

Appendix D

CH2M Beca Hospital Prince
of Wales Reservoir, Upper
Playing Field, Preliminary
Contamination Investigation -
2012





CH2M Beca

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31 October 2012

Attention: Keith Woolley

Dear Keith

Hospital Prince of Wales Reservoir, Upper Playing Field, Preliminary Contamination Investigation

CH2M Beca Ltd (Beca) has been commissioned by Wellington City Council (WCC) to provide a preliminary soil contamination assessment of the upper playing field at the Prince of Wales Park, Mt Cook, Wellington.

We understand that the park area may previously have been the site of a clay brick manufacturing facility. Brickworks usually require kilns to fire the bricks, which produce ash and clinker requiring disposal - often on site. Ash and clinker can contain heavy metals and products of combustion such as polycyclic aromatic hydrocarbons (PAH). The use of the area in recent times as a sports turf also indicates the possibility of pesticides and herbicide use for the maintenance of the turf area.

At the client's request, soil samples were collected during the preliminary geotechnical works on the periphery pitch area of the upper playing field and analysed for contaminants to give an initial indication of their likely presence.

Brief details of the sampling are included in this interim report, along with the results of the chemical laboratory analysis of the samples. It should be noted that this report does not constitute a full contamination assessment, rather a preliminary indication of whether contaminants are present.

1 Site Assessment Methodology

1.1 Approach to Ground Investigation

A geotechnical site investigation was undertaken between 11 and 21 September 2012 by J.Wall Ltd, with the borehole drilling subcontracted to Griffiths Drilling (NZ) Ltd, under the supervision of Beca.

The site investigations comprised the following:

- Two machine boreholes (BH01 and BH02) to depths of 8.45m and 10m respectively;
- Seven machine excavated test pits (ST02, ST05 and TP01 to TP05) to depths ranging from 0.36m to 3.7m;
- Four hand augers for geotechnical purposes (HA01, HA02, HA03B and HA04) to depths ranging from 0.9m to 3.45m to verify ground conditions.
- Four hand augers samples (HAS 1 (NW), HAS 2 (SE), HAS 3 (NE), HAS 4 (SW)) from the top 150mm to provide soil samples for contamination testing.

A map of the sampling locations for this report is included as **Attachment 1**.

For further details including sampling locations please refer to the report *Hospital Prince of Wales Reservoir Geotechnical Report – Addendum*, Beca, October 2012.

It should be noted that as agreed with the client this contamination investigation is not in accordance with Ministry for the Environment guidelines, and should be viewed as a preliminary contamination investigation only.

1.2 Site Investigation Activities

Soil samples for the purposes of contamination testing were collected from locations BH01, BH02 and HAS 1 (NW), HAS 2 (SE), HAS 3 (NE) and HAS 4 (SW). A map of the sampling locations is included as **Attachment 1**.

One surface (0m – 0.15m below ground level (bgl)) sample was collected at each location. Additional deeper samples were collected from locations BH01 and BH02 at approximate 1m intervals, as dictated by encountered lithology.

A total of 11 samples were collected. Sample details are provided in **Table 1**.

1.3 Laboratory testing

All chemical laboratory analyses were performed by R J Hill Laboratories Ltd (Hill Laboratories) who are IANZ accredited. The analysis suite is provided in **Table 1**. All samples submitted to Hill Laboratories for testing were accompanied by Chain of Custody forms which detailed the required handling and testing instructions. Copies of the Chain of Custody forms are available on request. The Hill Laboratories report is included as **Attachment 3**.

Table 1 – Summary of Soil Sampling and Analysis

Location	Investigation hole depth (m bgl)	Laboratory Number	Sample Depth (m)	Soil Type	Analysis Suite
HAS 1 (NW)	0.15	1051240.1	0 – 0.15	Silt	HM, OCP/ONP, PAH
HAS 2 (SE)	0.15	1051240.2	0 – 0.15	Silt	HM, OCP/ONP, PAH
HAS 3 (NE)	0.15	1051240.3	0 – 0.15	Silt	HM, OCP/ONP, PAH
HAS 4 (SW)	0.15	1051240.4	0 – 0.15	Silt	HM, OCP/ONP, PAH
BH01	8.45	1051240.5	0 – 0.15	Silt	HM, PAH
		1051240.6	0.9 – 1.2	Silt	HM, PAH
		1051240.7	1.9 – 2.2	Silt	HM, PAH
		1051240.8	2.9 – 3.1	Silt	HM, PAH
BH02	10.0	1051240.9	0 – 0.15	Silt	HM, PAH
		1051241.10	0.9 – 1.2	Silt	HM, PAH
		1051241.11	1.9 – 2.1	Silt	HM, PAH

HM = Heavy Metals (Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Zinc).

OCP/ONP = Organochlorine and Organonitro&phosphate Pesticides

PAH = Polycyclic Aromatic Hydrocarbons

The analysis suite for each sample was selected based on the history of the site, the potentially contaminating activities that may have occurred, and the likely contaminants associated with those activities.

2 Investigation Results

The results of the investigation showed the presence of low levels of organochlorine pesticide, DDT, and heavy metals (cadmium, lead and nickel) in shallow surface samples collected from the hand auger locations within the sports turf area. Low levels of PAH were also detected in these samples, as well as the shallow surface samples from the borehole locations.

Results of the sampling were compared against 'commercial/industrial outdoor worker' and 'recreational' assessment criteria selected from the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES (Soil)).

A Regional Resource Consent assessment has not been undertaken at this stage.

There were no results which exceeded the NES (Soil) criteria, although there were some elevated levels of heavy metals (cadmium, lead and nickel) and PAH above background levels. The assessment criteria at this stage indicate whether or not there is a potential human health risk to construction workers or current site users (i.e. above recreational or commercial/industrial assessment criteria).

A summary of the analytical results and adopted assessment criteria is presented in the Laboratory Results Summary Sheet in **Attachment 2**.

3 Discussion

The results of the investigation show that there has been historical application of DDT to the sports playing field (noting three sampling positions are located on the periphery of the field). There is also the presence of low levels of PAH in shallow soil samples, and some elevated levels of heavy metals above background levels. Certain elements or compounds of anthropogenic origin are widespread in the environment and accumulate in soils and are also present at what are effectively background levels. Such compounds include trace metals and hydrocarbons, including PAH.

3.1 Regulatory Requirements

The use of persistent pesticides on a sports turf is an activity listed on the Hazardous Activities and Industries List (HAIL). The NES (Soil) Regulations apply to a piece of land where a HAIL activity has occurred. The NES (Soil) Regulations provide a set of nationally consistent set of planning controls for certain activities occurring on HAIL land, including soil disturbance, underground tank removal, soil sampling, subdivision and land use change.

As the development activities at the sports turf involve soil disturbance by removing the top soil, then the activity must comply with the NES (Soil) Regulations.

For the soil disturbance to be a Permitted Activity under Regulation 8(3) of the NES (Soil), then no more than 25m³ per 500m² of soil can be disturbed and no more than 5m³ can be disposed of off site. The sports turf is approximately 7700m² and is assumed to have had pesticides applied across the entire area. Therefore 385m³ can be disturbed and 77m³ can be disposed. The disturbance and disposal volumes required for the project are significantly higher than this, and so the activity cannot comply with the Permitted Activity conditions.

A resource consent will be required to undertake the soil disturbance under either Regulation 9, 10 or 11 of the NES (Soil). Where a Detailed Site Investigation (DSI) report exists which states that the soil contamination does not exceed the standards in Regulation 7, then the activity can proceed as a Controlled Activity. Where a Detailed Site Investigation (DSI) report exists which states that the soil contamination does exceed the standards in Regulation 7, then the activity proceeds as a Restricted Discretionary Activity. Where no DSI exists, the activity proceeds as a Discretionary Activity.

The Regulations apply regardless of the level of contamination and control certain types of activities on contaminated land including soil disturbance.

4 Recommendations

Should WCC wish to undertake a DSI then we would recommend the following:

- Undertake an intrusive investigation in accordance with MfE Guidelines. This would involve the collection of additional samples from the surface of the sports turf to confirm the anticipated uniform presence of DDT. Further investigation may be required where there are known areas of ash/clinker deposits from the old brickworks. Consideration should be given as to whether a potentially contaminating activity has occurred within the area being excavated for the reservoir.
- Reporting of the DSI to MfE Guidelines, and preparation of a management and/or remediation plan for the disturbance of soils on site.
- Submission of DSI report and management plan alongside an application for land use consent under Regulation 9 or 10 of the NES (Soil) (depending on the risk posed by the contaminants identified through the investigation).

Alternatively, WCC may wish to default to an application for a Discretionary Activity consent under Regulation 11 of the NES (Soil), rather than undertaking a DSI. The implications of this are that the consenting team in WCC would have full discretion over how the works are managed, and may require an investigation to be undertaken.

We would be pleased to discuss the options available with WCC and provide a cost estimate for carrying out a DSI.

Yours faithfully

Genevieve Smith
Senior Environmental Scientist

on behalf of

CH2M Beca Ltd

Direct Dial: +64 9 308 4576

Email: genevieve.smith@beca.com

Attachment 1 – Map of Sample Locations

Attachment 2 – CH2M Beca Laboratory Results Summary Sheet

Attachment 3 – Hill Laboratories Report

Attachment 1
Geotechnical Site Plan
(Showing Sampling Locations)



Survey Legend

FEATURE	DESCRIPTION
---	Bottom of Bank
---	Top of Bank
---	Building
---	Edge of Concrete
---	Centreline of Ditch
---	Breakline
---	Fence
---	Gate
---	Edge of Track
---	Edge of Seal
---	Road Centreline
---	Post
---	Manhole
---	Power Pole
---	Fire Hydrant
---	Sign
---	Spot Height
---	Water Meter
---	Sluice Valve
-70.0-	Major Contour 5m
-70.0-	Minor Contour 1m

Notes:
 Height Datum: New City Datum
 Origin of Heights: Wellington Primary TGRM
 11.58m Wellington VD 1953
 (New City Datum = Wellington V.D. 1953)

Coordinate Datum: NZTM2000
 Origin of Coordinates: Wellington Airport
 (WGTN) LINZ continuous tracking station

Pot holing survey programmed for September

Geotechnical Legend

○	APPROXIMATE LOCATION OF PROPOSED RESERVOIR
→	ALIGNMENT OF SLOPE STABILITY SECTION
①	
⊕	BOREHOLE (OPUS, 2011)
⊕	TEST PIT (OPUS, 2011)
⊕	BOREHOLE (BECA, 2012)
⊕	TEST PIT (BECA, 2012)
●	CONTAMINATION SAMPLES (BECA, 2012)

DEFECTS:

↘	BEDDING	B
↘	JOINT	J
↘	SHEARED	S

DIP ANGLE

**FOR INFORMATION
NOT FOR CONSTRUCTION**

No.	Revision	By	Chk	Appd	Date
C	ADDENDUM REPORT	WZC	SS	SAE	31.10.12
B	PEER REVIEW COMMENTS	WZC	JS	SAE	03.10.12
A	FOR INITIAL GEOTECHNICAL REPORT	HLY	SRW	SAE	27.07.12

Original Scale (A1)	500	Design	JDB	Approved For Issue*	
Reduced Scale (A3)	1000	Drawn	HLY	26.07.12	Date
		Checked	JDB	26.06.12	
		Dwg Check	SAE	27.06.12	

* Refer to Revision 1 for Original Signature

Client: **Absolutely POSITIVELY**
 Wellington

Project: **HOSPITAL PRINCE OF WALES RESERVOIR**

Title: **GEOTECHNICAL SITE PLAN APPENDIX A**

Discipline	GEOTECHNICAL
Drawing No.	6517439-CE-250
Rev.	C

Attachment 2

CH2M Beca Laboratory Results Summary Sheet

CH2M BECA SOIL ANALYSIS RESULTS - WCC PRINCE OF WALES PARK												Assessment Criteria			
Sample Date	20-Sep-12	21-Sep-12	21-Sep-12	21-Sep-12	21-Sep-12	21-Sep-12	21-Sep-12	21-Sep-12	21-Sep-12	20-Sep-12	20-Sep-12	20-Sep-12	Background levels ^a	Recreational ^b	Commercial / industrial outdoor worker (unpaved) ^b
Hand Auger/BH Number	HAS 01 (NW)	HAS 02 (SE)	HAS 3 (NE)	HAS 4 (SW)	BH01 (NW)	BH01 (NW)	BH01 (NW)	BH01 (NW)	BH02	BH02	BH02				
Sample Number	12:123	12:123	12:123	12:123	12:123	12:123	12:123	12:123	12:123	12:123	12:123	12:123			
Laboratory Number	1051240.1	1051240.2	1051240.3	1051240.4	1051240.5	1051240.6	1051240.7	1051240.8	1051240.9	1051241.1	1051241.11				
Sample Depth (m)	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0.9 - 1.2	1.9 - 2.2	2.9 - 3.1	0 - 0.15	0.9 - 1.2	1.9 - 2.1				
Soil Type	Silt	Silt	Silt	Silt	Silt	Silt	Silt	Silt	Silt	Silt	Silt				
Heavy metals (mg/kg)															
Arsenic	7	3	5	5	5	2	2	4	3	3	3	<2-7	80	70	
Cadmium	0.29	0.11	0.15	0.14	0.17	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	<0.1-0.1	400	1,300	
Chromium	12	12	14	13	13	19	17	15	12	19	18	6-16	2,700	6,300	
Copper	11	9	19	11	16	16	12	14	9	16	16	3-25	>10,000	>10,000	
Lead	57	49	100	123	80	24	25	40	47	22	21	5.9-78.6	880	3,300	
Nickel	7	6	7	8	8	14	11	10	7	13	15	4-13	130 ^c	1,800 ^c	
Zinc	73	50	88	61	83	85	60	87	54	65	76	24-105	23,000 ^d	31,000 ^d	
Organochlorine Pesticides (mg/kg)															
2,4'-DDD	< 0.010	< 0.010	< 0.010	< 0.010				Not tested				-	-	-	
4,4'-DDD	0.017	0.035	0.023	0.032				Not tested				-	-	-	
2,4'-DDE	< 0.010	< 0.010	< 0.010	< 0.010				Not tested				-	-	-	
4,4'-DDE	0.081	0.079	0.28	0.189				Not tested				-	-	-	
2,4'-DDT	0.029	< 0.010	0.014	0.073				Not tested				-	-	-	
4,4'-DDT	0.162	0.44	0.24	0.38				Not tested				-	-	-	
Total DDT	0.309	0.584	0.577	0.694				Not tested				-	400	1,000	
All Other Compounds	Below Detection							Not tested				-	-	-	
Organonitro&phosphorus Pesticides (mg/kg)															
All Compounds	Below Detection				-	-	-	-	-	-	-	-	-	-	-
Polycyclic Aromatic Hydrocarbons (mg/kg)															
Acenaphthene	< 0.03	< 0.04	< 0.04	< 0.04	< 0.05	< 0.04	< 0.03	< 0.04	< 0.06	< 0.03	< 0.03	-	-	-	
Acenaphthylene	< 0.03	< 0.04	< 0.04	< 0.04	< 0.05	< 0.04	< 0.03	< 0.04	< 0.06	< 0.03	< 0.03	-	-	-	
Anthracene	< 0.03	< 0.04	0.09	< 0.04	< 0.05	< 0.04	< 0.03	< 0.04	< 0.06	< 0.03	< 0.03	<0.002-0.05	-	-	
Benzo[a]anthracene	0.05	0.04	0.23	0.04	0.08	< 0.04	< 0.03	< 0.04	0.07	< 0.03	< 0.03	-	-	-	
Benzo[a]pyrene (BAP)	0.06	0.05	0.24	0.05	0.08	< 0.04	< 0.03	< 0.04	0.09	< 0.03	< 0.03	<0.02-0.27	-	-	
Benzo[b]fluoranthene	0.07	0.06	0.3	0.06	0.11	< 0.04	< 0.03	< 0.04	0.11	< 0.03	< 0.03	-	-	-	
Benzo[g,h,i]perylene	0.06	0.06	0.23	0.06	0.1	< 0.04	< 0.03	< 0.04	0.1	< 0.03	< 0.03	-	-	-	
Benzo[k]fluoranthene	0.04	< 0.04	0.14	< 0.04	0.05	< 0.04	< 0.03	< 0.04	< 0.06	< 0.03	< 0.03	-	-	-	
Chrysene	0.07	0.05	0.26	0.05	0.09	< 0.04	< 0.03	< 0.04	0.09	< 0.03	< 0.03	-	-	-	
Dibenzo[a,h]anthracene	< 0.03	< 0.04	0.04	< 0.04	< 0.05	< 0.04	< 0.03	< 0.04	< 0.06	< 0.03	< 0.03	-	-	-	
Fluoranthene	0.15	0.1	0.66	0.09	0.19	< 0.04	< 0.03	< 0.04	0.19	< 0.03	< 0.03	<0.002-0.55	-	-	
Fluorene	< 0.03	< 0.04	< 0.04	< 0.04	< 0.05	< 0.04	< 0.03	< 0.04	< 0.06	< 0.03	< 0.03	-	-	-	
Indeno(1,2,3-c,d)pyrene	0.06	0.05	0.21	0.05	0.08	< 0.04	< 0.03	< 0.04	0.09	< 0.03	< 0.03	-	-	-	
Naphthalene	< 0.15	< 0.16	< 0.17	< 0.16	< 0.3	< 0.16	< 0.15	< 0.16	< 0.3	< 0.14	< 0.14	<0.002-0.01	-	-	
Phenanthrene	0.12	0.06	0.49	0.05	0.1	< 0.04	< 0.03	< 0.04	0.11	< 0.03	< 0.03	<0.002-0.26	-	-	
Pyrene	0.16	0.12	0.68	0.11	0.22	< 0.04	< 0.03	0.04	0.22	< 0.03	< 0.03	<0.002-0.57	-	-	
BaP equivalent	0.099	0.089	0.377	0.088	0.140	<0.1	<0.07	<0.1	0.153	<0.07	<0.07	-	40	35	

^a Determination of common pollutant background soil concentrations for the Wellington region, GWRC 2003. Values applicable to 'Main Soil Type 2 (Greywacke)' have been used.

^b Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES)

^c Environment Agency (EA). Soil Guideline Values for nickel in soil. Science report SC050021 / Nickel SGV (2009). 'Commercial' land use values used for outdoor worker exposure, 'Residential' land use values conservatively used for recreational user exposure

^d United States Environmental Protection Agency (USEPA). Regional Screening Level Summary Table April 2012. 'Industrial' soil values used for outdoor worker exposure, 'Residential' values used as conservative assessment for recreational user exposure

Grey shading indicates values above background levels.

Bold indicates values above NES criteria

- indicates no guideline value



Attachment 3

Hill Laboratories Report



ANALYSIS REPORT

Client:	Beca Infrastructure Limited	Lab No:	1051240	SPV1
Contact:	Kate Jackson C/- Beca Infrastructure Limited PO Box 6345 Wellesley Street AUCKLAND 1141	Date Registered:	25-Sep-2012	
		Date Reported:	09-Oct-2012	
		Quote No:		
		Order No:		
		Client Reference:	12:123	
		Submitted By:	Kate Jackson	

Sample Type: Soil

Sample Name:	12:123 HAS 1 (NW) 20-Sep-2012 10:30 am	12:123 HAS 2 (SE) 21-Sep-2012 10:00 am	12:123 HAS 3 (NE) 21-Sep-2012 10:15 am	12:123 HAS 4 (SW) 21-Sep-2012 12:00 pm	12:123 BH01 (NW) 0-15cm 21-Sep-2012 12:45 pm
Lab Number:	1051240.1	1051240.2	1051240.3	1051240.4	1051240.5

Individual Tests

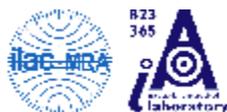
Dry Matter	g/100g as rcvd	79	75	75	79	58
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Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn

Total Recoverable Arsenic	mg/kg dry wt	7	3	5	5	5
Total Recoverable Cadmium	mg/kg dry wt	0.29	0.11	0.15	0.14	0.17
Total Recoverable Chromium	mg/kg dry wt	12	12	14	13	13
Total Recoverable Copper	mg/kg dry wt	11	9	19	11	16
Total Recoverable Lead	mg/kg dry wt	57	49	100	123	80
Total Recoverable Nickel	mg/kg dry wt	7	6	7	8	8
Total Recoverable Zinc	mg/kg dry wt	73	50	88	61	83

Organochlorine Pesticides Screening in Soil

Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	-
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
4,4'-DDD	mg/kg dry wt	0.017	0.035	0.023	0.032	-
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
4,4'-DDE	mg/kg dry wt	0.081	0.079	0.28	0.189	-
2,4'-DDT	mg/kg dry wt	0.029	< 0.010	0.014	0.073	-
4,4'-DDT	mg/kg dry wt	0.162	0.44	0.24	0.38	-
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Endrin Aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	-



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:		12:123 HAS 1 (NW) 20-Sep-2012 10:30 am	12:123 HAS 2 (SE) 21-Sep-2012 10:00 am	12:123 HAS 3 (NE) 21-Sep-2012 10:15 am	12:123 HAS 4 (SW) 21-Sep-2012 12:00 pm	12:123 BH01 (NW) 0-15cm 21-Sep-2012 12:45 pm
Lab Number:		1051240.1	1051240.2	1051240.3	1051240.4	1051240.5
Organonitro&phosphorus Pesticides Screen in Soil by GCMS						
Acetochlor	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Alachlor	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	-
Atrazine	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Atrazine-desethyl	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Atrazine-desisopropyl	mg/kg	< 0.12	< 0.13	< 0.13	< 0.12	-
Azaconazole	mg/kg	< 0.03	< 0.04	< 0.04	< 0.03	-
Azinphos-methyl	mg/kg	< 0.12	< 0.13	< 0.13	< 0.12	-
Benalaxyl	mg/kg	< 0.03	< 0.04	< 0.04	< 0.03	-
Bitertanol	mg/kg	< 0.12	< 0.13	< 0.13	< 0.12	-
Bromacil	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Bromopropylate	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Butachlor	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Captan	mg/kg	< 0.12	< 0.13	< 0.13	< 0.12	-
Carbaryl	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Carbofuran	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Chlorfluazuron	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Chlorothalonil	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Chlorpyrifos	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Chlorpyrifos-methyl	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Chlortoluron	mg/kg	< 0.12	< 0.13	< 0.13	< 0.12	-
Cyanazine	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Cyfluthrin	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Cyhalothrin	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Cypermethrin	mg/kg	< 0.12	< 0.13	< 0.13	< 0.12	-
Deltamethrin (Tralomethrin)	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Diazinon	mg/kg	< 0.03	< 0.04	< 0.04	< 0.03	-
Dichlofluanid	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Dichloran	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2	-
Dichlorvos	mg/kg	< 0.09	< 0.09	< 0.09	< 0.09	-
Difenoconazole	mg/kg	< 0.09	< 0.09	< 0.09	< 0.09	-
Dimethoate	mg/kg	< 0.12	< 0.13	< 0.13	< 0.12	-
Diphenylamine	mg/kg	< 0.12	< 0.13	< 0.13	< 0.12	-
Diuron	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Fenpropimorph	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Fluazifop-butyl	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Fluometuron	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Flusilazole	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Fluvalinate	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	-
Furalaxyl	mg/kg	< 0.03	< 0.04	< 0.04	< 0.03	-
Haloxifop-methyl	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Hexaconazole	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Hexazinone	mg/kg	< 0.03	< 0.04	< 0.04	< 0.03	-
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)	mg/kg dry wt	< 0.3	< 0.4	< 0.4	< 0.3	-
Iprodione	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Kresoxim-methyl	mg/kg	< 0.03	< 0.04	< 0.04	< 0.03	-
Linuron	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Malathion	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Metalaxyl (Mefenoxam)	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Methamidophos	mg/kg	< 0.3	< 0.4	< 0.4	< 0.3	-
Metolachlor	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	-
Metribuzin	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Molinate	mg/kg	< 0.12	< 0.13	< 0.13	< 0.12	-
Myclobutanil	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-

Sample Type: Soil

Sample Name:	12:123 HAS 1 (NW) 20-Sep-2012 10:30 am	12:123 HAS 2 (SE) 21-Sep-2012 10:00 am	12:123 HAS 3 (NE) 21-Sep-2012 10:15 am	12:123 HAS 4 (SW) 21-Sep-2012 12:00 pm	12:123 BH01 (NW) 0-15cm 21-Sep-2012 12:45 pm
Lab Number:	1051240.1	1051240.2	1051240.3	1051240.4	1051240.5

Organonitro&phosphorus Pesticides Screen in Soil by GCMS

Naled	mg/kg	< 0.3	< 0.4	< 0.4	< 0.3	-
Norflurazon	mg/kg	< 0.12	< 0.13	< 0.13	< 0.12	-
Oxadiazon	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Oxyfluorfen	mg/kg	< 0.03	< 0.04	< 0.04	< 0.03	-
Paclobutrazol	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Parathion-ethyl	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Parathion-methyl	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Pendimethalin	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Permethrin	mg/kg	< 0.02	< 0.02	< 0.02	< 0.02	-
Pirimicarb	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Pirimiphos-methyl	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Prochloraz	mg/kg	< 0.3	< 0.4	< 0.4	< 0.3	-
Procymidone	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Prometryn	mg/kg	< 0.03	< 0.04	< 0.04	< 0.03	-
Propachlor	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Propanil	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2	-
Propazine	mg/kg	< 0.03	< 0.04	< 0.04	< 0.03	-
Propiconazole	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	-
Pyriproxyfen	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Quizalofop-ethyl	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Simazine	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Simetryn	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Sulfentrazone	mg/kg	< 0.3	< 0.4	< 0.4	< 0.3	-
TCMTB [2-(thiocyanomethylthio) benzothiazole, Busan]	mg/kg dry wt	< 0.12	< 0.13	< 0.13	< 0.12	-
Tebuconazole	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Terbacil	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Terbufos	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Terbumeton	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Terbutylazine	mg/kg	< 0.03	< 0.04	< 0.04	< 0.03	-
Terbutylazine-desethyl	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Terbutryn	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Thiabendazole	mg/kg	< 0.3	< 0.4	< 0.4	< 0.3	-
Thiobencarb	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Tolyfluanid	mg/kg	< 0.03	< 0.04	< 0.04	< 0.03	-
Triazophos	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Trifluralin	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-
Vinclozolin	mg/kg	< 0.06	< 0.07	< 0.07	< 0.06	-

Polycyclic Aromatic Hydrocarbons Screening in Soil

Acenaphthene	mg/kg dry wt	< 0.03	< 0.04	< 0.04	< 0.04	< 0.05
Acenaphthylene	mg/kg dry wt	< 0.03	< 0.04	< 0.04	< 0.04	< 0.05
Anthracene	mg/kg dry wt	< 0.03	< 0.04	0.09	< 0.04	< 0.05
Benzo[a]anthracene	mg/kg dry wt	0.05	0.04	0.23	0.04	0.08
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.06	0.05	0.24	0.05	0.08
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	0.07	0.06	0.30	0.06	0.11
Benzo[g,h,i]perylene	mg/kg dry wt	0.06	0.06	0.23	0.06	0.10
Benzo[k]fluoranthene	mg/kg dry wt	0.04	< 0.04	0.14	< 0.04	0.05
Chrysene	mg/kg dry wt	0.07	0.05	0.26	0.05	0.09
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	< 0.04	0.04	< 0.04	< 0.05
Fluoranthene	mg/kg dry wt	0.15	0.10	0.66	0.09	0.19
Fluorene	mg/kg dry wt	< 0.03	< 0.04	< 0.04	< 0.04	< 0.05
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.06	0.05	0.21	0.05	0.08
Naphthalene	mg/kg dry wt	< 0.15	< 0.16	< 0.17	< 0.16	< 0.3

Sample Type: Soil

Sample Name:	12:123 HAS 1 (NW) 20-Sep-2012 10:30 am	12:123 HAS 2 (SE) 21-Sep-2012 10:00 am	12:123 HAS 3 (NE) 21-Sep-2012 10:15 am	12:123 HAS 4 (SW) 21-Sep-2012 12:00 pm	12:123 BH01 (NW) 0-15cm 21-Sep-2012 12:45 pm
Lab Number:	1051240.1	1051240.2	1051240.3	1051240.4	1051240.5

Polycyclic Aromatic Hydrocarbons Screening in Soil

Phenanthrene	mg/kg dry wt	0.12	0.06	0.49	0.05	0.10
Pyrene	mg/kg dry wt	0.16	0.12	0.68	0.11	0.22

Sample Name:	12:123 BH01 (NW) 0.9-1.2m 21-Sep-2012 12:50 pm	12:123 BH01 (NW) 1.9-2.2m 21-Sep-2012 12:55 pm	12:123 BH01 (NW) 2.9-3.1m 21-Sep-2012 1:00 pm	12:123 BH02 0-15cm 20-Sep-2012 1:15 pm	12:123 BH02 0.9-1.3m 20-Sep-2012 1:20 pm
Lab Number:	1051240.6	1051240.7	1051240.8	1051240.9	1051240.10

Individual Tests

Dry Matter	g/100g as rcvd	80	79	79	41	81
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Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn

Total Recoverable Arsenic	mg/kg dry wt	2	2	4	3	3
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	19	17	15	12	19
Total Recoverable Copper	mg/kg dry wt	16	12	14	9	16
Total Recoverable Lead	mg/kg dry wt	24	25	40	47	22
Total Recoverable Nickel	mg/kg dry wt	14	11	10	7	13
Total Recoverable Zinc	mg/kg dry wt	85	60	87	54	65

Polycyclic Aromatic Hydrocarbons Screening in Soil

Acenaphthene	mg/kg dry wt	< 0.04	< 0.03	< 0.04	< 0.06	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.04	< 0.03	< 0.04	< 0.06	< 0.03
Anthracene	mg/kg dry wt	< 0.04	< 0.03	< 0.04	< 0.06	< 0.03
Benzo[a]anthracene	mg/kg dry wt	< 0.04	< 0.03	< 0.04	0.07	< 0.03
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.04	< 0.03	< 0.04	0.09	< 0.03
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	< 0.04	< 0.03	< 0.04	0.11	< 0.03
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.04	< 0.03	< 0.04	0.10	< 0.03
Benzo[k]fluoranthene	mg/kg dry wt	< 0.04	< 0.03	< 0.04	< 0.06	< 0.03
Chrysene	mg/kg dry wt	< 0.04	< 0.03	< 0.04	0.09	< 0.03
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.04	< 0.03	< 0.04	< 0.06	< 0.03
Fluoranthene	mg/kg dry wt	< 0.04	< 0.03	< 0.04	0.19	< 0.03
Fluorene	mg/kg dry wt	< 0.04	< 0.03	< 0.04	< 0.06	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.04	< 0.03	< 0.04	0.09	< 0.03
Naphthalene	mg/kg dry wt	< 0.16	< 0.15	< 0.16	< 0.3	< 0.14
Phenanthrene	mg/kg dry wt	< 0.04	< 0.03	< 0.04	0.11	< 0.03
Pyrene	mg/kg dry wt	< 0.04	< 0.03	0.04	0.22	< 0.03

Sample Name:	12:123 BH02 1.9-2.1m 20-Sep-2012 1:25 pm				
Lab Number:	1051240.11				

Individual Tests

Dry Matter	g/100g as rcvd	83	-	-	-	-
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Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn

Total Recoverable Arsenic	mg/kg dry wt	3	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	18	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	16	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	21	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	15	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	76	-	-	-	-

Polycyclic Aromatic Hydrocarbons Screening in Soil

Acenaphthene	mg/kg dry wt	< 0.03	-	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.03	-	-	-	-
Anthracene	mg/kg dry wt	< 0.03	-	-	-	-

Sample Type: Soil						
Sample Name:		12:123 BH02 1.9-2.1m 20-Sep-2012 1:25 pm				
Lab Number:		1051240.11				
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Benzo[a]anthracene	mg/kg dry wt	< 0.03	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03	-	-	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	< 0.03	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	-	-	-	-
Chrysene	mg/kg dry wt	< 0.03	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	-	-	-	-
Fluoranthene	mg/kg dry wt	< 0.03	-	-	-	-
Fluorene	mg/kg dry wt	< 0.03	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.14	-	-	-	-
Phenanthrene	mg/kg dry wt	< 0.03	-	-	-	-
Pyrene	mg/kg dry wt	< 0.03	-	-	-	-

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
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	-	1-11
Organochlorine/nitro&phosphorus Pest.s Screen in Soils, GCMS	Sonication extraction, Dilution cleanup, GC-MS analysis. Tested on as received sample	-	1-4
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.	-	1-11
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	1-11
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	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.

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Ara Heron BSc (Tech)
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