



Final Report

Waiwhetu Stream Remediation Project

12 AUGUST 2010

Prepared for
CPG New Zealand Ltd (acting for Greater Wellington Regional Council)
23 Taranaki Street
PO Box 6643
Wellington 6141
New Zealand

42771630

URS

Report Author:


.....
Sarah Halliday
Environmental Scientist

URS Project Director:


.....
Sara Clarke
Principal

URS New Zealand Limited

**Lambton House, 160 Lambton Quay
Wellington 6011
PO Box 3367, Wellington 6140
New Zealand
T: 64 4 496 3750
F: 64 4 496 3755**

URS Project Manager:

Jonathan Coakley
Senior Associate
Environmental Scientist

Date: **12 August 2010**
Reference: 42771630/01/3
Status: FINAL

Document delivery

URS New Zealand provides this document in either printed format, electronic format or both. URS considers the printed version to be binding. The electronic format is provided for the client's convenience and URS requests that the client ensures the integrity of this electronic information is maintained. Storage of this electronic information should at a minimum comply with the requirements of the Electronic Transactions Act 2002.

Where an electronic only version is provided to the client, a signed hard copy of this document is held on file by URS and a copy will be provided if requested.

Table of Contents

Executive Summary	v
1 Introduction	1
1.1 Site Location and Description	1
1.2 Background	1
1.3 Scope of Work.....	2
1.4 Roles of Parties.....	3
1.5 Purpose and scope of this report.....	3
2 Remediation Design.....	5
2.1 Introduction	5
2.2 Preparation of the work area	5
2.3 Construction of cells using coffer-dams	5
2.4 By-pass pumping and cell de-watering	6
2.5 Excavation	6
2.6 Landfill disposal.....	7
2.7 Environmental guideline values	7
3 Overview of Remediation Site Works.....	13
3.1 Cell Preparation and Removal of Contaminated Material	13
3.1.1 Contaminated Material Characteristics	13
3.2 Sediment Validation Sampling	14
3.2.1 Resource Consent conditions	14
3.2.2 Validation Sampling Methodology	14
3.3 Levelling Fill/Daily Cover Testing.....	15
4 Cell A.....	17
4.1 Works	17
4.2 XRF and Laboratory Analysis.....	18
5 Cell B.....	23
5.1 Works	23
5.2 XRF and Laboratory Analysis.....	23
6 Cell C/D	31
6.2 Works	31

6.3	XRF and Laboratory Analysis	32
7	Cell E	39
7.1	Works	39
7.2	XRF and Laboratory Analysis	39
8	Cell F/G	47
8.1	Works	47
8.2	XRF and Laboratory Analysis	49
9	Cell H	55
9.1	Works	55
9.2	Trunk main sewer	56
9.3	Salt Marsh	56
9.4	XRF and Laboratory Analysis	57
10	Cell M	65
10.1	Works	65
10.2	XRF and Laboratory Analysis	66
11	Water Sampling	73
11.1	Resource Consent Conditions	73
11.2	Water Sampling Methodology	73
11.3	Water Sample Locations	74
12	Summary	77
12.1	Compliance with consent conditions for stream bed sediment sampling	77
12.2	Compliance with consent conditions for water sampling	79
13	References	81
14	Limitations	83

Tables

Table 1-1	Roles of involved parties	3
Table 2-1	Summary of material classifications	7
Table 3-1	Volumes of contaminated material removed	14

Table 4-1	Cell A - Summary of works	17
Table 4-2	Waiwhetu Stream Remediation Project; Cell A Validation Sample Results	20
Table 5-1	Cell B - Summary of works	23
Table 5-2	Waiwhetu Stream Remediation Project; Cell B Validation Sample Results	26
Table 6-1	Cell C/D - Summary of works.....	31
Table 6-2	Waiwhetu Stream Remediation Project; Cell C/D Validation Sample Results	34
Table 7-1	Cell E - Summary or works	39
Table 7-2	Waiwhetu Stream Remediation Project; Cell E Validation Sample Results	42
Table 8-1	Cell F/G - Summary of works.....	47
Table 8-2	Waiwhetu Stream Remediation Project; Cell F/G Validation Sample Results	51
Table 9-1	Cell H - Summary of works	55
Table 9-2	Waiwhetu Stream Remediation Project; Cell H Validation Sample Results.....	59
Table 10-1	Cell M - Summary of works.....	65
Table 10-2	Waiwhetu Stream Remediation Project; Cell M Validation Sample Results	68
Table 11-1	Water Sample Bottles and Analyses	73
Table 11-2	Water Sample Locations.....	74
Table 11-3	Waiwhetu Stream Remediation Project; Water Sample Results.....	76
Table 12-1	Summary of water sample exceedances.....	79

Figures

Figure 1-1	Catchment plan.....	4
Figure 2-1	Typical Remediation Setup.....	9
Figure 2-2	Typical Remediation Setup Details.....	10
Figure 2-3	Waiwhetu Stream Remediation Project; Site Overview Plan	11
Figure 4-1	Waiwhetu Stream Remediation Project; Cell A Validation Sample Locations.....	19
Figure 5-1	Waiwhetu Stream Remediation Project; Cell B Validation Sample Locations.....	25
Figure 6-1	Waiwhetu Stream Remediation Project; Cell C/D Validation Sample Locations.....	33
Figure 7-1	Waiwhetu Stream Remediation Project; Cell E Validation Sample Locations.....	41
Figure 8-1	Waiwhetu Stream Remediation Project; Cell F/G Validation Sample Locations	50
Figure 9-1	Waiwhetu Stream Remediation Project; Cell H Validation Sample Locations	58
Figure 10-1	Waiwhetu Stream Remediation Project; Cell M Validation Sample Locations	67
Figure 11-1	Waiwhetu Stream Remediation Project; Water Sample Locations.....	75

Charts

Chart 12-1	Average concentrations of Chromium (Cr) in validation samples from all cells vs. ISQG low and ISQG high criteria.	77
Chart 12-2	Average concentrations of Copper (Cu) in validation samples from all cells vs. ISQG low and ISQG high criteria.	78
Chart 12-3	Average concentrations of Zinc (Zn) in validation samples from all cells vs. ISQG low and ISQG high criteria.	78
Chart 12-4	Average concentrations of Lead (Pb) in validation samples from all cells vs. ISQG low and ISQG high criteria.	79

Appendices

Appendix A	Resource Consents
Appendix B	Validation Sample Results
Appendix C	Water Sample Results
Appendix D	XRF Data
Appendix E	Comparison of XRF to Laboratory Data

Executive Summary

A project to remove contaminated sediments from and widen and deepen the Waiwhetu Stream was carried out over the period November 2009 through May 2010. This report summarises the remediation aspects of the project.

The Waiwhetu Stream is a relatively small, slow flowing, and tidally-affected stream that rises in the Eastern Hills of the Hutt Valley, then flows south for approximately six kilometres to its confluence with the Hutt River estuary at Port Road. The lower reaches of the Waiwhetu Stream suffer from long standing heavy metal pollution, in particular lead, zinc, chromium and copper, as a result of historical untreated discharges from local industries in the Gracefield and Seaview area.

The project focused on the most heavily contaminated section of the stream, namely the lower reaches, between Bell Road Bridge and Port Road Bridge. The section of the stream that has been remediated is that extending approximately 1300 m downstream from Bell Road Bridge to approximately chainage 200, in a section now referred to as the “U-channel”. The salt marsh located downstream of Seaview Road Bridge was also remediated. Widening and deepening works occurred over the total reach, between Bell Road Bridge and Port Road Bridge (a total of around 1460 m).

The project was jointly funded by Greater Wellington Regional Council (GWRC) and Hutt City Council (HCC). The remediation aspect of the project has also been partially funded by the Ministry for the Environment’s Contaminated Sites Remediation Fund.

The contract for the project was tendered by GWRC in December 2008. GWRC selected Brian Perry Civil Ltd (BPC) as the main civil works contractor. CPG New Zealand Limited was appointed as Engineer to the Contract and URS New Zealand Limited was sub-contracted by CPG to monitor and oversee remediation of contaminated sediments.

The project proceeded under a suite of resource consents (WGN090127 [27264] - [27272]) issued by GWRC, and resource consent RM080615 issued by HCC. This report is required to satisfy condition 26 of land use consent WGN090127 [27265], in respect of the excavation and removal of contaminated sediment, and condition 14 of discharge permit WGN090127 [27267], in respect of the discharge of potentially contaminated water during the works.

Sediment Validation

Remediation of the sediments was effected by isolating sections of the stream using coffer dams, before excavating the contaminated material. In general, surface sediments to a depth of 0.5m to 1.5m were silty, black stream sediments with a strong sulphur odour. This black sediment is the contaminated material that has been referred to colloquially throughout the project as ‘ooze’. The key contaminants of concern in this material were heavy metals, predominantly lead, zinc, chromium and copper.

After the contaminated material had been excavated from the stream bed and banks, remaining sediments in the excavation cell were sampled and analysed to confirm compliance with the consent conditions. Condition 26 of land use consent WGN090127 [27265] required that concentration of the four key contaminants in remaining sediment should be less than their respective Australian and New Zealand Environmental Conservation Council (ANZECC) Interim Sediment Quality Guideline (ISQG) High criteria.

All validation sample results for lead, zinc, chromium and copper were below the ISQG-High criteria. All contaminated material excavated during the project was disposed of at Silverstream Landfill, Lower Hutt.

Executive Summary

Following validation, the stream channel was widened and deepened, and erosion and scour protection installed.

Discharge water quality

During the excavation works, the stream base flow was bypassed around the works by pumping and the excavation cells were de-watered by pumping. Surface water sampling was carried out as required by condition 14 of discharge permit WGN090127 [27267], to confirm the water quality in the stream downstream from the discharge of the by-pass and dewatering pumps.

The water sample results were compared with ANZECC Water Quality Guidelines (Table 3.4.1 trigger values for freshwater at 80% protection (ANZECC, 2000)). A total of 30 samples were taken and analysed, from four different locations. In six samples, all from sample locations 1 and 2, exceedances of one of the criteria were reported. The exceedances were likely due to the disturbance of sediment near the de-watering pump intake(s) in the excavation cell in the hours leading up to the water sample being collected. There was an improvement in the control of water in subsequent cells, as no samples from sampling points 3 and 4 exceeded criteria. The remainder of the results were below the guideline criteria.

Introduction

This report summarises the remediation aspects of the works carried out over the period November 2009 through May 2010 to remove the contamination from and increase the flood carrying capacity of the Waiwhetu Stream. The works were conducted in the lower reaches of the stream, between Bell Road Bridge and Port Road Bridge.

1.1 Site Location and Description

The Waiwhetu Stream is a relatively small, slow flowing, and tidally-affected stream that rises in the Eastern Hills of the Hutt Valley above the suburb of Naenae. It then flows south for approximately six kilometres through the suburbs of Epuni, Waterloo, Waiwhetu and Gracefield to its confluence with the Hutt River estuary at Port Road (see **Figure 1-1**).

The lower reaches of the Waiwhetu Stream suffer from long standing heavy metal pollution, in particular lead, zinc, chromium and copper, and were considered to contain some of the most contaminated sediments in New Zealand. This contamination resulted from historical untreated discharges from local industries in the Gracefield and Seaview area.

The reach that was the subject of these works is that downstream from Bell Road Bridge. The section of the stream between Bell Road Bridge and Seaview Road Bridge is a naturally formed stream, although its route has been historically modified by roading and bridge placements. The outlet of the Awamutu Stream joins the Waiwhetu Stream just north of the Seaview Road Bridge. South of Seaview Road Bridge, there is a salt marsh (an inter-tidal wetland), on the true left bank (adjacent to the Owhiti urupa). Downstream of the salt marsh, the Stream enters a section now referred to as the "U-channel", a formed channel created during the works that extends as far as the Port Road Bridge. The section of the stream that has been remediated is approximately 1300 m from Bell Road Bridge to approximately one third of the way down the U-channel (see **Figure 1-1**). Widening and deepening works occurred over the total reach, between Bell Road Bridge and Port Road Bridge (a total of around 1400-1500 m).

Geology

The Waiwhetu area is located above the confined region of the Hutt Aquifer system. The aquifer system comprises a confining aquitard, the Petone Marine Beds Formation (which extends to a depth of approximately 20 m), which overlies the deep confined aquifer of the Waiwhetu Artesian Gravels. The gravels are tapped for potable municipal water supply.

Beach and marginal marine deposits consisting of gravels with sand and mud are the predominant shallow sediments between Bell Road Bridge and approximately mid-way down the U-Channel. Downstream of this point, the shallow geology is reclamation material, predominantly sand, boulders and rock.

1.2 Background

Since 2000, Greater Wellington Regional Council (GWRC) and Hutt City Council (HCC) have been working with the local community to identify suitable methods to remediate the contaminated sediments in the lower reaches of the Waiwhetu Stream. The Waiwhetu Cleanup Project forms a significant, but separate component of a broader project being undertaken by Greater Wellington Regional Council and Hutt City Council, to bring about improved and sustainable management to the whole of the Waiwhetu catchment, including addressing the flood risk associated with the stream.

1 Introduction

A list of all the previous investigations into contamination in the Waiwhetu Stream is contained in Section 7 of this report.

By 2004 a number of options had been developed to the concept design stage. Between 2004 and 2007, GWRC and HCC undertook further studies into the degree of contamination and the methodology for remediating the contaminated sediments. It became clear through this process that the options to remediate the lower reaches of the Waiwhetu Stream and the options to mitigate flooding and enhance the stream environment were linked – the most sensible solution was to undertake the cleanup and flood mitigation works as part of the same physical works operation. The studies undertaken pointed to an in-stream remediation methodology of isolation and excavation of contaminated sediments as the most suitable methodology.

Excavation and disposal of the contaminated material at a secure landfill was selected as the most suitable method of remediating the contaminated stream bed. This methodology is based on processes adopted by the US Environmental Protection Agency and used for the remediation of heavily contaminated waterways in the USA.

In 2007 GWRC and HCC agreed to trial the in-stream remediation methodology to confirm suitability of the method in local conditions and to quantify any uncertainties prior to full works. The trial took place in March 2008. The scope of the trial was to test the proposed remediation methodology only; no other in-stream channel works, such as stream channel widening and deepening, were carried out.

Based on the results of the trial, GWRC and HCC approved full-scale remediation and flood mitigation works for the lower reaches of the Waiwhetu Stream. URS New Zealand Ltd (URS) completed the remediation design and consenting for the full works. CPG New Zealand Ltd (formerly AC Consulting Ltd) completed the flood mitigation design work (ie. channel widening and deepening, erosion and scour protection, retaining structures at the downstream end of the works). The contract for the project was tendered by GWRC in December 2008.

1.3 Scope of Work

The contracted scope of works was:

“...to cover remediation of heavily contaminated sediments in the lower reaches of the Waiwhetu Stream, and widening and deepening of the stream to increase the flood carrying capacity of the stream, between Bell Road Bridge and Port Road Bridge. Also included is relocation of sewer and water mains underneath the Stream and rationalisation of parts of the stormwater network.”

The works included a number of activities that happened concurrently:

1. Excavation of contaminated sediments between Bell Road Bridge and the salt marsh immediately downstream of Seaview Road Bridge. During the works it was discovered that the extent of contaminated material was greater than originally estimated and that part of the “U-channel” stretch of the stream contained contaminated material which was excavated as per the rest of the stream.
2. In-stream channel widening and deepening, including installation of erosion and scour protection, between Bell Road Bridge and the mouth of the Waiwhetu Stream at Port Road Bridge.
3. Repositioning and improvement of the stormwater network where it discharges to the Waiwhetu Stream, realignment of a water main and two sewer crossings.
4. Implementation of environmental enhancements between Bell Road Bridge and the salt marsh downstream of Seaview Road Bridge.

1 Introduction

1.4 Roles of Parties

CPG was appointed as Engineer to the Contract and URS were sub-contracted by CPG to monitor and oversee remediation of contaminated sediments. GWRC selected Brian Perry Civil Ltd (BPC) as the main civil works contractor. The roles of the parties involved in the project are summarised in **Table 1-1**.

Table 1-1 Roles of involved parties

Role	Organisation	Engaged by
Contract Holder	GWRC	-
Lead Civil Contractor	Brian Perry Civil Ltd	GWRC
Engineer to the contract	CPG NZ Ltd	GWRC
Remediation consultant	URS NZ Limited	CPG NZ Ltd

BPC engaged several subcontractors during the works. Notably, John Ray Ltd were engaged to excavate and transport the material removed from the streambed, both during the remediation and widening and deepening, and to construct and install the erosion and scour protection (gabion baskets and reno mattresses). Multi Civil Contractors were engaged to carry out the sewer and stormwater realignment works, including the construction of the new pumping station.

This project has been jointly funded by GWRC and HCC, and has also been assisted by funding from the Ministry for the Environment's Contaminated Sites Remediation Fund.

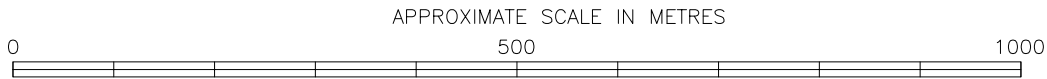
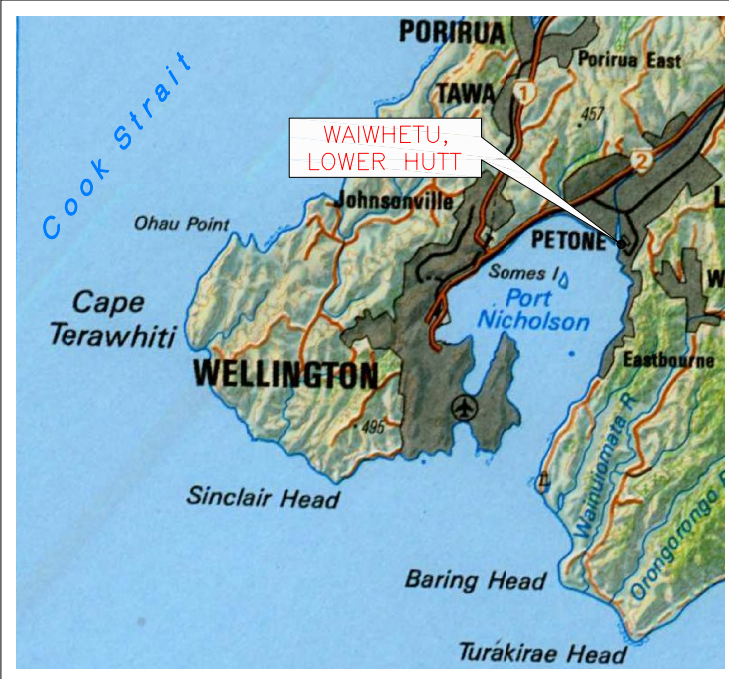
1.5 Purpose and scope of this report

The Waiwhetu Stream Project proceeded under a suite of resource consents (WGN090127 [27264] – WGN090127 [27272]) issued by GWRC, and resource consent RM080615 issued by HCC. These consents are provided as **Appendix A**. **This report summarises the remediation aspects of the project designed to remove the contamination from and increase the flood carrying capacity of the Waiwhetu Stream and is required to satisfy condition 26 of resource consent WGN090127 [27265] and condition 14 of resource consent WGN090127 [27267].**

This report is also required as a condition of the funding provided by the Ministry for the Environment (MfE), and has therefore been completed in general accordance with section 2.4 'Stage 4 – Site Validation Report', of the Ministry's Contaminated Land Management Guidelines: No. 1, Reporting on Contaminated Sites in New Zealand.

This report contains the following:

- The remediation system design, including cell construction, bypass pumping and de-watering, excavation and landfill disposal.
- Description of works carried out in each cell, including validation sampling required for resource consent compliance.
- Results of water quality sampling required for resource consent compliance.



KEY	
	REMEDIATED AREA
	U-CHANNEL

A							
Rev	Revision Description	Designed	Drawn	Checked	Approved	Date	

Tab	FIG 1-1
Scales	1:1000-A3 1:2000-A4
Original Size	A3



URS New Zealand Limited
Level 4, Lambton House
160 Lambton Quay
PO Box 3367, Wellington, 6140
Phone: 0-4-496 3750
Fax: 0-4-496 3755

CPG NEW ZEALAND LTD.

WAIWHETU STREAM REMEDIATION PROJECT

WAIWHETU STREAM
CATCHMENT PLAN

Status	
Drawing Number	FIGURE 1-1
Revision	A

Remediation Design

2.1 Introduction

The approach for the full remediation works included the following elements:

1. Preparation of the work area
2. Construction of an excavation cell and a number of sedimentation cells using sheet-pile coffer dams across the width of the stream
3. Bypass pumping of stream base flows around the works and de-watering pumping of the excavation cell
4. Excavation of contaminated material from the stream bed and banks in the excavation cell
5. Validation sampling and analysis of remaining sediments in the excavation cell to check compliance with consent conditions for remaining material.

When results of validation sampling showed compliance with the consent conditions further flood protection works including channel widening, deepening, scour protection and service modifications were completed in the excavation cell – these flood protection works are not described in this report.

A schematic diagram of the remediation works layout is shown in **Figures 2-1 and 2-2**. The following sections provide a brief overview of key elements of the remediation design that were generally adopted in the remediation works, and any changes to the design that were adopted by the project team during the works. Detailed information on the remediation design is provided in the two resource consent applications submitted for the works (URS 2008a and 2008b).

The physical layout of the site required certain modifications to the general approach to be able to work around existing site conditions (e.g. underground services, bridges, access). Sections 4 to 10 provide specific details on the work approach taken in each of the remediation cells, shown in **Figure 2-3**.

2.2 Preparation of the work area

The contractor prepared the works area by installing security fences, silt curtains upstream and downstream of the works, haulage roads, storage areas, site office facilities, identification and isolation of underground services, and other works to enable the remediation works to progress.

2.3 Construction of cells using coffer-dams

Between three and five sheet-pile coffer-dams were in place across the width of the stream at any time during the works to form the adjacent in-stream cells (excavation and sedimentation cells). Sheet-piles were driven by a crane-mounted vibrating hammer into the stream bed and banks. The coffer dams were installed to block the upstream base flows and downstream tidal flows from entering the excavation cell.

A flood contingency management plan (FCMP) was in place for the duration of the works as a requirement of the resource consent. The FCMP included criteria for assessing whether a significant risk of flooding was present during the works (i.e. due to severe weather events), and a procedure with responsibilities and actions for the project team to follow in the case of a significant flooding risk. The FCMP was submitted to GWRC consent officers prior to works commencing. There were a number of weather events where the project team discussed whether the FCMP actions should be implemented. On one occasion (15 January 2010) it was decided that this action was warranted, and coffer dam 4 was lowered. A key element of the FCMP was that the contractor would drive a 10 m x 0.5 m notch in

2 Remediation Design

all coffer-dams in the event of a severe weather forecast (and subsequent high stream flow) that could potentially result in flood conditions.

The original design of the sheet pile coffer dams, which required all coffer dam tip heights set to 1.1 m RL, was modified as part of the development of the FCMP because the contractor indicated they would not have time to drive sufficient sheet piles in the event of a severe weather forecast. The coffer-dam design was modified so that all coffer-dams downstream of the excavation cell (coffer dams 3, 4, and 5 in **Figure 2-3**) were installed with a 10 m x 0.5 m notch in place at all times. This plan, and revised calculations for the effectiveness of the sedimentation cells, was discussed with GWRC consent officers prior to the works commencing.

The original remediation design specified an alternative arrangement for the installation of coffer-dams in the salt marsh area of the works to eliminate the need for stream by-pass pumping in this area (refer to URS 2008 resource consent application). During the works, this approach was revised so that the arrangement of coffer-dams and the subsequent excavation in the salt marsh area was carried out in generally the same way as the rest of the works. This is described in more detail in Sections 10 and 11. Revised flood modelling was carried out for this approach prior to the works commencing, and these results were presented to GWRC consent officers for their approval.

2.4 By-pass pumping and cell de-watering

Stream flows accumulating on the upstream side of the excavation cell were bypassed around the excavation cell(s) by pumping into the first sedimentation cell. A 14" pump was used by the contractor to provide sufficient pumping capacity. The maximum flow rates measured at the Whites Line East monitoring station during the works was approximately 13 m³/s on 16 October 2010. This was the equivalent of a 2 year flood event. This and other rain events during October meant that by-pass pumping was did not commence until 2 November 2010. Typical flow rates were much lower during the remainder of the works (less than 0.5 m³/s) with some peak flows up to 7 m³/s. During periods of low flow, the contractor switched off the bypass pump until the stream levels upstream of the excavation cell reached a point where further pumping was necessary. The pump intake structure was designed and placed in such a way as to exclude fish as far as is practicable, and to present a minimal safety hazard to workers and the public.

Water that accumulated in the excavation cell was pumped using an array of 6" pumps which generally discharged into the by-pass pipe. In the later stages of the project (Cells H, M) the de-watering pumps were discharged into a separate pipe to the by-pass and discharged into Cell N. The estimated hydraulic retention time for 3 sedimentation cells (after modification of the design for the FCMP) was 5.8 hours. Silt curtains were set up both upstream and downstream of the works to provide protection against discharge of sediment to the stream from the works, as well as catching rubbish and debris that may block or damage the pumps.

2.5 Excavation

Cells A and B were excavated using 20 tonne diggers working in the stream bed. After Cell B was completed, a revised plan was developed by the project team in order to minimise the amount of water in the excavated material. The contractor was instructed to use long reach diggers from the banks of the stream to minimise the mixing of clean and contaminated material that had occurred in cells A and B, due to the diggers working in the stream bed. The contaminated material was excavated to a

2 Remediation Design

stockpile area on the stream banks prior to being loaded into sealed trucks by a second digger on the stream bank. The excavation works in each cell are described in more detail in Sections 4 to 11.

2.6 Landfill disposal

The material excavated during the project was disposed of at Silverstream Landfill (the landfill), Lower Hutt. The landfill is owned by Hutt City Council, who engages Transpacific to run the day to day operations, and Tonkin & Taylor Ltd as consultants to provide technical and environmental advice.

The material disposed of at the landfill included all contaminated material removed as part of the remediation works, and all material removed as part of the widening and deepening works after 17 December 2009.

The material taken to the landfill was classified into a specific 'type' depending on the water content and level of contamination. A summary of the material types developed for this project is presented in **Table 2-1**.

Table 2-1 Summary of material classifications

Material Type	Characteristics
A	Dry, Contaminated
B	Wet, Contaminated
C	Free water, Contaminated (not used)
D	Heavily contaminated material from Cell D
F	Dry, Daily cover/levelling fill
G	Wet, Daily cover/levelling fill (not used)

Typically the material excavated from the remediation cells was classified at the landfill as 'Type B', and disposed of in purpose-dug trenches within the existing landfill material.

An exception to this was the material excavated from Cell D and the upper 15 m of Cell E (see Sections 6 and 7). This material had been identified during the planning stage as being highly contaminated, or 'Type D' material, as the concentrations of lead, zinc, copper and chromium were significantly higher in these sections than elsewhere in the stream. Although this material was also disposed of in trenches, these trenches were located in a different area of the landfill, and were capped with an impermeable fill layer to minimise rainfall infiltration and leaching.

Material that was removed as part of the widening and deepening of the stream channel (that is, following validation sampling as described in section 3.2) was disposed of at Silverstream Landfill as daily cover/levelling fill when dry. This is discussed in Section 3.3.

2.7 Environmental guideline values

Sediments

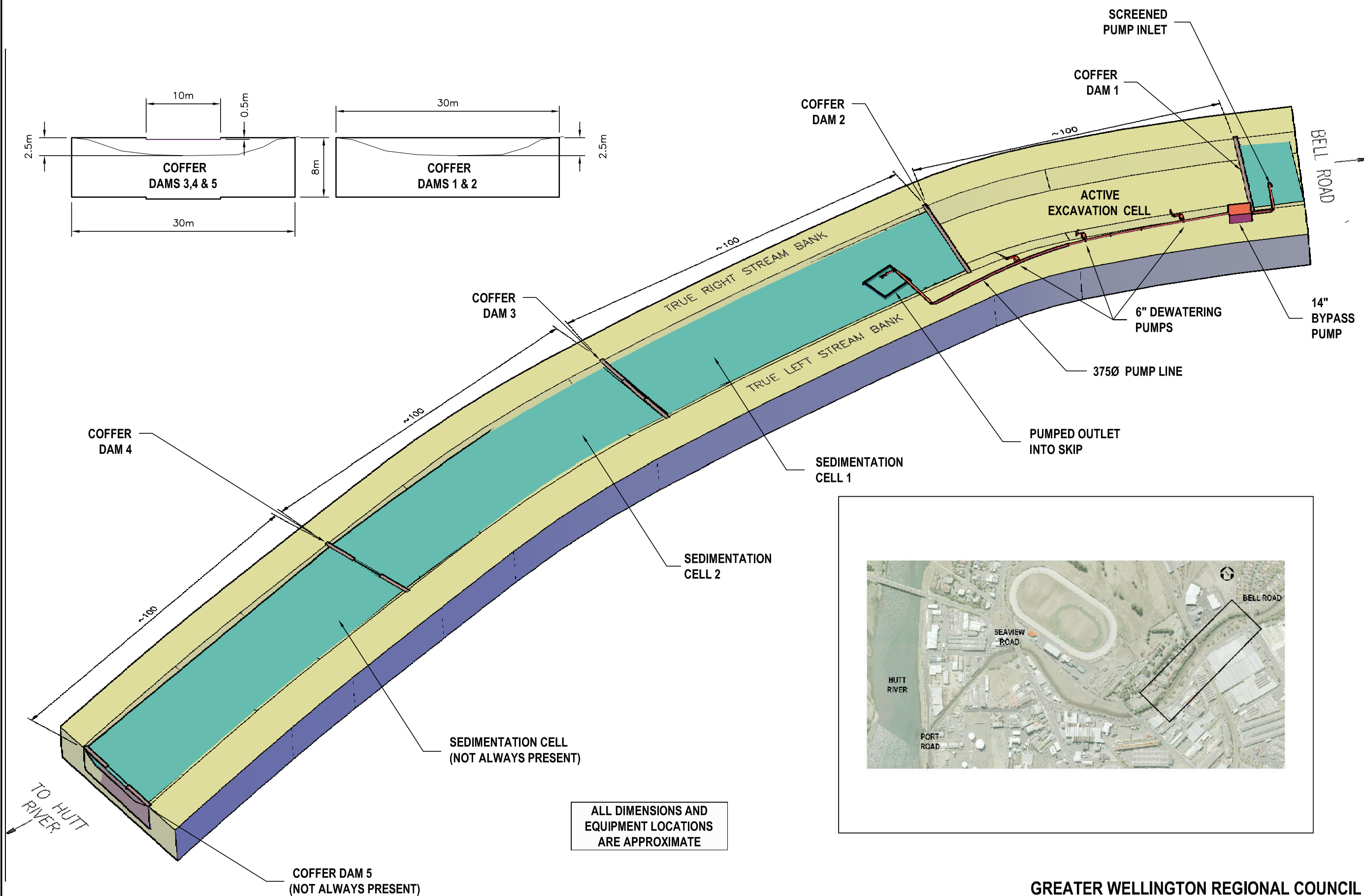
ANZECC Interim Sediment Quality Guideline (ISQG) values have been used to assess the degree of potential ecological hazard posed by contaminated stream sediments, and the requirements for remediation (ANZECC, 2000). The ANZECC ISQG values are the most appropriate criteria to apply to the Waiwhetu Stream as they are concerned with the biological responses of organisms to

2 Remediation Design

contaminants such as those currently present in the stream. The guidelines contain two concentrations, the ISQG-Low concentration (or trigger value) and the ISQG-High concentration. The trigger value is a threshold concentration below which the frequency of adverse biological effects is expected to be very low. The ISQG-High concentration is intended to represent a concentration above which biological effects are expected to occur more frequently. The resource consent for the works required that the sediment remaining in the streambed contain concentrations of the key contaminants of concern below the ISQG-High values.

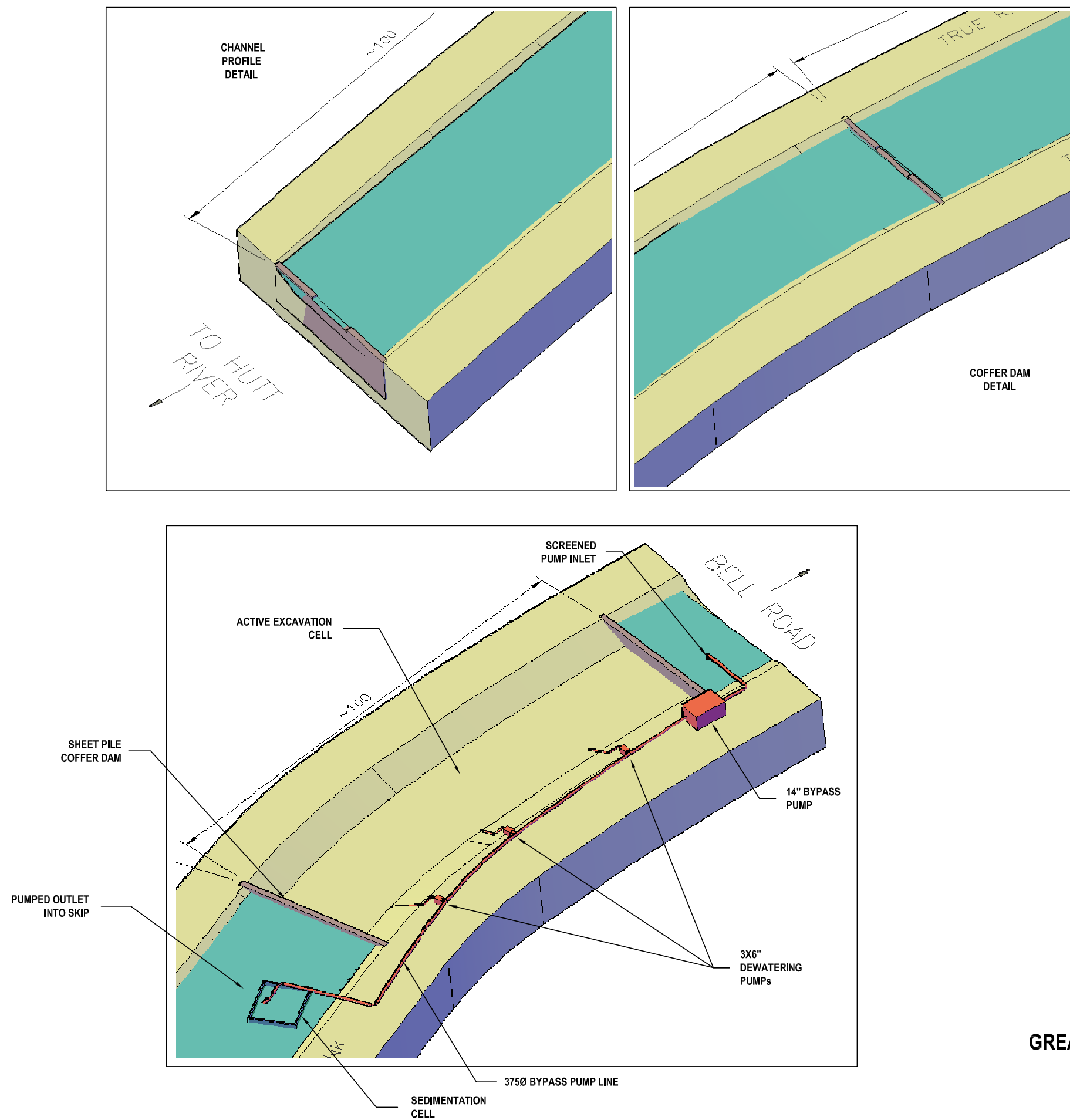
Water

Analytical results for water samples gathered during the trial have been compared to ANZECC guidelines trigger values for marine and freshwater (80% level of protection).



GREATER WELLINGTON REGIONAL COUNCIL
WAIWHETU STREAM
TYPICAL REMEDIATION SET-UP

FIGURE 2-1



GREATER WELLINGTON REGIONAL COUNCIL
WAIWHETU STREAM
TYPICAL REMDIATION SET-UP DETAILS

FIGURE 2-2



							Tab	 URS New Zealand Limited Level 4, Lambton House 160 Lambton Quay PO Box 3367, Wellington, 6140 Phone: 0-4-496 3750 Fax: 0-4-496 3755	CPG NEW ZEALAND LTD.	WAIWHETU STREAM REMEDIATION PROJECT		
						Scales				Status		
						1:1000-A3 1:2000-A4				Drawing Number	Revision	
						Original Size A3				FIGURE 2-3	A	
A												
Rev		Revision Description	Designed	Drawn	Checked	Approved	Date					

Overview of Remediation Site Works

The proposed start date for the excavation of contaminated material was 1 October 2009, however significant rainfall during October resulted in excavation commencing on 2 November 2009. Excavation paused for the Christmas period between 22 December 2009 and 11 January 2010, and validation of the final cell was completed on 4 May 2010.

3.1 Cell Preparation and Removal of Contaminated Material

Cells took approximately two to three days to dewater using the method outlined in Section 2.4. Removal of the contaminated material commenced once the cell was dewatered to a level acceptable to the Engineer. The time taken to excavate contaminated sediments ranged between six and 28 days depending on the length of the cell.

3.1.1 Contaminated Material Characteristics

During excavations, several sediment types were encountered in the stream bed. In general, surface sediments to a depth of 0.5 m to 1.5 m were silty, black stream sediments with a strong sulphur odour. This black sediment is the contaminated material that has been referred to colloquially throughout the project as 'ooze'. The key contaminants of concern were heavy metals, predominantly lead, zinc, chromium and copper.

Beneath the surface sediments a thin layer (0.1 m to 0.2 m thick) of brown clay was observed. Beneath the brown clay layer was coarse gravels, sands, and shells. In some cases a further lens of brown clay, or black silt sediment pockets, was observed within the layer of coarse gravels, sands, and shells.

During the works it was discovered that the 'ooze' profile extended laterally into the stream banks, further than the final design profile, suggesting the stream was historically wider than it is at present. The 'ooze' took the form of a seam of contaminated material, varying in thickness up to 250 mm, in both the true left and right banks following the completion of widening and deepening. Where possible, this seam of contamination was 'scaloped' out of the bank as far as practicable, and replaced with clean material. Remnants of this seam of contaminated material remain behind the clean material.

Surface soils on the stream banks comprised mixed silt, clay and gravel fill material overlying a thin layer of silty, black stream sediments (0.1 m to 0.2 m thick) and coarse gravels, sands, and shells below. It is likely that the surface soil is not native to the area and was historically imported and placed on the stream banks to contain the streams flow and allow development on the floodplain. URS is not aware of any historical records that document this filling process. The presence of fill material in the stream banks was found along the entire reach of the stream during the remediation works, including in the U-channel.

The contaminated material, when excavated, comprised 'ooze' mixed with the underlying clays and gravels. Collectively this is referred to as the contaminated material.

The volumes of material removed are summarised in Table 3-1. Volumes of material removed from each cell were provided by BPC based on survey data. The material removed from the 'seams' in the stream banks has been estimated based on truck loads (also provided by BPC).

3 Overview of Remediation Site Works

Table 3-1 Volumes of contaminated material removed

Cell	Volume (m ³)
A	1,111
B	2,971
C/D	4,037
E	2,980
F/G	6,558
H	4,862
M	3,768
Seams (all cells)	1,270
TOTAL	27,557

3.2 Sediment Validation Sampling

Following the removal of the contaminated material and prior to the widening and deepening of the stream channel, sediment samples, which will be referred to as 'validation samples', were collected from the active excavation cell in accordance with the conditions stated in Resource Consent No. WGN090127 [27265].

3.2.1 Resource Consent conditions

The full suite of resource consents issued for the project is provided in **Appendix A**. Condition 20 of Resource Consent WGN090127 [27265] sets out the minimum stream bed validation sampling requirements which, in brief, are:

- There are to be at least 5 equally spaced transects within the active remediation cell.
- These transects shall be located 10, 30, 50, 70 and 90 m from the upstream coffer dam wall.
- At least 15 samples shall be collected from each remediation cell (i.e., 3 samples per transect).
- Date, time, sampling method and weather conditions are to be recorded.
- Neither of the coffer dams that form the active remediation cell shall be removed until validation samples have been collected and the results submitted to the Manager, Environmental Regulation, GWRC.
- Each sample shall be analysed for total recoverable lead, zinc, copper and chromium, and results will be compared with the Interim Sediment Quality Guideline (ISQG) high concentration criteria, as set by the Australian and New Zealand Environmental Conservation Council (ANZECC, 2000).

3.2.2 Validation Sampling Methodology

Contaminated material was removed based on visual observations, and excavation generally continued down to the grey sandy gravels. The initial methodology stated that cells would be validated in full, only once all contaminated material had been removed. However in practice, it was common to validate a few transects of a cell at a time, provided that the risk of recontamination of the validated area was minimised.

Prior to validation samples being collected, the stream bed was spot checked with a portable X-Ray Fluorescence (XRF) analyser and any remaining areas of contaminated material were identified and

3 Overview of Remediation Site Works

removed. The purpose of using the portable XRF was to provide rapid screening data in the field, to assist in determining the end point of the excavation of contaminated material, and to minimise the cost and time associated with laboratory analyses.

When the resource consent was granted, it was expected that the cells would be in the vicinity of 100 m in length. Following modification to cell design, cells ranged in length from 107 m to 290 m (see **Figure 2-3**). To accommodate this, validation transects were placed every 20 m, with the first transect 10 m downstream of the upstream coffer dam. Three equally spaced samples were collected per transect, except for the salt marsh where 4-5 samples were collected per transect to accommodate the extra width of the cell.

The validation samples collected were representative of the top 100 mm of stream bed exposed after the removal of the contaminated 'ooze'. All samples were collected by hand, by a trained environmental scientist. As part of standard field reporting procedures the date, time and weather conditions were recorded at the time of sampling.

All validation samples were screened in the field using the portable XRF to allow comparison with laboratory results. The samples were then submitted to CRL Energy Ltd for lead, zinc, copper and chromium analysis. CRL is an IANZ accredited laboratory located in Seaview. Their estimated method detection limit for sediment analysis of the key contaminants is 0.001% (10 mg/kg), sufficient to satisfy the consent conditions. Results were typically received after 1 to 2 days, and were then compared with the ANZECC ISQG high concentration criteria, and provided to the Engineer's representative.

The validation sampling results and sample location plans for each cell are presented in Sections 4 to 11, and a comparison between the portable XRF results (corrected for moisture content) and laboratory analysis results is presented in **Appendix D**.

3.3 Levelling Fill/Daily Cover Testing

From 18 December 2009, all material excavated as part of the widening and deepening (after the removal of contaminated material) was removed to Silverstream Landfill as levelling fill/daily cover. Acceptance criteria and testing requirements were agreed between the project team and Tonkin & Taylor, advisors to HCC. In summary, the testing carried out was:

- 1 sample per truckload of material was screened with the portable XRF for lead, zinc, copper and chromium.
- 1 sample per 5 truckloads of material was collected and submitted for laboratory analysis for lead, zinc, copper, chromium, arsenic, nickel, cadmium, polycyclic aromatic hydrocarbons (PAH) and DDT.

All results for the levelling fill/daily cover testing have been provided to the Engineer's representative. They are not included in this report.

This report does not include an analysis of the flood mitigation works, including the works in the U-channel such as CFA drilling, installation of panels, scour protection measures, storm-water improvements, services (e.g. pump stations, duplication of sewer crossings etc). These items are mentioned in the summary of works tables in the Sections 4 to 10 in order to provide context and an overall picture of each cell.

Cell A

Cell A comprised the section of the stream between Bell Road Bridge and coffer dam 1, and included the area of the remediation trial (see **Figure 4-1**). While flood protection works were required around Bell Road Bridge, it was not originally expected that excavation of contaminated material would be required. However, sediment sampling carried out on 31 August 2009 upstream of coffer dam 1 indicated that contaminated sediment was still present, and therefore excavation was undertaken.

The dewatering methodology used in Cell A differed to the other cells as there was no upstream coffer dam. Instead, the stream flow was diverted through a channel along the true right hand side of the streambed, with a cut off drain adjacent to coffer dam 1 directing the stream flow to the 14" bypass pump. This allowed for the excavation of contaminated material from the true left hand side and middle of the stream in reasonably dry conditions. Excavation began at coffer dam 1 and moved upstream towards Bell Road Bridge. When validation of the true left hand side and middle of the stream had been completed, the diversion channel was relocated to the true left hand side to allow for the removal of the contaminated material and validation of the true right hand side of the stream.

4.1 Works

A summary of the works carried out in Cell A is presented in **Table 4-1**.

Table 4-1 Cell A - Summary of works

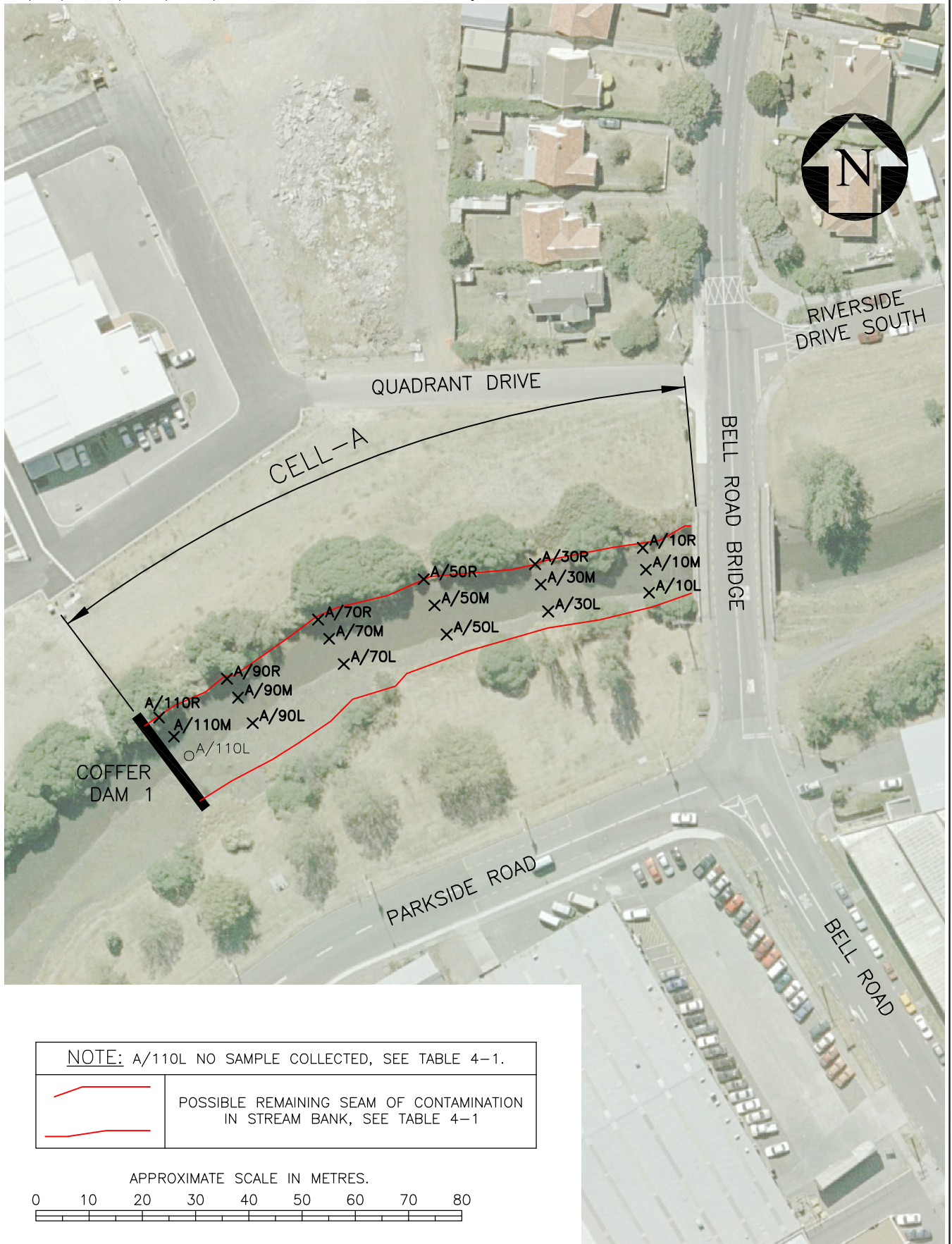
Date 'ooze' excavation commenced	14 November 2009
Top/bottom of cell	Top: Bell Road Bridge; Bottom: Cofferdam 1
Length of cell	107 m
Weather conditions during excavation	Heavy rainfall on 18 November caused the cell to flood.
Truckloads of 'ooze' removed (approximate)	156
Volume of 'ooze' removed	1111 m ³ [Note: Volume provided to URS by BPC Ltd. Does not include material removed from 'seams' – see Section 3.1]
Number of validation transects/samples	6 transects, 17 samples.
Flood protection and civil works in cell	- Reno mattresses downstream of Bell Road Bridge to approximately chainage 1445 - Widening and deepening of stream channel - Fitting of wing walls to service outfalls
Locations of remaining contaminated material (see Figure 4-1) Note: TRB = true right bank; TLB = true left bank	- A seam of contaminated material remained in both the TRB and TLB following the completion of the widening and deepening works. This seam was scalloped out and replaced with clean material where practicable. Some contaminated material may remain behind the overlying capping layer. - It is possible that contaminated material may remain in the vicinity of location A/110L (see below)
Areas not validated (see Figure 4-1)	Location A/110L was not validated because the sampling point was beneath the bypass pump intake, and the surrounding area was consistently under water. Visual inspection only.
Date validation complete	20 November 2009
Other notes/considerations	None

4 Cell A

4.2 XRF and Laboratory Analysis

The validation sample results for Cell A are presented in **Table 4-2**, and a sample location plan is presented in **Figure 4-1**. All validation samples were screened with the portable XRF prior to being sent to the laboratory.

All validation results were below ISQG-High criteria and therefore comply with condition 21 of Resource Consent No: WGN090127 [27265].



XRef's -	Tab FIG 1	Designed JC	Client CPG NEW ZEALAND LTD. Project WAIWHETU STREAM REMEDATION PROJECT	 URS New Zealand Limited Lambton House 160 Lambton Quay PO Box 3367 Wellington New Zealand Ph 0-4-496 3750 Fax 0-4-496 3755	Title CELL-A VALIDATION SAMPLE LOCATIONS Drawing Number FIGURE 4-1	Rev A
CAD File GW750k01 FIG 1		Drawn ABG				
Scales 1:1000-A4		Checked				
Original size A4		Approved				
Status DRAFT		Date 19/5/10				



Table 4-2: Cell A Validation Sediment Sample Analytical Results Compared to ANZECC Sediment Quality Guidelines

	Validation Sample Details and Analytical Results										
URS Sample Reference	A/10R	A/10M	A/10L	A/30R	A/30M	A/30L	A/50R	A/50M	A/50L	ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	SA12964-J	SA12964-J	SA12964-I	SA12964-J	SA12964-J	SA12964-I	SA12964-J	SA12964-J	SA12964-I		
Date Sampled	20-Nov-09	20-Nov-09	17-Nov-09	20-Nov-09	20-Nov-09	17-Nov-09	20-Nov-09	20-Nov-09	17-Nov-09		
Sample Location	10m transect, true right rank	10m transect, middle of stream bed	10m transect, true left bank	30m transect, true right rank	30m transect, middle of stream bed	30m transect, true left bank	50m transect, true right rank	50m transect, middle of stream bed	50m transect, true left bank	ISQG-Low	ISQG-High
Chromium	36	32	39	39	36	50	45	41	42	80	370
Copper	7	2	7	4	2	12	12	5	12	65	270
Zinc	82	64	61	71	64	131	123	68	143	200	410
Lead	31	21	20	24	18	61	54	20	65	50	220

	Validation Sample Details and Analytical Results										
URS Sample Reference	A/70R	A/70M	A/70L	A/90R	A/90M	A/90L	A/110R	A/110M	A/110L	ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	SA12964-J	SA12964-J	SA12964-I	SA12964-J	SA12964-J	SA12964-I	SA12964-J	SA12964-J			
Date Sampled	20-Nov-09	20-Nov-09	17-Nov-09	20-Nov-09	20-Nov-09	17-Nov-09	20-Nov-09	20-Nov-09			
Sample Location	70m transect, true right rank	70m transect, middle of stream bed	70m transect, true left bank	90m transect, true right rank	90m transect, middle of stream bed	90m transect, true left bank	110m transect, true right rank	110m transect, middle of stream bed	110m transect, true left bank	ISQG-Low	ISQG-High
Chromium	42	41	49	54	40	40	36	73	Not sampled. Sampling point is in pump intake area.	80	370
Copper	12	8	19	14	10	4	2	36		65	270
Zinc	108	79	149	95	122	66	58	382		200	410
Lead	58	28	65	33	50	21	17	164		50	220

All units mg/kg dry weight

Bold - exceeds the ANZECC Sediment Guidelines

¹ ANZECC, 2000. National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.

Values taken from Table 3.5.1

A Exceeds ISQG-Low

B Exceeds ISQG-High



Photograph 1: Excavation works in Cell A. Note diversion channel.



Photograph 2: Cell A during heavy rainfall on 18 November 2009.



Photograph 3: Cell A, looking upstream during excavation.
Orange pegs denote validation sample locations.



Photograph 4: Cell A looking downstream post-excavation.
Orange pegs denote validation sample locations.

Cell B

Cell B was the first cell to be excavated; removal of contaminated material began on 2 November 2009. Excavation began at coffer dam 1 and progressed downstream towards coffer dam 2 (see **Figure 5-1**). Two high pressure gas mains are located just downstream of the Ontrack rail bridge, at approximately chainage 1245. One of the pipes was found to be within the 'ooze' profile, so excavation in Cell B was temporarily stopped while it was decided how best to safely work around and protect the pipes, during which time excavation in Cell A took place. Excavation of contaminated material in Cell B resumed on 25 November.

5.1 Works

A summary of the works carried out in Cell B is presented in **Table 5-1**.

Table 5-1 Cell B - Summary of works

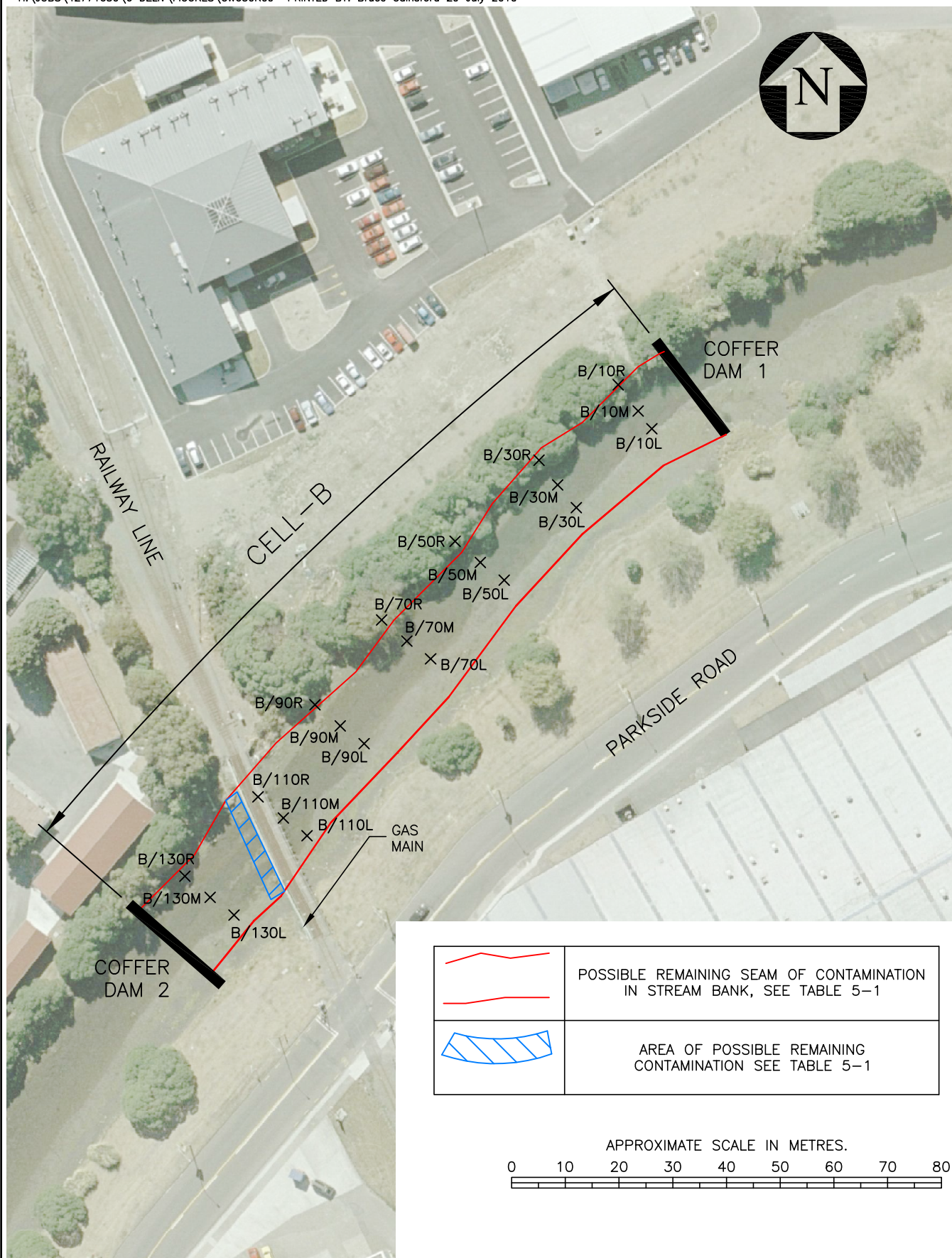
Date 'ooze' excavation commenced	2 November 2009
Top/bottom of cell	Top: coffer dam 1; Bottom: coffer dam 2
Length of cell	142 m
Weather conditions during excavation	Heavy rainfall on 18 November caused the cell to flood.
Truckloads of 'ooze' removed (approximate)	478
Volume of 'ooze' removed	2971 m ³ [Note: Volume provided to URS by BPC Ltd. Does not include material removed from 'seams' – see Section 3.1]
Number of validation transects/samples	7 transects, 21 samples
Flood protection and civil works in cell	- Gabion baskets beneath rail bridge - Temporary rock rip-rap/scour protection around high pressure gas main (at approximately chainage 1245) - Widening and deepening of stream channel - Fitting of wing walls to service outfalls
Locations of remaining contaminated material (see Figure 5-1) Note: TRB = true right bank; TLB = true left bank	- A seam of contaminated material remained in both the TRB and TLB following the completion of the widening and deepening works. This seam was scalloped out and replaced with clean material where practicable. Some contaminated material may remain behind the overlying capping layer. - It is possible that small amounts of contaminated material may remain immediately adjacent to the high pressure gas main. This area was excavated by hand, as opposed to machinery. It was visually inspected and spot-checked with the XRF, however no final scrape was possible with the excavator.
Areas not validated	None
Date validation complete	26 November 2009
Other notes/considerations	None

5.2 XRF and Laboratory Analysis

The validation sample results for Cell B are presented in **Table 5-2**, and a sample location plan is presented in **Figure 5-1**. All validation samples were screened with the portable XRF prior to being sent to the laboratory.

5 Cell B

All validation results were below ISQG-High criteria and therefore comply with condition 21 of Resource Consent No: WGN090127 [27265].



	POSSIBLE REMAINING SEAM OF CONTAMINATION IN STREAM BANK, SEE TABLE 5-1
	AREA OF POSSIBLE REMAINING CONTAMINATION SEE TABLE 5-1

APPROXIMATE SCALE IN METRES.
0 10 20 30 40 50 60 70 80

XRef's -	Tab FIG 1	Designed JC	Client CPG NEW ZEALAND LTD. Project WAIWHETU STREAM REMEDATION PROJECT	 URS New Zealand Limited Lambton House 160 Lambton Quay PO Box 3367 Wellington New Zealand Ph 0-4-496 3750 Fax 0-4-496 3755
CAD File GW750k01 FIG 1		Drawn ABG		
Scales 1:1000-A4		Checked		
Original size A4		Approved		
Status DRAFT		Date 19/5/10		Title CELL-B VALIDATION SAMPLE LOCATIONS Drawing Number FIGURE 5-1 Rev A



Table 5-2: Cell B Validation Sediment Sample Analytical Results Compared to ANZECC Sediment Quality Guidelines

	Validation Sample Details and Analytical Results									ANZECC Sediment Quality Guidelines ¹	
URS Sample Reference	B/10R	B/10M	B/10L	B/30R	B/30M	B/30L	B/50R	B/50M	B/50L		
Laboratory Sample Reference	SA12964-D	SA12964-D	SA12964-D	SA12964-D	SA12964-D	SA12964-D	SA12964-E	SA12964-E	SA12964-E		
Date Sampled	7-Nov-09	7-Nov-09	7-Nov-09	7-Nov-09	7-Nov-09	7-Nov-09	9-Nov-09	9-Nov-09	9-Nov-09		
Sample Location	10m transect, true right bank	10m transect, middle of stream bed	10m transect, true left bank	30m transect, true right rank	30m transect, middle of stream bed	30m transect, true left bank	50m transect, true right rank	50m transect, middle of stream bed	50m transect, true left bank	ISQG-Low	ISQG-High
Chromium	48	42	38	42	32	52	39	44	43	80	370
Copper	10	7	6	13	5	17	3	8	9	65	270
Zinc	96	110	73	161	65	244	54	87	102	200	410
Lead	36	38	21	64	17	99	14	28	36	50	220

	Validation Sample Details and Analytical Results												ANZECC Sediment Quality Guidelines ¹	
URS Sample Reference	B/70R	B/70M	B/70L	B/90R	B/90M	B/90L	B/110R	B/110M	B/110L	B/130R	B/130M	B/130L		
Laboratory Sample Reference	SA12964-E	SA12964-E	SA12964-E	SA12964-F	SA12964-F	SA12964-F	SA12964-K	SA12964-K	SA12964-K	SA12964-L	SA12964-L	SA12964-L		
Date Sampled	9-Nov-09	9-Nov-09	9-Nov-09	11-Nov-09	11-Nov-09	11-Nov-09	25-Nov-09	25-Nov-09	25-Nov-09	26-Nov-09	26-Nov-09	26-Nov-09		
Sample Location	70m transect, true right bank	70m transect, middle of stream bed	70m transect, true left bank	90m transect, true right bank	90m transect, middle of stream bed	90m transect, true left bank	110m transect, true right bank	110m transect, middle of stream bed	110m transect, true left bank	130m transect, true right bank	130m transect, middle of stream bed	130m transect, true left bank	ISQG-Low	ISQG-High
Chromium	42	39	54	43	43	42	42	46	37	33	33	44	80	370
Copper	7	4	11	8	8	8	12	10	4	1	2	5	65	270
Zinc	63	63	181	65	80	65	127	133	67	47	51	63	200	410
Lead	18	16	70	20	28	19	44	56	31	11	15	20	50	220

All units mg/kg dry weight
Bold - exceeds the ANZECC Sediment Guidelines
A Exceeds ISQG-High
- No Data
1 ANZECC, 2000. National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.
Values taken from Table 3.5.1



Photograph 1: Cell B immediately downstream of Cofferd Dam 1 prior to the commencement of excavation.



Photograph 2: Looking upstream towards Cofferd Dam 1 during excavation.



Photograph 3: The stream bed following the excavation of the contaminated material.



Photograph 4: The stream bed following the excavation of the contaminated material.



Photograph 5: Looking downstream towards the rail bridge. The gas main can be seen immediately downstream of the bridge.



Photograph 6: Looking downstream towards Cofferdam 2. Photograph taken from on top of the rail bridge, the gas main can be seen in the foreground.

Cell C/D

The excavation of Cell C began on 7 December 2009. It was decided that coffer dam 3 (which was part of the original design) would be removed, and cells C and D would be treated as one cell (see **Figure 6-1**). The location of coffer dam 4 was also moved approximately 15 m upstream from the original design location.

Prior to the excavation of contaminated material commencing, changes to the excavation methodology were discussed and implemented. In previous cells, excavator movements within the streambed, coupled with excess water, caused a considerable amount of the underlying clean sediment to be mixed with the contaminated material, thus increasing the volume of material removed to landfill.

Therefore, for this and all remaining cells, a long reach excavator was used to remove the 'ooze' from the streambed to the load out point(s). In addition, longitudinal and lateral drainage channels were excavated in the ooze to allow the drainage of latent water and groundwater to the dewatering pumps.

Excavation of the bulk of the contaminated material was completed before the Christmas/New Year shut down period. The stream bed was spot-checked using the XRF and then coffer dam 4 was lowered, and normal stream flow resumed, in accordance with the agreed Flood Contingency Plan. Cofferdam 4 was raised and the cell dewatered again after the Christmas/New Year period. Some further excavation of contaminated material was undertaken and the cell validated.

Highly Contaminated 'Type D' Material

During the planning and design stage of the project it had been established that the sediment in the section approximately between chainages 1105 and 960 contained concentrations of lead, zinc, copper and chromium that were significantly higher than elsewhere in the stream. This area of highly contaminated material was classified as 'Type D' material for the landfill. With the re-positioning of the coffer dams, this material was contained in Cell D, and the upstream part of Cell E.

6.2 Works

A summary of the works carried out in Cell C/D is presented in **Table 6-1**.

Table 6-1 Cell C/D - Summary of works

Date 'ooze' excavation commenced	7 December 2009
Top/bottom of cell	Top: coffer dam 2; Bottom: coffer dam 4
Length of cell	196 m
Weather conditions during excavation	Rainfall over the weekend of 12 and 13 December 2009 caused the cell to flood.
Truckloads of 'ooze' removed (approximate)	556
Volume of 'ooze' removed	4037 m ³ [Note: Volume provided to URS by BPC Ltd. Does not include material removed from 'seams' – see Section 3.1]
Number of validation transects/samples	10 transects, 30 samples
Civil works carried out in the cell following remediation	- Widening and deepening of stream channel - Fitting of wing walls to service outfalls

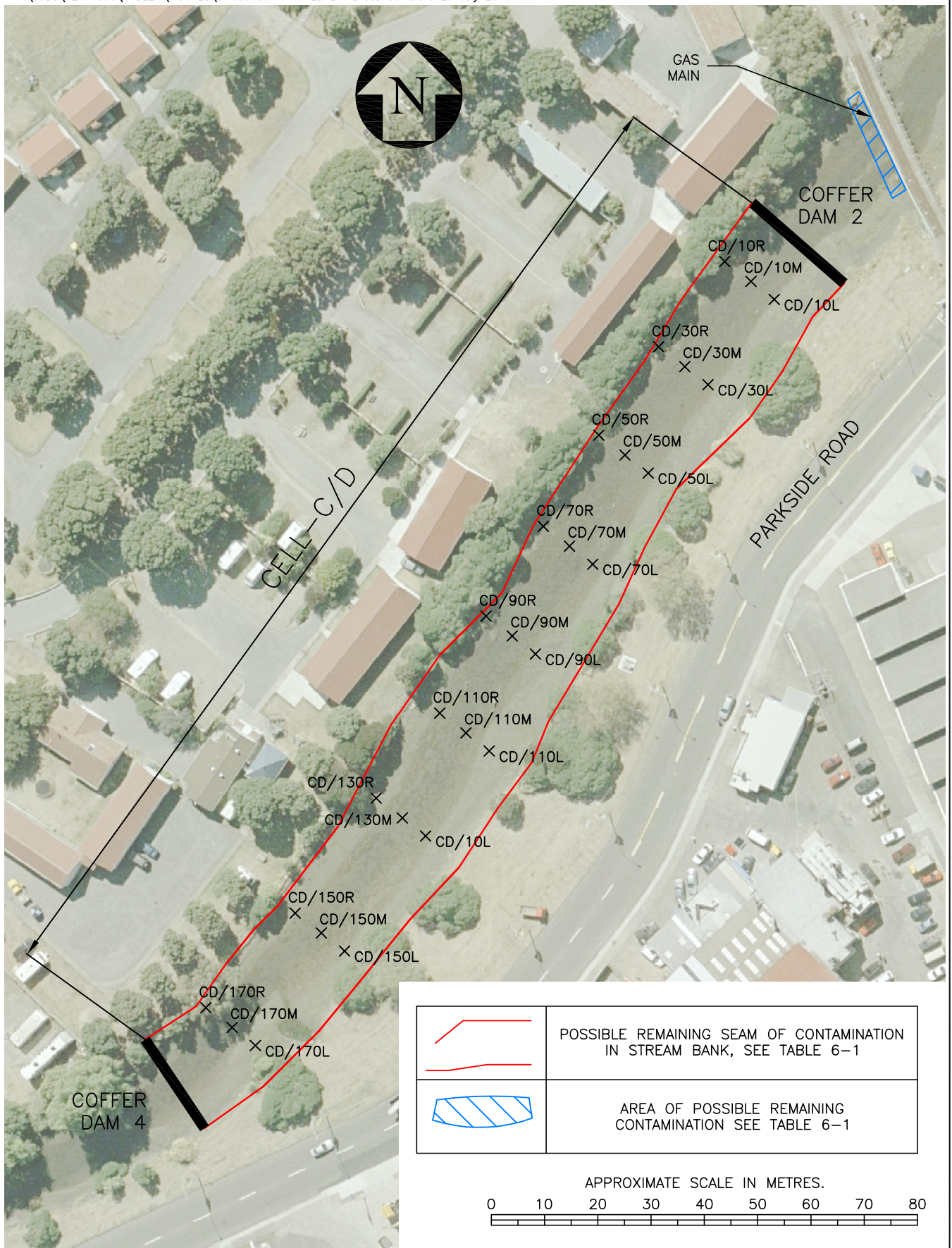
6 Cell C/D

Locations of remaining contaminated material (see Figure 6-1) Note: TRB = true right bank; TLB = true left bank	A seam of contaminated material remained in both the TRB and TLB following the completion of the widening and deepening works. This seam was scalloped out and replaced with clean material where practicable. Some contaminated material may remain behind the overlying capping layer.
Areas not validated	None
Date validation complete	15 January 2010
Other notes/considerations	'Ooze' removal took place in December 2009 and January 2010. Over the Christmas/New Year period. Cofferdam 4 was lowered in accordance with the 'Waiwhetu Stream Flood Contingency Plan', and the cell was flooded. - The material excavated from cell D was classified as 'type D' material.

6.3 XRF and Laboratory Analysis

The validation sample results for Cell C/D are presented in **Table 6-2**, and a sample location plan is presented in **Figure 6-1**. All validation samples were screened with the portable XRF prior to being sent to the laboratory.

All validation results were below ISQG-High criteria and therefore comply with condition 21 of Resource Consent No: WGN090127 [27265].



XRef's — —	Tab FIG 1	Designed JC	Client CPG NEW ZEALAND LTD. Project WAIWHETU STREAM REMEDATION PROJECT	 URS New Zealand Limited Lambton House 160 Lambton Quay PO Box 3367 Wellington New Zealand Ph 0-4-496 3750 Fax 0-4-496 3755
CAD File GW750k01 FIG 1		Drawn ABG		
Scales 1:1000—A4		Checked		
Original size A4		Approved		
Status DRAFT		Date 19/5/10		
			Title CELL - C/D VALIDATION SAMPLE LOCATIONS	
			Drawing Number FIGURE 6-1	



Table 6-2: Cell C/D Validation Sediment Sample Analytical Results Compared to ANZECC Sediment Quality Guidelines

	Validation Sample Details and Analytical Results										
URS Sample Reference	CD/10R	CD/10M	CD/10L	CD/30R	CD/30M	CD/30L	CD/50R	CD/50M	CD/50L	ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	SA13074-C	SA13074-C	SA13074-C	SA13074-C	SA13074-C	SA13074-C	SA13074-D	SA13074-D	SA13074-D		
Date Sampled	13-Jan-10	13-Jan-10	13-Jan-10	13-Jan-10	13-Jan-10	13-Jan-10	14-Jan-10	14-Jan-10	14-Jan-10		
Sample Location	10m transect, true right rank	10m transect, middle of stream bed	10m transect, true left bank	30m transect, true right rank	30m transect, middle of stream bed	30m transect, true left bank	50m transect, true right rank	50m transect, middle of stream bed	50m transect, true left bank	ISQG-Low	ISQG-High
Chromium	34	34	29	35	36	37	28	33	32	80	370
Copper	6	3	1	4	2	2	1	1	<1	65	270
Zinc	95	51	49	62	50	55	45	56	45	200	410
Lead	44	16	16	28	14	18	13	20	11	50	220

	Validation Sample Details and Analytical Results										
URS Sample Reference	CD/70R	CD/70M	CD/70L	CD/90R	CD/90M	CD/90L	CD/110R	CD/110M	CD/110L	ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	SA13074-D	SA13074-D	SA13074-D	SA13074-E	SA13074-E	SA13074-E	SA13074-E	SA13074-E	SA13074-E		
Date Sampled	14-Jan-10	14-Jan-10	14-Jan-10	15-Jan-10	15-Jan-10	15-Jan-10	15-Jan-10	15-Jan-10	15-Jan-10		
Sample Location	70m transect, true right rank	70m transect, middle of stream bed	70m transect, true left bank	90m transect, true right rank	90m transect, middle of stream bed	90m transect, true left bank	110m transect, true right rank	110m transect, middle of stream bed	110m transect, true left bank	ISQG-Low	ISQG-High
Chromium	25	26	24	29	35	32	28	33	27	80	370
Copper	<1	<1	1	<1	1	1	1	1	1	65	270
Zinc	43	47	44	46	51	48	47	49	47	200	410
Lead	12	14	17	13	14	13	14	13	17	50	220

	Validation Sample Details and Analytical Results													
URS Sample Reference	CD/130R	CD/130M	CD/130L	CD/150R	CD/150M	CD/150L	CD/170R	CD/170M	CD/170L	CD/190R	CD/190M	CD/190L	ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	SA13074-E	SA13074-E	SA13074-E	SA13074-E	SA13074-E	SA13074-E	SA13074-F	SA13074-F	SA13074-F	SA13074-F	SA13074-F	SA13074-F		
Date Sampled	15-Jan-10	15-Jan-10	15-Jan-10	15-Jan-10	15-Jan-10	15-Jan-10	15-Jan-10	15-Jan-10	15-Jan-10	15-Jan-10	15-Jan-10	15-Jan-10		
Sample Location	130m transect, true right rank	130m transect, middle of stream bed	130m transect, true left bank	150m transect, true right rank	150m transect, middle of stream bed	150m transect, true left bank	170m transect, true right rank	170m transect, middle of stream bed	170m transect, true left bank	190m transect, true right rank	190m transect, middle of stream bed	190m transect, true left bank	ISQG-Low	ISQG-High
Chromium	36	35	33	27	29	34	31	26	26	28	31	28	80	370
Copper	4	2	3	2	2	3	1	1	1	<1	2	1	65	270
Zinc	56	56	54	62	47	59	59	52	46	49	66	48	200	410
Lead	17	15	16	69	12	18	100	75	21	17	176	16	50	220

All units mg/kg dry weight

Bold - exceeds the ANZECC Sediment Guidelines

- No Data

1 ANZECC, 2000. National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.

Values taken from Table 3.5.1

CLIENT: CPG New Zealand Ltd

PROJECT: Waiwhetu Stream Remediation

FILE: J:\Jobs\42771630\5 Works\Field notes - Sampling - Lab\Lab and XRF analysis\Results tables\Cell C and D\Waiwhetu Stream Remediation Project - Cell C & D Validation samples.xls



Photograph 1: Cell C during the early stages of excavation. Cofferdam 3 (in background) was removed during the works.



Photograph 2: Cell C during the early stages of excavation. A long-reach excavator was used for Cell C/D and all downstream cells.



Photograph 3: Looking upstream towards coffer dam 2 following excavation.



Photograph 4: Looking upstream towards coffer dam 2 following excavation.



Photograph 5: Cell D during excavation.



Photograph 6: Cell C/D following excavation.

Cell E

The excavation of Cell E began on 21 January 2010. Due to the re-positioning of coffer dam 4 (described in Section 6), the material excavated within 15 m downstream of coffer dam 4 was classified as 'Type D' material, and was handled accordingly by the landfill. The remainder of the material in Cell E was classified as 'Type B' by Silverstream Landfill.

7.1 Works

A summary of the works carried out in Cell E is presented in **Table 7-1**.

Table 7-1 Cell E - Summary of works

Date 'ooze' excavation commenced	21 January 2010
Top/bottom of cell	Top: coffer dam 4; bottom: coffer dam 5.
Length of cell	210 m
Weather conditions during excavation	No significant rainfall events
Truckloads of 'ooze' removed (approximate)	451
Volume of 'ooze' removed	2980 m ³ [Note: Volume provided to URS by BPC Ltd. Does not include material removed from 'seams' – see Section 3.1]
Number of validation transects/samples	10 transects, 24 samples
Flood protection and civil works in cell	- Reno mattresses, massbloc wall and rock rip-rap around Hutt Park Bridge - Widening and deepening of stream channel - Fitting of wing walls to service outfalls
Locations of remaining contaminated material (see Figure 7-1) Note: TRB = true right bank; TLB = true left bank	- A seam of contaminated material remained in both the TRB and TLB following the completion of the widening and deepening works. This seam was scalloped out and replaced with clean material where practicable. Some contaminated material may remain behind the overlying capping layer. - E/70 and E/90 transects (see below).
Areas not validated (see Fig 7-1)	E/70 and E/90 transects were not validated at CPG instruction as this section (beneath the Hutt Park Bridge) was to be covered with reno mattresses. Visual inspection and XRF spot check only.
Date validation complete	4 February 2010
Other notes/considerations	The material removed from within 15 m (approximately) of coffer dam 4 was classified as 'type D' material. The remainder was 'type B'.

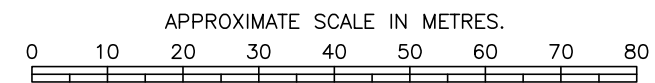
7.2 XRF and Laboratory Analysis

The validation sample results for Cell E are presented in **Table 7-2** and a sample location plan is presented in **Figure 7-1**. All validation samples were screened with the portable XRF prior to being sent to the laboratory.

All validation results were below ISQG-High criteria and therefore comply with condition 21 of Resource Consent No: WGN090127 [27265].



NOTE: E/70R, E70M, E70L,E90R, E90M, E90L NO SAMPLE COLLECTED, SEE TABLE 7-1.	
	POSSIBLE REMAINING SEAM OF CONTAMINATION IN STREAM BANK, SEE TABLE 7-1
	AREA OF POSSIBLE REMAINING CONTAMINATION SEE TABLE 7-1



								Tab FIG 7-1	 URS New Zealand Limited Level 4, Lambton House 160 Lambton Quay PO Box 3367, Wellington, 6140 Phone: 0-4-496 3750 Fax: 0-4-496 3755	CPG NEW ZEALAND LTD.	WAIWHETU STREAM REMEDIATION PROJECT			
							Scales 1:1000-A3 1:2000-A4				Status			
											Drawing Number FIGURE 7-1	Revision A		
A							Original Size A3							
Rev	Revision Description					Designed	Drawn	Checked	Approved	Date				



Table 7-2: Cell E Validation Sediment Sample Analytical Results Compared to ANZECC Sediment Quality Guidelines

	Validation Sample Details and Analytical Results										
URS Sample Reference	E/10R	E/10M	E/10L	E/30R	E/30M	E/30L	E/50R	E/50M	E/50L	ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	SA13074-I	SA13074-I	SA13074-I	SA13074-I	SA13074-I	SA13074-I	SA13074-I	SA13074-I	SA13074-I		
Date Sampled	28-Jan-10	28-Jan-10	28-Jan-10	28-Jan-10	28-Jan-10	28-Jan-10	28-Jan-10	28-Jan-10	28-Jan-10		
Sample Location	10m transect, true right bank	10m transect, middle of stream bed	10m transect, true left bank	30m transect, true right bank	30m transect, middle of stream bed	30m transect, true left bank	50m transect, true right bank	50m transect, middle of stream bed	50m transect, true left bank	ISQG-Low	ISQG-High
Chromium	31	32	32	31	30	31	36	35	29	80	370
Copper	1	4	22	<1	1	2	1	2	2	65	270
Zinc	51	69	70	52	59	50	52	55	52	200	410
Lead	13	142	200	21	22	15	13	13	13	50	220

	Validation Sample Details and Analytical Results										
URS Sample Reference	E/70R	E/70M	E/70L	E/90R	E/90M	E/90L	E/110R	E/110M	E/110L	ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	Not validated as per CPG instruction. This area is to be covered with reno mattresses.						SA13118-A	SA13118-A	SA13118-A		
Date Sampled							3-Feb-10	3-Feb-10	3-Feb-10		
Sample Location	70m transect, true right bank	70m transect, middle of stream bed	70m transect, true left bank	90m transect, true right bank	90m transect, middle of stream bed	90m transect, true left bank	110m transect, true right bank	110m transect, middle of stream bed	110m transect, true left bank	ISQG-Low	ISQG-High
Chromium	Not validated as per CPG instruction. This area is to be covered with reno mattresses.						38	42	31	80	370
Copper							5	8	2	65	270
Zinc							90	73	54	200	410
Lead							65	28	14	50	220

	Validation Sample Details and Analytical Results													
URS Sample Reference	E/130R	E/130M	E/130L	E/150R	E/150M	E/150L	E/170M	E/170L	E/170R	E/190M	E/190L	E/190R	ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	SA13118-A	SA13118-A	SA13118-A	SA13118-A	SA13118-A	SA13118-A	SA13118-A	SA13118-A	SA13118-B	SA13118-A	SA13118-A	SA13118-B		
Date Sampled	3-Feb-10	3-Feb-10	3-Feb-10	3-Feb-10	3-Feb-10	3-Feb-10	3-Feb-10	3-Feb-10	4-Feb-10	3-Feb-10	3-Feb-10	4-Feb-10		
Sample Location	130m transect, true right bank	130m transect, middle of stream bed	130m transect, true left bank	150m transect, true right bank	150m transect, middle of stream bed	150m transect, true left bank	170m transect, middle of stream bed	170m transect, true left bank	170m transect, true right bank	190m transect, middle of stream bed	190m transect, true left bank	190m transect, true right bank	ISQG-Low	ISQG-High
Chromium	34	37	34	32	29	32	30	29	31	34	36	36	80	370
Copper	2	5	2	2	3	3	5	2	1	2	3	7	65	270
Zinc	54	62	54	49	47	52	62	53	49	106	150	186	200	410
Lead	14	23	15	14	13	14	20	15	13	39	15	91	50	220

All units mg/kg dry weight

Bold - exceeds the ANZECC Sediment Guidelines

- No Data

1 ANZECC, 2000. National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.

Values taken from Table 3.5.1



Photograph 1: Looking upstream towards coffer dam 4. Photograph taken from Hutt Park Bridge.



Photograph 2: Cell E during excavation, looking downstream towards coffer dam 5.



Photograph 3: Cell E at coffer dam 5 during excavation.



Photograph 4: Looking upstream during excavation.



Photograph 5: Looking downstream towards coffer dam 5 following excavation.



Photograph 6: Looking upstream following excavation.



Photograph 7: Looking upstream towards coffer dam 4. Photograph taken from Hutt Park Bridge following excavation and installation of erosion and scour protection.



Photograph 8: Looking downstream towards Hutt Park Bridge, following excavation and installation of erosion and scour protection.

Cell F/G

Excavation works began on 17 February 2010. Cofferdam 6 (which was part of the original design) was removed to make cells F and G one cell.

The historical outfall of the Awamutu Stream (now a stormwater outfall) joins the stream on the true right bank at approximately chainage 770 (see **Figure 8-1**). The outfall was excavated as per the rest of the cell up to the edge of Hutt Park Road.

8.1 Works

A summary of the works carried out in Cell F/G is presented in **Table 8-1**.

Table 8-1 Cell F/G - Summary of works

Date 'ooze' excavation commenced	17 February 2010
Top/bottom of cell	Top: coffer dam 5; Bottom: coffer dam 7
Length of cell	290 m
Weather conditions during excavation	Severe southerly storm on 12 March 2010. Cells did not flood.
Truckloads of 'ooze' removed (approximate)	814
Volume of 'ooze' removed	6558 m ³ [Note: Volume provided to URS by BPC Ltd. Does not include material removed from 'seams' – see Section 3.1]
Number of validation transects/samples	14 transects, 42 samples
Flood protection and civil works in cell	- Deconstruction of the Hutt Park footbridge and realignment of attached water main at approximately chainage 695 - Realignment of sewer crossing at approximately chainage 550 - Widening and deepening of stream channel - Fitting of wing walls to service outfalls
Locations of remaining contaminated material (see Figure 8-1) Note: TRB = true right bank; TLB = true left bank	- A seam of contaminated material remained in both the TRB and TLB following the completion of the widening and deepening works. This seam was scalloped out and replaced with clean material where practicable. Some contaminated material may remain behind the overlying capping layer. - The historical Awamutu Stream outfall was visually inspected and spot-checked with the XRF, however as it did not fall on a validation transect, no validation samples were collected. No inspection of the box culvert running beneath Hutt Park Road was carried out following the removal of contaminated material by JetVac due to safety reasons.
Areas not validated	None
Date validation complete	18 March 2010
Other notes/considerations	- The remedial excavation in Cell F/G extended below the final design profile. The cell was excavated and validated, and then backfilled to profile using the bank material that would otherwise be removed during the widening and deepening works. - JetVac were engaged to remove the contaminated material from the box culvert running beneath Hutt Park Road using a vacuum truck.

8 Cell F/G

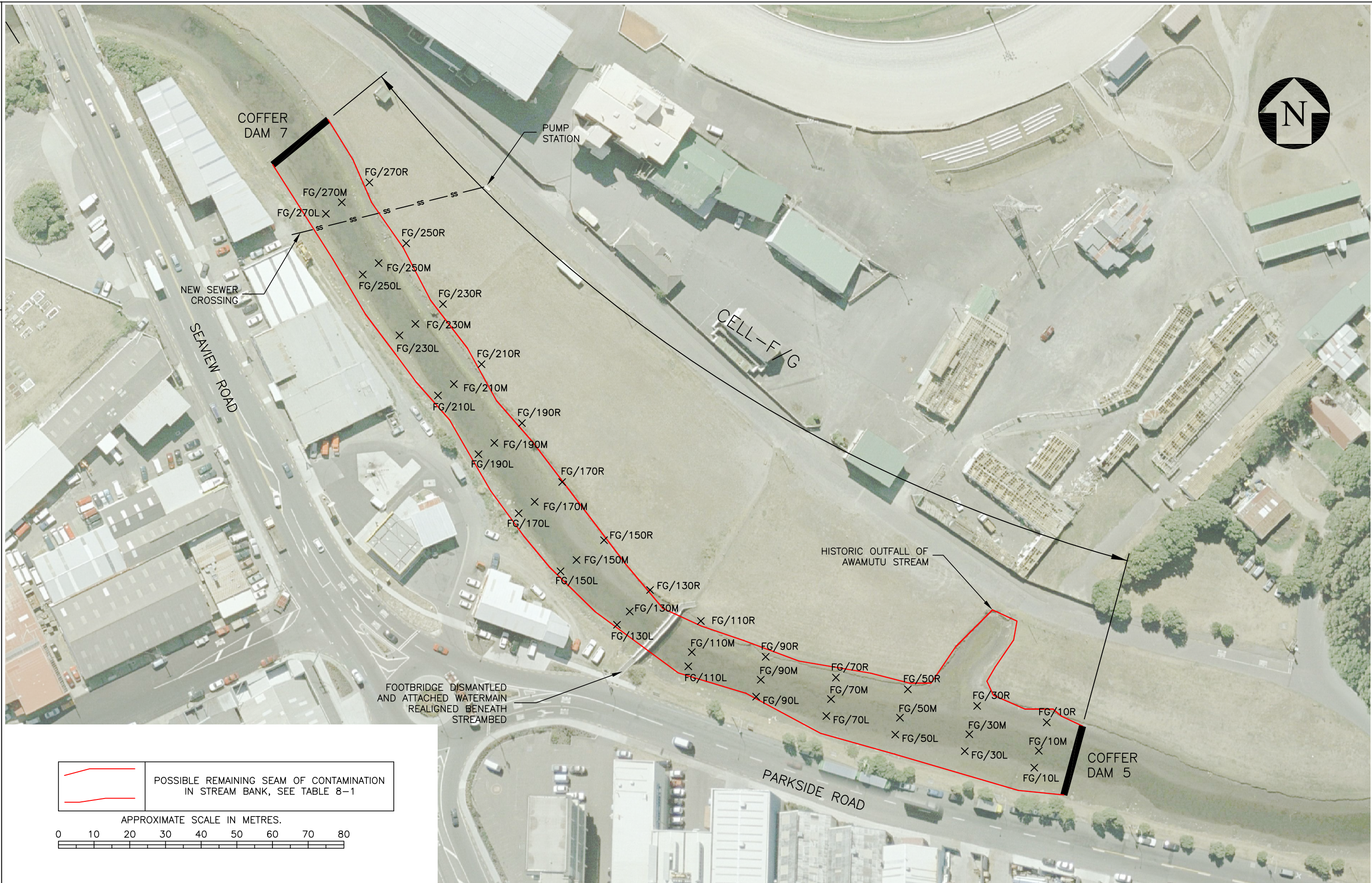
8.2 XRF and Laboratory Analysis

The validation sample results for Cell F/G are presented in **Table 8-2** and a sample location plan is presented in **Figure 8-1**. All validation samples were screened with the portable XRF prior to being sent to the laboratory.

All validation results were below ISQG-High criteria and therefore comply with condition 21 of Resource Consent No: WGN090127 [27265].

URS accepts no liability for the use of this drawing where it has been provided in electronic format, nor for any changes made to it following its issue. URS considers the printed version to be binding. A hard copy of this drawing is held on file by URS and may be provided if requested.

© Document copyright of URS New Zealand Limited 2010 and may only be used for its intended purpose.



POSSIBLE REMAINING SEAM OF CONTAMINATION
IN STREAM BANK, SEE TABLE 8-1

APPROXIMATE SCALE IN METRES.

0 10 20 30 40 50 60 70 80

						Tab	FIG 8-1
						Scales	1:1000-A3 1:2000-A4
						Original Size	A3
A							
Rev	Revision Description	Designed	Drawn	Checked	Approved	Date	



URS New Zealand Limited
Level 4, Lambton House
160 Lambton Quay
PO Box 3367, Wellington, 6140
Phone: 0-4-496 3750
Fax: 0-4-496 3755

CPG NEW ZEALAND LTD.

WAIWHETU STREAM REMEDIATION PROJECT

CELL F/G VALIDATION
SAMPLE ELOCATIONS

Status

Drawing Number

FIGURE 8-1

Revision

A



Table 8-2: Cell F/G Validation Sediment Sample Analytical Results Compared to ANZECC Sediment Quality Guidelines

	Validation Sample Details and Analytical Results																
URS Sample Reference	FG/10R	FG/10M	FG/10L	FG/30R	FG/30M	FG/30L	FG/50R	FG/50M	FG/50L	FG/70R	FG/70M	FG/70L	FG/90R	FG/90M	FG/90L	ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	SA13206-D	SA13206-A	SA13206-A	SA13206-D	SA13206-A	SA13206-A	SA13206-A	SA13206-A	SA13206-A	SA13206-B	SA13206-B	SA13206-B	SA13206-B	SA13206-B	SA13206-B		
Date Sampled	11-Mar-10	10-Mar-10	10-Mar-10	11-Mar-10	10-Mar-10	10-Mar-10	10-Mar-10	10-Mar-10	10-Mar-10	10-Mar-10	10-Mar-10	10-Mar-10	10-Mar-10	10-Mar-10	10-Mar-10		
Sample Location	10m transect, true right bank	10m transect, middle of stream bed	10m transect, true left bank	30m transect, true right bank	30m transect, middle of stream bed	30m transect, true left bank	50m transect, true right bank	50m transect, middle of stream bed	50m transect, true left bank	70m transect, true right bank	70m transect, middle of stream bed	70m transect, true left bank	90m transect, true right bank	90m transect, middle of stream bed	90m transect, true left bank	ISQG-Low	ISQG-High
Chromium	33	36	32	34	32	33	33	34	37	39	35	32	38	36	33	80	370
Copper	3	1	4	2	3	2	2	1	3	4	3	2	5	3	3	65	270
Zinc	48	54	106	84	85	51	50	48	82	122	74	51	87	65	51	200	410
Lead	14	13	15	34	18	19	14	12	39	72	30	14	46	24	13	50	220

	Validation Sample Details and Analytical Results																
URS Sample Reference	FG/110R	FG/110M	FG/110L	FG/130R	FG/130M	FG/130L	FG/150R	FG/150M	FG/150L	FG/170R	FG/170M	FG/170L	FG/190R	FG/190M	FG/190L	ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	SA13206-B	SA13206-B	SA13206-B	SA13206-F	SA13206-F	SA13206-F	SA13206-C	SA13206-C	SA13206-C	SA13206-C	SA13206-C	SA13206-C	SA13206-C	SA13206-C	SA13206-C		
Date Sampled	10-Mar-10	10-Mar-10	10-Mar-10	16-Mar-10	16-Mar-10	16-Mar-10	10-Mar-10	10-Mar-10	10-Mar-10	10-Mar-10	10-Mar-10	10-Mar-10	10-Mar-10	10-Mar-10	10-Mar-10		
Sample Location	110m transect, true right bank	110m transect, middle of stream bed	110m transect, true left bank	130m transect, true right bank	130m transect, middle of stream bed	130m transect, true left bank	150m transect, true right bank	150m transect, middle of stream bed	150m transect, true left bank	170m transect, true right bank	170m transect, middle of stream bed	170m transect, true left bank	190m transect, true right bank	190m transect, middle of stream bed	190m transect, true left bank	ISQG-Low	ISQG-High
Chromium	38	32	35	34	38	36	43	41	33	37	35	44	54	36	39	80	370
Copper	3	1	2	1	2	6	6	6	3	5	3	10	14	3	1	65	270
Zinc	65	58	60	55	53	95	110	82	51	79	76	130	183	55	57	200	410
Lead	27	25	16	17	16	46	63	37	11	34	38	49	116	17	16	50	220

	Validation Sample Details and Analytical Results													
URS Sample Reference	FG/210R	FG/210M	FG/210L	FG/230R	FG/230M	FG/230L	FG/250R	FG/250M	FG/250L	FG/270R	FG/270M	FG/270L	ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	15-Mar-10	15-Mar-10	15-Mar-10	15-Mar-10	15-Mar-10	15-Mar-10	15-Mar-10	15-Mar-10	15-Mar-10	16-Mar-10	16-Mar-10	16-Mar-10		
Date Sampled	SA13206-E	SA13206-E	SA13206-E	SA13206-E	SA13206-E	SA13206-E	SA13206-E	SA13206-E	SA13206-E	SA13206-F	SA13206-F	SA13206-F		
Sample Location	210m transect, true right bank	210m transect, middle of stream bed	210m transect, true left bank	230m transect, true right bank	230m transect, middle of stream bed	230m transect, true left bank	250m transect, true right bank	250m transect, middle of stream bed	250m transect, true left bank	270m transect, true right bank	270m transect, middle of stream bed	270m transect, true left bank	ISQG-Low	ISQG-High
Chromium	40	37	43	36	36	43	31	43	43	43	39	47	80	370
Copper	9	4	8	2	3	7	2	10	6	6	9	11	65	270
Zinc	88	75	144	53	64	129	54	131	124	129	130	203	200	410
Lead	167	33	85	14	23	82	16	86	89	98	102	153	50	220

All units mg/kg dry weight
Bold - exceeds the ANZECC Sediment Guidelines
- No Data
1 ANZECC, 2000. National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.
Values taken from Table 3.5.1



Photograph 1: View looking downstream towards coffer dam 7 during the removal of contaminated material.



Photograph 2: View looking upstream towards the Hutt Park footbridge that was dismantled during excavation works in this cell.



Photograph 3: View looking downstream towards the Hutt Park footbridge that was dismantled during excavation works in this cell.



Photograph 4: View looking downstream towards coffer dam 7 following the removal of the contaminated material.



Photograph 5: View looking upstream towards coffer dam 6 following the removal of the contaminated material.

Cell H

Cell H began at coffer dam 7 and included the stream channel and the salt marsh down to coffer dam 8 at approximately chainage 364 (see **Figure 9-1**). This configuration differed to the original design due to the discovery of contaminated material downstream in the U-Channel. This is discussed further in Section 10.

9.1 Works

The excavation of Cell H began at coffer dam 7 on 22 March 2010, and progressed downstream towards Seaview Road Bridge and coffer dam 8.

The Awamutu Stream discharged into Cell H, immediately upstream of Seaview Road Bridge. Additional dewatering pumps were used to mitigate the increase in base flow into the cell, particularly during rain events.

A summary of the works carried out in Cell H is presented in **Table 9-1**

Table 9-1 Cell H - Summary of works

Date 'ooze' excavation commenced	22 March 2010
Top/bottom of cell	Top: coffer dam 7; bottom: coffer dam 8 (subsequently removed after installation of coffer dam 9)
Length of cell	161 m
Weather conditions during excavation	Heavy rain on 24 March caused the cell to flood.
Truckloads of 'ooze' removed (approximate)	642
Volume of 'ooze' removed	4862 m ³ [Note: Volume provided to URS by BPC Ltd. Does not include material removed from 'seams' – see Section 3.1]
Number of validation transects/samples	8 transects, 28 samples
Flood protection and civil works in cell	• Realignment of sewer crossing at approximately chainage 470 • Reno mattresses on approach to and surrounding Seaview Road Bridge • Reno mattresses on top of trunk main sewer at approximately chainage 430 • CFA piling and panel placement along TRB • Widening and deepening of stream channel • Re-instatement of salt marsh

9 Cell H

Locations of remaining contaminated material (see Figure 9-1) Note: TRB = true right bank; TLB = true left bank	- Upstream of Seaview Road Bridge, A seam of contaminated material remained in both the TRB and TLB following the completion of the widening and deepening works. This seam was scalloped out and replaced with clean material where practicable. Some contaminated material may remain behind the overlying capping layer. - No visual inspection of the TRB downstream of Seaview Road Bridge was possible as a CFA pile wall and concrete panels were installed. This has the effect of containing any remaining contamination. - It is likely that contaminated material remains beneath the boardwalk on the edge of the salt marsh, beyond the extent of excavation (see Section 9.3). It was not practical to excavate further, as doing so would undermine the gardens and Urupa carpark.
Areas not validated	None
Date validation complete	26 April 2010
Other notes/considerations	- The Awamutu Stream discharged into Cell H, immediately upstream of the Seaview Road Bridge. Additional dewatering pumps were used to mitigate the increase in base flow into the cell, particularly during rain events. - The remedial excavation in Cell H downstream of Seaview Road Bridge extended below the final design profile in places. The cell was excavated and validated, and then backfilled to profile using imported Hutt River gravels.

9.2 Trunk main sewer

One of the high risk areas of the project was working around the trunk main sewer crossing located immediately downstream of the Seaview Road bridge, at approximately chainage 420. The sewer crossing, encased in concrete, was constructed in 1959. Its condition was unknown. Prior to works commencing in the vicinity of the sewer crossing, a contingency plan was developed by the Engineer to define a clear methodology for working around the sewer crossing, and a clear procedure for managing any incidents that may occur.

9.3 Salt Marsh

The salt marsh, located adjacent to the Urupa on the true left hand side of the stream between the Seaview Road Bridge and approximately chainage 300, was incorporated into cells H and M, and was excavated concurrently with the stream channel.

The extent of the contaminated material in the salt marsh was not accurately known prior to works commencing. GWRC consulted with Iwi during the works, and the preference was for all contaminated material to be removed from the salt marsh, and then for it to be rebuilt to its original profile.

The salt marsh was excavated up to an agreed extent behind the boardwalk, and filter cloth material was placed on the cut face to provide a marker of the extent of the excavation. The salt marsh was

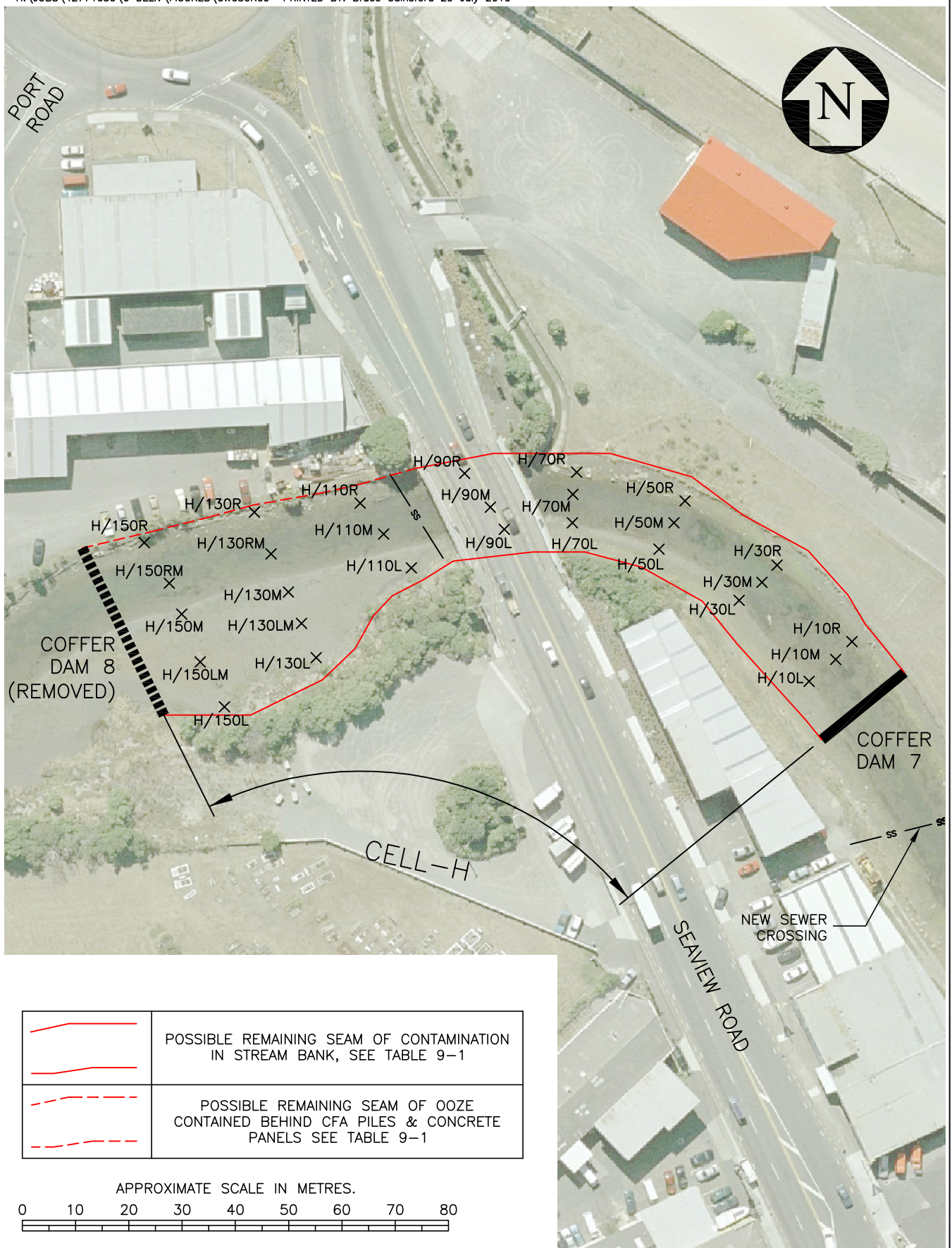
9 Cell H

rebuilt in layers using imported angular gravels as a base, with river gravels on top. All material was screened with the portable XRF prior to placement.

9.4 XRF and Laboratory Analysis

The validation sample results for Cell H are presented in **Table 9-2** and a sample location plan is presented in **Figure 9-1**. All validation samples were screened with the portable XRF prior to being sent to the laboratory.

All validation results were below ISQG-High criteria and therefore comply with condition 21 of Resource Consent No: WGN090127 [27265].



XRef's — —	Tab FIG 1	Designed JC	Client CPG NEW ZEALAND LTD.	URS URS New Zealand Limited Lambton House 160 Lambton Quay P.O. Box 3367 Wellington New Zealand Ph 0-4-496 3750 Fax 0-4-496 3755
CAD File 19/5/10 FIG 1		Drawn ABG		
Scales 1:1000-A4		Checked		
Original size A4		Approved		
Status DRAFT		Date 30/10/09		
			Project WAIWHETU STREAM REMEDIAION PROJECT	Title CELL - H VALIDATION SAMPLE LOCATIONS
			Drawing Number FIGURE 9-1	Rev A



Table 9-2: Cell H Validation Sediment Sample Analytical Results Compared to ANZECC Sediment Quality Guidelines

	Validation Sample Details and Analytical Results																
URS Sample Reference	H/10R	H/10M	H/10L	H/30R	H/30M	H/30L	H/50R	H/50M	H/50L	H/70R	H/70M	H/70L	H/90R	H/90M	H/90L	ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	SA13287-A	SA13287-A	SA13287-A	SA13287-A	SA13287-A	SA13287-A	SA13287-A	SA13287-A	SA13287-A	SA13287-E	SA13287-E	SA13287-E	SA13287-E	SA13287-E	SA13287-E		
Date Sampled	8-Apr-10	8-Apr-10	8-Apr-10	8-Apr-10	8-Apr-10	8-Apr-10	8-Apr-10	8-Apr-10	8-Apr-10	19-Apr-10	19-Apr-10	19-Apr-10	19-Apr-10	19-Apr-10	19-Apr-10		
Sample Location	10m transect, true right bank	10m transect, middle of stream bed	10m transect, true left bank	30m transect, true right bank	30m transect, middle of stream bed	30m transect, true left bank	50m transect, true right bank	50m transect, middle of stream bed	50m transect, true left bank	70m transect, true right bank	70m transect, middle of stream bed	70m transect, true left bank	90m transect, true right bank	90m transect, middle of stream bed	90m transect, true left bank	ISQG-Low	ISQG-High
Chromium	36	33	35	32	33	29	37	34	39	36	40	33	49	59	37	80	370
Copper	4	3	1	1	3	2	4	4	4	6	5	4	15	21	4	65	270
Zinc	93	57	48	51	53	49	71	57	94	83	78	82	219	223	86	200	410
Lead	33	18	13	13	15	13	31	17	37	39	41	35	160	182	51	50	220

	Validation Sample Details and Analytical Results														
URS Sample Reference	H/110R	H/110M	H/110L	H/130R	H/130MR	H/130M	H/130ML	H/130L	H/150R	H150MR	H/150M	H/150ML	H/150L	ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	SA13287-F	SA13287-F	SA13287-F	SA13287-F	SA13287-F	SA13287-F	SA13287-G	SA13287-G	SA13287-F	SA13287-F	SA13287-F	SA13287-F	SA13287-G		
Date Sampled	22-Apr-10	22-Apr-10	22-Apr-10	22-Apr-10	22-Apr-10	22-Apr-10	26-Apr-10	26-Apr-10	22-Apr-10	22-Apr-10	22-Apr-10	22-Apr-10	26-Apr-10		
Sample Location	110m transect, true right bank	110m transect, middle of stream bed	110m transect, true left bank	130m transect, true right bank	130m transect, middle/true right of streambed	130m transect, middle of stream bed	130m transect, middle/true left of streambed	130m transect, true left bank	150m transect, true right bank	150m transect, middle/true right of streambed	150m transect, middle of stream bed	150m transect, middle/true left of streambed	150m transect, true left bank	ISQG-Low	ISQG-High
Chromium	33	36	34	30	36	30	31	30	36	35	31	28	29	80	370
Copper	2	3	2	2	5	1	3	2	16	5	4	0	3	65	270
Zinc	59	76	56	47	64	51	54	57	83	60	61	45	58	200	410
Lead	23	35	21	13	24	13	16	22	51	24	25	12	12	50	220

All units mg/kg dry weight
Bold - exceeds the ANZECC Sediment Guidelines
- No Data
1 ANZECC, 2000. National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.
Values taken from Table 3.5.1
A Exceeds ISQG-Low
B Exceeds ISQG-High



Photograph 1: Cell H looking upstream towards coffer dam 7, prior to the removal of contaminated material.



Photograph 2: Cell H looking downstream towards Seaview Road Bridge, prior to the removal of contaminated material.



Photograph 3: Cell H looking downstream towards Seaview Road Bridge, following the removal of contaminated material.



Photograph 4: Cell H looking downstream towards Seaview Road Bridge, following the removal of contaminated material and during the installation of reno mattresses.



Photograph 5: View looking upstream towards Seaview Road Bridge of the salt marsh in Cell H during the removal of contaminated material.



Photograph 6: Close-up view of the contaminated material excavated from the salt marsh.



Photograph 7: View looking upstream towards Seaview Road Bridge of the salt marsh in Cell H following the removal of contaminated material.



Photograph 8: View from Seaview Road Bridge looking downstream following the removal of contaminated material, and during the re-building of the salt marsh.



Photograph 9: View of the re-built salt marsh



Photograph 10: View looking upstream towards Seaview Road Bridge following the removal of contaminated material, and the rebuilding of the salt marsh.

Cell M

There was no Cell M in the original design of the remediation work, however streambed sampling carried out on 3 December 2009 between Port Road Bridge and the entry to the U-Channel showed that contaminated material was likely to be present between chainage 290 and chainage 200. It was therefore decided that another cell would be required to allow for excavation of this material.

Cell M therefore began at coffer dam 8 and included the stream channel, the salt marsh and the U-Channel down to coffer dam 9 (at chainage 200) (see **Figure 10-1**).

10.1 Works

The excavation of Cell M commenced at coffer dam 8 on 6 April 2010. Cofferdam 8 was removed during the early stages of excavation; however cells H and M would continue to be treated as separate cells.

A summary of the works carried out in Cell M is presented in **Table 10-1**.

Table 10-1 Cell M - Summary of works

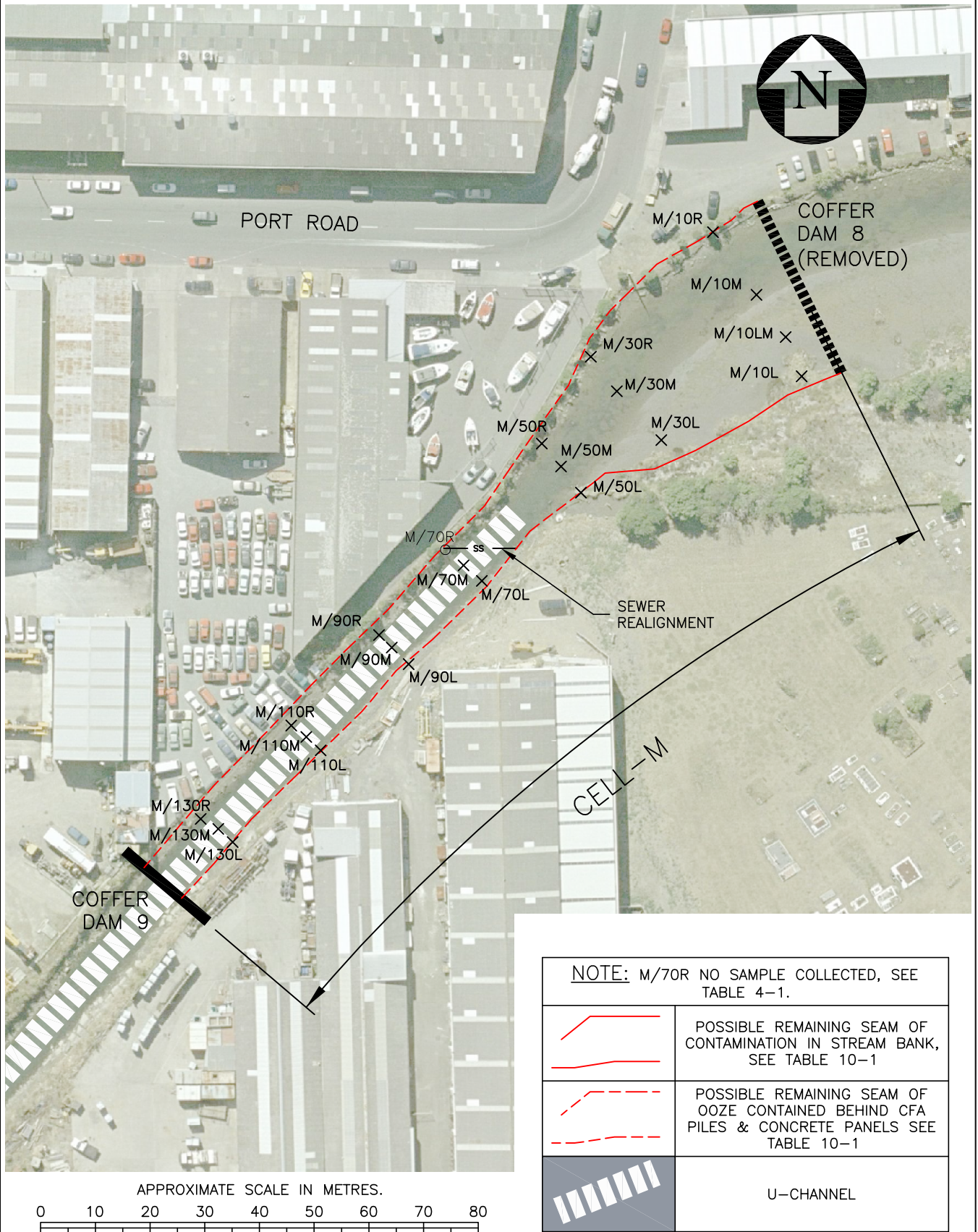
Date 'ooze' excavation commenced	6 April 2010
Top/bottom of cell	Top: coffer dam 8 (removed during the works), Bottom: coffer dam 9.
Length of cell	164 m
Weather conditions during excavation	Heavy rain on 27 April caused the cell to flood
Truckloads of 'ooze' removed (approximate)	240
Volume of 'ooze' removed	3768 m ³ [Note: Volume provided to URS by BPC Ltd. Does not include material removed from 'seams' – see Section 3.1]
Number of validation transects/samples	7 transects, 21 samples
Flood protection and civil works in cell	- CFA piling and panel placement on both sides of the stream - Re-instatement of Salt Marsh - Realignment of sewer crossing at approximately chainage 280.
Locations of remaining contaminated material (see Figure 10-1) Note: TRB = true right bank; TLB = true left bank	- No visual inspection of the TRB, or the TLB downstream of the salt marsh was possible as a CFA pile wall and concrete panels have been installed. This has the effect of containing any remaining contamination. - It is likely that contaminated material remains in the TLB on the edge of the salt marsh, beyond the extent of excavation (see Section 9.3). It was not practical to excavate further, as doing so would undermine the gardens and Urupa carpark.
Areas not validated (see Fig 10-1)	M/70R not validated as sample point was located on top of ch280 sewer crossing concrete slab
Date validation complete	4 May 2010
Other notes/considerations	The remedial excavation in Cell M extended below the final design profile in places. The cell was excavated and validated, and then backfilled to profile using imported Hutt River gravels.

10 Cell M

10.2 XRF and Laboratory Analysis

The validation sample results for Cell M are presented in **Table 10-2** and a sample location plan is presented in **Figure 10-1**. All validation samples were screened with the portable XRF prior to being sent to the laboratory.

All validation results were below ISQG-High criteria and therefore comply with condition 21 of Resource Consent No: WGN090127 [27265].



XRef's	Tab	Designed	JC
-	FIG 1		
CAD File		Drawn	ABG
GW750k01			
FIG 1		Checked	
Scales	1:1000-A4	Approved	
Original size	A4	Date	19/5/10
Status	DRAFT		

Client
CPG NEW ZEALAND LTD.

Project
**WAIWHETU STREAM
REMEDATION PROJECT**

URS

URS New Zealand Limited
Lambton House
160 Lambton Quay
PO Box 3367
Wellington
New Zealand
Ph 0-4-496 3750
Fax 0-4-496 3755

Title
CELL - M VALIDATION SAMPLE LOCATIONS
Drawing Number
FIGURE 10-1
Rev
A



Table 10-2: Cell M Validation Sediment Sample Analytical Results Compared to ANZECC Sediment Quality Guidelines

Validation Sample Details and Analytical Results												
URS Sample Reference	M/10R	M/10M	M/10ML	M/10L	M/30R	M/30M	M/30L	M/50R	M/50M	M/50L	ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	SA13287-G	SA13287-G	SA13287-G	SA13347-A	SA13287-H	SA13287-H	SA13347-A	SA13287-H	SA13287-H	SA13287-H		
Date Sampled	26-Apr-10	26-Apr-10	26-Apr-10	3-May-10	30-Apr-10	30-Apr-10	3-May-10	30-Apr-10	30-Apr-10	30-Apr-10		
Sample Location	10m transect, true right rank	10m transect, middle of stream bed	10m transect, middle left of stream bed	10m transect, true left bank	30m transect, true right rank	30m transect, middle of stream bed	30m transect, true left bank	50m transect, true right rank	50m transect, middle of stream bed	50m transect, true left bank	ISQG-Low	ISQG-High
Chromium	34	44	31	33	33	32	35	33	31	29	80	370
Copper	34	12	3	4	4	3	6	2	1	2	65	270
Zinc	48	136	72	70	58	58	76	50	55	48	200	410
Lead	13	98	12	13	16	22	58	14	22	13	50	220

Validation Sample Details and Analytical Results														
URS Sample Reference	M/70R	M/70M	M/70L	M/90R	M/90M	M/90L	M/110R	M/110M	M/110L	M/130R	M/130M	M/130L	ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	Sampling point not accessible located on top of concrete slab on chainage 280 sewer crossing.	SA13347-A	SA13347-A-2	SA13287-H	SA13287-H	SA13287-H	SA13287-F	SA13287-F	SA13287-F	SA13287-F	SA13287-F	SA13287-F		
Date Sampled		3-May-10	4-May-10	30-Apr-10	30-Apr-10	30-Apr-10	22-Apr-10	22-Apr-10	22-Apr-10	22-Apr-10	22-Apr-10	22-Apr-10		
Sample Location		70m transect, middle of stream bed	70m transect, true left bank	90m transect, true right rank	90m transect, middle of stream bed	90m transect, true left bank	110m transect, true right rank	110m transect, middle of stream bed	110m transect, true left bank	130m transect, true right rank	130m transect, middle of stream bed	130m transect, true left bank	ISQG-Low	ISQG-High
Chromium		30	33	35	33	36	37	40	47	42	38	37	80	370
Copper		3	3	3	3	3	4	5	10	6	6	4	65	270
Zinc		60	61	56	55	64	56	65	77	59	59	58	200	410
Lead		79	25	18	15	23	18	26	41	19	18	18	50	220

All units mg/kg dry weight

Bold - exceeds the ANZECC Sediment Guidelines

- No Data

1 ANZECC, 2000. National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.

Values taken from Table 3.5.1

A Exceeds ISQG-Low

B Exceeds ISQG-High



Photograph 1: Cell M immediately downstream of coffer dam 8 prior to the removal of contaminated material.



Photograph 2: Cell M (U-channel) looking downstream towards coffer dam 9 prior to the removal of contaminated material.



Photograph 3: Cell M looking upstream during the removal of contaminated material



Photograph 4: Cell M (U-channel) looking downstream towards coffer dam 9 following the removal of contaminated material.



Photograph 5: Cell M looking upstream following the removal of contaminated material and during the re-building of the stream bed level.



Photograph 6: Cell M (U-channel) looking downstream towards coffer dam 9 following the rebuilding of the salt marsh and the stream bed.

Water Sampling

11.1 Resource Consent Conditions

Condition 5 of resource consent WGN090127 [27267], sets out the minimum water sampling requirements which, in brief, are:

- There is to be a sampling point downstream of the active sedimentation cell.
- The downstream sampling point shall be no more than 150 m downstream from the most downstream coffer dam.
- Samples shall be collected within 24 hours of the first discharge occurring, then every third day while the discharge is occurring.
- Date, time, sampling method, tidal and weather conditions are to be recorded.
- Each sample shall be analysed for total and dissolved lead, zinc, copper, chromium, total suspended solids and pH.
- Specific electrical conductivity, turbidity, water temperature, water depth and an estimate of flow rate at the time of sampling are to be measured in the field at the time of sampling.
- The sampler will visually inspect the stream at the sampling point for any conspicuous oil, grease, film, scum, foam, floatable or suspended material, change in colour or visual clarity, biological growth, objectionable odour and erosion at the point of discharge.

11.2 Water Sampling Methodology

Sampling points were selected based on distance from the most downstream coffer dam, and accessibility.

Samples were collected from the flow of the stream using a telescopic sampling pole. The sample was collected directly into a 1L unpreserved sample bottle then decanted into two 100 mL acid preserved sample bottles. A summary of the bottles used and the relevant analyses is presented in **Table 11-1**.

Table 11-1 Water Sample Bottles and Analyses

Bottle type	Analysis
1 L unpreserved	Total suspended solids, pH
100 mL field filtered, acid preserved	Total dissolved Zn, Pb, Cr, Cu
100 mL acid preserved	Total recoverable Zn, Pb, Cr, Cu

Samples were collected prior to, and as near to, low tide as possible. If low tide did not fall within the hours of 7 am and 6 pm, or if the sampling day fell on a Sunday, the sample was collected the following day.

The samples were put on ice in chilly bins and couriered to R J Hill Laboratories (Hills), an IANZ-accredited laboratory in Hamilton, for analysis.

Hills' estimated method detection limits for water analysis of key contaminants (trace level) are 0.0005 g/m³ (chromium, copper), 0.0001 g/m³ (lead), and 0.001 g/m³ (zinc), which are sufficient to satisfy the consent conditions (i.e. ANZECC Water Quality Guidelines Table 3.4.1: Trigger Values For Freshwater (at 80% protection)).

Field measurements (e.g. conductivity, turbidity, temperature) were made at the same time the sample was collected using a Horiba U52-02 Multiparameter instrument. Water depth was visually assessed

11 Water Sampling

in the field at the time of sampling, and the stream flow rate was recorded from GWRC's website (data from the flow meter at White's Line East.¹

Laboratory results were typically received after 10 working days, and were then compared with the freshwater toxicity trigger values (for the 80% level of species protection) as specified in condition 9 of the Resource Consent, and provided to the Engineer's representative. While not required by the resource consent, the laboratory results were also compared with the marine toxicity trigger values (for the 80% level of species protection) for information and comparison.

11.3 Water Sample Locations

The four locations where water samples were collected during the works are summarised in **Table 11-2**, and are presented in **Figure 11-1**.

Table 11-2 Water Sample Locations

Sample Location	Location	Excavation of Cell(s)
1	Approx. 150 m downstream of coffer dam 5	A and B
2	Approx. 80 m downstream of coffer dam 6	C/D and E
3	Approx. 80 m downstream of coffer dam 7	F/G
4	Approx. 5 m downstream of Port Road Bridge.	H and M

The water sampling results are presented in **Table 11-3**.

¹ <http://www.gw.govt.nz/waiwhetu-stream-at-whites-line-east>



APPROXIMATE SCALE IN METRES.
0 40 80 120 160 200 240 280 320 360 400

Rev	Revision Description	Designed	Drawn	Checked	Approved	Date
A						

Tab	FIG 11-1
Scales	1:1000-A3 1:2000-A4
Original Size	A3



URS New Zealand Limited
Level 4, Lambton House
160 Lambton Quay
PO Box 3367, Wellington, 6140
Phone: 0-4-496 3750
Fax: 0-4-496 3755

CPG NEW ZEALAND LTD.

WAIWHETU STREAM REMEDIATION PROJECT

WATER SAMPLE
LOCATION PLAN

Status	
Drawing Number	FIGURE 11-1
Revision	A



Table 11-3: Surface Water Analytical Results Compared to ANZECC Water Quality Guidelines

	Sample Details and Analytical Results								ANZECC Freshwater / Marine Guidelines ¹
Sample Date	3-Nov-09	6-Nov-09	9-Nov-09	12-Nov-09	16-Nov-09	19-Nov-09	24-Nov-09	27-Nov-09	
Sample Location	Sampling Point 1: Approx 150 m downstream of coffer dam 5								
URS Sample time (NZDT)	12:00	14:45	17:30	7:20	11:20	15:55	17:30	7:00	
URS Sample Number	93270	93271	93272	93273	93274	93275	93276	93277	
Laboratory Sample Reference	740770.1	741840.1	742701.1	743756.1	744180.1	745506.1	747332.1	747635.1	
pH	7.3	7.5	7.5	7.6	7.4	7.6	7.6	7.5	
Total									
Suspended Solids (g/m ³)	180	52	51	11	220	92	160	12	- / -
Chromium	0.014	0.0041	< 0.0051	0.00062	0.0096	0.0039	0.0062	< 0.00051	- / -
Copper	0.024	0.0085	0.0059	0.0028	0.014	0.01	0.013	0.0031	- / -
Lead	0.17	0.058	0.077	0.016	0.12	0.05	0.061	0.014	- / -
Zinc	0.44	0.12	0.089	0.032	0.2	0.084	0.11	0.021	- / -
Dissolved									
Chromium	< 0.00050	< 0.00050	< 0.0010	< 00050	< 0.00050	< 0.00050	< 0.00050	< 0.00050	ID / 0.0906
Copper	0.0013	0.0011	0.016^A	0.0013	< 0.0010	0.0013	0.00096	< 0.0010	0.0025 / 0.008
Lead	0.0034	0.0059	0.0033	0.0011	0.0019	0.0047	0.0028	0.0014	0.0094 / 0.012
Zinc	0.0056	0.011	0.012	0.013	0.0048	0.011	0.0054	0.01	0.031 / 0.043
Field Parameters									
Temperature (°C)	17.9	20.5	14.38	10.3	16.24	20.4	20.71	15.9	- / -
Electrical Conductivity (µs/cm)	634	2431	2118	2169	2224	535	1336	2080	- / -
Turbidity (ntu)	270	76.4	53	15.1	342	134	270	17.6	- / -
Depth (mm)	500	500	500	300	500	500	500	500	- / -
Flow (L/sec)	225	179	180	180	154	150	131	122	- / -

	Sample Details and Analytical Results									ANZECC Freshwater / Marine Guidelines ¹
Sample Date	8-Dec-09	14-Dec-09	17-Dec-09	14-Jan-10	22-Jan-10	27-Jan-10	29-Jan-10	2-Feb-10	10-Feb-10	
Sample Location	Sampling Point 2: Approx 80 m downstream of coffer dam 6									
URS Sample time (NZDT)	16:10	10:00	13:00	10:15	16:15	8:30	9:30	14:20	9:00	
URS Sample Number	93278	93279	93280	93281	93282	93283	93284	93285	93286	
Laboratory Sample Reference	752398.1	752398.2	753751.1	758327	760443.1	761612.1	762392.1	763567.1	766045.1	
pH	7.4	7.4	7.4	7.7	7.5	7.6	7.8	8	7.9	
Total										
Suspended Solids (g/m ³)	27	15	15	15	61	23	13	51	9	- / -
Chromium	0.0024	0.0017	0.0018	< 0.0011	0.0074	0.002	< 0.0026	0.0036	< 0.0011	- / -
Copper	0.0034	0.0035	0.0037	0.0024	0.013	0.0049	< 0.0026	0.0041	0.0013*	- / -
Lead	0.26	0.13	0.63	0.038	0.47	0.12	0.052	0.11	0.019	- / -
Zinc	0.068	0.058	0.057	0.031	0.22	0.082	0.036	0.11	0.016	- / -
Dissolved										
Chromium	< 0.0010	< 0.00050	0.0018	< 0.0010	0.0074	< 0.00050	< 0.0025	< 0.0010	< 0.0010	ID / 0.0906
Copper	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0025	0.0017	< 0.0025	< 0.0010	0.0029^A	0.0025 / 0.008
Lead	0.03^{AB}	0.015^{AB}	0.095^{AB}	0.0087	0.0034	0.0073	0.0042	0.0022	0.0063	0.0094 / 0.012
Zinc	0.0099	0.02	0.016	0.014	0.036^A	0.02	0.0072	0.0027	0.0052	0.031 / 0.043
Field Parameters										
Temperature (°C)	20.26	17.12	19.31	18.54	20.59	19.47	20.62	20.8	19.23	- / -
Electrical Conductivity (µs/cm)	3200	618	1880	2620	9060	850	5580	2990	4000	- / -
Turbidity (ntu)	78.8	32.9	39.2	28.4	121	38.5	20.1	131	23.2	- / -
Depth (mm)	500	500	500	500	750	500	500	500	500	- / -
Flow (L/sec)	180	165	131	141	520	159	165	142	167	- / -

	Sample Details and Analytical Results						ANZECC Freshwater / Marine Guidelines ¹
Sample Date	17-Feb-10	23-Feb-10	26-Feb-10	1-Mar-10	4-Mar-10	10-Mar-10	
Sample Location	Sampling Point 3: Approx 70 m downstream of Seaview Road Bridge						
URS Sample time (NZDT)	14:41	16:45	8:35	11:55	15:00	8:30	
URS Sample Number	93287	93288	93289	93290	93291	93292	
Laboratory Sample Reference	767431.1	770208.1	770444.1	7711000.1	772654.1	774501.1	
pH	8.0	8	7.6	7.8	7.8	7.4	
Total							
Suspended Solids (g/m ³)	49	64	14	20	25	7.4	- / -
Chromium	0.0033	0.0060	0.0013	< 0.0026	0.0027	< 0.0011	- / -
Copper	0.0049	0.0058	0.0042	< 0.0026	0.0031	0.0014	- / -
Lead	0.078	0.083	0.020	0.020	0.062	0.0098	- / -
Zinc	0.110	0.120	0.060	0.033	0.072	0.013	- / -
Dissolved							
Chromium	< 0.00050	< 0.0010	< 0.00050	< 0.0025	< 0.0025	< 0.0010	ID / 0.0906
Copper	0.00061	< 0.0010	< 0.0025	< 0.0025	< 0.0025	< 0.0010	0.0025 / 0.008
Lead	0.0012	0.0014	0.0029	0.00070	0.0017	0.0025	0.0094 / 0.012
Zinc	0.0031	0.0033	0.029	< 0.0050	< 0.0050	0.0041	0.031 / 0.043
Field Parameters							
Temperature (°C)	20.54	21.73	18.87	19.22	20.33	18.46	- / -
Electrical Conductivity (µs/cm)	3220	2690	2150	2330	2870	4100	- / -
Turbidity (ntu)	178	483	97.4	102	69.4	14.9	- / -
Depth (mm)	500	500	500	500	500	500	- / -
Flow (L/sec)	81	65	65	56	48	45	- / -

	Sample Details and Analytical Results							ANZECC Freshwater / Marine Guidelines ¹
Sample Date	23-Mar-10	26-Mar-10	30-Mar-10	6-Apr-10	9-Apr-10	15-Apr-10	20-Apr-10	
Sample Location	Sampling Point 4: Waiwhetu Stream mouth, Port Road.							
URS Sample time	17:00*	07:30*	11:30*	16:30	6:45	9:30	14:24	
URS Sample Number	93293	93294	93295	93296	93297	93298	93299	
Laboratory Sample Reference	780319.1	780319.2	780319.3	784376.1	784376.2	784376.3	786737.1	
pH	5.9**	6.2**	6.2**	7.8	7.8	7.8	7.6	
Total								
Suspended Solids (g/m ³)	57	47	48	7.3	7.3	15.3	49	- / -
Chromium	< 0.003	< 0.003	< 0.003	< 0.011	< 0.011	< 0.011	< 0.010	- / -
Copper	< 0.006	< 0.006	< 0.006	< 0.011	< 0.011	< 0.011	< 0.010	- / -
Lead	0.024	0.024	0.023	0.0025	0.0021	0.0026	0.034	- / -
Zinc	0.035	0.035	0.034	< 0.03	< 0.03	< 0.03	< 0.02	- / -
Dissolved								
Chromium	< 0.003	< 0.003	< 0.003	< 0.010	< 0.010	< 0.010	< 0.010	ID / 0.0906
Copper	< 0.003	< 0.003	< 0.003	< 0.010	< 0.010	< 0.010	< 0.010	0.0025 / 0.008
Lead	0.00090	0.00095	0.00077	< 0.002	< 0.002	< 0.002	0.0021	0.0094 / 0.012
Zinc	0.0060	0.0073	0.0059	< 0.02	< 0.02	< 0.02	< 0.02	0.031 / 0.043
Field Parameters								
Temperature (°C)	16.25	16.25	16.26	15.67	15.66	15.67	17.43	- / -
Electrical Conductivity (µs/cm)	863	1010	1010	2470	2460	2400	1290	- / -
Turbidity (ntu)	82.2	78.2	72.1	50.1	18.2	21	71.6	- / -
Depth (mm)	750	750	750	750	750	750	750	- / -
Flow (L/sec)	69	106	105	131	118	72.7	73	- / -

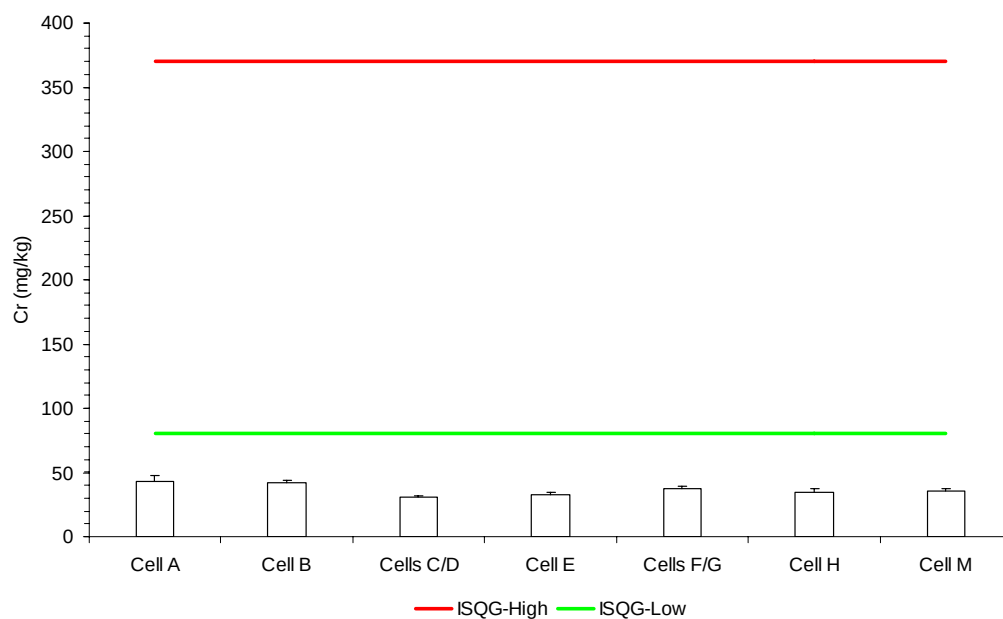
Notes:
* All samples times are in NZST unless marked with an * which sample times are in NZDT
pH values marked with an ** were field-recorded with a portable pH water meter
All results and criteria are expressed in units of mg/L unless otherwise stated.
Criteria used: ANZECC, 2000. National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.
1 Values taken from Table 3.4.1 as trigger values for freshwater, 80% level of protection.
ID - insufficient data is available to derive a reliable trigger value.
- no criteria/ no guideline trigger value
BOLD Denotes Exceedance of ANZECC Guideline criteria
^A Denotes exceedance of ANZECC Freshwater Guidelines

Summary

12.1 Compliance with consent conditions for stream bed sediment sampling

The resource consent that covers works in the bed of the stream associated with the excavation and removal of contaminated sediments (WGN090127 [27265]) includes a number of conditions related to the project. The key condition is that remaining sediments are shown, through validation sampling of the stream bed after excavation, to have key contaminant concentrations below the consent criteria (ANZECC ISQG-High). All validation results were below their respective ISQG-High criteria. The majority of validation results were also below the ANZECC ISQG-Low criteria. The following charts show average concentrations of key contaminants in each of the excavation cells compared to the consent criteria.

Chart 12-1 Average concentrations of Chromium (Cr) in validation samples from all cells.



12 Summary

Chart 12-2 Average concentrations of Copper (Cu) in validation samples from all cells.

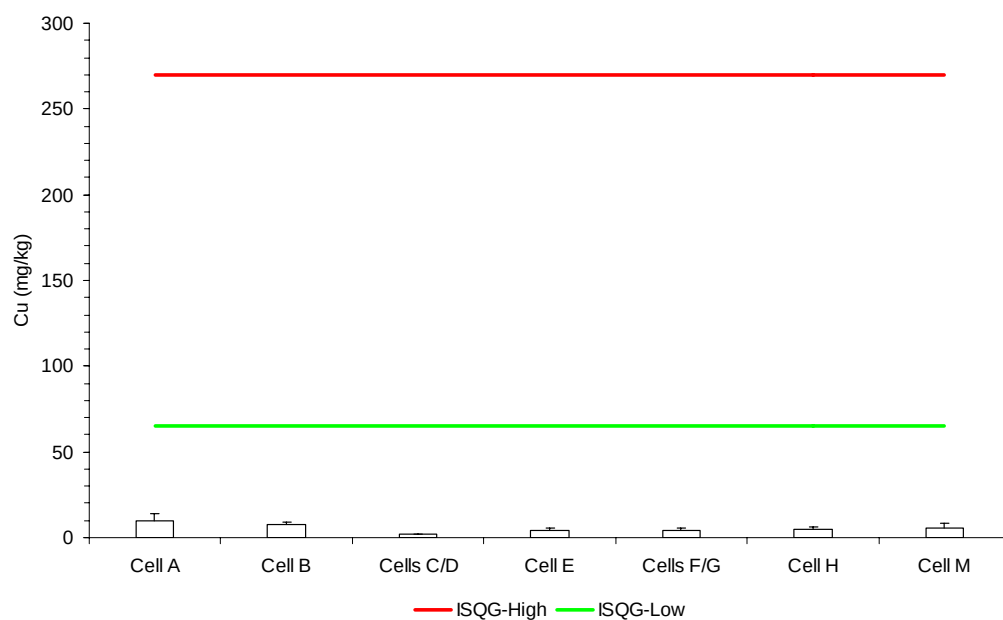
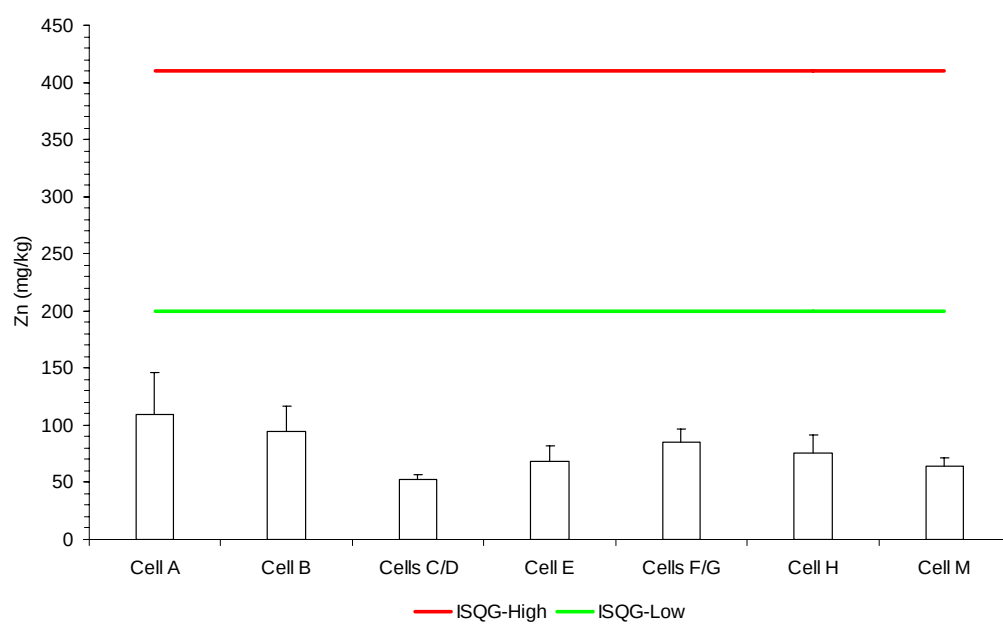
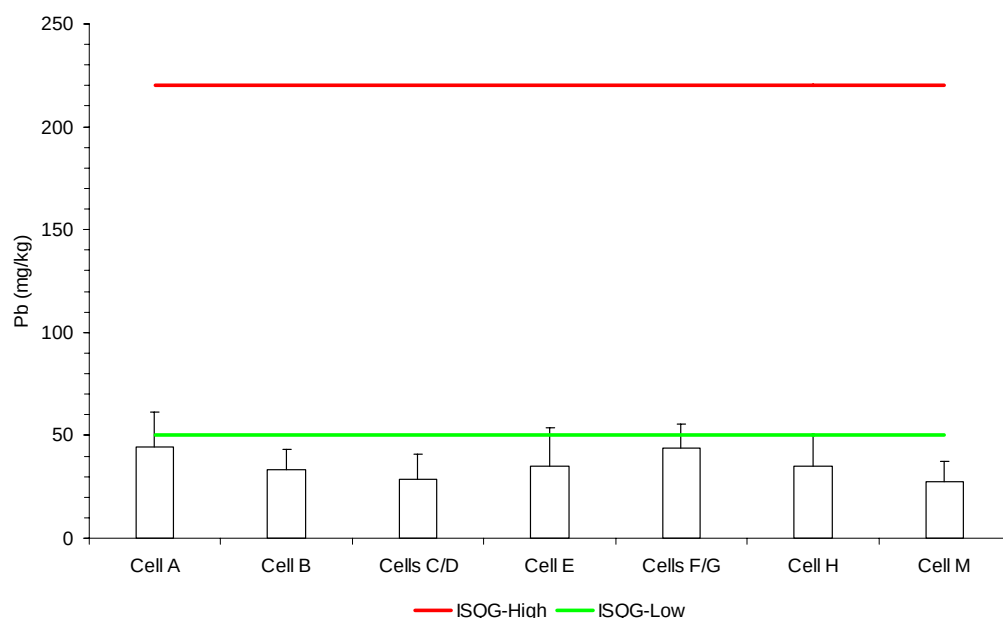


Chart 12-3 Average concentrations of Zinc (Zn) in validation samples from all cells.



12 Summary

Chart 12-4 Average concentrations of Lead (Pb) in validation samples from all cells.



There were some areas of contaminated material that could not be removed due to physical constraints. The resource consent required that any contaminated material remaining be identified and marked on a map, and explanations provided why the material was not removed. These areas and explanations are outlined in Sections 4 to 10. Based on the validation results the project was successful in meeting the resource consent conditions for removal of contaminated sediment.

12.2 Compliance with consent conditions for water sampling

Resource consent (WGN090127 [27265]) sets out the requirements for water monitoring. The sampling methodology is discussed in Section 11, and the sampling results are presented in **Table 11-1**. The resource consent required the comparison of total dissolved lead, zinc, chromium and copper, to the ANZECC Freshwater Toxicity Trigger Values (for the 80% level of species protection) ANZECC, 2000). The exceedances of the guideline criteria are summarised in **Table 12-1**. All other samples complied with the guideline criteria.

Table 12-1 Summary of water sample exceedances

Sample Location	Date sample collected	Sample name	Criteria Exceeded
1	9 Nov 09	93272	Total dissolved Copper
2	8 Dec 09	93278	Total dissolved Lead
2	14 Dec 09	93279	Total dissolved Lead
2	17 Dec 09	93280	Total dissolved Lead
2	22 Jan 10	93282	Total dissolved Zinc
2	10 Feb 10	93286	Total dissolved Copper

12 Summary

Exceedances were only seen at sample locations 1 and 2 (ie, during the excavation of cells A, B, C/D and E). The exceedances were likely due to the disturbance of sediment near the de-watering pump intake(s) in the excavation cell in the hours leading up to the water sample being collected. There was an improvement in the control of water in cell F/G, and in Cells H and M the de-watering pumps were discharged into a separate pipe to the by-pass pipe (as described in Section 2.4). Both of these factors are likely to have contributed to an improvement in the water quality, as no samples from sampling points 3 and 4 exceeded criteria.

References

ANZECC. (2000) *Australia and New Zealand guidelines for fresh and marine water quality, Volume 1, The guidelines*. Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

URS (2006). *The Waiwhetu Cleanup Project: Application for MfE Contaminated Sites Remediation Funding*. November 2006. Application submitted by Greater Wellington Regional Council and Hutt City Council to Ministry for the Environment. (Application prepared by URS New Zealand Ltd).

URS (2008a). *The Waiwhetu Project: Resource Consent Application*. October 2008. Application submitted by Greater Wellington Regional Council and Hutt City Council to Greater Wellington Regional Council. (Application prepared by URS New Zealand Ltd and AC Consulting Ltd).

URS (2008b). *Waiwhetu Project: HCC Resource Consent Application to Hutt City Council*. October 2008. Application submitted by Greater Wellington Regional Council and Hutt City Council to Hutt City Council. (Application prepared by URS New Zealand Ltd and AC Consulting Ltd).

The following bibliography lists previous investigations commissioned by Wellington Regional Council into contamination in the Waiwhetu Stream:

Sheppard, D and Goff, J. (2001). *Preliminary Study of Contaminants and Contaminated Sediments in the Lower reaches of the Waiwhetu Stream, Lower Hutt*.

Sheppard, D and Goff, J. (2001). *Contaminants and contaminated sediments in the Lower Reaches of the Waiwhetu Stream, Lower Hutt, Part 2 Organic Contaminants*. Greater Wellington, Wellington.

Sheppard, D and Goff, J. (2002). *Contaminants and Contaminated sediments in the Lower reaches of the Waiwhetu Stream, Lower Hutt, Part 3, Defining the limits of contaminants*.

Kingett Mitchell Ltd. (2002) *Ecological health of the Waiwhetu Stream*.

URS New Zealand Limited (2002). *Waiwhetu Stream Contaminated Sediments – Remedial Options Screening Study*.

Montgomery Watson Harza (2002). *Waiwhetu Stream Diversion Scoping Study*.

Montgomery Watson Harza (2003). *Waiwhetu Stream Remedial Options Risk Assessment*.

Montgomery Watson Harza (2004). *Waiwhetu Stream Remediation. Final Options Cost Benefit Study*.

Beca Infrastructure (2005). *Waiwhetu Stream Environmental Investigations*.

URS New Zealand Limited (2006). *Waiwhetu Project: Remedial Works Option, Contaminated Stream Bed Site Investigation*.

URS New Zealand Limited (2007). *Waiwhetu Project: Waiwhetu Stream Remediation Trial. Resource Consent Application and Assessment of Environmental Effects*. December 2007. Application submitted by Greater Wellington Regional Council and Hutt City Council to Greater Wellington Regional Council. (Application prepared by URS New Zealand Ltd).

URS New Zealand Limited (2008). *Summary Report – Waiwhetu Stream Remediation Trial*.

Wriggle (2009). *Waiwhetu Stream 2009, Broad and Fine Scale Baseline Monitoring in the Tidal Reaches*. Leigh Stevens and Barry Robertson. June 2009

Limitations

URS New Zealand Limited (URS) has prepared this report for the use of CPG New Zealand Limited and only those third parties who have been authorised in writing by URS to rely on the report. It has been prepared in accordance with the agreed scope of work and for the purpose outlined in Section 1. In particular, the scope of this report is to summarise the remediation aspects only of the remediation and widening and deepening of the Waiwhetu Stream, and is required to satisfy condition 26 of resource consent WGN090127 [27265], in respect of stream bed sediment remaining, and condition 14 of resource consent WGN090127 [27267], in respect of water quality sampling. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

Validation sampling and analysis was conducted in accordance with the agreed scope of works and the resource consent conditions. In particular the validation sampling density, and the suite of chemicals analysed, have been agreed by all parties prior to the works commencing. URS makes no statement or representation as to the existence (or otherwise) of any other chemicals. Conditions vary across the stream and cannot be exhaustively defined by the validation sampling and analysis conducted. The results and estimations expressed may not represent conditions at any location removed from the specific points of sampling. URS provides no guarantee that all contamination in the reach of stream containing the validation sampling points has been removed. The validation results represent contaminant levels at the time of sampling only. Conditions may change at any point in the stream due to migration of contaminants from inside and outside the project area. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Appendix A Resource Consents

WGN090127 [27264] Water permit

WGN090127 [27265] Land use consent

WGN090127 [27266] Land use consent

WGN090127 [27267] Discharge permit

WGN090127 [27268] Discharge permit

WGN090127 [27269] Land use consent

WGN090127 [27270] Land use consent

WGN080127 [27271] Land use consent

WGN090127 [27272] Coastal permit

Resource Consent

RESOURCE MANAGEMENT ACT 1991
Consent No. WGN090127 [27264]
Category: Water permit

Pursuant to sections 104, 104B and 108, and subject to all the relevant provisions of the Resource Management Act 1991 and any regulations made thereunder, a consent in respect of a natural resource is hereby granted to:

Name	Flood Protection Department, Wellington Regional Council	
Address	Flood Protection Department, Wellington Regional Council, PO Box 11646, Wellington 6142	
Duration of consent	Effective: 12 March 2009	Expires: 12 March 2015
Purpose for which right is granted	To temporarily divert the full flow of the Waiwhetu Stream around an active remediation cell, in the stream reach extending downstream from the Bell Road Bridge to the salt marsh area downstream of the Seaview Road Bridge.	
Location	The Waiwhetu Stream, Lower Hutt: the reach downstream from the Bell Road Bridge (south of the trial remediation area), Waiwhetu to the salt marsh area downstream of the Seaview Road Bridge, Seaview, between approximate map references NZMS 260: R27;2670395.5995230 and NZMS 260: R27;2669546.5995063.	
Legal description of land	Various	
Conditions	1 - 7 as attached	

For and on behalf of
 WELLINGTON REGIONAL COUNCIL


 Manager, Environmental Regulation

Date: 12 March 2009

Summary of your rights and responsibilities

(Not part of the resource consent)

This resource consent gives you the right to use a public resource (e.g. water, air, the coastal marine area) in the manner specified in the consent.

You may exercise the resource consent as you see fit provided that you comply with all the conditions of your resource consent and all other laws of the land.

If you wish to change the way you operate under this resource consent or if you wish to change or cancel any consent conditions, please contact the Wellington Regional Council (hereafter referred to as Greater Wellington) prior to making the changes. You may need a formal change to your resource consent conditions.

You may transfer your coastal, discharge, or water permit to any other person. If you sell your operation please contact Greater Wellington and we will arrange the transfer. The service is free of charge.

If your resource consent application contained inaccurate or misleading information, Greater Wellington may cancel or alter the resource consent.

Your resource consent does not:

- provide any warranty of any structure or process;
- provide any guarantee that the resource will be available at all times;
- provide any right of access through or over public or private land;
- negate the need for any approvals necessary under other legislation.

You, as the holder(s) of this resource consent and your agents (including contractors and employees), are jointly and severally liable for compliance with the conditions of this consent. It is important that anyone operating on your behalf fully understands and complies with the conditions of the resource consent.

You are required to pay any relevant charges that are associated with the consent. Greater Wellington fixes these charges under section 36 of the Resource Management Act 1991. The Act allows you to comment on any proposed charges *prior to them being fixed*. Charges may be reviewed every year. If you would like a copy of our current Resource Management Charging Policy please ask us.

You are required to allow Greater Wellington Enforcement Officers access to your site and operation at any reasonable time so that we can inspect your operation and confirm that it is complying with the resource consent.

Your resource consent will lapse if you do not give effect to it within five years of the date it was granted (unless otherwise specified in the resource consent conditions). If you wish to apply for an extension of this lapse date please contact Greater Wellington before the lapse date.

If you stop using your resource consent for a continuous five-year period, Greater Wellington may cancel your resource consent. We will advise you in advance if we propose to cancel your consent. You have the right to object to your consent being cancelled.

This consent is issued without prejudice to any claim that is lodged with the Waitangi Tribunal in relation to the customary ownership of natural resources, whether it be a claim that is awaiting hearing or awaiting settlement by the Crown.

Conditions to Resource Consent WGN090127 [27264]

General conditions

1. The location, design and construction of the diversion shall be in general accordance with the application, and its associated plans and documents, lodged with the Wellington Regional Council on 20 October 2008, and further information received:
 - At the pre hearing meeting on 2 December 2008;
 - On 5 December 2008 (via email); and
 - In the peer review received on 9 December 2008.

For the avoidance of doubt, where information contained in the application is contrary to conditions of this permit, the conditions shall prevail.

Minor changes to the location, design concepts and parameters, implementation and/or operation may be made by the permit holder where practicable and provided that these changes are to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Note: Any significant change from the location, design concepts and parameters, implementation and/or operation may require a new resource consent or a change of consent conditions pursuant to section 127 of the Resource Management Act 1991

2. The Manager, Environmental Regulation, Wellington Regional Council, shall be given a minimum of two working days (48 hours) notice prior to the works commencing.

Note: Notifications can be emailed to notifications@gw.govt.nz.

3. The permit holder shall provide a copy of this permit and any documents referred to in this permit to each operator or contractor undertaking works authorised by this permit, before that operator or contractor starts any works. The permit holder shall verbally brief the contractor regarding the conditions of the permit, prior to the works authorised by this permit commencing.
4. The permit holder shall ensure that a copy of this permit and all documents referred to in this permit, is kept on site at all times and presented to any Wellington Regional Council officer on request.

Works/design standard conditions

5. The permit holder shall ensure that the pump intake structure for the water diversion is screened or designed or adapted to exclude fish. If a screen is to be used on the intake structure it must be screened with a maximum mesh diameter of 3mm so that small fish, eggs and larvae do not enter the intake.
6. The permit holder shall re-instate the flow of the Waiwhetu Stream and remove all material used in the construction of the diversion as soon as is practicable. The materials used in the diversion shall not be removed until all works within a particular active cell, associated with the remediation, channel deepening and widening and erosion and scour protection works have been completed.

12/03/08
M

7. From the exercise of this permit the Wellington Regional Council may review any or all conditions of this permit by giving notice of its intention to do so pursuant to section 128 of the Resource Management Act 1991, at any time within three months of the first and second anniversary of the granting of this permit for the purpose of:

- Dealing with any adverse effects on the environment which may arise from the exercise of this permit, and which is appropriate to deal with at a later stage;
- To review the adequacy of any plans and/or methods used to divert the water; and/or
- Enable consistency with the relevant Regional Freshwater Plan and or with National Environmental Standards.

The Wellington Regional Council shall be entitled to recover from the permit holder the costs of any review, calculated in accordance with and limited to the Council's scale of charges in force and applicable at that time pursuant to Section 36 of the Resource Management Act 1991.

Note: For the purposes of this condition the "exercise of the permit" is deemed to be once the works authorised by this permit have commenced.



Resource Consent

RESOURCE MANAGEMENT ACT 1991

Consent No. WGN090127 [27265]

Category: Land use consent

Pursuant to sections 104, 104B and 108, and subject to all the relevant provisions of the Resource Management Act 1991 and any regulations made thereunder, a consent in respect of a natural resource is hereby granted to:

Name

Flood Protection Department, Wellington Regional Council

Address

Flood Protection Department, Wellington Regional Council, PO Box 11646, Wellington 6142

Duration of consent

Effective: 12 March 2009

Expires: 12 March 2015

Purpose for which right is granted

To undertake works in the bed of the Waiwhetu Stream associated with the excavation and removal of contaminated sediment and the placement, use and removal of an active remediation cell and sedimentation cell coffer dams, including any associated disturbance of and deposition on the stream bed in the stream reach extending downstream from the Bell Road Bridge to the salt marsh area downstream of the Seaview Road Bridge.

Location

The Waiwhetu Stream, Lower Hutt: the reach downstream from the Bell Road Bridge (south of the trial remediation area), Waiwhetu to the salt marsh area downstream of the Seaview Road Bridge, Seaview, between approximate map references NZMS 260: R27;2670395.5995230 and NZMS 260: R27;2669546.5995063.

Legal description of land

Various

Conditions

1 - 31 as attached

For and on behalf of
WELLINGTON REGIONAL COUNCIL

Manager, Environmental Regulation

Date: 12 March 2009

Summary of your rights and responsibilities

(Not part of the resource consent)

This resource consent gives you the right to use a public resource (e.g. water, air, the coastal marine area) in the manner specified in the consent.

You may exercise the resource consent as you see fit provided that you comply with all the conditions of your resource consent and all other laws of the land.

If you wish to change the way you operate under this resource consent or if you wish to change or cancel any consent conditions, please contact the Wellington Regional Council (hereafter referred to as Greater Wellington) prior to making the changes. You may need a formal change to your resource consent conditions.

You may transfer your coastal, discharge, or water permit to any other person. If you sell your operation please contact Greater Wellington and we will arrange the transfer. The service is free of charge.

If your resource consent application contained inaccurate or misleading information, Greater Wellington may cancel or alter the resource consent.

Your resource consent does not:

- provide any warranty of any structure or process;
- provide any guarantee that the resource will be available at all times;
- provide any right of access through or over public or private land;
- negate the need for any approvals necessary under other legislation.

You, as the holder(s) of this resource consent and your agents (including contractors and employees), are jointly and severally liable for compliance with the conditions of this consent. It is important that anyone operating on your behalf fully understands and complies with the conditions of the resource consent.

You are required to pay any relevant charges that are associated with the consent. Greater Wellington fixes these charges under section 36 of the Resource Management Act 1991. The Act allows you to comment on any proposed charges *prior to them being fixed*. Charges may be reviewed every year. If you would like a copy of our current Resource Management Charging Policy please ask us.

You are required to allow Greater Wellington Enforcement Officers access to your site and operation at any reasonable time so that we can inspect your operation and confirm that it is complying with the resource consent.

Your resource consent will lapse if you do not give effect to it within five years of the date it was granted (unless otherwise specified in the resource consent conditions). If you wish to apply for an extension of this lapse date please contact Greater Wellington before the lapse date.

If you stop using your resource consent for a continuous five-year period, Greater Wellington may cancel your resource consent. We will advise you in advance if we propose to cancel your consent. You have the right to object to your consent being cancelled.

This consent is issued without prejudice to any claim that is lodged with the Waitangi Tribunal in relation to the customary ownership of natural resources, whether it be a claim that is awaiting hearing or awaiting settlement by the Crown.

Conditions to Resource Consent

WGN090127 [27265]

General conditions

1. The location, design and construction of the works shall be in general accordance with the application, and its associated plans and documents, lodged with the Wellington Regional Council on 20 October 2008, and further information received:

- At the pre hearing meeting on 2 December 2008;
- On 5 December 2008 (via email); and
- In the peer review received on 9 December 2008.

For the avoidance of doubt, where information contained in the application is contrary to conditions of this consent, the conditions shall prevail.

Minor changes to the location, design concepts and parameters, implementation and/or operation may be made by the consent holder where practicable and provided that these changes are to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Note: Any significant change from the location, design concepts and parameters, implementation and/or operation may require a new resource consent or a change of consent conditions pursuant to section 127 of the Resource Management Act 1991

2. The Manager, Environmental Regulation, Wellington Regional Council, shall be given a minimum of two working days (48 hours) notice prior to the works commencing.

Note: Notifications can be emailed to notifications@gw.govt.nz.

3. The consent holder shall provide a copy of this consent and any documents referred to in this consent to each operator or contractor undertaking works authorised by this consent, before that operator or contractor starts any works. The consent holder shall verbally brief the contractor regarding the conditions of the consent, prior to the works authorised by this consent commencing.
4. The consent holder shall ensure that a copy of this consent and all documents referred to in this consent, is kept on site at all times and presented to any Wellington Regional Council officer on request.
5. All works affecting the Waiwhetu Stream, including tidy up on completion of the works, shall be completed to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Works/Design details

6. Prior to commencing the placement and removal of the coffer dams, the consent holder shall install silt curtains upstream and downstream of the proposed site. The silt curtains shall be installed at a maximum distance of 15 metres from the most upstream or downstream coffer dam or at a distance that is to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council. These silt curtains shall remain in place until works associated with the remediation and channel deepening and widening works have been completed.
7. The consent holder shall ensure the coffer dams are of a sufficient width to exclude water ingress as far as practicable into the active remediation cell while the works are being undertaken.

12/02/09
WJ

8. The consent holder shall ensure that the coffer dams that form the active cell and the sedimentation cells are in place and the active cell is dewatered as far as practicable prior to any excavation works commencing in the active cell.
9. Prior to any work that has the potential to affect neighbouring properties or infrastructure the consent holder shall inform the relevant utility service provider or property owner(s). The consent holder shall ensure that the works do not impede any utility service provider's or property owner(s) access to their property or infrastructure.
10. Where practicable, the closure of the active cell's downstream coffer dam shall occur during low tide, to prevent, as far as is possible, the trapping of fish in the active cell.
11. The tip heights of the coffer dams shall be placed at a sufficient height above the mean high sea level so that tidal waters do not enter the active remediation cell. In the event that tidal waters do enter the active remediation cell, the consent holder shall ensure that the tidal water is appropriately treated prior to being discharged back into the Waiwhetu Stream. The consent holder shall notify the Manager, Environmental Regulation, Wellington Regional Council within 24 hours, or the next working day, of the occurrence and the measures implemented to remedy the tidal overflow.

The consent holder shall keep tidal charts on site for the duration of these works and shall inform the contractor at least one working day in advance of high tide times, in particular the spring tide.

12. All contaminated sediment excavated from the channel in excess of the Interim Sediment Quality Guideline (ISQG) high concentration criteria in Table 3.5.1 of the Australian and New Zealand Environmental and Conservation Council (ANZECC, 2000) Sediment Quality Guidelines shall be removed from the area and disposed of in an appropriate manner. No such sediment is to be stockpiled on the flood plain.
13. Only sediment below the Interim Sediment Quality Guideline (ISQG) high concentration criteria in Table 3.5.1 of the Australian and New Zealand Environmental and Conservation Council (ANZECC, 2000) Sediment Quality Guidelines may be stockpiled on the floodplain. The consent holder shall install a silt fence or any other appropriate sediment control measure that is to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council, between any stockpiles and the stream to ensure no sediment laden runoff discharges to the stream. All stockpiles shall be aligned in such a way as to not impede flood flows and removed from the site as soon as practicable.

Note: Greater Wellington does not consider hay bales as an appropriate sediment control measure.

14. The permit holder shall re-instate the flow of the Waiwhetu Stream and remove all material used to construct the diversion as soon as is practicable but not until all works, associated with the remediation and channel deepening and widening, within the stream bed have been completed.

Works exclusion period

15. No works which impede the full flow of the Waiwhetu stream shall be carried out in the wetted channel during the native fish spawning/migration season (1 August to 30 September inclusive).

Note: The applicant has advised that the installation of the environmental enhancement structures, the works within the u shaped channel, and the works in the stretch between Bell Road Bridge and the remediation works, will take place within the native fish spawning/migration season.

Installation of fyke nets

16. During the period 1 February to 31 May inclusive, and only during those periods when the coffer dams are in place and the flow of the Waiwhetu Stream is stopped, fyke net(s) must be installed upstream of active cell to capture eels.

The consent holder shall ensure the fyke net(s) are in place by the end of each working day, or by 5pm, which ever is earliest.

The consent holder shall ensure that prior to works recommencing the following working day on site any eels caught in the fyke net(s) are relocated to below the most downstream silt curtain and released back into the Waiwhetu Stream during an outgoing tide.

Flood contingency measures

17. The consent holder shall prepare and submit a Flood Contingency Management Plan (FCMP) in relation to the proposed works in the Waiwhetu Stream to the Manager, Environmental Regulation, Wellington Regional Council for approval 20 working days prior to works commencing on site. The FCMP shall include, but not be limited to:

- A detailed description of what contingency methods will be used by the consent holder to reduce and manage the flood effects of the coffer dams in the Waiwhetu Stream;
- A detailed strategy outlining how the identified contingency measures will be undertaken in differing sized flood events/situations. For instance, the use of an on call roster, how those events that may lead to flooding will be identified and tracked, a list of key responsibilities and who will be responsible for implementing them when a flood is occurring.
- A description of what procedures will be used to stabilise the exposed areas of contaminated sediment in the active remediation cell and how any placed material(s) and/or structure(s) will be secured during a flood event e.g. to minimise erosion and scour effects of the stream bed and banks.

The consent holder shall provide a copy of the FCMP to the Team Leader, Resource Consents, Hutt City Council on approval.

18. The consent holder shall monitor the weather (e.g. metservice) to forecast flooding in the Waiwhetu Stream during the works period, including liaising with the Hutt City Council Emergency Management Officer and Wellington Regional Council Flood Warning Manager. Copies of the daily weather reports shall be kept onsite for the duration of the works. If a weather event is identified that may potentially lead to flooding, within 24 hours, or the next working day, the consent holder shall inform the Manager, Environmental Regulation, Wellington Regional Council and the Wellington Regional Council Duty Flood Manager.

19. The consent holder shall ensure that the appropriate machinery and operators are on 24 hour standby to implement the Flood Contingency Management Plan (FCMP) as required.

Stream bed sediment sampling

20. The consent holder shall submit for approval by the Manager, Environmental Regulation, Wellington Regional Council, prior to commencement of the works, a detailed sampling and analysis plan for assessing stream bed sediment quality in the active remediation cell. No works are to commence on site until this plan has been approved. This monitoring plan shall include, but not be limited to, the following:

- a) The locations of all the proposed stream bed sampling points. At a minimum, the consent holder shall undertake five equally spaced transects (located at 10, 30, 50, 70, and 90 metre distances from the away from the upstream coffer dam wall within each active cell) along the excavation cell and a minimum of 15 samples.
- b) The frequency and timing of sampling.
- c) The methods to be used to collect and analyse the stream bed samples. These methods shall include recording the date, time and weather conditions at the time that the samples are collected.

21. The consent holder shall not remove either of the coffer dams that form the active remediation cell until stream bed samples are taken from the final top layer of the stream bed and these sample results are submitted to the Manager, Environmental Regulation, Wellington Regional Council. The stream bed sample results shall be compared against the following parameter values, as specified in the Australian and New Zealand Environmental and Conservation Council (ANZECC, 2000) Interim Sediment Quality Guideline (ISQG) high concentration criteria in Table 3.5.1:

17/03/09
M

- a) Total recoverable lead: 220 mg/kg (dry weight);
- b) Total recoverable zinc: 410 mg/kg (dry weight);
- c) Total recoverable copper: 270 mg/kg (dry weight); and
- d) Total recoverable chromium: 370 mg/kg (dry weight).

22. If all of the contaminated sediment can not be removed from a particular area in the stream bed, due to circumstances outside of the consent holder's control, the consent holder shall:

- Identify and mark these affected areas where contaminated sediment may remain on a map and provide GIS coordinates for the affected areas; and
- Provide an explanation of why the contaminated sediment can not be removed.

On completion of the remediation works, the maps and GIS coordinates shall be submitted to the Manager, Environmental Regulation, Wellington Regional Council and Wellington Regional Council Contaminated Land Scientist so that the Wellington Regional Council Selected Land Use Register (SLUR) can be updated.

23. The sediment sampling location points for each active cell shall, as far as practicable, remain constant.

24. All sampling techniques employed in respect of the conditions of this consent shall be to the satisfaction of the Manager, Environment Regulation, Wellington Regional Council and in general accordance with the Ministry for the Environment's Contaminated Land Management Guidelines, where appropriate. All analyses undertaken in connection with this consent shall be performed by an International Accreditation New Zealand (IANZ) registered laboratory or otherwise as specifically approved by the Manager, Environmental Regulation, Wellington Regional Council.

Stream bed sampling reporting

25. The results of the stream bed sampling required by conditions 20 and 21 of this consent shall be provided as a hard and electronic copy to the Manager, Environmental Regulation, Wellington Regional Council on completion of the remediation and channel deepening and widening works. The hard copies of the results shall be in the form of analytical certificates under the letterhead of the laboratory which carried out the analyses and bear authorised signatures.

The results shall also include the sample dates and times in New Zealand Standard Time (NZST).

Note: The format of the test results submitted electronically should, where possible, be consistent with that required for upload to Wellington Regional Council's Hilltop Database.

Note: The results of the stream bed sampling may also be included in the completion report required by condition 26 of this consent.

26. The results of the stream bed sampling required by conditions 20 and 21 of this consent shall be submitted in a report to the Manager, Environmental Regulation, Wellington Regional Council within 3 months on completion of the remediation and channel deepening and widening works. The report shall be to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council, and shall include, but not be limited to the following:

- a) Comparison of the stream bed samples to the Interim Sediment Quality Guideline (ISQG) high concentration criteria in Table 3.5.1 of the Australian and New Zealand Environmental and Conservation Council (ANZECC, 2000) Sediment Quality Guidelines
- b) Details on those areas where contaminated stream bed sediments have not been fully removed and remain in the stream bed;
- c) Any other matters the consent holder considers relevant.

Note: The stream bed sampling report and the water sampling report required by condition 14 of WGN090127 [27267] can be combined into a single completion report.

Sedimentation effects

27. The consent holder shall take all practicable steps to minimise sedimentation and increased turbidity of the Waiwhetu Stream during the excavation and removal of contaminated sediment and the construction, implementation, use and removal of the active remediation cell and sedimentation cell/s, including but not limited to:
- a) Installation and use of at least two sedimentation cells at all times;
 - b) Installation and use of silt curtains upstream and downstream of the works area;
 - c) The installation of a second silt curtain upstream and downstream, unless installation is not practicable;
 - d) Completing all works in the minimum time practicable;
 - e) Minimising the area of disturbance at all times;
 - f) Avoiding placement of construction material or excavated matter in the flowing channel or in a location where runoff enters the stream; and
 - g) Undertaking works from outside the actively flowing stream bed, where practicable and separation of construction activities from flowing water (by diverting the stream flow around the works as detailed in the application).

Vehicle contaminants

28. The consent holder shall ensure that:
- a) All machinery is thoroughly cleaned of any vegetation, seeds or contaminants (such as sediments and mud) away from the works site prior to entering or exiting the works site. Cleaning shall be undertaken in an area where the wash water does not enter the stream;
 - b) No contaminants (including but not limited to oil, petrol, diesel or hydraulic fluid) shall be released into water from equipment being used for the works;
 - c) All contaminant storage or re-fuelling areas are bunded or contained in such a manner so as to prevent the discharge of contaminants;
 - d) All machinery is regularly maintained in such a manner so as to minimise the potential for leakage of contaminants (including but not limited to fuels, hydraulic fluids and lubricants); and

No machinery is stored or refuelled within 10 metres of any ephemeral or permanent watercourse.

Erosion and scour

29. During the works the active remediation cell and sedimentation cell(s) shall remain the responsibility of the consent holder and shall be maintained so that:
- a) Any erosion of the stream bed or banks that is attributable to the coffer dams is remedied by the consent holder to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council; and
 - b) The structural integrity of coffer dams remains sound.

Maintenance does not include any works outside of the scope of the application. Any additional works (including structures, reshaping or disturbance to the bed of the watercourse) following completion of the construction works as proposed in the application, may require further resource consents.

Handwritten signature/initials

30. If koiwi, taonga or other artefact material is discovered in any area during the works, the consent holder shall follow the 'Protocol for dealing with Koiwi and Taonga' outlined in the Hutt Park Management Plan submitted as Appendix F in the application documents 20 October 2008.

Review conditions

31. From the exercise of this consent the Wellington Regional Council may review any or all conditions of this permit by giving notice of its intention to do so pursuant to section 128 of the Resource Management Act 1991, at any time within three months of the first and second anniversary of the granting of this consent for the purpose of:
- Enabling consistency with the Waiwhetu Stream Floodplain Management Plan;
 - Dealing with any adverse effects on the environment which may arise from the exercise of this consent, and which is appropriate to deal with at a later stage;
 - To review the adequacy of any plans and/or methods used during the excavation and removal of contaminated sediment and the use of a active remediation cell and sedimentation cell; and/or
 - Enable consistency with the relevant Regional Freshwater Plan and or with National Environmental Standards.

The Wellington Regional Council shall be entitled to recover from the consent holder the costs of any review, calculated in accordance with and limited to the Council's scale of charges in force and applicable at that time pursuant to Section 36 of the Resource Management Act 1991.

Note: For the purposes of this condition the "exercise of the consent" is deemed to be once the works authorised by this consent have commenced.



Resource Consent

RESOURCE MANAGEMENT ACT 1991

Consent No. WGN090127 [27266]**Category: Land use consent**

Pursuant to sections 104, 104B and 108, and subject to all the relevant provisions of the Resource Management Act 1991 and any regulations made thereunder, a consent in respect of a natural resource is hereby granted to:

Name	Flood Protection Department, Wellington Regional Council	
Address	Flood Protection Department, Wellington Regional Council, PO Box 11646, Wellington 6142	
Duration of consent	Effective: 12 March 2009	Expires: 12 March 2015
Purpose for which right is granted	To widen and deepen the Waiwhetu Stream channel between Bell Road Bridge to the salt marsh area downstream of the Seaview Road Bridge, including any associated disturbance of and deposition on the stream bed.	
Location	The Waiwhetu Stream, Lower Hutt: the reach downstream, from the Bell Road Bridge, Waiwhetu, to the Waiwhetu Stream mouth at Port Road Bridge, Seaview between approximate map references NZMS 260: R27;2670458.5995245 and NZMS 260: R27;2669345.5994850.	
Legal description of land	Various	
Conditions	1 - 19 as attached	

For and on behalf of
WELLINGTON REGIONAL COUNCIL

Manager, Environmental Regulation

Date: 12 March 2009

Summary of your rights and responsibilities

(Not part of the resource consent)

This resource consent gives you the right to use a public resource (e.g. water, air, the coastal marine area) in the manner specified in the consent.

You may exercise the resource consent as you see fit provided that you comply with all the conditions of your resource consent and all other laws of the land.

If you wish to change the way you operate under this resource consent or if you wish to change or cancel any consent conditions, please contact the Wellington Regional Council (hereafter referred to as Greater Wellington) prior to making the changes. You may need a formal change to your resource consent conditions.

You may transfer your coastal, discharge, or water permit to any other person. If you sell your operation please contact Greater Wellington and we will arrange the transfer. The service is free of charge.

If your resource consent application contained inaccurate or misleading information, Greater Wellington may cancel or alter the resource consent.

Your resource consent does not:

- provide any warranty of any structure or process;
- provide any guarantee that the resource will be available at all times;
- provide any right of access through or over public or private land;
- negate the need for any approvals necessary under other legislation.

You, as the holder(s) of this resource consent and your agents (including contractors and employees), are jointly and severally liable for compliance with the conditions of this consent. It is important that anyone operating on your behalf fully understands and complies with the conditions of the resource consent.

You are required to pay any relevant charges that are associated with the consent. Greater Wellington fixes these charges under section 36 of the Resource Management Act 1991. The Act allows you to comment on any proposed charges *prior to them being fixed*. Charges may be reviewed every year. If you would like a copy of our current Resource Management Charging Policy please ask us.

You are required to allow Greater Wellington Enforcement Officers access to your site and operation at any reasonable time so that we can inspect your operation and confirm that it is complying with the resource consent.

Your resource consent will lapse if you do not give effect to it within five years of the date it was granted (unless otherwise specified in the resource consent conditions). If you wish to apply for an extension of this lapse date please contact Greater Wellington before the lapse date.

If you stop using your resource consent for a continuous five-year period, Greater Wellington may cancel your resource consent. We will advise you in advance if we propose to cancel your consent. You have the right to object to your consent being cancelled.

This consent is issued without prejudice to any claim that is lodged with the Waitangi Tribunal in relation to the customary ownership of natural resources, whether it be a claim that is awaiting hearing or awaiting settlement by the Crown.

Conditions to Resource Consent WGN090127 [27266]

General conditions

1. The location, design and construction of the works shall be in general accordance with the application, and its associated plans and documents, lodged with the Wellington Regional Council on 20 October 2008, and further information received:
 - At the pre hearing meeting on 2 December 2008;
 - On 5 December 2008 (via email); and
 - In the peer review received on 9 December 2008.

For the avoidance of doubt, where information contained in the application is contrary to conditions of this permit, the conditions shall prevail.

Minor changes to the location, design concepts and parameters, implementation and/or operation may be made by the consent holder where practicable and provided that these changes are to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Note: Any significant change from the location, design concepts and parameters, implementation and/or operation may require a new resource consent or a change of consent conditions pursuant to section 127 of the Resource Management Act 1991.

2. The Manager, Environmental Regulation, Wellington Regional Council, shall be given a minimum of two working days (48 hours) notice prior to the works commencing.

Note: Notifications can be emailed to notifications@gw.govt.nz.

3. The consent holder shall provide a copy of this consent and any documents referred to in this consent to each operator or contractor undertaking works authorised by this consent, before that operator or contractor starts any works. The consent holder shall verbally brief the contractor regarding the conditions of the consent, prior to the works authorised by this consent commencing.
4. The consent holder shall ensure that a copy of this consent and all documents referred to in this consent, is kept on site at all times and presented to any Wellington Regional Council officer on request.
5. All works affecting the Waiwhetu Stream, including tidy up on completion of the works, shall be completed to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Works/Design details

6. The consent holder shall contour the stream bed within the active remediation cell area to minimise erosion and scour of the stream bed and bank, to prevent the stream banks from collapsing and to ensure stability of the stream bed.
7. The consent holder shall ensure that the coffer dams that form the active cell and the sedimentation cells are in place and the active cell is dewatered as far as practicable prior to any works commencing in the active cell.
8. The consent holder shall ensure the coffer dams are of a sufficient width to exclude water ingress as far as practicable into the active remediation cell while the works are being undertaken.

12/03/08
M

9. Prior to any work that has the potential to affect neighbouring properties or infrastructure the consent holder shall inform the relevant utility service provider or property owner(s). The consent holder shall ensure that the works do not impede any utility service provider's or property owner(s) access to their property or infrastructure.
10. Only sediment below the Interim Sediment Quality Guideline (ISQG) high concentration criteria in Table 3.5.1 of the Australian and New Zealand Environmental and Conservation Council (ANZECC, 2000) Sediment Quality Guidelines may be stockpiled on the floodplain. The consent holder shall install a silt fence or any other appropriate sediment control measure that is to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council, between any stockpiles and the stream to ensure no sediment laden runoff discharges to the stream. All stockpiles shall be aligned in such a way as to not impede flood flows and removed from the site as soon as practicable.

Note: Greater Wellington does not consider hay bales as an appropriate sediment control measure.

11. The excavated stream banks shall be stabilised as soon as possible following completion of the works within that active remediation cell to prevent erosion and scour.

Note: "stabilised" in relation to any site or area means an area inherently resistant to erosion such as rock, or rendered resistant by the application of aggregate, geotextile, vegetation or mulch. Where seeding or grassing is used on a surface that is not otherwise resistant to erosion, the surface is considered stabilised once, on reasonable visual inspection by the Manager, Environmental Regulation, Wellington Regional Council, an 80% vegetative cover has been established.

Environmental enhancement planting plan

12. The consent holder shall prepare and submit an Environmental Enhancement Plan (EEP) for the Waiwhetu Stream to the Manager, Environmental Regulation, Wellington Regional Council for approval within 6 months of the commencement of this consent. The consent holder shall use native species such as those identified in the planting list received as further information at the pre hearing meeting on 2 December 2008, where practicable in the design of the proposed Environmental Enhancement works and shall engage a suitably qualified and experienced person to prepare the EEP.

The EEP shall include, but not be limited to:

- Details of the species to be planted (predominately eco sourced species to be used), when and where they are to be planted, size of the plants to be planted, density of planting, sourcing of plants and fertilising and time line for implementation;
- A to scale plan(s) showing the location and extent where planting will be undertaken and associated environmental enhancement structures (e.g. jetty's, boardwalks etc);
- Detailed methodology(s) of how the environmental enhancement structures will be constructed;
- What monitoring and maintenance will be used/undertaken to maintain the riparian plantings and structures and the duration of the monitoring and maintenance; and
- A list of the key responsibilities and who will be responsible for implementing the monitoring and maintenance.

The consent holder shall provide a copy of the EEP to the Director General of Conservation and the Team Leader, Resource Consents, Hutt City Council on approval.

The final EEP shall be developed in accordance with Drawing No. 4-13, Proposed Environmental Enhancements submitted to the Wellington Regional Council in the application on 20 October 2008.

The EEP is to be implemented prior to the expiry of this consent and the plantings shall be to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Note: The works described in the EEP are to be completed prior to the expiry of this consent.

Environmental bond

13. Prior to undertaking the remediation, channel deepening and widening and erosion and scour protection works, the consent holder shall provide a surety bond and associated bond document to ensure vegetation is established and maintained in accordance with the Environmental Enhancement Plan (EEP) as required by condition 12 of this consent and is to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

The bond shall be for 150% of the estimated value of the environmental enhancement works described in condition 12 of this consent for the establishment of plantings along the Waiwhetu Stream, based on a quote from an independent contractor engaged by the applicant and approved by the Manager, Environmental Regulation, Wellington Regional Council.

The consent holder's liability is not limited to the amount of the bond, should the necessary work exceed the bond figure. The form of the bond shall be as specified by the Manager, Environmental Regulation, Wellington Regional Council.

The bond shall be held until the expiry of this consent, or until works in accordance with the approved EEP are completed.

Works exclusion period

14. No works which impede the full flow of the Waiwhetu stream shall be carried out in the wetted channel during the native fish spawning/migration season (1 August to 30 September inclusive).

Note: The applicant has advised that the installation of the environmental enhancement structures, the works within the u shaped channel, and the works in the stretch between Bell Road Bridge and the remediation works, will take place within the native fish spawning/migration season.

Sedimentation effects

15. The consent holder shall take all practicable steps to minimise sedimentation and increased turbidity of the Waiwhetu Stream during the widening and deepening excavations, including but not limited to:

- a) Installation and use of at least two sedimentation cells in those areas as detailed in the application;
- b) Installation and use of silt curtains;
- c) The installation of a second silt curtain, unless the installation is not practicable;
- d) Completing all works in the minimum time practicable;
- e) Minimising the area of disturbance at all times;
- f) Avoiding placement of construction material or excavated matter in the flowing channel or in a location where runoff enters the stream; and
- g) Undertaking works from outside the actively flowing stream bed, where practicable and separation of construction activities from flowing water (by diverting the stream flow around the works as detailed in the application).

Vehicle contaminants

16. The consent holder shall ensure that:
- a) All machinery is thoroughly cleaned of any vegetation, seeds or contaminants (such as sediments and mud) away from the works site prior to entering or exiting the works site. Cleaning shall be undertaken in an area where the wash water does not enter the stream;
 - b) No contaminants (including but not limited to oil, petrol, diesel or hydraulic fluid) shall be released into

12/09/14

water from equipment being used for the works;

- c) All contaminant storage or re-fuelling areas are bunded or contained in such a manner so as to prevent the discharge of contaminants;
- d) All machinery is regularly maintained in such a manner so as to minimise the potential for leakage of contaminants (including but not limited to fuels, hydraulic fluids and lubricants); and

No machinery is stored or refuelled within 10 metres of any ephemeral or permanent watercourse.

Erosion and scour

17. The works shall remain the responsibility of the consent holder and shall be maintained to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council such that:
- a) Any erosion of the stream bed and banks that is attributable to the works carried out as part of this consent is repaired by the consent holder to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Maintenance does not include any works outside of the scope of the application. Any additional works (including structures, reshaping or disturbance to the bed of the watercourse) following completion of the construction works as proposed in the application, may require further resource consents.

Iwi

18. If koiwi, taonga or other artefact material is discovered in any area during the works, the consent holder shall follow the 'Protocol for dealing with Koiwi and Taonga' outlined in the Hutt Park Management Plan submitted as Appendix F in the application documents 20 October 2008.

Review conditions

19. From the exercise of this consent the Wellington Regional Council may review any or all conditions of this permit by giving notice of its intention to do so pursuant to section 128 of the Resource Management Act 1991, at any time within three months of the first and second anniversary of the granting of this consent for the purpose of:
- Enabling consistency with the Waiwhetu Stream Floodplain Management Plan;
 - Dealing with any adverse effects on the environment which may arise from the exercise of this consent, and which is appropriate to deal with at a later stage;
 - To review the adequacy of any plans and/or methods used in the widening and deepening works; and/or
 - Enable consistency with the relevant Regional Freshwater Plan and or with National Environmental Standards.

The Wellington Regional Council shall be entitled to recover from the consent holder the costs of any review, calculated in accordance with and limited to the Council's scale of charges in force and applicable at that time pursuant to Section 36 of the Resource Management Act 1991.

Note: For the purposes of this condition the "exercise of the consent" is deemed to be once the works authorised by this consent have commenced.



Resource Consent

RESOURCE MANAGEMENT ACT 1991

Consent No. WGN090127 [27267]**Category: Discharge permit**

Pursuant to sections 104, 104B, 105, 107 and 108, and subject to all the relevant provisions of the Resource Management Act 1991 and any regulations made thereunder, a consent in respect of a natural resource is hereby granted to:

Name

Flood Protection Department, Wellington Regional Council

Address

Flood Protection Department, Wellington Regional Council, PO Box 11646, Wellington 6142

Duration of consent

Effective: 12 March 2009

Expires: 12 March 2015

Purpose for which right is granted

To discharge potentially contaminated water (contaminated by mobilising contaminated sediments) to the Waiwhetu Stream during in stream remediation and channel widening and deepening works.

Location

The Waiwhetu Stream, Lower Hutt: the reach downstream from the Bell Road Bridge (south of the trial remediation area), Waiwhetu to the salt marsh area downstream of the Seaview Road Bridge, Seaview, between approximate map references NZMS 260: R27;2670395.5995230 and NZMS 260: R27;2669546.5995063.

Legal description of land

Various

Conditions

1 - 22 as attached

For and on behalf of
WELLINGTON REGIONAL COUNCIL

Manager, Environmental Regulation

Date: 12 March 2009

Summary of your rights and responsibilities

(Not part of the resource consent)

This resource consent gives you the right to use a public resource (e.g. water, air, the coastal marine area) in the manner specified in the consent.

You may exercise the resource consent as you see fit provided that you comply with all the conditions of your resource consent and all other laws of the land.

If you wish to change the way you operate under this resource consent or if you wish to change or cancel any consent conditions, please contact the Wellington Regional Council (hereafter referred to as Greater Wellington) prior to making the changes. You may need a formal change to your resource consent conditions.

You may transfer your coastal, discharge, or water permit to any other person. If you sell your operation please contact Greater Wellington and we will arrange the transfer. The service is free of charge.

If your resource consent application contained inaccurate or misleading information, Greater Wellington may cancel or alter the resource consent.

Your resource consent does not:

- provide any warranty of any structure or process;
- provide any guarantee that the resource will be available at all times;
- provide any right of access through or over public or private land;
- negate the need for any approvals necessary under other legislation.

You, as the holder(s) of this resource consent and your agents (including contractors and employees), are jointly and severally liable for compliance with the conditions of this consent. It is important that anyone operating on your behalf fully understands and complies with the conditions of the resource consent.

You are required to pay any relevant charges that are associated with the consent. Greater Wellington fixes these charges under section 36 of the Resource Management Act 1991. The Act allows you to comment on any proposed charges *prior to them being fixed*. Charges may be reviewed every year. If you would like a copy of our current Resource Management Charging Policy please ask us.

You are required to allow Greater Wellington Enforcement Officers access to your site and operation at any reasonable time so that we can inspect your operation and confirm that it is complying with the resource consent.

Your resource consent will lapse if you do not give effect to it within five years of the date it was granted (unless otherwise specified in the resource consent conditions). If you wish to apply for an extension of this lapse date please contact Greater Wellington before the lapse date.

If you stop using your resource consent for a continuous five-year period, Greater Wellington may cancel your resource consent. We will advise you in advance if we propose to cancel your consent. You have the right to object to your consent being cancelled.

This consent is issued without prejudice to any claim that is lodged with the Waitangi Tribunal in relation to the customary ownership of natural resources, whether it be a claim that is awaiting hearing or awaiting settlement by the Crown.

Conditions to Resource Consent

WGN090127 [27267]

General conditions

1. The location, design and construction of the discharge shall be in general accordance with the application, and its associated plans and documents, lodged with the Wellington Regional Council on 20 October 2008, and further information received:
 - At the pre hearing meeting on 2 December 2008;
 - On 5 December 2008 (via email); and
 - In the peer review received on 9 December 2008.

For the avoidance of doubt, where information contained in the application is contrary to conditions of this permit, the conditions shall prevail.

Minor changes to the location, design concepts and parameters, implementation and/or operation may be made by the permit holder where practicable and provided that these changes are to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Note: Any significant change from the location, design concepts and parameters, implementation and/or operation may require a new resource consent or a change of consent conditions pursuant to section 127 of the Resource Management Act 1991

2. The Manager, Environmental Regulation, Wellington Regional Council, shall be given a minimum of two working days (48 hours) notice prior to maintenance works commencing.

Note: Notifications can be emailed to notifications@gw.govt.nz.

3. The permit holder shall provide a copy of this permit and any documents referred to in this permit to each operator or contractor undertaking works authorised by this permit, before that operator or contractor starts any works. The permit holder shall verbally brief the contractor regarding the conditions of the permit, prior to the works authorised by this permit commencing.
4. The permit holder shall ensure that a copy of this permit and all documents referred to in this permit, is kept on site at all times and presented to any Wellington Regional Council officer on request.

Water Sampling

5. The permit holder shall submit for approval by the Manager, Environmental Regulation, Wellington Regional Council, at least 20 working days prior to commencement of the works, a detailed sampling and analysis plan for assessing stream water quality downstream of the works site. No works are to commence on site until this plan has been approved. This monitoring plan shall include, but not be limited to, the following:
 - a) The location of the proposed water sampling points downstream of the sedimentation cell(s). The sampling points shall be a maximum of 150 metres downstream from the most downstream coffer dam wall.
 - b) The frequency and timing of sampling. At a minimum, the permit holder shall take water samples at the downstream sampling points within 24 hours of the first discharge occurring, and then every third day thereafter for the duration of the discharge. These samples shall be taken while a discharge is occurring.

12/02/08
m

- c) The methods to be used to collect and analyse the water samples. These methods shall include recording the date, time, tidal and weather conditions at the time that the samples are collected.

Water sampling under this plan may cease once works under resource consents WGN090127 [27265] and WGN090127 [27266] have been completed.

- 6. The permit holder shall analyse each of the samples taken from the sampling point identified in condition 5 of this permit for the following parameters:

- a) Total recoverable and dissolved lead g/m³;
- b) Total recoverable and dissolved zinc g/m³;
- c) Total recoverable and dissolved copper g/m³;
- d) Total recoverable and dissolved chromium g/m³;
- e) Total suspended solids g/m³; and
- f) pH.

- 7. The permit holder shall measure and record field parameters in-situ at the sampling points identified in condition 5 of this permit daily. These field parameters shall include:

- a) Specific electrical conductivity (uS/cm);
- b) Turbidity (NTU);
- c) Water temperature (°C);
- d) An estimate of average water depth (mm); and
- e) An estimate of flow rate (l/s).

The permit holder shall record the date, time, tidal and weather conditions at the time that the samples are collected.

- 8. The permit holder shall at the sampling points identified in condition 5 of this permit at the time each water sample is collected visually inspect the stream for the following:

- a) Any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
- b) Any conspicuous change in colour or visual clarity;
- c) Any undesirable biological growths;
- d) Any emission of objectionable odour; and
- e) Any erosion at the point of discharge.

- 9. The permit holder shall compare the results of the samples taken under conditions 6 of this permit against the Freshwater toxicity Trigger Values (for the 80% level of species protection) in the Australian and New Zealand Environmental and Conservation Council (ANZECC, 2000) Water Quality Guidelines.

The permit holder shall inform the Manager, Environmental Regulation, Wellington Regional Council within 48 hours of the receipt of the sample results, if any of the samples taken are greater than the Freshwater toxicity Trigger Values (for the 80% level of species protection) in the Australian and New Zealand Environmental and Conservation Council (ANZECC, 2000) Water Quality Guidelines.

10. If the elevated sample result is attributable to the in stream channel remediation, channel deepening and widening works (i.e. it is not attributable to stormwater discharges or any other outside influences) the permit holder shall undertake site contaminant-source investigations to identify the likely sources of contaminants and implement measures to reduce contaminant levels including, but not limited to, installing additional silt curtains and reducing the discharge rate from the sedimentation cell.

The investigations undertaken shall be to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

The outcomes of any contaminant-source investigations undertaken and details of the activities undertaken to reduce contaminant levels shall be detailed in the completion report as required by condition 14 of this permit.

11. The water sampling location points for each active cell shall, as far as practicable, remain constant.
12. All sampling techniques employed in respect of the conditions of this permit shall be to the satisfaction of the Manager, Environment Regulation, Wellington Regional Council and in general accordance with the Ministry for the Environment's Contaminated Land Management Guidelines, where appropriate. All analyses undertaken in connection with this permit shall be performed by an International Accreditation New Zealand (IANZ) registered laboratory or otherwise as specifically approved by the Manager, Environmental Regulation, Wellington Regional Council.

Water sampling reporting

13. The results of the water sampling required by conditions 6 and 7 of this permit shall be provided as a hard and electronic copy to the Manager, Environmental Regulation, Wellington Regional Council on completion of the remediation and channel deepening and widening works. The hard copies of the results shall be in the form of analytical certificates under the letterhead of the laboratory which carried out the analyses and bear authorised signatures.

The results shall also include the sample dates and times in New Zealand Standard Time (NZST).

Note: The format of the test results submitted electronically should, where possible, be consistent with that required for upload to Wellington Regional Council's Hilltop Database.

Note: The results of the sampling may also be included in the completion report required by condition 14 of this permit.

14. The results of the water sampling required by conditions 6 and 7 of this permit shall be submitted in a report to the Manager, Environmental Regulation, Wellington Regional Council within 3 months on completion of the remediation and channel deepening and widening works. The report shall be to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council, and shall include, but not be limited to the following:
- a) Comparison of the water quality samples to the Freshwater toxicity Trigger Values (for the 80% level of species protection) in Table 3.4.1 of the Australian and New Zealand Environmental and Conservation Council (ANZECC, 2000) Water Quality Guidelines;
 - b) Details of any breaches of the limits as outlined in condition 9 of this permit and the site contaminant-source investigations undertaken under condition 10 of this permit and any measures implemented to remedy the breach;
 - c) Observations and photographs from the visual inspections undertaken under condition 8 of this permit; and
 - d) Any other matters the permit holder considers relevant.

Note: The water sampling report and the stream bed sampling report required by condition 26 of WGN090127 [27265] can be combined into a single completion report.

12/03/09
W

Sedimentation effects

15. The permit holder shall install at least one silt curtain downstream of the sedimentation cell and this silt curtain shall remain in place for the duration of the in-stream works. If any of the effects described in condition 8 occur the permit holder shall install a second silt curtain(s), unless the installation of a second silt curtain is impracticable.
16. The silt curtains shall remain the responsibility of the permit holder and be cleared of debris as required to maintain effectiveness. The silt curtains shall be installed, operated and maintained to the reasonable satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Flood contingency measures

17. The consent holder shall monitor the weather (e.g. metservice) to forecast flooding in the Waiwhetu Stream during the works period, including liaising with the Hutt City Council Emergency Management Officer and Wellington Regional Council Flood Warning Manager. Copies on the daily weather reports shall be kept onsite for the duration of the works. If a weather event is identified that may potentially lead to flooding, within 24 hours, or the next working day, the consent holder shall inform the Manager, Environmental Regulation, Wellington Regional Council and the Wellington Regional Council Duty Flood Manager.
18. The permit holder shall ensure that the appropriate machinery and operators are on 24 hour standby to implement the Flood Contingency Management Plan (FCMP) as required.

Note: the FCMP is required by condition 17 of WGN090127 [27265].

Erosion and scour

19. The discharge shall remain the responsibility of the permit holder and shall be managed so that any erosion of the stream bed or bank due to the discharge shall be remedied by the permit holder, to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Any activities undertaken in accordance with this condition shall be to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council. The permit holder shall notify the Manager, Environment Regulation, Wellington Regional Council within two working days of any activities undertaken.

Incident notification

20. The permit holder shall keep a permanent record of any incident(s) related to this permit that results, or could result, in an adverse effect on the environment beyond the boundary of the permit holder's site. The permit holder shall make the incident register available to officers of the Wellington Regional Council, on request.

The permit holder shall notify the Manager, Environmental Regulation, Wellington Regional Council, of any such incident within 24 hours of the incident being brought to the attention of the permit holder or the next working day.

The permit holder shall forward an incident report to the Manager, Environmental Regulation, Wellington Regional Council within seven (7) working days of the incident occurring, unless otherwise agreed with the Manager, Environmental Regulation, Wellington Regional Council. The report shall describe reasons for the incident, measures taken to mitigate the incident, and measures to prevent recurrence.

Public complaints

21. The permit holder shall maintain a permanent record of any complaints received alleging adverse effects from or related to the exercise of this permit. This record shall include the following:
 - a) The name and address of the complainant;
 - b) Date, time and details of the received complaint;
 - c) Weather conditions at the time of the alleged event;

- d) Investigations undertaken by the permit holder in regards to the complaint and any measures adopted to remedy the effects of the incident/complaint; and
- e) Measures put in place to prevent occurrence of a similar incident.

The permit holder shall notify the Manager, Environmental Regulation, Wellington Regional Council, of any complaints received, which relate to the exercise of this permit, within 24 hours of being received, or the next working day.

The complaints record shall be made available to the officers of the Wellington Regional Council on request.

Review conditions

22. From the exercise of this consent the Wellington Regional Council may review any or all conditions of this permit by giving notice of its intention to do so pursuant to section 128 of the Resource Management Act 1991, at any time within three months of the first and second anniversary of the granting of this consent for the purpose of:

- Enabling consistency with the Waiwhetu Stream Floodplain Management Plan;
- Dealing with any adverse effects on the environment which may arise from the exercise of this permit, and which is appropriate to deal with at a later stage;
- To review the adequacy of any monitoring plans and/or alter any monitoring requirements so as to incorporate into the permit any monitoring or other requirements which may become necessary to clarify or deal with any adverse effect on the environment of arising from this activity;
- Enable consistency with the relevant Regional Freshwater Plan and or with National Environmental Standards.

The Wellington Regional Council shall be entitled to recover from the permit holder the costs of any review, calculated in accordance with and limited to the Council's scale of charges in force and applicable at that time pursuant to Section 36 of the Resource Management Act 1991.

Note: For the purposes of this condition the "exercise of the permit" is deemed to be once the works authorised by this consent have commenced.

12/03/09
W



Resource Consent

RESOURCE MANAGEMENT ACT 1991

Consent No. WGN090127 [27268]**Category: Discharge permit**

Pursuant to sections 104, 104B, 105, 107 and 108, and subject to all the relevant provisions of the Resource Management Act 1991 and any regulations made thereunder, a consent in respect of a natural resource is hereby granted to:

Name	Flood Protection Department, Wellington Regional Council	
Address	Flood Protection Department, Wellington Regional Council, PO Box 11646, Wellington 6142	
Duration of consent	Effective: 12 March 2009	Expires: 12 March 2015
Purpose for which right is granted	To discharge silt and stream bed sediments into the Waiwhetu Stream associated with the widening and deepening works (being undertaken in the u-channel downstream of the Seaview Road Bridge and the stretch downstream of Bell Road Bridge and upstream of the remediation trial location, before the start of the excavation of contaminated sediment).	
Location	The Waiwhetu Stream, Lower Hutt: the reach downstream, from the Bell Road Bridge, Waiwhetu, Lower Hutt to the Waiwhetu Stream mouth at Port Road Bridge, Seaview, Lower Hutt between approximate map references NZMS 260: R27;2670458.5995245 and NZMS 260: R27;2669345.5994850.	
Legal description of land	Various	
Conditions	1 -13 as attached	

For and on behalf of
WELLINGTON REGIONAL COUNCIL

Manager, Environmental Regulation

Date: 12 March 2009

Summary of your rights and responsibilities

(Not part of the resource consent)

This resource consent gives you the right to use a public resource (e.g. water, air, the coastal marine area) in the manner specified in the consent.

You may exercise the resource consent as you see fit provided that you comply with all the conditions of your resource consent and all other laws of the land.

If you wish to change the way you operate under this resource consent or if you wish to change or cancel any consent conditions, please contact the Wellington Regional Council (hereafter referred to as Greater Wellington) prior to making the changes. You may need a formal change to your resource consent conditions.

You may transfer your coastal, discharge, or water permit to any other person. If you sell your operation please contact Greater Wellington and we will arrange the transfer. The service is free of charge.

If your resource consent application contained inaccurate or misleading information, Greater Wellington may cancel or alter the resource consent.

Your resource consent does not:

- provide any warranty of any structure or process;
- provide any guarantee that the resource will be available at all times;
- provide any right of access through or over public or private land;
- negate the need for any approvals necessary under other legislation.

You, as the holder(s) of this resource consent and your agents (including contractors and employees), are jointly and severally liable for compliance with the conditions of this consent. It is important that anyone operating on your behalf fully understands and complies with the conditions of the resource consent.

You are required to pay any relevant charges that are associated with the consent. Greater Wellington fixes these charges under section 36 of the Resource Management Act 1991. The Act allows you to comment on any proposed charges *prior to them being fixed*. Charges may be reviewed every year. If you would like a copy of our current Resource Management Charging Policy please ask us.

You are required to allow Greater Wellington Enforcement Officers access to your site and operation at any reasonable time so that we can inspect your operation and confirm that it is complying with the resource consent.

Your resource consent will lapse if you do not give effect to it within five years of the date it was granted (unless otherwise specified in the resource consent conditions). If you wish to apply for an extension of this lapse date please contact Greater Wellington before the lapse date.

If you stop using your resource consent for a continuous five-year period, Greater Wellington may cancel your resource consent. We will advise you in advance if we propose to cancel your consent. You have the right to object to your consent being cancelled.

This consent is issued without prejudice to any claim that is lodged with the Waitangi Tribunal in relation to the customary ownership of natural resources, whether it be a claim that is awaiting hearing or awaiting settlement by the Crown.

Conditions to Resource Consent

WGN090127 [27268]

General conditions

1. The location, design and construction of the discharge shall be in general accordance with the application, and its associated plans and documents, lodged with the Wellington Regional Council on 20 October 2008, and further information received:
 - At the pre hearing meeting on 2 December 2008;
 - On 5 December 2008 (via email); and
 - In the peer review received on 9 December 2008.

For the avoidance of doubt, where information contained in the application is contrary to conditions of this permit, the conditions shall prevail.

Minor changes to the location, design concepts and parameters, implementation and/or operation may be made by the permit holder where practicable and provided that these changes are to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Note: Any significant change from the location, design concepts and parameters, implementation and/or operation may require a new resource consent or a change of consent conditions pursuant to section 127 of the Resource Management Act 1991

2. The Manager, Environmental Regulation, Wellington Regional Council, shall be given a minimum of two working days (48 hours) notice prior to maintenance works commencing.

Note: Notifications can be emailed to notifications@gw.govt.nz.

3. The permit holder shall provide a copy of this permit and any documents referred to in this permit to each operator or contractor undertaking works authorised by this permit, before that operator or contractor starts any works. The permit holder shall verbally brief the contractor regarding the conditions of the permit, prior to the works authorised by this permit commencing.
4. The permit holder shall ensure that a copy of this permit and all documents referred to in this permit, is kept on site at all times and presented to any Wellington Regional Council officer on request.

Works/Design details

5. Machinery working in the flowing water shall take all practicable steps to minimise sediment loading and increased turbidity of the Waiwhetu Stream, such steps shall include, but not be limited to:
 - a) Only disturbing the river bed and banks as much as necessary to widen and deepen the channel; and
 - b) Spending the minimum amount of time possible working in flowing water.
6. The excavated stream banks shall be stabilised as soon as possible following completion of the works within the u-shaped channel and the stretch downstream of Bell Road Bridge before the start of the excavation of the contaminated sediment, to prevent erosion and scour.

Note: "stabilised" in relation to any site or area means an area inherently resistant to erosion such as rock, or rendered resistant by the application of aggregate, geotextile, vegetation or mulch.

12/03/09
H

7. Prior to works commencing downstream of the Bell Road Bridge before the start of the excavation of the contaminated sediment, the permit holder shall install silt curtains upstream and downstream of the proposed site. These silt curtains shall remain in place until works associated with the widening and deepening works have been completed in this area.
8. Prior to works commencing in the u shaped channel, the permit holder shall install longitudinal silt curtains around the proposed work site. These silt curtains shall remain in place until works in this area have been completed.
9. The discharge shall not cause any of the following effects in the receiving waters after reasonable mixing (the downstream boundary of the mixing zone shall be a maximum of 150 metres from the most downstream silt curtain):
 - a) The production of any conspicuous oil or grease films, scum or foams, or floatable or suspended material;
 - b) Any conspicuous change in the colour or visual clarity;
 - c) Any emission of objectionable odour; and
 - d) The formation of undesirable biological growths.

Sedimentation effects

10. The permit holder shall take all practicable steps to minimise sedimentation and increased turbidity of the Waiwhetu Stream during the widening and deepening excavations, including but not limited to:
 - a) Installation and use of silt curtains;
 - b) The installation of a second silt curtain, unless the installation is not practicable;
 - c) Completing all works in the minimum time practicable;
 - d) Minimising the area of disturbance at all times;
 - e) Avoiding placement of construction material or excavated matter in the flowing channel; and
 - f) Undertaking works from outside the actively flowing stream bed, where practicable.

Vehicle contaminants

11. The permit holder shall ensure that:
 - a) All machinery is thoroughly cleaned of any vegetation, seeds or contaminants (such as sediments and mud) away from the works site prior to entering or exiting the works site. Cleaning shall be undertaken in an area where the wash water does not enter the stream;
 - b) No contaminants (including but not limited to oil, petrol, diesel or hydraulic fluid) shall be released into water from equipment being used for the works;
 - c) All contaminant storage or re-fuelling areas are bunded or contained in such a manner so as to prevent the discharge of contaminants;
 - d) All machinery is regularly maintained in such a manner so as to minimise the potential for leakage of contaminants (including but not limited to fuels, hydraulic fluids and lubricants); and
 - e) No machinery is stored or refuelled within 10 metres of any ephemeral or permanent watercourse.

Erosion and scour

12. The works shall remain the responsibility of the permit holder and shall be maintained to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council such that:
- a) Any erosion of the stream bed and banks that is attributable to the works carried out as part of this permit is repaired by the permit holder to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Maintenance does not include any works outside of the scope of the application. Any additional works (including structures, reshaping or disturbance to the bed of the watercourse) following completion of the construction works as proposed in the application, may require further resource consents.

Review conditions

13. From the exercise of this permit the Wellington Regional Council may review any or all conditions of this permit by giving notice of its intention to do so pursuant to section 128 of the Resource Management Act 1991, at any time within three months of the first and second anniversary of the granting of this permit for the purpose of:
- Enabling consistency with the Waiwhetu Stream Floodplain Management Plan;
 - Dealing with any adverse effects on the environment which may arise from the exercise of this permit, and which is appropriate to deal with at a later stage;
 - To review the adequacy of any monitoring plans and/or alter any monitoring requirements so as to incorporate into the permit any monitoring or other requirements which may become necessary to clarify or deal with any adverse effect on the environment of arising from this activity; and
 - Enable consistency with the relevant Regional Freshwater Plan and or with National Environmental Standards.

The Wellington Regional Council shall be entitled to recover from the permit holder the costs of any review, calculated in accordance with and limited to the Council's scale of charges in force and applicable at that time pursuant to Section 36 of the Resource Management Act 1991.

Note: For the purposes of this condition the "exercise of the permit" is deemed to be once the works authorised by this consent have commenced.

12/03/08
W



Resource Consent

RESOURCE MANAGEMENT ACT 1991

Consent No. WGN090127 [27269]**Category: Land use consent**

Pursuant to sections 104, 104B and 108, and subject to all the relevant provisions of the Resource Management Act 1991 and any regulations made thereunder, a consent in respect of a natural resource is hereby granted to:

Name	Flood Protection Department, Wellington Regional Council	
Address	Flood Protection Department, Wellington Regional Council, PO Box 11646, Wellington 6142	
Duration of consent	Effective: 12 March 2009	Expires: 12 March 2015
Purpose for which right is granted	For works in, on, under or over the bed of the Waiwhetu Stream, including: • The widening and deepening of the Waiwhetu Stream channel in the u-channel downstream of the Seaview Road Bridge; • The construction and installation of retaining walls and associated works; • The construction and installation of erosion and scour protection and associated works; and • The construction of structures associated with the environmental enhancement works; including any associated disturbance of and deposition on the stream bed.	
Location	The Waiwhetu Stream, Lower Hutt: the reach downstream, from the Bell Road Bridge, Waiwhetu, Lower Hutt to the Waiwhetu Stream mouth at Port Road Bridge, Seaview, Lower Hutt between approximate map references NZMS 260: R27;2670458.5995245 and NZMS 260: R27;2669345.5994850.	
Legal description of land	Various	
Conditions	1 -17 as attached	

For and on behalf of
WELLINGTON REGIONAL COUNCIL

Manager, Environmental Regulation

Date: 12 March 2009

Summary of your rights and responsibilities

(Not part of the resource consent)

This resource consent gives you the right to use a public resource (e.g. water, air, the coastal marine area) in the manner specified in the consent.

You may exercise the resource consent as you see fit provided that you comply with all the conditions of your resource consent and all other laws of the land.

If you wish to change the way you operate under this resource consent or if you wish to change or cancel any consent conditions, please contact the Wellington Regional Council (hereafter referred to as Greater Wellington) prior to making the changes. You may need a formal change to your resource consent conditions.

You may transfer your coastal, discharge, or water permit to any other person. If you sell your operation please contact Greater Wellington and we will arrange the transfer. The service is free of charge.

If your resource consent application contained inaccurate or misleading information, Greater Wellington may cancel or alter the resource consent.

Your resource consent does not:

- provide any warranty of any structure or process;
- provide any guarantee that the resource will be available at all times;
- provide any right of access through or over public or private land;
- negate the need for any approvals necessary under other legislation.

You, as the holder(s) of this resource consent and your agents (including contractors and employees), are jointly and severally liable for compliance with the conditions of this consent. It is important that anyone operating on your behalf fully understands and complies with the conditions of the resource consent.

You are required to pay any relevant charges that are associated with the consent. Greater Wellington fixes these charges under section 36 of the Resource Management Act 1991. The Act allows you to comment on any proposed charges *prior to them being fixed*. Charges may be reviewed every year. If you would like a copy of our current Resource Management Charging Policy please ask us.

You are required to allow Greater Wellington Enforcement Officers access to your site and operation at any reasonable time so that we can inspect your operation and confirm that it is complying with the resource consent.

Your resource consent will lapse if you do not give effect to it within five years of the date it was granted (unless otherwise specified in the resource consent conditions). If you wish to apply for an extension of this lapse date please contact Greater Wellington before the lapse date.

If you stop using your resource consent for a continuous five-year period, Greater Wellington may cancel your resource consent. We will advise you in advance if we propose to cancel your consent. You have the right to object to your consent being cancelled.

This consent is issued without prejudice to any claim that is lodged with the Waitangi Tribunal in relation to the customary ownership of natural resources, whether it be a claim that is awaiting hearing or awaiting settlement by the Crown.

Conditions to Resource Consent

WGN090127 [27269]

General conditions

1. The location, design and construction of the works shall be in general accordance with the application, and its associated plans and documents, lodged with the Wellington Regional Council on 20 October 2008, and further information received:

- At the pre hearing meeting on 2 December 2008;
- On 5 December 2008 (via email); and
- In the peer review received on 9 December 2008.

For the avoidance of doubt, where information contained in the application is contrary to conditions of this consent, the conditions shall prevail.

Minor changes to the location, design concepts and parameters, implementation and/or operation may be made by the consent holder where practicable and provided that these changes are to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Note: Any significant change from the location, design concepts and parameters, implementation and/or operation may require a new resource consent or a change of consent conditions pursuant to section 127 of the Resource Management Act 1991

2. The Manager, Environmental Regulation, Wellington Regional Council, shall be given a minimum of two working days (48 hours) notice prior to the works commencing.

Note: Notifications can be emailed to notifications@gw.govt.nz.

3. The consent holder shall provide a copy of this consent and any documents referred to in this consent to each operator or contractor undertaking works authorised by this consent, before that operator or contractor starts any works. The consent holder shall verbally brief the contractor regarding the conditions of the consent, prior to the works authorised by this consent commencing.
4. The consent holder shall ensure that a copy of this consent and all documents referred to in this consent, is kept on site at all times and presented to any Wellington Regional Council officer on request.
5. All works affecting the Waiwhetu Stream, including tidy up on completion of the works, shall be completed to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Works/Design details

6. The consent holder shall ensure that no wet concrete, concrete wash water or any water contaminated with concrete enters the flowing water in the Waiwhetu Stream as a result of construction works.
7. Prior to any work that has the potential to affect neighbouring properties or infrastructure the consent holder shall inform the relevant utility service provider or property owner(s). The consent holder shall ensure that the works do not impede any utility service provider's or property owner(s) access to their property or infrastructure.
8. All structures (the erosion and scour protection structures, retaining walls and environmental enhancement structures) shall be bedded into the stream to a sufficient depth to prevent erosion and scour.

12/02/08
M

9. Only sediment below the Interim Sediment Quality Guideline (ISQG) high concentration criteria in Table 3.5.1 of the Australian and New Zealand Environmental and Conservation Council (ANZECC, 2000) Sediment Quality Guidelines may be stockpiled on the floodplain. The consent holder shall install a silt fence or any other appropriate sediment control measure that is to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council, between any stockpiles and the stream to ensure no sediment laden runoff discharges to the stream. All stockpiles shall be aligned in such a way as to not impede flood flows and removed from the site as soon as practicable.

Note: Greater Wellington does not consider hay bales as an appropriate sediment control measure.

10. The consent holder shall ensure the reno mattresses and gabion baskets are constructed and maintained to a high standard. The reno mattresses shall have tight joins, smooth edges, and returns at the ends.
11. The consent holder shall place rock rip-rap in the bed of the stream as a transition measure at the edges of all the bed linings (both concrete and reno mattresses) and at the upstream and downstream ends of the gabion basket structure located at the railway bridge.

Note: 'Transition measure' has the same meaning as that inferred in the peer review received on 9 December 2008 and is to ensure there is no local turbulence and hence scour at the edges of the proposed structures.

Works exclusion period

12. No works which impede the full flow of the Waiwhetu stream shall be carried out in the wetted channel during the native fish spawning/migration season (1 August to 30 September inclusive).

Note: The applicant has advised that the installation of the environmental enhancement structures, the works within the u shaped channel, and the works in the stretch between Bell Road Bridge and the remediation works, will take place within the native fish spawning/migration season.

Sedimentation effects

13. The consent holder shall take all practicable steps to minimise sedimentation and increased turbidity of the Waiwhetu Stream during the construction, implementation and maintenance of the structures, including but not limited to:
- a) Installation and use of silt curtains;
 - b) The installation of a second silt curtain, unless the installation is not practicable;
 - c) Completing all works in the minimum time practicable;
 - d) Minimising the area of disturbance at all times;
 - e) Avoiding placement of construction material or excavated matter in the flowing channel or in a location where runoff enters the stream; and
 - f) Undertaking works from outside the actively flowing stream bed, where practicable and separation of construction activities from flowing water (by diverting the stream flow around the works as detailed in the application).

Vehicle contaminants

14. The consent holder shall ensure that:
- a) All machinery is thoroughly cleaned of any vegetation, seeds or contaminants (such as sediments and mud) away from the works site prior to entering or exiting the works site. Cleaning shall be undertaken in an area where the wash water does not enter the stream;

- b) No contaminants (including but not limited to oil, petrol, diesel or hydraulic fluid) shall be released into water from equipment being used for the works;
- c) All contaminant storage or re-fuelling areas are bunded or contained in such a manner so as to prevent the discharge of contaminants;
- d) All machinery is regularly maintained in such a manner so as to minimise the potential for leakage of contaminants (including but not limited to fuels, hydraulic fluids and lubricants); and
- e) No machinery is stored or refuelled within 10 metres of any ephemeral or permanent watercourse.

Erosion and scour

15. The structures shall remain the responsibility of the consent holder and shall be maintained so that:
- a) Any erosion of the stream bed and banks that is attributable to the works carried out as part of this consent is repaired by the consent holder to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council;
 - b) Fish passage is not impeded on completion of the works;
 - c) The structures remain substantively clear of debris and rubbish; and
 - d) The structures associated with this consent (e.g. the reno mattresses etc) are kept in a well maintained condition and the structural integrity of all the structures authorised by this consent remains sound.

Maintenance does not include any works outside of the scope of the application. Any additional works (including structures, reshaping or disturbance to the bed of the watercourse) following completion of the construction works as proposed in the application, may require further resource consents.

Iwi

16. If koiwi, taonga or other artefact material is discovered in any area during the works, the consent holder shall follow the 'Protocol for dealing with Koiwi and Taonga' outlined in the Hutt Park Management Plan submitted as Appendix F in the application documents 20 October 2008.

Review conditions

17. From the exercise of this consent the Wellington Regional Council may review any or all conditions of this permit by giving notice of its intention to do so pursuant to section 128 of the Resource Management Act 1991, at any time within three months of the first, fifth, tenth, fifteenth, twentieth, twenty-fifth and thirtieth anniversary of the granting of this consent for the purpose of:
- Enabling consistency with the Waiwhetu Stream Floodplain Management Plan;
 - Dealing with any adverse effects on the environment which may arise from the exercise of this consent, and which is appropriate to deal with at a later stage;
 - To review the adequacy of any plans and/or methods used in the structures design or construction; and/or
 - Enable consistency with the relevant Regional Freshwater Plan and or with National Environmental Standards.

The Wellington Regional Council shall be entitled to recover from the consent holder the costs of any review, calculated in accordance with and limited to the Council's scale of charges in force and applicable at that time pursuant to Section 36 of the Resource Management Act 1991.

Note: For the purposes of this condition the "exercise of the consent" is deemed to be once the works authorised by this consent have commenced.

12/01/08
H



RESOURCE MANAGEMENT ACT 1991

Consent No. WGN090127 [27270]

Category: Land use consent

Pursuant to sections 104, 104B and 108, and subject to all the relevant provisions of the Resource Management Act 1991 and any regulations made thereunder, a consent in respect of a natural resource is hereby granted to:

Name	Hutt City Council	
Address	Hutt City Council, Private Bag 31912, Lower Hutt, 5040	
Duration of consent	Effective: 12 March 2009	Expires: 12 March 2044
Purpose for which right is granted	For works in, on, under or over the bed of the Waiwhetu Stream, including: • The upgrade, relocation, removal and demolition of obsolete and existing stormwater outfall structures and the construction of new stormwater outfall structures including the maintenance of these structures; and • The construction and/or upgrade and maintenance of 4 pipelines (sewer main downstream of urupa, sewer main duplication upstream of Seaview Road Bridge, sewer main at Hutt Park and the water main at Hutt Park Bridge) under the bed of the Waiwhetu Stream; including any associated disturbance of and deposition of stream bed material on the stream bed.	
Location	The Waiwhetu Stream, Lower Hutt: the reach downstream, from the Bell Road Bridge, Waiwhetu, Lower Hutt to the Waiwhetu Stream mouth at Port Road Bridge, Seaview, Lower Hutt between approximate map references NZMS 260: R27;2670458.5995245 and NZMS 260: R27;2669345.5994850.	
Legal description of land	Various	
Conditions	1 -15 as attached	

For and on behalf of
WELLINGTON REGIONAL COUNCIL

Manager, Environmental Regulation

Date: 12 March 2009

Summary of your rights and responsibilities

(Not part of the resource consent)

This resource consent gives you the right to use a public resource (e.g. water, air, the coastal marine area) in the manner specified in the consent.

You may exercise the resource consent as you see fit provided that you comply with all the conditions of your resource consent and all other laws of the land.

If you wish to change the way you operate under this resource consent or if you wish to change or cancel any consent conditions, please contact the Wellington Regional Council (hereafter referred to as Greater Wellington) prior to making the changes. You may need a formal change to your resource consent conditions.

You may transfer your coastal, discharge, or water permit to any other person. If you sell your operation please contact Greater Wellington and we will arrange the transfer. The service is free of charge.

If your resource consent application contained inaccurate or misleading information, Greater Wellington may cancel or alter the resource consent.

Your resource consent does not:

- provide any warranty of any structure or process;
- provide any guarantee that the resource will be available at all times;
- provide any right of access through or over public or private land;
- negate the need for any approvals necessary under other legislation.

You, as the holder(s) of this resource consent and your agents (including contractors and employees), are jointly and severally liable for compliance with the conditions of this consent. It is important that anyone operating on your behalf fully understands and complies with the conditions of the resource consent.

You are required to pay any relevant charges that are associated with the consent. Greater Wellington fixes these charges under section 36 of the Resource Management Act 1991. The Act allows you to comment on any proposed charges *prior to them being fixed*. Charges may be reviewed every year. If you would like a copy of our current Resource Management Charging Policy please ask us.

You are required to allow Greater Wellington Enforcement Officers access to your site and operation at any reasonable time so that we can inspect your operation and confirm that it is complying with the resource consent.

Your resource consent will lapse if you do not give effect to it within five years of the date it was granted (unless otherwise specified in the resource consent conditions). If you wish to apply for an extension of this lapse date please contact Greater Wellington before the lapse date.

If you stop using your resource consent for a continuous five-year period, Greater Wellington may cancel your resource consent. We will advise you in advance if we propose to cancel your consent. You have the right to object to your consent being cancelled.

This consent is issued without prejudice to any claim that is lodged with the Waitangi Tribunal in relation to the customary ownership of natural resources, whether it be a claim that is awaiting hearing or awaiting settlement by the Crown.

Conditions to Resource Consent

WGN090127 [27270]

General conditions

1. The location, design and construction of the works shall be in general accordance with the application, and its associated plans and documents, lodged with the Wellington Regional Council on 20 October 2008, and further information received:
 - At the pre hearing meeting on 2 December 2008;
 - On 5 December 2008 (via email); and
 - In the peer review received on 9 December 2008.

For the avoidance of doubt, where information contained in the application is contrary to conditions of this consent, the conditions shall prevail.

Minor changes to the location, design concepts and parameters, implementation and/or operation may be made by the consent holder where practicable and provided that these changes are to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Note: Any significant change from the location, design concepts and parameters, implementation and/or operation may require a new resource consent or a change of consent conditions pursuant to section 127 of the Resource Management Act 1991

2. The Manager, Environmental Regulation, Wellington Regional Council, shall be given a minimum of two working days (48 hours) notice prior to the works commencing.

Note: Notifications can be emailed to notifications@gw.govt.nz.

3. The consent holder shall provide a copy of this consent and any documents referred to in this consent to each operator or contractor undertaking works authorised by this consent, before that operator or contractor starts any works. The consent holder shall verbally brief the contractor regarding the conditions of the consent, prior to the works authorised by this consent commencing.
4. The consent holder shall ensure that a copy of this consent and all documents referred to in this consent, is kept on site at all times and presented to any Wellington Regional Council officer on request.
5. All works affecting the Waiwhetu Stream, including tidy up on completion of the works, shall be completed to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Works/Design details

6. The consent holder shall ensure that no wet concrete, concrete wash water or any water contaminated with concrete enters the flowing water in the Waiwhetu Stream as a result of construction works.
7. Prior to any work that has the potential to affect neighbouring properties or infrastructure the consent holder shall inform the relevant utility service provider or property owner(s). The consent holder shall ensure that the works do not impede any utility service provider's or property owner(s) access to their property or infrastructure.
8. The upgraded and newly created stormwater outfall structures shall be suitably embedded in the stream bed to minimise the potential for erosion and scour.

12/02/09
W

9. Only sediment below the Interim Sediment Quality Guideline (ISQG) high concentration criteria in Table 3.5.1 of the Australian and New Zealand Environmental and Conservation Council (ANZECC, 2000) Sediment Quality Guidelines may be stockpiled on the floodplain. The consent holder shall install a silt fence or any other appropriate sediment control measure that is to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council, between any stockpiles and the stream to ensure no sediment laden runoff discharges to the stream. All stockpiles shall be aligned in such a way as to not impede flood flows and removed from the site as soon as practicable.

Note: Greater Wellington does not consider hay bales as an appropriate sediment control measure.

Works exclusion period

10. No works which impede the full flow of the Waiwhetu stream shall be carried out in the wetted channel during the native fish spawning/migration season (1 August to 30 September inclusive).

Note: The applicant has advised that the installation of the environmental enhancement structures, the works within the u shaped channel, and the works in the stretch between Bell Road Bridge and the remediation works, will take place within the native fish spawning/migration season.

Sedimentation effects

11. The consent holder shall take all practicable steps to minimise sedimentation and increased turbidity of the Waiwhetu Stream during the upgrade, construction, implementation and maintenance of the pipelines and stormwater outfall structures, including but not limited to:
- a) Installation and use of at least two sedimentation cells in those areas as detailed in the application;
 - b) Installation and use of silt curtains;
 - c) The installation of a second silt curtain, unless the installation is not practicable;
 - d) Completing all works in the minimum time practicable;
 - e) Minimising the area of disturbance at all times;
 - f) Avoiding placement of construction material or excavated matter in the flowing channel or in a location where runoff enters the stream; and
 - g) Undertaking works from outside the actively flowing stream bed, where practicable and separation of construction activities from flowing water (by diverting the stream flow around the works as detailed in the application).

Vehicle contaminants

12. The consent holder shall ensure that:
- a) All machinery is thoroughly cleaned of any vegetation, seeds or contaminants (such as sediments and mud) away from the works site prior to entering or exiting the works site. Cleaning shall be undertaken in an area where the wash water does not enter the stream;
 - b) No contaminants (including but not limited to oil, petrol, diesel or hydraulic fluid) shall be released into water from equipment being used for the works;
 - c) All contaminant storage or re-fuelling areas are bunded or contained in such a manner so as to prevent the discharge of contaminants;
 - d) All machinery is regularly maintained in such a manner so as to minimise the potential for leakage of contaminants (including but not limited to fuels, hydraulic fluids and lubricants); and

No machinery is stored or refuelled within 10 metres of any ephemeral or permanent watercourse.

Erosion and scour

13. The pipes and stormwater outfall structures shall remain the responsibility of the consent holder and shall be maintained so that:
- a) Any erosion or scour of the stream bed and banks that is attributable to the works carried out as part of this consent is repaired by the consent holder to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council;
 - b) The pipelines are kept in a well maintained condition so that there are no leakages from the pipes;
 - c) Fish passage is not impeded on completion of the works;
 - d) The structures remain substantively clear of debris and rubbish; and
 - e) The structures associated with this consent are kept in a well maintained condition and the structural integrity of all the structures authorised by this consent remains sound.

Maintenance does not include any works outside of the scope of the application. Any additional works (including structures, reshaping or disturbance to the bed of the watercourse) following completion of the construction works as proposed in the application, may require further resource consents.

Iwi

14. If koiwi, taonga or other artefact material is discovered in any area during the works, the consent holder shall follow the 'Protocol for dealing with Koiwi and Taonga' outlined in the Hutt Park Management Plan submitted as Appendix F in the application documents 20 October 2008.

Review conditions

15. From the exercise of this consent the Wellington Regional Council may review any or all conditions of this permit by giving notice of its intention to do so pursuant to section 128 of the Resource Management Act 1991, at any time within three months of the first, fifth, tenth, fifteenth, twentieth, twenty-fifth and thirtieth anniversary of the granting of this consent for the purpose of:
- Enabling consistency with the Waiwhetu Stream Floodplain Management Plan;
 - Dealing with any adverse effects on the environment which may arise from the exercise of this consent, and which is appropriate to deal with at a later stage;
 - To review the adequacy of any plans and/or methods used in the pipelines and stormwater outfall structures design or construction; and/or
 - Enable consistency with the relevant Regional Freshwater Plan and or with National Environmental Standards.

The Wellington Regional Council shall be entitled to recover from the consent holder the costs of any review, calculated in accordance with and limited to the Council's scale of charges in force and applicable at that time pursuant to Section 36 of the Resource Management Act 1991.

Note: For the purposes of this condition the "exercise of the consent" is deemed to be once the works authorised by this consent have commenced.



RESOURCE MANAGEMENT ACT 1991

Consent No. WGN090127 [27271]**Category: Land use consent**

Pursuant to sections 104, 104B and 108, and subject to all the relevant provisions of the Resource Management Act 1991 and any regulations made thereunder, a consent in respect of a natural resource is hereby granted to:

Name	Flood Protection Department, Wellington Regional Council	
Address	Flood Protection Department, Wellington Regional Council, PO Box 11646, Wellington 6142	
Duration of consent	Effective: 12 March 2009	Expires: 12 March 2044
Purpose for which right is granted	For future maintenance works in, on, under or over the bed of the Waiwhetu Stream, including: • Maintenance works associated with the various erosion and scour protection structures and with the channel widening and deepening works; • Bed and bank recontouring (including the removal of silt build up); and • The maintenance of environmental enhancements and associated structures; including any associated disturbance of and deposition on the stream bed and any associated discharges to the stream.	
Location	The Waiwhetu Stream, Lower Hutt: the reach downstream, from the Bell Road Bridge, Waiwhetu, Lower Hutt to the Waiwhetu Stream mouth at Port Road Bridge, Seaview, Lower Hutt between approximate map references NZMS 260: R27;2670458.5995245 and NZMS 260: R27;2669345.5994850.	
Legal description of land	Various	
Conditions	1 -15 as attached	

For and on behalf of
WELLINGTON REGIONAL COUNCIL

Manager, Environmental Regulation

Date: 12 March 2009

Summary of your rights and responsibilities

(Not part of the resource consent)

This resource consent gives you the right to use a public resource (e.g. water, air, the coastal marine area) in the manner specified in the consent.

You may exercise the resource consent as you see fit provided that you comply with all the conditions of your resource consent and all other laws of the land.

If you wish to change the way you operate under this resource consent or if you wish to change or cancel any consent conditions, please contact the Wellington Regional Council (hereafter referred to as Greater Wellington) prior to making the changes. You may need a formal change to your resource consent conditions.

You may transfer your coastal, discharge, or water permit to any other person. If you sell your operation please contact Greater Wellington and we will arrange the transfer. The service is free of charge.

If your resource consent application contained inaccurate or misleading information, Greater Wellington may cancel or alter the resource consent.

Your resource consent does not:

- provide any warranty of any structure or process;
- provide any guarantee that the resource will be available at all times;
- provide any right of access through or over public or private land;
- negate the need for any approvals necessary under other legislation.

You, as the holder(s) of this resource consent and your agents (including contractors and employees), are jointly and severally liable for compliance with the conditions of this consent. It is important that anyone operating on your behalf fully understands and complies with the conditions of the resource consent.

You are required to pay any relevant charges that are associated with the consent. Greater Wellington fixes these charges under section 36 of the Resource Management Act 1991. The Act allows you to comment on any proposed charges *prior to them being fixed*. Charges may be reviewed every year. If you would like a copy of our current Resource Management Charging Policy please ask us.

You are required to allow Greater Wellington Enforcement Officers access to your site and operation at any reasonable time so that we can inspect your operation and confirm that it is complying with the resource consent.

Your resource consent will lapse if you do not give effect to it within five years of the date it was granted (unless otherwise specified in the resource consent conditions). If you wish to apply for an extension of this lapse date please contact Greater Wellington before the lapse date.

If you stop using your resource consent for a continuous five-year period, Greater Wellington may cancel your resource consent. We will advise you in advance if we propose to cancel your consent. You have the right to object to your consent being cancelled.

This consent is issued without prejudice to any claim that is lodged with the Waitangi Tribunal in relation to the customary ownership of natural resources, whether it be a claim that is awaiting hearing or awaiting settlement by the Crown.

Conditions to Resource Consent

WGN090127 [27271]

General conditions

1. The location, design and construction of the works shall be in general accordance with the application, and its associated plans and documents, lodged with the Wellington Regional Council on 20 October 2008, and further information received:
 - At the pre hearing meeting on 2 December 2008;
 - On 5 December 2008 (via email); and
 - In the peer review received on 9 December 2008.

For the avoidance of doubt, where information contained in the application is contrary to conditions of this consent, the conditions shall prevail.

Minor changes to the location, design concepts and parameters, implementation and/or operation may be made by the consent holder where practicable and provided that these changes are to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Note: Any significant change from the location, design concepts and parameters, implementation and/or operation may require a new resource consent or a change of consent conditions pursuant to section 127 of the Resource Management Act 1991

2. The Manager, Environmental Regulation, Wellington Regional Council, shall be given a minimum of two working days (48 hours) notice prior to maintenance works commencing.

Note: Notifications can be emailed to notifications@gw.govt.nz.

3. The consent holder shall provide a copy of this consent and any documents referred to in this consent to each operator or contractor undertaking works authorised by this consent, before that operator or contractor starts any works. The consent holder shall verbally brief the contractor regarding the conditions of the consent, prior to the works authorised by this consent commencing.
4. The consent holder shall ensure that a copy of this consent and all documents referred to in this consent, is kept on site at all times and presented to any Wellington Regional Council officer on request.
5. All maintenance works affecting the Waiwhetu Stream, including tidy up on completion of the works, shall be completed to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Works/Design details

6. Once the remediation, channel deepening and widening and erosion and protection works are complete the consent holder shall keep annual records (from 1 July to 30 June inclusively) of all maintenance works that occur on the Waiwhetu Stream, including the specific location, details on what maintenance has been undertaken on a particular structure or plantings. The records shall also identify those areas where any bed or bank recontouring has been undertaken and quantities of silt removed from the stream bed. This information should be submitted to the Manager, Environmental Regulation, Wellington Regional Council by the 10 July each year.

12/02/09
W

7. The consent holder shall provide prior to undertaking any maintenance works a detailed methodology for the proposed works, including but not limited to:
- Location and timeline for the works;
 - How the works will be undertaken (e.g. details on any temporary diversion);
 - Identification of who the contractor is for the works;
 - What erosion and sediment control measures will be implemented on site to minimise sedimentation to the Waiwhetu Stream.

The methodology shall be to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

8. Prior to any work that has the potential to affect neighbouring properties or infrastructure the consent holder shall inform the relevant utility service provider or property owner(s). The consent holder shall ensure that the works do not impede any utility service provider's or property owner(s) access to their property or infrastructure.
9. Only sediment below the Interim Sediment Quality Guideline (ISQG) high concentration criteria in Table 3.5.1 of the Australian and New Zealand Environmental and Conservation Council (ANZECC, 2000) Sediment Quality Guidelines may be stockpiled on the floodplain. The consent holder shall install a silt fence or any other appropriate sediment control measure that is to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council, between any stockpiles and the stream to ensure no sediment laden runoff discharges to the stream. All stockpiles shall be aligned in such a way as to not impede flood flows and removed from the site as soon as practicable.

Note: Greater Wellington does not consider hay bales as an appropriate sediment control measure.

10. The consent holder shall ensure all structures including the reno mattresses and gabion baskets are maintained to a high standard to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Works exclusion period

11. No works shall be carried out within the wetted channel of the stream during the native fish spawning/migration season (1 April to 31 July inclusive).

Sedimentation effects

12. The consent holder shall take all practicable steps to minimise sedimentation and increased turbidity of the Waiwhetu Stream during the maintenance works, including but not limited to:
- a) Completing all works in the minimum time practicable;
 - b) The installation of a silt curtain, unless the installation is not practicable;
 - c) Minimising the area of disturbance at all times;
 - d) Undertaking works in low flow conditions;
 - e) Avoiding placement of construction material or excavated matter in the flowing channel; and
 - f) Undertaking works from outside the actively flowing stream bed and the separation of construction activities from flowing water.

Vehicle contaminants

13. The consent holder shall ensure that:
- a) All machinery is thoroughly cleaned of any vegetation, seeds or contaminants (such as sediments and mud) away from the works site prior to entering or exiting the works site. Cleaning shall be undertaken in an area where the wash water does not enter the stream;

- b) No contaminants (including but not limited to oil, petrol, diesel or hydraulic fluid) shall be released into water from equipment being used for the works;
- c) All contaminant storage or re-fuelling areas are bunded or contained in such a manner so as to prevent the discharge of contaminants;
- d) All machinery is regularly maintained in such a manner so as to minimise the potential for leakage of contaminants (including but not limited to fuels, hydraulic fluids and lubricants); and
- e) No machinery is stored or refuelled within 10 metres of any ephemeral or permanent watercourse.

Erosion and scour

14. The structures shall remain the responsibility of the consent holder and shall be maintained so that:
- a) Any erosion of the stream bed and banks that is attributable to the works carried out as part of this consent is repaired by the consent holder to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council;
 - b) Fish passage is not impeded on completion of the works;
 - c) The structures remain substantively clear of debris and rubbish; and
 - d) The structures associated with this consent are kept in a well maintained condition and the structural integrity of all the structures authorised by this consent remains sound.

Maintenance does not include any works outside of the scope of the application. Any additional works (including structures, reshaping or disturbance to the bed of the watercourse) following completion of the construction works as proposed in the application, may require further resource consents.

Review conditions

15. From the exercise of this consent the Wellington Regional Council may review any or all conditions of this permit by giving notice of its intention to do so pursuant to section 128 of the Resource Management Act 1991, at any time within three months of the first, fifth, tenth, fifteenth, twentieth, twenty-fifth and thirtieth anniversary of the granting of this consent for the purpose of:
- Enabling consistency with the Waiwhetu Stream Floodplain Management Plan;
 - Dealing with any adverse effects on the environment which may arise from the exercise of this consent, and which is appropriate to deal with at a later stage;
 - To review the adequacy of the maintenance being undertaken; and/or
 - Enable consistency with the relevant Regional Freshwater Plan and or with National Environmental Standards.

The Wellington Regional Council shall be entitled to recover from the consent holder the costs of any review, calculated in accordance with and limited to the Council's scale of charges in force and applicable at that time pursuant to Section 36 of the Resource Management Act 1991.

Note: For the purposes of this condition the "exercise of the consent" is deemed to be once the works authorised by this consent have commenced.

12/03/09
W



 RESOURCE MANAGEMENT ACT 1991
Consent No. WGN090127 [27272]**Category: Coastal permit**

Pursuant to sections 104, 104B, 105 and 108, and subject to all the relevant provisions of the Resource Management Act 1991 and any regulations made thereunder, a consent in respect of a natural resource is hereby granted to:

Name

Flood Protection Department, Wellington Regional Council

Address

Flood Protection Department, Wellington Regional Council, PO Box 11646, Wellington 6142

Duration of consent

Effective: 12 March 2009

Expires: 12 March 2044

Purpose for which right is granted

For works in the coastal marine area (CMA) at the mouth of the Waiwhetu Stream, including:

- Removal, replacement and occupation of existing erosion protection around the abutments and piles of the Port Road Bridge; and
- Construction and maintenance of erosion and scour protection at Port Road Bridge, including any associated disturbance and occupation of the coastal marine area (CMA) with these structures at the mouth of the Waiwhetu Stream.

Location

The Waiwhetu Stream mouth at Port Road Bridge, Seaview, Lower Hutt at or about map reference NZMS 260: R27;2669352.5994859.

Legal description of land

Various

Conditions

1 -15 as attached

For and on behalf of
WELLINGTON REGIONAL COUNCIL

Manager, Environmental Regulation

Date: 12 March 2009

Summary of your rights and responsibilities

(Not part of the resource consent)

This resource consent gives you the right to use a public resource (e.g. water, air, the coastal marine area) in the manner specified in the consent.

You may exercise the resource consent as you see fit provided that you comply with all the conditions of your resource consent and all other laws of the land.

If you wish to change the way you operate under this resource consent or if you wish to change or cancel any consent conditions, please contact the Wellington Regional Council (hereafter referred to as Greater Wellington) prior to making the changes. You may need a formal change to your resource consent conditions.

You may transfer your coastal, discharge, or water permit to any other person. If you sell your operation please contact Greater Wellington and we will arrange the transfer. The service is free of charge.

If your resource consent application contained inaccurate or misleading information, Greater Wellington may cancel or alter the resource consent.

Your resource consent does not:

- provide any warranty of any structure or process;
- provide any guarantee that the resource will be available at all times;
- provide any right of access through or over public or private land;
- negate the need for any approvals necessary under other legislation.

You, as the holder(s) of this resource consent and your agents (including contractors and employees), are jointly and severally liable for compliance with the conditions of this consent. It is important that anyone operating on your behalf fully understands and complies with the conditions of the resource consent.

You are required to pay any relevant charges that are associated with the consent. Greater Wellington fixes these charges under section 36 of the Resource Management Act 1991. The Act allows you to comment on any proposed charges *prior to them being fixed*. Charges may be reviewed every year. If you would like a copy of our current Resource Management Charging Policy please ask us.

You are required to allow Greater Wellington Enforcement Officers access to your site and operation at any reasonable time so that we can inspect your operation and confirm that it is complying with the resource consent.

Your resource consent will lapse if you do not give effect to it within five years of the date it was granted (unless otherwise specified in the resource consent conditions). If you wish to apply for an extension of this lapse date please contact Greater Wellington before the lapse date.

If you stop using your resource consent for a continuous five-year period, Greater Wellington may cancel your resource consent. We will advise you in advance if we propose to cancel your consent. You have the right to object to your consent being cancelled.

This consent is issued without prejudice to any claim that is lodged with the Waitangi Tribunal in relation to the customary ownership of natural resources, whether it be a claim that is awaiting hearing or awaiting settlement by the Crown.

Conditions to Resource Consent

WGN090127 [27272]

General conditions

1. The location, design and construction of the works shall be in general accordance with the application, and its associated plans and documents, lodged with the Wellington Regional Council on 20 October 2008, and further information received:
 - At the pre hearing meeting on 2 December 2008;
 - On 5 December 2008 (via email); and
 - In the peer review received on 9 December 2008.

For the avoidance of doubt, where information contained in the application is contrary to conditions of this permit, the conditions shall prevail.

Minor changes to the location, design concepts and parameters, implementation and/or operation may be made by the permit holder where practicable and provided that these changes are to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Note: Any significant change from the location, design concepts and parameters, implementation and/or operation may require a new resource consent or a change of consent conditions pursuant to section 127 of the Resource Management Act 1991

2. The Manager, Environmental Regulation, Wellington Regional Council, shall be given a minimum of two working days (48 hours) notice prior to maintenance works commencing.

Note: Notifications can be emailed to notifications@gw.govt.nz.

3. The permit holder shall provide a copy of this permit and any documents referred to in this permit to each operator or contractor undertaking works authorised by this permit, before that operator or contractor starts any works. The permit holder shall verbally brief the contractor regarding the conditions of the permit, prior to the works authorised by this permit commencing.
4. The permit holder shall ensure that a copy of this permit and all documents referred to in this permit, is kept on site at all times and presented to any Wellington Regional Council officer on request.
5. All works affecting the Waiwhetu Stream and the coastal marine area, including tidy up on completion of the works, shall be completed to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

Works/Design details

6. Prior to any work that has the potential to affect neighbouring properties or infrastructure the consent holder shall inform the relevant utility service provider or property owner(s). The consent holder shall ensure that the works do not impede any utility service provider's or property owner(s) access to their property or infrastructure.
7. All sediment excavated from the channel shall be removed from the area and disposed of in an appropriate manner.
8. All structures (the erosion and scour protection structures, retaining walls and environmental enhancement structures) shall be bedded into the stream to a sufficient depth to prevent erosion and scour.

12/02/09
W

9. The permit holder shall ensure that no wet concrete, concrete wash water or any water contaminated with concrete enters the flowing water in the Waiwhetu Stream as a result of construction works.
10. Upon completion of the works, all materials surplus to the works shall be removed from the coastal marine area and disposed of in an appropriate manner.

Sedimentation effects

11. The permit holder shall take all practicable steps to minimise sedimentation and increased turbidity of Waiwhetu Stream and the coastal marine area due to the implementation and operation of the works, including but not limited to:
 - a) Completing all works in the minimum time practicable;
 - b) Minimising the area of disturbance at all times;
 - c) Separating construction activities from the coastal marine area and from outside the actively flowing stream bed, where practicable;
 - d) Ensuring that no excavated, surplus or waste construction materials are dumped or stored in the coastal marine area or in the flowing channel; and
 - e) Undertaking the works in such weather, tidal or sea conditions where the potential for sediment to be mobilised into the coastal marine area is minimised

Vehicle contaminants

12. The permit holder shall ensure that:
 - a) All machinery is thoroughly cleaned of any vegetation, seeds or contaminants (such as sediments and mud) away from the works site prior to entering or exiting the works site. Cleaning shall be undertaken in an area where the wash water does not enter the stream;
 - b) No contaminants (including but not limited to oil, petrol, diesel or hydraulic fluid) shall be released into water from equipment being used for the works;
 - c) All contaminant storage or re-fuelling areas are bunded or contained in such a manner so as to prevent the discharge of contaminants;
 - d) All machinery is regularly maintained in such a manner so as to minimise the potential for leakage of contaminants (including but not limited to fuels, hydraulic fluids and lubricants); and
 - e) No machinery is stored or refuelled within 10 metres of any ephemeral or permanent watercourse or refuelled within the coastal marine area.

Erosion and scour

13. The works and structures shall remain the responsibility of the permit holder and shall be maintained so that:
 - a) Any erosion of the stream bed or banks that is attributable to the works carried out as part of this permit is remedied by the permit holder to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council;
 - b) Any erosion of the foreshore that is attributable to the structures is repaired by the permit holder;
 - c) Access to the foreshore is not impeded by the structure(s);
 - d) The structures do not pose a hazard to navigation; and
 - e) The structural integrity of the structures remains sound.

Maintenance does not include any works outside of the scope of the application. Any additional works (including structures, reshaping or disturbance to the bed of the watercourse) following completion of the construction works as proposed in the application, may require further resource consents.

Iwi

14. If koiwi, taonga or other artefact material is discovered in any area during the works, the consent holder shall follow the 'Protocol for dealing with Koiwi and Taonga' outlined in the Hutt Park Management Plan submitted as Appendix F in the application documents 20 October 2008.

Review conditions

15. From the exercise of this permit the Wellington Regional Council may review any or all conditions of this permit by giving notice of its intention to do so pursuant to section 128 of the Resource Management Act 1991, at any time within three months of the first, fifth, tenth, fifteenth, twentieth, twenty-fifth and thirtieth anniversary of the granting of this permit for the purpose of:

- Enabling consistency with the Waiwhetu Stream Floodplain Management Plan;
- Dealing with any adverse effects on the environment which may arise from the exercise of this permit, and which is appropriate to deal with at a later stage;
- To review the adequacy of any plans and/or methods used during the works; and/or
- Enable consistency with the relevant Regional Freshwater and Coastal Plans and or with National Environmental Standards.

The Wellington Regional Council shall be entitled to recover from the permit holder the costs of any review, calculated in accordance with and limited to the Council's scale of charges in force and applicable at that time pursuant to Section 36 of the Resource Management Act 1991.

Note: For the purposes of this condition the "exercise of the permit" is deemed to be once the works authorised by this consent have commenced.

21/03/08
M

Appendix B Validation Sample Results

CLIENT : URS NEW ZEALAND LTD
ADDRESS : PO BOX 3367, WELLINGTON 6011.
EMAIL : sarah_halliday@urscorp.com
TEL : 04 496 3877
ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA12964-J

CLIENT REFERENCE : PROJECT No. not supplied
SAMPLE TYPE[S] : 12 x SLUDGES/STREAM SEDIMENTS
DATE OF SAMPLE RECEIPT : 21/11/2009 **CONDITION** : COARSE WET SOLID
ANALYSES CARRIED OUT : TRACE ELEMENTS
REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand.
 This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 23/11/2009 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
 P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA12964-J

X-RAY FLUORESCENCE ANALYSES

SAMPLE	A/110R 20.11.09	A/110M 20.11.09	A/90R 20.11.09	A/90M 20.11.09	A/70R 20.11.09	A/70M 20.11.09
Cr	36	73	54	40	42	41
Cu	2	36	14	10	12	8
Zn	58	382	95	122	108	79
Pb	17	164	33	50	58	28

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	18.3	56.4	46.9	29.0	23.5	23.2
<2mm fraction %	-	-	-	-	-	-
>2mm fraction %	-	-	-	-	-	-

URS NEW ZEALAND LTD

JOB REFERENCE : SA12964-J

X-RAY FLUORESCENCE ANALYSES

SAMPLE	A/50R 20.11.09	A/50M 20.11.09	A/30R 20.11.09	A/30M 20.11.09	A/10R 20.11.09	A/10M 20.11.09
Cr	45	41	39	36	36	32
Cu	12	5	4	2	7	2
Zn	123	68	71	64	82	64
Pb	54	20	24	18	31	21

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	28.0	12.8	22.7	15.8	17.7	16.7
<2mm fraction %	-	-	-	-	-	-
>2mm fraction %	-	-	-	-	-	-

CLIENT : **URS NEW ZEALAND LTD**

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA12964-D

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 6 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 9/11/2009 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand. This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 9/11/2009 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA12964-D

X-RAY FLUORESCENCE ANALYSES

SAMPLE	1/10R 07.11.09	1/10M 07.11.09	1/10L 07.11.09	1/30R 07.11.09	1/30M 07.11.09	1/30L 07.11.09
Cr	48	42	38	42	32	52
Cu	10	7	6	13	5	17
Zn	96	110	73	161	65	244
Pb	36	38	21	64	17	99

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	20.1	27.7	20.6	19.1	19.1	20.6
<2mm fraction %	-	-	-	-	-	-
>2mm fraction %	-	-	-	-	-	-

CLIENT : **URS NEW ZEALAND LTD**

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA12964-E

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 6 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 10/11/2009 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand. This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 10/11/2009 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA12964-E

X-RAY FLUORESCENCE ANALYSES

SAMPLE	1/50R 09.11.09	1/50M 09.11.09	1/50L 09.11.09	1/70R 09.11.09	1/70M 09.11.09	1/70L 09.11.09
Cr	39	44	43	42	39	54
Cu	3	8	9	7	4	11
Zn	54	87	102	63	63	181
Pb	14	28	36	18	16	70

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	14.3	22.8	22.4	20.4	18.2	20.4
<2mm fraction %	-	-	-	-	-	-
>2mm fraction %	-	-	-	-	-	-

CLIENT : **URS NEW ZEALAND LTD**

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA12964-F

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 3 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 11/11/2009 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand. This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 12/11/2009 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
 P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA12964-F

X-RAY FLUORESCENCE ANALYSES

SAMPLE	1/90R	1/90M	1/90L
	11.11.09	11.11.09	11.11.09
Cr	43	43	42
Cu	8	8	8
Zn	65	80	65
Pb	20	28	19

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	25.1	22.2	20.9
<2mm fraction %	-	-	-
>2mm fraction %	-	-	-

CLIENT : **URS NEW ZEALAND LTD**

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA12964-K

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 3 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 26/11/2009 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand.

This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 26/11/2009 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
 P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA12964-K

X-RAY FLUORESCENCE ANALYSES

SAMPLE	B/110R 25.11.09	B/110M 25.11.09	B/110L 25.11.09
Cr	42	46	37
Cu	12	10	4
Zn	127	133	67
Pb	44	56	31

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	24.2	26.9	3.8
<2mm fraction %	-	-	-
>2mm fraction %	-	-	-

CLIENT : **URS NEW ZEALAND LTD**

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA12964-L

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 3 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 27/11/2009 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand. This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 27/11/2009 **Signed** : Lee Searle IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
 P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA12964-L

X-RAY FLUORESCENCE ANALYSES

SAMPLE	B/130L 25.11.09	B/130M 25.11.09	B/110R 25.11.09
Cr	33	33	44
Cu	1	2	5
Zn	47	51	63
Pb	11	15	20

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	19.3	21.2	21.1
<2mm fraction %	-	-	-
>2mm fraction %	-	-	-

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13074-C

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 6 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 14/01/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand. This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 15/01/2010 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13074-C

X-RAY FLUORESCENCE ANALYSES

SAMPLE	CD/10L 13.01.10	CD/10M 13.01.10	CD/10R 13.01.10	CD/30L 13.01.10	CD/30M 13.01.10	CD/30R 13.01.10
Cr	29	34	34	37	36	35
Cu	1	3	6	2	2	4
Zn	49	51	95	55	50	62
Pb	16	16	44	18	14	28

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content % 12.6 6.0 17.4 20.6 15.2 16.5

CLIENT : URS NEW ZEALAND LTD
ADDRESS : PO BOX 3367, WELLINGTON 6011.
EMAIL : sarah_halliday@urscorp.com
TEL : 04 496 3877
ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13074-D

CLIENT REFERENCE : PROJECT No. not supplied
SAMPLE TYPE[S] : 6 x SLUDGES/STREAM SEDIMENTS
DATE OF SAMPLE RECEIPT : 14/01/2010 **CONDITION** : COARSE WET SOLID
ANALYSES CARRIED OUT : TRACE ELEMENTS
REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand. This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 15/01/2010 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13074-D

X-RAY FLUORESCENCE ANALYSES

SAMPLE	CD/50R	CD/50M	CD/50L	CD/70R	CD/70M	CD/70L
	14.01.10	14.01.10	14.01.10	14.01.10	14.01.10	14.01.10
Cr	28	33	32	25	26	24
Cu	1	1	<1	<1	<1	1
Zn	45	56	45	43	47	44
Pb	13	20	11	12	14	17

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content % 18.8 5.9 15.9 20.9 16.9 16.3

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13074-E

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 12 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 15/01/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand.

This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 18/01/2010 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
 P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13074-E

X-RAY FLUORESCENCE ANALYSES

SAMPLE	CD/90L 14.01.10	CD/90M 14.01.10	CD/90R 14.01.10	CD/110L 14.01.10	CD/110M 14.01.10	CD/110R 14.01.10
Cr	32	35	29	27	33	28
Cu	1	1	<1	1	1	1
Zn	48	51	46	47	49	47
Pb	13	14	13	17	13	14

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	18.9	19.4	19.9	19.2	19.6	20.5
---------------------------	------	------	------	------	------	------

URS NEW ZEALAND LTD

JOB REFERENCE : SA13074-E

X-RAY FLUORESCENCE ANALYSES

SAMPLE	CD/130L 14.01.10	CD/130M 14.01.10	CD/130R 14.01.10	CD/150L 14.01.10	CD/150M 14.01.10	CD/150R 14.01.10
Cr	33	35	36	34	29	27
Cu	3	2	4	3	2	2
Zn	54	56	56	59	47	62
Pb	16	15	17	18	12	69

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	21.6	16.0	18.6	22.2	12.3	16.6
---------------------------	------	------	------	------	------	------

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13074-F

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 6 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 15/01/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand.

This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 18/01/2010 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13074-F

X-RAY FLUORESCENCE ANALYSES

SAMPLE	CD/170L	CD/170M	CD/170R	CD/190L	CD/190M	CD/190R
	15.01.10	15.01.10	15.01.10	15.01.10	15.01.10	15.01.10
Cr	26	26	31	28	31	28
Cu	1	1	1	1	2	<1
Zn	46	52	59	48	66	49
Pb	21	75	100	16	176	17

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	17.5	18.4	16.9	9.7	23.1	18.7
---------------------------	------	------	------	-----	------	------

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13074-I

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 9 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 28/01/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb, As & Ni	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand. This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 29/01/2010 **Signed :** Lee Searle IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13074-I

X-RAY FLUORESCENCE ANALYSES

SAMPLE	E/10R 28.01.10	E/10M 28.01.10	E10/L 28.01.10	E/30R 28.01.10	E/30M 28.01.10	E/30L 28.01.10
Cr	31	32	32	31	30	31
Cu	1	4	22	<1	1	2
Zn	51	69	70	52	59	50
Pb	13	142	200	21	22	15
As	5	6	7	2	2	3
Ni	12	12	15	12	12	13

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	15.4	14.0	5.5	18.7	10.3	5.6
---------------------------	------	------	-----	------	------	-----

URS NEW ZEALAND LTD

JOB REFERENCE : SA13074-I

X-RAY FLUORESCENCE ANALYSES

SAMPLE	E/50R 28.01.10	E/50M 28.01.10	E/50L 28.01.10
Cr	36	35	29
Cu	1	2	2
Zn	52	55	52
Pb	13	13	13
As	3	4	4
Ni	12	13	14

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content % 23.5 22.5 21.0

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13118-A

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 13 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 3/02/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb.	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand. This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 4/02/2010 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13118-A

X-RAY FLUORESCENCE ANALYSES

SAMPLE	E/110R 3.02.10	E/110M 3.02.10	E110/L 3.02.10	E/130R 3.02.10	E/130M 3.02.10	E/130L 3.02.10	E/150R 3.02.10
Cr	38	42	31	34	37	34	32
Cu	5	8	2	2	5	2	2
Zn	90	73	54	54	62	54	49
Pb	65	28	14	14	23	15	14

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	22.7	25.0	22.4	17.2	20.7	15.7	13.8
---------------------------	------	------	------	------	------	------	------

URS NEW ZEALAND LTD

JOB REFERENCE : SA13118-A

X-RAY FLUORESCENCE ANALYSES

SAMPLE	E/150M 3.02.10	E/150L 3.02.10	E/170M 3.02.10	E/170L 3.02.10	E/190M 3.02.10	E/190L 3.02.10
Cr	29	32	30	29	34	36
Cu	3	3	5	2	2	3
Zn	47	52	62	53	106	150
Pb	13	14	20	15	39	15

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	13.1	12.7	12.8	9.7	9.5	16.0
---------------------------	------	------	------	-----	-----	------

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13118-B

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 2 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 4/02/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb.	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand. This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 5/02/2010 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13118-B

X-RAY FLUORESCENCE ANALYSES

SAMPLE	E/170R	E/190R
	4.02.10	4.02.10
Cr	31	36
Cu	1	7
Zn	49	186
Pb	13	91

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content	%	11.8	14.4
------------------	---	------	------

CLIENT : URS NEW ZEALAND LTD
ADDRESS : PO BOX 3367, WELLINGTON 6011.
EMAIL : sarah_halliday@urscorp.com
TEL : 04 496 3877
ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13206-A

CLIENT REFERENCE : PROJECT No. not supplied
SAMPLE TYPE[S] : 7 x SLUDGES/STREAM SEDIMENTS
DATE OF SAMPLE RECEIPT : 10/03/2010 **CONDITION** : COARSE WET SOLID
ANALYSES CARRIED OUT : TRACE ELEMENTS
REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb.	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand.
 This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 11/03/2010 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
 P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13206-A

X-RAY FLUORESCENCE ANALYSES

SAMPLE	FG/10L 10.03.10	FG/10M 10.03.10	FG/30L 10.03.10	FG/30M 10.03.10	FG/30R 10.03.10	FG/50L 10.03.10	FG/50M 10.03.10
Cr	32	36	33	32	34	37	34
Cu	4	1	2	3	2	3	1
Zn	106	54	51	85	84	82	48
Pb	15	13	19	18	34	39	12

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	15.0	15.4	6.0	14.2	14.3	5.5	7.9
---------------------------	------	------	-----	------	------	-----	-----

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13206-B

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 9 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 10/03/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb.	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand. This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 12/03/2010 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13206-B

X-RAY FLUORESCENCE ANALYSES

SAMPLE	FG/70L 10.03.10	FG/70M 10.03.10	FG/70R 10.03.10	FG/90L 10.03.10	FG/90M 10.03.10	FG/90R 10.03.10	FG/110L 10.03.10	FG/110M 10.03.10	FG/110R 10.03.10
Cr	32	35	39	33	36	38	35	32	38
Cu	2	3	4	3	3	5	2	1	3
Zn	51	74	122	51	65	87	60	58	65
Pb	14	30	72	13	24	46	16	25	27

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	1.5	13.1	15.1	7.1	14.4	10.7	16.5	12.3	4.3
--------------------	-----	------	------	-----	------	------	------	------	-----

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13206-C

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 9 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 10/03/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb.	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand. This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 12/03/2010 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13206-C

X-RAY FLUORESCENCE ANALYSES

SAMPLE	FG/150L 10.03.10	FG/150M 10.03.10	FG/150R 10.03.10	FG/170L 10.03.10	FG/170M 10.03.10	FG/170R 10.03.10	FG/190L 10.03.10	FG/190M 10.03.10	FG/190R 10.03.10
Cr	33	41	43	44	35	37	39	36	54
Cu	3	6	6	10	3	5	1	3	14
Zn	51	82	110	130	76	79	57	55	183
Pb	11	37	63	49	38	34	16	17	116

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	4.5	16.6	10.0	20.2	8.3	5.9	9.7	2.3	4.0
--------------------	-----	------	------	------	-----	-----	-----	-----	-----

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13206-D

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 2 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 11/03/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb.	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand.

This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 12/03/2010 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13206-D

X-RAY FLUORESCENCE ANALYSES

SAMPLE	FG/10R	FG/50R
Cr	33	33
Cu	3	2
Zn	48	50
Pb	14	14

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	15.7	14.8
--------------------	------	------

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13206-E

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 9 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 16/03/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb.	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand. This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 17/03/2010 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13206-E

X-RAY FLUORESCENCE ANALYSES

SAMPLE	FG/210L 15.03.10	FG/210M 15.03.10	FG/210R 15.03.10	FG/230L 15.03.10	FG/230M 15.03.10	FG/230R 15.03.10	FG/250L 15.03.10	FG/250M 15.03.10	FG/250R 15.03.10
Cr	43	37	40	43	36	36	43	43	31
Cu	8	4	9	7	3	2	6	10	2
Zn	144	75	88	129	64	53	124	131	54
Pb	85	33	167	82	23	14	89	86	16

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	5.7	4.1	3.0	5.5	2.7	3.6	8.7	12.8	3.5
--------------------	-----	-----	-----	-----	-----	-----	-----	------	-----

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13206-F

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 6 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 16/03/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb.	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand.

This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 18/03/2010 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
 P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13206-F

X-RAY FLUORESCENCE ANALYSES

SAMPLE	FG/270L 16.03.10	FG/270M 16.03.10	FG/270R 16.03.10	FG/130L 16.03.10	FG/130M 16.03.10	FG/130R 16.03.10
Cr	47	39	43	36	38	34
Cu	11	9	6	6	2	1
Zn	203	130	129	95	53	55
Pb	153	102	98	46	16	17

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	11.1	11.5	14.7	8.4	5.6	5.8
--------------------	------	------	------	-----	-----	-----

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13287-A

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 9 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 8/04/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb.	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand. This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 9/04/2010 **Signed :** Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13287-A

X-RAY FLUORESCENCE ANALYSES

SAMPLE	H/10L 8.04.10	H/10M 8.04.10	H/10R 8.04.10	H/30L 8.04.10	H/30M 8.04.10	H/30R 8.04.10	H/50L 8.04.10	H/50M 8.04.10	H/50R 8.04.10
Cr	35	33	36	29	33	32	39	34	37
Cu	1	3	4	2	3	1	4	4	4
Zn	48	57	93	49	53	51	94	57	71
Pb	13	18	33	13	15	13	37	17	31

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	3.1	3.5	9.6	2.8	5.2	10.9	7.5	17.3	9.3
--------------------	-----	-----	-----	-----	-----	------	-----	------	-----

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13287-C

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 6 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 15/04/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb.	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand. This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 19/04/2010 **Signed :** Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13287-C

X-RAY FLUORESCENCE ANALYSES

SAMPLE	H/110 L 13.04.10	H/110 M 13.04.10	H/130 L 13.04.10	H/130 LM 13.04.10	H/130 M 13.04.10	H/130 RM 13.04.10
Cr	31	34	35	31	31	33
Cu	2	4	2	1	2	1
Zn	55	74	67	51	54	52
Pb	19	33	31	16	18	18

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	4.0	5.8	3.2	2.6	3.2	2.3
--------------------	-----	-----	-----	-----	-----	-----

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13287-E

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 6 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 20/04/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb.	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand.

This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 21/04/2010 **Signed :** Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13287-E

X-RAY FLUORESCENCE ANALYSES

SAMPLE	H/70 M 19.04.10	H/70 L 19.04.10	H/70 R 19.04.10	H/90 M 19.04.10	H/90 L 19.04.10	H/90 R 19.04.10
Cr	40	33	36	59	37	49
Cu	5	4	6	21	4	15
Zn	78	82	83	223	86	219
Pb	41	35	39	182	51	160

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	8.9	3.4	7.9	11.1	15.4	11.6
--------------------	-----	-----	-----	------	------	------

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13287-F

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 17 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 23/04/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb.	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand. This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 27/04/2010 **Signed :** Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13287-F

X-RAY FLUORESCENCE ANALYSES

SAMPLE	M/110 L 22.04.10	M/110 M 22.04.10	M/110 R 22.04.10	M/130 L 22.04.10	M/130 M 22.04.10	M/130 R 22.04.10	H/110 L rep 22.04.10	H/110 M rep 22.04.10	H/110 R rep 22.04.10
Cr	47	40	37	37	38	42	34	36	33
Cu	10	5	4	4	6	6	2	3	2
Zn	77	65	56	58	59	59	56	76	59
Pb	41	26	18	18	18	19	21	35	23

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	21.7	6.2	16.5	6.3	4.0	20.6	10.4	11.9	11.4
--------------------	------	-----	------	-----	-----	------	------	------	------

URS NEW ZEALAND LTD

JOB REFERENCE : SA13287-F

X-RAY FLUORESCENCE ANALYSES

SAMPLE	H/130 M rep 22.04.10	H/130 MR rep 22.04.10	H/130 R 22.04.10	H/150 ML 22.04.10	H/150 M 22.04.10	H/150 MR 22.04.10	H/150 R 22.04.10	MBS 22.04.10
Cr	30	36	30	28	31	35	36	34
Cu	1	5	2	0	4	5	16	3
Zn	51	64	47	45	61	60	83	52
Pb	13	24	13	12	25	24	51	17

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content	%	14.1	7.9	13.3	3.3	6.8	4.2	12.8	10.1
------------------	---	------	-----	------	-----	-----	-----	------	------

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13287-G

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 6 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 28/04/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb.	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand.

This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 30/04/2010 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13287-G

X-RAY FLUORESCENCE ANALYSES

SAMPLE	M/10 R 26.04.10	M/10 M 26.04.10	M/10 LM 26.04.10	H/150 L 26.04.10	H/130 L 26.04.10	H/130 LM 26.04.10
Cr	34	44	31	29	30	31
Cu	34	12	3	3	2	3
Zn	48	136	72	58	57	54
Pb	13	98	12	12	22	16

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	4.7	5.5	3.2	3.8	6.2	4.7
--------------------	-----	-----	-----	-----	-----	-----

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13287-H

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 13 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 30/04/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb. As & Ni	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand.

This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 3/05/2010 **Signed** : Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13287-F

X-RAY FLUORESCENCE ANALYSES

SAMPLE	UCW 5 30.04.10	UCW 10 30.04.10	UCW 15 30.04.10	UCW 20 30.04.10	UCW 25 30.04.10
	H1	H2	H3	H4	H5
Cr	42	43	38	40	35
Cu	12	16	9	6	7
Zn	120	122	115	84	80
Pb	91	89	84	46	43
As	6	8	6	4	5
Ni	14	14	15	13	13

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	8.9	8.7	8.6	9.4	9.4
--------------------	-----	-----	-----	-----	-----

URS NEW ZEALAND LTD

JOB REFERENCE : SA13287-H

X-RAY FLUORESCENCE ANALYSES

SAMPLE	M/30 R 30.04.10	M/30 M 30.04.10	M/50 R 30.04.10	M/50 M 30.04.10	M/50 L 30.04.10	M/90 R 30.04.10	M/90 M 30.04.10	M/90 L 30.04.10
Cr	33	32	33	31	29	35	33	36
Cu	4	3	2	1	2	3	3	3
Zn	58	58	50	55	48	56	55	64
Pb	16	22	14	22	13	18	15	23

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	8.8	4.6	3.9	6.8	4.5	18.6	16.5	14.6
--------------------	-----	-----	-----	-----	-----	------	------	------

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13347-A

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 4 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 3/05/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb.	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand. This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 4/05/2010 **Signed :** Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13347-A

X-RAY FLUORESCENCE ANALYSES

SAMPLE	M/10 L 3.05.10	M/30 L 3.05.10	M/70 L 3.05.10	M/70 M 3.05.10
Cr	33	35	36	30
Cu	4	6	6	3
Zn	70	76	102	60
Pb	13	58	371	79

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content	%	10.4	5.2	7.9	10.3
------------------	---	------	-----	-----	------

CLIENT : URS NEW ZEALAND LTD

ADDRESS : PO BOX 3367, WELLINGTON 6011.

EMAIL : sarah_halliday@urscorp.com

TEL : 04 496 3877

ATTENTION : SARAH HALLIDAY **JOB REFERENCE** : SA13347-A2

CLIENT REFERENCE : PROJECT No. not supplied

SAMPLE TYPE[S] : 1 x SLUDGES/STREAM SEDIMENTS

DATE OF SAMPLE RECEIPT : 4/05/2010 **CONDITION** : COARSE WET SOLID

ANALYSES CARRIED OUT : TRACE ELEMENTS

REPORTING BASIS : OVEN DRIED (110°C) - on <2mm fraction

The analytical results presented in this report apply to the sample(s) received by SpectraChem Analytical.

Analysis	Method used	LLD	Unit
Cr, Cu, Zn, Pb.	Powder briquette / X-ray spectrometry / Spectra ^{plus}	1	mg/Kg



SpectraChem Analytical is an IANZ accredited analytical laboratory. All analyses presented in this report other than those indicated (*), have been carried out by SpectraChem or by a sub-contracted laboratory in accordance with the requirements of International Accreditation New Zealand.

This report may not be reproduced either in part or whole without the prior consent of the undersigned.

Date : 5/05/2010 **Signed :** Craig Fraser IANZ Signatory

SpectraChem Analytical, CRL Energy Ltd : 68 Gracefield Rd : Lower Hutt
 P O Box 31-244 Lower Hutt : Tel. 04 589-6333 : Fax. 04 569-6605 : Email. spectra@spectrachem.co.nz

URS NEW ZEALAND LTD

JOB REFERENCE : SA13347-A-2

X-RAY FLUORESCENCE ANALYSES

SAMPLE	M/70 L
	(repeat)
	4.05.10
Cr	33
Cu	3
Zn	61
Pb	25

Results are expressed as mg/Kg on oven-dried 110°C basis.

Moisture Content %	6.7
--------------------	-----

Appendix C Water Sample Results



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	740770	SPv1
Contact:	Dr J Coakley	Date Registered:	04-Nov-2009	
	C/- URS New Zealand Limited	Date Reported:	10-Nov-2009	
	PO Box 3367	Quote No:	36794	
	WELLINGTON 6140	Order No:	42771630	
		Client Reference:	GWRC - Waiwhetu Stream	
		Submitted By:	S Halliday	

Sample Type: Aqueous						
Sample Name:		93270				
		03-Nov-2009				
Lab Number:		740770.1				
pH	pH Units	7.3	-	-	-	-
Total Suspended Solids	g/m ³	180	-	-	-	-
Dissolved Chromium	g/m ³	< 0.00050	-	-	-	-
Total Chromium	g/m ³	0.014	-	-	-	-
Dissolved Copper	g/m ³	0.0013	-	-	-	-
Total Copper	g/m ³	0.024	-	-	-	-
Dissolved Lead	g/m ³	0.0034	-	-	-	-
Total Lead	g/m ³	0.17	-	-	-	-
Dissolved Zinc	g/m ³	0.0056	-	-	-	-
Total Zinc	g/m ³	0.44	-	-	-	-

Analyst's Comments	
Appendix No.1 - Chain of Custody	

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Digestion	Boiling nitric acid digestion. APHA 3030 E 21 st ed. 2005.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Chromium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005 / US EPA 200.8.	0.00053 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005 / US EPA 200.8.	0.00053 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Lead	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005 / US EPA 200.8.	0.00011 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005 / US EPA 200.8.	0.0011 g/m ³	1



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.

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.

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, appearing to be 'Ara Heron', with a stylized, overlapping structure.

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

740770

No of Samples **1**

No of Fractions 6



0317407708

URS

FROM:		TO:	
URS New Zealand Limited Lambton House 1160 Lambton Quay Wellington Ph: (04) 496 3750 Fax (09) 496 3755		R J Hill Laboratories Limited 1 Clyde Street Hamilton Ph: (07) 858 2000	
RESULTS ATTENTION: <i>Sarah Halliday</i> <i>Jennifer Cookley</i> SAMPLER(S): <i>Sarah Halliday.</i>		CLIENT: <i>SWRC</i> SITE: <i>WAIWHIRI STREAM</i> PROJECT NO: <i>42771630.</i> LAB QUOTE NO: ☒ 36794 Normal Priority ☐ 36795 High Priority ☐ 36796 Urgent Priority	
RESULTS REQUIRED BY:		COMMENTS	
SAMPLE ID <i>53270</i>	MATRIX <i>Water.</i>	DATE/TIME <i>3-11-09</i>	
Total No. of Sample Bottles:	<i>3</i>		
CHAIN OF CUSTODY DATA			
RELINQUISHED BY <i>Sarah Halliday</i>		RECEIVED BY <i>M. Smith</i>	
NAME: <i>Sarah Halliday</i>		NAME:	
COMPANY: URS		COMPANY: <i>Hill Labs</i>	
DATE: <i>3-11-09</i>		DATE: <i>4/11/09</i>	
TIME: <i>13.20.</i>		TIME: <i>10:17am</i>	
SAMPLE RECEIPT DATA			
PLEASE COMPLETE THIS SECTION (CIRCLE AS APPROPRIATE) AND RETURN FAX A COPY IMMEDIATELY AFTER RECEIVING SAMPLES)			
ALL SAMPLES AND ASSOCIATED DOCUMENTATION WERE RECEIVED IN GOOD ORDER		YES / NO	
		<i>YES / NO</i>	
SPECIAL HANDLING/STORAGE OR DISPOSAL INSTRUCTIONS:			
CAUTION - SAMPLES MAY CONTAIN HAZARDOUS SUBSTANCES			
REPORTING			
REPORT FORMAT: ☐ FAX ☐ LETTER ☒ DISK ☐		METHOD OF SHIPMENT HILLS DOCKET	
EMAIL ADDRESS:		CUSTODY SEAL INTACT: YES / NO / NA	
		SAMPLES CHILLED: YES / NO / NA	
		LABORATORY BATCH NO:	
INTERNAL USE - URS WORK INSTRUCTIONS AND CHECKLIST OVERLEAF			



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	741840	SPv1
Contact:	S Halliday	Date Registered:	07-Nov-2009	
	C/- URS New Zealand Limited	Date Reported:	19-Nov-2009	
	PO Box 3367	Quote No:	36794	
	WELLINGTON 6140	Order No:	42771630	
		Client Reference:	Waiwhetu	
		Submitted By:	Dr J Coakley	

Sample Type: Aqueous

Sample Name:	93271				
	06-Nov-2009				
Lab Number:	741840.1				

Individual Tests

pH	pH Units	7.5	-	-	-	-
Total Suspended Solids	g/m ³	52	-	-	-	-
Heavy metals, dissolvd, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Dissolved Arsenic	g/m ³	< 0.0010	-	-	-	-
Dissolved Cadmium	g/m ³	< 0.000050	-	-	-	-
Dissolved Chromium	g/m ³	< 0.00050	-	-	-	-
Dissolved Copper	g/m ³	0.0011	-	-	-	-
Dissolved Lead	g/m ³	0.0059	-	-	-	-
Dissolved Nickel	g/m ³	0.00070	-	-	-	-
Dissolved Zinc	g/m ³	0.011	-	-	-	-
Heavy metals, totals, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Arsenic	g/m ³	0.0024	-	-	-	-
Total Cadmium	g/m ³	0.00048	-	-	-	-
Total Chromium	g/m ³	0.0041	-	-	-	-
Total Copper	g/m ³	0.0085	-	-	-	-
Total Lead	g/m ³	0.058	-	-	-	-
Total Nickel	g/m ³	0.0020	-	-	-	-
Total Zinc	g/m ³	0.12	-	-	-	-

Analyst's Comments

Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Samples
Heavy metals, dissolvd, trace As,Cd,Cr,Cu,Ni,Pb,Zn	0.45µm filtration, ICP-MS, trace level	-	1
Heavy metals, totals, trace As,Cd,Cr,Cu,Ni,Pb,Zn	Nitric acid digestion, ICP-MS, trace level	-	1
Total Digestion	Boiling nitric acid digestion. APHA 3030 E 21 st ed. 2005.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1



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.

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.

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, appearing to read 'Peter Robinson', with a long horizontal flourish extending to the right.

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

Page 1 of 1



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	742701	SPV1
Contact:	S Halliday C/- URS New Zealand Limited PO Box 3367 WELLINGTON 6140	Date Registered:	11-Nov-2009	
		Date Reported:	24-Nov-2009	
		Quote No:		
		Order No:	42771630	
		Client Reference:	SWRC - Waiwhetu	
		Submitted By:	Dr J Coakley	

Sample Type: Aqueous						
Sample Name:		93272				
		09-Nov-2009				
Lab Number:		742701.1				
pH	pH Units	7.5	-	-	-	-
Total Suspended Solids	g/m ³	51	-	-	-	-
Dissolved Chromium	g/m ³	< 0.0010	-	-	-	-
Total Recoverable Chromium	g/m ³	< 0.0051	-	-	-	-
Dissolved Copper	g/m ³	0.016	-	-	-	-
Total Recoverable Copper	g/m ³	0.0059	-	-	-	-
Dissolved Lead	g/m ³	0.0033	-	-	-	-
Total Recoverable Lead	g/m ³	0.077	-	-	-	-
Dissolved Zinc	g/m ³	0.012	-	-	-	-
Total Recoverable Zinc	g/m ³	0.089	-	-	-	-

Analyst's Comments	
Appendix No.1 - Chain of Custody	

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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.

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.

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, consisting of several overlapping loops and a long horizontal stroke extending to the right.

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

FACTS

FROM:		TO:	
URS New Zealand Limited Lambton House 160 Lambton Quay Wellington Ph: (04) 496 3750 Fax (08) 496 3755		R J Hill Laboratories Limited 1 Clyde Street Hamilton Ph: (07) 858 2000	
RESULTS ATTENTION: <i>Sarah Halliday.</i> <i>Jordan Cookley.</i>		CLIENT: <i>GWRG</i> SITE: <i>WATERBURY</i>	
SAMPLER(S): <i>Sarah Halliday.</i>		PROJECT NO: <i>42771630.</i>	
		LAB QUOTE NO: ☒ 36794 Normal Priority ☐ 36795 High Priority ☐ 36796 Urgent Priority	
		RESULTS REQUIRED BY:	
SAMPLE ID	MATRIX	DATE/TIME	COMMENTS
93272	<i>Water</i>	<i>9-11-03</i>	
Total No. of Sample Bottles:		<i>3</i>	
CHAIN OF CUSTODY DATA			
RELINQUISHED BY		RECEIVED BY	
NAME: <i>Sarah Halliday.</i>		NAME: <i>Maureen Smith</i>	
COMPANY: URS		COMPANY: <i>Hills</i>	
DATE: <i>9-11-03</i>		DATE: <i>11/11/09</i>	
TIME: <i>1900</i>		TIME: <i>10:23</i>	
SAMPLE RECEIPT DATA			
PLEASE COMPLETE THIS SECTION (CIRCLE AS APPROPRIATE) AND RETURN FAX A COPY IMMEDIATELY AFTER RECEIVING SAMPLES)			
ALL SAMPLES AND ASSOCIATED DOCUMENTATION WERE RECEIVED IN GOOD ORDER		YES / NO	
ORDER		YES / NO / NA	
SPECIAL HANDLING/STORAGE OR DISPOSAL INSTRUCTIONS:		YES / NO / NA	
CAUTION - SAMPLES MAY CONTAIN HAZARDOUS SUBSTANCES		YES / NO / NA	
INTERNAL USE - URS WORK INSTRUCTIONS AND CHECKLIST OVERLEAF		TEMP: <i>11.6°C</i>	



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	743756	SPV1
Contact:	Dr J Coakley C/- URS New Zealand Limited PO Box 3367 WELLINGTON 6140	Date Registered:	14-Nov-2009	
		Date Reported:	20-Nov-2009	
		Quote No:	36794	
		Order No:	42771630	
		Client Reference:	GWRL - Waiwhetu	
		Submitted By:	S Halliday	

Sample Type: Aqueous						
Sample Name:		93273				
		12-Nov-2009				
Lab Number:		743756.1				
pH	pH Units	7.6	-	-	-	-
Total Suspended Solids	g/m ³	11	-	-	-	-
Dissolved Chromium	g/m ³	< 0.00050	-	-	-	-
Total Recoverable Chromium	g/m ³	0.00062	-	-	-	-
Dissolved Copper	g/m ³	0.0013	-	-	-	-
Total Recoverable Copper	g/m ³	0.0028	-	-	-	-
Dissolved Lead	g/m ³	0.0011	-	-	-	-
Total Recoverable Lead	g/m ³	0.016	-	-	-	-
Dissolved Zinc	g/m ³	0.013	-	-	-	-
Total Recoverable Zinc	g/m ³	0.032	-	-	-	-

Analyst's Comments
Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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

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

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, reading "Carole Rodgers-Carroll". The signature is fluid and cursive, with the first name "Carole" being more prominent.

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

Page 1 of 1



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	744180	SPV1
Contact:	Dr J Coakley	Date Registered:	17-Nov-2009	
	C/- URS New Zealand Limited	Date Reported:	27-Nov-2009	
	PO Box 3367	Quote No:		
	WELLINGTON 6140	Order No:	42771630	
		Client Reference:	SWRC Waiwhetu	
		Submitted By:	S Halliday	

Sample Type: Aqueous						
Sample Name:		93274				
		16-Nov-2009				
Lab Number:		744180.1				
pH	pH Units	7.4	-	-	-	-
Total Suspended Solids	g/m ³	220	-	-	-	-
Dissolved Chromium	g/m ³	< 0.00050	-	-	-	-
Total Recoverable Chromium	g/m ³	0.0096	-	-	-	-
Dissolved Copper	g/m ³	< 0.0010	-	-	-	-
Total Recoverable Copper	g/m ³	0.014	-	-	-	-
Dissolved Lead	g/m ³	0.0019	-	-	-	-
Total Recoverable Lead	g/m ³	0.12	-	-	-	-
Dissolved Zinc	g/m ³	0.0048	-	-	-	-
Total Recoverable Zinc	g/m ³	0.20	-	-	-	-

Analyst's Comments
Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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.

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.

This report must not be reproduced, except in full, without the written consent of the signatory.



Karen Nichol BSc
Client Services Manager - Environmental Division

REF

Page 1 of 11



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	745506	SPV1
Contact:	S Halliday C/- URS New Zealand Limited PO Box 3367 WELLINGTON 6140	Date Registered:	20-Nov-2009	
		Date Reported:	30-Nov-2009	
		Quote No:	36794	
		Order No:	42771630	
		Client Reference:	GWRC	
		Submitted By:	Dr J Coakley	

Sample Type: Aqueous						
Sample Name:		93275				
		19-Nov-2009				
Lab Number:		745506.1				
pH	pH Units	7.6	-	-	-	-
Total Suspended Solids	g/m ³	92	-	-	-	-
Dissolved Chromium	g/m ³	< 0.00050	-	-	-	-
Total Recoverable Chromium	g/m ³	0.0039	-	-	-	-
Dissolved Copper	g/m ³	0.0013	-	-	-	-
Total Recoverable Copper	g/m ³	0.010	-	-	-	-
Dissolved Lead	g/m ³	0.0047	-	-	-	-
Total Recoverable Lead	g/m ³	0.050	-	-	-	-
Dissolved Zinc	g/m ³	0.011	-	-	-	-
Total Recoverable Zinc	g/m ³	0.084	-	-	-	-

Analyst's Comments	
Appendix No.1 - Chain of Custody	

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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.

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.

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, consisting of several overlapping loops and a long horizontal stroke extending to the right.

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

RTD

745506

No of Samples. 1

No of Fractions: 6



0317455068

FROM:		TO:	
URS New Zealand Limited Lambton House 160 Lambton Quay Wellington Ph: (04) 496 3750 Fax (09) 496 3755		R J Hill Laboratories Limited 1 Clyde Street Hamilton Ph: (07) 858 2000 CLIENT: GWR SITE: WAIWATERU PROJECT NO: 42771630 LAB QUOTE NO: ☒ 36794 Normal Priority ☐ 36795 High Priority ☐ 36796 Urgent Priority RESULTS REQUIRED BY:	
RESULTS ATTENTION: Sarah Halliday Janelle Cookley SAMPLER(S): Sarah Halliday		COMMENTS	
SAMPLE ID	MATRIX	DATE/TIME	
93275	water	19-11-09	
Total No. of Sample Bottles:			
RELINQUISHED BY		CHAIN OF CUSTODY DATA	
NAME: Sarah Halliday COMPANY: URS		NAME: Anneke COMPANY: Hill Labs DATE: 19-11-09 TIME: 14.30 SAMPLE RECEIPT DATA PLEASE COMPLETE THIS SECTION (CIRCLE AS APPROPRIATE) AND RETURN FAX A COPY IMMEDIATELY AFTER RECEIVING SAMPLES	
ALL SAMPLES AND ASSOCIATED DOCUMENTATION WERE RECEIVED IN GOOD ORDER		YES / NO	
SPECIAL HANDLING/STORAGE OR DISPOSAL INSTRUCTIONS:		REPORTING	
CAUTION - SAMPLES MAY CONTAIN HAZARDOUS SUBSTANCES		REPORT FORMAT: ☐ FAX ☐ LETTER ☐ EMAIL ☒ DISK ☐	
INTERNAL USE - URS WORK INSTRUCTIONS AND CHECKLIST OVERLEAF		INTERNAL USE - URS WORK INSTRUCTIONS AND CHECKLIST OVERLEAF	



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	747332	SPV1
Contact:	S Halliday C/- URS New Zealand Limited PO Box 3367 WELLINGTON 6140	Date Registered:	27-Nov-2009	
		Date Reported:	08-Dec-2009	
		Quote No:		
		Order No:	42771630	
		Client Reference:	GWRC WAIWHETU	
		Submitted By:	Dr J Coakley	

Sample Type: Aqueous						
Sample Name:		93276				
		26-Nov-2009				
Lab Number:		747332.1				
pH	pH Units	7.6	-	-	-	-
Total Suspended Solids	g/m ³	160	-	-	-	-
Dissolved Chromium	g/m ³	< 0.00050	-	-	-	-
Total Recoverable Chromium	g/m ³	0.0062	-	-	-	-
Dissolved Copper	g/m ³	0.00096	-	-	-	-
Total Recoverable Copper	g/m ³	0.013	-	-	-	-
Dissolved Lead	g/m ³	0.0028	-	-	-	-
Total Recoverable Lead	g/m ³	0.061	-	-	-	-
Dissolved Zinc	g/m ³	0.0054	-	-	-	-
Total Recoverable Zinc	g/m ³	0.11	-	-	-	-

Analyst's Comments
Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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.

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.

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, appearing to read 'Peter Robinson', with a long horizontal flourish extending to the right.

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

Page 1 of 1



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	747635	SPV1
Contact:	S Halliday C/- URS New Zealand Limited PO Box 3367 WELLINGTON 6140	Date Registered:	28-Nov-2009	
		Date Reported:	14-Dec-2009	
		Quote No:		
		Order No:	42771630	
		Client Reference:	GWRC Waiwetū	
		Submitted By:	Dr J Coakley	

Sample Type: Aqueous						
Sample Name:		93277				
		27-Nov-2009				
Lab Number:		747635.1				
pH	pH Units	7.5	-	-	-	-
Total Suspended Solids	g/m ³	12	-	-	-	-
Dissolved Chromium	g/m ³	< 0.00050	-	-	-	-
Total Recoverable Chromium	g/m ³	< 0.00051	-	-	-	-
Dissolved Copper	g/m ³	< 0.0010	-	-	-	-
Total Recoverable Copper	g/m ³	0.0031	-	-	-	-
Dissolved Lead	g/m ³	0.0014	-	-	-	-
Total Recoverable Lead	g/m ³	0.014	-	-	-	-
Dissolved Zinc	g/m ³	0.010	-	-	-	-
Total Recoverable Zinc	g/m ³	0.021	-	-	-	-

Analyst's Comments
Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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.

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.

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, consisting of several overlapping loops and a long horizontal stroke extending to the right.

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

2

747635

[illegible]



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	752398	SPV1
Contact:	Dr J Coakley C/- URS New Zealand Limited PO Box 3367 WELLINGTON 6140	Date Registered:	15-Dec-2009	
		Date Reported:	24-Dec-2009	
		Quote No:		
		Order No:	42771630	
		Client Reference:	GWRC	
		Submitted By:	S Halliday	

Sample Type: Aqueous						
Sample Name:		93278	93279			
		14-Dec-2009	14-Dec-2009			
Lab Number:		752398.1	752398.2			
pH	pH Units	7.4	7.4	-	-	-
Total Suspended Solids	g/m ³	27	15	-	-	-
Dissolved Chromium	g/m ³	< 0.0010	< 0.00050	-	-	-
Total Recoverable Chromium	g/m ³	0.0024	0.0017	-	-	-
Dissolved Copper	g/m ³	< 0.0010	< 0.0010	-	-	-
Total Recoverable Copper	g/m ³	0.0034	0.0035	-	-	-
Dissolved Lead	g/m ³	0.030	0.015	-	-	-
Total Recoverable Lead	g/m ³	0.26	0.13	-	-	-
Dissolved Zinc	g/m ³	0.0099	0.020	-	-	-
Total Recoverable Zinc	g/m ³	0.068	0.058	-	-	-

Analyst's Comments
Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1-2
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1-2
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1-2
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1-2
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1-2
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1-2
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1-2
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1-2
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1-2
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1-2
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1-2



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.

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.

This report must not be reproduced, except in full, without the written consent of the signatory.



Karen Nichol BSc
Client Services Manager - Environmental Division

152398



031752398

[illegible]



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	753751	SPV1
Contact:	S Halliday C/- URS New Zealand Limited PO Box 3367 WELLINGTON 6140	Date Registered:	18-Dec-2009	
		Date Reported:	07-Jan-2010	
		Quote No:	36794	
		Order No:	42771630	
		Client Reference:	Waiwhetu	
		Submitted By:	Dr J Coakley	

Sample Type: Aqueous						
Sample Name:		93280				
		17-Dec-2009				
Lab Number:		753751.1				
pH	pH Units	7.4	-	-	-	-
Total Suspended Solids	g/m ³	15	-	-	-	-
Dissolved Chromium	g/m ³	< 0.00050	-	-	-	-
Total Chromium	g/m ³	0.0018	-	-	-	-
Dissolved Copper	g/m ³	< 0.0010	-	-	-	-
Total Copper	g/m ³	0.0037	-	-	-	-
Dissolved Lead	g/m ³	0.095	-	-	-	-
Total Lead	g/m ³	0.63	-	-	-	-
Dissolved Zinc	g/m ³	0.016	-	-	-	-
Total Zinc	g/m ³	0.057	-	-	-	-

Analyst's Comments
Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Digestion	Boiling nitric acid digestion. APHA 3030 E 21 st ed. 2005.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Chromium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005 / US EPA 200.8.	0.00053 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005 / US EPA 200.8.	0.00053 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Lead	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005 / US EPA 200.8.	0.00011 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005 / US EPA 200.8.	0.0011 g/m ³	1



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.

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.

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, appearing to be 'Ara Heron', written over a horizontal line.

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

Job No

753751

No. of Samples. 1

No of Fractions **6**

0317537512

CHAIN OF CUSTODY AND SAMPLE RECEIPT DOCUMENTATION

[illegible]



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	758327	SPV1
Contact:	S Halliday C/- URS New Zealand Limited PO Box 3367 WELLINGTON 6140	Date Registered:	15-Jan-2010	
		Date Reported:	20-Jan-2010	
		Quote No:		
		Order No:	42771630	
		Client Reference:	GWRC - Waiwhetu	
		Submitted By:	S Halliday	

Sample Type: Aqueous						
Sample Name:		93281				
		14-Jan-2010				
Lab Number:		758327.1				
pH	pH Units	7.7	-	-	-	-
Total Suspended Solids	g/m ³	15	-	-	-	-
Dissolved Chromium	g/m ³	< 0.0010	-	-	-	-
Total Recoverable Chromium	g/m ³	< 0.0011	-	-	-	-
Dissolved Copper	g/m ³	< 0.0010	-	-	-	-
Total Recoverable Copper	g/m ³	0.0024	-	-	-	-
Dissolved Lead	g/m ³	0.0087	-	-	-	-
Total Recoverable Lead	g/m ³	0.038	-	-	-	-
Dissolved Zinc	g/m ³	0.014	-	-	-	-
Total Recoverable Zinc	g/m ³	0.031	-	-	-	-

Analyst's Comments
Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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

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

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, consisting of several overlapping loops and a long horizontal stroke extending to the right.

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

INTERNAL USE - URS WORK INSTRUCTIONS AND CHECKLIST OVERLEAF



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	760443	SPV1
Contact:	S Halliday	Date Registered:	23-Jan-2010	
	C/- URS New Zealand Limited	Date Reported:	02-Feb-2010	
	PO Box 3367	Quote No:	36794	
	WELLINGTON 6140	Order No:	42771630	
		Client Reference:	GWRC - Waiwhetu	
		Submitted By:	S Halliday	

Sample Type: Aqueous

Sample Name:	93282				
	22-Jan-2010				
Lab Number:	760443.1				
pH	pH Units	7.5	-	-	-
Total Suspended Solids	g/m ³	61	-	-	-
Dissolved Chromium	g/m ³	< 0.0025	-	-	-
Total Recoverable Chromium	g/m ³	0.0074	-	-	-
Dissolved Copper	g/m ³	< 0.0025	-	-	-
Total Recoverable Copper	g/m ³	0.013	-	-	-
Dissolved Lead	g/m ³	0.0034	-	-	-
Total Recoverable Lead	g/m ³	0.47	-	-	-
Dissolved Zinc	g/m ³	0.036	-	-	-
Total Recoverable Zinc	g/m ³	0.22	-	-	-

Analyst's Comments

Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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.

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.

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, consisting of several overlapping loops and a long horizontal stroke extending to the right.

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

Time Received: 23-Jan-2010 10:41:59 am
Job No: **760443**
No of Samples: 1 No of Fractions: 6

Page 1 of 1



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	761612	SPV1
Contact:	S Halliday	Date Registered:	28-Jan-2010	
	C/- URS New Zealand Limited	Date Reported:	09-Feb-2010	
	PO Box 3367	Quote No:	36794	
	WELLINGTON 6140	Order No:	42771630	
		Client Reference:	GWRC Waiwhetu	
		Submitted By:	S Halliday	

Sample Type: Aqueous

Sample Name:	93283				
	27-Jan-2010				
Lab Number:	761612.1				
pH	pH Units	7.6	-	-	-
Total Suspended Solids	g/m ³	23	-	-	-
Dissolved Chromium	g/m ³	< 0.00050	-	-	-
Total Recoverable Chromium	g/m ³	0.0020	-	-	-
Dissolved Copper	g/m ³	0.0017	-	-	-
Total Recoverable Copper	g/m ³	0.0049	-	-	-
Dissolved Lead	g/m ³	0.0073	-	-	-
Total Recoverable Lead	g/m ³	0.12	-	-	-
Dissolved Zinc	g/m ³	0.020	-	-	-
Total Recoverable Zinc	g/m ³	0.082	-	-	-

Analyst's Comments

Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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.

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.

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, consisting of several overlapping loops and a long horizontal stroke extending to the right.

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

ARTS

No of Samples **1**No of Fractions **6**Page 1 of 1



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	762392	SPV1
Contact:	S Halliday C/- URS New Zealand Limited PO Box 3367 WELLINGTON 6140	Date Registered:	30-Jan-2010	
		Date Reported:	08-Feb-2010	
		Quote No:		
		Order No:	42771630	
		Client Reference:	GWRC Waiwhetu	
		Submitted By:	S Halliday	

Sample Type: Aqueous						
Sample Name:		93284				
		29-Jan-2010				
Lab Number:		762392.1				
pH	pH Units	7.8	-	-	-	-
Total Suspended Solids	g/m ³	13	-	-	-	-
Dissolved Chromium	g/m ³	< 0.0025	-	-	-	-
Total Recoverable Chromium	g/m ³	< 0.0026	-	-	-	-
Dissolved Copper	g/m ³	< 0.0025	-	-	-	-
Total Recoverable Copper	g/m ³	< 0.0026	-	-	-	-
Dissolved Lead	g/m ³	0.0042	-	-	-	-
Total Recoverable Lead	g/m ³	0.052	-	-	-	-
Dissolved Zinc	g/m ³	0.0072	-	-	-	-
Total Recoverable Zinc	g/m ³	0.036	-	-	-	-

Analyst's Comments
Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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.

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.

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, consisting of several overlapping loops and a long horizontal stroke extending to the right.

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

No of Fractions **6**

Appendix No.1 - Chain of Custody - Page 1 of 1

Page 1 of 1



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	763567	SPV1
Contact:	S Halliday	Date Registered:	04-Feb-2010	
	C/- URS New Zealand Limited	Date Reported:	16-Feb-2010	
	PO Box 3367	Quote No:	36794	
	WELLINGTON 6140	Order No:	42771630	
		Client Reference:	GWRC WAIWHETU	
		Submitted By:	S Halliday	

Sample Type: Aqueous						
Sample Name:		93285				
		02-Feb-2010				
Lab Number:		763567.1				
pH	pH Units	8.0	-	-	-	-
Total Suspended Solids	g/m ³	51	-	-	-	-
Dissolved Chromium	g/m ³	< 0.0010	-	-	-	-
Total Recoverable Chromium	g/m ³	0.0036	-	-	-	-
Dissolved Copper	g/m ³	< 0.0010	-	-	-	-
Total Recoverable Copper	g/m ³	0.0041	-	-	-	-
Dissolved Lead	g/m ³	0.0022	-	-	-	-
Total Recoverable Lead	g/m ³	0.11	-	-	-	-
Dissolved Zinc	g/m ³	0.0027	-	-	-	-
Total Recoverable Zinc	g/m ³	0.11	-	-	-	-

Analyst's Comments
Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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.

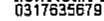
These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

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.

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, appearing to be 'Ara Heron', with a stylized, overlapping structure.

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

Page 1 of 1



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	766045	SPV1
Contact:	S Halliday	Date Registered:	12-Feb-2010	
	C/- URS New Zealand Limited	Date Reported:	19-Feb-2010	
	PO Box 3367	Quote No:	36794	
	WELLINGTON 6140	Order No:	42771630	
		Client Reference:	GWRC Waiwhetu	
		Submitted By:	S Halliday	

Sample Type: Aqueous						
Sample Name:		93286				
		10-Feb-2010				
Lab Number:		766045.1				
pH	pH Units	7.9	-	-	-	-
Total Suspended Solids	g/m ³	9.0	-	-	-	-
Dissolved Chromium	g/m ³	< 0.0010	-	-	-	-
Total Recoverable Chromium	g/m ³	< 0.0011	-	-	-	-
Dissolved Copper	g/m ³	0.0029 #1	-	-	-	-
Total Recoverable Copper	g/m ³	0.0013 #1	-	-	-	-
Dissolved Lead	g/m ³	0.0063	-	-	-	-
Total Recoverable Lead	g/m ³	0.019	-	-	-	-
Dissolved Zinc	g/m ³	0.0052	-	-	-	-
Total Recoverable Zinc	g/m ³	0.016	-	-	-	-

Analyst's Comments	
#1 It has been noted that the results for the dissolved fraction were greater than those for the total recoverable fraction, but within analytical variation of the method.	
Appendix No.1 - Chain of Custody	

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1

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

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

This report must not be reproduced, except in full, without the written consent of the signatory.



Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental Division

CHAIN OF CUSTODY AND SAMPLE RECEIPT DOCUMENTATION

FROM:		TO:		ANALYSES REQUIRED													
URS New Zealand Limited Lambton House 160 Lambton Quay Wellington Ph: (04) 496 3750 Fax (09) 496 3755		R J Hill Laboratories Limited 1 Clyde Street Hamilton Ph: (07) 858 2000 CLIENT: SWRC SITE: WATWITI		CONTAINERS		ANALYTES											
RESULTS ATTENTION: Sarah Halliday SAMPLER(S): Sarah Halliday		PROJECT NO: 42771630 LAB QUOTE NO: ☒ 36794 Normal Priority ☐ 36795 High Priority ☐ 36796 Urgent Priority		ANALYTES Total value Pb, Zn, Cu, Cr Total disc. Pb, Zn, Cu, Cr 184.		ANALYSES REQUIRED (Grid for analysis results)											
RESULTS REQUIRED BY: DATE/TIME 10 Feb		COMMENTS 10 Feb															
Total No. of Sample Bottles: 3		CHAIN OF CUSTODY DATA		Including:		Blank or Duplicate Samples											
RELINQUISHED BY NAME: Sarah Halliday COMPANY: URS		DATE: 11 Feb 10 TIME: 1009		RECEIVED BY NAME: M. Osmont COMPANY: HILLS		DATE: 12/2/10 TIME: 12.34		METHOD OF SHIPMENT URS RECEPTION HILLS DOCKET									
ALL SAMPLES AND ASSOCIATED DOCUMENTATION WERE RECEIVED IN GOOD ORDER		YES / NO		PLEASE CONTACT THE LABORATORY CUSTODY SEAL INTACT: SAMPLES CHILLED: LABORATORY BATCH NO:		YES / NO / NA YES / NO / NA Temp: 15.9 °C											
SPECIAL HANDLING/STORAGE OR DISPOSAL INSTRUCTIONS:		REPORTING REPORT FORMAT: ☐ FAX ☐ LETTER ☐ EMAIL ☒ DISK ☐		EMAIL ADDRESS:		INTERNAL USE - URS WORK INSTRUCTIONS AND CHECKLIST OVERLEAF											
CAUTION - SAMPLES MAY CONTAIN HAZARDOUS SUBSTANCES																	



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	767431	SPV1
Contact:	S Halliday C/- URS New Zealand Limited PO Box 3367 WELLINGTON 6140	Date Registered:	18-Feb-2010	
		Date Reported:	01-Mar-2010	
		Quote No:	36794	
		Order No:	42771630	
		Client Reference:	GWRC-Waiwhetu	
		Submitted By:	S Halliday	

Sample Type: Aqueous

Sample Name:	93287				
	17-Feb-2010				
Lab Number:	767431.1				
pH	pH Units	8.0	-	-	-
Total Suspended Solids	g/m ³	49	-	-	-
Dissolved Chromium	g/m ³	< 0.00050	-	-	-
Total Recoverable Chromium	g/m ³	0.0033	-	-	-
Dissolved Copper	g/m ³	0.00061	-	-	-
Total Recoverable Copper	g/m ³	0.0049	-	-	-
Dissolved Lead	g/m ³	0.0012	-	-	-
Total Recoverable Lead	g/m ³	0.078	-	-	-
Dissolved Zinc	g/m ³	0.0031	-	-	-
Total Recoverable Zinc	g/m ³	0.11	-	-	-

Analyst's Comments

Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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.

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.

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, reading "Carole Rodgers-Carroll". The signature is fluid and cursive, with the first name "Carole" being more prominent.

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

CHAIN OF CUSTODY AND SAMPLE RECEIPT DOCUMENTATION

[illegible]



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	770208	SPV1
Contact:	S Halliday C/- URS New Zealand Limited PO Box 3367 WELLINGTON 6140	Date Registered:	26-Feb-2010	
		Date Reported:	11-Mar-2010	
		Quote No:	36794	
		Order No:	42771630	
		Client Reference:	GWRC Waiwhetu	
		Submitted By:	S Halliday	

Sample Type: Aqueous						
Sample Name:		93288				
		23-Feb-2010				
Lab Number:		770208.1				
pH	pH Units	8.0	-	-	-	-
Total Suspended Solids	g/m ³	64	-	-	-	-
Dissolved Chromium	g/m ³	< 0.0010	-	-	-	-
Total Recoverable Chromium	g/m ³	0.0060	-	-	-	-
Dissolved Copper	g/m ³	< 0.0010	-	-	-	-
Total Recoverable Copper	g/m ³	0.0058	-	-	-	-
Dissolved Lead	g/m ³	0.0014	-	-	-	-
Total Recoverable Lead	g/m ³	0.083	-	-	-	-
Dissolved Zinc	g/m ³	0.0033	-	-	-	-
Total Recoverable Zinc	g/m ³	0.12	-	-	-	-

Analyst's Comments
Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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

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

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, appearing to read 'G Corban', is positioned above the printed name.

Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental Division

250

770208

No of Samples: 1

No of Fractions **6**

0317702089

[illegible]



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	770444	SPV1
Contact:	S Halliday	Date Registered:	27-Feb-2010	
	C/- URS New Zealand Limited	Date Reported:	10-Mar-2010	
	PO Box 3367	Quote No:	36794	
	WELLINGTON 6140	Order No:	42771630	
		Client Reference:	GWRC Waiwhetu	
		Submitted By:	S Halliday	

Sample Type: Aqueous						
Sample Name:		93289				
		26-Feb-2010				
Lab Number:		770444.1				
pH	pH Units	7.6	-	-	-	-
Total Suspended Solids	g/m ³	14	-	-	-	-
Dissolved Chromium	g/m ³	< 0.00050	-	-	-	-
Total Recoverable Chromium	g/m ³	0.0013	-	-	-	-
Dissolved Copper	g/m ³	< 0.0025	-	-	-	-
Total Recoverable Copper	g/m ³	0.0042	-	-	-	-
Dissolved Lead	g/m ³	0.0029	-	-	-	-
Total Recoverable Lead	g/m ³	0.020	-	-	-	-
Dissolved Zinc	g/m ³	0.029	-	-	-	-
Total Recoverable Zinc	g/m ³	0.060	-	-	-	-

Analyst's Comments
Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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.

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.

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, consisting of several overlapping loops and a long horizontal stroke extending to the right.

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

FROM:		TO:		ANALYSES REQUIRED									
URS New Zealand Limited Lambton House 160 Lambton Quay Wellington Ph: (04) 496 3750 Fax (09) 496 3755		R J Hill Laboratories Limited 1 Clyde Street Hamilton Ph: (07) 858 2000 CLIENT: <u>SWRC</u> SITE: <u>WAIMATE</u>		ANALYTES CONTAINERS PH. 12LP Total 545 solids Total divided Pb, Zn, Cu Total relov. Pb, Zn, Cu N100.									
RESULTS ATTENTION:		PROJECT NO: <u>42771630</u>		ANALYSES CONTAINERS PH. 12LP Total 545 solids Total divided Pb, Zn, Cu Total relov. Pb, Zn, Cu N100.									
SAMPLER(S):		LAB QUOTE NO: ☒ 36794 Normal Priority ☐ 36795 High Priority ☐ 36796 Urgent Priority		ANALYSES CONTAINERS PH. 12LP Total 545 solids Total divided Pb, Zn, Cu Total relov. Pb, Zn, Cu N100.									
RESULTS REQUIRED BY:		DATE/TIME		COMMENTS									
93289		26.02.10		Temperature On Arrival <u>8.6</u> °C Temperature was measured on one or more arbitrarily chosen samples in this batch.									
Total No. of Sample Bottles:		(3)		Blank or Duplicate Samples									
RELINQUISHED BY				RECEIVED BY				METHOD OF SHIPMENT					
NAME: <u>Sarah Halliday</u>		DATE: <u>26.02.10</u>		NAME: <u>Nick Dwyer</u>		DATE: <u>27.2.10</u>		METHOD OF SHIPMENT		METHOD OF SHIPMENT			
COMPANY: URS		TIME: <u>1600</u>		COMPANY: <u>Hill Labs</u>		TIME: <u>3.00</u>		METHOD OF SHIPMENT		METHOD OF SHIPMENT			
SAMPLE RECEIPT DATA				SAMPLE RECEIPT DATA				SAMPLE RECEIPT DATA					
PLEASE COMPLETE THIS SECTION (CIRCLE AS APPROPRIATE) AND RETURN FAX A COPY IMMEDIATELY AFTER RECEIVING SAMPLES)				PLEASE COMPLETE THIS SECTION (CIRCLE AS APPROPRIATE) AND RETURN FAX A COPY IMMEDIATELY AFTER RECEIVING SAMPLES)				PLEASE COMPLETE THIS SECTION (CIRCLE AS APPROPRIATE) AND RETURN FAX A COPY IMMEDIATELY AFTER RECEIVING SAMPLES)					
ALL SAMPLES AND ASSOCIATED DOCUMENTATION WERE RECEIVED IN GOOD ORDER		YES / NO		PLEASE CONTACT THE LABORATORY		CUSTODY SEAL INTACT:		YES / NO / NA		Temp:			
						SAMPLER(S) CHILLED:		YES / NO / NA					
						LABORATORY BATCH NO:							
SPECIAL HANDLING/STORAGE OR DISPOSAL INSTRUCTIONS:				REPORTING				REPORTING					
CAUTION - SAMPLES MAY CONTAIN HAZARDOUS SUBSTANCES				REPORT FORMAT: ☐ FAX ☐ LETTER ☐ EMAIL ☒ DISK ☐				INTERNAL USE - URS WORK INSTRUCTIONS AND CHECKLIST OVERLEAF					



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	771000	SPV1
Contact:	S Halliday C/- URS New Zealand Limited PO Box 3367 WELLINGTON 6140	Date Registered:	02-Mar-2010	
		Date Reported:	12-Mar-2010	
		Quote No:	36794	
		Order No:	42771630	
		Client Reference:	GWRC Waiwhetu	
		Submitted By:	S Halliday	

Sample Type: Aqueous						
Sample Name:		93290				
		01-Mar-2010				
Lab Number:		771000.1				
pH	pH Units	7.8	-	-	-	-
Total Suspended Solids	g/m ³	20	-	-	-	-
Dissolved Chromium	g/m ³	< 0.0025	-	-	-	-
Total Recoverable Chromium	g/m ³	< 0.0026	-	-	-	-
Dissolved Copper	g/m ³	< 0.0025	-	-	-	-
Total Recoverable Copper	g/m ³	< 0.0026	-	-	-	-
Dissolved Lead	g/m ³	0.00070	-	-	-	-
Total Recoverable Lead	g/m ³	0.020	-	-	-	-
Dissolved Zinc	g/m ³	< 0.0050	-	-	-	-
Total Recoverable Zinc	g/m ³	0.033	-	-	-	-

Analyst's Comments
Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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

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

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, consisting of several overlapping loops and a long horizontal stroke extending to the right.

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

275

INTERNAL USE - IRS WORK INSTRUCTIONS AND CHECKLIST OVERVIEW



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	772654	SPV1
Contact:	S Halliday	Date Registered:	06-Mar-2010	
	C/- URS New Zealand Limited	Date Reported:	12-Mar-2010	
	PO Box 3367	Quote No:	36794	
	WELLINGTON 6140	Order No:	42771630	
		Client Reference:	GWRC Waiwhetu	
		Submitted By:	S Halliday	

Sample Type: Aqueous						
Sample Name:		93291				
		04-Mar-2010				
Lab Number:		772654.1				
pH	pH Units	7.8	-	-	-	-
Total Suspended Solids	g/m ³	25	-	-	-	-
Dissolved Chromium	g/m ³	< 0.0025	-	-	-	-
Total Recoverable Chromium	g/m ³	0.0027	-	-	-	-
Dissolved Copper	g/m ³	< 0.0025	-	-	-	-
Total Recoverable Copper	g/m ³	0.0031	-	-	-	-
Dissolved Lead	g/m ³	0.0017	-	-	-	-
Total Recoverable Lead	g/m ³	0.062	-	-	-	-
Dissolved Zinc	g/m ³	< 0.0050	-	-	-	-
Total Recoverable Zinc	g/m ³	0.072	-	-	-	-

Analyst's Comments	
Appendix No.1 - Chain of Custody	

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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.

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.

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, consisting of several overlapping loops and a long horizontal stroke extending to the right.

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

Time Received: 06-Mar-2018 14:52:00
Job No: **772654**
No of Samples: **1** No of Fractions: **6**

0317726544

[illegible]



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	774501	SPV1
Contact:	S Halliday C/- URS New Zealand Limited PO Box 3367 WELLINGTON 6140	Date Registered:	12-Mar-2010	
		Date Reported:	19-Mar-2010	
		Quote No:		
		Order No:	42771630	
		Client Reference:	GWRC Waiwhetu	
		Submitted By:	S Halliday	

Sample Type: Aqueous

Sample Name:	93292				
	10-Mar-2010				
Lab Number:	774501.1				
pH	pH Units	7.4	-	-	-
Total Suspended Solids	g/m ³	7.4	-	-	-
Dissolved Chromium	g/m ³	< 0.0010	-	-	-
Total Recoverable Chromium	g/m ³	< 0.0011	-	-	-
Dissolved Copper	g/m ³	< 0.0010	-	-	-
Total Recoverable Copper	g/m ³	0.0014	-	-	-
Dissolved Lead	g/m ³	0.0025	-	-	-
Total Recoverable Lead	g/m ³	0.0098	-	-	-
Dissolved Zinc	g/m ³	0.0041	-	-	-
Total Recoverable Zinc	g/m ³	0.013	-	-	-

Analyst's Comments

Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3.0 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00050 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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.

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.

This report must not be reproduced, except in full, without the written consent of the signatory.



Karen Nichol BSc
Client Services Manager - Environmental Division

FROM:							
URS New Zealand Limited Lambton House 160 Lambton Quay Wellington Ph: (04) 496 3750 Fax (09) 496 3755						TO: R J Hill Laboratories Limited 1 Clyde Street Hamilton Ph: (07) 858 2000	
RESULTS ATTENTION: Sarah Halliday							
SAMPLER(S): Sarah Halliday							
SAMPLE ID	MATRIX	DATE/TIME	COMMENTS				
G3292	water	10-25-07					
Total No. of Sample Bottles:	3			Including:	Blank or Duplicate Samples		
CHAIN OF CUSTODY DATA							
RELINQUISHED BY NAME: Sarah Halliday COMPANY: URS				RECEIVED BY NAME: Andrew Hill Labs COMPANY: Hill Labs			
DATE: 11-08-10. TIME: 1100				DATE: 12/03/10 TIME: 1:57			
SAMPLE RECEIPT DATA PLEASE COMPLETE THIS SECTION (CIRCLE AS APPROPRIATE) AND RETURN FAX A COPY IMMEDIATELY AFTER RECEIVING SAMPLES.							
ALL SAMPLES AND ASSOCIATED DOCUMENTATION WERE RECEIVED IN GOOD ORDER				YES / NO			
SPECIAL HANDLING/STORAGE OR DISPOSAL INSTRUCTIONS:				REPORTING			
CAUTION - SAMPLES MAY CONTAIN HAZARDOUS SUBSTANCES				INTERNAL USE - URS WORK INSTRUCTIONS AND CHECKLIST OVERLEAF			



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	780319	SPv1
Contact:	S Halliday	Date Registered:	01-Apr-2010	
	C/- URS New Zealand Limited	Date Reported:	16-Apr-2010	
	PO Box 3367	Quote No:	36794	
	WELLINGTON 6140	Order No:	GWRC Waiwhetu	
		Client Reference:	GWRC Waiwhetu	
		Submitted By:	S Halliday	

Sample Type: Aqueous						
Sample Name:		93293	93294	93295		
		23-Mar-2010	26-Mar-2010	30-Mar-2010		
Lab Number:		780319.1	780319.2	780319.3		
Total Suspended Solids	g/m ³	57	47	48	-	-
Dissolved Chromium	g/m ³	< 0.003	< 0.003	< 0.003	-	-
Total Recoverable Chromium	g/m ³	< 0.003	< 0.003	< 0.003	-	-
Dissolved Copper	g/m ³	< 0.003	< 0.003	< 0.003	-	-
Total Recoverable Copper	g/m ³	< 0.006	< 0.006	< 0.006	-	-
Dissolved Lead	g/m ³	0.00090	0.00095	0.00077	-	-
Total Recoverable Lead	g/m ³	0.024	0.024	0.023	-	-
Dissolved Zinc	g/m ³	0.0060	0.0073	0.0059	-	-
Total Recoverable Zinc	g/m ³	0.035	0.035	0.034	-	-

Analyst's Comments
Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1-3
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3 g/m ³	1-3
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0005 g/m ³	1-3
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0005 g/m ³	1-3
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0005 g/m ³	1-3
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0005 g/m ³	1-3
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1-3
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1-3
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1-3
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1-3



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

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

This report must not be reproduced, except in full, without the written consent of the signatory.



Karen Nichol BSc
Client Services Manager - Environmental Division



CHAIN OF CUSTODY AND SAMPLE RECEIPT DOCUMENTATION

FROM: URS New Zealand Limited Lambton House 160 Lambton Quay Wellington Ph: (04) 496 3750 Fax (09) 496 3755		TO: R J Hill Laboratories Limited 1 Clyde Street Hamilton Ph: (07) 858 2000 CLIENT: <u>GNRC</u> SITE: <u>NAIWHEDL</u> PROJECT NO: LAB QUOTE NO: ☒ 36794 Normal Priority ☐ 36795 High Priority ☐ 36796 Urgent Priority RESULTS REQUIRED BY:		ANALYSES REQUIRED	
RESULTS ATTENTION: Sarah Halliday SAMPPLER(S): Sarah Halliday		CONTAINERS		ANALYTES	
SAMPLE ID 93293 93294 93295		MATRIX WATER ↓		DATE/TIME 23.03.10 26.03.10 30.03.10	
COMMENTS		Blank or Duplicate Samples		Blank or Duplicate Samples	
Total No. of Sample Bottles: 9		CHAIN OF CUSTODY DATA		Blank or Duplicate Samples	
RELINQUISHED BY NAME: <u>Sarah Halliday</u> COMPANY: <u>URS</u>		RECEIVED BY NAME: <u>Alphonse Ivisia</u> COMPANY: <u>Hill Labs</u>		METHOD OF SHIPMENT DATE: <u>1/4/10</u> TIME: <u>10:20am</u> URS RECEPTION HILLS DOCKET	
SAMPLE RECEIPT DATA PLEASE COMPLETE THIS SECTION (CIRCLE AS APPROPRIATE) AND RETURN FAX A COPY IMMEDIATELY AFTER RECEIVING SAMPLES		YES / NO		REPORTING	
ALL SAMPLES AND ASSOCIATED DOCUMENTATION WERE RECEIVED IN GOOD ORDER		PLEASE CONTACT THE LABORATORY		CUSTODY SEAL INTACT: SAMPLES CHILLED: LABORATORY BATCH NO:	
SPECIAL HANDLING/STORAGE OR DISPOSAL INSTRUCTIONS:		REPORT FORMAT: ☐ FAX ☐ LETTER ☒ EMAIL ☐ DISK ☐		YES / NO / NA YES / NO / NA Temp: <u>11.0</u> °C	
CAUTION - SAMPLES MAY CONTAIN HAZARDOUS SUBSTANCES		INTERNAL USE - URS WORK INSTRUCTIONS AND CHECKLIST OVERLEAF			



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	784376	SPV1
Contact:	S Halliday C/- URS New Zealand Limited PO Box 3367 WELLINGTON 6140	Date Registered:	16-Apr-2010	
		Date Reported:	22-Apr-2010	
		Quote No:	36794	
		Order No:	42771630	
		Client Reference:	CPG - Waiwhetu	
		Submitted By:	R Sutherland	

Sample Type: Aqueous						
Sample Name:		93296	93297	93298		
		06-Apr-2010	09-Apr-2010	15-Apr-2010		
Lab Number:		784376.1	784376.2	784376.3		
pH	pH Units	7.8	7.8	7.8	-	-
Total Suspended Solids	g/m ³	7.3	7.3	15.3	-	-
Dissolved Chromium	g/m ³	< 0.010	< 0.010	< 0.010	-	-
Total Recoverable Chromium	g/m ³	< 0.011	< 0.011	< 0.011	-	-
Dissolved Copper	g/m ³	< 0.010	< 0.010	< 0.010	-	-
Total Recoverable Copper	g/m ³	< 0.011	< 0.011	< 0.011	-	-
Dissolved Lead	g/m ³	< 0.002	< 0.002	< 0.002	-	-
Total Recoverable Lead	g/m ³	0.0025	0.0021	0.0026	-	-
Dissolved Zinc	g/m ³	< 0.02	< 0.02	< 0.02	-	-
Total Recoverable Zinc	g/m ³	< 0.03	< 0.03	< 0.03	-	-

Analyst's Comments
Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1-3
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1-3
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3 g/m ³	1-3
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0005 g/m ³	1-3
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0005 g/m ³	1-3
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0005 g/m ³	1-3
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0005 g/m ³	1-3
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1-3
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1-3
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1-3
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1-3



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

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

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, appearing to read 'Peter Robinson', with a long horizontal flourish extending to the right.

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



CHAIN OF CUSTODY AND SAMPLE RECEIPT DOCUMENTATION

FROM:		TO:		ANALYSES REQUIRED											
URS New Zealand Limited Lambton House Lambton Quay Wellington Ph: (04) 496 3750 Fax (09) 496 3755		R J Hill Laboratories Limited 160 Clyde Street Hamilton (07) 858 2000 Ph: CLIENT: CPG SITE: Waiwhetu		PROJECT NO: 42771630 LAB QUOTE NO: ☒ 36794 Normal Priority ☐ 36795 High Priority ☐ 36796 Urgent Priority RESULTS REQUIRED BY:											
RESULTS ATTENTION: Sarah Halliday		SAMPLER(S): Sarah Halliday		DATE/TIME COMMENTS											
SAMPLE ID	MATRIX														
93296	water	6.04.10.													
93297	water	9.04.10													
93298	water	15.04.10													
Total No. of Sample Bottles:				Including:											
Blank or Duplicate Samples				METHOD OF SHIPMENT											
RECEIVED BY: <u>Mark Osmont</u>				DATE: <u>16/4/10</u>											
NAME: <u>Sarah Halliday</u>				HILLS DOCKET											
COMPANY: URS				TIME: <u>1:04pm</u>											
SAMPLE RECEIPT DATA				YES / NO / NA											
PLEASE COMPLETE THIS SECTION (CIRCLE AS APPROPRIATE) AND RETURN FAX A COPY IMMEDIATELY AFTER RECEIVING SAMPLES)				YES / NO / NA											
CUSTODY SEAL INTACT:				YES / NO / NA											
SAMPLES CHILLED:				YES / NO / NA											
LABORATORY BATCH NO:				Temp: <u>14.8 °C</u>											
ALL SAMPLES AND ASSOCIATED DOCUMENTATION WERE RECEIVED IN GOOD ORDER				REPORTING											
YES / NO				FAX ☐ LETTER ☐ EMAIL ☒ DISK ☐											
SPECIAL HANDLING/STORAGE OR DISPOSAL INSTRUCTIONS:				REPORT FORMAT:											
CAUTION - SAMPLES MAY CONTAIN HAZARDOUS SUBSTANCES				EMAIL ADDRESS: sarah_halliday@urscorp.com / ryan_sutherland@urscorp.com											
				INTERNAL USE - URS WORK INSTRUCTIONS AND CHECKLIST OVERLEAF											

Time Received: 16-Apr-2010 1:08:21 pm

Job No:

784376

No of Samples 3

No of Fractions 18



0317843762



ANALYSIS REPORT

Page 1 of 2

Client:	URS New Zealand Limited	Lab No:	786737	SPV1
Contact:	S Halliday	Date Registered:	24-Apr-2010	
	C/- URS New Zealand Limited	Date Reported:	10-May-2010	
	PO Box 3367	Quote No:		
	WELLINGTON 6140	Order No:	42771630	
		Client Reference:	Waiwhetu	
		Submitted By:	S Halliday	

Sample Type: Aqueous						
Sample Name:		93299				
		20-Apr-2010				
Lab Number:		786737.1				
pH	pH Units	7.6	-	-	-	-
Total Suspended Solids	g/m ³	49	-	-	-	-
Dissolved Chromium	g/m ³	< 0.010	-	-	-	-
Total Recoverable Chromium	g/m ³	< 0.010	-	-	-	-
Dissolved Copper	g/m ³	< 0.010	-	-	-	-
Total Recoverable Copper	g/m ³	< 0.010	-	-	-	-
Dissolved Lead	g/m ³	0.0021	-	-	-	-
Total Recoverable Lead	g/m ³	0.034	-	-	-	-
Dissolved Zinc	g/m ³	< 0.02	-	-	-	-
Total Recoverable Zinc	g/m ³	< 0.02	-	-	-	-

Analyst's Comments
Appendix No.1 - Chain of Custody

SUMMARY OF METHODS

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

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Samples
Total Recoverable Extraction	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hours. US EPA 1638.	-	1
pH	pH meter. APHA 4500-H ⁺ B 21 st ed. 2005.	0.1 pH Units	1
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 21 st ed. 2005.	3 g/m ³	1
Dissolved Chromium	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0005 g/m ³	1
Total Recoverable Chromium	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0005 g/m ³	1
Dissolved Copper	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0005 g/m ³	1
Total Recoverable Copper	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0005 g/m ³	1
Dissolved Lead	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Total Recoverable Lead	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.00010 g/m ³	1
Dissolved Zinc	Filtered sample, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1
Total Recoverable Zinc	Nitric/Hydrochloric acid extraction, 85°C, 2.75 hr, ICP-MS, trace level. APHA 3125 B 21 st ed. 2005.	0.0010 g/m ³	1



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.

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.

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, reading "Carole Rodgers-Carroll". The signature is fluid and cursive, with the first name "Carole" being more prominent.

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

CHAIN OF CUSTODY AND SAMPLE RECEIPT DOCUMENTATION

No of Samples: **1** No of Fractions: **6**

FROM:		TO:	
URS New Zealand Limited Lambton House Lambton Quay Wellington Ph: (04) 496 3750 Fax (09) 496 3755		R J Hill Laboratories Limited Clyde Street Hamilton (07) 858 2000 CLIENT: CPG SITE: Waikohu	
RESULTS ATTENTION: Sarah Halliday		PROJECT NO: 42771630 LAB QUOTE NO: ☒ 36794 Normal Priority ☐ 36795 High Priority ☐ 36796 Urgent Priority	
SAMPLER(S): Sarah Halliday	MATRIX WATER	DATE/TIME 20-04-10	COMMENTS
SAMPLE ID NO 93299			
Total No. of Sample Bottles:		Including: 3	
CHAIN OF CUSTODY DATA			
RELINQUISHED BY		RECEIVED BY	
NAME: Sarah Halliday COMPANY: URS		NAME: Nick Dester COMPANY: Hill Labs	
DATE: 23-04-10 TIME: 1300		DATE: 24/4/10 TIME: 2:20	
METHOD OF SHIPMENT URS RECEPTION HILLS DOCKET			
SAMPLE RECEIPT DATA			
PLEASE COMPLETE THIS SECTION (CIRCLE AS APPROPRIATE) AND RETURN FAX A COPY IMMEDIATELY AFTER RECEIVING SAMPLES)			
ALL SAMPLES AND ASSOCIATED DOCUMENTATION WERE RECEIVED IN GOOD ORDER		YES / NO / NA YES / NO / NA	
SPECIAL HANDLING/STORAGE OR DISPOSAL INSTRUCTIONS:		REPORTING	
CAUTION - SAMPLES MAY CONTAIN HAZARDOUS SUBSTANCES		FAX ☐ LETTER ☐ EMAIL ☒ DISK ☐	
INTERNAL USE - SAMPLES MAY CONTAIN HAZARDOUS SUBSTANCES		INTERNAL USE - URS WORK INSTRUCTIONS AND CHECKLIST OVERLEAF	

Appendix D XRF Data

XRF Data 02 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	Standardisation				
4	Standardisation				
5	<LOD	<LOD	462	168	091102T3
6	<LOD	43	1067	398	091102T4
7	<LOD	<LOD	39	<LOD	091102T5
8	<LOD	<LOD	563	182	091102T5
9	<LOD	<LOD	433	135	091102T6
10	<LOD	<LOD	247	80	091102T7
11	<LOD	<LOD	1034	374	091102T8
12	<LOD	33	733	239	091102T9
13	<LOD	<LOD	430	172	091102T10
14	<LOD	<LOD	414	228	091102T11
15	<LOD	<LOD	27	<LOD	091102T12
16	<LOD	<LOD	623	289	091102T12
17	Standardisation				
18	Standardisation				
19	<LOD	65	1566	684	091102T13
20	<LOD	37	1711	576	091102T14
21	<LOD	<LOD	483	230	091102T15
22	<LOD	42	468	156	091102T16
23	<LOD	<LOD	483	155	091102T17
24	<LOD	<LOD	510	203	091102T18
25	<LOD	42	332	125	091102T19
26	<LOD	<LOD	372	133	091102T20
27	<LOD	<LOD	479	172	091102T21
28	<LOD	<LOD	419	158	091102T22
29	<LOD	<LOD	441	176	091102T23
30	<LOD	<LOD	422	170	091102T24
31	<LOD	<LOD	376	146	091102T25
32	<LOD	<LOD	474	195	091102T26
33	<LOD	<LOD	441	155	091102T27
34	<LOD	<LOD	429	161	091102T28
35	<LOD	<LOD	693	202	091102T29
36	Standardisation				
37	Error				
38	<LOD	<LOD	430	175	091102T30
39	<LOD	<LOD	349	141	091102T31
40	<LOD	<LOD	368	173	091102T32
41	<LOD	<LOD	411	201	091102T33
42	<LOD	<LOD	301	139	091102T34
43	<LOD	34	634	323	091102T35
44	<LOD	<LOD	413	148	091102T36
45	<LOD	<LOD	354	163	091102T37
46	<LOD	<LOD	175	59	091102T38
47	<LOD	41	369	161	091102T39

XRF Data 03 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	397	160	091103T1
3	<LOD	<LOD	410	172	091103T2
4	<LOD	<LOD	454	189	091103T3
5	<LOD	<LOD	397	143	091103T4
6	<LOD	<LOD	353	128	091103T5
7	<LOD	<LOD	376	133	091103T6
8	<LOD	<LOD	425	149	091103T7
9	<LOD	<LOD	547	226	091103T8
10	<LOD	<LOD	407	179	091103T9
11	<LOD	49	461	168	091103T10
12	<LOD	<LOD	307	128	091103T11
13	<LOD	<LOD	356	132	091103T12
14	<LOD	<LOD	327	151	091103T13
15	Standardisation				
16	<LOD	<LOD	317	119	091103T14
17	<LOD	<LOD	471	161	091103T15
18	<LOD	<LOD	258	79	091103T16
19	<LOD	<LOD	356	115	091103T16
20	<LOD	<LOD	380	159	091103T17
21	<LOD	<LOD	60	14	TRB Screen
22	Standardisation				
23	<LOD	<LOD	524	229	TRB Screen
24	<LOD	<LOD	256	109	TRB Screen
25	<LOD	<LOD	28	<LOD	TRB Screen
26	<LOD	<LOD	266	90	TRB Screen
27	<LOD	<LOD	34	<LOD	SS01
28	<LOD	<LOD	326	104	091103T26
29	<LOD	<LOD	277	100	091103T41
30	<LOD	<LOD	285	90	091103T42
31	<LOD	<LOD	758	175	091103T43
32	<LOD	<LOD	184	53	091103T44
33	<LOD	<LOD	370	137	091103T45

XRF Data 04 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	<LOD	<LOD	263	140	091104T1
4	<LOD	35	346	137	091104T2
5	<LOD	<LOD	624	463	091104T3
6	<LOD	38	950	519	091104T4
7	<LOD	<LOD	222	94	091104T5
8	<LOD	<LOD	266	118	091104T6
9	<LOD	<LOD	233	91	091104T7
10	<LOD	34	289	86	091104T8
11	<LOD	<LOD	235	81	091104T9
12	<LOD	<LOD	277	115	091104T10
13	<LOD	<LOD	360	113	091104T11
14	<LOD	<LOD	333	149	091104T12
15	<LOD	<LOD	330	166	091104T13
16	<LOD	<LOD	276	89	091104T14
17	<LOD	59	473	230	091104T15
18	<LOD	33	1490	293	091104T18
19	<LOD	<LOD	358	175	091104T19
20	<LOD	<LOD	246	76	091104T20
21	<LOD	<LOD	420	137	091104T21
22	<LOD	35	372	144	091104T21
23	<LOD	<LOD	351	143	091104T22
24	<LOD	<LOD	256	112	091104T23
25	<LOD	<LOD	348	119	091104T24
26	<LOD	<LOD	282	99	091104T25
27	<LOD	<LOD	90	18	091104T26
28	<LOD	<LOD	203	66	091104T27
29	<LOD	49	576	271	091104T28
30	<LOD	<LOD	526	206	091104T29
31	Standardisation				
32	<LOD	<LOD	250	90	091104T34
33	<LOD	<LOD	154	49	091104T35
34	<LOD	<LOD	365	148	091104T36
35	<LOD	<LOD	274	105	091104T37
36	<LOD	<LOD	363	165	091104T38
37	<LOD	<LOD	196	71	091104T40
38	<LOD	<LOD	260	110	091104T41
39	<LOD	<LOD	237	78	SPRING
40	<LOD	<LOD	405	134	TRB
41	<LOD	<LOD	58	26	TLB shingle

XRF Data 05 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	<LOD	<LOD	203	74	Cell B 091105T1
4	<LOD	<LOD	392	170	Cell B 091105T2
5	<LOD	<LOD	52	17	Cell B 091105T3
6	<LOD	<LOD	656	339	CFA 212A
7	Standardisation				
8	<LOD	<LOD	66	26	CFA 212A
9	<LOD	<LOD	472	212	CFA 212A
10	<LOD	<LOD	105	32	CFA 212A
11	179	<LOD	192	71	Cell B 091105T4
12	<LOD	<LOD	28	<LOD	Cell B 091105T5
13	<LOD	<LOD	28	14	Cell B 091105T6
14	<LOD	<LOD	112	48	Cell B 091105T7
15	<LOD	<LOD	35	<LOD	Cell B 091105T8
16	<LOD	<LOD	103	28	Cell B 091105T9
17	<LOD	<LOD	156	52	Cell B 091105T10
18	<LOD	<LOD	235	69	Cell B 091105T11
19	<LOD	<LOD	190	63	Cell B 091105T12

XRF Data 06 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	<LOD	<LOD	422	190	091116/1
4	475	108	434	128	NIST 2702
5	179	580	1148	195	NIST 2781
6	<LOD	542	1145	186	NIST 2781
7	<LOD	41	770	805	CFA Pile 213D
8	<LOD	<LOD	46	16	CFA stockpile in Urupa sed cell.
9	<LOD	<LOD	39	12	
10	<LOD	42	50	31	
11	<LOD	<LOD	51	12	
12	<LOD	<LOD	57	<LOD	
13	<LOD	<LOD	53	20	
14	<LOD	<LOD	50	32	
15	<LOD	<LOD	61	22	
16	<LOD	<LOD	53	16	
17	<LOD	<LOD	310	109	Cell B Pre validation
18	Standardisation				
19	<LOD	<LOD	185	74	Cell B Pre validation screen, top 30 m
20	<LOD	<LOD	332	126	
21	<LOD	<LOD	139	51	
22	<LOD	<LOD	316	152	
23	<LOD	<LOD	510	326	
24	<LOD	<LOD	40	<LOD	
25	<LOD	<LOD	107	22	
26	<LOD	<LOD	93	18	
27	<LOD	<LOD	222	82	
28	<LOD	<LOD	164	52	
29	<LOD	<LOD	115	38	
30	<LOD	<LOD	237	73	
31	<LOD	<LOD	153	65	
32	<LOD	<LOD	280	97	
33	<LOD	33	165	56	
34	<LOD	<LOD	199	78	
35	<LOD	<LOD	118	44	
36	<LOD	<LOD	175	65	
37	<LOD	<LOD	116	43	
38	<LOD	<LOD	33	<LOD	
39	<LOD	<LOD	167	67	
40	<LOD	<LOD	41	<LOD	
41	<LOD	<LOD	52	<LOD	
42	<LOD	<LOD	181	78	
43	<LOD	<LOD	137	59	
44	<LOD	<LOD	157	46	

XRF Data 07 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	<LOD	<LOD	251	92	Cell B Pre-validation check top 30m
4	<LOD	<LOD	263	110	
5	<LOD	<LOD	283	114	
6	<LOD	<LOD	485	246	
7	<LOD	<LOD	172	96	
8	<LOD	<LOD	601	116	
9	<LOD	44	102	31	
10	<LOD	<LOD	1240	692	
11	<LOD	<LOD	438	83	
12	<LOD	<LOD	255	175	
13	<LOD	<LOD	227	189	
14	<LOD	<LOD	281	110	
15	<LOD	<LOD	354	138	
16	<LOD	<LOD	106	38	
17	<LOD	<LOD	207	97	
18	<LOD	38	262	125	
19	<LOD	<LOD	398	147	
20	<LOD	<LOD	149	47	
21	<LOD	<LOD	345	133	
22	<LOD	<LOD	300	152	
23	<LOD	<LOD	337	123	
24	<LOD	<LOD	1353	496	
25	<LOD	<LOD	172	71	
26	<LOD	<LOD	261	95	
27	<LOD	133	194	77	
28	<LOD	71	1002	387	
29	<LOD	<LOD	201	138	
30	<LOD	<LOD	38	<LOD	
31	<LOD	<LOD	145	<LOD	
32	<LOD	<LOD	552	548	
33	<LOD	<LOD	259	43	
34	<LOD	<LOD	168	<LOD	
35	<LOD	<LOD	114	42	
36	<LOD	<LOD	61	19	
37	<LOD	<LOD	32	<LOD	
38	<LOD	<LOD	357	148	
39	<LOD	<LOD	403	146	
40	Standardisation				
41	<LOD	<LOD	116	33	Cell B Pre-
42	<LOD	<LOD	39	<LOD	B/10L
43	<LOD	<LOD	117	35	B/10M
44	<LOD	<LOD	54	17	B/10R
45	<LOD	<LOD	179	67	B/30L
46	<LOD	<LOD	50	<LOD	B/30M
47	<LOD	<LOD	100	40	B/30R

Validation

XRF Data 09 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	41	<LOD	Cell B 30 - 90m pre-validation
3	<LOD	<LOD	37	<LOD	
4	<LOD	<LOD	210	52	
5	<LOD	<LOD	38	14	
6	<LOD	<LOD	47	19	
7	Standardisation				
8	<LOD	43	118	42	Cell B 30 - 90m pre-validation
9	<LOD	<LOD	467	246	
10	<LOD	<LOD	288	155	
11	<LOD	<LOD	154	77	
12	<LOD	<LOD	1498	216	
13	<LOD	<LOD	191	48	
14	<LOD	47	1134	1285	
15	<LOD	<LOD	301	157	
16	<LOD	<LOD	522	283	
17	<LOD	<LOD	103	49	
18	<LOD	<LOD	36	<LOD	
19	<LOD	<LOD	87	40	
20	<LOD	<LOD	43	<LOD	
21	<LOD	<LOD	210	81	
22	<LOD	<LOD	389	152	
23	Standardisation				
24	<LOD	<LOD	39	14	Cell B 30 - 90m pre-validation
25	<LOD	<LOD	148	64	
26	<LOD	39	1276	1266	
27	<LOD	<LOD	178	51	
28	<LOD	<LOD	1301	675	
29	<LOD	<LOD	176	42	
30	<LOD	34	462	349	
31	<LOD	<LOD	160	35	
32	<LOD	32	116	134	
33	<LOD	<LOD	67	37	
34	<LOD	<LOD	55	11	
35	<LOD	<LOD	144	67	
36	<LOD	31	198	151	
37	<LOD	<LOD	249	99	
38	<LOD	<LOD	828	732	
39	<LOD	<LOD	396	153	
40	<LOD	38	484	223	
41	<LOD	<LOD	273	65	
42	<LOD	<LOD	82	23	
43	<LOD	<LOD	538	128	
44	<LOD	<LOD	64	31	
45	<LOD	<LOD	206	123	
46	<LOD	<LOD	175	106	
47	<LOD	<LOD	227	97	
48	<LOD	<LOD	235	114	
49	<LOD	<LOD	283	98	
50	<LOD	<LOD	44	13	B/50R
51	<LOD	<LOD	43	15	B/50M
52	<LOD	<LOD	37	<LOD	B/50L
53	<LOD	<LOD	39	<LOD	B/70R
54	<LOD	<LOD	27	12	B/70M
55	<LOD	<LOD	113	34	B/70L

Validation

CLIENT: CPG New Zealand Ltd

PROJECT: Waiwhetu Stream Remediation

FILE: J:\Jobs\42771630\5 Works\Field notes - Sampling - Lab\Lab and XRF analysis\XRF data\XRF Data 2009 Master.xls9 Nov 09

XRF Data 10 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				Cell B: Pre validation check, and delineation of ooze remaining in TLB, 0 - 90m.
2	<LOD	<LOD	178	101	
3	<LOD	<LOD	237	137	
4	<LOD	<LOD	59	65	
5	<LOD	63	1682	684	
6	<LOD	<LOD	128	67	
7	<LOD	<LOD	82	<LOD	
8	<LOD	<LOD	165	37	
9	<LOD	<LOD	323	90	
10	<LOD	<LOD	104	10	
11	<LOD	100	1887	611	
12	<LOD	<LOD	502	135	
13	<LOD	<LOD	208	115	
14	<LOD	<LOD	66	<LOD	
15	<LOD	<LOD	38	<LOD	
16	<LOD	<LOD	165	53	
17	<LOD	<LOD	841	121	
18	<LOD	<LOD	181	69	
19	183	<LOD	1164	697	
20	<LOD	<LOD	207	33	
21	<LOD	<LOD	166	40	
22	<LOD	<LOD	195	59	
23	<LOD	<LOD	42	15	
24	<LOD	<LOD	174	42	
25	<LOD	<LOD	201	69	
26	<LOD	76	1570	595	
27	<LOD	<LOD	265	80	
28	<LOD	<LOD	288	57	
29	<LOD	<LOD	182	103	
30	<LOD	<LOD	402	178	
31	<LOD	<LOD	388	152	
32	<LOD	<LOD	231	78	
33	<LOD	<LOD	82	21	
34	<LOD	<LOD	103	19	
35	<LOD	<LOD	<LOD	<LOD	
36	<LOD	51	616	213	
37	<LOD	<LOD	104	34	
38	<LOD	<LOD	51	15	
39	<LOD	<LOD	80	27	
40	<LOD	<LOD	54	19	
41	<LOD	<LOD	50	<LOD	
42	<LOD	39	289	163	
43	143	<LOD	349	137	
44	<LOD	<LOD	120	33	
45	<LOD	<LOD	147	41	
46	<LOD	35	670	368	
47	<LOD	<LOD	90	47	
48	<LOD	<LOD	36	<LOD	
49	<LOD	<LOD	81	20	
50	<LOD	<LOD	202	86	
51	<LOD	<LOD	227	135	
52	<LOD	<LOD	114	100	
53	<LOD	<LOD	301	142	
54	<LOD	<LOD	239	96	
55	<LOD	<LOD	263	150	
56	<LOD	44	628	172	
57	<LOD	<LOD	277	129	
58	<LOD	<LOD	109	45	
59	<LOD	<LOD	150	48	
60	<LOD	<LOD	108	55	
61	<LOD	<LOD	46	<LOD	
62	<LOD	<LOD	797	190	
63	<LOD	<LOD	180	97	
64	<LOD	<LOD	38	<LOD	
65	Standardisation				

XRF Data 11 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	41	<LOD	B90R
3	<LOD	<LOD	58	16	B/90M
4	<LOD	<LOD	40	<LOD	B/90L
5	Standardisation				
6	Standardisation				
7	<LOD	<LOD	90	422	Waiu St
8	<LOD	<LOD	154	1157	
9	<LOD	<LOD	43	19	
10	<LOD	<LOD	62	130	
11	Standardisation				
12	<LOD	<LOD	463	114	Cell B in and around rail bridge. Spot check while removing material.
13	<LOD	<LOD	206	178	
14	<LOD	39	782	896	
15	<LOD	<LOD	57	14	
16	<LOD	<LOD	42	<LOD	
17	<LOD	<LOD	87	37	
18	<LOD	<LOD	1488	431	
19	<LOD	<LOD	46	<LOD	
20	<LOD	<LOD	435	231	
21	<LOD	<LOD	159	72	
22	<LOD	<LOD	156	19	
23	<LOD	<LOD	57	19	
24	<LOD	<LOD	86	25	
25	<LOD	<LOD	74	12	
26	<LOD	127	6388	356	
27	<LOD	<LOD	300	322	Cell B TRB seam

Validation

XRF Data 12 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	30	318	130	Spot checking d/s of rail bridge
3	<LOD	<LOD	1215	172	
4	Standardisation				
5	<LOD	<LOD	729	521	Spot checking d/s of rail bridge
6	<LOD	<LOD	678	539	
7	<LOD	<LOD	248	158	
8	<LOD	<LOD	183	125	
9	<LOD	<LOD	198	131	

CLIENT: CPG New Zealand Ltd

PROJECT: Waiwhetu Stream Remediation

FILE: J:\Jobs\42771630\5 Works\Field notes - Sampling - Lab\Lab and XRF analysis\XRF data\XRF Data 2009 Master.xls12 Nov 09

XRF Data 13 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	Standardisation				
4	<LOD	<LOD	246	58	Spot checking d/s of rail bridge
5	<LOD	<LOD	248	91	
6	<LOD	<LOD	125	42	

XRF Data 14 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	103	44	
3	<LOD	<LOD	344	150	
4	<LOD	<LOD	280	83	
5	<LOD	<LOD	229	75	
6	<LOD	<LOD	214	72	
7	<LOD	<LOD	132	51	
8	<LOD	53	447	692	Seam in TRB of Cell B
9	<LOD	<LOD	222	83	
10	<LOD	<LOD	236	168	
11	<LOD	41	316	334	
12	<LOD	68	1037	927	
13	<LOD	<LOD	455	441	
14	<LOD	<LOD	238	258	
15	<LOD	<LOD	<LOD	<LOD	
16	<LOD	<LOD	880	170	Bed of Cell B
17	<LOD	77	2152	639	

XRF Data 16 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	36	837	361	Spot check Cell A
3	<LOD	<LOD	180	43	
4	<LOD	<LOD	117	50	
5	Standardisation				
6	<LOD	207	250	174	Spot check Cell A
7	<LOD	<LOD	116	28	
8	<LOD	<LOD	35	15	
9	<LOD	<LOD	100	87	
10	<LOD	<LOD	21	<LOD	
11	<LOD	<LOD	165	78	
12	<LOD	<LOD	31	<LOD	
13	<LOD	<LOD	50	14	
14	<LOD	<LOD	360	195	
15	<LOD	<LOD	52	20	
16	<LOD	<LOD	98	34	
17	<LOD	<LOD	185	130	
18	<LOD	<LOD	370	208	

XRF Data 17 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	<LOD	<LOD	105	43	Demo GWRC
4	Standardisation				
5	<LOD	<LOD	427	46	Spot check TLB Cell A
6	<LOD	165	82	22	
7	<LOD	<LOD	43	10	
8	<LOD	<LOD	39	<LOD	
9	<LOD	<LOD	27	<LOD	
10	<LOD	<LOD	51	22	
11	<LOD	<LOD	118	35	
12	<LOD	<LOD	138	53	
13	<LOD	<LOD	194	75	
14	<LOD	<LOD	31	11	A/10L
15	<LOD	<LOD	61	28	A/30L
16	<LOD	<LOD	77	36	A/50L
17	<LOD	<LOD	92	40	A/70L
18	<LOD	<LOD	42	<LOD	A/90L

Validation

XRF Data 19 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	180	44	Spot check Cell A TLB Pre- validation
3	<LOD	<LOD	145	53	
4	<LOD	<LOD	22	<LOD	
5	<LOD	<LOD	226	65	
6	<LOD	<LOD	264	146	
7	<LOD	45	2376	1687	
8	<LOD	<LOD	38	<LOD	
9	<LOD	<LOD	412	297	
10	<LOD	<LOD	153	94	
11	<LOD	<LOD	56	23	
12	<LOD	<LOD	55	<LOD	
13	<LOD	<LOD	200	69	
14	<LOD	<LOD	43	15	
15	<LOD	<LOD	77	63	
16	<LOD	<LOD	80	36	
17	<LOD	<LOD	36	<LOD	
18	<LOD	<LOD	52	18	
19	<LOD	<LOD	49	<LOD	
20	<LOD	<LOD	271	335	Slump in Cell B
21	<LOD	44	359	62	
22	<LOD	175	8386	55	
23	<LOD	<LOD	199	87	
24	<LOD	<LOD	159	63	
25	<LOD	<LOD	117	53	Beneath Bell Rd Bridge
26	<LOD	<LOD	243	181	
27	<LOD	38	146	215	
28	<LOD	<LOD	251	83	
29	<LOD	49	1305	564	
30	<LOD	<LOD	181	79	Urupa 1
31	<LOD	<LOD	222	66	Urupa 2
32	<LOD	<LOD	61	26	Urupa 3
33	<LOD	<LOD	54	16	Urupa 4
34	<LOD	<LOD	48	<LOD	Urupa 5
35	<LOD	<LOD	38	13	Urupa 6
36	<LOD	<LOD	33	<LOD	
37	<LOD	<LOD	54	<LOD	

XRF Data 20 November 2009

Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	<LOD	<LOD	SiO2 Blank
3	347	110	388	148	NIST2702
4	173	531	1158	186	NIST2781
5	Standardisation				
6	<LOD	<LOD	165	1084	Training with Suz and spot check of Cell A pre validation.
7	<LOD	<LOD	111	380	
8	<LOD	<LOD	175	497	
9	<LOD	<LOD	123	857	
10	<LOD	<LOD	62	17	
11	<LOD	<LOD	119	60	
12	Standardisation				
13	<LOD	<LOD	239	98	Training with Suz and spot check of Cell A pre validation.
14	<LOD	<LOD	51	24	
15	<LOD	<LOD	71	23	
16	<LOD	<LOD	129	60	
17	<LOD	<LOD	179	49	
18	<LOD	<LOD	76	15	
19	<LOD	<LOD	113	61	
20	<LOD	<LOD	83	21	
21	<LOD	<LOD	46	<LOD	
22	<LOD	<LOD	49	<LOD	
23	<LOD	<LOD	47	19	
24	<LOD	<LOD	46	17	
25	<LOD	<LOD	189	145	
26	<LOD	37	94	54	
27	<LOD	<LOD	58	20	
28	<LOD	<LOD	57	31	
29	<LOD	<LOD	40	<LOD	A/110R
30	<LOD	<LOD	41	<LOD	
31	<LOD	<LOD	42	<LOD	
32	<LOD	<LOD	39	<LOD	A/90R
33	<LOD	<LOD	65	34	A/70R
34	<LOD	<LOD	77	38	A/50R
35	<LOD	<LOD	142	58	A/110M
36	<LOD	<LOD	69	24	A/90M
37	<LOD	<LOD	90	39	A/70M
38	<LOD	<LOD	43	14	A/50M
39	<LOD	<LOD	49	16	Errors
40	<LOD	<LOD	86	50	
41	Standardisation				
42	Standardisation				
43	<LOD	<LOD	47	21	Errors
44	<LOD	<LOD	37	<LOD	
45	<LOD	35	59	15	
46	<LOD	<LOD	50	<LOD	
47	<LOD	<LOD	57	19	A/10R
48	<LOD	<LOD	93	30	
49	<LOD	<LOD	70	16	
50	<LOD	<LOD	45	<LOD	A/30R
51	<LOD	<LOD	36	<LOD	A/30M
52	<LOD	<LOD	40	<LOD	A/10M

Validation

XRF Data 24 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	74	21	Exposed ooze in Cell A TLB
3	<LOD	<LOD	349	172	
4	<LOD	36	172	114	
5	Standardisation				
6	Standardisation				
7	<LOD	48	864	256	

XRF Data 25 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	211	77	Spot check Cell B 90 - 110m, also around gas pipes.
3	<LOD	<LOD	54	24	
4	<LOD	<LOD	52	31	
5	<LOD	<LOD	49	14	
6	<LOD	<LOD	42	14	
7	<LOD	<LOD	52	23	
8	<LOD	<LOD	148	36	
9	<LOD	<LOD	101	<LOD	
10	<LOD	<LOD	353	<LOD	
11	<LOD	<LOD	83	<LOD	
12	<LOD	<LOD	249	14	
13	<LOD	<LOD	55	<LOD	
14	<LOD	<LOD	92	28	
15	<LOD	<LOD	223	30	
16	<LOD	<LOD	50	17	
17	<LOD	<LOD	170	103	
18	<LOD	<LOD	608	666	
19	<LOD	<LOD	46	21	
20	<LOD	<LOD	110	52	
21	464	216	<LOD	12349	
22	<LOD	<LOD	143	80	
23	<LOD	<LOD	120	65	
24	<LOD	<LOD	176	133	
25	<LOD	<LOD	212	138	
26	<LOD	<LOD	320	194	
27	<LOD	<LOD	110	62	
28	<LOD	<LOD	322	343	
29	<LOD	<LOD	184	106	
30	<LOD	<LOD	72	85	
31	<LOD	<LOD	166	98	
32	<LOD	<LOD	75	19	B/110R
33	<LOD	<LOD	113	43	B/110M
34	<LOD	<LOD	63	20	B/110L

Validation

XRF Data 26 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	214	265	Spot Check Cell B D/S of gas pipes and under rail bridge
3	<LOD	<LOD	465	343	
4	<LOD	<LOD	29	<LOD	
5	<LOD	<LOD	380	159	
6	<LOD	<LOD	66	33	
7	<LOD	<LOD	757	39	
8	<LOD	38	86	35	
9	<LOD	<LOD	120	68	
10	<LOD	<LOD	289	63	
11	<LOD	<LOD	228	73	
12	<LOD	<LOD	54	21	
13	153	<LOD	1286	591	
14	<LOD	<LOD	326	25	
15	<LOD	55	448	939	
16	<LOD	<LOD	96	24	
17	<LOD	44	1431	433	
18	<LOD	49	338	215	
19	<LOD	<LOD	56	35	
20	<LOD	<LOD	40	<LOD	
21	<LOD	<LOD	229	20	
22	<LOD	<LOD	274	134	
23	<LOD	<LOD	173	64	
24	<LOD	<LOD	159	57	
25	<LOD	<LOD	60	18	
26	Standardisation				
27	<LOD	<LOD	353	431	Spot Check Cell B D/S of gas pipes and under rail bridge
28	<LOD	45	1061	565	
29	<LOD	71	1030	1404	
30	<LOD	35	813	1350	
31	<LOD	<LOD	28	<LOD	
32	<LOD	<LOD	125	38	
33	<LOD	57	203	175	
34	<LOD	<LOD	42	<LOD	
35	<LOD	<LOD	48	<LOD	
36	<LOD	<LOD	72	36	
37	<LOD	<LOD	51	<LOD	
38	<LOD	<LOD	55	38	
39	Standardisation				
40	<LOD	<LOD	207	89	Spot Check Cell B D/S of gas pipes and under rail bridge
41	<LOD	<LOD	48	12	
42	<LOD	<LOD	32	<LOD	
43	<LOD	<LOD	43	21	
44	<LOD	<LOD	39	<LOD	B/130L
45	<LOD	<LOD	30	<LOD	B/130M
46	<LOD	<LOD	39	<LOD	B/130R

Validation

XRF Data 27 November 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	313	1084	U-channel piles of material from bed, stockpiled on TRB
3	<LOD	44	526	400	
4	<LOD	<LOD	243	185	
5	<LOD	75	828	547	

XRF Data 03 December 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	72	23	
3	Standardisation				
4	Standardisation				
5	Standardisation				
6	<LOD	<LOD	86	479	Waiu St Comp 1
7	<LOD	<LOD	98	460	Waiu St Comp 2
8	<LOD	<LOD	59	90	Waiu St Comp 3
9	<LOD	<LOD	49	20	Waiu St Comp 4
10	<LOD	<LOD	75	36	Waiu St Comp 5
11	<LOD	<LOD	76	80	Waiu St Comp 6
12	<LOD	<LOD	53	23	Waiu St Comp 7

XRF Data 05 December 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	2266	2014	

XRF Data 07 December 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	45	16	U-Ch/L1
3	<LOD	<LOD	135	90	U-Ch/L2
4	<LOD	<LOD	73	35	U-Ch/L3
5	<LOD	<LOD	100	18	Cell C brown clay beneath ooze
6	<LOD	<LOD	110	70	
7	<LOD	<LOD	99	56	U-Ch/L4
8	<LOD	<LOD	154	100	U-Ch/L5
9	<LOD	<LOD	127	82	U-Ch/L6
10	<LOD	<LOD	50	17	U-Ch/R7
11	<LOD	112	309	269	U-Ch/R8
12	<LOD	<LOD	353	301	U-Ch/R9
13	<LOD	<LOD	393	471	U-Ch/R9a
14	<LOD	<LOD	274	202	U-Ch/R10
15	<LOD	58	229	222	U-Ch/R11
16	<LOD	<LOD	54	13	U-Ch/R11a
17	Standardisation				
18	<LOD	<LOD	344	337	Spot check in Cell C
19	<LOD	<LOD	38	<LOD	
20	<LOD	56	504	396	
21	<LOD	63	1669	722	
22	<LOD	33	417	203	
23	<LOD	<LOD	131	22	
24	<LOD	58	815	377	
25	<LOD	45	871	487	
26	<LOD	<LOD	103	18	

XRF Data 11 December 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	47	29	Waiu St visit with CPG. CPG directed testing and recorded results at the time
3	<LOD	<LOD	50	35	
4	<LOD	<LOD	86	47	
5	<LOD	<LOD	358	123	
6	<LOD	<LOD	26	24	
7	<LOD	<LOD	132	332	
8	<LOD	<LOD	96	223	
9	<LOD	<LOD	114	396	
10	<LOD	<LOD	98	330	
11	<LOD	<LOD	80	127	
12	<LOD	<LOD	81	97	
13	<LOD	42	95	369	
14	<LOD	<LOD	81	480	
15	<LOD	<LOD	61	76	
16	<LOD	<LOD	55	31	
17	<LOD	40	862	370	
18	<LOD	<LOD	99	305	
19	<LOD	<LOD	47	59	
20	<LOD	<LOD	42	18	
21	<LOD	<LOD	55	28	
22	<LOD	<LOD	44	19	
23	<LOD	38	64	36	
24	<LOD	<LOD	39	15	
25	<LOD	<LOD	80	242	
26	<LOD	<LOD	126	199	
27	<LOD	<LOD	87	953	

XRF Data 16 December 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	<LOD	<LOD	259	119	
4	<LOD	<LOD	233	184	
5	<LOD	<LOD	165	66	
6	<LOD	<LOD	35	<LOD	
7	<LOD	<LOD	114	79	
8	<LOD	<LOD	49	<LOD	
9	<LOD	<LOD	252	178	
10	<LOD	<LOD	167	65	
11	<LOD	<LOD	<LOD	<LOD	
12	<LOD	<LOD	147	90	
13	<LOD	<LOD	159	58	
14	<LOD	<LOD	491	290	
15	<LOD	39	846	383	
16	<LOD	36	444	257	
17	<LOD	<LOD	461	337	
18	<LOD	<LOD	444	246	
19	<LOD	<LOD	194	100	
20	<LOD	<LOD	586	392	
21	<LOD	<LOD	45	<LOD	
22	<LOD	<LOD	23	<LOD	
23	<LOD	<LOD	93	38	
24	<LOD	<LOD	241	142	
25	<LOD	<LOD	90	38	
26	<LOD	<LOD	188	130	
27	<LOD	<LOD	79	29	
28	<LOD	<LOD	44	<LOD	
29	<LOD	<LOD	32	<LOD	
30	<LOD	37	707	594	
31	<LOD	<LOD	57	<LOD	
32	<LOD	<LOD	250	200	
33	<LOD	<LOD	32	<LOD	
34	<LOD	56	936	440	
35	<LOD	<LOD	492	295	
36	<LOD	<LOD	331	150	
37	<LOD	<LOD	257	80	
38	<LOD	<LOD	527	486	
39	<LOD	<LOD	43	11	

XRF Data 17 December 2009



Reading	Cr	Ni	Cu	Zn	Pb	Description
1	Standardisation					
2	Standardisation					
3	<LOD	<LOD	<LOD	86	24	
4	<LOD	<LOD	<LOD	48	17	
5	<LOD	<LOD	<LOD	78	22	
6	<LOD	<LOD	<LOD	65	30	
7	<LOD	<LOD	<LOD	58	19	
8	<LOD	<LOD	<LOD	68	22	
9	<LOD	<LOD	41	751	612	

XRF Data 18 December 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	69	26	CFC/T1/1218
3	<LOD	<LOD	56	24	CFC/T2/1218
4	<LOD	<LOD	63	35	CFC/T3/1218
5	<LOD	<LOD	79	33	CFC/T4/1218
6	<LOD	<LOD	69	23	CFC/T5/1218
7	<LOD	<LOD	36	<LOD	CFC/T6/1218

Lab tested

XRF Data 19 December 2009



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	52	15	CFC/T7/1219
3	<LOD	<LOD	65	19	CFC/T8/1219
4	<LOD	<LOD	65	27	CFC/T9/1219
5	<LOD	<LOD	57	28	CFC/T10/1219
6	<LOD	<LOD	65	28	CFC/T11/1219
7	<LOD	<LOD	71	33	CFC/T12/1219
8	<LOD	<LOD	63	30	CFC/T13/1219
9	<LOD	<LOD	171	<LOD	CFC/T14/1219
10	<LOD	<LOD	76	22	CFU/T15/1219
11	<LOD	<LOD	50	<LOD	CFC/T16/1219
12	<LOD	<LOD	82	20	CFC/T17/1219
13	<LOD	<LOD	50	24	CFC/T14/1219
14	<LOD	<LOD	69	20	CFC/T18/1219
15	<LOD	<LOD	66	27	CFU/T19/1219
16	<LOD	<LOD	66	29	CFC/T20/1219
17	<LOD	<LOD	57	16	CFU/T21/1219
18	<LOD	34	79	26	CFU/T22/1219
19	<LOD	<LOD	65	26	CFC/T23/1219
20	<LOD	<LOD	66	25	CFC/T24/1219
21	Standardisation				
22	<LOD	<LOD	65	34	CFU/T25/1219
23	<LOD	<LOD	76	39	CFC/T26/1219
24	<LOD	<LOD	70	25	CFC/T27/1219

Lab tested

XRF Data 21 December 2009



Reading	Cr	Cu	Zn	Pb	Description
1			Standardisation		
2	<LOD	<LOD	74	25	CFC/T28/1221
3	<LOD	<LOD	63	14	CFC/T29/1221
4	<LOD	<LOD	69	32	CFC/T30/1221
5	<LOD	<LOD	54	20	CFC/T31/1221
6	<LOD	37	57	19	CFC/T32/1221
7	<LOD	<LOD	73	16	CFC/T33/1221
8	<LOD	<LOD	72	27	CFC/T34/1221
9	<LOD	<LOD	70	16	CFC/T35/1221
10	<LOD	<LOD	72	20	CFC/T36/1221
11	<LOD	<LOD	71	20	CFC/T37/1221
12	<LOD	<LOD	59	15	CFC/T38/1221
13	<LOD	<LOD	51	<LOD	CFC/T39/1221
14	<LOD	37	71	27	CFC/T40/1221
15	<LOD	<LOD	56	23	CFC/T41/1221
16			Standardisation		
17	<LOD	<LOD	58	26	CFC/T42/1221
18	<LOD	<LOD	61	26	CFC/T43/1221
19			Standardisation		
20	<LOD	<LOD	63	26	CFC/T44/1221
21	<LOD	<LOD	42	24	CFC/T45/1221
22	<LOD	55	58	19	CFC/T46/1221
23	<LOD	<LOD	60	16	CFC/T47/1221
24	<LOD	<LOD	59	25	CFC/T48/1221
25	<LOD	<LOD	38	<LOD	CFC/T49/1221
26	<LOD	<LOD	59	21	CFC/T50/1221
27	<LOD	<LOD	65	19	CFC/T51/1222
28	<LOD	<LOD	72	23	Stockpile sampling of remaining material in compound stockpiles. CF01 - CF07 were collected for lab analysis.
29	<LOD	<LOD	72	20	
30	<LOD	<LOD	59	24	
31	<LOD	<LOD	252	20	
32	<LOD	<LOD	68	19	
33	<LOD	<LOD	68	16	
34	<LOD	<LOD	94	24	
35	<LOD	<LOD	77	24	
36	<LOD	<LOD	55	24	
37	<LOD	<LOD	71	29	
38	<LOD	<LOD	66	28	
39	<LOD	<LOD	67	21	
40	<LOD	<LOD	72	25	
41	<LOD	<LOD	62	31	
42	<LOD	<LOD	87	25	
43	<LOD	<LOD	64	24	
44	<LOD	<LOD	70	41	
45	<LOD	<LOD	66	253	
46	<LOD	<LOD	68	35	
47	<LOD	<LOD	63	16	
48	<LOD	<LOD	53	20	
49	<LOD	<LOD	57	45	
50	<LOD	<LOD	73	27	
51	<LOD	<LOD	51	<LOD	
52	<LOD	<LOD	90	29	
53	<LOD	<LOD	68	23	
54	<LOD	<LOD	47	35	
55	<LOD	<LOD	50	<LOD	
56	<LOD	<LOD	63	15	
57	<LOD	<LOD	53	<LOD	
58	<LOD	<LOD	100	33	
59	<LOD	<LOD	75	15	
60	<LOD	<LOD	43	19	
61	176	<LOD	88	24	CF01
62	<LOD	<LOD	108	69	CF02
63	<LOD	<LOD	96	25	CF03
64	<LOD	<LOD	43	<LOD	CF04
65	<LOD	39	61	28	CF05
66	<LOD	<LOD	85	30	CF06
67	<LOD	<LOD	70	35	CF07

Lab tested

XRF Data 22 December 2009



Reading	Cr	Cu	Zn	Pb	Description
1			Standardisation		
2	<LOD	<LOD	32	20	Compound stockpile spot check
3	<LOD	<LOD	52	<LOD	
4	<LOD	<LOD	45	19	
5	<LOD	<LOD	36	<LOD	
6	<LOD	<LOD	55	27	
7	<LOD	<LOD	61	16	
8	<LOD	<LOD	78	24	
9	<LOD	<LOD	57	15	
10	<LOD	<LOD	46	<LOD	
11	<LOD	<LOD	45	<LOD	
12	<LOD	<LOD	42	<LOD	
13	<LOD	<LOD	49	<LOD	
14	<LOD	<LOD	57	20	
15	<LOD	<LOD	44	<LOD	
16	<LOD	<LOD	40	21	
17	<LOD	<LOD	42	16	
18	<LOD	<LOD	38	<LOD	CFC/SP2/1
19	<LOD	<LOD	39	<LOD	CFC/SP2/2
20	<LOD	<LOD	55	<LOD	CFC/SP2/3
21	<LOD	<LOD	47	13	CFC/SP2/4
22	<LOD	36	98	54	
23	<LOD	<LOD	71	25	
24	<LOD	<LOD	190	180	
25	<LOD	<LOD	208	84	
26	<LOD	<LOD	22	<LOD	
27	<LOD	<LOD	165	91	
28	<LOD	<LOD	626	242	
29	<LOD	37	286	143	
30	<LOD	<LOD	197	70	
31	<LOD	<LOD	236	96	
32	<LOD	<LOD	193	122	
33	<LOD	<LOD	196	94	
34	<LOD	<LOD	88	145	
35	<LOD	<LOD	82	144	
36	<LOD	<LOD	96	106	
37	<LOD	45	131	125	
38	<LOD	<LOD	124	124	
39	<LOD	<LOD	99	200	
40	<LOD	<LOD	80	144	
41	<LOD	<LOD	80	105	
42	<LOD	<LOD	88	106	
43	<LOD	40	71	107	
44	<LOD	<LOD	121	189	
45			Standardisation		
46	<LOD	<LOD	69	96	
47	<LOD	40	76	107	
48	<LOD	<LOD	113	152	
49	<LOD	<LOD	93	139	
50	<LOD	<LOD	109	188	
51	<LOD	<LOD	145	166	
52	<LOD	<LOD	79	43	
53	<LOD	<LOD	112	115	
54	<LOD	<LOD	128	235	
55	<LOD	<LOD	201	87	
56	<LOD	<LOD	164	303	
57	<LOD	<LOD	101	91	
58	<LOD	<LOD	96	49	
59	<LOD	<LOD	69	32	
60	<LOD	<LOD	85	64	
61	<LOD	<LOD	825	51	
62	<LOD	<LOD	146	330	
63	<LOD	<LOD	51	53	
64	<LOD	<LOD	119	168	
65	<LOD	<LOD	103	80	
66	<LOD	<LOD	148	73	
67	<LOD	<LOD	83	141	

Cell C/D spot check
Waiu St

XRF Data 22 December 2009



Reading	Cr	Cu	Zn	Pb	Description
68	<LOD	<LOD	94	380	
69	<LOD	<LOD	46	29	
70	<LOD	<LOD	58	65	
71	<LOD	<LOD	58	16	
72	<LOD	<LOD	112	67	
73	<LOD	<LOD	69	49	
74	<LOD	<LOD	82	322	
75	<LOD	<LOD	50	31	
76	<LOD	<LOD	74	80	
77	<LOD	<LOD	66	42	
78	<LOD	<LOD	59	42	
79	<LOD	45	75	103	
80	<LOD	<LOD	176	269	
81	<LOD	<LOD	150	96	
82	<LOD	<LOD	102	99	
83	<LOD	<LOD	80	135	
84	<LOD	<LOD	64	24	
85	<LOD	34	68	43	
86	<LOD	<LOD	142	43	
87	<LOD	<LOD	150	341	
88	<LOD	<LOD	80	203	
89	<LOD	<LOD	149	97	
90	<LOD	<LOD	82	48	
91	<LOD	<LOD	78	99	
92	<LOD	<LOD	126	181	
93	<LOD	<LOD	69	45	

Lab tested

XRF Data 12 January 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	<LOD	<LOD	120	378	Waiu St final spot check under CPG direction
4	<LOD	<LOD	55	37	
5	<LOD	<LOD	61	35	
6	<LOD	<LOD	47	37	
7	<LOD	<LOD	47	38	
8	<LOD	<LOD	88	112	
9	<LOD	<LOD	85	216	
10	<LOD	<LOD	52	38	
11	<LOD	<LOD	51	44	
12	<LOD	<LOD	66	72	
13	<LOD	<LOD	99	290	
14	169	<LOD	91	102	
15	<LOD	<LOD	44	36	
16	<LOD	<LOD	101	180	
17	<LOD	<LOD	77	75	
18	<LOD	<LOD	42	<LOD	
19	<LOD	<LOD	42	14	

XRF Data 13 January 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	108	42	
3	<LOD	<LOD	324	104	
4	<LOD	<LOD	32	<LOD	
5	<LOD	<LOD	27	<LOD	
6	Standardisation				
7	<LOD	<LOD	273	173	
8	<LOD	<LOD	34	13	CD/10L
9	<LOD	<LOD	33	<LOD	CD/10M
10	<LOD	<LOD	42	16	CD/10R
11	<LOD	<LOD	39	16	CD/30L
12	<LOD	<LOD	42	<LOD	CD/30M
13	<LOD	<LOD	45	19	CD/30R

Validation

XRF Data 14 January 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	101	113	Cell C/D spot check
3	<LOD	<LOD	68	50	
4	<LOD	<LOD	82	41	
5	<LOD	<LOD	<LOD	<LOD	
6	Standardisation				
7	<LOD	<LOD	241	676	Cell C/D spot check
8	<LOD	<LOD	125	300	
9	<LOD	<LOD	137	207	
10	<LOD	<LOD	218	524	
11	<LOD	<LOD	117	154	
12	<LOD	<LOD	146	227	
13	<LOD	<LOD	189	361	
14	<LOD	<LOD	187	253	
15	<LOD	<LOD	256	149	
16	174	<LOD	158	646	
17	<LOD	<LOD	453	707	
18	<LOD	<LOD	29	<LOD	
19	<LOD	<LOD	92	159	
20	<LOD	<LOD	28	<LOD	CD/70L
21	<LOD	<LOD	38	<LOD	CD/70M
22	<LOD	<LOD	32	<LOD	CD/70R
23	<LOD	<LOD	30	<LOD	CD/50L
24	<LOD	<LOD	68	17	CD/50M
25	<LOD	<LOD	28	<LOD	CD/50R
26	<LOD	<LOD	28	<LOD	Cell C/D spot check
27	<LOD	<LOD	37	<LOD	
28	<LOD	<LOD	259	198	

Validation

XRF Data 15 January 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	23	<LOD	CD/90L
3	<LOD	<LOD	36	<LOD	CD/90M
4	<LOD	<LOD	25	<LOD	CD/90R
5	<LOD	<LOD	49	18	CD/110L
6	<LOD	<LOD	34	<LOD	CD/110M
7	<LOD	<LOD	35	<LOD	CD/110R
8	<LOD	<LOD	25	<LOD	CD/130L
9	<LOD	<LOD	40	14	CD/130M
10	<LOD	<LOD	32	<LOD	CD/130R
11	<LOD	<LOD	41	<LOD	CD/150L
12	<LOD	<LOD	33	<LOD	CD/150M
13	<LOD	<LOD	70	26	CD/150R
14	<LOD	<LOD	29	<LOD	CD/170L
15	Standardisation				
16	Standardisation				
17	<LOD	<LOD	35	16	CD/170M
18	<LOD	<LOD	77	121	CD/170R
19	<LOD	<LOD	38	13	CD/190L
20	<LOD	<LOD	40	77	CD/190M
21	<LOD	<LOD	45	12	CD/190R
22	<LOD	<LOD	151	308	Spot checking validation samples as concerned about high levels.
23	<LOD	<LOD	87	183	
24	<LOD	<LOD	81	119	
25	<LOD	<LOD	90	192	
26	<LOD	<LOD	31	18	
27	<LOD	<LOD	44	<LOD	
28	<LOD	<LOD	52	117	
29	<LOD	<LOD	35	<LOD	
30	<LOD	<LOD	40	50	
31	<LOD	<LOD	27	<LOD	CF/CD1
32	<LOD	<LOD	37	18	CF/CD2
33	<LOD	<LOD	33	<LOD	CF/CD3
34	<LOD	<LOD	40	<LOD	CF/CD4
35	<LOD	<LOD	23	40	CF/CD5

Validation
Lab tested

XRF Data 18 January 2010



Reading	Cr	Cu	Zn	Pb	Description	Type
1	Standardisation					
2	<LOD	<LOD	41	18	CF/CD6	
3	<LOD	<LOD	53	40	CF/CD7	
4	<LOD	<LOD	61	61	CF/CD8	
5	<LOD	<LOD	56	83	CF/CD9	
6	<LOD	<LOD	54	81	CF/CD10	
7	<LOD	<LOD	42	61	CF/CD11	
8	<LOD	<LOD	43	54	CF/CD12	
9	<LOD	<LOD	68	143	CF/CD13	
10	<LOD	<LOD	67	166	CF/CD14	
11	<LOD	<LOD	58	176		
12	<LOD	<LOD	49	131	CF/CD15	
13	<LOD	37	116	434	These trucks went as type A. From here on I made an effort to test the truckloads before they left and advise if type A or F.	
14	<LOD	<LOD	83	171		
15	<LOD	<LOD	52	66		
16	<LOD	38	123	68		
17	<LOD	<LOD	166	105		
18	<LOD	<LOD	193	95		
19	<LOD	<LOD	158	123	CD/CD16	A
20	Standardisation					
21	<LOD	<LOD	171	69	CF/CD17	F
22	<LOD	<LOD	124	64	CF/CD18	F
23	<LOD	<LOD	108	104	CF/CD19	F
24	<LOD	<LOD	104	78	CF/CD20	F
25	<LOD	<LOD	155	138	CF/CD21	F
26	<LOD	53	162	92		
27	<LOD	<LOD	82	63	CF/CD22	F
28	<LOD	<LOD	82	39	CF/CD23	F
29	<LOD	<LOD	98	113	CF/CD24	F
30	<LOD	<LOD	123	55	CF/CD25	F
31	Standardisation					
32	167	<LOD	60	38	CF/CD26	F
33	<LOD	<LOD	114	45	CF/CD27	F
34	<LOD	67	241	310	CF/CD28	A
35	<LOD	98	392	572	CF/CD29	A
36	<LOD	45	174	159	CF/CD30	A
37	<LOD	63	167	179		

Lab tested

XRF Data 19 January 2010



Reading	Cr	Cu	Zn	Pb	Description	Type
1	Standardisation					
2	<LOD	<LOD	134	107	CF/CF31	F
3	<LOD	<LOD	109	85		
4	<LOD	<LOD	120	67		
5	<LOD	45	60	44	CF/CD32	A
6	<LOD	84	552	425	CF/CD33	A
7	Standardisation					
8	<LOD	101	400	253	CF/CD34	A
9	<LOD	<LOD	111	74	CFU/1	B
10	Standardisation					
11	<LOD	<LOD	137	102	CFU/2	B

Lab tested

XRF Data 20 January 2010



Reading	Cr	Cu	Zn	Pb	Description	Type
1	Standardisation					
2	<LOD	48	305	354	CFU/3	B
3	<LOD	<LOD	53	19	CFU/4	B
4	<LOD	<LOD	85	30	CFU/5	B
5	<LOD	<LOD	62	32	CFU/6	B
6	<LOD	<LOD	93	32	CFU/7	B
7	<LOD	<LOD	60	<LOD	CFU/8	B
8	<LOD	<LOD	58	22	CFU/9	B
9	<LOD	<LOD	45	<LOD		
10	<LOD	<LOD	41	<LOD		
11	<LOD	<LOD	83	53	CFU/10	B
12	<LOD	<LOD	83	27	CFU/11	B
13	<LOD	<LOD	66	36	CFU/12	B
14	Standardisation					
15	<LOD	<LOD	77	19	CFU/13	B
16	<LOD	<LOD	61	26	CFU/14	B
17	<LOD	<LOD	66	28	CFU/15	B
18	<LOD	<LOD	58	17	CFU/16	B
19	<LOD	<LOD	64	14	CFU/17	B
20	<LOD	<LOD	27	<LOD	CFU/18	B
21	Standardisation					
22	<LOD	<LOD	83	31	CFU/19	B
23	<LOD	<LOD	75	18	CFU/20	B
24	<LOD	<LOD	49	21	CFU/21	B
25	<LOD	<LOD	60	19	CFU/22	B
26	<LOD	<LOD	49	18	CFU/23	B
27	<LOD	<LOD	51	22	CFU/24	B
28	<LOD	<LOD	51	15	CFU/25	B
29	<LOD	<LOD	61	20	CFU/26	B
30	<LOD	<LOD	66	25	CFU/27	B
31	<LOD	<LOD	66	15	CFU/28	B
32	<LOD	<LOD	66	29	CFU/29	B
33	<LOD	<LOD	91	40	CFU/30	B
34	<LOD	<LOD	<LOD	<LOD	Error	
35	<LOD	<LOD	21	<LOD	CFU/31	B
36	<LOD	<LOD	53	24	CFU/32	B
37	<LOD	<LOD	78	23	CFU/33	B
38	<LOD	<LOD	89	36	CFU/34	B
39	<LOD	<LOD	35	20	CFU/35	B
40	<LOD	<LOD	54	19	CFU/36	B

Lab tested

XRF Data 21 January 2010



Reading	Cr	Cu	Zn	Pb	Description	Type
1	Standardisation					
2	<LOD	<LOD	43	24	CFU/37	B
3	<LOD	<LOD	76	31	CFU/38	B
4	<LOD	<LOD	27	<LOD	CFU/39	B
5	<LOD	<LOD	36	<LOD	CFU/40	B
6	<LOD	<LOD	49	19	CFU/41	B
7	<LOD	<LOD	35	21	CFU/42	B
8	<LOD	<LOD	31	14	CFU/43	B
9	<LOD	<LOD	37	<LOD	CFU/44	B
10	<LOD	<LOD	32	<LOD	CFU/45	B
11	162	<LOD	61	15	CFU/46	B
12	<LOD	<LOD	41	13	CFU/47	B
13	<LOD	<LOD	48	24	CFU/48	B
14	Standardisation					
15	<LOD	<LOD	73	39	CFU/49	B
16	<LOD	<LOD	43	<LOD	CFU/50	B
17	<LOD	<LOD	88	53	CFU/51	B
18	<LOD	<LOD	70	87	CFU/52	B
19	<LOD	<LOD	93	61	CFU/53	B
20	<LOD	<LOD	53	15	Show ERMA XRF	
21	<LOD	43	74	17	CFU/54	B
22	<LOD	<LOD	53	54	CFU/55	B
23	<LOD	<LOD	61	23	CFU/56	B
24	<LOD	<LOD	50	25	CFU/57	B
25	<LOD	<LOD	63	27	CFU/58	B
26	<LOD	45	94	43	CFU/59	B
27	<LOD	<LOD	61	31	CFU/60	B
28	<LOD	<LOD	82	30	CFU/61	B
29	<LOD	<LOD	49	18	CFU/62	B

Lab tested

XRF Data 22 January 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	43	769	3474	Spot Check Cell E

XRF Data 26 January 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	101	151	Spot Check Cell E
3	<LOD	<LOD	44	<LOD	
4	<LOD	<LOD	139	656	
5	<LOD	<LOD	72	30	CFU/63

XRF Data 27 January 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	69	<LOD	Spot Check Cell E
3	Standardisation				
4	<LOD	64	1124	19154	Spot Check Cell E
5	<LOD	<LOD	386	2030	
6	<LOD	<LOD	287	1459	
7	<LOD	<LOD	197	1223	
8	<LOD	<LOD	309	575	
9	<LOD	<LOD	170	582	
10	<LOD	<LOD	189	995	
11	<LOD	<LOD	57	145	
12	<LOD	<LOD	32	<LOD	

XRF Data 28 January 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	39	92	
3	<LOD	<LOD	27	30	
4	<LOD	<LOD	28	<LOD	
5	<LOD	58	1776	1769	
6	<LOD	<LOD	40	33	
7	<LOD	<LOD	38	18	E/10R
8	<LOD	<LOD	43	68	E/10M
9	<LOD	<LOD	42	133	E/10L
10	<LOD	<LOD	47	184	
11	<LOD	<LOD	29	13	E/30R
12	<LOD	<LOD	37	15	E/30M
13	<LOD	<LOD	28	<LOD	E/30L
14	Standardisation				
15	<LOD	<LOD	58	32	
16	<LOD	<LOD	313	351	
17	<LOD	<LOD	24	<LOD	
18	<LOD	<LOD	43	<LOD	
19	<LOD	<LOD	31	<LOD	E/50R
20	<LOD	<LOD	44	14	E/50M
21	<LOD	<LOD	16	24	E/50L

Validation

XRF Data 02 February 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	98	47	CF/CD35

Lab tested

XRF Data 03 February 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	35	31	Spot Check Cell E
3	<LOD	<LOD	39	<LOD	
4	<LOD	<LOD	47	12	
5	<LOD	<LOD	50	26	
6	<LOD	<LOD	23	<LOD	
7	<LOD	43	316	323	
8	<LOD	<LOD	127	87	
9	<LOD	<LOD	192	152	
10	<LOD	<LOD	31	21	
11	<LOD	<LOD	60	32	
12	<LOD	<LOD	143	154	
13	<LOD	<LOD	81	56	
14	<LOD	<LOD	127	98	
15	<LOD	<LOD	368	490	
16	<LOD	<LOD	307	84	
17	<LOD	<LOD	58	14	
18	<LOD	<LOD	33	<LOD	
19	<LOD	<LOD	219	152	
20	<LOD	<LOD	94	13	
21	<LOD	<LOD	203	25	
22	<LOD	<LOD	124	20	
23	<LOD	<LOD	105	37	
24	<LOD	<LOD	97	20	
25	Standardisation				
26	<LOD	<LOD	75	51	Spot Check Cell E
27	<LOD	<LOD	120	54	
28	<LOD	<LOD	65	36	
29	<LOD	<LOD	36	15	
30	<LOD	<LOD	36	27	
31	<LOD	<LOD	50	24	
32	<LOD	<LOD	50	24	
33	<LOD	<LOD	41	26	
34	<LOD	<LOD	35	15	
35	<LOD	<LOD	68	37	
36	<LOD	<LOD	36	19	
37	<LOD	<LOD	40	17	
38	<LOD	<LOD	195	166	
39	<LOD	<LOD	114	149	
40	<LOD	<LOD	132	148	
41	<LOD	<LOD	109	112	
42	<LOD	<LOD	158	238	
43	<LOD	<LOD	44	12	
44	<LOD	<LOD	91	70	
45	<LOD	<LOD	55	27	
46	<LOD	<LOD	137	98	
47	<LOD	<LOD	82	<LOD	
48	<LOD	<LOD	136	106	
49	<LOD	<LOD	97	77	
50	<LOD	<LOD	95	60	
51	<LOD	<LOD	126	93	
52	<LOD	<LOD	61	19	
53	<LOD	<LOD	81	46	
54	<LOD	<LOD	86	48	
55	<LOD	<LOD	230	239	
56	<LOD	<LOD	50	52	
57	<LOD	<LOD	39	<LOD	
58	<LOD	<LOD	146	129	
59	<LOD	<LOD	100	75	
60	<LOD	<LOD	75	66	
61	<LOD	<LOD	43	15	
62	<LOD	<LOD	197	196	
63	<LOD	<LOD	103	59	

XRF Data 03 February 2010



Reading	Cr	Cu	Zn	Pb	Description
64	<LOD	<LOD	57	38	E/110R
65	<LOD	<LOD	33	<LOD	
66	<LOD	<LOD	84	77	
67	<LOD	<LOD	50	26	E/110M
68	<LOD	<LOD	29	13	
69	<LOD	<LOD	37	14	
70	<LOD	<LOD	30	13	E/110L
71	<LOD	<LOD	36	<LOD	
72	<LOD	<LOD	29	<LOD	
73	<LOD	<LOD	30	18	E/130R
74	<LOD	<LOD	31	<LOD	
75	<LOD	<LOD	21	<LOD	
76	<LOD	<LOD	39	18	E/130M
77	<LOD	<LOD	33	<LOD	
78	<LOD	<LOD	36	15	
79	<LOD	<LOD	<LOD	12	E/130L
80	<LOD	<LOD	24	<LOD	
81	<LOD	<LOD	35	<LOD	
82	<LOD	<LOD	<LOD	<LOD	E/150R
83	<LOD	<LOD	24	<LOD	
84	<LOD	<LOD	32	<LOD	
85	<LOD	<LOD	23	13	E/150M
86	<LOD	<LOD	31	13	
87	<LOD	<LOD	31	15	
88	<LOD	<LOD	39	<LOD	E/150L
89	<LOD	<LOD	27	12	
90	<LOD	<LOD	39	17	
91	<LOD	<LOD	61	19	E/170M
92	<LOD	<LOD	38	13	
93	<LOD	<LOD	56	19	
94	<LOD	<LOD	23	<LOD	E/170L
95	<LOD	<LOD	21	<LOD	
96	<LOD	<LOD	28	<LOD	
97	<LOD	<LOD	55	23	E/190M
98	<LOD	<LOD	86	41	
99	<LOD	<LOD	90	19	
100	<LOD	<LOD	109	<LOD	E/190L
101	<LOD	<LOD	130	<LOD	
102	<LOD	<LOD	125	<LOD	

Validation

XRF Data 04 February 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	375	159	Spot Check Cell E
3	<LOD	<LOD	112	26	
4	<LOD	<LOD	143	45	
5	<LOD	<LOD	124	78	
6	<LOD	<LOD	291	173	
7	<LOD	<LOD	30	<LOD	
8	<LOD	<LOD	27	<LOD	
9	<LOD	<LOD	30	<LOD	
10	<LOD	<LOD	27	<LOD	
11	<LOD	<LOD	62	18	
12	<LOD	<LOD	157	128	
13	<LOD	<LOD	69	13	
14	<LOD	<LOD	31	14	
15	<LOD	<LOD	32	<LOD	E/170R
16	<LOD	<LOD	27	<LOD	
17	<LOD	<LOD	24	<LOD	
18	<LOD	<LOD	46	40	E/190R
19	<LOD	<LOD	143	89	
20	<LOD	<LOD	117	37	
21	<LOD	<LOD	55	35	CFC/1
22	<LOD	<LOD	68	21	CFC/2
23	<LOD	<LOD	55	25	CFC/3
24	<LOD	<LOD	114	31	CFC/4
25	<LOD	<LOD	48	39	CFC/5
26	<LOD	<LOD	59	26	CFC/6
27	Standardisation				
28	<LOD	<LOD	57	138	CFC/7
29	<LOD	<LOD	78	37	CFC/8
30	<LOD	<LOD	56	103	CFC/9
31	<LOD	<LOD	72	34	CFC/10
32	<LOD	<LOD	76	48	CFC/11
33	<LOD	<LOD	42	26	CFC/12
34	<LOD	<LOD	49	30	CFC/13
35	<LOD	<LOD	57	22	CFC/14
36	<LOD	<LOD	70	33	CFC/15
37	<LOD	<LOD	61	19	CFC/16
38	<LOD	<LOD	46	21	CFC/17
39	<LOD	<LOD	79	36	CFC/18
40	<LOD	<LOD	64	27	CFC/19
41	Standardisation				
42	<LOD	<LOD	41	31	CFC/20
43	<LOD	<LOD	36	16	CFC/21
44	<LOD	<LOD	46	21	CFC/22
45	<LOD	<LOD	52	36	CFC/23
46	<LOD	<LOD	55	22	CFC/24
47	<LOD	<LOD	42	21	CFC/25
48	<LOD	<LOD	52	31	CFC/26
49	<LOD	<LOD	38	12	CFC/27
50	Standardisation				
51	Standardisation				
52	<LOD	<LOD	43	36	CFC/28
53	<LOD	<LOD	73	37	CFC/29

Validation
Lab tested

XRF Data 05 February 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	<LOD	<LOD	68	81	CFC/30
4	<LOD	<LOD	63	23	CFC/31
5	<LOD	<LOD	76	31	CFC/32
6	<LOD	<LOD	64	27	CFC/33
7	<LOD	<LOD	53	29	CFC/34
8	<LOD	<LOD	51	22	CFC/35
9	<LOD	36	65	31	CFC/36
10	<LOD	<LOD	60	34	CFC/37
11	<LOD	<LOD	37	18	CFC/38
12	<LOD	<LOD	46	26	CFC/39
13	<LOD	<LOD	63	26	CFC/40
14	<LOD	<LOD	52	24	CFC/41
15	<LOD	<LOD	64	35	CFC/42
16	<LOD	<LOD	50	17	CFC/43
17	<LOD	<LOD	88	77	Didn't go to tip
18	<LOD	<LOD	62	27	CFC/45
19	<LOD	<LOD	51	39	CFC/46
20	<LOD	<LOD	53	38	CFC/47
21	<LOD	<LOD	42	32	CFC/48
22	Standardisation				
23	<LOD	<LOD	74	30	CFC/49
24	<LOD	<LOD	70	34	CFC/50
25	<LOD	<LOD	77	46	CFC/51
26	Standardisation				
27	<LOD	<LOD	58	20	CFC/52
28	<LOD	<LOD	39	23	CFC/53
29	<LOD	<LOD	49	23	CFC/54
30	<LOD	<LOD	36	<LOD	Peat layer in stream
31	<LOD	<LOD	61	56	CFC/55
32	<LOD	<LOD	53	26	CFC/56
33	<LOD	<LOD	55	17	CFC/57
34	<LOD	<LOD	72	40	CFC/58
35	<LOD	<LOD	65	39	CFC/59
36	<LOD	<LOD	41	21	CFC/60
37	<LOD	<LOD	94	34	CFC/61
38	<LOD	<LOD	58	33	CFC/62
39	<LOD	<LOD	43	23	CFC/63
40	<LOD	<LOD	76	34	CFC/64
41	<LOD	<LOD	55	25	CFC/65
42	<LOD	<LOD	43	19	CFC/66
43	<LOD	<LOD	62	32	CFC/67
44	<LOD	<LOD	45	31	CFC/68

Lab tested

XRF Data 08 February 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	63	42	CFC/69
3	<LOD	<LOD	67	41	CFC/70
4	<LOD	<LOD	67	42	CFC/71
5	<LOD	<LOD	49	21	CFC/72
6	<LOD	<LOD	55	29	CFC/73
7	<LOD	<LOD	63	36	CF/E1
8	<LOD	<LOD	103	37	CF/E2
9	<LOD	<LOD	93	49	CF/E3
10	<LOD	<LOD	67	47	CF/E4
11	<LOD	<LOD	137	53	CF/E5
12	<LOD	<LOD	188	112	CF/E6
13	<LOD	<LOD	138	74	CF/E7
14	<LOD	<LOD	390	45	CF/E8
15	<LOD	<LOD	383	60	
16	<LOD	37	309	41	CF/E9
17	<LOD	<LOD	147	29	
18	<LOD	<LOD	431	44	CF/E10
19	<LOD	<LOD	228	116	
20	<LOD	<LOD	273	132	CF/E11
21	<LOD	<LOD	101	60	
22	<LOD	<LOD	53	<LOD	CF/E12
23	<LOD	<LOD	344	139	CF/E13
24	<LOD	<LOD	248	122	
25	<LOD	<LOD	59	40	CF/E14
26	<LOD	<LOD	49	17	CF/E15
27	<LOD	<LOD	85	14	CF/E17
28	<LOD	<LOD	64	27	CF/E16
29	<LOD	<LOD	98	31	CF/E18
30	Standardisation				
31	Standardisation				
32	<LOD	<LOD	72	25	CFC/74
33	<LOD	<LOD	61	30	CFC/75
34	<LOD	<LOD	64	47	CFC/76
35	188	<LOD	53	34	CFC/77
36	<LOD	<LOD	39	<LOD	CFC/78
37	<LOD	<LOD	38	21	CFC/79
38	<LOD	<LOD	64	33	CFC/80
39	<LOD	<LOD	69	25	CFC/81
40	<LOD	<LOD	44	23	CFC/82
41	<LOD	<LOD	68	63	CFC/83
42	<LOD	<LOD	70	29	CFC/84
43	<LOD	<LOD	73	57	CFC/85
44	<LOD	<LOD	61	20	CFC/86
45	<LOD	<LOD	53	27	CFC/87
46	<LOD	<LOD	69	51	CFC/88
47	<LOD	<LOD	78	56	CFC/89
48	<LOD	<LOD	47	27	CFC/90
49	<LOD	<LOD	68	38	CFC/91
50	<LOD	<LOD	50	35	CFC/92
51	<LOD	<LOD	79	65	CFC/93
52	<LOD	<LOD	62	37	CFC/94
53	<LOD	<LOD	49	33	CFC/95
54	<LOD	<LOD	69	104	CFC/96

Lab tested

XRF Data 09 February 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	60	29	CFC/97
3	<LOD	<LOD	50	21	CFC/98
4	<LOD	<LOD	53	29	CFC/99
5	<LOD	<LOD	<LOD	<LOD	Error
6	<LOD	<LOD	47	43	CFC/100
7	<LOD	<LOD	68	45	CFC/101
8	<LOD	<LOD	61	32	CFC/102
9	<LOD	<LOD	69	30	CFC/103
10	<LOD	<LOD	70	41	CFC/104
11	<LOD	<LOD	68	37	CFC/105
12	<LOD	<LOD	78	62	CFC/106
13	<LOD	<LOD	69	54	CFC/107
14	<LOD	<LOD	72	46	CFC/108
15	<LOD	<LOD	74	44	CFC/109
16	<LOD	<LOD	63	27	CFC/110
17	Standardisation				
18	<LOD	<LOD	65	44	CFC/111
19	<LOD	<LOD	110	49	CFC/112
20	<LOD	<LOD	344	457	CFC/113
21	<LOD	<LOD	222	79	
22	<LOD	<LOD	103	145	CFC/114
23	<LOD	<LOD	191	85	CFC/115
24	<LOD	<LOD	187	82	CFC/116
25	<LOD	<LOD	175	89	CFC/117
26	<LOD	<LOD	178	74	CFC/118
27	365	36	193	97	CFC/119
28	309	61	217	135	
29	<LOD	<LOD	119	45	CFC/120
30	<LOD	<LOD	153	68	
31	<LOD	<LOD	138	68	CFC/121
32	<LOD	<LOD	150	253	CFC/122
33	<LOD	<LOD	241	131	
34	<LOD	<LOD	121	67	CFC/123
35	<LOD	<LOD	134	66	CFC/124
36	<LOD	<LOD	132	75	CFC/125
37	<LOD	<LOD	241	771	CFC/126
38	<LOD	57	228	193	
39	<LOD	<LOD	363	367	
40	<LOD	<LOD	524	261	
41	<LOD	<LOD	235	101	CFC/127
42	<LOD	57	193	79	CFC/128
43	<LOD	<LOD	27	<LOD	CFC/129
44	<LOD	<LOD	128	157	CFC/130
45	<LOD	<LOD	94	67	
46	<LOD	<LOD	67	31	CFC/131
47	<LOD	<LOD	150	114	CFC/132
48	<LOD	<LOD	118	212	CFC/133
49	<LOD	<LOD	117	104	
50	<LOD	<LOD	123	62	CFC/134
51	<LOD	<LOD	107	97	CFC/135
52	<LOD	<LOD	148	80	CFC/136
53	<LOD	<LOD	145	204	CFC/138
54	<LOD	<LOD	138	69	CFC/139
55	<LOD	<LOD	67	19	CFC/140
56	<LOD	<LOD	106	76	CFC/141
57	<LOD	<LOD	108	122	CFC/143
58	<LOD	<LOD	233	111	CFC/144
59	<LOD	<LOD	137	87	CFC/145
60	<LOD	<LOD	132	108	CFC/137
61	<LOD	<LOD	120	61	CFC/142

Lab tested

XRF Data 10 February 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	89	74	CFC/143
3	<LOD	<LOD	95	69	CFC/144
4	<LOD	<LOD	112	82	CFC/145
5	<LOD	<LOD	103	119	CFC/146
6	<LOD	<LOD	106	76	CFC/147
7	<LOD	<LOD	94	71	CFC/148
8	<LOD	<LOD	197	84	CFC/149
9	<LOD	<LOD	86	62	CFC/150
10	<LOD	<LOD	101	63	CFC/151
11	<LOD	<LOD	148	64	CFC/152
12	<LOD	<LOD	124	80	CFC/153
13	<LOD	<LOD	186	61	CFC/154
14	<LOD	<LOD	229	78	CFC/155
15	<LOD	<LOD	176	60	CFC/156
16	<LOD	<LOD	133	35	CFC/157
17	<LOD	<LOD	80	36	CFC/158
18	<LOD	<LOD	147	108	CFC/159
19	<LOD	<LOD	104	71	CFC/160
20	<LOD	<LOD	138	56	CFC/161
21	<LOD	<LOD	168	114	CFC/162
22	<LOD	46	126	129	CFC/163
23	<LOD	<LOD	172	93	
24	<LOD	<LOD	257	155	
25	<LOD	59	163	87	
26	324	<LOD	279	172	
27	<LOD	<LOD	69	51	CF/E19
28	Standardisation				
29	<LOD	<LOD	93	78	CF/E20
30	<LOD	<LOD	100	73	CF/E21

Lab tested

XRF Data 11 February 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	93	74	CF/E22
3	<LOD	<LOD	137	107	CF/E23
4	<LOD	<LOD	143	80	CF/E24
5	<LOD	38	101	95	CF/E25
6	<LOD	<LOD	51	35	CF/E26
7	<LOD	<LOD	169	146	CF/E27
8	<LOD	<LOD	155	174	CF/E28
9	<LOD	<LOD	203	152	CF/E29
10	<LOD	<LOD	32	13	CF/E30
11	<LOD	<LOD	174	148	CF/E31
12	<LOD	<LOD	92	57	CF/E32
13	Standardisation				
14	Standardisation				
15	<LOD	<LOD	132	116	CF/E33
16	<LOD	<LOD	134	106	CF/E34
17	<LOD	<LOD	146	433	CF/E35
18	<LOD	<LOD	113	79	
19	<LOD	45	107	84	CF/E36
20	Standardisation				
21	<LOD	<LOD	227	121	CF/E37
22	<LOD	<LOD	132	128	CF/E38
23	<LOD	<LOD	161	115	CF/E39
24	<LOD	<LOD	133	104	CF/E40
25	<LOD	<LOD	<LOD	<LOD	Error
26	<LOD	<LOD	77	50	CF/E41
27	<LOD	<LOD	110	64	CF/E42
28	<LOD	<LOD	206	236	CF/E43
29	<LOD	<LOD	126	110	
30	<LOD	<LOD	182	140	CF/E44
31	<LOD	<LOD	148	166	CF/E45
32	<LOD	<LOD	140	133	CF/E46
33	<LOD	<LOD	254	179	CF/E48
34	<LOD	<LOD	174	193	
35	<LOD	<LOD	148	207	CF/E47
36	<LOD	<LOD	178	151	

Lab tested

XRF Data 12 February 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	177	<LOD	301	233	CF/E49
3	<LOD	<LOD	149	126	
4	<LOD	<LOD	154	106	CF/E50
5	<LOD	<LOD	121	88	CF/E51
6	<LOD	<LOD	131	104	CF/E52
7	<LOD	<LOD	208	200	CF/E53
8	<LOD	<LOD	114	94	
9	<LOD	<LOD	140	116	CF/E54
10	<LOD	<LOD	66	67	CF/E55
11	<LOD	<LOD	84	75	CF/E56
12	Standardisation				
13	<LOD	<LOD	72	79	CF/E57
14	<LOD	<LOD	68	90	CF/E58
15	<LOD	<LOD	138	84	CF/E59
16	<LOD	<LOD	125	86	
17	<LOD	79	137	293	CF/E60
18	<LOD	78	198	412	Unsure what these tests were for
19	<LOD	237	208	328	
20	<LOD	<LOD	65	64	
21	<LOD	58	139	233	
22	<LOD	<LOD	46	<LOD	
23	<LOD	<LOD	46	21	
24	<LOD	<LOD	152	364	
25	<LOD	<LOD	92	126	CF/E62
26	<LOD	<LOD	314	143	CF/E66
27	<LOD	<LOD	166	133	
28	Standardisation				
29	<LOD	<LOD	93	85	CF/E60
30	<LOD	<LOD	139	100	CF/E61
31	<LOD	<LOD	83	102	CF/E63
32	<LOD	<LOD	77	68	CF/E64
33	<LOD	<LOD	192	175	CF/E65
34	<LOD	<LOD	158	167	CF/E67
35	198	<LOD	272	631	CF/E68
36	<LOD	37	176	183	
37	<LOD	<LOD	160	157	CF/E69
38	<LOD	<LOD	53	61	
39	<LOD	<LOD	166	127	CF/E70

Lab tested

XRF Data 24 February 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	Standardisation				
4	Standardisation				
5	<LOD	<LOD	38	13	Spot Check TLB of Cell F/G
6	<LOD	<LOD	103	53	
7	<LOD	<LOD	56	22	
8	<LOD	38	1372	1494	
9	<LOD	<LOD	303	186	
10	<LOD	<LOD	118	48	

XRF Data 02 March 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	105	111	Spot Check Cell F/G
3	<LOD	<LOD	81	82	

XRF Data 09 March 2010



Reading	Cr	Cu	Zn	Pb	Description	
1	Standardisation					
2	<LOD	<LOD	487	303	ST1	Cell F/G Shoulder Trial
3	<LOD	<LOD	484	488	ST2	
4	<LOD	48	365	312	ST3	
5	<LOD	57	338	220	ST4	
6	<LOD	<LOD	126	80	ST5	
7	<LOD	<LOD	98	86	ST6	
8	<LOD	<LOD	635	582	ST7	
9	<LOD	<LOD	140	105	ST8	
10	<LOD	42	579	538	ST9	
11	<LOD	<LOD	473	283	ST10	
12	<LOD	<LOD	383	359	ST11	
13	Standardisation					
14	<LOD	<LOD	58	12	Spot Checking Cell F/G	
15	<LOD	<LOD	105	34		
16	<LOD	<LOD	136	134		
17	<LOD	<LOD	38	20		
18	<LOD	<LOD	43	12		
19	<LOD	<LOD	32	<LOD		
20	<LOD	<LOD	249	249		
21	<LOD	<LOD	302	94		
22	<LOD	<LOD	140	91		
23	<LOD	<LOD	114	110		
24	<LOD	<LOD	79	18		

XRF Data 10 March 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	57	<LOD	Cell F/G stockpile to go in around sewer crossing spot check
3	<LOD	<LOD	37	20	
4	<LOD	<LOD	43	26	
5	<LOD	<LOD	183	177	
6	<LOD	<LOD	151	117	
7	<LOD	<LOD	72	40	Cell F/G spot check
8	<LOD	<LOD	86	<LOD	
9	<LOD	<LOD	110	20	
10	<LOD	<LOD	55	<LOD	FG/10L
11	<LOD	<LOD	25	<LOD	FG/10M
12	<LOD	<LOD	38	<LOD	FG/30L
13	<LOD	<LOD	83	12	FG/30M
14	<LOD	<LOD	55	20	FG/30R
15	<LOD	<LOD	44	<LOD	FG/50L
16	<LOD	<LOD	29	<LOD	FG/50M
17	<LOD	<LOD	38	<LOD	FG/70L
18	<LOD	<LOD	23	14	FG/70M
19	<LOD	<LOD	105	56	
20	<LOD	<LOD	29	13	FG/70R
21	<LOD	<LOD	34	<LOD	FG/90L
22	<LOD	<LOD	57	20	FG/90M
23	<LOD	<LOD	72	31	FG/90R
24	<LOD	<LOD	35	<LOD	FG/110L
25	<LOD	<LOD	43	19	FG/110M
26	<LOD	<LOD	47	22	FG/110R
27	<LOD	<LOD	44	34	Cell F/G spot check
28	Standardisation				
29	<LOD	<LOD	652	312	Cell F/G spot check
30	<LOD	<LOD	75	28	
31	<LOD	<LOD	61	22	
32	<LOD	<LOD	39	20	
33	<LOD	<LOD	75	29	
34	<LOD	<LOD	41	<LOD	FG/150L
35	<LOD	<LOD	79	35	FG/150M
36	<LOD	<LOD	59	23	FG/150R
37	<LOD	<LOD	98	37	FG/170L
38	<LOD	<LOD	41	20	FG/170M
39	<LOD	<LOD	71	30	FG/170R
40	<LOD	<LOD	37	13	FG/190L
41	<LOD	<LOD	28	<LOD	FG/190M
42	<LOD	<LOD	84	54	FG/190R
43	Standardisation				
44	<LOD	<LOD	34	<LOD	

Validation

XRF Data 11 March 2010



Reading	Cr	Cu	Zn	Pb	Description	Type
1	Standardisation					
2	<LOD	<LOD	<LOD	<LOD		
3	<LOD	<LOD	19	<LOD		
4	Standardisation					
5	<LOD	<LOD	314	192	CF/FG1	A
6	<LOD	<LOD	221	308	CF/FG2	A
7	<LOD	<LOD	157	69	CF/FG3	A
8	<LOD	<LOD	390	502		
9	<LOD	<LOD	113	80	CF/FG4	A
10	<LOD	<LOD	88	46		
11	<LOD	<LOD	148	56		
12	<LOD	47	217	134	CF/FG5	A
13	<LOD	<LOD	166	45		
14	<LOD	<LOD	144	36	CF/FG6	F
15	<LOD	<LOD	328	187	CF/FG7	A
16	<LOD	<LOD	160	106	CF/FG8	A
17	Standardisation					
18	<LOD	<LOD	266	210	CF/FG9	A
19	<LOD	<LOD	154	84	CF/FG10	A
20	<LOD	<LOD	173	61		
21	<LOD	<LOD	193	127		
22	<LOD	44	248	158	CF/FG11	A
23	<LOD	<LOD	67	40		
24	<LOD	<LOD	323	212	CF/FG12	A
25	<LOD	<LOD	161	57	CF/FG13	A
26	<LOD	49	136	91		
27	<LOD	<LOD	250	66		
28	<LOD	<LOD	99	21	CF/FG14	F
29	<LOD	<LOD	89	39	CF/FG15	F
30	<LOD	<LOD	96	28		

Lab tested

XRF Data 12 March 2010



Reading	Cr	Cu	Zn	Pb	Description	Type
1	Standardisation					
2	<LOD	<LOD	250	118	CF/FG16	A
3	<LOD	<LOD	277	142		
4	<LOD	<LOD	227	102	CF/FG17	A
5	<LOD	41	213	112		
6	178	<LOD	329	185	CF/FG18	A
7	<LOD	<LOD	359	173		
8	172	<LOD	190	100	CF/FG19	A
9	<LOD	<LOD	228	110		
10	<LOD	44	319	166		
11	<LOD	<LOD	278	171	CF/FG20	A
12	<LOD	53	427	169	CF/FG21	A
13	<LOD	48	311	189	CF/FG22	A
14	<LOD	<LOD	187	96	CF/FG23	A
15	<LOD	<LOD	308	156		
16	<LOD	<LOD	108	56	CF/FG24	F
17	<LOD	<LOD	85	14		
18	<LOD	<LOD	127	43	CF/FG25	A
19	204	<LOD	289	130		
20	<LOD	<LOD	389	330	CF/FG26	A
21	<LOD	<LOD	109	50	Spot check of topsoil stockpile	
22	<LOD	<LOD	202	77		
23	<LOD	<LOD	86	34		
24	<LOD	<LOD	384	313	CF/FG27	A
25	<LOD	<LOD	137	68	CF/FG28	F
26	<LOD	<LOD	137	69		
27	<LOD	44	320	169	CF/FG29	A
28	<LOD	<LOD	163	116	CF/FG30	A
29	<LOD	<LOD	41	22		
30	<LOD	<LOD	208	145	CF/FG31	A
31	<LOD	<LOD	109	16		
32	<LOD	<LOD	58	15		
33	<LOD	<LOD	317	143	CF/FG32	A
34	Standardisation					
35	<LOD	<LOD	195	92	CF/FG33	F
36	<LOD	<LOD	200	96		
37	<LOD	<LOD	500	376	CF/FG34	A
38	<LOD	<LOD	116	27	CF/FG35	F
39	<LOD	<LOD	117	45		
40	<LOD	<LOD	105	43	CF/FG36	F
41	<LOD	<LOD	143	54		
42	<LOD	<LOD	70	23		
43	<LOD	<LOD	284	182	CF/FG37	A
44	<LOD	<LOD	50	14	CF/FG38	F
45	<LOD	<LOD	51	35	CF/FG39	F
46	<LOD	<LOD	50	13	CF/FG40	F
47	<LOD	<LOD	63	23	CF/FG41	F
48	<LOD	<LOD	56	23	CF/FG42	F
49	<LOD	<LOD	54	18	CF/FG43	F
50	<LOD	<LOD	52	<LOD	CF/FG44	F
51	<LOD	<LOD	409	87	CF/FG45	A
52	<LOD	<LOD	198	88		

CLIENT: CPG New Zealand Ltd

PROJECT: Waiwhetu Stream Remediation

FILE: J:\Jobs\42771630\5 Works\Field notes - Sampling - Lab\Lab and XRF analysis\XRF data\XRF Data 2010 Master.xls12 Mar 10

XRF Data 12 March 2010



Reading	Cr	Cu	Zn	Pb	Description	Type
53	<LOD	<LOD	83	38	Spot check of stockpile to be used to backfill around Cell F/G water main	
54	<LOD	<LOD	116	62		
55	<LOD	111	701	669		
56	<LOD	<LOD	184	163		
57	<LOD	<LOD	85	80		
58	<LOD	<LOD	116	33	CF/FG46	F
59	<LOD	<LOD	85	29	CF/FG47	F
60	<LOD	41	93	37	CF/FG48	F
61	<LOD	<LOD	104	40	CF/FG49	F
62	<LOD	<LOD	84	25	CF/FG50	F
63	Standardisation					
64	<LOD	<LOD	97	32	CF/FG51	F
65	<LOD	<LOD	130	27	CF/FG52	F
66	<LOD	<LOD	80	44	CF/FG53	F
67	<LOD	<LOD	122	34	CF/FG54	F
68	<LOD	<LOD	89	32	CF/FG55	F
69	<LOD	<LOD	53	20		

Lab tested

XRF Data 13 March 2010



Reading	Cr	Cu	Zn	Pb	Description	Type
1	Standardisation					
2	Standardisation					
3	<LOD	<LOD	102	25	CF/FG56 - CF/FG59	F
4	<LOD	<LOD	57	15	CF/FG60	F
5	<LOD	<LOD	65	30	CF/FG61	F
6	<LOD	<LOD	170	105	CF/FG62	F
7	<LOD	<LOD	82	23	CF/FG63	F
8	<LOD	<LOD	119	58	CF/FG64	F
9	<LOD	<LOD	261	79	CF/FG65	F
10	<LOD	<LOD	38	13	CF/FG66	F
11	<LOD	<LOD	73	83	CF/FG67	F
12	<LOD	<LOD	56	16	CF/FG68	F
13	<LOD	<LOD	56	15	CF/FG69	F
14	<LOD	<LOD	40	<LOD	CF/FG70	F
15	<LOD	39	252	185	CF/FG71	A
16	<LOD	<LOD	123	102		
17	<LOD	<LOD	112	62	CF/FG72	F
18	<LOD	<LOD	68	41		
19	<LOD	<LOD	61	23	CF/FG73	F
20	<LOD	<LOD	48	27	CF/FG74	F
21	<LOD	<LOD	137	684	CF/FG75	A
22	Standardisation					
23	<LOD	<LOD	136	507	CF/FG75	A
24	<LOD	57	199	168	CF/FG76	F
25	<LOD	<LOD	94	18		
26	<LOD	<LOD	78	55	CF/FG77	F
27	<LOD	<LOD	92	44	CF/FG78	F
28	<LOD	<LOD	140	104	CF/FG79	A
29	<LOD	<LOD	166	156		
30	<LOD	<LOD	123	107	CF/FG80	F
31	Standardisation					
32	<LOD	47	135	161	CF/FG81	A
33	<LOD	<LOD	149	128	CF/FG82	F
34	<LOD	<LOD	78	40		
35	<LOD	<LOD	98	48	CF/FG83	F

Lab tested

XRF Data 15 March 2010



Reading	Cr	Cu	Zn	Pb	Description	Type
1	Standardisation					
2	<LOD	<LOD	151	110	CF/FG84	A
3	<LOD	<LOD	147	134		
4	<LOD	<LOD	98	35	CF/FG85	F
5	<LOD	42	164	127	CF/FG86	F
6	<LOD	<LOD	88	42		
7	<LOD	<LOD	152	87	CF/FG87	F
8	<LOD	37	137	97	CF/FG88	F
9	<LOD	<LOD	167	62	CF/FG89	F
10	<LOD	101	305	320	CF/FG90	F
11	<LOD	<LOD	95	88		
12	<LOD	<LOD	92	60		
13	<LOD	<LOD	171	120	CF/FG91	A
14	<LOD	<LOD	406	686		
15	<LOD	<LOD	87	39	CF/FG92	F
16	<LOD	<LOD	211	188	Checking material being used to fill streambed.	
17	<LOD	<LOD	101	110		
18	Standardisation					
19	<LOD	<LOD	97	74	Checking material being used to fill streambed.	
20	<LOD	<LOD	151	127		
21	<LOD	<LOD	125	86		
22	<LOD	<LOD	119	54	CF/FG93	F
23	<LOD	<LOD	39	21	CF/FG94	F
24	Standardisation					
25	<LOD	<LOD	123	90	CF/FG95	F
26	<LOD	<LOD	118	102	CF/FG96	F
27	<LOD	<LOD	124	77		
28	<LOD	<LOD	104	62	CF/FG97	F
29	<LOD	<LOD	188	138	CF/FG98	F
30	<LOD	<LOD	90	64		
31	<LOD	<LOD	105	45		
32	<LOD	<LOD	82	42	CF/FG100	F
33	<LOD	<LOD	43	<LOD	CF/FG101	F
34	<LOD	<LOD	101	55	CF/FG102	F
35	<LOD	<LOD	56	34	FG/210L	
36	<LOD	<LOD	61	24	FG/210M	
37	<LOD	<LOD	50	20	FG/210R	
38	<LOD	<LOD	90	81	FG/230L	
39	<LOD	<LOD	68	26	FG/230M	
40	<LOD	<LOD	48	<LOD	FG/230R	
41	<LOD	<LOD	77	18	CF/FG103	F
42	<LOD	<LOD	43	<LOD	CF/FG104	F
43	<LOD	<LOD	47	30	CF/FG105	F
44	<LOD	<LOD	30	20	CF/FG106	F
45	<LOD	<LOD	87	34	CF/FG107	F
46	<LOD	<LOD	149	79	CF/FG108	F
47	<LOD	<LOD	119	78	CF/FG109	F
48	<LOD	<LOD	83	53	CF/FG110	F
49	<LOD	<LOD	78	26	CF/FG111	F

Lab tested

CLIENT: CPG New Zealand Ltd

PROJECT: Waiwhetu Stream Remediation

FILE: J:\Jobs\42771630\5 Works\Field notes - Sampling - Lab\Lab and XRF analysis\XRF data\XRF Data 2010 Master.xls15 Mar 10

XRF Data 16 March 2010



Reading	Cr	Cu	Zn	Pb	Description	Type
1	Standardisation					
2	<LOD	<LOD	78	16	CF/FG112	F
3	<LOD	<LOD	38	19	CF/FG113	F
4	<LOD	<LOD	31	16	CF/FG114	F
5	158	<LOD	37	20	CF/FG115	F
6	<LOD	<LOD	53	23	CF/FG116	F
7	<LOD	<LOD	135	125	CF/FG117	F
8	<LOD	<LOD	263	95		
9	<LOD	<LOD	90	64		
10	<LOD	<LOD	44	22		
11	<LOD	<LOD	107	60	CF/FG120	F
12	<LOD	<LOD	52	40	CF/FG121	F
13	<LOD	<LOD	65	36	FG/130L	
14	<LOD	<LOD	32	<LOD	FG/130M	
15	<LOD	<LOD	29	15	FG/130R	
16	<LOD	48	98	47	CF/FG122	F
17	<LOD	<LOD	103	66	CF/FG123	F
18	<LOD	<LOD	201	126	CF/FG124	F
19	<LOD	47	194	112	CF/FG125	F
20	<LOD	<LOD	97	65	CF/FG126	F
21	Standardisation					
22	<LOD	<LOD	120	86	CF/FG127	F
23	<LOD	<LOD	119	59	CF/FG128	F
24	<LOD	<LOD	66	50	CF/FG129	F
25	<LOD	<LOD	130	71		
26	<LOD	<LOD	99	67		
27	<LOD	<LOD	86	41		
28	<LOD	<LOD	52	<LOD		
29	<LOD	<LOD	114	117		
30	<LOD	<LOD	126	77		
31	<LOD	<LOD	90	90		
32	<LOD	<LOD	148	168		
33	<LOD	<LOD	245	127		
34	<LOD	<LOD	65	45		
35	<LOD	<LOD	128	76	CF/FG130	F
36	<LOD	<LOD	52	26	CF/FG131	F
37	<LOD	<LOD	516	5137	CF/FG132	A
38	<LOD	<LOD	3046	48607		
39	<LOD	<LOD	401	1411		
40	<LOD	<LOD	102	57	CF/FG133	F
41	<LOD	<LOD	105	80	CF/FG134	F
42	<LOD	<LOD	77	88	CF/FG135	F
43	Standardisation					
44	<LOD	<LOD	60	38	CF/FG136	F
45	<LOD	<LOD	101	50	CF/FG137	F
46	<LOD	42	225	44	CF/FG138	F
47	<LOD	<LOD	72	27	CF/FG139	F
48	<LOD	<LOD	110	33	CF/FG140	F
49	<LOD	<LOD	115	86	FG/250L	
50	<LOD	<LOD	162	123	FG/250M	
51	<LOD	<LOD	28	14	FG/250R	
52	<LOD	<LOD	372	173	FG/270L	

CLIENT: CPG New Zealand Ltd

PROJECT: Waiwhetu Stream Remediation

FILE: J:\Jobs\42771630\5 Works\Field notes - Sampling - Lab\Lab and XRF analysis\XRF data\XRF Data 2010 Master.xls16 Mar 10

XRF Data 16 March 2010



Reading	Cr	Cu	Zn	Pb	Description	Type
53	<LOD	<LOD	118	129	FG/270M	
54	<LOD	<LOD	42	33	FG/270R	
55	<LOD	<LOD	182	93	CF/FG141	F
56	<LOD	<LOD	118	62	CF/FG142	F
57	<LOD	<LOD	37	15	CF/FG143	F
58	<LOD	<LOD	70	47	CF/FG144	F
59	<LOD	<LOD	146	71	CF/FG145	F
60	<LOD	<LOD	87	37	CF/FG146	F
61	<LOD	<LOD	121	33	CF/FG147	F
62	<LOD	<LOD	73	51	CF/FG148	F
63	<LOD	<LOD	108	72	CF/FG149	F
64	<LOD	<LOD	43	<LOD	CF/FG150	F
65	<LOD	<LOD	44	202	CF/FG151	A
66	<LOD	<LOD	130	1496		
67	<LOD	<LOD	45	80	CF/FG152	F
68	<LOD	<LOD	53	57	CF/FG153	F
69	<LOD	<LOD	164	83	CF/FG154	F
70	<LOD	<LOD	266	311	CF/FG155	A
71	<LOD	<LOD	44	17	CF/FG156	F
72	<LOD	<LOD	435	33		
73	<LOD	<LOD	203	41		
74	<LOD	<LOD	118	43	CF/FG157	F
75	<LOD	<LOD	144	93		
76	Standardisation					
77	Standardisation					

Lab tested

XRF Data 17 March 2010



Reading	Cr	Cu	Zn	Pb	Description	Type
1	Standardisation					
2	<LOD	<LOD	52	42	CF/FG158	F
3	<LOD	<LOD	94	41	CF/FG159	F
4	<LOD	<LOD	89	41	CF/FG160	F
5	<LOD	<LOD	135	96	CF/FG161	F
6	<LOD	<LOD	193	114	CF/FG162	F
7	<LOD	<LOD	95	50	CF/FG163	F
8	<LOD	<LOD	138	100		
9	<LOD	46	473	595	CF/FG164	A
10	<LOD	<LOD	110	107	CF/FG165	F
11	<LOD	<LOD	93	87	CF/FG166	F
12	<LOD	<LOD	135	115	CF/FG167	F
13	<LOD	<LOD	97	81		
14	<LOD	<LOD	417	533	CF/FG168	A
15	<LOD	<LOD	75	79	CF/FG169	A
16	<LOD	47	194	244	CF/FG170	A
17	Standardisation					
18	<LOD	<LOD	180	132	CF/FG171	A
19	<LOD	<LOD	353	75	CF/FG172	F
20	<LOD	<LOD	126	53		
21	<LOD	<LOD	121	142	CF/FG173	A
22	<LOD	<LOD	227	233		
23	<LOD	45	400	427	CF/FG174	A
24	<LOD	<LOD	87	59	CF/FG175	F
25	<LOD	<LOD	97	44	CF/FG176	F
26	<LOD	<LOD	260	227	CF/FG177	A
27	<LOD	75	1412	2183	CF/FG178	A
28	Standardisation					
29	Standardisation					
30	<LOD	<LOD	119	90	CF/FG179	F
31	<LOD	<LOD	124	122	CF/FG180	A
32	<LOD	49	316	206		
33	<LOD	<LOD	77	77	CF/FG181	F
34	<LOD	<LOD	192	192	CF/FG182	A
35	<LOD	<LOD	150	131		
36	<LOD	<LOD	178	311	CF/FG183	A
37	<LOD	<LOD	459	548		
38	<LOD	<LOD	124	151	CF/FG184	A
39	<LOD	<LOD	154	134		
40	<LOD	<LOD	169	117	CF/FG185	F
41	<LOD	<LOD	185	186	CF/FG186	A
42	<LOD	<LOD	66	109	CF/FG187	F
43	<LOD	<LOD	238	66		
44	<LOD	<LOD	172	108	CF/FG188	F
45	<LOD	<LOD	124	106	CF/FG189	F
46	<LOD	<LOD	88	61	CF/FG190	F
47	<LOD	<LOD	110	84	CF/FG191	F
48	<LOD	56	99	90	CF/FG192	F
49	<LOD	<LOD	98	73	CF/FG193	F
50	<LOD	<LOD	119	149	CF/FG194	F
51	<LOD	<LOD	117	71	CF/FG195	F
52	<LOD	<LOD	117	89		

Lab tested

CLIENT: CPG New Zealand Ltd

PROJECT: Waiwhetu Stream Remediation

FILE: J:\Jobs\42771630\5 Works\Field notes - Sampling - Lab\Lab and XRF analysis\XRF data\XRF Data 2010 Master.xls 17 Mar 10

XRF Data 18 March 2010



Reading	Cr	Cu	Zn	Pb	Description	Type
1	Standardisation					
2	<LOD	<LOD	120	91	CF/FG196	F
3	<LOD	<LOD	98	57	CF/FG197	F
4	<LOD	<LOD	149	122	CF/FG198	F
5	<LOD	<LOD	103	61	CF/FG199	F
6	<LOD	<LOD	146	85	CF/FG200	F
7	<LOD	<LOD	115	71	CF/FG201	F
8	<LOD	<LOD	114	84		
9	Standardisation					
10	<LOD	<LOD	92	92	CF/FG202	F
11	<LOD	<LOD	59	34	CF/FG203	F
12	<LOD	<LOD	91	68	CF/FG204	F
13	<LOD	<LOD	162	66	CF/FG205	F
14	<LOD	<LOD	136	77	CF/FG206	F
15	<LOD	<LOD	99	52	CF/FG207	F
16	<LOD	<LOD	32	48	CF/FG208	F
17	<LOD	<LOD	103	73	CF/FG209	F
18	<LOD	<LOD	108	81	CF/FG210	F
19	<LOD	<LOD	79	43	CF/FG211	F
20	<LOD	<LOD	84	76	CF/FG212	F
21	<LOD	<LOD	68	76	CF/FG213	F
22	<LOD	<LOD	133	81	CF/FG214	F
23	<LOD	<LOD	98	61	CF/FG215	F
24	<LOD	<LOD	107	68	CF/FG216	F
25	<LOD	41	161	102	CF/FG217	F
26	<LOD	<LOD	117	75		
27	<LOD	48	240	197	CF/FG218	F
28	<LOD	<LOD	112	107		
29	<LOD	<LOD	101	78	CF/FG219	F
30	<LOD	<LOD	81	65	CF/FG220	F
31	<LOD	<LOD	96	70	CF/FG221	F
32	<LOD	<LOD	130	108	CF/FG222	A
33	<LOD	<LOD	197	157		
34	<LOD	<LOD	94	69	CF/FG223	F
35	<LOD	<LOD	84	58	CF/FG224	F
36	Standardisation					
37	<LOD	<LOD	114	81	CF/FG225	F
38	<LOD	<LOD	208	111	CF/FG226	F
39	<LOD	<LOD	141	83	CF/FG227	F
40	<LOD	39	151	155	CF/FG228	F
41	<LOD	<LOD	143	116	CF/FG229	F
42	<LOD	<LOD	110	75	CF/FG230	F
43	<LOD	<LOD	51	19	CF/FG231	F
44	<LOD	<LOD	105	51	CF/FG232	F
45	<LOD	<LOD	96	59	CF/FG233	F
46	<LOD	<LOD	94	74	CF/FG234	F
47	<LOD	<LOD	136	117	CF/FG235	F
48	Standardisation					
49	<LOD	<LOD	168	98	CF/FG236	F
50	<LOD	<LOD	69	<LOD	CF/FG237	F
51	<LOD	<LOD	133	92	CF/FG238	F
52	<LOD	<LOD	153	117	CF/FG239	F

CLIENT: CPG New Zealand Ltd

PROJECT: Waiwhetu Stream Remediation

FILE: J:\Jobs\42771630\5 Works\Field notes - Sampling - Lab\Lab and XRF analysis\XRF data\XRF Data 2010 Master.xls 18 Mar 10

XRF Data 18 March 2010



Reading	Cr	Cu	Zn	Pb	Description	Type
53	<LOD	<LOD	231	143	CF/FG240	F
54	<LOD	<LOD	136	89		
55	<LOD	<LOD	97	74	CF/FG241	F
56	<LOD	<LOD	73	29	CF/FG242	F
57	<LOD	<LOD	64	40	CF/FG243	F
58	<LOD	<LOD	70	41	CF/FG244	F
59	<LOD	<LOD	52	20	CF/FG245	F
60	<LOD	<LOD	81	71	CF/FG246	F
61	<LOD	<LOD	92	46	CF/FG247	F
62	<LOD	<LOD	78	35	CF/FG248	F
63	<LOD	<LOD	87	44	CF/FG249	F
64	<LOD	<LOD	66	28	CF/FG250	F
65	<LOD	<LOD	66	36	CF/FG251	F
66	<LOD	<LOD	85	40	CF/FG252	F
67	<LOD	<LOD	76	40	CF/FG253	F
68	<LOD	<LOD	72	57	CF/FG254	F
69	<LOD	<LOD	78	43	CF/FG255	F

Lab tested

XRF Data 19 March 2010



Reading	Cr	Cu	Zn	Pb	Description	Type
1	Standardisation					
2	<LOD	<LOD	81	43	CF/FG256	F
3	<LOD	<LOD	80	57	CF/FG257	F
4	<LOD	<LOD	77	39	CF/FG258	F
5	<LOD	<LOD	154	32	CF/FG259	F
6	<LOD	<LOD	75	55	CF/FG260	F
7	<LOD	<LOD	114	114	CF/FG261	F
8	<LOD	<LOD	99	51	CF/FG262	F
9	<LOD	<LOD	79	41	CF/FG263	F
10	<LOD	<LOD	96	54	CF/FG264	F
11	<LOD	<LOD	143	69	CF/FG265	F
12	<LOD	<LOD	84	53	CF/FG266	F
13	<LOD	<LOD	119	74	CF/FG267	F
14	<LOD	<LOD	89	34	CF/FG268	F
15	Standardisation					
16	<LOD	<LOD	87	53	CF/FG268	F
17	<LOD	<LOD	158	91	CF/FG269	F
18	<LOD	<LOD	43	20	CF/FG270	F
19	<LOD	<LOD	74	47	CF/FG271	F
20	<LOD	<LOD	81	50	CF/FG272	F
21	<LOD	<LOD	79	46	CF/FG273	F
22	<LOD	<LOD	75	36	CF/FG274	F
23	<LOD	<LOD	26	<LOD	CF/FG275	F
24	<LOD	<LOD	92	54	CF/FG276	F
25	<LOD	<LOD	70	42	CF/FG277	F
26	<LOD	<LOD	109	100	CF/FG278	F
27	Standardisation					
28	<LOD	<LOD	95	73	CF/FG279	F
29	<LOD	<LOD	48	33	CF/FG280	F
30	<LOD	<LOD	114	91	CF/FG281	F
31	<LOD	<LOD	171	183	CF/FG282	F
32	<LOD	<LOD	138	217	CF/FG283	A
33	<LOD	<LOD	226	299		
34	<LOD	<LOD	226	163	CF/FG284	F
35	<LOD	<LOD	181	119		
36	<LOD	<LOD	215	314	CF/FG285	A
37	<LOD	<LOD	171	122	CF/FG286	A
38	<LOD	<LOD	107	75	CF/FG287	F
39	<LOD	<LOD	67	30	CF/FG288	F
40	<LOD	<LOD	130	126	CF/FG289	F
41	<LOD	<LOD	447	362	CF/FG290	A
42	<LOD	<LOD	68	68		
43	<LOD	<LOD	876	162	CF/FG291	A
44	<LOD	<LOD	31	16	CF/FG292	F
45	<LOD	<LOD	80	37		

Lab tested

XRF Data 20 March 2010



Reading	Cr	Cu	Zn	Pb	Description	Type
1	Standardisation					
2	<LOD	<LOD	120	55	CF/FG293	F
3	<LOD	<LOD	538	394	CF/FG294	F
4	<LOD	<LOD	79	<LOD		
5	<LOD	<LOD	172	165	CF/FG295	A
6	<LOD	<LOD	217	195		
7	<LOD	<LOD	94	87	CF/FG296	F
8	<LOD	<LOD	143	99	CF/FG297	F
9	<LOD	167	116	105	CF/FG298	A
10	<LOD	157	446	251		
11	<LOD	68	115	94		
12	<LOD	<LOD	181	152	CF/FG299	A
13	<LOD	49	248	320		
14	<LOD	<LOD	490	273	CF/FG300	A
15	<LOD	<LOD	407	187		
16	<LOD	<LOD	150	139	CF/FG301	A
17	<LOD	<LOD	484	147		
18	<LOD	<LOD	163	53	CF/FG302	F
19	<LOD	52	215	94		
20	<LOD	<LOD	193	91	CF/FG303	F
21	<LOD	52	158	94	CF/FG304	F
22	<LOD	53	187	86		
23	<LOD	<LOD	344	189	CF/FG305	A
24	<LOD	<LOD	240	125		
25	<LOD	<LOD	217	133	CF/FG306	A
26	<LOD	<LOD	162	55	CF/FG307	F
27	<LOD	<LOD	221	76	CF/FG308	F
28	<LOD	<LOD	200	90		
29	<LOD	<LOD	159	54	CF/FG309	F
30	<LOD	46	450	202	CF/FG310	A
31	Standardisation					
32	<LOD	47	178	82	CF/FG312	F
33	<LOD	<LOD	339	150	CF/FG311	F
34	<LOD	<LOD	463	485	CF/FG313	A
35	<LOD	50	326	135	Spot Check material being used to raise bed of cell F/G	
36	<LOD	<LOD	98	29		
37	<LOD	<LOD	238	102		
38	<LOD	<LOD	115	42		
39	<LOD	<LOD	244	193	CF/FG314	A
40	<LOD	<LOD	272	171		
41	<LOD	<LOD	416	144	Spot Check material being used to raise bed of cell F/G	
42	<LOD	<LOD	344	175		
43	<LOD	<LOD	557	221		
44	<LOD	<LOD	346	144		
45	<LOD	<LOD	261	94		
46	<LOD	<LOD	490	202		
47	<LOD	<LOD	280	112		
48	<LOD	<LOD	230	88		
49	<LOD	<LOD	293	244		
50	194	40	373	303		
51	<LOD	<LOD	206	403		
52	<LOD	<LOD	283	240	CF/FG315	A
53	<LOD	64	188	157	CF/FG316	A
54	<LOD	<LOD	219	118	Spot Check material being used to raise bed of cell F/G	
55	<LOD	<LOD	239	72		
56	<LOD	<LOD	230	89	CF/FG317	A

Lab tested

CLIENT: CPG New Zealand Ltd

PROJECT: Waiwhetu Stream Remediation

FILE: J:\Jobs\42771630\5 Works\Field notes - Sampling - Lab\Lab and XRF analysis\XRF data\XRF Data 2010 Master.xls 20 Mar 10

XRF Data 22 March 2010



Reading	Cr	Cu	Zn	Pb	Description
1			Standardisation		
2	<LOD	<LOD	133	44	FG/30L
3	<LOD	<LOD	35	<LOD	FG/30M
4	<LOD	<LOD	35	13	FG/30R
5	166	<LOD	124	63	FG/50R
6	<LOD	<LOD	129	66	
7	<LOD	<LOD	85	23	FG/50M
8	<LOD	<LOD	145	81	FG/50L
9	<LOD	<LOD	34	<LOD	FG/70L
10	<LOD	<LOD	57	21	FG/70M
11	<LOD	<LOD	44	20	FG/70R
12	<LOD	<LOD	39	15	FG/90R
13	<LOD	<LOD	50	18	FG/90M
14	<LOD	<LOD	41	<LOD	FG/90L
15	<LOD	<LOD	58	19	FG/110L
16	<LOD	<LOD	51	15	FG/110M
17	200	<LOD	52	20	FG110R
18	<LOD	<LOD	43	<LOD	
19	<LOD	<LOD	56	36	FG/130R
20	<LOD	<LOD	73	28	FG/130M
21	<LOD	<LOD	46	16	FG/130L
22	<LOD	<LOD	78	50	FG/150R
23	<LOD	<LOD	97	<LOD	FG/150M
24	<LOD	<LOD	52	134	FG/150L
25	<LOD	<LOD	45	16	FG/170R
26	<LOD	<LOD	42	23	FG/170M
27	<LOD	<LOD	102	60	FG/170L
28	<LOD	<LOD	96	36	FG/190R
29	<LOD	<LOD	85	25	FG/190M
30	<LOD	<LOD	79	37	FG/190L
31	<LOD	<LOD	69	35	FG/210R
32	<LOD	<LOD	72	37	FG/210M
33	<LOD	<LOD	28	20	FG/210L
34	<LOD	<LOD	30	<LOD	FG/230R
35	<LOD	<LOD	58	24	FG/230M
36	<LOD	<LOD	75	24	FG/230L
37	<LOD	<LOD	38	19	FG/250L
38	<LOD	<LOD	96	63	FG/250M
39	<LOD	<LOD	33	14	FG/250R
40	<LOD	82	196	156	
41	<LOD	<LOD	164	101	
42	<LOD	<LOD	123	96	
43	<LOD	<LOD	147	85	
44	<LOD	58	108	57	
45	<LOD	46	182	88	
46	<LOD	<LOD	195	163	
47	<LOD	<LOD	98	189	
48	<LOD	<LOD	140	143	
49	<LOD	<LOD	132	127	
50	<LOD	<LOD	215	150	
51	<LOD	<LOD	117	115	

Not validation, but checking material deposited to raise stream bed.

XRF Data 25 March 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	<LOD	<LOD	SiO2 blank
3	288	92	426	134	NIST xx
4	176	523	1145	178	NIST xx
5	Standardisation				
6	<LOD	<LOD	46	15	Salt Marsh Brown
7	<LOD	55	915	1548	Salt Marsh Black

XRF Data 31 March 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	52	181	297	Screen of stockpile TLB of Cell D around where John Rays are doing drainage works (D/S of culvert)
3	<LOD	72	145	102	
4	<LOD	<LOD	76	46	
5	<LOD	<LOD	220	169	
6	<LOD	65	185	141	
7	164	<LOD	125	37	
8	<LOD	<LOD	96	29	
9	<LOD	<LOD	196	186	
10	<LOD	80	222	172	Screen of stockpile TLB of Cell D around where HCC contractors are doing drainage works (U/S of culvert)
11	<LOD	<LOD	189	84	
12	<LOD	41	172	85	
13	<LOD	105	471	212	
14	<LOD	<LOD	828	724	
15	<LOD	50	298	251	

CLIENT: CPG New Zealand Ltd

PROJECT: Waiwhetu Stream Remediation

FILE: J:\Jobs\42771630\5 Works\Field notes - Sampling - Lab\Lab and XRF analysis\XRF data\XRF Data 2010 Master.xls31 March

XRF Data 07 April 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	Standardisation				
4	<LOD	<LOD	53	17	Spot Check Cell H top transects
5	<LOD	<LOD	57	<LOD	
6	<LOD	<LOD	28	<LOD	
7	Standardisation				
8	<LOD	<LOD	69	29	Spot Check Cell H top transects
9	<LOD	<LOD	99	39	

XRF Data 08 April 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	31	<LOD	Spot Check top 3 transects of Cell H
3	<LOD	<LOD	24	<LOD	
4	<LOD	<LOD	135	71	
5	<LOD	<LOD	99	54	
6	<LOD	<LOD	34	<LOD	H/10L
7	<LOD	<LOD	36	13	H/10M
8	<LOD	<LOD	73	24	H/10R
9	<LOD	<LOD	36	<LOD	H/30L
10	<LOD	<LOD	38	<LOD	H/30M
11	<LOD	<LOD	<LOD	<LOD	H/30R
12	<LOD	<LOD	62	32	H/50L
13	<LOD	<LOD	22	<LOD	H/50M
14	<LOD	<LOD	22	<LOD	H/50R

Validation

XRF Data 09 April 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	Standardisation				
4	<LOD	<LOD	121	73	Checking material being removed from Cell M
5	<LOD	<LOD	127	129	
6	<LOD	<LOD	171	596	
7	<LOD	54	389	493	
8	<LOD	<LOD	243	1164	
9	<LOD	50	364	1923	
10	<LOD	<LOD	87	50	
11	<LOD	38	65	74	
12	<LOD	<LOD	27	<LOD	
13	<LOD	<LOD	99	51	
14	<LOD	45	124	65	
15	<LOD	<LOD	60	27	

XRF Data 12 April 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	Standardisation				
4	Standardisation				
5	Standardisation				
6	Standardisation				
7	Standardisation				
8	Standardisation				
9	<LOD	<LOD	117	57	PR1
10	<LOD	<LOD	77	35	PR2
11	<LOD	<LOD	1496	30	PR3
12	<LOD	<LOD	81	34	PR4

XRF Data 13 April 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	Standardisation				
4	<LOD	<LOD	64	27	Spot check Cell H sewer X-ing backfill
5	<LOD	<LOD	51	33	
6	<LOD	<LOD	121	74	Spot check Cell H transects 110, 130 and 150. Also ooze layer beneath boardwalk.
7	<LOD	<LOD	81	23	
8	<LOD	<LOD	2208	2896	
9	<LOD	<LOD	92	28	
10	<LOD	<LOD	53	40	
11	<LOD	<LOD	59	47	
12	<LOD	<LOD	95	27	
13	<LOD	<LOD	261	182	
14	<LOD	<LOD	54	21	
15	<LOD	<LOD	35	19	
16	<LOD	45	357	290	
17	<LOD	41	225	144	
18	<LOD	<LOD	143	115	

XRF Data 14 April 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	Standardisation				
4	<LOD	<LOD	35	21	H/110L
5	<LOD	<LOD	53	18	H/110M
6	<LOD	<LOD	36	19	H/130L
7	<LOD	<LOD	50	<LOD	H/130RM
8	<LOD	<LOD	52	14	H/130M
9	<LOD	<LOD	29	<LOD	H/130LM
10	<LOD	62	198	799	Checking material up against panels on TRB of Cell H.
11	<LOD	<LOD	67	30	
12	<LOD	<LOD	71	50	
13	<LOD	<LOD	79	34	
14	<LOD	<LOD	96	152	
15	<LOD	<LOD	114	296	

Validation

XRF Data 15 April 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	Standardisation				
4	<LOD	<LOD	61	23	PRSP1
5	<LOD	<LOD	69	29	PRSP2
6	<LOD	<LOD	53	19	PRSP3
7	<LOD	<LOD	55	14	PRSP4
8	<LOD	<LOD	67	18	PRSP5
9	<LOD	<LOD	51	21	PRSP6
10	<LOD	<LOD	42	16	PRSP7
11	<LOD	<LOD	75	26	PRSP8
12	<LOD	<LOD	53	<LOD	PRSP9
13	<LOD	<LOD	78	54	PRSP10
14	<LOD	<LOD	326	310	
15	Standardisation				
16	<LOD	<LOD	22	<LOD	
17	<LOD	<LOD	199	150	
18	<LOD	<LOD	285	113	
19	<LOD	<LOD	231	72	

Lab tested

XRF Data 16 April 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	<LOD	<LOD	53	<LOD	Check of Port Road stockpile of material in compound for possible use as backfill.
4	<LOD	<LOD	76	26	
5	<LOD	<LOD	75	26	
6	<LOD	<LOD	83	31	

XRF Data 19 April 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	61	49	CF/CW1
3	<LOD	<LOD	97	123	CF/CW2
4	<LOD	<LOD	73	33	CF/CW3
5	<LOD	<LOD	63	104	CF/CW4
6	<LOD	<LOD	97	102	CF/CW5
7	<LOD	<LOD	64	76	CF/CW6
8	<LOD	<LOD	78	74	CF/CW7
9	<LOD	<LOD	58	24	CF/CW8
10	<LOD	<LOD	124	88	CF/CW9
11	<LOD	<LOD	170	139	CF/CW10

Lab tested

XRF Data 20 April 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardization				
2	Standardization				
3	Standardization				
4	<LOD	<LOD	106	93	
5	<LOD	<LOD	78	13	

XRF Data 22 April 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	Standardisation				
4	<LOD	<LOD	46	18	
5	<LOD	<LOD	36	16	
6	<LOD	54	863	688	
7	<LOD	<LOD	272	137	
8	<LOD	<LOD	372	214	
9	<LOD	<LOD	32	<LOD	
10	<LOD	<LOD	37	21	
11	<LOD	<LOD	30	<LOD	
12	<LOD	<LOD	44	17	
13	<LOD	<LOD	91	38	
14	<LOD	42	136	102	
15	Standardisation				
16	<LOD	<LOD	55	33	
17	<LOD	<LOD	511	671	
18	<LOD	<LOD	817	704	
19	<LOD	<LOD	193	161	
20	<LOD	<LOD	60	31	
21	<LOD	<LOD	193	154	

XRF Data 23 April 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	Standardisation				
4	Standardisation				
5	<LOD	<LOD	49	35	M/110L
6	<LOD	<LOD	48	22	M/110M
7	<LOD	<LOD	33	<LOD	M/110R
8	<LOD	<LOD	43	14	M/130L
9	<LOD	<LOD	42	17	M/130M
10	<LOD	<LOD	29	16	M/130R
11	<LOD	<LOD	31	<LOD	MBS
12	<LOD	<LOD	61	21	H/110L
13	<LOD	<LOD	65	33	H/110M
14	<LOD	<LOD	45	17	H/110R
15	<LOD	<LOD	23	<LOD	H/130M
16	<LOD	<LOD	47	<LOD	H/130MR
17	<LOD	<LOD	20	<LOD	H/130R
18	<LOD	<LOD	25	14	H/150ML
19	<LOD	<LOD	31	15	H/150M
20	<LOD	<LOD	44	15	H/150MR
21	<LOD	<LOD	64	20	H/150R
22	<LOD	<LOD	59	26	
23	<LOD	<LOD	82	42	
24	<LOD	76	916	735	
25	<LOD	37	143	150	

Validation

XRF Data 26 April 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	Standardisation				
4	Standardisation				
5	<LOD	42	416	582	
6	Standardisation				
7	<LOD	<LOD	44	<LOD	
8	<LOD	51	517	497	
9	<LOD	<LOD	612	917	
10	<LOD	<LOD	117	88	
11	<LOD	<LOD	38	12	

XRF Data 27 April 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	227	42	52	28	
3	<LOD	<LOD	241	73	
4	<LOD	102	2641	1263	
5	<LOD	<LOD	236	272	

XRF Data 28 April 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	80	55	Spot check Cell H 130 - 150, Cell M10 transects
3	<LOD	<LOD	98	55	
4	<LOD	<LOD	132	105	
5	<LOD	<LOD	127	92	
6	<LOD	<LOD	114	85	
7	<LOD	<LOD	137	84	
8	<LOD	<LOD	91	71	
9	<LOD	<LOD	108	56	
10	<LOD	<LOD	126	69	
11	<LOD	<LOD	118	53	
12	<LOD	<LOD	121	92	
13	<LOD	<LOD	57	<LOD	H/130L
14	<LOD	<LOD	33	<LOD	H/130LM
15	<LOD	<LOD	42	<LOD	H/150L
16	<LOD	<LOD	46	<LOD	M/10LM
17	<LOD	<LOD	100	72	M/10M
18	<LOD	<LOD	22	<LOD	M/10R

Validation

XRF Data 29 April 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	50	<LOD	Checking Cell after rain event 27 April
3	<LOD	<LOD	154	39	
4	<LOD	<LOD	91	51	
5	<LOD	<LOD	990	6938	
6	<LOD	<LOD	120	98	
7	<LOD	<LOD	115	152	
8	<LOD	<LOD	132	476	
9	<LOD	<LOD	69	101	
10	<LOD	<LOD	38	17	
11	<LOD	<LOD	64	91	
12	<LOD	<LOD	91	70	
13	<LOD	<LOD	79	55	
14	<LOD	<LOD	266	154	
15	<LOD	<LOD	40	28	
16	<LOD	42	697	160	
17	<LOD	<LOD	69	39	
18	<LOD	<LOD	55	20	

XRF Data 30 April 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	Standardisation				
4	<LOD	<LOD	110	73	Spot check Urupa causeway material being taken as Type F.
5	<LOD	<LOD	116	81	
6	<LOD	<LOD	106	89	
7	<LOD	<LOD	110	84	
8	<LOD	<LOD	122	78	
9	<LOD	<LOD	119	75	
10	<LOD	<LOD	76	60	
11	<LOD	<LOD	75	65	
12	<LOD	<LOD	76	48	
13	Standardisation				
14	<LOD	<LOD	61	30	Spot check Urupa causeway material being taken as Type F.
15	<LOD	<LOD	44	16	
16	<LOD	<LOD	80	61	
17	<LOD	<LOD	82	22	
18	<LOD	<LOD	38	13	
19	<LOD	<LOD	40	<LOD	
20	<LOD	<LOD	46	31	
21	<LOD	<LOD	40	25	
22	<LOD	<LOD	109	139	
23	<LOD	<LOD	52	32	
24	<LOD	<LOD	49	19	
25	<LOD	<LOD	49	24	
26	<LOD	<LOD	58	50	
27	<LOD	<LOD	128	110	UCW5
28	Standardisation				
29	<LOD	<LOD	91	65	UCW10
30	<LOD	<LOD	74	41	UCW15
31	<LOD	<LOD	51	28	UCW20
32	<LOD	<LOD	71	59	UCW25
33	<LOD	<LOD	49	<LOD	M/30M
34	<LOD	<LOD	57	15	M/30R
35	<LOD	<LOD	30	<LOD	M/50L
36	<LOD	<LOD	42	<LOD	M/50M
37	181	<LOD	43	14	M/50R
38	<LOD	<LOD	35	<LOD	
39	<LOD	<LOD	57	14	M/90L
40	<LOD	<LOD	24	<LOD	M/90M
41	<LOD	<LOD	39	<LOD	M/90R

Validation
Lab tested

XRF Data 03 May 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	61	379	2322	Spot check in Cell M around ch280 sewer as contaminated material around old pipe is removed.
3	<LOD	<LOD	107	22	
4	<LOD	<LOD	173	35	
5	<LOD	<LOD	98	25	
6	<LOD	<LOD	84	20	
7	<LOD	<LOD	99	95	
8	<LOD	87	357	169	
9	<LOD	<LOD	233	88	
10	<LOD	<LOD	104	117	
11	<LOD	116	110	123	
12	<LOD	57	506	720	
13	<LOD	<LOD	104	443	
14	<LOD	<LOD	64	72	
15	<LOD	<LOD	74	153	
16	<LOD	<LOD	102	204	
17	<LOD	<LOD	115	222	
18	<LOD	<LOD	92	107	
19	<LOD	<LOD	82	132	
20	<LOD	<LOD	79	71	
21	<LOD	<LOD	86	154	
22	Standardisation				
23	<LOD	<LOD	58	99	Spot check in Cell M where casueway on TLB was removed
24	<LOD	<LOD	67	50	
25	<LOD	<LOD	60	78	
26	<LOD	<LOD	74	176	
27	<LOD	<LOD	32	21	
28	<LOD	<LOD	45	<LOD	
29	<LOD	<LOD	45	<LOD	M/10L
30	<LOD	<LOD	51	59	M/30L
31	<LOD	<LOD	60	53	M/70L
32	<LOD	<LOD	35	16	M/70M

Validation

XRF Data 05 May 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	Standardisation				
3	Standardisation				
4	<LOD	<LOD	80	28	Screening of Port Rd material being backfilled into Saltmarsh
5	<LOD	<LOD	79	28	
6	237	<LOD	51	48	
7	<LOD	<LOD	74	42	
8	<LOD	<LOD	59	31	
9	<LOD	<LOD	88	48	
10	<LOD	<LOD	72	<LOD	
11	<LOD	<LOD	297	31	
12	<LOD	<LOD	57	21	
13	<LOD	<LOD	57	26	
14	<LOD	<LOD	56	24	
15	<LOD	<LOD	50	23	
16	<LOD	<LOD	53	<LOD	
17	<LOD	<LOD	52	22	
18	<LOD	<LOD	48	20	Checking area on TLB between salt marsh and start of panels
19	<LOD	<LOD	51	35	
20	<LOD	<LOD	41	23	
21	<LOD	<LOD	137	124	
22	<LOD	<LOD	51	22	
23	<LOD	46	93	46	
24	<LOD	<LOD	45	18	
25	<LOD	<LOD	131	127	
26	<LOD	<LOD	126	133	
27	<LOD	<LOD	138	137	
28	<LOD	<LOD	61	<LOD	
29	<LOD	<LOD	29	<LOD	
30	Standardisation				
31	<LOD	<LOD	67	37	Spot check of material backfilled into saltmarsh
32	<LOD	<LOD	63	20	
33	<LOD	<LOD	122	73	
34	<LOD	<LOD	45	32	
35	<LOD	<LOD	61	43	
36	<LOD	<LOD	35	34	

XRF Data 06 May 2010



Reading	Cr	Cu	Zn	Pb	Description
1	Standardisation				
2	<LOD	<LOD	59	48	Spot check Salt marsh
3	<LOD	<LOD	72	20	
4	<LOD	<LOD	63	43	

Appendix E Comparison of XRF to Laboratory Data

Appendix E

Comparison of XRF screening and laboratory results

The purpose of using the portable XRF was to provide rapid screening data in the field, to assist in determining the end point of the excavation of contaminated material, and to a lesser extent, the classification of some material at the landfill.

All validation samples collected during the works were screened with the portable XRF analyser prior to being submitted to the laboratory. A detailed statistical analysis of the correlation between the two sets of results (XRF and laboratory) has not been carried out as part of this report, however some general comments are included here.

Reference Material

The key reference documents used to develop appropriate testing procedures were:

- Instruction manual: Innov-X Systems, Alpha Series™, X-Ray Fluorescence Spectrometers, August 2005, Version 2.1.
- *Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment* – Method 6200 of SW-846 (Test Methods for Evaluating Solid Waste, Physical/Chemical Methods), US EPA. This will be referred to as 'Method 6200'.

The latter is not a training manual, however it provides general information on the application of the instrument which can be used as a basic starting point for generating a testing procedure.

Interferences

Interferences, generally user or application related, can cause error in the data, and are the main sources of variance from laboratory data.

Sources of interference relevant to this project were:

- Variation in the physical character of the sample, eg. particle size, uniformity, homogeneity and surface condition
- Moisture content
- Position of sample during testing

Correction factor for moisture content

A correction factor must be applied to the XRF results, to account for moisture content (as the laboratory results are cited as per unit dry weight). The correction factor was developed from the XRF instruction manual, which states that:

"The results will be higher [than the laboratory results] by the amount of moisture content in the sample. For example, laboratory results will be 10% higher compared to XRF results, if the sample contained 10% by weight water when it was tested with XRF."

The XRF value was therefore adjusted as follows:

$$\text{XRF Reading} \times \frac{100}{100 - \% \text{ moisture}}$$

Measurement times

The measurement times for the tests carried out during the works were developed in general accordance with Method 6200, and are presented in **Table E-1**:

Table E-1 Measurement times

Test type	Measurement time
In-situ screen/hot-spot delineation	30 seconds
Screen of validation sample prior to laboratory analysis	3 x 30 seconds. Values averaged.

Comparison of results

The XRF screening and laboratory results have been tabulated together and are presented in this appendix. In general after application of the correction factor for moisture content, the XRF and laboratory results showed a reasonably good comparison for lead and zinc results. The comparison was good enough to give confidence that the application of the portable XRF in the field during the project would yield useful and reasonably accurate data.

Concentrations of chromium and copper were not as well represented by the portable XRF as lead and zinc. Reasons for this could be attributed to:

- Detection limits: The detection limit for chromium was approximately 130 ppm for a 30 second test, which was significantly higher than for the other three metals. Therefore, a result would not have been given unless the concentration of chromium in the sample was above 130 ppm.
- Interference: Method 6200 states that the intensities of both copper and chromium measured by the analyser will be affected by the presence of iron (Fe) in the sample.



Appendix E - Cell A Validation Sediment Sample Laboratory Results Compared with Corrected portable XRF results and ANZECC Sediment Quality Guidelines

Validation Sample Details and Analytical Results																				
URS Sample Reference	A/10R		A/10M		A/10L		A/30R		A/30M		A/30L		A/50R		A/50M		A/50L		ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	SA12964-J		SA12964-J		SA12964-I		SA12964-J		SA12964-J		SA12964-I		SA12964-J		SA12964-J		SA12964-I			
Date Sampled	20-Nov-09		20-Nov-09		17-Nov-09		20-Nov-09		20-Nov-09		17-Nov-09		20-Nov-09		20-Nov-09		17-Nov-09			
Sample Location	10m transect, true right rank		10m transect, middle of stream bed		10m transect, true left bank		30m transect, true right rank		30m transect, middle of stream bed		30m transect, true left bank		50m transect, true right rank		50m transect, middle of stream bed		50m transect, true left bank		ISQG-Low	ISQG-High
Result type	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	80	370
Chromium	36	0	32	0	39	0	39	0	36	0	50	0	45	0	41	0	42	0		
Copper	7	0	2	0	7	0	4	0	2	0	12	0	12	0	5	0	12	0		
Zinc	82	85	64	48	61	49	71	58	64	43	131	98	123	107	68	49	143	95		
Lead	31	19	21	0	20	17	24	0	18	0	61	45	54	53	20	16	65	44		
Moisture content (%)	17.7		16.7		36.3		22.7		15.8		37.9		28.0		12.8		19.1		NA	NA
Moisture correction	1.22		1.20		1.57		1.29		1.19		1.61		1.39		1.15		1.24		NA	NA

Validation Sample Details and Analytical Results																				
URS Sample Reference	A/70R		A/70M		A/70L		A/90R		A/90M		A/90L		A/110R		A/110M		A/110L		ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	SA12964-J		SA12964-J		SA12964-I		SA12964-J		SA12964-J		SA12964-I		SA12964-J		SA12964-J		N/A			
Date Sampled	20-Nov-09		20-Nov-09		17-Nov-09		20-Nov-09		20-Nov-09		17-Nov-09		20-Nov-09		20-Nov-09		N/A			
Sample Location	70m transect, true right rank		70m transect, middle of stream bed		70m transect, true left bank		90m transect, true right rank		90m transect, middle of stream bed		90m transect, true left bank		110m transect, true right rank		110m transect, middle of stream bed		110m transect, true left bank		ISQG-Low	ISQG-High
Result type	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Not sampled. Sampling point is in pump intake area.	80	370	
Chromium	42	0	41	0	49	0	54	0	40	0	40	0	36	0	73	0				
Copper	12	0	8	0	19	0	14	0	10	0	4	0	2	0	36	0				
Zinc	108	85	79	117	149	119	95	73	122	51	66	49	58	50	382	326				
Lead	58	44	28	51	65	52	33	0	50	0	21	0	17	0	164	133				
Moisture content (%)	23.5		23.2		22.7		46.9		29.0		14.0		18.3		56.4				NA	NA
Moisture correction	1.31		1.30		1.29		1.88		1.41		1.16		1.22		2.29				NA	NA

All units mg/kg dry weight

Bold - exceeds the ANZECC Sediment Guidelines

1 ANZECC, 2000. National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.

Values taken from Table 3.5.1

A Exceeds ISQG-Low

B Exceeds ISQG-High

* XRF values have been corrected for moisture



Appendix E - Cell B Validation Sediment Sample Laboratory Results Compared with Corrected portable XRF results and ANZECC Sediment Quality Guidelines

Validation Sample Details and Analytical Results																								
URS Sample Reference	B/10R		B/10M		B/10L		B/30R		B/30M		B/30L		B/50R		B/50M		B/50L		B/70R		B/70M		ANZECC Sediment Quality Guidelines	
Laboratory Sample Reference	SA12964-D		SA12964-D		SA12964-D		SA12964-D		SA12964-D		SA12964-D		SA12964-E		SA12964-E		SA12964-E		SA12964-E		SA12964-E			
Date Sampled	7-Nov-09		7-Nov-09		7-Nov-09		7-Nov-09		7-Nov-09		7-Nov-09		9-Nov-09		9-Nov-09		9-Nov-09		9-Nov-09		9-Nov-09			
Sample Location	10m transect, true right bank		10m transect, middle of stream bed		10m transect, true left bank		30m transect, true right bank		30m transect, middle of stream bed		30m transect, true left bank		50m transect, true right bank		50m transect, middle of stream bed		50m transect, true left bank		70m transect, true right bank		70m transect, middle of stream bed		ISQG-Low	ISQG-High
Result type	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*		
Chromium	48	0	42	0	38	0	42	0	32	0	52	0	39	0	44	0	43	0	42	0	39	0	80	370
Copper	10	0	7	0	6	0	13	0	5	0	17	0	3	0	8	0	9	0	7	0	4	0		
Zinc	96	68	110	162	73	49	161	124	65	62	244	225	54	51	87	56	102	48	63	49	63	33		
Lead	36	21	38	48	21	0	64	49	17	0	99	84	14	15	28	19	36	0	18	0	16	15		
Moisture content (%)	20.1		27.7		20.6		19.1		19.1		20.6		14.3		22.8		22.4		20.4		18.2			
Moisture correction	1.25		1.38		1.26		1.24		1.24		1.26		1.17		1.30		1.29		1.26		1.22		NA	NA

Validation Sample Details and Analytical Results																								
URS Sample Reference	B/70L		B/90R		B/90M		B/90L		B/110R		B/110M		B/110L		B/130R		B/130M		B/130L		Left blank for formatting purposes			
Laboratory Sample Reference	SA12964-E		SA12964-F		SA12964-F		SA12964-F		SA12964-J		SA12964-J		SA12964-J		SA12964-K		SA12964-K		SA12964-K					
Date Sampled	9-Nov-09		11-Nov-09		11-Nov-09		11-Nov-09		25-Nov-09		25-Nov-09		25-Nov-09		26-Nov-09		26-Nov-09		26-Nov-09					
Sample Location	70m transect, true left bank		90m transect, true right bank		90m transect, middle of stream bed		90m transect, true left bank		110m transect, true right bank		110m transect, middle of stream bed		110m transect, true left bank		130m transect, true right bank		130m transect, middle of stream bed		130m transect, true left bank					
Result type	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*		
Chromium	54	0	43	0	43	0	42	0	42	0	46	0	37	0	33	0	33	0	44	0				
Copper	11	0	8	0	8	0	8	0	12	0	10	0	4	0	1	0	2	0	5	0				
Zinc	181	142	65	55	80	75	65	51	127	99	133	155	67	65	47	49	51	38	63	48				
Lead	70	43	20	0	28	21	19	0	44	25	56	59	31	21	11	0	15	0	20	0				
Moisture content (%)	20.4		25.1		22.2		20.9		24.2		26.9		3.8		21.1		21.2		19.3					
Moisture correction	1.26		1.34		1.29		1.26		1.32		1.37		1.04		1.27		1.27		1.24					

All units mg/kg dry weight

Bold - exceeds the ANZECC Sediment Guidelines

¹ ANZECC, 2000. National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.

Values taken from Table 3.5.1

A Exceeds ISQG-Low

B Exceeds ISQG-High

* XRF values have been corrected for moisture



Appendix E - Cell C/D Validation Sediment Sample Laboratory Results Compared with Corrected portable XRF results and ANZECC Sediment Quality Guidelines

	Validation Sample Details and Analytical Results																									
URS Sample Reference	CD/10R		CD/10M		CD/10L		CD/30R		CD/30M		CD/30L		CD/50R		CD/50M		CD/50L		CD/70R		CD/70M		CD/70L		ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	SA13074-C		SA13074-C		SA13074-C		SA13074-C		SA13074-C		SA13074-C		SA13074-D		SA13074-D		SA13074-D		SA13074-D		SA13074-D		SA13074-D			
Date Sampled	13-Jan-10		13-Jan-10		13-Jan-10		13-Jan-10		13-Jan-10		13-Jan-10		14-Jan-10		14-Jan-10		14-Jan-10		14-Jan-10		14-Jan-10		14-Jan-10			
Sample Location	10m transect, true right bank		10m transect, middle of stream bed		10m transect, true left bank		30m transect, true right bank		30m transect, middle of stream bed		30m transect, true left bank		50m transect, true right bank		50m transect, middle of stream bed		50m transect, true left bank		70m transect, true right bank		70m transect, middle of stream bed		70m transect, true left bank		ISQG-Low	ISQG-High
Result type	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	80	370
Chromium	34	0	34	0	29	0	35	0	36	0	37	0	28	0	33	0	32	0	25	0	26	0	24	0		
Copper	6	0	3	0	1	0	4	0	2	0	2	0	1	0	1	0	< 1	0	< 1	0	< 1	0	1	0		
Zinc	95	51	51	35	49	39	62	54	50	50	55	49	45	34	56	72	45	36	43	40	47	46	44	33		
Lead	44	19	16	0	16	15	28	23	14	0	18	20	13	0	20	18	11	0	12	0	14	0	17	0		
Moisture content (%)	17.4		6.0		12.6		16.5		15.2		20.6		18.8		5.9		15.9		20.9		16.9		16.3		NA	NA
Moisture correction	1.21		1.06		1.14		1.20		1.18		1.26		1.23		1.06		1.19		1.26		1.20		1.19		NA	NA

Validation Sample Details and Analytical Results																					
URS Sample Reference	CD/90R		CD/90M		CD/90L		CD/110R		CD/110M		CD/110L		CD/130R		CD/130M		CD/130L		Left blank for formatting purposes	ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	SA13074-E		SA13074-E		SA13074-E		SA13074-E		SA13074-E		SA13074-E		SA13074-E		SA13074-E		SA13074-E			ISQG-Low ISQG-High	
Date Sampled	15-Jan-10		15-Jan-10		15-Jan-10		15-Jan-10		15-Jan-10		15-Jan-10		15-Jan-10		15-Jan-10		15-Jan-10				
Sample Location	90m transect, true right bank		90m transect, middle of stream bed		90m transect, true left bank		110m transect, true right bank		110m transect, middle of stream bed		110m transect, true left bank		130m transect, true right bank		130m transect, middle of stream bed		130m transect, true left bank				
Result type	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*			
Chromium	29	0	35	0	32	0	28	0	33	0	27	0	36	0	35	0	33	0		80 370	
Copper	< 1	0	1	0	1	0	1	0	1	0	1	0	4	0	2	0	3	0		65 270	
Zinc	46	31	51	45	48	28	47	44	49	42	47	61	56	39	56	48	54	32		200 410	
Lead	13	0	14	0	13	0	14	0	13	0	17	22	17	0	15	17	16	0		50 220	
Moisture content (%)	19.9		19.4		18.9		20.5		19.6		19.2		18.6		16.0		21.6			NA NA	
Moisture correction	1.25		1.24		1.23		1.26		1.24		1.24		1.23		1.19		1.28			NA NA	

	Validation Sample Details and Analytical Results																			Left blank for formatting purposes			
URS Sample Reference	CD/150R		CD/150M		CD/150L		CD/170R		CD/170M		CD/170L		CD/190R		CD/190M		CD/190L		ANZECC Sediment Quality Guidelines ¹				
Laboratory Sample Reference	SA13074-E		SA13074-E		SA13074-E		SA13074-F		SA13074-F		SA13074-F		SA13074-F		SA13074-F		SA13074-F						
Date Sampled	15-Jan-10		15-Jan-10		15-Jan-10		15-Jan-10		15-Jan-10		15-Jan-10		15-Jan-10		15-Jan-10		15-Jan-10						
Sample Location	70m transect, true left bank		90m transect, true right bank		90m transect, middle of stream bed		90m transect, true left bank		110m transect, true right bank		110m transect, middle of stream bed		110m transect, true left bank		130m transect, true right bank		130m transect, middle of stream bed		ISQG-Low				ISQG-High
Result type	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*					
Chromium	27	0	29	0	34	0	31	0	26	0	26	0	28	0	31	0	28	0	80				370
Copper	2	0	2	0	3	0	1	0	1	0	1	0	< 1	0	2	0	1	0	65				270
Zinc	62	84	47	38	59	53	59	93	52	43	46	35	49	55	66	52	48	42	200				410
Lead	69	31	12	0	18	0	100	146	75	20	21	0	17	15	176	100	16	14	50				220
Moisture content (%)	16.6		12.3		22.2		16.9		18.4		17.5		18.7		23.1		9.7		NA				NA
Moisture correction	1.20		1.14		1.29		1.20		1.23		1.21		1.23		1.30		1.11		NA				NA

All units mg/kg dry weight

Bold - exceeds the ANZECC Sediment Guidelines

1 ANZECC, 2000. National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.

Values taken from Table 3.5.1

A Exceeds ISQG-Low

B Exceeds ISQG-High

* XRF values have been corrected for moisture



Appendix E - Cell E Validation Sediment Sample Laboratory Results Compared with Corrected portable XRF results and ANZECC Sediment Quality Guidelines

	Validation Sample Details and Analytical Results																									
URS Sample Reference	E/10R		E/10M		E/10L		E/30R		E/30M		E/30L		E/50R		E/50M		E/50L		E/70R		E/70M		ANZECC Sediment Quality Guidelines ¹			
Laboratory Sample Reference	SA13074-I		SA13074-I		SA13074-I		SA13074-I		SA13074-I		SA13074-I		SA13074-I		SA13074-I		SA13074-I		Not validated as per CPG instruction. Transects were beneath area to be covered with reno mattresses.				ISQG-Low		ISQG-High	
Date Sampled	28-Jan-10		28-Jan-10		28-Jan-10		28-Jan-10		28-Jan-10		28-Jan-10		28-Jan-10		28-Jan-10		28-Jan-10									
Sample Location	10m transect, true right bank		10m transect, middle of stream bed		10m transect, true left bank		30m transect, true right bank		30m transect, middle of stream bed		30m transect, true left bank		50m transect, true right bank		50m transect, middle of stream bed		50m transect, true left bank									
Result type	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*								
Chromium	31	0	32	0	32	0	31	0	30	0	32	0	36	0	35	0	29	0					80	370		
Copper	1	0	4	0	22	0	< 1	0	1	0	2	0	1	0	2	0	2	0					65	270		
Zinc	51	45	69	50	70	48	52	36	59	41	50	30	52	41	55	57	52	20					200	410		
Lead	13	21	142	79	200	168	21	16	22	17	15	0	13	0	13	18	13	30					50	220		
Moisture content (%)	15.4		14.0		5.5		18.7		10.3		5.6		23.5		22.5		21.0						NA	NA		
Moisture correction	1.18		1.16		1.06		1.23		1.11		1.06		1.31		1.29		1.27						NA	NA		

	Validation Sample Details and Analytical Results																		
URS Sample Reference	E/70L	E/90R	E/90M	E/90L	E/110R		E/110M		E/110L		E/130R		E/130M		E/130L		Left blank for formatting purposes	ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	Not validated as per CPG instruction. Transects were beneath area to be covered with reno matresses.				SA13118-A		SA13118-A		SA13118-A		SA13118-A		SA13118-A		SA13118-A			ISQG-Low	ISQG- High
Date Sampled					3-Feb-10		3-Feb-10		3-Feb-10		3-Feb-10		3-Feb-10		3-Feb-10				
Sample Location					110m transect, true right bank		110m transect, middle of stream bed		110m transect, true left bank		130m transect, true right bank		130m transect, middle of stream bed		130m transect, true left bank				
Result type					Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*			
Chromium					38	0	42	0	31	0	34	0	37	0	34	0		80 65 200 50	370 270 410 220
Copper					5	0	8	0	2	0	2	0	5	0	5	0			
Zinc					90	75	73	52	54	41	54	33	62	45	54	36			
Lead					65	75	28	24	14	17	14	22	23	21	15	14			
Moisture content (%)					22.7		25.0		22.4		17.2		20.7		15.7			NA	NA
Moisture correction	1.29		1.33		1.29		1.21		1.26		1.19		NA	NA					

	Validation Sample Details and Analytical Results																									
URS Sample Reference	E/150R		E/150M		E/150L		E/170R		E/170M		E/170L		E/190R		E/190M		E/190L		Left blank for formatting purposes	ANZECC Sediment Quality Guidelines ¹						
Laboratory Sample Reference	SA13118-A		SA13118-A		SA13118-A		SA13118-B		SA13118-A		SA13118-A		SA13118-B		SA13118-A		SA13118-A			ISQG-Low	ISQG-High					
Date Sampled	3-Feb-10		3-Feb-10		3-Feb-10		4-Feb-10		3-Feb-10		3-Feb-10		4-Feb-10		3-Feb-10		3-Feb-10									
Sample Location	70m transect, true left bank		90m transect, true right bank		90m transect, middle of stream bed		90m transect, true left bank		110m transect, true right bank		110m transect, middle of stream bed		110m transect, true left bank		130m transect, true right bank		130m transect, middle of stream bed			80	370					
Result type	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*				65	270			
Chromium	32	0	29	0	32	0	31	0	30	0	29	0	36	0	34	0	36	0	200					410		
Copper	2	0	3	0	3	0	1	0	5	0	2	0	7	0	2	0	3	0							50	220
Zinc	49	32	47	32	52	40	49	32	62	60	53	27	186	119	106	85	150	144								
Lead	14	0	13	16	14	17	13	0	20	19	15	0	91	64	39	31	15	0								
Moisture content (%)	13.8		13.1		12.7		11.8		12.8		9.7		14.4		9.5		16.0			NA	NA					
Moisture correction	1.16		1.15		1.15		1.13		1.15		1.11		1.17		1.10		1.19		NA	NA						

All units mg/kg dry weight
Bold - exceeds the ANZECC Sediment Guidelines
1 ANZECC, 2000. National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.
Values taken from Table 3.5.1
A Exceeds ISQG-Low
B Exceeds ISQG-High
* XRF values have been corrected for moisture



Appendix E - Cell F/G Validation Sediment Sample Laboratory Results Compared with Corrected portable XRF results and ANZECC Sediment Quality Guidelines

			Validation Sample Details and Analytical Results																															
URS Sample Reference	FG/10R		FG/10M		FG/10L		FG/30R		FG/30M		FG/30L		FG/50R		FG/50M		FG/50L		FG/70R		FG/70M		FG/70L		FG/90R		FG/90M		FG/90L		ANZECC Sediment Quality Guidelines ¹			
Laboratory Sample Reference	SA13206-D		SA13206-A		SA13206-A		SA13206-A		SA13206-A		SA13206-A		SA13206-D		SA13206-A		SA13206-A		SA13206-B		SA13206-B		SA13206-B		SA13206-A		SA13206-A		SA13206-A					
Date Sampled	11-Mar-10		10-Mar-10		10-Mar-10		10-Mar-10		10-Mar-10		10-Mar-10		11-Mar-10		10-Mar-10		10-Mar-10		10-Mar-10		10-Mar-10		10-Mar-10		10-Mar-10		10-Mar-10		10-Mar-10					
Sample Location	10m transect, true right bank		10m transect, middle of stream bed		10m transect, true left bank		30m transect, true right bank		30m transect, middle of stream bed		30m transect, true left bank		50m transect, true right bank		50m transect, middle of stream bed		50m transect, true left bank		70m transect, true right bank		70m transect, middle of stream bed		70m transect, true left bank		90m transect, true right bank		90m transect, middle of stream bed		90m transect, true left bank		ISQG-Low	ISQG- High		
Result type	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*			Lab	XRF*
Chromium	33	Not XRFd	36	0	32	0	34	0	32	0	33	0	33	Not XRFd	34	0	37	0	39	0	35	0	32	0	38	0	36	0	33	0				
Copper	3		1	0	4	0	2	0	3	0	2	0	2		1	0	3	0	4	0	3	0	2	0	5	0	3	0	3	0				
Zinc	48		54	30	106	65	84	64	85	97	51	40	50		48	31	82	47	122	34	74	74	51	39	87	81	51	67	51	37				
Lead	14		13	0	15	0	34	23	18	14	19	0	14		12	0	39	0	72	15	30	40	14	0	46	35	13	23	13	0				
Moisture content (%)	15.7		15.4		15.0		14.3		14.2		6.0		14.8		7.9		5.5		15.1		13.1		1.5		10.7		14.4		7.1		NA	NA		
Moisture correction	1.19		1.18		1.18		1.17		1.17		1.06		1.17		1.09		1.06		1.18		1.15		1.02		1.12		1.17		1.08		NA	NA		

		Validation Sample Details and Analytical Results																																
URS Sample Reference	FG/110R		FG/110M		FG/110L		FG/130R		FG/130M		FG/130L		FG/150R		FG/150M		FG/150L		FG/170R		FG/170M		FG/170L		FG/190R		FG/190M		FG/190L		ANZECC Sediment Quality Guidelines ¹			
Laboratory Sample Reference	SA13206-A		SA13206-A		SA13206-A		SA13206-F		SA13206-F		SA13206-F		SA13206-A		SA13206-A		SA13206-A		SA13206-A		SA13206-A		SA13206-A		SA13206-A		SA13206-A		SA13206-A					
Date Sampled	10-Mar-10		10-Mar-10		10-Mar-10		16-Mar-10		16-Mar-10		16-Mar-10		10-Mar-10		10-Mar-10		10-Mar-10		10-Mar-10		10-Mar-10		10-Mar-10		10-Mar-10		10-Mar-10		10-Mar-10					
Sample Location	110m transect, true right bank		110m transect, middle of stream bed		110m transect, true left bank		130m transect, true right bank		130m transect, middle of stream bed		130m transect, true left bank		70m transect, true left bank		90m transect, true right bank		90m transect, middle of stream bed		90m transect, true left bank		110m transect, true right bank		110m transect, middle of stream bed		110m transect, true left bank		130m transect, true right bank		130m transect, middle of stream bed		ISQG-Low	ISQG- High		
Result type	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*			Lab	XRF*
Chromium	38	0	32	0	35	0	34	0	38	0	36	0	43	0	41	0	33	0	37	0	35	0	44	0	54	0	36	0	39	0				
Copper	3	0	1	0	2	0	1	0	2	0	6	0	6	0	6	0	3	0	5	0	3	0	10	0	14	0	3	0	1	0				
Zinc	65	49	58	49	60	42	55	41	53	34	95	71	110	66	82	95	51	43	79	75	76	45	130	122	183	88	55	29	57	41				
Lead	27	23	25	22	16	0	17	16	16	0	46	39	63	26	37	42	11	0	34	32	38	22	49	46	116	56	17	0	16	14				
Moisture content (%)	4.3		12.3		16.5		5.8		5.6		8.4		10.0		16.6		4.5		5.9		8.3		20.2		4		2.3		9.7		NA	NA		
Moisture correction	1.04		1.14		1.20		1.06		1.06		1.09		1.11		1.20		1.05		1.06		1.09		1.25		1.04		1.02		1.11		NA	NA		

		Validation Sample Details and Analytical Results																						Left blank for formating purposes		ANZECC Sediment Quality Guidelines ¹		
URS Sample Reference	FG/210R		FG/210M		FG/210L		FG/230R		FG/230M		FG/230L		FG/250R		FG/250M		FG/250L		FG/270R		FG/270M		FG/270L					
Laboratory Sample Reference	SA13206-E		SA13206-E		SA13206-E		SA13206-E		SA13206-E		SA13206-E		SA13206-E		SA13206-E		SA13206-E		SA13206		SA13207		SA13208					
Date Sampled	15-Mar-10		15-Mar-10		15-Mar-10		15-Mar-10		15-Mar-10		15-Mar-10		15-Mar-10		15-Mar-10		15-Mar-10		16-Mar-10		17-Mar-10		18-Mar-10					
Sample Location	130m transect, true right bank		130m transect, middle of stream bed		130m transect, true left bank		70m transect, true left bank		90m transect, true right bank		90m transect, middle of stream bed		90m transect, true left bank		110m transect, true right bank		110m transect, middle of stream bed		110m transect, true left bank		130m transect, true right bank		130m transect, middle of stream bed					
Result type	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab					XRF*
Chromium	40	0	37	0	43	0	36	0	36	0	43	0	31	0	43	0	43	0	43	0	39	0	47					0
Copper	9	0	4	0	8	0	2	0	3	0	7	0	2	0	10	0	6	0	6	0	9	0	11					0
Zinc	88	52	75	64	144	59	53	50	64	70	129	95	54	29	131	186	124	126	129	49	130	133	203					418
Lead	167	21	33	25	85	36	14	0	23	27	82	86	16	15	86	141	89	94	98	39	102	146	153					195
Moisture content (%)	3.0		4.1		5.7		3.6		2.7		5.5		3.5		12.8		8.7		14.7		11.5		11.1					
Moisture correction	1.03		1.04		1.06		1.04		1.03		1.06		1.04		1.15		1.10		1.17		1.13		1.12					



Appendix E - Cell H Validation Sediment Sample Laboratory Results Compared with Corrected portable XRF results and ANZECC Sediment Quality Guidelines

	Validation Sample Details and Analytical Results																							
URS Sample Reference	H/10R		H/10M		H/10L		H/30R		H/30M		H/30L		H/50R		H/50M		H/50L		H/70R		H/70M		ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	SA13287-A		SA13287-A		SA13287-A		SA13287-A		SA13287-A		SA13287-A		SA13287-A		SA13287-A		SA13287-A		SA13287-E		SA13287-E			
Date Sampled	8-Apr-10		8-Apr-10		8-Apr-10		8-Apr-10		8-Apr-10		8-Apr-10		8-Apr-10		8-Apr-10		8-Apr-10		19-Apr-10		19-Apr-10			
Sample Location	10m transect, true right bank		10m transect, middle of stream bed		10m transect, true left bank		30m transect, true right bank		30m transect, middle of stream bed		30m transect, true left bank		50m transect, true right bank		50m transect, middle of stream bed		50m transect, true left bank		70m transect, true right bank		70m transect, middle of stream bed		ISQG-Low	ISQG-High
Result type	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	80 65 200 50	370 270 410 220
Chromium	36	0	33	0	35	0	32	0	33	0	29	0	37	0	34	0	39	0	36	Not XRFd	40	Not XRFd		
Copper	4	0	3	0	1	0	1	0	3	0	2	0	4	0	4	0	4	0	6		5			
Zinc	93	81	57	37	48	35	51	0	53	40	49	37	71	24	57	27	94	67	83		78			
Lead	33	23	18	13	13	0	13	0	15	0	13	0	31	0	17	0	37	35	39		41			
Moisture content (%)	9.6		3.5		3.1		10.9		5.2		2.8		9.3		17.3		7.5		7.9		8.9		NA	NA
Moisture correction	1.11		1.04		1.03		1.12		1.05		1.03		1.10		1.21		1.08		1.09		1.10		NA	NA

	Validation Sample Details and Analytical Results																									
URS Sample Reference	H/70L		H/90R		H/90M		H/90L		H/110R		H/110M		H/110L		H/130R		H/130MR		H/130M		H/130ML		ANZECC Sediment Quality Guidelines ¹			
Laboratory Sample Reference	SA13287-E		SA13287-E		SA13287-E		SA13287-E		SA13287-F		SA13287-F		SA13287-F		SA13287-F		SA13287-F		SA13287-F		SA13287-G					
Date Sampled	19-Apr-10		19-Apr-10		19-Apr-10		19-Apr-10		22-Apr-10		22-Apr-10		22-Apr-10		22-Apr-10		22-Apr-10		22-Apr-10		26-Apr-10					
Sample Location	70m transect, true left bank		90m transect, true right bank		90m transect, middle of stream bed		90m transect, true left bank		110m transect, true right bank		110m transect, middle of stream bed		110m transect, true left bank		130m transect, true right bank		130m transect, middle of stream bed		130m transect, true left bank		130m transect, true left bank		ISQG-Low	ISQG-High		
Result type	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	80	370		
Chromium	33	Not XRFd	49	Not XRFd	59	Not XRFd	37	Not XRFd	33	0	36	0	34	0	30	0	36	0	30	0	31	0				
Copper	4		15		21		4		2	0	3	0	2	0	5	0	1	0	3	0	65	270				
Zinc	82		219		223		86		59	51	76	74	56	68	47	23	64	51	51	27	54	35			200	410
Lead	35		160		182		51		23	19	35	37	21	23	13	0	24	0	13	0	16	0			50	220
Moisture content (%)	3.4		11.6		11.1		15.4		11.4		11.9		10.4		13.3		7.9		14.1		4.7		NA	NA		
Moisture correction	1.04		1.13		1.12		1.18		1.13		1.14		1.12		1.15		1.09		1.16		1.05		NA	NA		

	Validation Sample Details and Analytical Results													Left blank for formatting purposes		
URS Sample Reference	H/130L		H/150R		H/150MR		H/150M		H/150ML		H/150L		ANZECC Sediment Quality Guidelines ¹			
Laboratory Sample Reference	SA13287-G		SA13287-F		SA13287-F		SA13287-F		SA13287-F		SA13287-G					
Date Sampled	26-Apr-10		22-Apr-10		22-Apr-10		22-Apr-10		22-Apr-10		26-Apr-10					
Sample Location	70m transect, true left bank		90m transect, true right bank		90m transect, middle of stream bed		90m transect, true left bank		110m transect, true right bank		110m transect, middle of stream bed					
Result type	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*				
Chromium	30	0	36	0	35	0	31	0	28	0	29	0	80	370		
Copper	2	0	16	0	5	0	4	0	0	0	3	0	65	270		
Zinc	57	61	83	73	60	46	61	33	45	26	58	44	200	410		
Lead	22	0	51	23	24	16	25	16	12	14	12	0	50	220		
Moisture content (%)	6.2		12.8		4.2		6.8		3.3		3.8		NA	NA		
Moisture correction	1.07		1.15		1.04		1.07		1.03		1.04		NA	NA		

All units mg/kg dry weight
Bold - exceeds the ANZECC Sediment Guidelines
1 ANZECC, 2000. National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.
Values taken from Table 3.5.1
A Exceeds ISQG-Low
B Exceeds ISQG-High
* XRF values have been corrected for moisture



Appendix E - Cell M Validation Sediment Sample Laboratory Results Compared with Corrected portable XRF results and ANZECC Sediment Quality Guideliness

		Validation Sample Details and Analytical Results																								
URS Sample Reference	M/10R		M/10M		M/10ML		M/10L		M/30R		M/30M		M/30L		M/50R		M/50M		M/50L		M/70R		M/70M		ANZECC Sediment Quality Guidelines ¹	
Laboratory Sample Reference	SA13287-G		SA13287-G		SA13287-G		SA13347-A		SA13287-H		SA13287-H		SA13287-H		SA13287-H		SA13287-H		SA13287-H				SA13347-A			
Date Sampled	26-Apr-10		26-Apr-10		26-Apr-10		3-May-10		30-Apr-10		30-Apr-10		30-Apr-10		30-Apr-10		30-Apr-10		30-Apr-10				3-May-10			
Sample Location	10m transect, true right bank		10m transect, middle of stream bed		10m transect, middle/left of stream bed		10m transect, true left bank		30m transect, true right bank		30m transect, middle of stream bed		30m transect, true left bank		50m transect, true right bank		50m transect, middle of stream bed		50m transect, true left bank		70m transect, true right bank		70m transect, middle of stream bed		ISQG-Low	ISQG-High
Result type	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Validation sample not collected as sample point was located on top of ch280 sewer crossing concrete slab	Lab	XRF*	80	370	
Chromium	34	0	44	0	31	0	33	0	33	0	32	0	35	0	33	0	31	0	29	0		30	0			
Copper	34	0	12	0	3	0	4	0	4	0	3	0	6	0	2	0	1	0	2	0		3	0			
Zinc	48	23	136	106	72	48	70	50	58	63	58	51	76	54	50	41	55	45	48	31		60	39			
Lead	13	0	98	76	12	0	13	0	16	16	22	0	58	62	14	15	22	0	13	0		79	18			
Moisture content (%)	4.7		5.5		3.2		10.4		8.8		4.6		5.2		3.9		6.8		4.5			10.3		NA	NA	
Moisture correction	1.05		1.06		1.03		1.12		1.10		1.05		1.05		1.04		1.07		1.05		1.11		NA	NA		

Validation Sample Details and Analytical Results																							
URS Sample Reference	M/70L		M/90R		M/90M		M/90L		M/110R		M/110M		M/110L		M/130R		M/130M		M/130L		ANZECC Sediment Quality Guidelines ¹		
Laboratory Sample Reference	SA13347-A-2		SA13287-H		SA13287-H		SA13287-H		SA13287-F		SA13287-F		SA13287-F		SA13287-F		SA13287-F		SA13287-F				
Date Sampled	4-May-10		30-Apr-10		30-Apr-10		30-Apr-10		22-Apr-10		22-Apr-10		22-Apr-10		22-Apr-10		22-Apr-10		22-Apr-10				
Sample Location	70m transect, true left bank		90m transect, true right bank		90m transect, middle of stream bed		90m transect, true left bank		110m transect, true right bank		110m transect, middle of stream bed		110m transect, true left bank		130m transect, true right bank		130m transect, middle of stream bed		130m transect, true left bank		Left blank for formatting purposes	ISQG-Low	ISQG-High
Result type	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*	Lab	XRF*		80	370
Chromium	33	0	35	0	33	0	36	0	37	0	40	0	47	0	42	0	38	0	37	0		65	270
Copper	3	0	3	0	3	0	3	0	4	0	5	0	10	0	6	0	6	0	4	0		200	410
Zinc	61	35	56	48	55	29	64	67	56	40	65	51	77	63	59	37	59	44	58	46		50	220
Lead	25	24	18	0	15	0	23	16	18	0	26	23	41	45	19	20	18	18	18	15			
Moisture content (%)	6.7		18.6		16.5		14.6		16.5		6.2		21.7		20.6		4.0		6.3		NA	NA	
Moisture correction	1.07		1.23		1.20		1.17		1.20		1.07		1.28		1.26		1.04		1.07		NA	NA	

All units mg/kg dry weight
Bold - exceeds the ANZECC Sediment Guidelines
1 ANZECC, 2000. National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.
Values taken from Table 3.5.1
A Exceeds ISQG-Low
B Exceeds ISQG-High
* XRF values have been corrected for moisture



URS New Zealand Limited
Lambton House, 160 Lambton Quay
Wellington 6011
PO Box 3367, Wellington 6140
New Zealand
T: 64 4 496 3750
F: 64 4 496 3755

www.urscorp.co.nz

