole Rodgers-Carroll BA, NZCS
Client Services Manager - Environmental Division

D R A F T

Appendix E

Soil Borelogs

LOG OF DRILLHOLE

HOLE IDENTIFICATION **MW01**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates 1804010mE 5790290mN
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift (0 - 100%)	Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		(No sample collected)		0.0			Sandy SILT with minor fine gravel; dark brown. Soft; slightly moist; moderate plasticity. Organics.	FILL	No staining, no odour.		A
							Sandy SILT minor fine to medium gravel; dark brown. Soft; slightly moist; moderate plasticity.				
		(No sample collected)		0.0	1		FILL; brown. Loose; slightly moist; moderate plasticity. Refuse (glass, plastic and ash).		No staining, no odour.		
Direct Push		(No sample collected)		0.0	2		Sandy CLAY with minor fine gravel; light brown with orange mottling. Very stiff; slightly moist; very high plasticity.	NATURAL	No staining, no odour.	1	
		(No sample collected)		0.0	3				No staining, no odour.		
		(No sample collected)		0.0	4				No staining, no odour.		
							MW01 terminated at 4.6m				

GROUNDWATER OBSERVATIONS

Depth	Reading	Date
1.95m	1	22/04/2015

Date logged 22/04/2015
Logged AMC
Checked SH

Remarks
1) Refuse (glass, plastic and ash) was observed between 0.90 and 1.30 m bgl.
2) Depth to groundwater measured from top of casing.
3) PID headspace readings taken from bag sample with miniRAE PID calibrated to 100 ppm isobutylene.
4) The well was fitted with a 50 mm PVC pipe and flush mounted Toby cover.

Driller DCN
Drill Rig Sonic Drill Rig
Started 22/04/2015
Finished 22/04/2015

Date Printed: 11/06/2015

DRILLHOLE LOG ENVIRONMENTAL 60433891_BORE LOGS.GPJ BASE.GDT 11/06/15

LOG OF DRILLHOLE

HOLE IDENTIFICATION **MW02**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates 1803901mE 5790232mN
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		(No sample collected)		0.0	1		Silty SAND with minor fine to medium gravel; brown. Moderately dense; slightly moist; moderate plasticity.	FILL	No staining, unknown odour.		
							... with refuse.				
							Sandy SILT with minor fine to medium gravel; dark brown with some light brown mottling. Stiff; moist; moderate plasticity. Refuse (wood).				
							Sandy SILT with minor fine to medium gravel; brown. Soft; moist; moderate plasticity. Refuse (ash).				
							FILL with minor medium gravel; dark brown. Loose; moist; low plasticity.				
					2		(No material description due to loss of core)				
Direct Push		(No sample collected)		0.0			Silty CLAY; light brownish orange. Stiff; moist; very high plasticity. Organics.	NATURAL	No staining, no odour.		
		(No sample collected)		0.0	3				No staining, no odour.		
							... grades to silty CLAY with some fine sand. Very stiff.				
		(No sample collected)		0.0	4				No staining, no odour.	1	
		(No sample collected)		0.0	5				No staining, no odour.		
							Silty CLAY. Very stiff; saturated; very high plasticity.				
		(No sample collected)		0.0	6				No staining, no odour.		
		(No sample collected)		0.0	7				No staining, no odour.		
							MW02 terminated at 7.21m				

GROUNDWATER OBSERVATIONS

Depth	Reading	Date
4.61m	1	22/04/2015

Date logged 22/04/2015
Logged AMC
Checked SH

Remarks
1) Refuse (wood and ash) was observed between 0.60 and 2.0 m bgl.
2) Depth to groundwater measured from top of casing.
3) PID headspace readings taken from bag sample with miniRAE PID calibrated to 100 ppm isobutylene.
4) The well was fitted with a 50 mm PVC pipe and flush mounted Toby cover.

Driller DCN
Drill Rig Sonic Drill Rig
Started 22/04/2015
Finished 22/04/2015

Date Printed: 11/06/2015

LOG OF DRILLHOLE

HOLE IDENTIFICATION **MW03**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates 1803888mE 5790144mN
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		(No sample collected)		0.0	1		Silty SAND; dark brown. Moderately dense; slightly moist; moderate plasticity. Rootlets.				
							Sandy SILT with some clay; dark brown. Very soft; slightly moist; high plasticity. Organics.				
							... grades to brown. No organics or clay.				
							... grades to sandy SILT with some clay; orange brown. Moderate plasticity.		No staining, no odour		
Direct Push		(No sample collected)		0.0	2		Sandy SILT with minor fine to medium sand; light brown. Stiff; moist; low to moderate plasticity.	NATURAL	No staining, no odour		
		(No sample collected)		0.0	3				No staining, no odour		
		(No sample collected)		0.0	4				No staining, no odour		
		(No sample collected)		0.0	5		Silty CLAY with some fine gravels; light brown. Very stiff; very moist; high plasticity.		No staining, no odour	1	
		(No sample collected)		0.0	6		... grades to saturated. Organics.		No staining, no odour		
		(No sample collected)		0.0	7				No staining, no odour		
					8		*MW03 terminated at 7.3m*				
					9						

GROUNDWATER OBSERVATIONS

Depth	_	Reading	Date
5.06m		1	22/04/2015

Date logged 22/04/2015
Logged AMC
Checked SH

Remarks
1) No refuse was observed.
2) Depth to groundwater measured from top of casing.
3) PID headspace readings taken from bag sample with miniRAE PID calibrated to 100 ppm isobutylene.
4) The well was fitted with a 50 mm PVC pipe and flush mounted Toby cover.

Driller DCN
Drill Rig Sonic Drill Rig
Started 22/04/2015
Finished 22/04/2015

Date Printed: 11/06/2015

LOG OF DRILLHOLE

HOLE IDENTIFICATION **MW04**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA							Silty SAND; dark brown. Loose; slightly moist; low plasticity.				
							Sandy SILT with some gravel; dark brown. Soft; slightly moist; low plasticity.				
		(No sample collected)		0.0	1		Silty SAND; brown with orange mottling. Moderately dense; moist; moderate plasticity.		No staining, no odour.		
		(No sample collected)		0.3	2		Sandy SILT with minor fine gravel; dark brown with dark grey mottling. Moderately stiff; moist; low plasticity.		No staining, solvent odour.		
Direct Push		(No sample collected)		0.0	3		SAND with minor silt; dark grey. Loose; moist; low plasticity.	FILL	No staining, no odour.		
		(No sample collected)		1.2	4		... grades to very moist.		No staining, solvent odour.	1	
		(No sample collected)		0.9	5		SAND with minor fine to medium gravel; dark greyish brown. Loose; very moist; low plasticity.		No staining, no odour.		
		(No sample collected)		0.8	6		Clayey SILT with some fine to medium gravel; light brown. Saturated; high plasticity.	NATURAL	No staining, no odour.		
		(No sample collected)		0.0	7		*MW04 terminated at 7.3m*		No staining, no odour.		

GROUNDWATER OBSERVATIONS

Depth	Reading	Date
4.4m	1	11/04/2015

Date logged 11/04/2015
Logged AMC
Checked SH

Remarks
1) Refuse (glass, plastic, ash) was observed between 1.20 and 6.20 m bgl.
2) Depth to groundwater measured from top of casing.
3) PID headspace readings taken from bag sample with miniRAE PID calibrated to 100 ppm isobutylene.
4) The well was fitted with a 50 mm PVC pipe and flush mounted Toby cover

Driller DCN
Drill Rig Sonic Drill Rig
Started 11/04/2015
Finished 11/04/2015

Date Printed: 11/06/2015

TERMINOLOGY AND SYMBOLS

Drilling / Investigation Methods

AH - Air Hammer.
AR - Air Rotary.
CFHSA - Continuous Flight Hollow Stem Auger.
CFSSA - Continuous Flight Solid Stem Auger.
DCP - Dynamic Cone Penetrometer.
HA - Hand Auger.
HQ3 - HQ Triple Tube.
HQWL - HQ Wire Line.
HWOB - Heavy Weight Open Barrel.
NQ3 - NQ Triple Tube.
NQWL - NQ Wire Line.
OB - 100mm diameter Open Barrel.
OB70 - 70mm diameter Open Barrel.
PERC - Percussion.
PQ3 - PQ Triple Tube.
PQWL - PQ Wire Line.
RC - Reverse Circulation.
RCDHH - Reverse Circulation Down Hole Hammer.
SPT - Standard Penetration Test.
SSA - Solid Stem Auger.
PT - Push Tube Sample
VAC EX - Vacuum Excavation.
WASH - Wash Drilling.

Test Results

SPT "N" value; uncorrected blow count for 300 mm penetration
/# / # / # / # / # blows per 75 mm penetration

ss - Standard Penetration Test - split spoon
sc - Standard Penetrattion Test - solid cone
SUOW - Sunk Under Own Weight

Vane Shear Strength Tests

/ # Vane shear strenght test results given as peak / remoulded shear strengths (kPa). Test as per NZGS Guideline, 2001.

= Vane test performed on core recovered prior to extrusion from core barrel.
* = Vane test performed on excavated material of suitable size.

UTP - Unable to penetrate.

Piezometer Installation

Standpipe		Grout	
Slotted Standpipe		Cement	
Drill Cuttings		Gravel Pack Filer	
Bentonite		Sand Pack Filter	

Groundwater Records

Water Level During Drilling	
Static Water Level	
Seep	

Samples

PT - Thin Wall Push Sample
U - Undisturbed
D - Disturbed (Core)
B - Disturbed (Pit)

ROCK DESCRIPTIONS

Relative Strength

		USC (MPa)
ES	- Extremely strong	> 250
VS	- Very Strong	100 - 250
S	- Strong	50 - 100
MS	- Moderately Strong	20 - 50
W	- Weak	5 - 20
VW	- Very Weak	1 - 5
EW	- Extremely Weak	< 1

Weathering

UW	- Unweathered
SW	- Slightly Weathered
MW	- Moderately Weathered
HW	- Highly Weathered
CW	- Completely Weathered

SOIL DESCRIPTIONS

Consistency Cohesive Soils

	Su (kPa)
Very Soft	< 12
Soft	12 - 25
Firm	25 - 50
Stiff	50 - 100
Very Stiff	100 - 200
Hard	200 - 500

Relative Density Non-cohesive soils

	SPT "N" Value (uncorrected)
Very Loose	< 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

Rock Defect Abbreviations

Defect Type
J = Joint
Slk = Slickenside
BP = Bedding Plane Defect
SZ = Shear Zone
FZ = Fracture Zone
WZ = Weak Zone
F = Fracture
BkJ = Broken Joint
L = Lamination
HJ = Healed Joint
DB = Drilling Break

Defect Apperance
BkJ = Broken Joint
L = Lamination
HJ = Healed Joint
DB = Drilling Break
R = Rough
vR = Very Rough
Sm = Smooth
T = Tight
Pl = Planar
Cn = Clean
Bed = Bedding
\\ = Parallel
Ud = Undulating
St = Stepped
Op = Open
Pol = Polished
H = Healed

Infill Material
Mn = Manganese
Fe = Iron Oxide
Qtz = Quartz
S = Sand
Gr = Graphite
Ch = Chlorite
NF = No Infill
Co = Coalified
Py = Pyrite
Slt = Silt
CC = Calcite
Cb = Carbonaceous
Cl = Clay
V = Veneer
Calc = Calcareous

Graphic Log (typical symbols)

Organic Material	Mudstone
Clay	Siltstone
Silt	Sandstone
Sand	Volcanic Rock
Gravel / Cobbles	No recovery

Rock Classification Abbreviations

GSI = Geological Strength Index
RQD = Rock Quality Designation
Jn = Joint Set Number
Jr = Joint Roughness Number
Ja = Joint Alteration Number

Soil and rock descriptions generally as in "Guidelines for the Field Description of Soil and Rock for Engineering Purposes" by the NZ Geotechnical Society Inc, December 2005.

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA01**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates 1804010mE 5790294mN
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		PHA01 0.15 m 0.15 m bgl.	Metals SVOC	0.0 ppm			SILT, some sand, dark brown, moist, organics.	FILL	No odour		
							Sandy SILT, some gravel and sand, brown, fine to medium sand.				
		PHA01 0.55 m 0.55 m bgl.		0.0 ppm			Silt, some clay, brown, light brown streaks.				
					1		End of hole at 0.62 m below ground level. Refuse: metal, some ash.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 21/04/2015
Logged JB
Checked SH

Remarks
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 21/04/2015
Finished 21/04/2015

Date Printed: 2/10/2015

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA02**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates 1803986mE 5790291mN
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		PHA02 0.1 m 0.1 m bgl.	Metals SVOC	8.0 ppm			SILT, minor sand, dark brown, fine to medium sand.				
							SILT, some clay, minor gravel, brown, light brown streaks, fine gravel.				
							SILT, some clay, brown, mottled light brown, moist.	FILL			
		PHA02 0.4 m 0.4 m bgl.	Metals	0.0 ppm			At 0.3 m bgl. refuse: plastic.				
					1		End of hole at 0.5 m below ground level. Refuse: wood, ash and black, brittle pieces.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 21/04/2015
Logged JB
Checked SH

Remarks
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 21/04/2015
Finished 21/04/2015

Date Printed: 2/10/2015

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA03**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates 1803957mE 5790272mN
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		PHA03 0.2 m 0.2 m bgl.	Metals SVOC	9.6 ppm			SILT, some clay and gravel, dark brown.	FILL	No odour		
							At 0.2 m bgl. thin layer orange iron staining approximately 0.02 m thick.				
							Sandy SILT, some gravel, dark brown, loose.		No odour		
		PHA03 0.45 m 0.45 m bgl.	Metals	0.0 ppm							
							CLAY, brown-orange.				
							Refuse: steel, nails, pipe.				
					1		End of hole at 0.6 m below ground level. Refuse: steel, nails, pipe.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 21/04/2015
Logged JB
Checked SH

Remarks
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 21/04/2015
Finished 21/04/2015

Date Printed: 2/10/2015

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA04/M01**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates 1803993mE 5790269mN
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift (0 - 100%)	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		PHA04 0.1 m 0.1 m bgl.	Metals SVOC	28 ppm			TOPSOIL	FILL	No odour		
							Clayey SILT, dark brown, moist.		No odour		
							CLAY, some silt and sand, orange-brown, fine sand.				
		PHA04 0.4 m 0.4 m bgl.		0.0 ppm							
					1		End of hole at 0.45 m below ground level. Ash, dark grey, powdered, very fine.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 21/04/2015
Logged JB
Checked SH

Remarks
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 21/04/2015
Finished 21/04/2015

Date Printed: 2/10/2015

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA05**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates 1803950mE 5790252mN
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		PHA05 0.1 m 0.1 m bgl.	Metals SVOC	17.0 ppm			SILT, minor sand, dark brown, friable.	FILL	No odour		
							Clayey SILT, dark brown, mottled light brown, friable.		No odour		
		PHA05 0.45 m 0.45 m bgl.	Metals	0.0 ppm							
					1		End of hole at 0.5 m below ground level. Refuse: bricks, wood.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 21/04/2015
Logged JB
Checked SH

Remarks
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 21/04/2015
Finished 21/04/2015

Date Printed: 2/10/2015

AECOM

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA06**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		PHA06 0.1 m 0.1 m bgl.	Metals SVOC	0.1 ppm			Sandy SILT, some sand and gravel, dark brown, fine sand, organics.	FILL	No odour		
		PHA02 0.4 m 0.4 m bgl.		0.0 ppm							
					1		End of hole at 0.45 m below ground level. Refuse: glass, ceramic.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 21/04/2015
Logged JB
Checked SH

Remarks
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 21/04/2015
Finished 21/04/2015

Date Printed: 2/10/2015

DRILLHOLE LOG ENVIRONMENTAL HAND AUGER LOGS TE AWAMUTU.GPJ BASE.GDT 02/10/15

AECOM

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA07/M04**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates 18033956mE 5790225mN
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		PHA07 0.1 m 0.1 m bgl.	Metals SVOC	2.0 ppm			Sandy SILT, some gravel, poorly sorted.		No odour		
							Silty SAND, some gravel, brown, fine well sorted gravel.	FILL	No odour		
		PHA07 0.4 m 0.4 m bgl.	Metals	0.0 ppm							
					1		End of hole at 0.45 m below ground level. Refuse: glass, paper, bricks.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 21/04/2015
Logged JB
Checked SH

Remarks
In garden area next to house. Cracking in house foundation.

No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 21/04/2015
Finished 21/04/2015

Date Printed: 2/10/2015

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA08**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates 1803959mE 5790213mN
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		PHA08 0.1 m 0.1 m bgl.	Metals SVOC	0.0 ppm			Sandy SILT, some gravel, brown, very fine sand, slightly friable.				
							SILT, some clay, dark brown, friable.	FILL			
		PHA08 0.5 m 0.5 m bgl.		0.0 ppm			Refuse				
					1		End of hole at 0.6 m below ground level. Refuse: bricks, ceramic, clay.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 21/04/2015
Logged JB
Checked SH

Remarks
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 21/04/2015
Finished 21/04/2015

Date Printed: 2/10/2015

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA09/M03**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates 1803944mE 5790198mN
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA							Dead grass		No odour		
		PHA09 0.2 m 0.2 m bgl.	Metals SVOC	0.0 ppm			SILT, some clay and gravel, brown, dry, fine gravel, friable.	FILL	No odour		
		PHA09 0.45 m 0.45 m bgl.	Metals	0.0 ppm			Sandy SILT, light brown, very fine.		No odour		
							Refuse.				
					1		End of hole at 0.55 m below ground level. Refuse: plastic bags, glass.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 21/04/2015
Logged JB
Checked SH

Remarks
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 21/04/2015
Finished 21/04/2015

Date Printed: 2/10/2015

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA10**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates 1803933mE 5790187mN
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		PHA10 0.3 m 0.3 m bgl.	Metals SVOC	0.0 ppm			SILT, Some clay, brown, friable, thin capping.	FILL	No odour.		
							Refuse: glass, rope.				
					1		End of hole at 0.45 m below ground level. Refuse: glass, rope.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 21/04/2015
Logged JB
Checked SH

Remarks
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 21/04/2015
Finished 21/04/2015

Date Printed: 2/10/2015

AECOM

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA11/M02**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates 1803924mE 5790161mN
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		PHA11 0.2 m 0.2 m bgl.	Metals SVOC	6.0 ppm			Grass.	FILL	No odour		
							Sandy SILT, some clay, brown, moist, fine sand, slightly friable.		No odour		
		PHA11 0.8 m 0.8 m bgl.		0.0 ppm			Silty CLAY, brown, moist, friable.				
					1		End of hole at 0.9m below ground level. Refuse: rubber rings, glass.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 21/04/2015
Logged JB
Checked SH

Remarks
Methane spike 13ppm.
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 21/04/2015
Finished 21/04/2015

Date Printed: 2/10/2015

DRILLHOLE LOG ENVIRONMENTAL HAND AUGER LOGS TE AWAMUTU.GPJ BASE.GDT 02/10/15

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA12/M01**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates 1803899mE 5490161mN
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift (0 - 100%)	Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		PHA12 0.1 m 0.1 m bgl.	Metals SVOC	0.0 ppm			Topsoil	FILL	No odour.		
							Sandy SILT, some clay, dark brown, slightly moist, friable.		No odour.		
		PHA12 0.6 m 0.6 m bgl.	Metals	0.0 ppm							
					1		End of hole at 0.75m below ground level. Refuse.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 21/04/2015
Logged JB
Checked SH

Remarks
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 21/04/2015
Finished 21/04/2015

Date Printed: 2/10/2015

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA13**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		SAB151 0.05 - 0.1 m bgl.	LEAD	7.4 ppm			SILT, some sand, dark brown, firm, dry to moist, medium sand, friable, minor rootlets.	FILL	No odour		
							SILT, some clay and sand, dark brown, mottled yellow-brown, minor black organics.		No odour		
							At 0.25 m bgl iron staining and black pieces.				
		SAB152 0.4 - 0.6 m bgl.	LEAD	6.9 ppm			At 0.4 m bgl becomes trace coarse rounded gravel.				
							Clayey SILT, some sand, yellow-brown, moist, medium sand.		No odour		
					1						
							End of hole at 1.2 m below ground level. Target depth.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 10/09/2015
Logged LKH
Checked ET

Remarks
PID background 5.2
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 10/09/2015
Finished 10/09/2015

Date Printed: 2/10/2015

DRILLHOLE LOG ENVIRONMENTAL HAND AUGER LOGS TE AWAMUTU.GPJ BASE.GDT 02/10/15

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA14**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		SAB153 SAB154 (dup) 0.05 - 0.1m bgl.	LEAD	6.7 ppm			SILT, some clay, minor to some sand, minor gravel, dark brown, dark grey gravel, dry to moist, friable, fine sand, fine to medium gravel, some rootlets.	FILL	No odour		
							SILT, some sand, trace clay and gravel, yellow-brown, mottled dark brown, dry, fine sand, minor rootlets decreasing with depth.	TAURANGA GROUP	No odour		
					1		End of hole at 0.55m below ground level. Target depth.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 10/09/2015
Logged LKH
Checked ET

Remarks
PID background 5.3
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 10/09/2015
Finished 10/09/2015

Date Printed: 2/10/2015

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA15**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		SAB155 0.05 - 0.1m bgl.	LEAD	7.1 ppm			Gravelly SILT, some sand, dark brown, dark grey gravel, soft to firm, dry to moist, medium angular gravel, friable, rootlets. At 0.1 m bgl. becomes mottled yellow-brown.	FILL	No odour		
					1		End of hole at 0.15 below ground level. Refuse: black ash.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 10/09/2015
Logged LKH
Checked ET

Remarks
PID background 5.6

No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 10/09/2015
Finished 10/09/2015

Date Printed: 2/10/2015

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA16**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		SAB156 0.03 - 0.1 m bgl.	LEAD	8.2 ppm			SILT, some sand, trace clay, dark brown, soft to firm, dry to moist, fine sand, rootlets. At 0.05 m bgl. becomes mottled yellow-brown, minor to some clay. At 0.1 m bgl. trace coarse gravel.	FILL	No odour		
					1		End of hole at 0.2 m below ground level. Black ash pieces and refuse. Becomes some clay, brown, mottled light-brown, rootlets.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 10/09/2015
Logged LKH
Checked ET

Remarks
PID background 5.1
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 10/09/2015
Finished 10/09/2015

Date Printed: 2/10/2015

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA17**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		SAB157 0.05 - 0.1m bgl.	LEAD	8.5 ppm			SILT, some sand, trace gravel and clay, soft to firm, dry to moist, medium to coarse sand, fine gravel, friable, rootlets, quartz sand.	FILL	No odour		
							At 0.1 m bgl. becomes mottled, yellow-brown, some gravel, fine to coarse. Black ash and fibrous plastic on the side of the hole.				
							End of hole at 0.2 m below ground level. Refuse: black ash and fibrous plastic.				
					1						

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 10/09/2015
Logged LKH
Checked ET

Remarks
PID background 5.2
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 10/09/2015
Finished 10/09/2015

Date Printed: 2/10/2015

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA18**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		SAB158 0.05 - 0.1 m bgl.	LEAD	3.5 ppm			SILT, some sand, minor gravel, trace clay, dark brown, soft to firm, moist, fine to medium sand, fine to coarse angular gravel, friable, rootlets.	FILL	No odour		
							At 0.1 m bgl. becomes yellow-brown.		No odour		
							Silty SAND, minor gravel, trace clay, yellow-brown, soft to firm, moist, fine to medium sand, fine to coarse angular gravel, friable, rootlets.		No odour		
		SAB159 0.3 - 0.5 m bgl.	LEAD	2.4 ppm			At 0.3 bgl. becomes pieces of black and white ash.				
							SILT, some sand, trace clay, ash pieces, yellow-brown with dark brown, black and white ash, green-grey piece of soil, moist, fine to medium sand, friable.		No odour		
					1		End of hole at 0.5 m below ground level. Refuse: ash.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 10/09/2015
Logged LKH
Checked ET

Remarks
PID re-zeroed. PID background 0.9 after testing
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 10/09/2015
Finished 10/09/2015

Date Printed: 2/10/2015

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA19**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		SAB160 SAB161 (dup) 0.05 - 0.1m bgl.	LEAD	4.5 ppm			SILT, some sand, trace clay, dark brown, mottled light yellow-brown, soft to firm, moist, fine quartz sand, friable, rootlets. At 0.07 m bgl. becomes minor clay, mottled light yellow-brown.		No odour		
							SILT, some sand, trace clay and gravel, yellow-brown mottled dark brown, soft to firm, fine to medium sand, fine gravel, angular gravel, rootlets.	FILL	No odour		
							Gravelly SAND, some silt, white, mottled brown, dark brown, yellow-brown and grey, tightly packed, moist, coarse sand, fine angular gravel.		No odour		
					1		End of hole at 0.35 m below ground level. Refusal: coarse gravel.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 10/09/2015
Logged LKH
Checked ET

Remarks
PID background 2.6

No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 10/09/2015
Finished 10/09/2015

Date Printed: 2/10/2015

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA20**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		SAB162 0.05 - 0.1m bgl.	LEAD	4.6 ppm			SILT, some sand, trace clay and gravel, dark brown, soft to firm, moist, medium sand, fine angular gravel, rootlets.	FILL	No odour		
							At 0.08 m bgl. becomes minor clay, mottled yellow-brown, white specs.				
							Sandy SILT, trace gravel, yellow-brown, minor mottles of brown and dark grey, dry to moist, medium to coarse sand, fine gravel, trace rootlets, black organics, trace to minor wood.		No odour		
					1		End of hole at 0.5 m below ground level. Refuse: black ash.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 10/09/2015
Logged LKH
Checked ET

Remarks
PID background 2.6
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 10/09/2015
Finished 10/09/2015

Date Printed: 2/10/2015

AECOM

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA21**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		SAB164 0.05 - 0.1 m bgl.	LEAD	5.5 ppm			SILT, some sand, trace clay and gravel, dark brown, soft, moist, fine to medium sand, fine gravel, friable.	FILL	No odour		
							SILT, some clay, some sand, trace gravel, yellow-brown, mottled brown, firm, dry, friable, fine sand, fine gravel.		No odour		
					1		End of hole at 0.3 m below ground level. Refuse: black and red-brown ash.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 10/09/2015
Logged LKH
Checked ET

Remarks
PID background 2.8
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 10/09/2015
Finished 10/09/2015

Date Printed: 2/10/2015

AECOM

LOG OF DRILLHOLE

HOLE IDENTIFICATION **HA22**

Client Waipa District Council
Project Palmer Street Development
Project number 60343891

Co-ordinates
Orientation -90° Elevation
Location Palmer Street, Te Awamutu
Consent No.

Excavation Method / Casing remarks	Core Loss/Lift 0 - 100%	SAMPLING & TESTING: Sample ID	Analysis	PID (ppm)	Depth	Graphic Log	MATERIAL DESCRIPTION (consistency, relative density, water content, plasticity, grading, etc)	GEOLOGICAL DESCRIPTION	STAINING/ ODOURS AND COMMENTS	Groundwater	Piezometer Construction
HA		SAB163 0.05 - 0.1 m bgl.	LEAD	7.4 ppm			SILT, some sand, trace clay, dark brown, soft to firm, moist, fine sand, friable, rootlets. At 0.07 m bgl. a piece of red plastic. At 0.1 m bgl becomes yellow-brown, mottled dark brown.	FILL	No odour		
							Ash, minor gravel, dark brown, mottled light brown, white, yellow-brown and black.				
					1		End of hole at 0.3 m below ground level. Refuse: ash.				

GROUNDWATER OBSERVATIONS
Depth _ Reading Date

Date logged 10/09/2015
Logged LKH
Checked ET

Remarks
PID background 2.7
No ground water encountered

Driller AECOM
Drill Rig Hand Auger
Started 10/09/2015
Finished 10/09/2015

Date Printed: 2/10/2015

DRAFT

Appendix F

Laboratory Results and Chain of Custody Documentation

Hill Laboratories
BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
Hamilton 3240, New Zealand

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	AECOM New Zealand Limited	**Lab No:**	1416847 SPv1
Contact:	David Dangerfield	**Date Registered:**	23-Apr-2015
	C/- AECOM New Zealand Limited	**Date Reported:**	27-May-2015
	PO Box 4241	**Quote No:**	42967
	Shortland Street	**Order No:**	60343891 Task 02.04
	AUCKLAND 1140	**Client Reference:**	6034391 Palmer Street
		Submitted By:	J Brown

Sample Type: Soil

Sample Name:		PHA01 0.15m 21-Apr-2015 4:55 pm	PHA02 0.1m 21-Apr-2015 4:10 pm	PHA02 0.4m 21-Apr-2015 4:15 pm	PHA03 0.2m 21-Apr-2015 3:45 pm	PHA03 0.45m 21-Apr-2015 3:50 pm
Lab Number:		1416847.1	1416847.3	1416847.4	1416847.5	1416847.6
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	6	12	9	9	10
Total Recoverable Cadmium	mg/kg dry wt	0.19	0.37	0.39	0.29	0.30
Total Recoverable Chromium	mg/kg dry wt	14	12	12	13	14
Total Recoverable Copper	mg/kg dry wt	42	24	26	36	41
Total Recoverable Lead	mg/kg dry wt	93	26	35	53	67
Total Recoverable Mercury	mg/kg dry wt	0.24	< 0.10	0.15	0.19	0.14
Total Recoverable Nickel	mg/kg dry wt	6	5	5	7	11
Total Recoverable Zinc	mg/kg dry wt	84	112	92	99	220

Sample Name:		PHA04 0.1m 21-Apr-2015 3:20 pm	PHA05 0.1m 21-Apr-2015 3:00 pm	PHA 05 0.45m 21-Apr-2015 3:10 pm	PHA06 0.1m 21-Apr-2015 2:30 pm	PHA07 0.1m 21-Apr-2015 2:00 pm
Lab Number:		1416847.7	1416847.9	1416847.10	1416847.11	1416847.13
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	14	6	5	11	6
Total Recoverable Cadmium	mg/kg dry wt	0.46	0.11	0.10	0.41	0.22
Total Recoverable Chromium	mg/kg dry wt	15	13	11	14	13
Total Recoverable Copper	mg/kg dry wt	50	27	24	46	37
Total Recoverable Lead	mg/kg dry wt	2,900	35	32	96	50
Total Recoverable Mercury	mg/kg dry wt	0.10	0.16	< 0.10	0.20	0.18
Total Recoverable Nickel	mg/kg dry wt	8	5	4	8	7
Total Recoverable Zinc	mg/kg dry wt	156	73	66	168	96

Sample Name:		PHA07 0.4m 21-Apr-2015 2:08 pm	PHA08 0.1m 21-Apr-2015 1:40 pm	PHA09 0.2m 21-Apr-2015 1:05 pm	PHA09 0.45m 21-Apr-2015 1:10 pm	PHA10 0.3m 21-Apr-2015 12:30 pm
Lab Number:		1416847.14	1416847.15	1416847.17	1416847.18	1416847.19
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	7	8	8	13	9
Total Recoverable Cadmium	mg/kg dry wt	0.34	0.27	0.23	0.40	0.39
Total Recoverable Chromium	mg/kg dry wt	14	13	13	15	17
Total Recoverable Copper	mg/kg dry wt	35	24	31	58	61
Total Recoverable Lead	mg/kg dry wt	69	23	60	114	220
Total Recoverable Mercury	mg/kg dry wt	0.13	< 0.10	0.14	0.31	0.30
Total Recoverable Nickel	mg/kg dry wt	8	6	6	13	13
Total Recoverable Zinc	mg/kg dry wt	140	77	107	500	320

Sample Type: Soil						
Sample Name:		PHA11 0.2m 21-Apr-2015 12:05 pm	PHA12 0.1m 21-Apr-2015 11:30 am	PHA12 0.6m 21-Apr-2015 11:38 am	PHA 03_asb 0.2m 21-Apr-2015	PHA 05_asb 0.1m 21-Apr-2015
Lab Number:		1416847.20	1416847.22	1416847.23	1416847.26	1416847.28
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg						
Total Recoverable Arsenic	mg/kg dry wt	3	8	8	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.28	0.23	-	-
Total Recoverable Chromium	mg/kg dry wt	15	12	15	-	-
Total Recoverable Copper	mg/kg dry wt	50	37	43	-	-
Total Recoverable Lead	mg/kg dry wt	27	33	37	-	-
Total Recoverable Mercury	mg/kg dry wt	0.30	0.23	0.29	-	-
Total Recoverable Nickel	mg/kg dry wt	6	7	9	-	-
Total Recoverable Zinc	mg/kg dry wt	45	74	90	-	-
Asbestos in Soil						
As Received Weight	g	-	-	-	313.1	287.1
Dry Weight	g	-	-	-	272.5	255.8
<2mm Subsample Weight	g ashed wt	-	-	-	50.4	53.0
Asbestos Presence / Absence		-	-	-	Asbestos NOT detected.	Asbestos NOT detected.
Description of Asbestos Form		-	-	-	-	-

Sample Name:		PHA 07_asb 0.1m 21-Apr-2015	PHA 09_asb 0.2m 21-Apr-2015	PHA 11_asb 0.2m 21-Apr-2015	PHA 12_asb 0.1m 21-Apr-2015	Composite of PHA01 0.15m, PHA02 0.1m, PHA03 0.2m & PHA04 0.1m
Lab Number:		1416847.30	1416847.32	1416847.34	1416847.35	1416847.36
Individual Tests						
Dry Matter	g/100g as rcvd	-	-	-	-	69
Asbestos in Soil						
As Received Weight	g	304.9	160.0	221.9	207.0	-
Dry Weight	g	266.8	120.8	173.7	163.5	-
<2mm Subsample Weight	g ashed wt	62.2	Entire Fraction	54.4	64.8	-
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	-
Description of Asbestos Form		-	-	-	-	-
Haloethers in SVOC Soil Samples by GC-MS						
Bis(2-chloroethoxy) methane	mg/kg dry wt	-	-	-	-	< 1.6
Bis(2-chloroethyl)ether	mg/kg dry wt	-	-	-	-	< 1.6
Bis(2-chloroisopropyl)ether	mg/kg dry wt	-	-	-	-	< 1.6
4-Bromophenyl phenyl ether	mg/kg dry wt	-	-	-	-	< 1.6
4-Chlorophenyl phenyl ether	mg/kg dry wt	-	-	-	-	< 1.6
Nitrogen containing compounds in SVOC Soil Samples by GC-MS						
3,3'-Dichlorobenzidine	mg/kg dry wt	-	-	-	-	< 8
2,4-Dinitrotoluene	mg/kg dry wt	-	-	-	-	< 4
2,6-Dinitrotoluene	mg/kg dry wt	-	-	-	-	< 4
Nitrobenzene	mg/kg dry wt	-	-	-	-	< 1.6
N-Nitrosodi-n-propylamine	mg/kg dry wt	-	-	-	-	< 4
N-Nitrosodiphenylamine	mg/kg dry wt	-	-	-	-	< 4
Organochlorine Pesticides in SVOC Soil Samples by GC-MS						
Aldrin	mg/kg dry wt	-	-	-	-	< 1.6
alpha-BHC	mg/kg dry wt	-	-	-	-	< 1.6
beta-BHC	mg/kg dry wt	-	-	-	-	< 1.6
delta-BHC	mg/kg dry wt	-	-	-	-	< 1.6
gamma-BHC (Lindane)	mg/kg dry wt	-	-	-	-	< 1.6
4,4'-DDD	mg/kg dry wt	-	-	-	-	< 1.6
4,4'-DDE	mg/kg dry wt	-	-	-	-	< 1.6
4,4'-DDT	mg/kg dry wt	-	-	-	-	< 4
Dieldrin	mg/kg dry wt	-	-	-	-	< 1.6
Endosulfan I	mg/kg dry wt	-	-	-	-	< 4
Endosulfan II	mg/kg dry wt	-	-	-	-	< 4

Sample Type: Soil						
Sample Name:		PHA 07_asb 0.1m 21-Apr-2015	PHA 09_asb 0.2m 21-Apr-2015	PHA 11_asb 0.2m 21-Apr-2015	PHA 12_asb 0.1m 21-Apr-2015	Composite of PHA01 0.15m, PHA02 0.1m, PHA03 0.2m & PHA04 0.1m
Lab Number:		1416847.30	1416847.32	1416847.34	1416847.35	1416847.36
Organochlorine Pesticides in SVOC Soil Samples by GC-MS						
Endosulfan sulphate	mg/kg dry wt	-	-	-	-	< 4
Endrin	mg/kg dry wt	-	-	-	-	< 4
Endrin ketone	mg/kg dry wt	-	-	-	-	< 4
Heptachlor	mg/kg dry wt	-	-	-	-	< 1.6
Heptachlor epoxide	mg/kg dry wt	-	-	-	-	< 1.6
Hexachlorobenzene	mg/kg dry wt	-	-	-	-	< 1.6
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS						
Acenaphthene	mg/kg dry wt	-	-	-	-	< 0.8
Acenaphthylene	mg/kg dry wt	-	-	-	-	< 0.8
Anthracene	mg/kg dry wt	-	-	-	-	< 0.8
Benzo[a]anthracene	mg/kg dry wt	-	-	-	-	< 0.8
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	-	-	-	< 1.6
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	-	-	-	< 1.6
Benzo[g,h,i]perylene	mg/kg dry wt	-	-	-	-	< 1.6
Benzo[k]fluoranthene	mg/kg dry wt	-	-	-	-	< 1.6
2-Chloronaphthalene	mg/kg dry wt	-	-	-	-	< 0.8
Chrysene	mg/kg dry wt	-	-	-	-	< 0.8
Dibenzo[a,h]anthracene	mg/kg dry wt	-	-	-	-	< 1.6
Fluoranthene	mg/kg dry wt	-	-	-	-	< 0.8
Fluorene	mg/kg dry wt	-	-	-	-	< 0.8
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	-	-	-	< 1.6
2-Methylnaphthalene	mg/kg dry wt	-	-	-	-	< 0.8
Naphthalene	mg/kg dry wt	-	-	-	-	< 0.8
Phenanthrene	mg/kg dry wt	-	-	-	-	< 0.8
Pyrene	mg/kg dry wt	-	-	-	-	< 0.8
Phenols in SVOC Soil Samples by GC-MS						
4-Chloro-3-methylphenol	mg/kg dry wt	-	-	-	-	< 5
2-Chlorophenol	mg/kg dry wt	-	-	-	-	< 1.6
2,4-Dichlorophenol	mg/kg dry wt	-	-	-	-	< 1.6
2,4-Dimethylphenol	mg/kg dry wt	-	-	-	-	< 3
3 & 4-Methylphenol (m- + p-cresol)	mg/kg dry wt	-	-	-	-	< 4
2-Methylphenol (o-Cresol)	mg/kg dry wt	-	-	-	-	< 1.6
2-Nitrophenol	mg/kg dry wt	-	-	-	-	< 5
Pentachlorophenol (PCP)	mg/kg dry wt	-	-	-	-	< 40
Phenol	mg/kg dry wt	-	-	-	-	< 4
2,4,5-Trichlorophenol	mg/kg dry wt	-	-	-	-	< 4
2,4,6-Trichlorophenol	mg/kg dry wt	-	-	-	-	< 4
Plasticisers in SVOC Soil Samples by GC-MS						
Bis(2-ethylhexyl)phthalate	mg/kg dry wt	-	-	-	-	< 7
Butylbenzylphthalate	mg/kg dry wt	-	-	-	-	< 4
Di(2-ethylhexyl)adipate	mg/kg dry wt	-	-	-	-	< 1.6
Diethylphthalate	mg/kg dry wt	-	-	-	-	< 4
Dimethylphthalate	mg/kg dry wt	-	-	-	-	< 4
Di-n-butylphthalate	mg/kg dry wt	-	-	-	-	< 4
Di-n-octylphthalate	mg/kg dry wt	-	-	-	-	< 4
Other Halogenated compounds in SVOC Soil Samples by GC-MS						
1,2-Dichlorobenzene	mg/kg dry wt	-	-	-	-	< 4
1,3-Dichlorobenzene	mg/kg dry wt	-	-	-	-	< 4
1,4-Dichlorobenzene	mg/kg dry wt	-	-	-	-	< 4
Hexachlorobutadiene	mg/kg dry wt	-	-	-	-	< 4
Hexachlorocyclopentadiene	mg/kg dry wt	-	-	-	-	< 8

Sample Type: Soil						
Sample Name:		PHA 07_asb 0.1m 21-Apr-2015	PHA 09_asb 0.2m 21-Apr-2015	PHA 11_asb 0.2m 21-Apr-2015	PHA 12_asb 0.1m 21-Apr-2015	Composite of PHA01 0.15m, PHA02 0.1m, PHA03 0.2m & PHA04 0.1m
Lab Number:		1416847.30	1416847.32	1416847.34	1416847.35	1416847.36
Other Halogenated compounds in SVOC Soil Samples by GC-MS						
Hexachloroethane	mg/kg dry wt	-	-	-	-	< 4
1,2,4-Trichlorobenzene	mg/kg dry wt	-	-	-	-	< 1.6
Other compounds in SVOC Soil Samples by GC-MS						
Benzyl alcohol	mg/kg dry wt	-	-	-	-	< 16
Carbazole	mg/kg dry wt	-	-	-	-	< 1.6
Dibenzofuran	mg/kg dry wt	-	-	-	-	< 1.6
Isophorone	mg/kg dry wt	-	-	-	-	< 1.6

Sample Name:		Composite of PHA05 0.1m, PHA06 0.1m, PHA07 0.1m & PHA08 0.1m	Composite of PHA09 0.2m, PHA10 0.3m, PHA11 0.2m & PHA12 0.1m			
Lab Number:		1416847.37	1416847.38			
Individual Tests						
Dry Matter	g/100g as rcvd	76	63	-	-	-
Haloethers in SVOC Soil Samples by GC-MS						
Bis(2-chloroethoxy) methane	mg/kg dry wt	< 1.5	< 1.7	-	-	-
Bis(2-chloroethyl)ether	mg/kg dry wt	< 1.5	< 1.7	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg dry wt	< 1.5	< 1.7	-	-	-
4-Bromophenyl phenyl ether	mg/kg dry wt	< 1.5	< 1.7	-	-	-
4-Chlorophenyl phenyl ether	mg/kg dry wt	< 1.5	< 1.7	-	-	-
Nitrogen containing compounds in SVOC Soil Samples by GC-MS						
3,3'-Dichlorobenzidine	mg/kg dry wt	< 8	< 9	-	-	-
2,4-Dinitrotoluene	mg/kg dry wt	< 3	< 4	-	-	-
2,6-Dinitrotoluene	mg/kg dry wt	< 3	< 4	-	-	-
Nitrobenzene	mg/kg dry wt	< 1.5	< 1.7	-	-	-
N-Nitrosodi-n-propylamine	mg/kg dry wt	< 3	< 4	-	-	-
N-Nitrosodiphenylamine	mg/kg dry wt	< 3	< 4	-	-	-
Organochlorine Pesticides in SVOC Soil Samples by GC-MS						
Aldrin	mg/kg dry wt	< 1.5	< 1.7	-	-	-
alpha-BHC	mg/kg dry wt	< 1.5	< 1.7	-	-	-
beta-BHC	mg/kg dry wt	< 1.5	< 1.7	-	-	-
delta-BHC	mg/kg dry wt	< 1.5	< 1.7	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 1.5	< 1.7	-	-	-
4,4'-DDD	mg/kg dry wt	< 1.5	< 1.7	-	-	-
4,4'-DDE	mg/kg dry wt	< 1.5	< 1.7	-	-	-
4,4'-DDT	mg/kg dry wt	< 3	< 4	-	-	-
Dieldrin	mg/kg dry wt	< 1.5	< 1.7	-	-	-
Endosulfan I	mg/kg dry wt	< 3	< 4	-	-	-
Endosulfan II	mg/kg dry wt	< 3	< 4	-	-	-
Endosulfan sulphate	mg/kg dry wt	< 3	< 4	-	-	-
Endrin	mg/kg dry wt	< 3	< 4	-	-	-
Endrin ketone	mg/kg dry wt	< 3	< 4	-	-	-
Heptachlor	mg/kg dry wt	< 1.5	< 1.7	-	-	-
Heptachlor epoxide	mg/kg dry wt	< 1.5	< 1.7	-	-	-
Hexachlorobenzene	mg/kg dry wt	< 1.5	< 1.7	-	-	-
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS						
Acenaphthene	mg/kg dry wt	< 0.8	< 0.9	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.8	< 0.9	-	-	-
Anthracene	mg/kg dry wt	< 0.8	< 0.9	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.8	1.3	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 1.5	< 1.7	-	-	-

Sample Type: Soil						
Sample Name:		Composite of PHA05 0.1m, PHA06 0.1m, PHA07 0.1m & PHA08 0.1m	Composite of PHA09 0.2m, PHA10 0.3m, PHA11 0.2m & PHA12 0.1m			
Lab Number:		1416847.37	1416847.38			
Polycyclic Aromatic Hydrocarbons in SVOC Soil Samples by GC-MS						
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 1.5	< 1.7	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 1.5	< 1.7	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 1.5	< 1.7	-	-	-
2-Chloronaphthalene	mg/kg dry wt	< 0.8	< 0.9	-	-	-
Chrysene	mg/kg dry wt	< 0.8	1.3	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 1.5	< 1.7	-	-	-
Fluoranthene	mg/kg dry wt	< 0.8	3.9	-	-	-
Fluorene	mg/kg dry wt	< 0.8	< 0.9	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 1.5	< 1.7	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.8	< 0.9	-	-	-
Naphthalene	mg/kg dry wt	< 0.8	< 0.9	-	-	-
Phenanthrene	mg/kg dry wt	< 0.8	3.1	-	-	-
Pyrene	mg/kg dry wt	< 0.8	3.3	-	-	-
Phenols in SVOC Soil Samples by GC-MS						
4-Chloro-3-methylphenol	mg/kg dry wt	< 5	< 5	-	-	-
2-Chlorophenol	mg/kg dry wt	< 1.5	< 1.7	-	-	-
2,4-Dichlorophenol	mg/kg dry wt	< 1.5	< 1.7	-	-	-
2,4-Dimethylphenol	mg/kg dry wt	< 3	< 3	-	-	-
3 & 4-Methylphenol (m- + p-cresol)	mg/kg dry wt	< 3	< 4	-	-	-
2-Methylphenol (o-Cresol)	mg/kg dry wt	< 1.5	< 1.7	-	-	-
2-Nitrophenol	mg/kg dry wt	< 5	< 5	-	-	-
Pentachlorophenol (PCP)	mg/kg dry wt	< 30	< 40	-	-	-
Phenol	mg/kg dry wt	< 3	< 4	-	-	-
2,4,5-Trichlorophenol	mg/kg dry wt	< 3	< 4	-	-	-
2,4,6-Trichlorophenol	mg/kg dry wt	< 3	< 4	-	-	-
Plasticisers in SVOC Soil Samples by GC-MS						
Bis(2-ethylhexyl)phthalate	mg/kg dry wt	< 6	< 7	-	-	-
Butylbenzylphthalate	mg/kg dry wt	< 3	< 4	-	-	-
Di(2-ethylhexyl)adipate	mg/kg dry wt	< 1.5	< 1.7	-	-	-
Diethylphthalate	mg/kg dry wt	< 3	< 4	-	-	-
Dimethylphthalate	mg/kg dry wt	< 3	< 4	-	-	-
Di-n-butylphthalate	mg/kg dry wt	< 3	< 4	-	-	-
Di-n-octylphthalate	mg/kg dry wt	< 3	< 4	-	-	-
Other Halogenated compounds in SVOC Soil Samples by GC-MS						
1,2-Dichlorobenzene	mg/kg dry wt	< 3	< 4	-	-	-
1,3-Dichlorobenzene	mg/kg dry wt	< 3	< 4	-	-	-
1,4-Dichlorobenzene	mg/kg dry wt	< 3	< 4	-	-	-
Hexachlorobutadiene	mg/kg dry wt	< 3	< 4	-	-	-
Hexachlorocyclopentadiene	mg/kg dry wt	< 8	< 9	-	-	-
Hexachloroethane	mg/kg dry wt	< 3	< 4	-	-	-
1,2,4-Trichlorobenzene	mg/kg dry wt	< 1.5	< 1.7	-	-	-
Other compounds in SVOC Soil Samples by GC-MS						
Benzyl alcohol	mg/kg dry wt	< 15	< 17	-	-	-
Carbazole	mg/kg dry wt	< 1.5	< 1.7	-	-	-
Dibenzofuran	mg/kg dry wt	< 1.5	< 1.7	-	-	-
Isophorone	mg/kg dry wt	< 1.5	< 1.7	-	-	-

Analyst's Comments

Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1, 3-7, 9-11, 13-15, 17-20, 22-23
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	36-38
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1, 3-7, 9-11, 13-15, 17-20, 22-23
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	1, 3, 5, 7, 9, 11, 13, 15, 17, 19-20, 22
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	1, 3-7, 9-11, 13-15, 17-20, 22-23
Semivolatile Organic Compounds Screening in Soil by GC-MS	Sonication extraction, GPC cleanup (if required), GC-MS FS analysis. Tested on as received sample	0.3 - 30 mg/kg dry wt	36-38
Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	26, 28, 30, 32, 34-35
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	26, 28, 30, 32, 34-35
<2mm Subsample Weight	Sample ashed at 400°C, weight of <2mm sample fraction taken for asbestos identification if less than entire fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	-	26, 28, 30, 32, 34-35
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	26, 28, 30, 32, 34-35
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	26, 28, 30, 32, 34-35

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Martin Cowell - BSc
Client Services Manager - Environmental Division

1/5 B

Form:

Chain of Custody & Analysis Request Form

AECOM

AECOM - Auckland
PO Box 4241
Auckland 1140
Tel: 64 9 967 9200
Fax: 64 9 967 9201
Email: david.dangerfield@aecom.com

Laboratory Details
Lab. Name: R J Hill Laboratories Ltd
Lab. Address: 1 Clyde St, Hamilton
Contact Name: Jean Connick
Lab. Ref:
Tel: 07 858 2000
Fax: 07 858 2001
Preliminary Report by:
Final Report by:
Lab Quote No: [redacted]

Project Name: ~~Auckland - SCI~~ Palmer Street **Project Number:** [redacted] 6034391

Sample collected by: Indy Brown [redacted] **Purchase Order Number:** [redacted]

Sample Results to be returned to: David Dangerfield of AECOM

Specifications: [redacted]

	(Tick)		
1. Urgent TAT required? (please circle: 24hr 48hr _____days)	Yes	☑ No	N/A
2. Fast TAT Guarantee Required?	Yes	☑ No	N/A
3. Is any sediment layer present in waters to be excluded from extractions?	Yes	☑ No	N/A
4. Special storage requirements?	Yes	☑ No	N/A
5. Preservation requirements?	Yes	☑ No	N/A
6. Other requirements? ☐ Fax ☐ Hard copy ☑ Email	Yes	☐ No	N/A
7. Report Format: Email: david.dangerfield@aecom.com 8. Project Manager: D. Dangerfield			tel: 09 967 9291

Lab. ID	Sample ID	Sampling Date & ~~time (on)~~	Sampling ~~Date~~ & Time ~~(off)~~	Matrix: soil	water	other	Preservation: filt'ed	acid	ice	other	Container (No. & type)	Hold Cold	MSHMs-(heavy-metals-scr)	MSHMHgs-(MH+-mercury-	TPHOI-(TPH)	TPHOIBXp-(TPH-&-BTEX)	VOCPTsc-(VOCs-scr)	SVOCt-(SVOCs-tr)	PAHt-(PAH-tr)	OCNPsc-(Pesticides-scr)	PCBsc-(PCB-scr)	Remarks & comments
	PHA01 0.15m	21-4-15	16.55	X					X			X										
	PHA01 0.55m		17.20																			
	PHA02 0.1m		16.10																			
	PHA02 0.4m		16.15																			
	PHA03 0.2m		1545																			
	PHA03 0.45		1550																			
	PHA04 0.1		1520																			
	PHA04 0.4		1525																			
	PHA05 0.1		1500																			
	PHA05 0.45	↓	1510	↓					↓			↓										

Relinquished By:
Name: Indy Brown Date: 23-4-15
of: AECOM Time:

Received by:
Name: David Watson Date:
of: Time:

Relinquished By:
Name: Date:
of: Time:

Received by:
Name: Date:
of: Time:

Received in good condition?	Yes/No/NA	Method of Shipment ☐ Courier ☐ Pc	
Samples received chilled? 15.1°C	Yes/No/NA	Consignment Note No.	
	Yes/No/NA	Transport Co:	
Received in good condition?	Yes/No/NA	Method of Shipment ☐ Courier ☐ Pc	
Samples received chilled?	Yes/No/NA	Consignment Note No.	
	Yes/No/NA	Transport Co:	

3114168477

Job No: 141 6847
Date Recv: 23-Apr-15 15:43
Received by: Kim Harrison

Printed copies of this document are uncontrolled

Environment

BM

2/5

Form:

Chain of Custody & Analysis Request Form

AECOM

AECOM - Auckland
PO Box 4241
Auckland 1140
Tel: 64 9 967 9200
Fax: 64 9 967 9201
Email: david.dangerfield@aecom.com

Laboratory Details
Lab. Name: R J Hill Laboratories Ltd
Lab. Address: 1 Clyde St, Hamilton
Contact Name: Jean Connick
Lab. Ref:
Tel: 07 858 2000
Fax: 07 858 2001
Preliminary Report by:
Final Report by:
Lab Quote No: ~~62183~~

Project Name: [redacted] Palmer St
Project Number: ~~60348004~~ 603439/
Purchase Order Number: ~~60348004 Task 20.9~~

Sample collected by: J. Brown. [redacted]
Sample Results to be returned to: David Dangerfield of AECOM

Specifications: Special Quote 62183

	(Tick)		
1. Urgent TAT required? (please circle: 24hr 48hr _____days)	Yes	No	N/A
2. Fast TAT Guarantee Required?	Yes	No	N/A
3. Is any sediment layer present in waters to be excluded from extractions?	Yes	No	N/A
4. Special storage requirements?	Yes	No	N/A
5. Preservation requirements?	Yes	No	N/A
6. Other requirements? ☐ Fax ☐ Hard copy ☑ Email	Yes	No	N/A
7. Report Format: Email: david.dangerfield@aecom.com 8. Project Manager: D. Dangerfield	Yes	No	N/A

tel: 09 967 9291

Lab. ID	Sample ID	Sampling Date & ~~time (on)~~	Sampling ~~Date~~ & Time ~~(off)~~	Matrix: soil	Matrix: water	Matrix: other	Preservation: filt'ed	Preservation: acid	Preservation: ice	Preservation: other	Container (No. & type)	Hold Cold	MSHMs (heavy metals-scr)	MSHMHgs (MH + mercury-scr)	TPHOI (TPH)	TPHOIBXp (TPH & BTEX)	VOCPTsc (VOCs-scr)	SVOCt (SVOCs-tr)	PAHt (PAH-tr)	OCNPsc (Pesticides-scr)	PCBsc (PCB-scr)	Remarks & comments
	PHA 06 0.1m	21-4-15	1430	X								X										
	PHA 06 0.4m		1440																			
	PHA 07 0.1m		1400																			
	PHA 07 0.4m		1408																			
	PHA 08 0.1m		1340																			
	PHA 08 0.5m		1345																			
	PHA 09 0.2m		1305																			
	PHA 09 0.45m		1310																			
	PHA 10 0.3m		1230																			
	PHA 11 0.2m	✓	1205	✓								✓										

Relinquished By:
Name: Date:
of: Time:

Received by:
Name: Date:
of: Time:

Received in good condition? Yes/No/NA
Samples received chilled? Yes/No/NA Yes/No/NA
Method of Shipment ☐ Courier ☐ Postal ☐ By Hand
Consignment Note No.
Transport Co:

Relinquished By:
Name: Date:
of: Time:

Received by:
Name: Date:
of: Time:

Received in good condition? Yes/No/NA
Samples received chilled? Yes/No/NA Yes/No/NA
Method of Shipment ☐ Courier ☐ Postal ☐ By Hand
Consignment Note No.
Transport Co:

3/5

Form:

Chain of Custody & Analysis Request Form

AECOM

AECOM - Auckland
PO Box 4241
Auckland 1140

Tel: 64 9 967 9200
Fax: 64 9 967 9201
Email: david.dangerfield@aecom.com

Laboratory Details
Lab. Name: R J Hill Laboratories Ltd
Lab. Address: 1 Clyde St, Hamilton
Contact Name: Jean Connick
Lab. Ref:
Tel: 07 858 2000
Fax: 07 858 2001
Preliminary Report by:
Final Report by:
Lab Quote No: [redacted]

Project Name: [redacted] Palmer Street
Project Number: [redacted] 603439/
Purchase Order Number: [redacted]
Sample collected by: J Brown [redacted]
Sample Results to be returned to: David Dangerfield of AECOM
Specifications: [redacted]

	(Tick)		
1. Urgent TAT required? (please circle: 24hr 48hr ______ days)	☐ Yes	☑ No	☐ N/A
2. Fast TAT Guarantee Required?	☐ Yes	☑ No	☐ N/A
3. Is any sediment layer present in waters to be excluded from extractions?	☐ Yes	☑ No	☐ N/A
4. Special storage requirements?	☐ Yes	☑ No	☐ N/A
5. Preservation requirements?	☐ Yes	☑ No	☐ N/A
6. Other requirements? ☐ Fax ☐ Hard copy ☑ Email	☐ Yes	☑ No	☐ N/A
7. Report Format: Email: david.dangerfield@aecom.com 8. Project Manager: D. Dangerfield tel: 09 967 9291			

Lab. ID	Sample ID	Sampling Date & ~~time (on)~~	Sampling ~~Date~~ ~~&~~ Time ~~(off)~~	Matrix: soil	Matrix: water	Matrix: other	filt'ed	Preservation: acid	Preservation: ice	Preservation: other	Container (No. & type)	Hold Cold	MSHMs (heavy metals-scr)	MSHMHgs (MH + mercury-)	TPHOI (TPH)	TPHOIBXp (TPH & BTEX)	VOCPTsc (VOCs-scr)	SVOCt (SVOCs-tr)	PAHt (PAH-tr)	OCNPsc (Pesticides-scr)	PCBsc (PCB-scr)						Remarks & comments
	PHA 11 0.8m	21-4-15	12.05	✓								↓															
	PHA 12 0.1m	↓	11.30	↓								↓															
	PHA 12 0.6m	↓	11.38	↓								↓															

Relinquished By:		Received by:				
Name:	Date:	Name:	Date:	Received in good condition?	Yes/No/NA	Method of Shipment ☐ ~~Courier~~ ☐ ~~Postal~~ ☐ ~~By Hand~~
of:	Time:	of:	Time:	Samples received chilled?	Yes/No/NA	Consignment Note No.
					Yes/No/NA	Transport Co:

Relinquished By:		Received by:				
Name:	Date:	Name:	Date:	Received in good condition?	Yes/No/NA	Method of Shipment ☐ ~~Courier~~ ☐ ~~Postal~~ ☐ ~~By Hand~~
of:	Time:	of:	Time:	Samples received chilled?	Yes/No/NA	Consignment Note No.
					Yes/No/NA	Transport Co:

Hill Laboratories
BETTER TESTING BETTER RESULTS

ANALYSIS REQUEST

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
Hamilton 3240, New Zealand

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

Client

Name: AECOM.
Address: 8 Mahuhu Crescent, Auckland
Phone: Fax:
Client Reference:
Quote No: Order Number:

Primary Contact David Dangerfield.
Submitted By Judy Brown.
Charge To

Results To ☒ Mail Client ☐ Mail Submitter
☐ Fax Results
☑ Email Results David Dangerfield.

Office use only Job No:

CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories Date & Time: Name: Signature:
☐ Please tick if you require COC to be faxed back

Received at Hill Laboratories Date & Time: Name: Signature:

Condition Temp:
☐ Room Temp ☐ Chilled ☐ Frozen
☐ Sample Analysis details checked
Signature:

ADDITIONAL INFORMATION

Project # 6034391
Palmer Street

Priority
☐ Low ☒ Normal ☐ High
☐ Urgent (ASAP, extra charge applies, please contact the lab first)

Requested Reporting Date:

Sample Types

Waters	E Effluent	G Geothermal	Pot1 Potable Water (LAS/EU)	Pot2 Potable Water (NZDWS)
	GW Ground Water	L Leachate	☐ Audit Monitoring	Pot3 Potable Water (other)
	SW Surface Water	S Saline	☐ Check Monitoring	Pool Swimming/Spa Pool
	TW Trade Waste			
Solids	ES Soil	SE Sediment	SL Sludge	PL Plant
Other	O O Oil	M Miscellaneous	FS FS Fish/shellfish/biota	BM BM Biological Material

No.	Sample Name	Sample Date & Time	Sample Type	Tests Required
1	PHA 01_asb 0-1m	21-4-15	ES	HOLD COLD.
2	PHA 02_asb 0-1m			
3	PHA 03_asb 0-2m			
4	PHA 04_asb 0-1m			
5	PHA 05_asb 0-1m			
6	PHA 06_asb 0-1m			
7	PHA 07_asb 0-1m			
8	PHA 08_asb 0-1m			
9	PHA 01_asb 0-2m			

5/5

Hill Laboratories

BETTER TESTING BETTER RESULTS

ANALYSIS REQUEST

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
Hamilton 3240, New Zealand

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

Client

Name AECOM.

Address 8 Mahuhu Crescent.
Auckland

Phone Fax

Client Reference

Quote No Order Number

Primary Contact David Dangerfield

Submitted By Mary Brown

Charge To

Results To ☒ Mail Client ☐ Mail Submitter

☐ Fax Results

☒ Email Results David Dangerfield

Office use only Job No:

CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories
Date & Time:
Name:
☐ Please tick if you require COC to be faxed back
Signature:

Received at Hill Laboratories
Date & Time:
Name:
Signature:

Condition Temp:
☐ Room Temp ☐ Chilled ☐ Frozen

☐ Sample Analysis details checked
Signature:

ADDITIONAL INFORMATION

project # 603439
Palmer Street.

Priority

☐ Low ☒ Normal ☐ High

☐ Urgent (ASAP, extra charge applies, please contact the lab first)

Requested Reporting Date:

Sample Types

Waters	E	Effluent	G	Geothermal	Pot1	Potable Water (LAS/EU)	Pot2	Potable Water (NZDWS)
	GW	Ground Water	L	Leachate	☐	Audit Monitoring	Pot3	Potable Water (other)
	SW	Surface Water	S	Saline	☐	Check Monitoring	Pool	Swimming/Spa Pool
	TW	Trade Waste						
Solids	ES	Soil	SE	Sediment	SL	Sludge	PL	Plant
Other	O	O Oil	M	Miscellaneous	FS	FS Fish/shellfish/biota	BM	BM Biological Material

No.	Sample Name	Sample Date & Time	Sample Type	Tests Required
1	PHA 10 - asb 0.3m	21-4-15	ES	HOLD COLD
2	PHA 11 - asb 0.2m	↓	↓	↓
3	PHA12 - asb 0.1m	↓	↓	↓
4				
5				
6				
7				
8				
9				

AECOM - Sydney (Macquarie Park)
AECOM - Auckland
PO Box 4241
Auckland 1140
Tel : 64 9 967 9200
Email: david.dangerfield@aecom.com

Laboratory Details
Lab. Name: R J Hill Laboratory Ltd
Lab. Address: 1 Clyde St, Hamilton
Contact Name: Jean Connick
Lab. Ref:
Tel: 07 858 2000
Fax:
Preliminary Report by:
Final Report by:
Lab Quote No:

Project Name: Palmer Street **Project Number:** 6034391 **Purchase Order Number:**

Sample collected by: Judy Brown **Sample Results to be returned to:** David Dangerfield of AECOM

Specifications:

	(Tick)		
1. Urgent TAT required? (please circle: 24hr 48hr _____days)	☐ Yes	☑ No	☐ N/A
2. Fast TAT Guarantee Required?	☐ Yes	☑ No	☐ N/A
3. Is any sediment layer present in waters to be excluded from extractions?	☐ Yes	☑ No	☐ N/A
4. Special storage requirements?	☐ Yes	☑ No	☐ N/A
5. Preservation requirements?	☐ Yes	☑ No	☐ N/A
6. Other requirements?	☐ Yes	☑ No	☐ N/A

7. Report Format: Email : david.dangerfield@aecom.com 8. Project Manager: David Dangerfield tel: 09 9679291

Lab. ID	Sample ID	Sampling Date	Sampling Time	Matrix: soil	Matrix: water	Matrix: other	Preservation: fil'ed	Preservation: acid	Preservation: ice	Preservation: other	Container (No. & type)	Analysis Request: MSHMHgs (MH + Mercury)	Analysis Request: Hold Cold	Remarks & comments
	PHA 1 0.15m	21/04/2015		*								*		
	PHA 01 0.55m	21/04/2015		*									*	
	PHA 02 0.1m	21/04/2015		*								*		
	PHA 02 0.4m	21/04/2015		*								*		
	PHA 03 0.2m	21/04/2015		*								*		
	PHA 03 0.45m	21/04/2015		*								*		
	PHA 04 0.1m	21/04/2015		*								*		
	PHA 04 0.4m	21/04/2015		*									*	
	PHA 05 0.1m	21/04/2015		*								*		
	PHA 05 0.45m	21/04/2015		*								*		

Relinquished By:
Name: Judy Brown Date: 21/4/15
of: AECOM Time:

Received by:
Name: Date:
of: Time:

Received in good condition? Yes/No/NA
Samples received chilled? Yes/No/NA
Yes/No/NA
Method of Shipment
Consignment Note No.
Transport Co:

Relinquished By:
Name: Date:
of: Time:

Received by:
Name: Date:
of: Time:

Received in good condition? Yes/No/NA
Samples received chilled? Yes/No/NA
Yes/No/NA
Method of Shipment
Consignment Note No.
Transport Co:

AECOM - Sydney (Macquarie Park)
AECOM - Auckland
PO Box 4241
Auckland 1140
Tel : 64 9 967 9200
Email: david.dangerfield@aecom.com

Laboratory Details
Lab. Name: R J Hill Laboratory Ltd
Lab. Address: 1 Clyde St, Hamilton
Contact Name: Jean Connicl
Lab. Ref:
Tel: 07 858 2000
Fax:
Preliminary Report by:
Final Report by:
Lab Quote No:

Project Name: Palmer Street **Project Number:** 6034391 **Purchase Order Number:**

Sample collected by: Judy Brown **Sample Results to be returned to:** David Dangerfield of AECOM

Specifications:

	(Tick)		
1. Urgent TAT required? (please circle: 24hr 48hr _____days)	☐ Yes	☑ No	☐ N/A
2. Fast TAT Guarantee Required?	☐ Yes	☑ No	☐ N/A
3. Is any sediment layer present in waters to be excluded from extractions?	☐ Yes	☑ No	☐ N/A
4. Special storage requirements?	☐ Yes	☑ No	☐ N/A
5. Preservation requirements?	☐ Yes	☑ No	☐ N/A
6. Other requirements?	☐ Yes	☑ No	☐ N/A

7. Report Format: Email : david.dangerfield@aecom.com 8. Project Manager: David Dangerfield tel: 09 9679291

Lab. ID	Sample ID	Sampling Date	Sampling Time	Matrix: soil	Matrix: water	Matrix: other	Preservation: fil'ed	Preservation: acid	Preservation: ice	Preservation: other	Container (No. & type)	Analysis Request: MSHMHgs (MH + Mercury)	Analysis Request: Hold Cold	Remarks & comments
	PHA 06 0.1m	21/04/2015		*								*		
	PHA 06 0.4m	21/04/2015		*									*	
	PHA 07 0.1m	21/04/2015		*								*		
	PHA 07 0.4m	21/04/2015		*								*		
	PHA 08 0.1m	21/04/2015		*								*		
	PHA 08 0.5m	21/04/2015		*									*	
	PHA 09 0.2m	21/04/2015		*								*		
	PHA 09 0.45m	21/04/2015		*								*		
	PHA 10 0.3m	21/04/2015		*								*		
	PHA 11 0.2m	21/04/2015		*								*		

Relinquished By:
Name: Judy Brown Date: 21/4/15
of: AECOM Time:

Received by:
Name: Date:
of: Time:

Received in good condition? Yes/No/NA — Method of Shipment
Samples received chilled? Yes/No/NA — Consignment Note No.
Yes/No/NA — Transport Co:

Relinquished By:
Name: Date:
of: Time:

Received by:
Name: Date:
of: Time:

Received in good condition? Yes/No/NA — Method of Shipment
Samples received chilled? Yes/No/NA — Consignment Note No.
Yes/No/NA — Transport Co:

AECOM - Sydney (Macquarie Park)
AECOM - Auckland
PO Box 4241
Auckland 1140
Tel : 64 9 967 9200
Email: david.dangerfield@aecom.com

Laboratory Details
Lab. Name: R J Hill Laboratory Ltd
Lab. Address: 1 Clyde St, Hamilton
Contact Name: Jean Connicl
Lab. Ref:
Tel: 07 858 2000
Fax:
Preliminary Report by:
Final Report by:
Lab Quote No:

Project Name: Palmer Street **Project Number:** 6034391 **Purchase Order Number:**

Sample collected by: Judy Brown **Sample Results to be returned to:** David Dangerfield of AECOM

Specifications:

	(Tick)		
1. Urgent TAT required? (please circle: 24hr 48hr _____days)	☐ Yes	☑ No	☐ N/A
2. Fast TAT Guarantee Required?	☐ Yes	☑ No	☐ N/A
3. Is any sediment layer present in waters to be excluded from extractions?	☐ Yes	☑ No	☐ N/A
4. Special storage requirements?	☐ Yes	☑ No	☐ N/A
5. Preservation requirements?	☐ Yes	☑ No	☐ N/A
6. Other requirements?	☐ Yes	☑ No	☐ N/A

7. Report Format: Email : david.dangerfield@aecom.com 8. Project Manager: David Dangerfield tel: 09 9679291

Analysis Request

Lab. ID	Sample ID	Sampling Date & time (on)	Sampling Date & Time (off)	Matrix: soil	Matrix: water	Matrix: other	Preservation: filt'ed	Preservation: acid	Preservation: ice	Preservation: other	Container (No. & type)	MSHMHgs (MH + Mercury)	Hold Cold	SVOCs	Remarks & comments
	PHA 11 0.8m	21/04/2015		*									*		
	PHA 12 0.1m	21/04/2015		*								*			
	PHA 12 0.6m	21/04/2015		*								*			
	Composite Sample of PHA 01 0.15m, PHA 02 0.1m, PHA 03 0.2m, PHA 04 0.1m	21/04/2015		*										*	
	Composite Sample of PHA 05 0.1m, PHA 06 0.1m, PHA 07 0.1m, PHA 08 0.1m	21/04/2015		*										*	

Relinquished By:
Name: Judy Brown Date: 21/4/15
of: AECOM Time:

Received by:
Name: Date:
of: Time:

Received in good condition? Yes/No/NA
Samples received chilled? Yes/No/NA
Yes/No/NA
Method of Shipment
Consignment Note No.
Transport Co:

Relinquished By:
Name: Date:
of: Time:

Received by:
Name: Date:
of: Time:

Received in good condition? Yes/No/NA
Samples received chilled? Yes/No/NA
Yes/No/NA
Method of Shipment
Consignment Note No.
Transport Co:

AECOM - Sydney (Macquarie Park)
AECOM - Auckland
PO Box 4241
Auckland 1140
Tel : 64 9 967 9200
Email: david.dangerfield@aecom.com

Laboratory Details
Lab. Name: R J Hill Laboratory Ltd
Lab. Address: 1 Clyde St, Hamilton
Contact Name: Jean Connicl
Lab. Ref:
Tel: 07 858 2000
Fax:
Preliminary Report by:
Final Report by:
Lab Quote No:

Project Name: Palmer Street **Project Number:** 6034391 **Purchase Order Number:**

Sample collected by: Judy Brown **Sample Results to be returned to:** David Dangerfield of AECOM

Specifications:

	(Tick)		
1. Urgent TAT required? (please circle: 24hr 48hr _____days)	☐ Yes	☑ No	☐ N/A
2. Fast TAT Guarantee Required?	☐ Yes	☑ No	☐ N/A
3. Is any sediment layer present in waters to be excluded from extractions?	☐ Yes	☑ No	☐ N/A
4. Special storage requirements?	☐ Yes	☑ No	☐ N/A
5. Preservation requirements?	☐ Yes	☑ No	☐ N/A
6. Other requirements?	☐ Yes	☑ No	☐ N/A

7. Report Format: Email : david.dangerfield@aecom.com 8. Project Manager: David Dangerfield tel: 09 9679291

Lab. ID	Sample ID	Sampling Date	Sampling Time	Matrix: soil	Matrix: water	Matrix: other	Preservation: filt'ed	Preservation: acid	Preservation: ice	Preservation: other	Container (No. & type)	Analysis Request: MSHMHgs (MH + Mercury)	Analysis Request: SVOC	Remarks & comments
	Composite Sample of PHA09 0.2m, PHA 10 0.3m, PHA 11 0.2m, PHA12 0.1m	21/04/2015		*									*	
				*										
				*										
				*										
				*										
				*										
				*										
				*										
				*										
				*										

Relinquished By:
Name: Judy Brown Date: 21/4/15
of: AECOM Time:

Received by:
Name: Date:
of: Time:

Received in good condition? Yes/No/NA
Samples received chilled? Yes/No/NA
Yes/No/NA
Method of Shipment
Consignment Note No.
Transport Co:

Relinquished By:
Name: Date:
of: Time:

Received by:
Name: Date:
of: Time:

Received in good condition? Yes/No/NA
Samples received chilled? Yes/No/NA
Yes/No/NA
Method of Shipment
Consignment Note No.
Transport Co:

AECOM - Sydney (Macquarie Park)
AECOM - Auckland
PO Box 4241
Auckland 1140
Tel : 64 9 967 9200
Email: david.dangerfield@aecom.com

Laboratory Details
Lab. Name: R J Hill Laboratory Ltd
Lab. Address: 1 Clyde St, Hamilton
Contact Name: Jean Connicl
Lab. Ref:
Tel: 07 858 2000
Fax:
Preliminary Report by:
Final Report by:
Lab Quote No:

Project Name: Palmer Street **Project Number:** 6034391 **Purchase Order Number:**

Sample collected by: Judy Brown **Sample Results to be returned to:** David Dangerfield of AECOM

Specifications:

	(Tick)		
1. Urgent TAT required? (please circle: 24hr 48hr _____days)	☐ Yes	☑ No	☐ N/A
2. Fast TAT Guarantee Required?	☐ Yes	☑ No	☐ N/A
3. Is any sediment layer present in waters to be excluded from extractions?	☐ Yes	☑ No	☐ N/A
4. Special storage requirements?	☐ Yes	☑ No	☐ N/A
5. Preservation requirements?	☐ Yes	☑ No	☐ N/A
6. Other requirements?	☐ Yes	☑ No	☐ N/A

7. Report Format: Email : david.dangerfield@aecom.com 8. Project Manager: David Dangerfield tel: 09 9679291

Analysis Request

Lab. ID	Sample ID	Sampling Date	Sampling Time	Matrix: soil	Matrix: water	Matrix: other	Preservation: filt'ed	Preservation: acid	Preservation: ice	Preservation: other	Container (No. & type)	Asbestos	Hold Cold	Remarks & comments
	PHA 01_asb 0.1m	21/04/2015		*									*	
	PHA 02_Asb 0.1m	21/04/2015		*									*	
	PHA 03 Asb 0.2m	21/04/2015		*								*		
	PHA 04_Asb 0.1m	21/04/2015		*									*	
	PHA 05_Asb 0.1m	21/04/2015		*								*		
	PHA 06_ Asb 0.1m	21/04/2015		*									*	
	PHA 07_Asb 0.1m	21/04/2015		*								*		
	PHA 08_Asb 0.1m	21/04/2015		*									*	
	PHA 09_Asb 0.2m	21/04/2015		*								*		
	PHA 10_Asb 0.3m	21/04/2015		*									*	
	PHA 11_Asb 0.2m	21/04/2015		*								*		
	PHA 12_Asb 0.1m	21/04/2015		*								*		

Relinquished By:
Name: Judy Brown Date: 21/4/15
of: AECOM Time:

Received by:
Name: Date:
of: Time:

Received in good condition? Yes/No/NA Method of Shipment
Samples received chilled? Yes/No/NA Consignment Note No
Yes/No/NA Transport Co:

Relinquished By:
Name: Date:
of: Time:

Received by:
Name: Date:
of: Time:

Received in good condition? Yes/No/NA Method of Shipment
Samples received chilled? Yes/No/NA Consignment Note No
Yes/No/NA Transport Co:

Hill Laboratories
BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
Hamilton 3240, New Zealand

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	AECOM New Zealand Limited	**Lab No:**	1474279 SPv1
Contact:	E Trembath	**Date Registered:**	10-Sep-2015
	C/- AECOM New Zealand Limited	**Date Reported:**	21-Sep-2015
	PO Box 4241	**Quote No:**	
	Shortland Street	**Order No:**	60343891.02.04
	AUCKLAND 1140	**Client Reference:**	60343891
		Submitted By:	Lorraine Hamilton

Sample Type: Soil

	Sample Name:	SAB151 10-Sep-2015	SAB152 10-Sep-2015	SAB153 10-Sep-2015	SAB154 10-Sep-2015	SAB155 10-Sep-2015
	Lab Number:	1474279.1	1474279.2	1474279.3	1474279.4	1474279.5
Total Recoverable Lead	mg/kg dry wt	112	34	57	61	101

	Sample Name:	SAB156 10-Sep-2015	SAB157 10-Sep-2015	SAB158 10-Sep-2015	SAB159 10-Sep-2015	SAB160 10-Sep-2015
	Lab Number:	1474279.6	1474279.7	1474279.8	1474279.9	1474279.10
Total Recoverable Lead	mg/kg dry wt	133	36	60	85	54

	Sample Name:	SAB161 10-Sep-2015	SAB162 10-Sep-2015	SAB163 10-Sep-2015	SAB164 10-Sep-2015	
	Lab Number:	1474279.11	1474279.12	1474279.13	1474279.14	
Total Recoverable Lead	mg/kg dry wt	54	89	39	41	-

Analyst's Comments

Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-14
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-14
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.4 mg/kg dry wt	1-14

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Peter Robinson MSc (Hons), PhD, FNZIC
Client Services Manager - Environmental Division

URS

AECOM

Job No: Pr147 4279

Date Recv: 10-Sep-15 17:59

Received by: Karl Prendergast

Subject: Soil Samples

To: Project: 60343891 Date:

Verified By: Date:

Project/ 3114742792

File Stru

Date:

Sheet: of

charge to this code on invoice

Sample #	Jars	Date sampled	HOLD	COLD	Sample type
SAB151	1 x glass	10/9/15			Soil
SAB152					
SAB153					
SAB154					
SAB155					
SAB156					
SAB157					
SAB158					
SAB159					
SAB160					
SAB161					
SAB162					
SAB163					
SAB164					

Sampled by: Lorraine Hamilton

Attn: Emma Trembath

Total : 14 jars.

Temperature On Arrival

12.8 °C

- Temperature was measured on arbitrarily chosen samples in this batch. The Microbiology sample temperature will be recorded at Melville Lab before testing.

Hill Laboratories
BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
Hamilton 3240, New Zealand

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	AECOM New Zealand Limited	**Lab No:**	1428804 SPv3
Contact:	David Dangerfield	**Date Registered:**	20-May-2015
	C/- AECOM New Zealand Limited	**Date Reported:**	16-Jun-2015
	PO Box 4241	**Quote No:**	68287
	Shortland Street	**Order No:**	60249091 Task 20.9
	AUCKLAND 1140	**Client Reference:**	60343891 T 02.04 Te Awamutu - Palmer St Landfill
		Submitted By:	N Jancic

Amended Report

This report replaces an earlier report issued on the 03 Jun 2015 at 9:59 am
At the client's request, boron has been added to sample 1.

Sample Type: Aqueous

Sample Name:		MW01 GAA 461 20-May-2015	MW02 GAA 462 20-May-2015	MW04 GAA 463 20-May-2015	QC100 GAA 464 20-May-2015	MW03 GAA 465 20-May-2015
Lab Number:		1428804.1	1428804.2	1428804.3	1428804.4	1428804.5
Individual Tests						
Sum of Anions	meq/L	-	-	4.0	-	-
Sum of Cations	meq/L	-	-	3.3	-	-
pH	pH Units	5.9	6.7	6.4	-	5.9
Total Alkalinity	g/m³ as $CaCO_3$	-	-	175	-	-
Bicarbonate	g/m³ at 25°C	-	-	210	-	-
Total Hardness	g/m³ as $CaCO_3$	-	-	110	-	-
Electrical Conductivity (EC)	mS/m	8.5	9.4	42.7	-	8.6
Dissolved Aluminium	g/m³	-	-	0.079	-	-
Dissolved Boron	g/m³	0.082	-	1.45	-	-
Dissolved Calcium	g/m³	-	-	33	-	-
Dissolved Cobalt	g/m³	-	-	0.0021	-	-
Dissolved Magnesium	g/m³	-	-	6.8	-	-
Dissolved Manganese	g/m³	-	-	1.36	-	-
Dissolved Potassium	g/m³	-	-	7.9	-	-
Dissolved Sodium	g/m³	-	-	11.3	-	-
Chloride	g/m³	-	-	15.6	-	-
Total Nitrogen	g/m³	5.2	1.28	9.4	-	2.8
Total Ammoniacal-N	g/m³	< 0.010	< 0.010	5.3	-	< 0.010
Nitrite-N	g/m³	< 0.002	< 0.002	< 0.02 #1	-	< 0.002
Nitrate-N	g/m³	1.68	0.51	< 0.02	-	2.3
Nitrate-N + Nitrite-N	g/m³	1.68	0.51	< 0.02 #1	-	2.3
Total Kjeldahl Nitrogen (TKN)	g/m³	3.5	0.76	9.4	-	0.51
Sulphate	g/m³	-	-	1.1	-	-
Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)	g O_2/m³	-	-	2	-	-
Chemical Oxygen Demand (COD)	g O_2/m³	-	-	114	-	-
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Dissolved Arsenic	g/m³	< 0.0010	< 0.0010	0.0017	0.0021	< 0.0010
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Chromium	g/m³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Copper	g/m³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Lead	g/m³	0.00014	< 0.00010	0.00018	0.00011	< 0.00010
Dissolved Nickel	g/m³	< 0.0005	< 0.0005	0.0009	0.0015	< 0.0005
Dissolved Zinc	g/m³	0.0059	0.0060	0.026	0.027	0.0095
Haloethers Trace in SVOC Water Samples by GC-MS						

Sample Type: Aqueous						
Sample Name:		MW01 GAA 461 20-May-2015	MW02 GAA 462 20-May-2015	MW04 GAA 463 20-May-2015	QC100 GAA 464 20-May-2015	MW03 GAA 465 20-May-2015
Lab Number:		1428804.1	1428804.2	1428804.3	1428804.4	1428804.5
Haloethers Trace in SVOC Water Samples by GC-MS						
Bis(2-chloroethoxy) methane	g/m³	-	-	< 0.0005	-	-
Bis(2-chloroethyl)ether	g/m³	-	-	< 0.0005	-	-
Bis(2-chloroisopropyl)ether	g/m³	-	-	< 0.0005	-	-
4-Bromophenyl phenyl ether	g/m³	-	-	< 0.0005	-	-
4-Chlorophenyl phenyl ether	g/m³	-	-	< 0.0005	-	-
Nitrogen containing compounds Trace in SVOC Water Samples, GC-MS						
3,3'-Dichlorobenzidine	g/m³	-	-	< 0.003	-	-
2,4-Dinitrotoluene	g/m³	-	-	< 0.0010	-	-
2,6-Dinitrotoluene	g/m³	-	-	< 0.0010	-	-
Nitrobenzene	g/m³	-	-	< 0.0005	-	-
N-Nitrosodi-n-propylamine	g/m³	-	-	< 0.0010	-	-
N-Nitrosodiphenylamine	g/m³	-	-	< 0.0010	-	-
Organochlorine Pesticides Trace in SVOC Water Samples by GC-MS						
Aldrin	g/m³	-	-	< 0.0005	-	-
alpha-BHC	g/m³	-	-	< 0.0005	-	-
beta-BHC	g/m³	-	-	< 0.0005	-	-
delta-BHC	g/m³	-	-	< 0.0005	-	-
gamma-BHC (Lindane)	g/m³	-	-	< 0.0005	-	-
4,4'-DDD	g/m³	-	-	< 0.0005	-	-
4,4'-DDE	g/m³	-	-	< 0.0005	-	-
4,4'-DDT	g/m³	-	-	< 0.0010	-	-
Dieldrin	g/m³	-	-	< 0.0005	-	-
Endosulfan I	g/m³	-	-	< 0.0010	-	-
Endosulfan II	g/m³	-	-	< 0.0010	-	-
Endosulfan sulfate	g/m³	-	-	< 0.0010	-	-
Endrin	g/m³	-	-	< 0.0010	-	-
Endrin ketone	g/m³	-	-	< 0.0010	-	-
Heptachlor	g/m³	-	-	< 0.0005	-	-
Heptachlor epoxide	g/m³	-	-	< 0.0005	-	-
Hexachlorobenzene	g/m³	-	-	< 0.0005	-	-
Polycyclic Aromatic Hydrocarbons Trace in SVOC Water Samples						
Acenaphthene	g/m³	-	-	< 0.0003	-	-
Acenaphthylene	g/m³	-	-	< 0.0003	-	-
Anthracene	g/m³	-	-	< 0.0003	-	-
Benzo[a]anthracene	g/m³	-	-	< 0.0003	-	-
Benzo[a]pyrene (BAP)	g/m³	-	-	< 0.0005	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m³	-	-	< 0.0005	-	-
Benzo[g,h,i]perylene	g/m³	-	-	< 0.0005	-	-
Benzo[k]fluoranthene	g/m³	-	-	< 0.0005	-	-
2-Chloronaphthalene	g/m³	-	-	< 0.0003	-	-
Chrysene	g/m³	-	-	< 0.0003	-	-
Dibenzo[a,h]anthracene	g/m³	-	-	< 0.0005	-	-
Fluoranthene	g/m³	-	-	< 0.0003	-	-
Fluorene	g/m³	-	-	< 0.0003	-	-
Indeno(1,2,3-c,d)pyrene	g/m³	-	-	< 0.0005	-	-
2-Methylnaphthalene	g/m³	-	-	< 0.0003	-	-
Naphthalene	g/m³	-	-	< 0.0003	-	-
Phenanthrene	g/m³	-	-	< 0.0003	-	-
Pyrene	g/m³	-	-	< 0.0003	-	-
Phenols Trace (drinkingwater) in SVOC Water Samples by GC-MS						
2-Chlorophenol	g/m³	-	-	< 0.0005	-	-
2,4-Dichlorophenol	g/m³	-	-	< 0.0005	-	-
2,4,6-Trichlorophenol	g/m³	-	-	< 0.0010	-	-
Phenols Trace (non-drinkingwater) in SVOC Water Samples by GC-MS						

Sample Type: Aqueous						
Sample Name:		MW01 GAA 461 20-May-2015	MW02 GAA 462 20-May-2015	MW04 GAA 463 20-May-2015	QC100 GAA 464 20-May-2015	MW03 GAA 465 20-May-2015
Lab Number:		1428804.1	1428804.2	1428804.3	1428804.4	1428804.5
Phenols Trace (non-drinkingwater) in SVOC Water Samples by GC-MS						
4-Chloro-3-methylphenol	g/m³	-	-	< 0.0010	-	-
2,4-Dimethylphenol	g/m³	-	-	< 0.0005	-	-
3 & 4-Methylphenol (m- + p-cresol)	g/m³	-	-	< 0.0010	-	-
2-Methylphenol (o-Cresol)	g/m³	-	-	< 0.0005	-	-
2-Nitrophenol	g/m³	-	-	< 0.0010	-	-
Pentachlorophenol (PCP)	g/m³	-	-	< 0.010	-	-
Phenol	g/m³	-	-	< 0.0010	-	-
2,4,5-Trichlorophenol	g/m³	-	-	< 0.0010	-	-
Plasticisers Trace (non-drinkingwater) in SVOC Water by GCMS						
Butylbenzylphthalate	g/m³	-	-	< 0.0010	-	-
Diethylphthalate	g/m³	-	-	< 0.0010	-	-
Dimethylphthalate	g/m³	-	-	< 0.0010	-	-
Di-n-butylphthalate	g/m³	-	-	< 0.0010	-	-
Di-n-octylphthalate	g/m³	-	-	< 0.0010	-	-
Plasticisers Trace (drinkingwater) in SVOC Water Samples by GCMS						
Bis(2-ethylhexyl)phthalate	g/m³	-	-	< 0.003	-	-
Di(2-ethylhexyl)adipate	g/m³	-	-	< 0.0010	-	-
Other Halogenated compounds Trace (drinkingwater) in SVOC Water						
1,2-Dichlorobenzene	g/m³	-	-	< 0.0010	-	-
1,3-Dichlorobenzene	g/m³	-	-	< 0.0010	-	-
1,4-Dichlorobenzene	g/m³	-	-	< 0.0010	-	-
Other Halogenated compounds Trace (non-drinkingwater) in SVOC						
Hexachlorobutadiene	g/m³	-	-	< 0.0010	-	-
Hexachloroethane	g/m³	-	-	< 0.0010	-	-
1,2,4-Trichlorobenzene	g/m³	-	-	< 0.0005	-	-
Other SVOC Trace in SVOC Water Samples by GC-MS						
Benzyl alcohol	g/m³	-	-	< 0.005	-	-
Carbazole	g/m³	-	-	< 0.0005	-	-
Dibenzofuran	g/m³	-	-	< 0.0005	-	-
Isophorone	g/m³	-	-	< 0.0005	-	-
BTEX in VOC Water by Purge&Trap GC-MS						
Benzene	g/m³	-	-	< 0.0005	-	-
Toluene	g/m³	-	-	< 0.0010	-	-
Ethylbenzene	g/m³	-	-	< 0.0005	-	-
m&p-Xylene	g/m³	-	-	< 0.0005	-	-
o-Xylene	g/m³	-	-	< 0.0005	-	-
Halogenated Aliphatics in VOC Water by Purge&Trap GC-MS						
Bromomethane (Methyl Bromide)	g/m³	-	-	< 0.002	-	-
Carbon tetrachloride	g/m³	-	-	< 0.0005	-	-
Chloroethane	g/m³	-	-	< 0.0005	-	-
Chloromethane	g/m³	-	-	< 0.0005	-	-
1,2-Dibromo-3-chloropropane	g/m³	-	-	< 0.0005	-	-
1,2-Dibromoethane (ethylene dibromide, EDB)	g/m³	-	-	< 0.0004	-	-
Dibromomethane	g/m³	-	-	< 0.0005	-	-
Dichlorodifluoromethane	g/m³	-	-	< 0.0005	-	-
1,1-Dichloroethane	g/m³	-	-	< 0.0005	-	-
1,2-Dichloroethane	g/m³	-	-	< 0.0005	-	-
1,1-Dichloroethene	g/m³	-	-	< 0.0005	-	-
cis-1,2-Dichloroethene	g/m³	-	-	< 0.0005	-	-
trans-1,2-Dichloroethene	g/m³	-	-	< 0.0005	-	-
Dichloromethane (methylene chloride)	g/m³	-	-	< 0.010	-	-
1,2-Dichloropropane	g/m³	-	-	< 0.0005	-	-
1,3-Dichloropropane	g/m³	-	-	< 0.0005	-	-

Sample Type: Aqueous						
Sample Name:		MW01 GAA 461 20-May-2015	MW02 GAA 462 20-May-2015	MW04 GAA 463 20-May-2015	QC100 GAA 464 20-May-2015	MW03 GAA 465 20-May-2015
Lab Number:		1428804.1	1428804.2	1428804.3	1428804.4	1428804.5
Halogenated Aliphatics in VOC Water by Purge&Trap GC-MS						
1,1-Dichloropropene	g/m³	-	-	< 0.0005	-	-
cis-1,3-Dichloropropene	g/m³	-	-	< 0.0005	-	-
trans-1,3-Dichloropropene	g/m³	-	-	< 0.0005	-	-
Hexachlorobutadiene	g/m³	-	-	< 0.0005	-	-
1,1,1,2-Tetrachloroethane	g/m³	-	-	< 0.0005	-	-
1,1,2,2-Tetrachloroethane	g/m³	-	-	< 0.0005	-	-
Tetrachloroethene (tetrachloroethylene)	g/m³	-	-	< 0.0005	-	-
1,1,1-Trichloroethane	g/m³	-	-	< 0.0005	-	-
1,1,2-Trichloroethane	g/m³	-	-	< 0.0005	-	-
Trichloroethene (trichloroethylene)	g/m³	-	-	< 0.0005	-	-
Trichlorofluoromethane	g/m³	-	-	< 0.0005	-	-
1,2,3-Trichloropropane	g/m³	-	-	< 0.0005	-	-
1,1,2-Trichlorotrifluoroethane (Freon 113)	g/m³	-	-	< 0.004	-	-
Vinyl chloride	g/m³	-	-	< 0.0005	-	-
Halogenated Aromatics in VOC Water by Purge&Trap GC-MS						
Bromobenzene	g/m³	-	-	< 0.0005	-	-
Chlorobenzene (monochlorobenzene)	g/m³	-	-	< 0.0005	-	-
2-Chlorotoluene	g/m³	-	-	< 0.0005	-	-
4-Chlorotoluene	g/m³	-	-	< 0.0005	-	-
1,2-Dichlorobenzene	g/m³	-	-	< 0.0005	-	-
1,3-Dichlorobenzene	g/m³	-	-	< 0.0005	-	-
1,4-Dichlorobenzene	g/m³	-	-	< 0.0005	-	-
1,2,3-Trichlorobenzene	g/m³	-	-	< 0.0005	-	-
1,2,4-Trichlorobenzene	g/m³	-	-	< 0.0005	-	-
1,3,5-Trichlorobenzene	g/m³	-	-	< 0.0005	-	-
Monoaromatic Hydrocarbons in VOC Water by Purge&Trap GC-MS						
n-Butylbenzene	g/m³	-	-	< 0.0005	-	-
tert-Butylbenzene	g/m³	-	-	< 0.0005	-	-
Isopropylbenzene (Cumene)	g/m³	-	-	< 0.0005	-	-
4-Isopropyltoluene (p-Cymene)	g/m³	-	-	< 0.0005	-	-
n-Propylbenzene	g/m³	-	-	< 0.0005	-	-
sec-Butylbenzene	g/m³	-	-	< 0.0005	-	-
Styrene	g/m³	-	-	< 0.0005	-	-
1,2,4-Trimethylbenzene	g/m³	-	-	< 0.0005	-	-
1,3,5-Trimethylbenzene	g/m³	-	-	< 0.0005	-	-
Ketones in VOC Water by Purge&Trap GC-MS						
Acetone	g/m³	-	-	< 0.05	-	-
2-Butanone (MEK)	g/m³	-	-	< 0.005	-	-
Methyl tert-butylether (MTBE)	g/m³	-	-	< 0.005	-	-
4-Methylpentan-2-one (MIBK)	g/m³	-	-	< 0.005	-	-
Trihalomethanes in VOC Water by Purge&Trap GC-MS						
Bromodichloromethane	g/m³	-	-	< 0.0005	-	-
Bromoform (tribromomethane)	g/m³	-	-	< 0.0005	-	-
Chloroform (Trichloromethane)	g/m³	-	-	< 0.0005	-	-
Dibromochloromethane	g/m³	-	-	< 0.0005	-	-
Other VOC in Water by Purge&Trap GC-MS						
Carbon disulphide	g/m³	-	-	< 0.005	-	-
Naphthalene	g/m³	-	-	< 0.0005	-	-
System monitoring Compounds for VOC - % Recovery						
4-Bromofluorobenzene	%	-	-	96	-	-
Toluene-d8	%	-	-	93	-	-

Analyst's Comments

#1 Severe matrix interferences required that a dilution be performed prior to analysis of this sample, resulting in a detection limit higher than that normally achieved for the NO2N, NO3N and NOxN analysis.

Sample 3 Comment:
It has been noted that the method performance for Hexachlorocyclopentadiene for SVOC analysis is not acceptable therefore we are unable to report this compound at this present time.

Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn	0.45µm filtration, ICP-MS, trace level. APHA 3125 B 21st ed. 2005.	0.00005 - 0.0010 g/m^3	1-5
Semivolatile Organic Compounds Trace in Water by GC-MS	Liquid/Liquid extraction, GPC cleanup (if required), GC-MS FS analysis	0.0003 - 0.010 g/m^3	3
Volatile Organic Compounds Trace in Water by Purge&Trap	Purge & Trap, GC-MS FS analysis [KBIs:28233,2694]	0.0004 - 1.0 g/m^3	3
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-3, 5
Total Kjeldahl Digestion	Sulphuric acid digestion with copper sulphate catalyst.	-	1-3, 5
Total anions for anion/cation balance check	Calculation: sum of anions as mEquiv/L calculated from Alkalinity (bicarbonate), Chloride and Sulphate. Nitrate-N, Nitrite-N. Fluoride, Dissolved Reactive Phosphorus and Cyanide also included in calculation if available. APHA 1030 E 22nd ed. 2012.	0.07 meq/L	3
Total cations for anion/cation balance check	Sum of cations as mEquiv/L calculated from Sodium, Potassium, Calcium and Magnesium. Iron, Manganese, Aluminium, Zinc, Copper, Lithium, Total Ammoniacal-N and pH (H^+) also included in calculation if available. APHA 1030 E 22nd ed. 2012.	0.05 meq/L	3
pH	pH meter. APHA 4500-H^+ B 22nd ed. 2012.	0.1 pH Units	1-3, 5
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (Modified for alk <20) 22nd ed. 2012.	1.0 g/m^3 as $CaCO_3$	3
Bicarbonate	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO_2 D 22nd ed. 2012.	1.0 g/m^3 at 25°C	3
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 22nd ed. 2012.	1.0 g/m^3 as $CaCO_3$	3
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012.	0.1 mS/m	1-3, 5
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.003 g/m^3	3
Dissolved Boron	Filtered sample, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.005 g/m^3	1, 3
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.05 g/m^3	3
Dissolved Cobalt	Filtered sample, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.0002 g/m^3	3
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.02 g/m^3	3
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.0005 g/m^3	3
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.05 g/m^3	3
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.02 g/m^3	3
Chloride	Filtered sample. Ferric thiocyanate colorimetry. Discrete Analyser. APHA 4500 Cl^- E (modified from continuous flow analysis) 22nd ed. 2012.	0.5 g/m^3	3
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m^3 is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m^3, the Default Detection Limit for Total Nitrogen will be 0.11 g/m^3.	0.05 g/m^3	1-3, 5
Total Ammoniacal-N	Filtered sample. Phenol/hypochlorite colorimetry. Discrete Analyser. (NH_4-N = NH_4+-N + NH_3-N). APHA 4500-NH_3 F (modified from manual analysis) 22nd ed. 2012.	0.010 g/m^3	1-3, 5

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I 22nd ed. 2012 (modified).	0.002 g/m³	1-3, 5
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m³	1-3, 5
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO_3^- I 22nd ed. 2012 (modified).	0.002 g/m³	1-3, 5
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N_{org} D. (modified) 4500 NH_3 F (modified) 22nd ed. 2012.	0.10 g/m³	1-3, 5
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B 22nd ed. 2012.	0.5 g/m³	3
Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)	Incubation 5 days, DO meter, nitrification inhibitor added, dilutions, seeded. Analysed at Hill Laboratories - Microbiology; 1 Clow Place, Hamilton. APHA 5210 B (modified) 22nd ed. 2012.	2 g O_2/m³	3
Chemical Oxygen Demand (COD), trace level	Dichromate/sulphuric acid digestion in Hach tubes, colorimetry. Trace Level method. APHA 5220 D 22nd ed. 2012.	6 g O_2/m³	3

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Martin Cowell - BSc
Client Services Manager - Environmental Division

Hill, 1428804

Form: **AECOM**

Chain of Custody & Analysis Request Form

AECOM - Auckland
PO Box 4241
Auckland 1140

Tel: 64 9 967 9200
Fax: 64 9 967 9201
Email: david.dangerfield@aecom.com

Laboratory Details

Lab. Name:	R J Hill Laboratories Ltd	Tel:	07 858 2000
Lab. Address:	1 Clyde St, Hamilton	Fax:	07 858 2001
Contact Name:	Jean Connick	Preliminary Report by:	
Lab. Ref:		Final Report by:	
		Lab Quote No:	**68287**

Project Name: Te Awamutu - Palmer St Landfill **Project Number:** 60343891 T 02.04 **Purchase Order Number:** 60249091 Task 20.9

Sample collected by: Nebojsa Jancic **Sample Results to be returned to:** David Dangerfield of AECOM

Specifications: Special Quote 68287

	(Tick)		
1. Urgent TAT required? (please circle: 24hr 48hr ______days)	☐ Yes	☐ No	☐ N/A
2. Fast TAT Guarantee Required?	☐ Yes	☐ No	☐ N/A
3. Is any sediment layer present in waters to be excluded from extractions?	☐ Yes	☐ No	☐ N/A
4. Special storage requirements?	☐ Yes	☐ No	☐ N/A
5. Preservation requirements?	☐ Yes	☐ No	☐ N/A
6. Other requirements? ☐ Fax ☐ Hard copy ☑ Email	☐ Yes	☐ No	☐ N/A

7. Report Format: Email: david.dangerfield@aecom.com 8. Project Manager: D. Dangerfield tel: 09 967 9291

Analysis Request

Lab. ID	Sample ID	Sampling Date & time (on)	Sampling Date & Time (off)	Matrix: soil	Matrix: water	Matrix: other	Preservation: filt'ed	Preservation: acid	Preservation: ice	Preservation: other	Container (No. & type)	Hold Cold	Dissolved metals, heavy metals	pH, EC, TKN	Total ammon, total N	VOCs	SVOCs	Anion/cation	cBOD / COD	Dissolved Al, Br, Cb, Mg, Mn	Nitrate - N	Nitrite - N					Remarks & comments
	MW01 / GAA 461	20/05			✓							✓	✓	✓	✓			-	-	-	✓	✓					1x S200, 2x VOCs, 1x ILUP, 1x FN100, 1x org, +1x UPra
	MW02 / GAA 462	↓			✓							✓	✓	✓	✓			-	-	-	✓	✓					—//—
	MW06 / GAA 463	↓			✓							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					—//—
	QC100 / GAA 464	↓			✓							✓	✓	.	.	.	.	.			✓	✓					FN100
	MW03 / GAA 465	↓			✓							✓	✓	✓	✓			-	-	-	✓	✓					—//—
																											TOTAL 30 bottles

Relinquished By:		Received by:		Received in good condition?	Yes/No/NA	Method of Shipment	☐ Courier ☐ Postal ☑ By Hand
Name: Nebojsa Jancic	Date: 20/05/14	Name:	Date:	Samples received chilled?	Yes/No/NA	Consignment Note No.	
of: AECOM - AKL	Time: 17:30	of:	Time:		Yes/No/NA	Transport Co:	

Relinquished By:		Received by:		Received in good condition?	Yes/No/NA	Method of Shipment	☐ Courier ☐ Postal ☐ By Hand
Name:	Date:	Name:	Date:	Samples received chilled?	Yes/No/NA	Consignment Note No.	
of:	Time:	of:	Time:		Yes/No/NA	Transport Co:	

D R A F T

Appendix G

Fill Gas Survey Photographs

D R A F T

Appendix G Fill Gas Survey Photographs

PHOTOGRAPHIC LOG		
Client Name: Waipa District Council	**Site Location:** Palmer Street	**Project No.** 60343891

Photo No.	Location No.
1	P-M01 / HA-12

Description:

Reading obtained near a concrete pad and a near concrete path.

Dead grass area near concrete path, some cracking.

Photo No.	Location No.
2	P-M03 / HA-09

Description:

Near ivy fencing, dead grass area.

D R A F T

PHOTOGRAPHIC LOG		
Client Name: Waipa District Council	**Site Location:** Palmer Street	**Project No.** 60343891

Photo #	Location No.
3	P-M04 / HA07

Description:

Garden area, on bare ground, close to cracking in house foundations.

Photo No.	Location No.
4	P-M05 / HA06

Description:

Vegetable garden.