Duplicate									
Organochlorine Pesticides				Result 1	Result 2	RPD			
Chlordanes - Total	M14-Se10807	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
4.4'-DDD	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDE	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDT	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
a-BHC	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Aldrin	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
b-BHC	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
d-BHC	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Dieldrin	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan I	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan II	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan sulphate	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin aldehyde	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin ketone	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
g-BHC (Lindane)	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor epoxide	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Hexachlorobenzene	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Methoxychlor	M14-Se10807	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Toxaphene	M14-Se10807	CP	mg/kg	< 1	< 1	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs

Authorised By

Tammy Lakeland	Client Services
Carroll Lee	Senior Analyst-Volatile (VIC)
Emily Rosenberg	Senior Analyst-Metal (VIC)
Huong Le	Senior Analyst-Inorganic (VIC)
Stacey Jenkins	Senior Analyst-Organic (VIC)

Glenn Jackson
Laboratory Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

DATE: 18/09/2014

JOB NUMBER: J004867

Reference No: ID004867

PRECISE
CONSULTING & LABORATORY

Coffey Geotechnics (NZ) Ltd

131 Wrights Road

Addington

Christchurch, 8024

Client Reference: GENZCHRI15611AA / PO# GEOT-10107

Dear Anne Hellie,

Re: Asbestos Identification Analysis – Mandeville Plan Change

Two (2) samples were received on Tuesday, 16th September 2014 by Laura Viney.

The results of fibre analysis were performed by Lyeta Payet of Precise Consulting and Laboratory Ltd.

The samples were stated to be from Mandeville Plan Change.

Sample analysis was performed using polarised light microscopy with dispersion staining in accordance with Precise Consulting and laboratory test method: *LAB0002 'Asbestos Identification Analysis'* and following the guidelines of *AS4964-2004 Method for the qualitative identification of asbestos in bulk samples.*

The results of the fibre analysis are presented in the appended table.

Should you require further information please contact Lyeta Payet.

Yours sincerely,

LYETA PAYET

PRECISE LABORATORY IDENTIFIER

Precise Consulting & Laboratory Limited
Unit 5 / 161 Waltham Rd, Sydenham Christchurch City, 8023
P: (03) 943 5394 W: www.preciseconsulting.co.nz

Sample Analysis Results

PRECISE
CONSULTING & LABORATORY

Reference No: ID004867

Thursday, 18th September 2014

Site Address: Mandeville Plan Change			
Sample ID	**Client Sample Number**	**Sample Location/Description/Dimensions**	**Analysis Results**
ID004867.1	S5	Non-homogenous Soil 181.16g	**Chrysotile (White Asbestos)** **Crocidolite (Blue Asbestos)** Organic Fibres
ID004867.2	S6	Non-homogenous Soil 324.75g	No Asbestos Detected Organic Fibres

Note 1: The reporting limit for this analysis is 0.1g/kg (0.01%) by application of polarised light microscopy, dispersion staining and trace analysis techniques.

Note 2: If mineral fibres of unknown type detected (UMF), by PLM and dispersion staining, these may or may not be asbestos fibres. To confirm the identity of this fibre, another independent analytical technique such as XRD analysis is advised.

Note 3: The samples in this report as reported "as received" and Precise Consulting does not take responsibility for the sampling procedure or accuracy of sample location description as these have been provided by the client.

Note 4: Non-homogenous soil samples < 30g may or may not be representative of the overall site. This is at the discretion of the client.

Identified by

Lyeta Payet (BSc (EnvSci))
Approved Identifier

Reviewed by

Tim Trembath (BSc (Hons))
Key Technical Person

Precise Consulting & Laboratory Limited
Unit 5 / 161 Waltham Rd, Sydenham Christchurch City, 8023
P: (03) 943 5394 W: www.preciseconsulting.co.nz

IANZ ACCREDITED LABORATORY
All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

Appendix F – ECan LLUR Statements

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha

Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

P. 03 365 3828
F. 03 365 3194
E. ecinfo@ecan.govt.nz

www.ecan.govt.nz

Dear Sir/Madam

Thank you for submitting your property enquiry in regards to our Listed Land Use Register (LLUR) which holds information about sites that have been used, or are currently used for activities which have the potential to have caused contamination.

The LLUR statement provided indicates the location of the land parcel(s) you enquired about and provides information regarding any LLUR sites within a radius specified in the statement of this land.

Please note that if a property is not currently entered on the LLUR, it does not mean that an activity with the potential to cause contamination has never occurred, or is not currently occurring there. The LLUR is not complete, and new sites are regularly being added as we receive information and conduct our own investigations into current and historic land uses.

The LLUR only contains information held by Environment Canterbury in relation to contaminated or potentially contaminated land; other information relevant to potential contamination may be held in other files (for example consent and enforcement files).

If your enquiry relates to a farm property, please note that many current and past activities undertaken on farms may not be listed on the LLUR. Activities such as the storage, formulation and disposal of pesticides, offal pits, foot rot troughs, animal dips and underground or above ground fuel tanks have the potential to cause contamination.

Please contact and Environment Canterbury Contaminated Sites Officer if you wish to discuss the contents of the LLUR statement, or if you require additional information.
For any other information regarding this land please contact Environment Canterbury Customer Services.

Yours sincerely

Contaminated Sites Team

Property Statement
from the Listed Land Use Register

Visit www.ecan.govt.nz/HAIL for more information about land uses.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

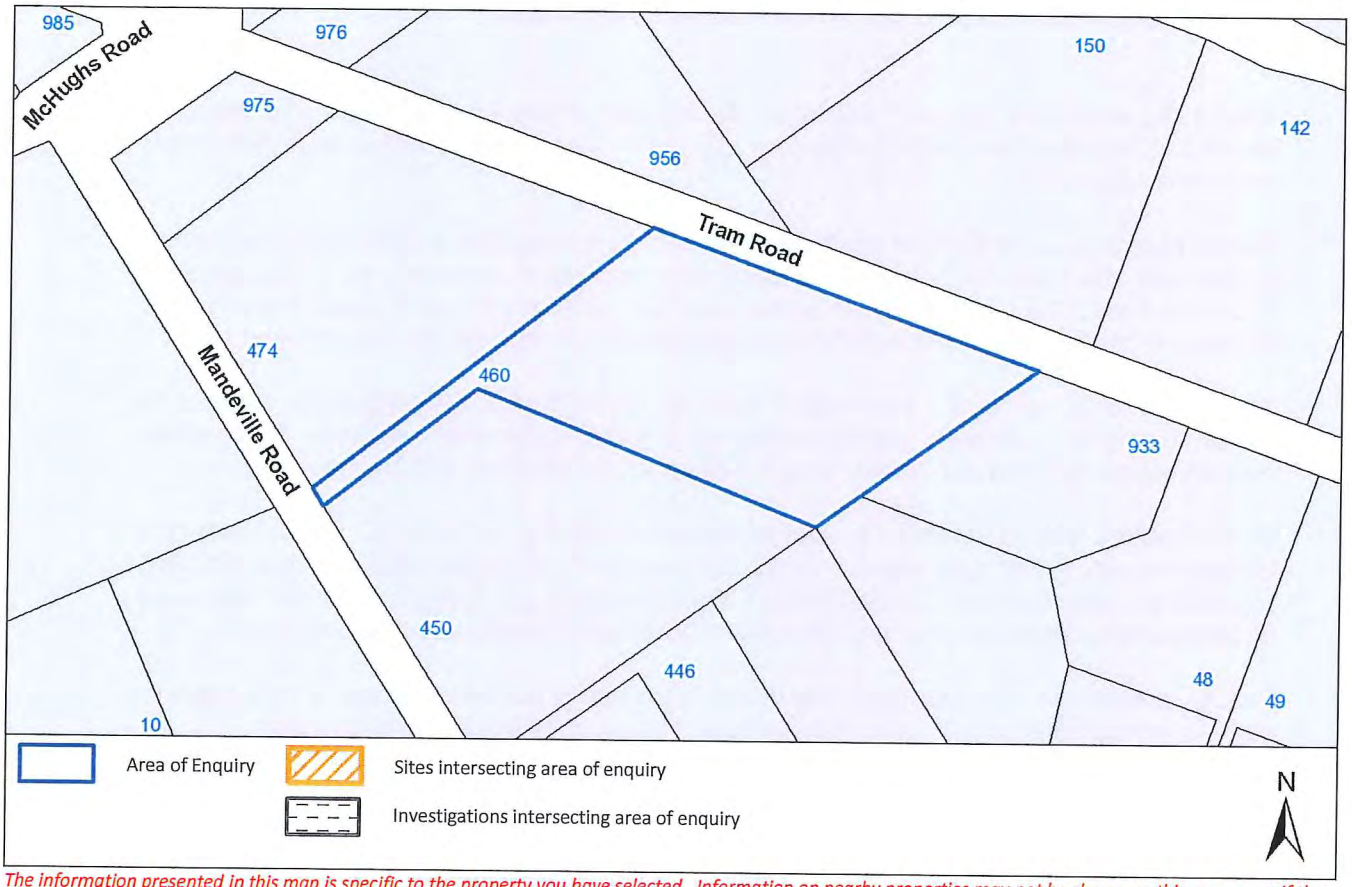
Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

P. 03 365 3828
F. 03 365 3194
E. ecinfo@ecan.govt.nz

www.ecan.govt.nz

Date:	19 September 2014
Land Parcels:	Lot 2 DP 312522 Valuation No(s): 2174043201



The information presented in this map is specific to the property you have selected. Information on nearby properties may not be shown on this map, even if the property is visible.

Summary of sites:

There are no sites associated with the area of enquiry.

Information held about the sites on the Listed Land Use Register

There are no sites associated with the area of enquiry.

Information held about other investigations on the Listed Land Use Register

There are no investigations associated with the area of enquiry.

For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ69250.

Our Ref: ENQ69250
Produced by: LLUR Public 19/09/2014 11:43:12 a.m.

Disclaimer:

The enclosed information is derived from Environment Canterbury's Listed Land Use Register and is made available to you under the Local Government Official Information and Meetings Act 1987 and Environment Canterbury's Contaminated Land Information Management Strategy (ECan 2009).

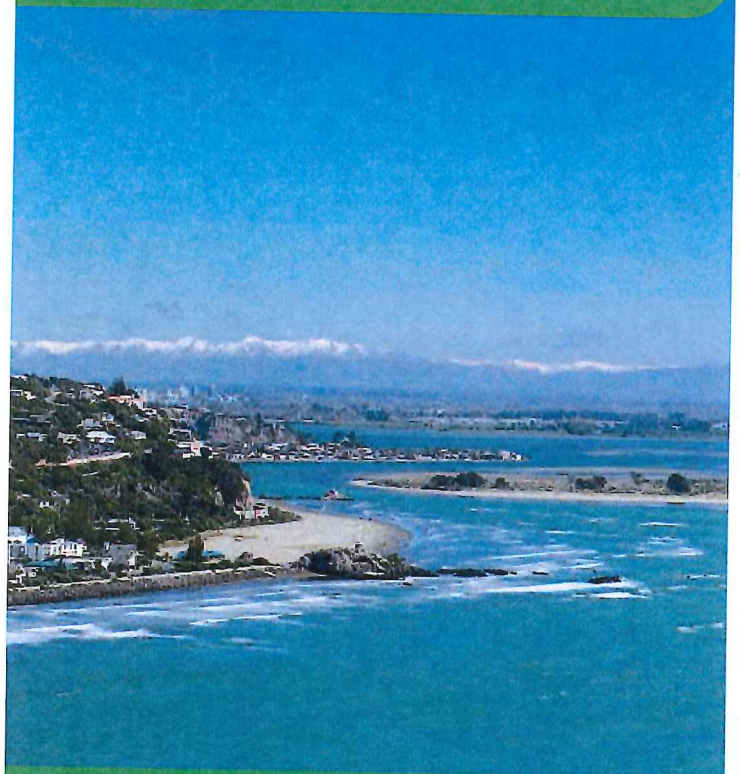
The information contained in this report reflects the current records held by Environment Canterbury regarding the activities undertaken on the site, its possible contamination and based on that information, the categorisation of the site. Environment Canterbury has not verified the accuracy or completeness of this information. It is released only as a copy of Environment Canterbury's records and is not intended to provide a full, complete or totally accurate assessment of the site. It is provided on the basis that Environment Canterbury makes no warranty or representation regarding the reliability, accuracy or completeness of the information provided or the level of contamination (if any) at the relevant site or that the site is suitable or otherwise for any particular purpose. Environment Canterbury accepts no responsibility for any loss, cost, damage or expense any person may incur as a result of the use, reference to or reliance on the information contained in this report.

Any person receiving and using this information is bound by the provisions of the Privacy Act 1993.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Listed Land Use Register

What you need to know



Everything is connected

What is the Listed Land Use Register (LLUR)?

The LLUR is a database that Environment Canterbury uses to manage information about land that is, or has been, associated with the use, storage or disposal of hazardous substances.

Why do we need the LLUR?

Some activities and industries are hazardous and can potentially contaminate land or water. We need the LLUR to help us manage information about land which could pose a risk to your health and the environment because of its current or former land use.

Section 30 of the Resource Management Act (RMA, 1991) requires Environment Canterbury to investigate, identify and monitor contaminated land. To do this we follow national guidelines and use the LLUR to help us manage the information.

The information we collect also helps your local district or city council to fulfil its functions under the RMA. One of these is implementing the National Environmental Standard (NES) for Assessing and Managing Contaminants in Soil, which came into effect on 1 January 2012.

For information on the NES, contact your city or district council.

How does Environment Canterbury identify sites to be included on the LLUR?

We identify sites to be included on the LLUR based on a list of land uses produced by the Ministry for the Environment (MfE). This is called the Hazardous Activities and Industries List (HAIL)[1]. The HAIL has 53 different activities, and includes land uses such as fuel storage sites, orchards, timber treatment yards, landfills, sheep dips and any other activities where hazardous substances could cause land and water contamination.

We have two main ways of identifying HAIL sites:

- We are actively identifying sites in each district using historic records and aerial photographs. This project started in 2008 and is ongoing.
- We also receive information from other sources, such as environmental site investigation reports submitted to us as a requirement of the Regional Plan, and in resource consent applications.

[1]The Hazardous Activities and Industries List (HAIL) can be downloaded from MfE's website www.mfe.govt.nz, keyword search HAIL

How does Environment Canterbury classify sites on the LLUR?

Where we have identified a HAIL land use, we review all the available information, which may include investigation reports if we have them. We then assign the site a category on the LLUR. The category is intended to best describe what we know about the land use and potential contamination at the site and is signed off by a senior staff member.

Please refer to the Site Categories and Definitions factsheet for further information.

What does Environment Canterbury do with the information on the LLUR?

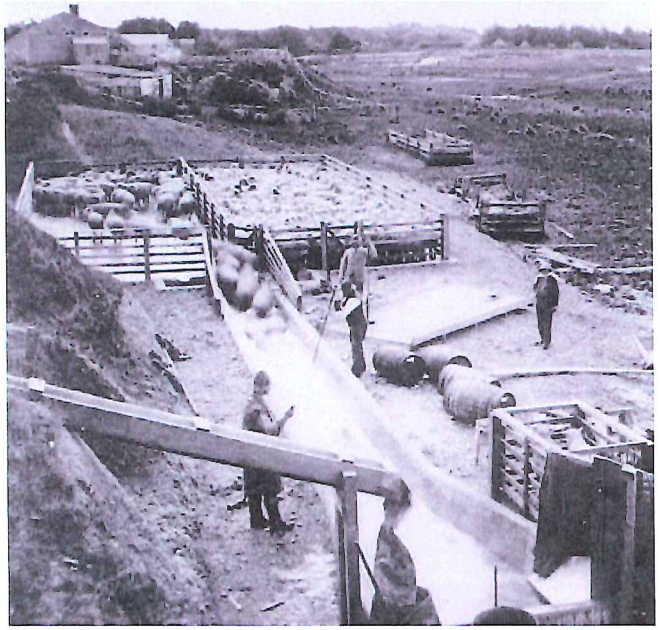
The LLUR is available online at www.llur.ecan.govt.nz. We mainly receive enquiries from potential property buyers and environmental consultants or engineers working on sites. An inquirer would typically receive a summary of any information we hold, including the category assigned to the site and a list of any investigation reports.

We may also use the information to prioritise sites for further investigation, remediation and management, to aid with planning, and to help assess resource consent applications. These are some of our other responsibilities under the RMA.

If you are conducting an environmental investigation or removing an underground storage tank at your property, you will need to comply with the rules in the Regional Plan and send us a copy of the report. This means we can keep our records accurate and up-to-date, and we can assign your property an appropriate category on the LLUR. To find out more, visit www.ecan.govt.nz/HAIL.

IMPORTANT!

The LLUR is an online database which we are continually updating. A property may not currently be registered on the LLUR, but this does not necessarily mean that it hasn't had a HAIL use in the past.



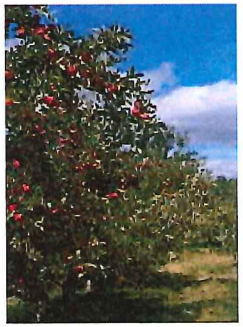
Sheep dipping (ABOVE) and gas works (TOP) are among the former land uses that have been identified as potentially hazardous. (Photo above by Wheeler & Son in 1987, courtesy of Canterbury Museum.)

My land is on the LLUR – what should I do now?

IMPORTANT! Just because your property has a land use that is deemed hazardous or is on the LLUR, it doesn't necessarily mean it's contaminated. The only way to know if land is contaminated is by carrying out a detailed site investigation, which involves collecting and testing soil samples.

You do not need to do anything if your land is on the LLUR and you have no plans to alter it in any way. It is important that you let a tenant or buyer know your land is on the Listed Land Use Register if you intend to rent or sell your property. If you are not sure what you need to tell the other party, you should seek legal advice.

You may choose to have your property further investigated for your own peace of mind, or because you want to do one of the activities covered by the National Environmental Standard for Assessing and Managing Contaminants in Soil. Your district or city council will provide further information.



If you wish to engage a suitably qualified experienced practitioner to undertake a detailed site investigation, there are criteria for choosing a practitioner on www.ecan.govt.nz/HAIL.

I think my site category is incorrect – how can I change it?

If you have an environmental investigation undertaken at your site, you must send us the report and we will review the LLUR category based on the information you provide. Similarly, if you have information that clearly shows your site has not been associated with HAIL activities (eg. a preliminary site investigation), or if other HAIL activities have occurred which we have not listed, we need to know about it so that our records are accurate.

If we have incorrectly identified that a HAIL activity has occurred at a site, it will be not be removed from the LLUR but categorised as Verified Non-HAIL. This helps us to ensure that the same site is not re-identified in the future.

Contact us

Property owners have the right to look at all the information Environment Canterbury holds about their properties.

It is free to check the information on the LLUR, online at www.llur.ecan.govt.nz.

If you don't have access to the internet, you can enquire about a specific site by phoning us on (03) 353 9007 or toll free on 0800 EC INFO (32 4636) during business hours.

Contact Environment Canterbury:

Email: ecinfo@ecan.govt.nz

Phone:
Calling from Christchurch: (03) 353 9007
Calling from any other area: 0800 EC INFO (32 4636)

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Everything is connected

Promoting quality of life through balanced resource management.

www.ecan.govt.nz E13/101

131 Wrights Road, Addington
Christchurch
8024 New Zealand

t: +64 3 374 9600

coffey.com

Waimakariri District Council
Private Bag 1005
Rangiora 7440

19 November 2014

Attention: Matthew Bacon

Dear Matthew

RE: Addendum - Environmental Site Assessment for Plan Change for Mandeville North

Coffey have presented the findings of an Environmental Site Assessment carried out to support the proposed Mandeville North land use change for properties at 975 Tram Road, and 450, 460 and 474 Mandeville Road from 'Rural' to 'Rural-residential' and 'Business' land use in report reference GENZCHRI15611AA, dated 31 October 2014. The environmental assessment comprised a desk top review, site walkover inspection and collection of soil samples.

Waimakariri District Council (WDC) have requested that Coffey comment with regards to the likely appropriateness of the existing testing applying to an adjacent site at 933 Tram Road, Ohoka.

Coffey have reviewed a CH2M Beca Ltd Detailed Site Investigation report on this adjacent site, reference 6518788//NZ1-7781692-6 0.6, dated 13 August 2013. Coffey concur with the recommendations of this report based on the data contained within the report, when written. However Coffey have neither carried out a site walkover inspection nor collected, analysed and reported on soil samples for this site.

Yours sincerely

Ramon Scoble
Associate Environmental Consultant/Team Leader

coffey

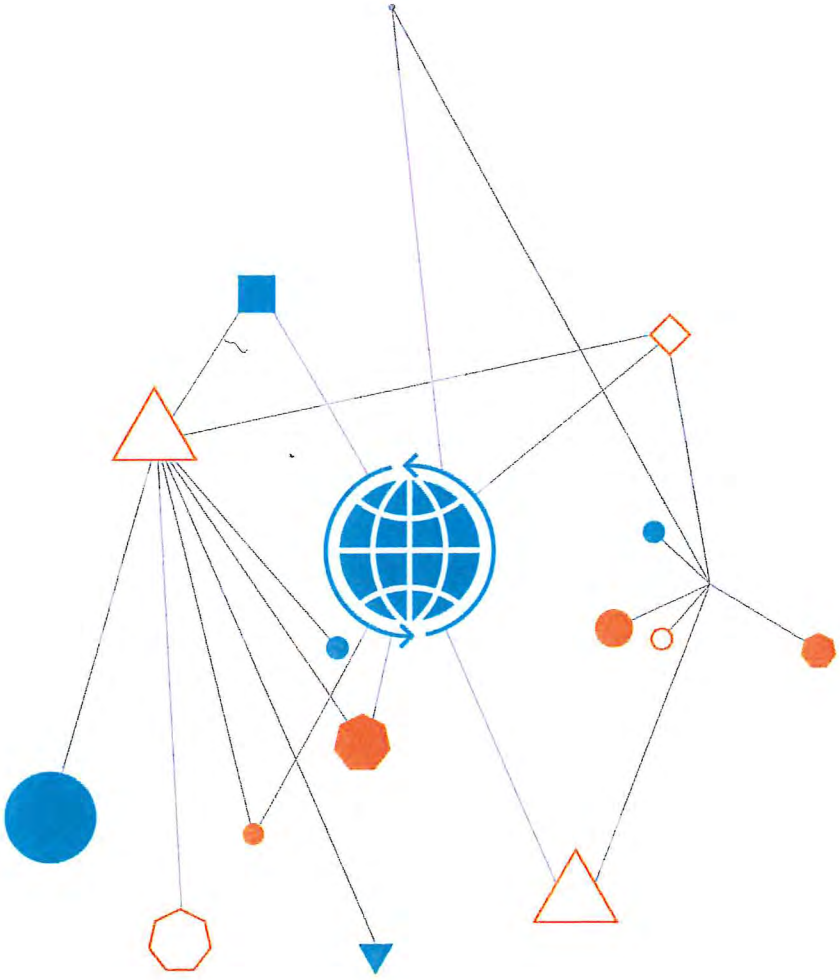
Waimakariri District Council

Mandeville North Plan Change

Geotechnical Assessment

7 January 2015

WAIMAKARIRI DISTRICT COUNCIL



When you think with a global mind problems get smaller

131 Wrights Road
Addington, Christchurch
PO Box 1872
Christchurch 8140 New Zealand
t: +64 3 374 9600
f: +64 3 374 9601
coffey.com

7 January 2015

Waimakariri District Council
Private Bag 1005
Rangiora 7440

Dear Matthew

Coffey Project No: GENZCHRI15611AA

GEOTECHNICAL ASSESSMENT REPORT FOR THE MANDEVILLE NORTH PLAN CHANGE

Please find attached our geotechnical report presenting the findings of our geotechnical investigation for the approximately 6.8ha area of land known as Mandeville North to confirm the suitability of the site for a land-use change from rural to rural residential and business land use.

Our investigation and reporting has been conducted in accordance with our proposal, dated 11 October 2013.

If you have queries or you require further clarification on any aspects of this report, please contact the undersigned.

For and on behalf of Coffey

M Herry Haryono
MEng (MT) MIEAust MIPENZ CPEng IntPE(NZ)
Geotechnical Engineer

Mandeville North Plan Change

Prepared for
Waimakariri District Council

Prepared by
Coffey Geotechnics (NZ) Ltd
131 Wrights Road, Addington
Christchurch 8024 New Zealand
t: +64 3 374 9600 f: +64 3 374 9601

7 January 2015

GENZCHRI15611AA

Quality information

Revision history

Revision	Description	Date	Originator	Reviewer	Approver
V3	Final	20/11/2014	B.R	A.G	C.A.A
V4	Final – minor amendment requested by WDC	07/01/2015	B.R	D.A.S	M.F.H

Distribution

Report Status	No. of copies	Format	Distributed to	Date
Final	1	PDF	Matthew Bacon	20/11/2014
Final	1	PDF	Matthew Bacon	07/01/2015

Table of contents

Tables

Figures

Appendices

1. Introduction

Coffey Geotechnics (NZ) Limited (Coffey) has been commissioned by Waimakariri District Council (WDC) to carry out a combined geotechnical and environmental investigation for the Mandeville North Plan Change area. This report comprises the geotechnical element of the reporting and should be read in conjunction with our environmental site assessment (ESA) report dated 7 January 2015[1].

The purpose of our work was to evaluate the ground conditions and provide a high level geotechnical characterisation of the site; assess if any geotechnical hazards are present in accordance with S106 of the Resource Management Act (RMA) and comment on the suitability of the site for a land-use change from "Rural" to "Rural Residential 4A" and "Business". The business zone will be new zoning specific to the site and will be approximately 6500m^2 in area[2]. In accordance with the Waimakariri District Plan[3], the characteristics for Residential 4A include the following:

- Predominant activity is living;
- Detached dwellings and associated buildings;
- Some limited farming and horticulture;
- Dwelling density is lowest for Residential Zones;
- Dwelling in generous settings;
- Average lot size of 0.5 hectare (ha);
- Limited number of lots located in rural environment;
- Rural style roads and access ways;
- Opportunity for a rural outlook from within the zone;
- Few vehicle movements within the zone;
- Access to zones not from arterial roads;
- Community water and/or sewerage schemes; and
- Limited kerb, channelling and street lighting.

Our report combines the findings of our desktop study, site walkover assessment and results of the subsurface investigation. The scope of our investigations and reporting has been undertaken in line with the current Ministry of Business, Innovation and Employment[4] (MBIE) requirements. This report is considered appropriate to accompany a Plan Change application.

---

[1] Environmental Site Assessment, Plan Change for Mandeville North, Canterbury, GENZCHRI15611AA, V2 Final, 7 January 2015.

[2] Emails received from Resource Management Planner for Waimakariri District Council Matthew Bacon on 2 and 9 October 2013.

[3] Waimakariri District Plan, 9 December 2013 accessed via http://www.waimakariri.govt.nz/Libraries/District_Plan/17_Residential_Zones.sflb.ashx

[4] Ministry of Business, Innovation and Employment, 2012: Repairing and rebuilding houses affected by the Canterbury earthquakes, December 2012. Particular reference to Part D: Guidelines for the geotechnical investigation and assessment of subdivisions in the Canterbury region.

2. Scope of works

The geotechnical scope of the work was to:

- Undertake a desktop study to review geological maps, EQC maps, GNS maps; EQC boreholes/ Piezocone Cone Penetrometer Tests (CPTs), ECan boreholes; and post-earthquake aerial photographs (if any).
- Undertake a site walkover to understand surface ground conditions and scope suitable testing locations.
- Characterise the site using shallow excavator inspection pits.
- Confirm the suitability of the land for Rural Residential 4A and Business development and provide recommendations on the type of ground-works/ foundations needed for the intended use.
- Assess potential geotechnical hazards and comment on RMA S106 Natural Hazards.
- Report in line with current MBIE requirements.

3. Existing information

For the purpose of this investigation reference have been made to soil sampling test pits carried out by CH2M Beca as part of the Ohoka Meadows and Mandeville Waste Water Treatment Plant (WWTP) site investigation across 933 Tram Road[5]. Extracts from the CH2M Beca report are included in Appendix A showing the soil sampling locations and the corresponding engineer's logs. In addition, the approximate outline of the investigation area is shown on Figure 2.

A review of the ECan online Geographic Information System (GIS)[6] was undertaken to identify borehole or well records within the site area. According to the records a total of 3 wells[7] (M35/17875, M35/6817 and M35/4680) are shown within the boundaries of the site however none include reports of strata encountered during drilling of the holes. However, several wells[8] within 250m of the site do include strata records and have been referred to under Section 6.1 of the report and included in Appendix B of the report.

---

[5] Received by email on 9 September 2014 from Gavin Bennett the homeowner of 460 Mandeville Road. Report 933 Tram Road, Ohoka – Detailed Site Investigation (Contamination), dated 13 August 2013. Reported by CH2M Beca for Waimakariri District Council (Job No. 6518788).

[6] http://canterburymaps.govt.nz/AdvancedViewer/

[7] M35/17875 on 450 Mandeville Road, M35/6817 on 460 Mandeville Road and M35/4680 on 474 Mandeville Road.

[8] Borehole records: M35/9398, M35/9876, M35/9184, M35/ 9741 and M35/11107.

4. Site description

The site is located on the corner of McHughs, Mandeville and Tram Roads in Mandeville North which is situated approximately 10km west of Kaiapoi (refer to Figure 1).

The original Council plan change site covers an area of approximately 6.5ha and includes the following properties[2]:

- 450 Mandeville Road (Lot 3, DP312522)
- 460 Mandeville Road (Lot 2, DP312522)
- 474 Mandeville Road (Lot 1, DP312522)
- 975 Tram Road (RES4924)

It is these properties that our proposal dated 11 October 2013 was based on and formed the basis of our investigation area (refer to "orange" shaded area on Figure 2).

Council has since added a portion (approximately 0.3ha) of 933 Tram Road (Lot 31 DP77464) into the plan change area, which is situated adjacent to 460 Mandeville Road[9] (refer to "red" shaded area on Figure 2).

The site is largely occupied by open paddocks with three residential dwellings located along Mandeville Road. A former sewage waste water treatment plant is located at 933 Tram Road, and the corner of Tram, McHughs and Mandeville Roads is identified as a Council Reserve which is currently occupied by a forestry plantation.

Figure 1: Site location plan (scale as shown)[10]

[9] Emails received from Resource Management Planner for Waimakariri District Council Matthew Bacon on 7 November 2014.

5. Performance of the site

5.1. Site walkover assessment

During our site walkover assessment on 5 September 2014 no evidence of liquefaction-induced ground deformation was observed on the site resulting from the Canterbury earthquake sequence; no sand boils, ground undulations or ground cracks associated with lateral spreading were observed. Buildings showed no apparent signs of earthquake-induced damage.

5.2. Ground motion

Using inferred Peak Ground Accelerations (PGAs) for the site (based on the mapped estimated PGAs available through the Canterbury Geotechnical Database[11]), and the MBIE[4] and Bradley & Hughes (2012)[12] procedure, it is considered unlikely that the site has been "sufficiently tested" to the Serviceability Limit State (SLS) level of earthquake demand during the Canterbury earthquake sequence.

6. Ground conditions

6.1. Existing geotechnical information

The Kaiapoi geological map[13] indicates that surface geology consists of "*Older post – glacial fluviatile gravel, sand and silt deposits*" of the Halkett Member of the Springston Formation.

Available ECan borehole records conducted within approximately 250m of the site confirm the presence of the gravel in the site area and indicate gravel from approximately ground surface level to approximately 25m depth (refer to Appendix B for borehole records: M35/9184, M35/9398, M35/9741, M35/9876 and M35/11107).

No geotechnical data available through the Canterbury Geotechnical Database is available within the vicinity of the site.

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[10] Aerial imaging sourced from Google Earth retrieved 19 September 2014.
[11] Canterbury Geotechnical Database (2013) "Conditional PGA for Liquefaction Assessment", Map Layer CGD5110 - 21 Feb 2013, retrieved September 2014 from https://canterburygeotechnicaldatabase.projectorbit.com/
[12] Bradley & Hughes (2012) *Conditional Peak Ground Accelerations in the Canterbury Earthquakes for Conventional Liquefaction Assessment.* Report for DBH (MBIE), April 2012.
[13] Brown, L.J., 1973, Sheet S76 (1st Edition) Kaiapoi, Geological Map of New Zealand, 1:63 360 (scale is inches to miles).

6.2. Ground investigation

The scope of Coffey's shallow ground investigations at the site satisfies the advised testing method and density of MBIE Guidance Appendix D[4] and comprised eleven excavator inspection pits (IP01 to IP11) to depths of 3.3 to 5.0m below ground level (bgl). Dynamic Cone Penetrometer (DCP) tests were performed adjacent to the inspection pits to refusal depths of 0.5 to 0.8m bgl to assist in the assessment of relative densities of the soil profile and depth to competent material.

Test locations are shown on Figure 2 and the field test results are attached in Appendix C for reference.

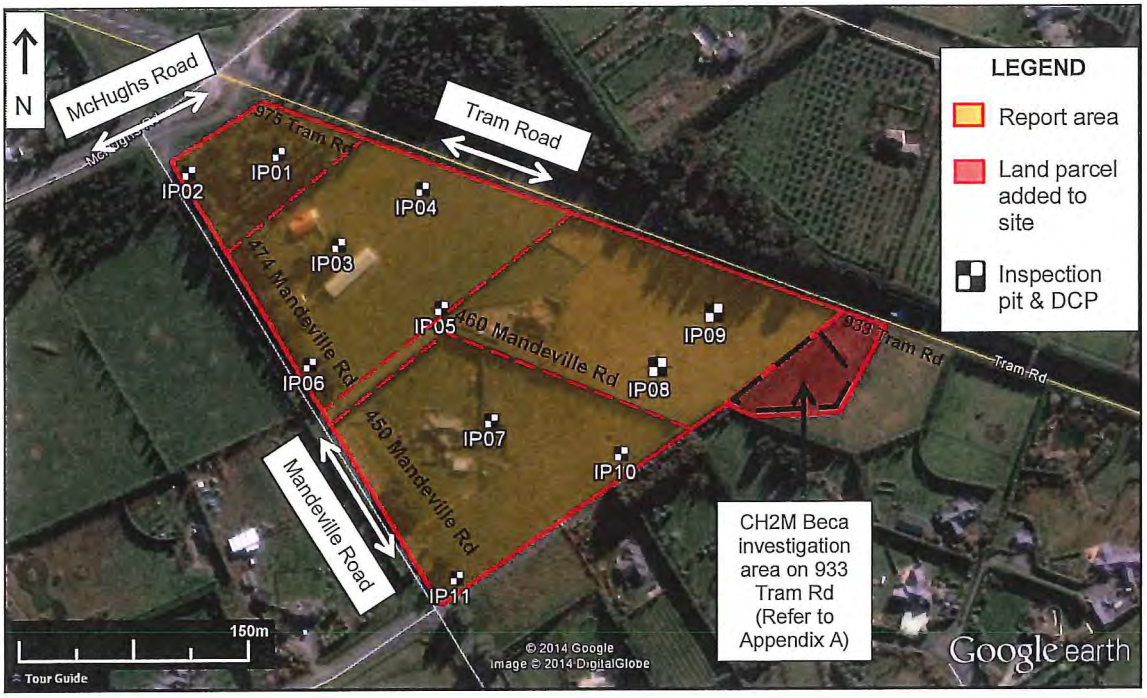

Figure 2: Testing location plan (scale as shown)

6.3. Ground conditions

The ground conditions are relatively consistent between the test locations across the site.

The inspection pit results indicate that silty topsoil was encountered across the site to a maximum depth of 0.3m bgl. No fill material was encountered at any of the inspection pit positions. It is noted that CH2M Beca's three test pits in the vicinity of the former sewage waste water treatment plant on 933 Tram Road (TP110, TP111 and TP112[5]) recorded gravelly fill up to 3.4m bgl.

Below the topsoil the site is largely underlain by silty sandy gravel to sandy gravel. The DCP test results indicate the gravels are generally "medium dense to dense" in the upper 0.6m of the soil profile, thereafter the relative density of the gravel has been inferred as "very dense" based on visual observation during the excavation of the inspection pits.

The ground investigations confirmed that the site conditions are generally consistent with the published geological information and the results of the CH2M Beca site investigation across 933 Tram Road. The general soil profile encountered is summarised in Table 1.

Table 1: Ground conditions summary table

New Zealand Geotechnical Society (NZGS) soil and strength description	Origin	Approx. depth range to bottom of layer (m bgl)	Approx. range of layer thickness (m)
SILT: non plastic to low plasticity, dark brown with some fine to coarse grained sand and minor gravel.	Topsoil	0.1 – 0.3	0.1 – 0.3
Sandy GRAVEL: fine to coarse grained, sub-rounded, pale brown to brown-grey, sand is fine to coarse grained. Medium dense to dense. Contains minor to some cobbles. Contains silt in the upper 0.3 to 1.0m (not present in IP01 and IP02).	Springston Formation	Proven to 5.0	3.1 – 4.8 (proven thickness)

Coffey's ESA report[1] describes imported soil, and building material rubbish at surface level can be found at 450 and 474 Mandeville Road properties. Refer to that report for full details.

6.4. Groundwater regime

We reviewed EQC event-specific groundwater surface depths and GNS Science median groundwater surface elevations but Mandeville North is outside these groundwater study areas. Similarly, the site is outside the groundwater maps included in the Brown & Weeber memoirs.

Groundwater levels recorded during the shallow ground investigation (IP01 – IP11) indicate that at the time of excavation (10 and 11 September 2014) groundwater ranged from 3.9 to 4.8m bgl with an average groundwater level of 4.2m bgl.

6.5. Site subsoil class

In accordance with NZS1170.5, Section 3.1.3, a site subsoil classification of "Class D – Deep or soft soil sites" may be assumed for this site.

7. Natural hazards

7.1. Liquefaction susceptibility

The site is mapped within the ECan liquefaction assessment area map as "damaging liquefaction unlikely"[14].

No EQC aerial photography is available for the site following the Canterbury earthquake sequence; however, during our site walkover assessment in September 2014 no signs of earthquake-induced ground deformation were observed.

The soil profile underlying the site largely consists of medium dense to dense sandy gravels (proven thickness of 3.1 to 4.8m; up to 25m thickness according to ECan well records) which are soils with low susceptibility to liquefaction. The depth to groundwater during the investigation was measured at an average depth of 4.2m bgl. The thin silty topsoil mantle overlying the gravels will be well above the water table and is therefore considered to also have a low susceptibility to liquefaction.

Liquefaction is considered to pose a relatively low risk to the site.

7.2. RMA Section 106

With regard to the natural hazards included in RMA Section 106 we provide the comments below.

7.2.1. Erosion

There are no sources of erosion at the site.

7.2.2. Falling debris

There are no sources of falling debris at the site.

7.2.3. Subsidence

Subsidence that may occur due to construction on poor / soft / peat soil and earthquake-induced ground deformation (settlement) is considered unlikely at this site under normal building loads and foundation types. Assessment of ground conditions for foundation design and Building Consent application purposes should be site-specific to each building. Normal investigation practices and consenting processes should apply.

7.2.4. Slippage

There are no sources of slippage at the site.

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[14] Review of liquefaction hazard information in eastern Canterbury, including Christchurch City and parts of Selwyn, Waimakariri and Hurunui Districts, Report No. R12/83 dated December 2012, Figure 2.1.

7.2.5. Inundation

River flooding

Refer to the Wamakariri District localised flood hazard assessment[15] report to inform decisions on land use in this area.

According to the Waimakariri District Flood Hazard Management Strategy flood modelling maps[16] the site is not considered to be at risk of inundation from flooding of the Ashley River.

Tsunami

The site is situated approximately 14km from the coast, and based on Land Information New Zealand[17] topographical maps the elevation of Mandeville North is 35m above sea level. The risk to the site with regard to a tsunami hazard is therefore expected to be low. Nevertheless, it is recommended that WDC consult with institutions such as NIWA and GNS Science who respectively have prepared several recent publications for modelling coastal inundation in Canterbury from a South America tsunami[18] and prepared updates to the tsunami hazard in New Zealand[19].

Stormwater

With regard to stormwater inundation, the design and management of stormwater should be addressed as part of the subdivision design and building design processes.

7.2.6. Subsequent use

Proposed changes to the land include the development of a small retail complex of approximately 1300m^2 of retail space (under a specific land use zoning for this site). Such development is considered unlikely to accelerate, worsen, or result in material damage to the land or structures by erosion, falling debris, subsidence, slippage or inundation from any source.

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[15] Waimakariri District Localised Flood Hazard Assessment, prepared by the Project Delivery Unit, April 2014.
[16] Waimakariri District Flood Hazard Management Strategy, Ashley River Floodplain Investigation, Report No. R08/23, Tony Oliver, June 2008.
[17] www.linz.govt.nz
[18] Prepared by the New Zealand National Institute of Water & Atmospheric Research Ltd (NIWA) for Environment Canterbury, Report R11/08 dated February 2011 and Report R12/38 dated June 2012.
[19] GNS Science Consultancy Report 2013/131 dated August 2013.

8. Engineering discussion and recommendations

- Our assessment has found that no part of the site is precluded from the intended rezoning to "Residential 4A" and "Business" land-use. As the late addition land parcel across 933 Tram Road did not form part of our initial scope of works, and CH2M Beca's investigation revealed the presence of some fill in the area of the old sewage waste water treatment plant, Coffey recommends that additional inspection pits are carried out in this area during the subdivision and building design phases to confirm the ground conditions.
- No unusual ground conditions have been encountered.
- Normal ground investigation practices and subdivision / building consenting processes should apply.
- Assessment of ground conditions for foundation design and Building Consent application purposes should be site-specific to each building, as is normal practice.
- Our September 2014 investigation revealed shallow groundwater depths of 3.9 to 4.8m bgl. Taking into account expected seasonal fluctuations in water levels, for bearing capacity assessment purposes the design groundwater level across the site may vary between approximately 3.0 and 5.0m depth.
- Liquefaction and lateral spread risk are considered to be low.
- Ground improvement is unlikely to be required for normal building loads and structures.
- Building foundations for normal structures are likely to be shallow footings tied into ground-bearing reinforced concrete slabs.

9. Limitations

This report has been prepared solely for the use of our client Waimakariri District Council and their professional advisers and in relation to the specific project described herein. No liability is accepted in respect of its use for any other purpose or by any other person or entity.

The opinions, recommendations and comments given in this report result from the application of normal methods of site investigation. As factual evidence has been obtained solely from test methods that by their nature only provide information about a relatively small volume of subsoils, there may be special conditions pertaining to this site that have not been disclosed by the investigation and that have not been taken into account in the report. If variations in the subsoils occur from those described or assumed to exist, then the matter should be referred to us immediately.

Please also refer to the enclosed *Important Information about Your Coffey Report.*

10. Closure

If you have any queries or you require any further clarification on any aspects of this report, please contact the undersigned.

For and on behalf of Coffey

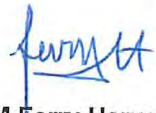
Prepared by

Bjorn Raasch
BSc (Hons)
Project Engineering Geologist

Reviewed by

David Sullivan
BSc MBA CE (Calif) MIPENZ
Principal Geotechnical Engineer

Approved by



M Ferry Haryono
MEng (MT) MIEAust MIPENZ CPEng IntPE(NZ)
Geotechnical Engineer

coffey

Important information about your Coffey Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time.

The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Important information about your Coffey Report

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way.

Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks.

If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

Rely on Coffey for additional assistance

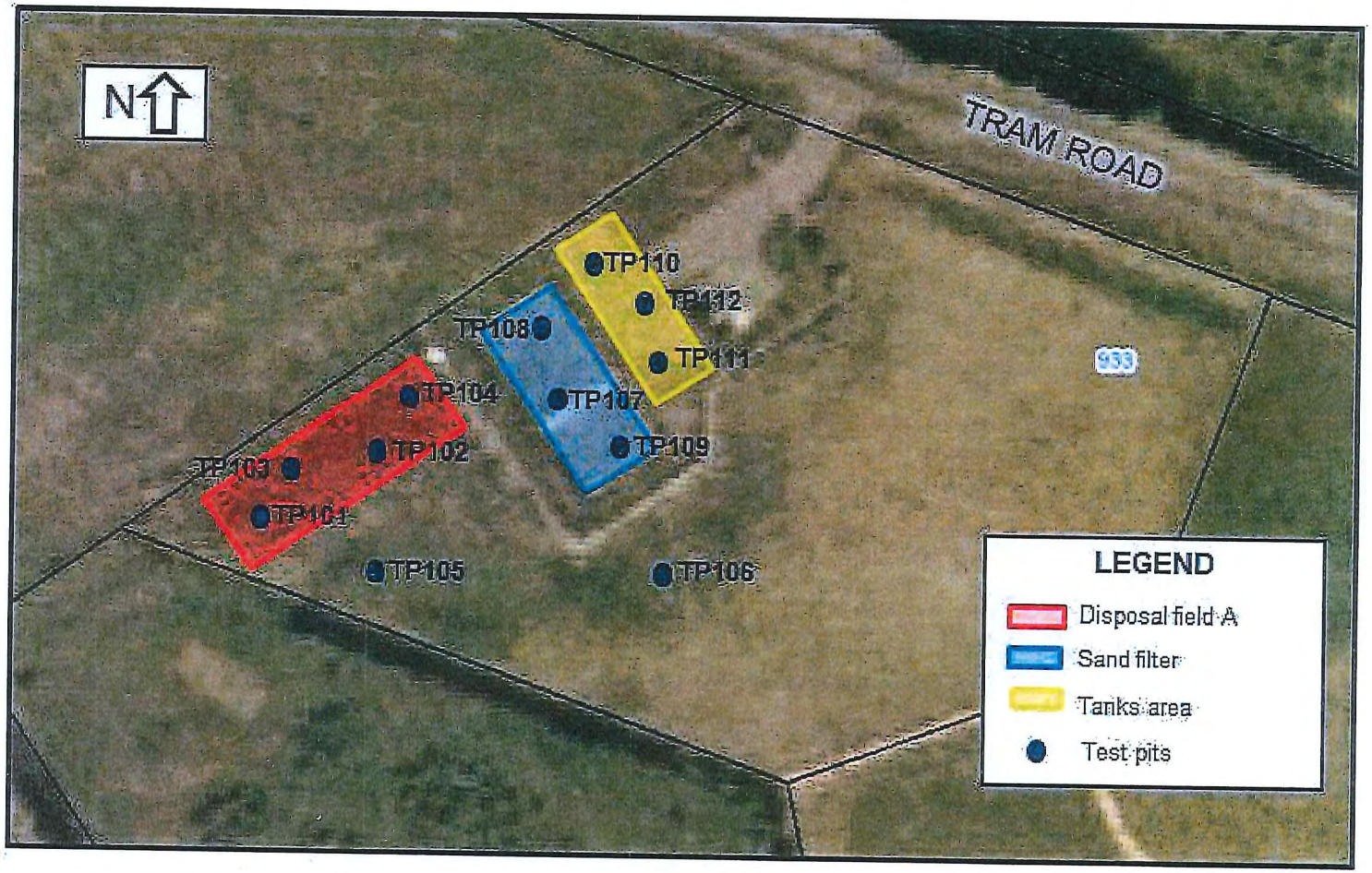
Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

Appendix A - CH2M Beca's Ohoka Meadows and Mandeville WWTP soil sampling test locations and engineer's logs (933 Tram Road)

Ohoka Meadows Wastewater Treatment Soil Sampling Locations



TEST PIT No: **TP101**

TEST PIT LOG

SHEET 1 of 1

PROJECT: Ohoka Meadows and Mandeville WWTP soil sampling — JOB NUMBER: 6518788

SITE LOCATION: — CLIENT: WDC

CIRCUIT: — TEST PIT LOCATION:

COORDINATES: N — R L:

E — DATUM:

DEPTH (m)	WATER LEVEL	GRAPHIC LOG	USCS	MOISTURE	SOIL / ROCK DESCRIPTION	GEOLOGICAL UNIT	Scala	SV	T (kPa)	SAMPLES	DEPTH (m)
			OL	M	SILT, some fine to medium sand, minor medium to coarse gravel, trace clay; dark grey; moist, low plasticity. Gravel: rounded to sub-angular. Trace rootlets..	TOPSOIL				S1	
0.5			GW	M	Fine to coarse GRAVEL, minor fine to coarse sand, trace clay; light brownish grey; moist. Gravel: rounded to sub-angular.	RIVER GRAVELS				S2	0.5
1.0										S3	1.0
					END OF LOG @ 1.1 m						
1.5											1.5
2.0											2.0
2.5											2.5
3.0											3.0
3.5											3.5

DATE EXCAVATED: 22/7/13 — CONTRACTOR: Phil (Dawe Contracting Ltd)

LOGGED BY: CJS — EQUIPMENT:

SHEAR VANE No: — METHOD:

COMMENTS:
S1 13:068 TP101 0.0-0.1m
S2 13:068 TP101 0.4-0.5m
S3 13:068 TP101 1.0-1.1m

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET — Revision 1

TEST_PIT P:\6518788\OHOKA MEADOWS DSI\GINT\OHOKAM.GPJ BECA.GDT 13/8/13

A4 Scale 1:20