CONTAMINATED LAND ASSESSMENT WITH NATIONAL ENVIRONMENTAL STANDARD FOR ASSESSING AND MANAGING CONTAMINANTS IN SOIL TO PROTECT HUMAN HEALTH

PROPOSED WHAKATU ARTERIAL LINK HASTINGS, HAWKE'S BAY

PROJECT NO. EAM361-REP-V4

PREPARED FOR
HASTINGS DISTRICT COUNCIL

PREPARED BY
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MAY 2014

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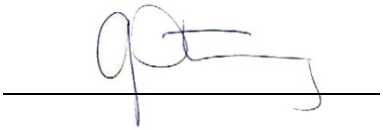

EAM
ENVIRONMENTAL CONSULTANTS

EXECUTIVE SUMMARY

EAM NZ Limited (EAM) has been engaged by Hastings District Council (HDC), to provide an assessment in line with the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES) which became effective 1 January 2012 with regards to pre and post construction of a proposed Whakatu Arterial Link (WAL) road.

Potential Effects

As the area of land within the WAL footprint is dominated by orchard and agricultural activities it was identified that the NES will be triggered by the proposed WAL as there will be significant earthworks through land that has been identified as having, currently or in the past, an activity undertaken on it that is listed on the Hazardous Activities or Industrial List (HAIL).

The identified soil contaminants of concern to human health are the metals arsenic, lead and copper as well as Organo-Chlorine Pesticide compounds (OCPs) such as DDT all of which (historically) were common constituents in orchard pesticide sprays.

Of particular concern in this project is the safety of site workers as well as the wider public through airborne dusts generated during construction activities.

Assessments Undertaken

On 6th and 13th November 2013, EAM NZ Ltd collected surface (0-150 mm) samples from 12 sample sites along the WAL corridor. This manner of sampling was designed to provide an understanding of the likely average soil concentrations of identified contaminants across the WAL construction site.

At each sample site a total of ten 150mm cores (as this represents the predominant topsoil depth at this site) were collected around a central point to ensure good coverage of each area.

Once collected, samples were stored in a chilly bin and then despatched to Hill Laboratories Ltd in Hamilton.

Results of Assessments

Preliminary laboratory results of analysis found soil concentrations of arsenic, lead and copper were well below even the strictest NES land use scenario of rural residential lifestyle block (25% produce)[1]. Similarly, Organo-Chlorine Pesticides concentrations were either below method detection limits or at trace levels only.

These results suggest that adverse effects on human health as a result of the development proposed are considered unlikely and that the soils are compliant with the NES. As such no further site investigation/remediation works are required.

During the site sampling exercise two sheds with bore/well heads were identified in/near the WAL route. These sheds appear to be areas used for the storage and preparation of agricultural/horticultural sprays and as such should be considered as likely hotspots with regards to soil contamination. These would require more detailed sampling to determine the extent of contamination (if any) should the WAL construction works encompass these sites.

[1] Land use scenario rural residential lifestyle block (25% produce) has the lowest contaminant concentrations under the NES and as such any soils at or below these can be considered to be clean topsoil.

Suggested Approach for Effects Identified

Although the results of this assessment indicate compliance with the NES it should be noted that these results are based on broad scale sampling and analysis and therefore only provide the likely average contaminant concentrations over the site.

As such, should soils be removed from the site for use as general topsoil it is recommended that they are further sampled and analysed to confirm contaminant levels prior to removal. This will ensure that they are suitable for their identified end use with regards to NES land use scenarios.

It is further recommended that sampling of the two shed areas be carried out prior to the start of construction of the WAL. Initial sampling would likely involve collecting individual soil samples from around the sheds as well as under the concrete pads.

The results of this sampling would determine whether or not a more detailed assessment and/or soil remediation is required. Should elevated contaminant concentrations be found in the soils around the sheds a Remediation Action Plan (RAP) and appropriate resource consent under the NES will be required.

Depending on the levels of contaminants found (if any) it is highly likely that on-site soil mixing will be a viable remediation option considering the large volume of soil available during the construction phase of the WAL.

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INTRODUCTION

1.1 BRIEF

EAM NZ Limited (EAM) has been engaged by Environmental Management Services Limited (EMS), on behalf of Hastings District Council (HDC), to provide an assessment in line with the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES) which became effective 1 January 2012 with regards to pre and post construction of a proposed Whakatu Arterial Link (WAL) road.

The WAL will provide an efficient heavy vehicle route for the movement of freight between the Whakatu industrial area and the Port of Napier and will run between State Highway 2 North and Pakowhai Road. It will also provide direct linkage to the Whakatu industrial area via Whakatu and Anderson Roads.

The WAL is to be a two lane carriageway of approximately 3.5 kilometres in length with a total construction footprint width of between 30 metres and 80 metres. The link road will run parallel to the Karamu Stream for much of its length. The land traversed by the proposed WAL is predominately flat horticultural, agricultural and industrial land.

The NES will be triggered by the proposed WAL as there will be significant earthworks through land that has been identified as having, currently or in the past, an activity undertaken on it (in this case predominantly orchards) that is listed on the Hazardous Activities or Industrial List (HAIL).

Additionally the results of such an assessment will provide some clarity as to the possible end use of any surplus topsoil post construction.

To assist with this application EAM NZ Limited was engaged by EMS/HDC to undertake a detailed site assessment pursuant to the new NES requirements.

This report provides the following information:

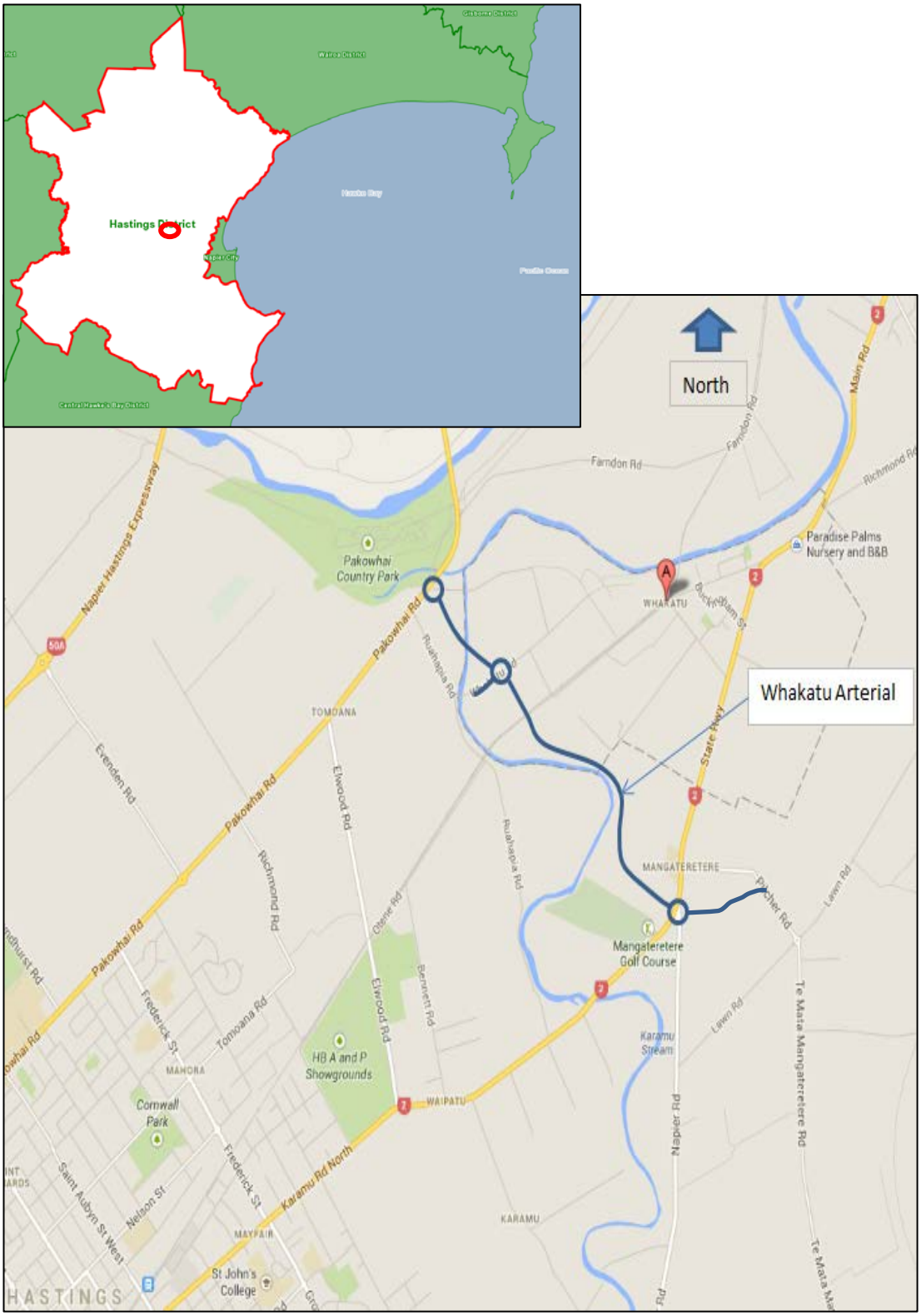
- Background information;
- Site history and laboratory results;
- Evaluation of determinants and risk assessment;
- Brief outline of recommendations; and
- Conclusions.

Notwithstanding the Report Limitations set out in Appendix 2, we confirm that Hastings District Council can rely on this report for the purposes of determining compliance with the NES guidelines with respect to the development identified in this assessment.

1.2 SITE DESCRIPTION AND LOCATION

The proposed route of the WAL runs in a northwest to southwest direction between State Highway 2 North and Pakowhai Road (Figure 1).

FIGURE 1: PREFERRED ROUTE OF PROPOSED WHAKATU ARTERIAL LINK.



A site visit was carried out on 8th November 2013. A number of observations were made in relation to the current condition and layout of the proposed WAL construction site.

The topography of the site and surrounds is low gradient flat land. A review of the soil map of the Heretaunga Plains (Griffiths, 2001) shows that the soils are of imperfect drainage with a depth to the water table (after wet periods) of between 30 to 60 centimetres (Figure 2).

Land use immediately surrounding the site is predominantly industry, orchards and cropping with associated residential dwellings (Figures 3 to 5).

During the site sampling exercise it was noted that at two sites (Figures 6 and 7) the WAL route will result in the disturbance / relocation of sheds with bore/well heads. Both these sheds appear to be areas used for the storage and preparation of agricultural/horticultural sprays and as such should be considered as likely hotspots with regards to soil contamination. These would require more detailed sampling to determine the extent of contamination (if any) should the WAL construction works encompass these sites.

It is recommended that sampling of these shed areas be carried out prior to the start of construction of the WAL. Initial sampling would likely involve collecting individual soil samples from around the sheds as well as under the concrete pads.

It is envisaged that suitable holes could be punched through the concrete pads to allow soil sampling as this methodology would minimise soil disturbance and be considered a permitted activity under the NES.

The results of this sampling would determine whether or not a more detailed assessment and/or soil remediation is required. Should elevated contaminant concentrations be found in the soils around the sheds, a Remediation Action Plan (RAP) and appropriate resource consent will be required.

FIGURE 2: EXCERPT OF THE SOIL MAP OF THE HERETAUNGA PLAINS (GRIFFITHS, 2001) SHOWING GENERAL AREA OF ASSESSMENT IN RED

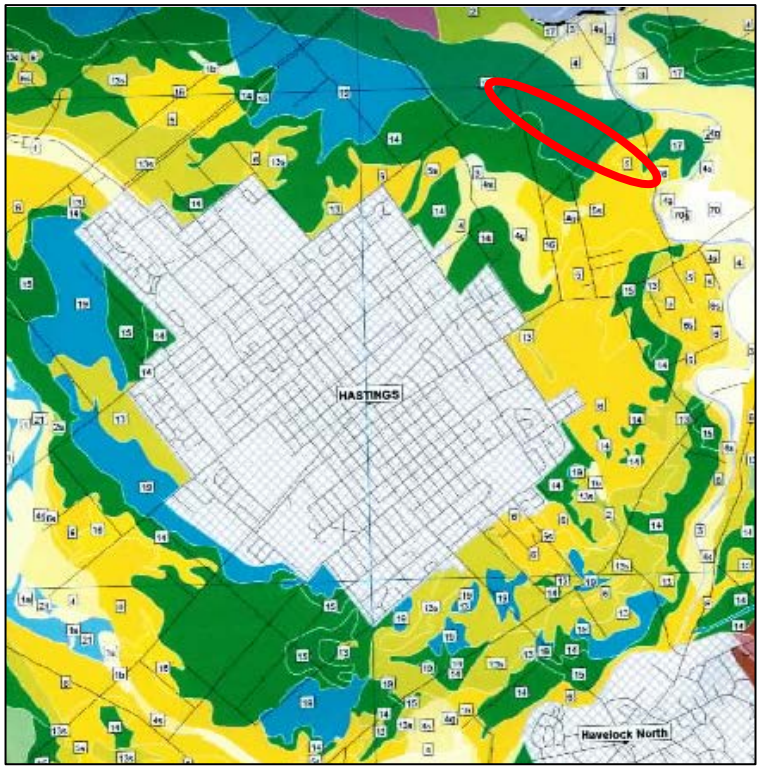


FIGURE 3: CROPPING LAND LOCATED AT PILCHER ROAD.

FIGURE 4: INDUSTRIAL GREENFIELD AREA – NIMONS SITE

FIGURE 5: TYPICAL ORCHARD AREA ALONG PROPOSED ROUTE OF WAL

FIGURE 6: BORE AND SHED SITE – 262 RUAHAPIA ROAD WAIPATU

FIGURE 7: CHEMICAL STORAGE AND PUMP/BORE AREA – 280 STATE HIGHWAY 2 NORTH

2.0 REVIEW OF SITE HISTORY

The following resources were utilised to aid in assessing the likelihood of historic contaminants being present within the WAL route;

- A search of land database and historical records held at HDC.
- A search of land database and historical records held at Hawke's Bay Regional Council (HBRC).
- Review of historical photographs of the site provided by HDC and New Zealand Aerial Mapping (NZAM).

The most significant information came from historical photos (Figures 8, 9 and 10) sourced from NZAM. These images illustrate that orchards were relatively late to establish in this area (post 1964). Prior to this, the area was utilised for predominantly pastoral grazing.

No additional information was found regarding the site from other sources mentioned.

Based on this historical information we can conclude that an activity (in this case orchards) listed on the HAIL has been undertaken on the proposed WAL site and as such is more likely than not to contain contaminants associated with this activity. Therefore an assessment in line with the NES is required.

FIGURE 8: HISTORICAL (1950) AERIAL PHOTOGRAPH OF GENERAL ASSESSMENT AREA

FIGURE 9: HISTORICAL (1964) AERIAL PHOTOGRAPH OF GENERAL ASSESSMENT AREA

FIGURE 10: HISTORICAL (1988) AERIAL PHOTOGRAPH OF GENERAL ASSESSMENT AREA

3.0 NES PRIORITY CONTAMINANTS

The NES has identified a number of priority contaminants and provides standards for these within soil for the protection of human health under a series of potential land use scenarios. A number of these priority contaminants are inorganic substances and include arsenic, boron, cadmium, chromium III & VI, copper, inorganic mercury and inorganic lead. Others relate to organic compounds and include Benzo(a)pyrene (BaP), Dichlorodiphenyltrichloroethane (DDT), Dieldrin, Pentachlorophenol (PCP) and Dioxins.

It is not necessary to test for all of these contaminants if the history of the site suggests the past use is unlikely to have resulted in specific contamination with the identified priority contaminants.

On the basis that land use within the area of the WAL site has been predominantly agricultural and horticultural (primarily orchards) the priority contaminants of concern are considered to be metals, in particular arsenic, copper and lead, as well as organic pesticide compounds (OCPs) such as DDT.

The results (presented in Section 5 of this report) from this assessment are compared against the figures provided for the NES Soil Contaminant Standards for health (SCS $_{(health)}$). The NES considers various land use scenarios (Table 1), with differing guideline values attached to each.

The proposed development of this site consists of major earthworks for the creation of a new roadway, with the remainder remaining as an orchard activity. Therefore in this instance due consideration to all NES land use scenarios has been given.

TABLE 1: SUMMARY OF LAND USE SCENARIOS AND SCS $_{(HEALTH)}$ (MFE, 2012)

Land-Use Scenario	Description
Rural Residential /lifestyle block 25% Produce	**Rural residential land use, including home-grown produce consumption (25%). Applicable to the residential vicinity of farm houses for protection of farming families, but not the productive parts of agricultural land.**
Residential 10% produce	**Standard residential lot, for single dwelling sites with gardens, including home grown produce consumption (10 %).**
High-Density Residential	**Urban residential with limited soil contact, including small ornamental gardens but no vegetable garden (no home-grown produce consumption); applicable to urban townhouses, flats and ground-floor apartments with small ornamental gardens, but not high-rise apartments.**
Park / Recreational	**Public and private green area and reserves used for active sports and recreation. This scenario is intended to cover playing fields and suburban reserves where children play frequently. It can also reasonably cover secondary school playing fields but not primary school playing fields.**
Commercial/industrial outdoor worker (unpaved)	**Commercial/industrial site with varying degrees of exposed soil. Exposure of outdoor workers to near-surface soil during routine maintenance and gardening activities with occasional excavation as part of maintaining subsurface utilities (i.e. a caretaker or site maintenance personnel). Also conservatively applicable to outdoor workers on a largely unpaved site.**

4.0 SITE SAMPLING

4.1 GENERAL SITE SAMPLING

The number of samples collected as part of this assessment was in keeping with the "Contaminated Land Guidelines No. 5" (MfE 2011). These guidelines set out (in Table A1; p63) the *"minimum sampling points required for detection of circular hotspots using a systematic sampling pattern at 95% confidence level"*.

On 6th and 13th November 2013, EAM NZ Ltd collected surface (0-150 mm) samples from 12 areas (Figure 11) along the WAL corridor.

At each sample site a total of ten 150mm cores (as this represents the predominant topsoil depth at this site) were collected around a central point to ensure good coverage of each area.

Soil samples were collected using a hand auger and were handled using disposable gloves. Samples were collected in clean glass jars provided by Hill Laboratories Limited (Hills) and labelled with sample name, number, time and date collected. Once collected, samples were stored in a chilly bin and then despatched to Hill Laboratories Ltd in Hamilton. Sample sites were identified and marked using a wooden peg and co-ordinates were taken using a handheld GPS.

4.2 FIELD SAMPLE COMPOSITING

To keep costs to a minimum samples were composited for analysis i.e. the ten samples at each site were composited together.

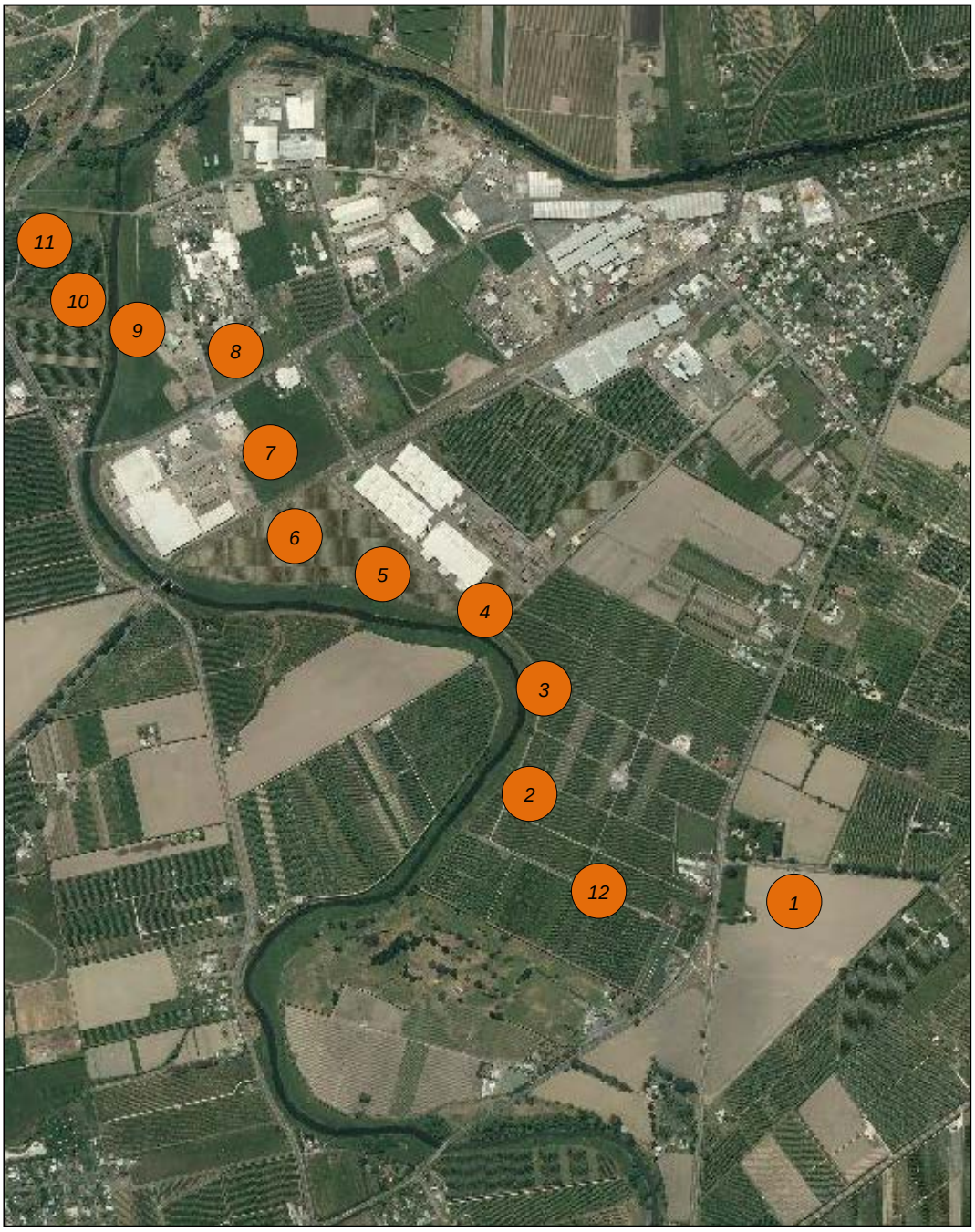
Composites of the individual site sample locations were prepared by the laboratory.

4.3 FIELD QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

Quality Assurance and Quality Control procedures undertaken during sampling included the following:

- Changing of disposable gloves after each sample;
- Decontaminating and rinsing of tools between each sample;
- Collection of soil samples in new, clean, appropriately labelled glass jars supplied by Hill Laboratories;
- Storing samples in chilled conditions whilst on site and until delivery to the laboratory for analysis; and
- Use of chain of custody procedures and forms; and Use of IANZ accredited laboratories with in-house QA/QC procedures for the analyses requested.

FIGURE 11: GENERAL LOCATIONS OF SOIL SAMPLES COLLECTED BY EAM NZ LTD



5.0 RESULTS OF ANALYSIS - DISCUSSION

The laboratory results of analysis have been compared directly against determinands from the listed NES Priority contaminants. The full laboratory reports of analysis are attached as Appendix 1.

5.1 ARSENIC, COPPER & LEAD

Table 2 shows the laboratory results of analysis for soil concentrations of arsenic, copper and lead from this assessment.

TABLE 2: SUMMARY OF SOIL METAL RESULTS (ALL RESULTS $mgkg^{-1}$ DRY WEIGHT)

Sample Name	Arsenic	Lead	Copper
Composite sample 1	6	30	36
Composite sample 2	5	13.3	22
Composite sample 3	5	13.0	21
Composite sample 4	5	14.6	23
Composite sample 5	12	22	36
Composite sample 6	7	17.2	24
Composite sample 7	6	20	29
Composite sample 8	5	15.2	10
Composite sample 9	5	15.7	11
Composite sample 10	6	30	34
Composite sample 11	7	22	28
Composite sample 12	4	14.4	55
NES Rural Residential/lifestyle block 25% produce	**17**	**160**	**>10,000**
NES Rural Residential 10% produce	**20**	**210**	**>10,000**
NES High Density Residential	**45**	**500**	**>10,000**
NES Park/recreational	**80**	**880**	**>10,000**
NES Commercial/Industrial	**70**	**3,300**	**>10,000**

The results show that all composited samples were significantly below even the most stringent of accepted soil standard values (NES rural residential/lifestyle block 25% produce scenario) for arsenic, lead and copper.

Generally speaking the results indicate that arsenic, lead and copper soil concentrations are relatively uniform across the sampled area.

5.2 ORGANO-CHLORINE PESTICIDES (OCPS)

OCP results from the soils collected as part of this assessment are very low with only trace levels of DDT recorded (between 0.010mg/kg to 0.052mg/kg ∑DDT) in three out of eight composite samples (Composites 1, 5, and 11).

All other OCP results were below laboratory method detection limits and as such are well below standard values for the NES recreation scenario.

5.3 RISK ASSESSMENT

Based on the findings of the laboratory analysis no contaminant source has been identified. An absence of an identified contaminant of concern indicates no hazard–pathway-receptor pollution linkage can exist and this site is therefore considered low risk with regards to human health.

6.0 NES COMPLIANCE

From this review it is determined that due consideration was given to the full range of potential contaminants that might be expected to occur on land previously used for cropping and orchards. This includes consideration of and sample laboratory analysis for the metals lead, arsenic and copper as well as screening for OCPs.

Comparison of the sample results with the NES standard guideline values showed that no contaminants are present at levels that may present a risk to human health with regard to the proposed activities at this site or to the future use of any superfluous soils from the proposed earthworks.

This site of the proposed WAL footprint is compliant with NES.

To ensure continued compliance throughout the construction period, additional sampling of two potential hotspot sites is recommended, as well as sampling of soil that is leaving the construction area for offsite disposal.

7.0 CONCLUSIONS

On the basis of the findings of this report:

- A review of the site history indicated a requirement for site sampling as orchard activities in particular have attributed to the current and historical land use within the WAL footprint ;
- Appropriate site sampling and preliminary laboratory soil analysis found soil concentrations of the metals arsenic, lead and copper were well below even the strictest NES land use scenario of rural residential lifestyle block (25% produce);
- Similarly, OCP concentrations were either below method detection limits or at trace concentrations only.
- Adverse effects on human health as a result of the development proposed for this site are considered unlikely.
- The soils are compliant with the NES.
- Minor additional sampling is recommended prior to and during the construction phase to monitor compliance with NES requirements.

8.0 RECOMMENDATIONS

As these results are based on broad scale sampling and analysis (with compositing) they provide what is considered to be a likely average over the site for the components analysed for. As such should soils be removed from the site for use as general topsoil it is recommended that they are further sampled and analysed to more accurately determine contaminant levels prior to removal. This will ensure that they are suitable for their identified end use with regards to NES land use scenarios.

Further, there are two potential hotspot sites around existing sheds that will be relocated / removed as part of the construction of the well. More invasive sampling is required to confirm compliance with NES requirements at these sites, and it is recommend that this carried out once the designation is confirmed.

It is also recommended that a log be kept detailing the soil volumes removed from the site and their final destination.

9.0 REFERENCES

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

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

MfE 2011 Contaminated Land Management Guidelines No.5; Site Investigation and Analysis of Soil. Ministry for the Environment.

APPENDIX 1

LABORATORY REPORT OF ANALYSIS

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:	EAM NZ Ltd	Lab No:	1201198 SPv2
Contact:	J Strong	Date Registered:	09-Nov-2013
	C/- EAM NZ Ltd	Date Reported:	13-Nov-2013
	PO Box 1154	Quote No:	
	NAPIER 4140	Order No:	J116
		Client Reference:	Whakatu Arterial Project
		Submitted By:	J Strong

Sample Type: Soil

Sample Name:		Composite 1 08-Nov-2013	Composite 2 08-Nov-2013	Composite 3 08-Nov-2013	Composite 4 08-Nov-2013	Composite 5 08-Nov-2013
Lab Number:		1201198.1	1201198.2	1201198.3	1201198.4	1201198.5
Individual Tests						
Total Recoverable Arsenic	mg/kg dry wt	6	5	5	5	12
Total Recoverable Copper	mg/kg dry wt	36	22	21	23	36
Total Recoverable Lead	mg/kg dry wt	30	13.3	13.0	14.6	22
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	-	< 0.010	-	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	-	< 0.010	-	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	-	< 0.010	-	< 0.010
4,4'-DDE	mg/kg dry wt	0.025	-	< 0.010	-	< 0.010
2,4'-DDT	mg/kg dry wt	< 0.010	-	< 0.010	-	< 0.010
4,4'-DDT	mg/kg dry wt	0.020	-	< 0.010	-	0.010
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
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:		Composite 6 08-Nov-2013	Composite 7 08-Nov-2013	Composite 8 08-Nov-2013	Composite 9 08-Nov-2013	Composite 10 08-Nov-2013
Lab Number:		1201198.6	1201198.7	1201198.8	1201198.9	1201198.10
Individual Tests						
Total Recoverable Arsenic	mg/kg dry wt	7	6	5	5	6
Total Recoverable Copper	mg/kg dry wt	24	29	10	11	34
Total Recoverable Lead	mg/kg dry wt	17.2	20	15.2	15.7	30
Organochlorine Pesticides Screening in Soil						

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Soil						
Sample Name:		Composite 6 08-Nov-2013	Composite 7 08-Nov-2013	Composite 8 08-Nov-2013	Composite 9 08-Nov-2013	Composite 10 08-Nov-2013
Lab Number:		1201198.6	1201198.7	1201198.8	1201198.9	1201198.10
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	-	-	< 0.010	< 0.010	-
alpha-BHC	mg/kg dry wt	-	-	< 0.010	< 0.010	-
beta-BHC	mg/kg dry wt	-	-	< 0.010	< 0.010	-
delta-BHC	mg/kg dry wt	-	-	< 0.010	< 0.010	-
gamma-BHC (Lindane)	mg/kg dry wt	-	-	< 0.010	< 0.010	-
cis-Chlordane	mg/kg dry wt	-	-	< 0.010	< 0.010	-
trans-Chlordane	mg/kg dry wt	-	-	< 0.010	< 0.010	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	-	-	< 0.04	< 0.04	-
2,4'-DDD	mg/kg dry wt	-	-	< 0.010	< 0.010	-
4,4'-DDD	mg/kg dry wt	-	-	< 0.010	< 0.010	-
2,4'-DDE	mg/kg dry wt	-	-	< 0.010	< 0.010	-
4,4'-DDE	mg/kg dry wt	-	-	< 0.010	< 0.010	-
2,4'-DDT	mg/kg dry wt	-	-	< 0.010	< 0.010	-
4,4'-DDT	mg/kg dry wt	-	-	< 0.010	< 0.010	-
Dieldrin	mg/kg dry wt	-	-	< 0.010	< 0.010	-
Endosulfan I	mg/kg dry wt	-	-	< 0.010	< 0.010	-
Endosulfan II	mg/kg dry wt	-	-	< 0.010	< 0.010	-
Endosulfan sulphate	mg/kg dry wt	-	-	< 0.010	< 0.010	-
Endrin	mg/kg dry wt	-	-	< 0.010	< 0.010	-
Endrin Aldehyde	mg/kg dry wt	-	-	< 0.010	< 0.010	-
Endrin ketone	mg/kg dry wt	-	-	< 0.010	< 0.010	-
Heptachlor	mg/kg dry wt	-	-	< 0.010	< 0.010	-
Heptachlor epoxide	mg/kg dry wt	-	-	< 0.010	< 0.010	-
Hexachlorobenzene	mg/kg dry wt	-	-	< 0.010	< 0.010	-
Methoxychlor	mg/kg dry wt	-	-	< 0.010	< 0.010	-

Sample Name:		Composite 11 08-Nov-2013				
Lab Number:		1201198.11				
Individual Tests						
Total Recoverable Arsenic	mg/kg dry wt	7	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	28	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	22	-	-	-	-
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	0.019	-	-	-	-
2,4'-DDE	mg/kg dry wt	< 0.010	-	-	-	-
4,4'-DDE	mg/kg dry wt	0.019	-	-	-	-
2,4'-DDT	mg/kg dry wt	< 0.010	-	-	-	-
4,4'-DDT	mg/kg dry wt	0.013	-	-	-	-
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	-	-	-	-

Sample Type: Soil						
Sample Name:		Composite 11 08-Nov-2013				
Lab Number:		1201198.11				
Organochlorine Pesticides Screening in Soil						
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	-	-	-	-

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%.	-	1-11
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082).. Tested on dried sample	-	1, 3, 5, 8-9, 11
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-11
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	1-11
Total Recoverable Copper	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-11
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	1-11

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.

Ara Heron BSc (Tech)
Client Services Manager - Environmental Division

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ANALYSIS REPORT

Client:	EAM NZ Limited	Lab No:	1203291	SPv2
Contact:	J Strong	Date Registered:	14-Nov-2013	
	C/- EAM NZ Limited	Date Reported:	27-Nov-2013	
	PO Box 1154	Quote No:		
	NAPIER 4140	Order No:		
		Client Reference:		
		Submitted By:	J Strong	

Amended Report

This report replaces an earlier report issued on the 21 Nov 2013 at 3:27 pm
At the client's request, a copper result has been added.

Sample Type: Soil						
Sample Name:		Wal Composite Fulfords				
Lab Number:		1203291.1				
Individual Tests						
Total Recoverable Arsenic	mg/kg dry wt	4	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	55	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	14.4	-	-	-	-
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	< 0.010	-	-	-	-
2,4'-DDE	mg/kg dry wt	< 0.010	-	-	-	-
4,4'-DDE	mg/kg dry wt	< 0.010	-	-	-	-
2,4'-DDT	mg/kg dry wt	< 0.010	-	-	-	-
4,4'-DDT	mg/kg dry wt	< 0.010	-	-	-	-
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	-	-	-	-

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
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082).. Tested on dried sample	-	1
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1
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
Total Recoverable Copper	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
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

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.

Ara Heron BSc (Tech)
Client Services Manager - Environmental Division

APPENDIX 2

REPORT LIMITATIONS

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