

# Prince of Wales Playing Fields - Contaminated Soils Management Plan

Prepared for Wellington Water Limited

Prepared by Beca Limited

7 August 2019



## Revision History

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## Document Acceptance

Action	Name	Signed	Date
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Reviewed by	<b>Andrew Henderson</b>		28/05/2019
Approved by	<b>Richard Hickman</b>		07/08/2019
on behalf of	Beca Limited		

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Detailed Site Investigation Report

# 1 Introduction

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Beca Ltd has been commissioned by Wellington Water Limited (WWL) to prepare a Contaminated Soils Management Plan (CSMP) for the Prince of Wales Playing Fields, which are to be used as part of the construction works associated with the Ōmaroro Reservoir.

The purpose of this CSMP is to identify procedures that shall be undertaken during site redevelopment to control the disturbance and movement of soils, including any potentially contaminated soils.

A Detailed Site Investigation (DSI) (dated May 2019) has been undertaken to characterise contamination present in materials beneath the playing fields as a result of current and historical activities. This DSI is included at **Appendix** and a brief summary is provided in **Section 1.4** below. This DSI was prepared following two Preliminary Site Investigation (PSI) reports, one for the upper field (dated Oct 2012) and one for the lower field (dated October 2017), which identified that the playing fields have generally been used for recreational purposes since being incorporated within the Wellington Town Belt in the early 1890's.

The planning controls of the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (2012) (NESCS) are applicable. The activity proposed on the site involves soil disturbance in excess of the permitted activity criteria set out in Regulation 8 of the NESCS; therefore land use consent is required from Wellington City Council (WCC). This CSMP will support the consent application for soil disturbance under the NESCS.

The site does not meet the definition of a contaminated site or contaminated land under the Greater Wellington Regional Council (GWRC) operative or proposed regional plans; therefore, consent is not required from GWRC.

## 1.1 Site Location and Description

The site is known as the 'Prince of Wales Playing Fields'. In total, the two playing fields occupy an area of approximately 16,900m<sup>2</sup>. Both fields fall under the legal description Part Lot 2 DP 10337. The location of the property is shown in Figure 1 below.

The upper playing field was formed by cutting into the ridgeline that runs along the side of Rolleston Street to above Asquith Terrace/Dorking Street. Pedestrian and maintenance access to the field is from the top of Rolleston Street and there is an additional pedestrian access at the top of Hargreaves Street. The lower playing field was cut into the east facing side of the ridgeline. The lower field is accessed from Salisbury Terrace along the eastern side of the field, which continues south to a carpark and the Wellington Scottish Athletics and Poneke Kyokushin Karate Dojo clubrooms. A sports pavilion at the north end of the field can be accessed by a steep drive off Salisbury Terrace. There is also a track connecting the upper and lower fields.

The sports fields are used for both organised/formal and casual/informal recreation activities. Both fields are managed by Wellington City Council Parks, Sports and Recreation team as tier two fields and are intensively used during the summer months but have lower use in winter.



Figure 1 - Location of the St. James Theatre and Counties building. (Source: Greater Wellington Regional Council (GWRC) Web Map Viewer)

### 1.1.1 Surrounding Land Use

Land to the north and east of the site is residential. To the south and west of the site is Wellington's Town Belt; an open space used for recreational purposes. Approximately 320m to the north east of the site is Massey University and further to the east, in the suburb of Newtown is Wellington Regional Hospital.

## 1.2 Summary of Geology and Hydrogeology

The Geological Map of New Zealand<sup>1</sup> shows the site to be underlain by grey sandstone-mudstone sequences and poorly bedded sandstone with minor coloured mudstone, conglomerate, basalt chert and rare limestone of the late Triassic/early Jurassic Rakaia Terrane.

## 1.3 Proposed Works

The proposed reservoir and associated works have received consent under the Wellington Town Belt Act (the Town Belt Consent) and have been approved in accordance with Designation SR394052. Consent has

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<sup>1</sup> Begg, J.G.; Johnston, M.R. (compilers) 2000: Geology of the Wellington area: scale 1:250,000. Lower Hutt: Institute of Geological & Nuclear Sciences. Institute of Geological & Nuclear Sciences 1:250,000 geological map 10. 64 p. + 1 folded map

also been received from Greater Wellington Regional Council for groundwater take, earthworks and discharge of stormwater associated with the reservoir construction (ref WGN 180065).

In summary, the consented works comprise:

- The Omāroro reservoir structure and pipe tunnel
- Access to the reservoir and pipe tunnel
- Associated connections to the bulk water supply, local water supply, and local stormwater networks
- Activities associated with the proposed reinstatement of the upper and lower Prince of Wales playing fields for recreation use.

With regard to the playing fields specifically, the consented scheme allows for the use of both upper and lower fields for material storage and stockpiling during construction. Prior to the placement of excavated material on the playing fields, the topsoil will be removed. The total quantity of topsoil which will be stripped from the site will be 1,000m<sup>3</sup>. It is intended that this topsoil will be stockpiled on site and reused as part of the construction works, although this is subject to finalisation of the construction methodology. Should the material be taken off site, then due to the low-level concentrations of heavy metals, PAH and organochlorine pesticides it is likely that the classification of managed fill will apply. The appointed contractor will follow best practice procedures and the acceptance of the soil would be confirmed with the disposal site operators prior to the commencement of any soil disturbance.

## 1.4 Summary of Site History

A DSI was undertaken to characterise contamination present in materials beneath the playing fields as a result of current and historical activities. This DSI has been prepared following two Preliminary Site Investigation (PSI) reports, one for the upper field (dated Oct 2012) and one for the lower field (dated October 2017). The PSI reports identified that the sites have generally been used for recreational purposes since being incorporated within the Wellington Town Belt in the early 1890's. The PSI for the upper playing field stated that it is believed that the area may previously have been the site of a clay brick manufacturing facility, based on the historic correspondence reviewed.

It is also anticipated that the site has been the subject of earthworks in the past to achieve the current topography, although no details of these works are available.

The following and key findings and MfE Hazardous Activities and Industries List (HAIL) activities were identified for the site:

- A10 (persistent pesticide use associated with the maintenance of the sports turf.
- The PSI for the upper playing field reported that the site may have been the location of a clay brick manufacturing facility or was potentially used for the disposal of waste material or products associated with the operation. The HAIL codes for the upper playing field have therefore been identified as A10 and G5 (waste disposal to land).

Ground investigation works were undertaken in February 2019 and comprised 14 test pits which were excavated to a maximum extent of 2m bgl, from which 29 samples (plus two duplicate samples) were taken.

Soil analytical results showed low levels of heavy metals, PAH and organochlorine pesticides in a number of samples across the site at varying depths. However, no contaminant concentrations exceeded the NESCS criteria for 'commercial / industrial outdoor worker (unpaved)', or 'recreational' criteria based upon the site's continued future use as a sports turf, nor did they exceed the adopted environmental protection criteria.

Soil analytical results do not indicate that the site has been significantly impacted as a consequence of historical landuse activities, such as pesticide application and potentially disposal of clay works products, and the human health and environmental risk is considered low.

## 1.5 Contamination Status of Site Soils and Identified Hazards

Review of the site historical information has identified land use activities which may have resulted in the contamination of soil and/or groundwater at the site, summarised in the table below. Previous investigations indicated that the land may have previously been the site of a clay brick manufacturing facility. The use of the area as a sports turf also indicated the possibility of pesticides and herbicides.

Contaminants of potential concern associated with these activities have also been identified.

Table 1 Contaminants of Potential Concern

Activity	HAIL Code	Contaminants of Potential Concern
■ Sports turf and playing fields	■ A10 – Persistent pesticide bulk storage or use including sports turfs, market gardens, orchards, glasshouses or spray sheds	■ Arsenic, lead, copper, mercury; wide range of organic compounds including acidic herbicides, organophosphates, and organochlorines
■ Uncontrolled waste disposal to land	■ G5 – Waste disposal to land	■ Heavy metals, PAH, semi-volatile organic compounds

## 1.6 Development Implications

The NESCS applies to land, as per Regulation 5(7) outlined below:

“Land covered:

- (7) *The piece of land is a piece of land that is described by 1 of the following:*
- (a) *an activity or industry described in the HAIL is being undertaken on it;*
  - (b) *an activity or industry described in the HAIL has been undertaken on it;*
  - (c) *it is more likely than not that an activity or industry described in the HAIL is being or has been undertaken on it.”*

Based on the above it is considered that on a ‘more likely than not’ basis, one or more HAIL activities have been undertaken on the site.

The NESCS applies to this proposal as the development at the site involves the disturbance of soil on a ‘piece of land’ that has been identified as having had a HAIL activity undertaken on it.

Under Regulation 8(3) of the NESCS, soil disturbance of up to 25m<sup>3</sup> per 500m<sup>2</sup> and disposal of up to 5m<sup>3</sup> per 500m<sup>2</sup> is allowed as a Permitted Activity. The playing fields have a total area of 16,900m<sup>2</sup>. The total permitted volume of soil disturbance is therefore 845m<sup>3</sup>, of which 169m<sup>3</sup> can be disposed of offsite as a Permitted Activity.

The proposed works comprise stripping topsoil, which is likely to involve 1,000m<sup>3</sup> of soil disturbance. This is in excess of the 845m<sup>3</sup> threshold, and therefore does not meet the Permitted Activity requirements.

Although the current intention is for the topsoil to be stockpiled on site and reused within the construction process, this is subject to confirmation of the final construction methodology. There is the potential for the topsoil to be removed from the site. Should all the topsoil be removed, this would involve 1,000m<sup>3</sup> of soil which would exceed the 169m<sup>3</sup> threshold, and therefore does not meet the Permitted Activity requirements.

In accordance with Regulation 8(5), if a requirement described in any of the sub clauses 8(1) to (4) is not met, then the activity is a controlled activity under Regulation 9 of the NES:CS while it meets the following requirements of 9(1). The site meets these requirements with provision of the DSI and low levels of contaminants which have been identified.

Therefore, the proposed soil disturbance is a **Controlled Activity**.



## 2 Management Procedures

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This section sets out general management procedures and requirements that will be adhered to throughout the earthworks.

1. It is recommended that implementation of this CSMP is contractually enforced throughout the duration of the site construction works.
2. This CSMP applies to the site that is the subject of this consent application, which includes the area of land owned by WCC known as the 'Prince of Wales Playing Fields'. In total, the two playing fields occupy an area of approximately 16,900m<sup>2</sup>. Both fields fall under the legal description Part Lot 2 DP 10337.
3. All personnel involved in the site construction works are to be familiar with this CSMP and ensure that the requirements of this CSMP have been followed.
4. A copy of this CSMP is to remain available onsite at all times so that reference can be made to it when undertaking any site works.
5. The CSMP is intended to assist the site Contractor in meeting their legal obligations related to potentially contaminated soils with respect to health, safety and the environment. It is not intended to cover the general site safety procedures required for typical excavation and construction activities at the site. The CSMP is not intended to relieve the Contractor of their legal responsibilities.
6. Excavation, demolition and construction activities at the site may be subject to other controls/rules/policies under the relevant district and regional plans, including but not limited to, the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011. Any conditions imposed by the regulatory authorities must be adhered to. However, it is expected that this CSMP will be incorporated into any consent/permit involving excavation/disturbance work at the site to ensure the risks associated with contaminated soils are managed appropriately.
7. The specific requirements and provisions of this management plan will be under the control of the site Contractor.

## 3 Site Management

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The below management procedures shall be undertaken for all site works involving the disturbance of soil or direct exposure of soil to workers. As low levels of contaminants have been detected across the site at varying depths, the following procedures apply to all soils contained within the bounds of the site.

As stated in **Section 1.3** of this CSMP, it is proposed to store the topsoil which has been stripped from the site in stockpiles. As such, management procedures are required to ensure the stockpiles are routinely maintained, monitored and that limited contact by persons surrounding the site occurs. The following section is considered sufficient in managing the associated risks.

### 3.1 Pre-development Site Set-up

A site meeting shall be held and attended by the Client, the Contractor, the Engineer and personnel involved with the earthworks (eg sub-contractor, if any) to discuss the risks and site procedures for handling any soils at the site. The Contractor shall prepare a site specific Contractor’s Health & Safety Plan (CHSP) for the earthworks which shall cover potential exposure to soils.

Procedures relating to the management of noise, dust, stormwater, stockpiling and the site working hours shall be detailed in the Contractor’s Construction Management Plan (CMP) and shall be implemented by the Contractor. All procedures shall comply with the relevant Council bylaws and conditions of applicable consents.

Prior to works commencing, the Contractor shall establish the following controls to aid in the management of aspects of site safety and environmental compliance:

- Restriction of access to the earthworks areas to authorised personnel (such as warning tape or barriers), following appropriate site induction procedures;
- Signage, including site works information, health and safety requirements, site reporting requirements;
- Health and safety facilities such as personal protection equipment;
- Stormwater (surface runoff) diversion and collection systems; and
- Dust control systems.

Procedures relating to the management of dust, sediment, stormwater and stockpiling are detailed below and shall be implemented by the Contractor. All procedures shall comply with the relevant Council bylaws and conditions of any applicable consents.

#### 3.1.1 Site Contacts

The following contact details shall be included in this CSMP prior to works commencing:

Engineer to Contract for civil works: .....

Engineer’s Representative: .....

Environmental Scientist/Engineer: .....

#### 3.1.1 Dust Control Procedures

Standard good practice for dust controls shall be implemented by the Contractor including the following, as determined in conjunction with the Engineer:

- Timing of works including prevalent wind direction.
- Dampening any exposed soils during dry and windy conditions through use of a water truck or portable water sprays.
- Covering any stockpiles.
- Reduction of vehicle speeds on site.
- Minimising drop heights from loaders.

If strong odours are detected during excavation, excavation is to cease until the appropriate assessment has been made by the Engineer's Representative.

### 3.1.2 Stormwater and Sediment Control Procedures

Erosion and sediment controls shall be installed by the Contractor prior to earthworks / excavations commencing and shall be designed for the treatment of surface water runoff in accordance with Greater Wellington Regional Council Erosion and Sediment Control Guidelines for the Wellington Region (2002).

Stormwater runoff should be preferentially maintained onsite and allowed to infiltrate wherever possible to reduce the volume of water and material discharged.

During rain events, sediment that has been stockpiled or left in a destabilised condition can become mobilised in surface water run-off resulting in discharges off-site.

To limit as far as practicable the potential effects from a rainfall event, a range of mitigation and management techniques will be employed, including but not limited to:

- Where possible limit earthworks to drier days;
- Avoiding the stockpiling of sediment as far as practicable;
- Loading excavated materials directly to waiting covered trucks for off-site disposal, as far as practicable;
- Washing trucks on an as-needed basis to minimise tracking sediment beyond the site; and
- Cesspit protection measures such as filter socks and sand bags should be used to trap any sediment from collected runoff.

Sediment captured from the excavation of soils shall be stockpiled, as described in Section 3.1.3.

### 3.1.3 Stockpile Procedures

Stockpiles shall be maintained in accordance with Condition DC.21 of the Designation, which states:

*By 6pm every working day earthwork stockpiles shall not exceed the following height limits, measured from the base of each stockpile:*

- a) Upper Playing field- 5.5m in height*
- b) Lower Playing field - 7m in height.*

The stockpiles shall be managed by the Contractor as follows:

- Stockpiles shall be sited within an area away from the main working area to minimise potential contact by site workers;
- Stockpiled materials shall be placed on suitable material (i.e. polythene sheet) to prevent contaminants leaching into clean soils; and

- Where adverse weather is forecast, the stockpiled material shall be covered by a suitable material (such as polythene) to prevent the ingress of rainwater into the material and therefore minimise the potential for generation of leachate or sediment in stormwater.

## 3.2 Soil Excavation/ Disturbance Procedures

### 3.2.1 Onsite Soil Management and Movement

Excavated soil is to be immediately stockpiled and the procedures outlined in **Section 3.1.3** are to be employed.

The Contractor shall ensure that records are kept of all excavations and soil movements on-site. These shall include the location and dimensions of the excavation, the ground conditions, and the soil's movement on site and whether waste materials, unusual staining and/or odour were observed.

### 3.2.2 Off-Site Disposal

If materials are to be disposed of off-site, then landfill acceptance of excavated materials to be disposed offsite shall be obtained prior to works commencing. Offsite disposal of contaminated soil must be to a facility licensed to accept such material and approval shall be obtained by the Contractor prior to transportation. The Contractor must retain copies of all disposal receipts/documentation and provide these to Wellington Water Ltd within 5 days of receipt.

The excavation, handling and off-site removal of the material shall be managed by the Contractor as follows:

- Materials requiring excavation for disposal to a licensed landfill or reuse at another commercial location shall be excavated and loaded directly into trucks where possible (limiting stockpiling), subject to the necessary approvals being obtained as outlined above.
- All trucks shall be covered before leaving site and any soils brushed off wheels to avoid tracking onto public roads. Should the site become wet and material adheres to wheels a wheel wash facility shall be installed and truck wheels washed before exiting the site.
- The Contractor shall maintain a register of soil movements and records such as location of excavation, disposal location, quantity of material and off site weighbridge documents.

### 3.2.3 Contamination Discovery

The procedures outlined below provide the Contractor with protocols to identify potential contamination if suspected contaminated soils or hazardous materials are discovered during the excavation works other than contaminated soils already identified in this CSMP. These protocols will enable the appropriate action to avoid exposure of contaminants to site workers or the dispersion of contaminants into the surrounding environment.

Contamination indicators or hazardous materials may include but are not limited to the following:

- Unusual odours
- Discoloured or stained water seeps and soils
- Petroleum hydrocarbon contaminated soil and/or free product
- Liquid waste, putrescible waste, household refuse and any material that normally would be sent to a licensed landfill
- Suspected Asbestos Containing Material (ACM)
- Intact or broken drums and containers.

During the earthworks on site, the Contractor shall actively monitor for the conditions/materials specified above. In the event that one of these is identified, the Contractor should take the following actions:

- Stop all earthworks within a 5m radius of the area where the suspected material/emission/discharge has been recorded
- Immediately notify the site supervisor
- Cordon off the area as practicable with a suitable barrier.
- Work shall not resume or commence within a 5m radius of the area unless authorised by the Engineer's Representative

The site supervisor shall contact the Engineer's Representative who will consult with the suitably qualified and experienced practitioner and advise on the appropriate course of action. The suitably qualified and experienced practitioner shall:

- Notify the regulatory authorities, that contamination has been discovered and contingency action is being implemented.
- Characterise the contamination by collecting samples for chemical laboratory analysis.
- If appropriate, advise the Contractor to excavate the suspected contaminated material and stockpile (as detailed in Section 3.1.4) or place in a covered container to allow works to continue with minimum delay.
- If stockpiling/containerising is inappropriate, advise construction work to proceed to an area clear of contamination indicators until material testing, as necessary, defines the material characteristics.
- When the material characteristics have been established, advise the site supervisor as to whether the materials may remain on site or what remedial measures are required to manage this material on-site.
- Instruct relevant staff so that all appropriate information such as location and quantity of material and off-site weighbridge dockets are recorded.

Should asbestos be observed or suspected during the earthworks, all work shall cease and Health & Safety at Work (Asbestos) Regulations (2016) will be followed. Works can recommence once all asbestos has been removed safely. Any such asbestos works (assessment, delineation, removal and verification) shall be undertaken by a specialist asbestos contractor.

### 3.3 Imported Materials

Material imported to the site for the purposes of filling and landscaping shall be certified cleanfill. Records must be provided by the Contractor to demonstrate that any imported material is obtained from a quarry or other certified source. Material shall not be imported from any site that is, or would be considered, a Hazardous Activities and Industries List (HAIL) site (MfE, 2011), unless sampled by a suitably qualified environmental scientist/engineer to show that it is suitable for the intended land use and is acceptable to the client.

### 3.4 Groundwater Procedures

If groundwater is encountered during the excavation works, the Contractor shall:

- Contain groundwater within the excavation and not allow it to discharge across the site surface.
- If dewatering is required, the pumped groundwater discharge could be discharged to Wellington City Council's reticulated wastewater system with prior approval.

## 4 Health and Safety Procedures

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Given the land use activities that have occurred at the site, there is the potential to encounter contaminated soils and/or groundwater as part of the proposed site works. Prior to work being undertaken, a Job Safety and Environment Analysis (JSEA) will be carried out by the Contractor that will identify the appropriate personal protective equipment (PPE) and behaviours to reduce the exposure risk. Note the contaminants identified at this site potentially pose a low health risk to construction workers.

Workers may be exposed to contaminants via the accidental ingestion of, or skin contact with soil and/or groundwater and/or surface water. To prevent this exposure, procedures should be followed by workers who are likely to come in contact with contaminated soil and/or water, including the following:

- Wear cloth overalls.
- All staff physically involved in works likely to result in hand contact with contaminated materials should wear gloves.
- Wear a P2 dust mask if conditions generate dust.
- Minimise hand to mouth contact.
- Wash hands and face prior to eating, drinking or smoking.
- No eating or drinking within the excavation area.
- Wash any skin abrasions immediately and treat to prevent infections.
- Follow any additional requirements in the Contractor (Site Specific) Health and Safety Plan.

Further hazards may be identified during the course of the works. The Contractor is responsible for reviewing any new work element and assessing whether there are any new associated hazards, and whether these can be eliminated, isolated or minimised. The Contractor shall then instruct all staff on the health and safety procedures associated with the new hazard and update the site CHSP.

## 5 Limitations

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This report has been prepared by Beca Ltd solely for Wellington Water Limited (Client). Beca has been requested by the Client to provide a Contaminated Soils Management Plan (CSMP) in relation to the Prince of Wales Playing Fields, legal description Part Lot 2 DP 10337. This report is prepared solely for the purpose of the management of contaminated soils encountered during this project. The contents of this report may not be used by the Client for any purpose other than in accordance with the stated scope.

This report is prepared solely for the Client. Beca accepts no liability to any other person for their use of or reliance on this report, and any such use or reliance will be solely at their own risk.

Unless specifically stated otherwise in this report, Beca has relied on the accuracy, completeness, currency and sufficiency of all information provided to it by, or on behalf of, the Client or any third party, and has not independently verified the information provided. Beca accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the information provided.

The contents of this report are based upon our understanding and interpretation of current legislation and guidelines (“Standards”) as consulting professionals, and should not be construed as legal opinions or advice. Unless special arrangements are made, this report will not be updated to take account of subsequent changes to any such Standards.

This report should be read in full, having regard to all stated assumptions, limitations and disclaimers.

Appendix A

# Detailed Site Investigation Report





# D

Appendix D – Preliminary Site Investigation for Upper Field

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Capacity Infrastructure Services  
Private Bag 39804  
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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 25m<sup>3</sup> per 500m<sup>2</sup> of soil can be disturbed and no more than 5m<sup>3</sup> can be disposed of off site. The sports turf is approximately 7700m<sup>2</sup> and is assumed to have had pesticides applied across the entire area. Therefore 385m<sup>3</sup> can be disturbed and 77m<sup>3</sup> 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

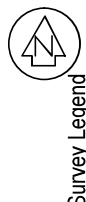
Email: [genevieve.smith@beca.com](mailto:genevieve.smith@beca.com)

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 Culch
	Fence
	Gate
	Edge of Track
	Post-Centreline
	Manhole
	Power Pole
	Fire Hydrant
	Sign
	Water Height
	Sluice Valve
	Major Contour 5m
	Minor Contour 1m

**Notes:**  
 Height Datum: New City Datum  
 Origin of Heights: Wellington Primary TGRM  
 (New City Datum = Wellington V.D. 1953)  
 Coordinate Datum: NZTM2000  
 Origin of Coordinates: Wellington Airport  
 (WGS1984) LINC continuous tracking station  
 Pot-holing survey programmed for September

### Geotechnical Legend

**APPROXIMATE LOCATION OF PROPOSED RESERVOIR**

**ALIGNMENT OF SLOPE STABILITY SECTION**

**BOREHOLE (OPUS, 2011)**

**TEST PIT (OPUS, 2011)**

**BOREHOLE (BECA, 2012)**

**TEST PIT (BECA, 2012)**

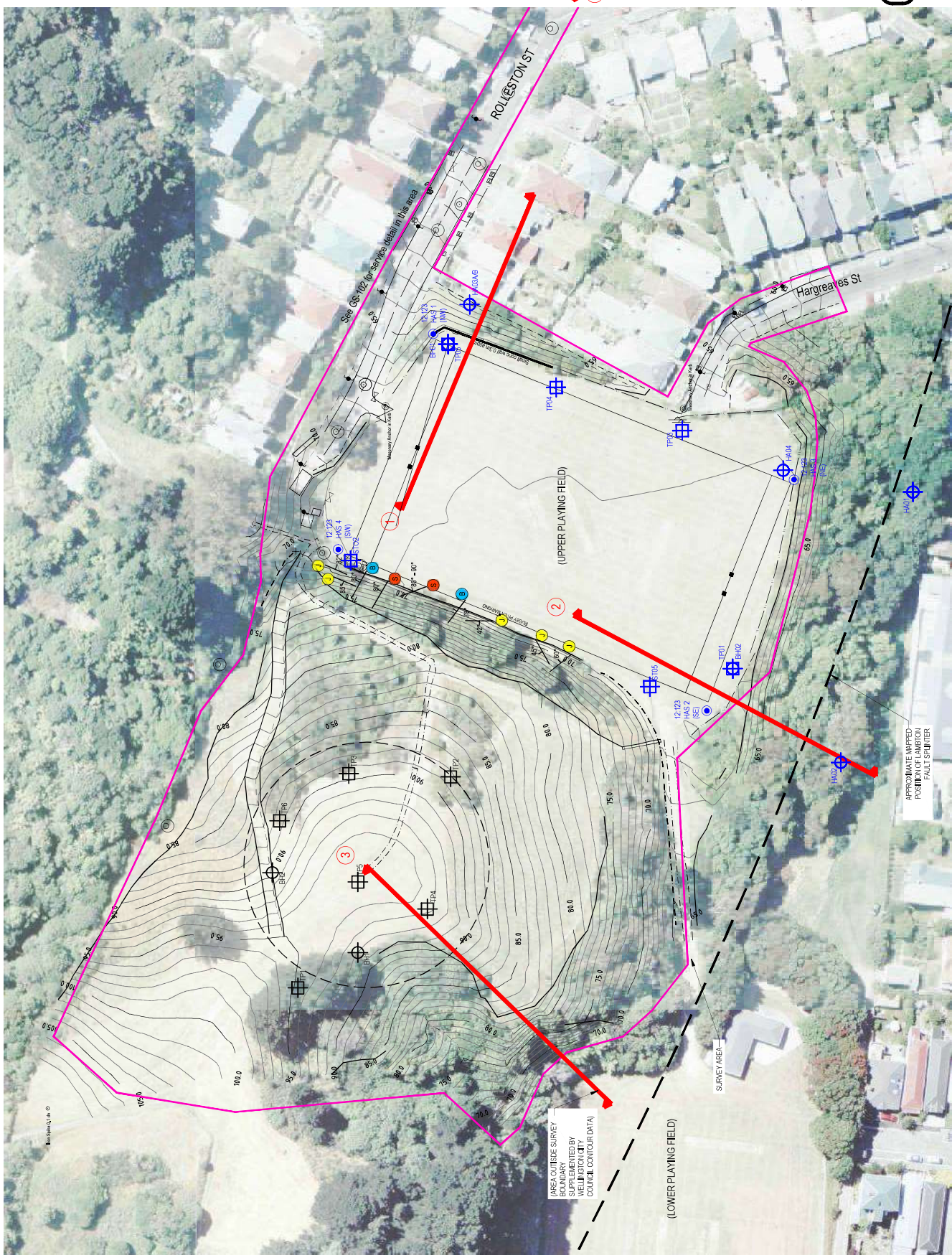
**CONTAMINATION SAMPLES (BECA, 2012)**

**DEFECTS:**

- B** BEDDING
- J** JOINT
- S** SHEARED

**DIP ANGLE**

**FOR INFORMATION NOT FOR CONSTRUCTION**



Project		Client		Design		Checked		Approved	
GEOTECHNICAL SITE PLAN APPENDIX A		HOSPITAL PRINCE OF WALES RESERVOIR		JOS		JOS		JOS	
6517439-CE-250		[Logo]		[Logo]		[Logo]		[Logo]	
DATE SCALE		DATE SCALE		DATE SCALE		DATE SCALE		DATE SCALE	
DATE SCALE		DATE SCALE		DATE SCALE		DATE SCALE		DATE SCALE	



## Attachment 2

# CH2M Beca Laboratory Results Summary Sheet

CH2M BECA SOIL ANALYSIS RESULTS - WCC PRINCE OF WALES PARK														
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	20-Sep-12	20-Sep-12	20-Sep-12	Assessment Criteria		
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	Background levels <sup>a</sup>	Recreational <sup>b</sup>	Commercial / industrial outdoor worker (unpaved) <sup>b</sup>
Sample Number	12-123	12-123	12-123	12-123	12-123	12-123	12-123	12-123	12-123	12-123	12-123	<2-7	80	70
Laboratory Number	1051240.1	1051240.2	1051240.3	1051240.4	1051240.5	1051240.6	1051240.7	1051240.8	1051240.9	1051241.1	1051241.1	<0.1-0.1	400	1,300
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	0.9-1.2	6-16	2,700	6,300
Soil Type	Silt	Silt	Silt	Silt	Silt	Silt	Silt	Silt	Silt	Silt	Silt	3-25	>10,000	>10,000
Heavy metals (mg/kg)												5.9-76.8	880	3,300
Asenic	7	3	5	5	2	2	2	4	3	3	3	4-13	130 <sup>c</sup>	1,800 <sup>c</sup>
Cadmium	0.29	0.11	0.15	0.14	0.17	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	24-105	23,000 <sup>b</sup>	31,000 <sup>a</sup>
Chromium	12	12	14	13	19	16	17	15	12	19	18	-	-	-
Copper	11	9	19	11	16	12	12	14	9	16	16	-	-	-
Lead	57	49	100	123	80	24	25	40	47	22	21	-	-	-
Nickel	7	6	7	8	8	14	11	10	7	13	15	-	-	-
Zinc	73	50	88	61	83	85	60	87	54	65	76	-	-	-
<b>Organochlorine Pesticides (mg/kg)</b>														
2,4-DDE	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	Not tested	<0.06	<0.03	<0.03	<0.002-0.05	-	-
2,4-DDD	0.017	0.035	0.023	0.032	0.023	0.023	0.023	Not tested	<0.06	<0.03	<0.03	<0.002-0.05	-	-
2,4-DDDE	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	Not tested	<0.06	<0.03	<0.03	<0.002-0.05	-	-
4,4-DDDE	0.081	0.079	0.28	0.189	0.28	0.189	0.189	Not tested	0.07	<0.03	<0.03	<0.002-0.05	-	-
2,4-DDT	0.029	<0.010	0.014	0.073	<0.010	0.014	0.073	Not tested	0.09	<0.03	<0.03	<0.002-0.05	-	-
4,4-DDT	0.162	0.44	0.24	0.38	0.24	0.24	0.38	Not tested	0.11	<0.03	<0.03	<0.002-0.05	-	-
Total DDT	0.309	0.584	0.577	0.694	0.584	0.577	0.694	Not tested	0.1	<0.03	<0.03	<0.002-0.05	-	-
<b>All Other Compounds</b>														
Below Detection														
<b>Organotrifluorophosphorus Pesticides (mg/kg)</b>														
Below Detection														
<b>All Compounds</b>														
Below Detection														
<b>Polycyclic Aromatic Hydrocarbons (mg/kg)</b>														
Acenaphthene	<0.03	<0.04	<0.04	<0.04	<0.05	<0.04	<0.03	<0.04	<0.06	<0.03	<0.03	<0.002-0.05	-	-
Acenaphthylene	<0.03	<0.04	<0.04	<0.04	<0.05	<0.04	<0.03	<0.04	<0.06	<0.03	<0.03	<0.002-0.05	-	-
Anthracene	<0.03	<0.04	<0.04	<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	0.08	0.04	0.08	<0.04	<0.03	<0.04	0.07	<0.03	<0.03	<0.002-0.05	-	-
Benzo[a]pyrene (BAP)	0.06	0.05	0.24	0.06	0.08	<0.04	<0.03	<0.04	0.09	<0.03	<0.03	<0.002-0.05	-	-
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	<0.002-0.05	-	-
Benzo[k]fluoranthene	0.06	0.23	0.23	0.06	0.1	<0.04	<0.03	<0.04	0.1	<0.03	<0.03	<0.002-0.05	-	-
Benzo[k]fluoranthene	0.04	<0.04	0.14	<0.04	0.05	<0.04	<0.03	<0.04	0.1	<0.03	<0.03	<0.002-0.05	-	-
Chrysene	0.07	0.05	0.26	0.05	0.09	<0.04	<0.03	<0.04	0.09	<0.03	<0.03	<0.002-0.05	-	-
Dibenz[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	<0.002-0.05	-	-
Fluoranthene	0.15	0.1	0.66	0.09	0.19	<0.04	<0.03	<0.04	0.19	<0.03	<0.03	<0.002-0.05	-	-
Fluorene	<0.03	<0.04	<0.04	<0.04	<0.05	<0.04	<0.03	<0.04	<0.06	<0.03	<0.03	<0.002-0.05	-	-
Indeno[1,2,3-cd]pyrene	0.06	0.05	0.21	0.05	0.08	<0.04	<0.03	<0.04	0.09	<0.03	<0.03	<0.002-0.05	-	-
Naphthalene	<0.15	<0.17	<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	<0.002-0.01	-	-
Pyrene	0.16	0.12	0.68	0.11	0.22	<0.04	<0.03	<0.04	0.22	<0.03	<0.03	<0.002-0.01	-	-
BaP equivalent	0.099	0.089	0.377	0.088	0.140	<0.1	<0.07	<0.1	0.153	<0.07	<0.07	<0.002-0.01	40	35

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

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

<sup>c</sup> 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

<sup>d</sup> 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

<b>Client:</b>	Beca Infrastructure Limited	<b>Lab No:</b>	1051240	SPV1
<b>Contact:</b>	Kate Jackson C/- Beca Infrastructure Limited PO Box 6345 Wellesley Street AUCKLAND 1141	<b>Date Registered:</b>	25-Sep-2012	
		<b>Date Reported:</b>	09-Oct-2012	
		<b>Quote No:</b>		
		<b>Order No:</b>		
		<b>Client Reference:</b>	12:123	
		<b>Submitted By:</b>	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	
<b>Individual Tests</b>						
Dry Matter	g/100g as rcvd	79	75	75	79	58
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
<b>Organochlorine Pesticides Screening in Soil</b>						
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	-



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	-
Terbuthylazine	mg/kg	< 0.03	< 0.04	< 0.04	< 0.03	-
Terbuthylazine-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	-
Vindozolin	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						
<b>Sample Name:</b>	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	
<b>Lab Number:</b>	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
<b>Sample Name:</b>	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	
<b>Lab Number:</b>	1051240.6	1051240.7	1051240.8	1051240.9	1051240.10	
Individual Tests						
Dry Matter	g/100g as rcvd	80	79	79	41	81
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
<b>Sample Name:</b>	12:123 BH02 1.9-2.1m 20-Sep-2012 1:25 pm					
<b>Lab Number:</b>	1051240.11					
Individual Tests						
Dry Matter	g/100g as rcvd	83	-	-	-	-
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						
<b>Sample Name:</b>		12:123 BH02 1.9-2.1m 20-Sep-2012 1:25 pm				
<b>Lab Number:</b>		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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