MOVEMENT SUMMARY

Site: Mandeville - Base 2013 & Dev

Mandeville Intersection
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: McHughs Road											
1	L2	16	1.6	0.019	10.5	LOS B	0.1	0.5	0.38	0.86	61.9
2	T1	33	1.5	0.245	17.5	LOS C	1.0	7.1	0.65	1.01	55.8
3	R2	62	1.2	0.245	17.9	LOS C	1.0	7.1	0.65	1.01	56.2
Approach		111	1.3	0.245	16.7	LOS C	1.0	7.1	0.61	0.99	56.8
East: Tram Road											
4	L2	60	0.9	0.033	7.9	LOS A	0.0	0.0	0.00	0.66	74.2
5	T1	280	1.5	0.145	0.0	LOS A	0.0	0.0	0.00	0.00	99.9
6	R2	71	0.9	0.056	8.9	LOS A	0.2	1.6	0.24	0.60	72.4
Approach		411	1.3	0.145	2.7	NA	0.2	1.6	0.04	0.20	89.6
North: Bradley's Road											
7	L2	21	0.6	0.020	9.5	LOS A	0.1	0.5	0.23	0.87	62.9
8	T1	28	0.6	0.089	15.6	LOS C	0.3	2.4	0.60	0.97	57.5
9	R2	9	0.7	0.089	16.5	LOS C	0.3	2.4	0.60	0.97	58.2
Approach		59	0.6	0.089	13.6	LOS B	0.3	2.4	0.47	0.94	59.5
West: Tram Road											
10	L2	8	0.9	0.005	7.9	LOS A	0.0	0.0	0.00	0.66	74.2
11	T1	125	1.9	0.065	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R2	2	0.0	0.002	9.5	LOS A	0.0	0.1	0.39	0.59	72.7
Approach		136	1.8	0.065	0.6	NA	0.0	0.1	0.01	0.05	97.3
All Vehicles		716	1.4	0.245	5.4	NA	1.0	7.1	0.16	0.35	80.4

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: Mandeville - future year (double) on 2013

Mandeville Intersection
Stop (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: McHughs Road											
1	L2	32	1.5	0.055	13.0	LOS B	0.2	1.3	0.54	0.95	59.7
2	T1	64	1.1	1.306	350.8	LOS F	32.3	227.6	1.00	2.48	9.2
3	R2	109	0.9	1.306	351.2	LOS F	32.3	227.6	1.00	2.48	9.2
Approach		205	1.0	1.306	299.0	LOS F	32.3	227.6	0.93	2.25	10.6
East: Tram Road											
4	L2	120	0.9	0.065	7.9	LOS A	0.0	0.0	0.00	0.66	74.2
5	T1	523	1.6	0.271	0.0	LOS A	0.0	0.0	0.00	0.00	99.8
6	R2	141	0.9	0.129	9.6	LOS A	0.5	3.7	0.38	0.66	71.6
Approach		784	1.4	0.271	2.9	NA	0.5	3.7	0.07	0.22	88.9
North: Bradley's Road											
7	L2	42	0.6	0.047	10.2	LOS B	0.2	1.2	0.35	0.88	62.4
8	T1	57	1.0	0.496	43.9	LOS E	2.0	14.4	0.92	1.07	40.1
9	R2	19	0.7	0.496	44.7	LOS E	2.0	14.4	0.92	1.07	40.5
Approach		118	0.8	0.496	32.0	LOS D	2.0	14.4	0.71	1.00	46.0
West: Tram Road											
10	L2	17	0.9	0.009	7.9	LOS A	0.0	0.0	0.00	0.66	74.2
11	T1	251	1.9	0.130	0.0	LOS A	0.0	0.0	0.00	0.00	99.9
12	R2	4	0.0	0.006	11.5	LOS B	0.0	0.2	0.54	0.68	70.5
Approach		272	1.8	0.130	0.7	NA	0.0	0.2	0.01	0.05	97.2
All Vehicles		1379	1.4	1.306	49.1	NA	32.3	227.6	0.24	0.55	41.2

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Abley Transportation Consultants Limited www.abley.com info@abley.com

Christchurch phone +64(0)3 377 4703 fax +64(0)3 377 4702
Level 1 and 2, 30a Carlyle Street
PO Box 25350, Christchurch 8144, New Zealand

Auckland phone +64(0)9 974 9820 fax +64(0)9 974 9824
PO Box 911336, Auckland 1142, New Zealand

WAIMAKARIRI DISTRICT COUNCIL

MEMO

FILE NO AND TRIM NO:	DDS-06-05-02-33-01 / 141125129403
DATE:	25 November 20114
MEMO TO:	Matthew Bacon, Resource Management Planner
FROM:	Kalley Simpson, 3 Waters Manager
SUBJECT:	PC33 Mandeville Business – Flooding and Stormwater

The following documents the flooding and stormwater issues and constraints associated with the proposed PC 33 Mandeville Business Plan Change located at 474 Mandeville Road, Mandeville.

Flooding

The site is predominantly identified as a Low Flood Hazard area in the 200 year flood event (0.5% AEP flood event), which means that flood water may be up to 300mm deep in parts of the site (refer Figure 1 below).

Figure 1: Flood Hazard Map

The proposed rule to set the floor levels a minimum of 400 mm above the 200 year flood event (0.5% AEP flood event) is appropriate to mitigate the flood risk based on the localised rainfall modelling.

Stormwater

The site falls to the east generally towards Tram Road. The site is located in an area with medium soil soakage, which indicates that testing would need to be undertaken to confirm the suitability of discharge to ground of stormwater. Based on other developments in the Mandeville area it is likely that discharge to ground may be suitable, however recent high rainfall and high groundwater levels in the Mandeville area would suggest that discharge to ground could not be relied on in all circumstances. Adequate provisions would need to be made for an overflow system to Tram Road to accommodate for situations where discharge to ground is not suitable.

The stormwater system will most likely require a discharge consent from Environment Canterbury. Appropriate measures will need to be installed to treat the stormwater from hardstanding areas prior to discharge to ground or to Tram Road. The treatment could potentially be achieved in the form of a first flush pond, swales, rain gardens or proprietary sump inserts or oil/grit separators. Roof areas can discharge to ground directly without treatment.

Preliminary calculations suggest that a first flush basin with approximately 140m3 storage covering an area of approximately 450m2 would be adequate to treat the proposed hardstanding area. This could potentially be located within the grassed area immediately adjacent to Tram Road. Alternative stormwater measures such as rain gardens or proprietary devices could be integrated with the proposed car parking area if space was limited.

Although detailed calculated have not been undertaken at this stage there are a number of stormwater management measures available to appropriate deal with the stormwater from this site.

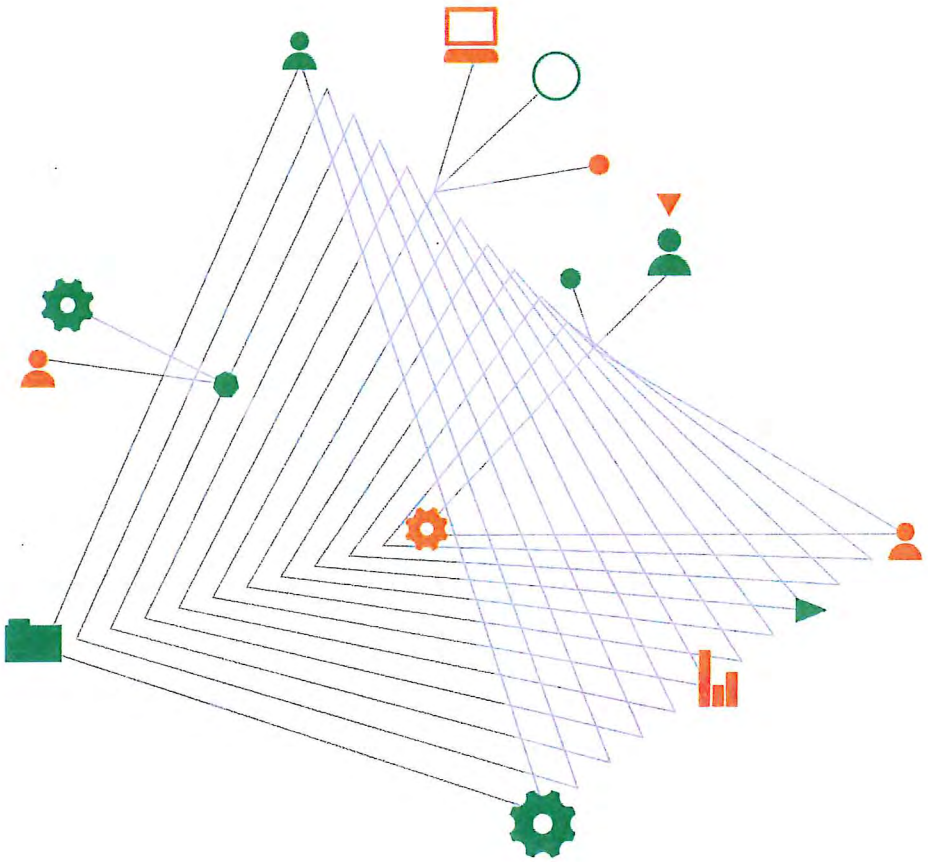
coffey

Waimakariri District Council

Environmental Site Assessment

Plan Change for Mandeville North, Canterbury

7 January 2015



Experience
comes to life
when it is
powered by
expertise

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 2014

Waimakariri District Council
Private Bag 1005
Rangiora 7440

Attention: Mr M Bacon

Dear Matthew Bacon

Coffey Project No: GENZCHR15611AA

RE: Environmental Site Assessment for Plan Change for Mandeville North

Please find attached our report presenting the findings of an Environmental Site Assessment carried out to support the proposed Mandeville North land use change from 'Rural' to 'Rural-residential' and 'Business' land use. This assessment was conducted in accordance with our proposal, dated 11 October 2013.

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

For and on behalf of Coffey

Warren Sharp
Associate Geoenvironmental Consultant

Environmental Site Assessment

Prepared for
Waimakariri District Council

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

f: +64 3 374 9601

Project Director	Erika McDonald Environments Team Leader
Project Manager	Anne Hellie Environmental Engineer
Prepared By	Nicole Morgan Environmental Engineer

7 January 2015

GENZCHRI15611AA

Quality information

Revision history

Revision	Description	Date	Author	Reviewer
V1 Final	Final	31/10/2014	A.H	DT
V2 Final	Final – minor amendment requested by WDC	07/01/2015	A.H	DT

Distribution

Report Status	No. of copies	Format	Distributed to	Date
V1 Final	1	PDF	Matthew Bacon, Waimakariri District Council	31/10/2014
V2 Final	1	PDF	Matthew Bacon, Waimakariri District Council	07/01/2015

Executive Summary

Waimakariri District Council (WDC) contacted Coffey to conduct an environmental site assessment (ESA) and a geotechnical assessment of 975 Tram Road, and 450, 460 and 474 Mandeville Road being properties included in the Mandeville North plan change area. It is understood that the assessment was required to confirm the suitability of the site for a land use change from 'Rural' to 'Rural Residential 4A' and 'Business'.

The environmental assessment comprised a desk top review, site walkover inspection and collection of soil samples. The results of the desk top review and site walkover indicated that the following potential Hazardous activities and Industries List (HAIL) activities may have been carried out on the site; persistent pesticide bulk storage or use (potential historical cropping), pest control (battery farming), asbestos products (including sites with buildings containing asbestos known to be in an deteriorated condition), and motor vehicle workshops.

Seventeen soil samples were collected from locations across the site. Fifteen samples were analysed for heavy metals. Of these fifteen samples, nine were also tested for organochlorine pesticides (OCPs), two for total recoverable hydrocarbons (TRH), two for polycyclic aromatic hydrocarbons (PAHs) and two for triazine, organochlorine pesticides (OCPs) and organophosphorous pesticides (OPPs). Two samples were analysed for the presence of asbestos only. Investigation findings can be summarised as follows:

- Arsenic was detected above SCS Human health levels for residential land use (25% produce consumption) in a soil sample collected from the base of a disused vehicle inspection pit. Elevated petroleum hydrocarbon concentrations typical of oil were detected in the same sample. However, given the sample was collected at a depth of 1.5 m, the concentrations of arsenic and TRH detected in this sample are considered unlikely to present a risk to human health for residential occupants of the site.
- Asbestos was confirmed to be present in sample S5, collected from a small stockpile with visible cement board fragments between two sheds on 474 Mandeville Road. This indicates the cement board buildings on 474 Mandeville Road are likely to be asbestos containing material (ACM). The presence of visible ACM in the stockpile exceeds human health criteria for asbestos in soils. However, the asbestos detected is unlikely to present a risk to current occupants of the site unless the stockpile is disturbed.
- Arsenic was detected above background concentrations in all samples tested. Lead and zinc concentrations in samples S2, S4 and S7 and copper concentrations in samples S2 and S4, all from 474 Mandeville Road, also exceed background concentrations.

Due to the presence of HAIL activities on the site, it is considered that the NES regulations do apply to the site.

Subdividing or changing land use is a permitted activity under the NES if 4(b) *the report on the preliminary site investigation states it is highly unlikely that there will be a risk to human health if the activity is done to the piece of land.* The detected arsenic and hydrocarbon contamination in the vehicle inspection pit is considered unlikely to present a risk to site occupants. However, the presence of visible asbestos containing material in the small stockpile on 474 Mandeville Road exceeds human health criteria. As such, under the NES the proposed land use change would require application for restricted discretionary consent.

If the asbestos were removed from the site it is considered that the proposed land use change and any further potential subdivision would be unlikely to present a risk to human health on-site from contaminants in soil and as such would be a permitted activity under the NES.

The potential exists for this material to pose a risk to the health of site workers in the event that subsequent works on the site at this location were to penetrate to this depth and should be adequately recorded on site documents to ensure safe work and to ensure that services installed in this location are appropriately protected.

It is possible that contaminated soil at the site may still be present that has not been identified through the ESA. In the event that further contamination is identified Coffey would be pleased to assist to characterise the soil and propose suitable management options.

Consideration may need to be made separately by the Regional Council regarding the potential risk to the environment through groundwater and to groundwater users.

Accordingly, removal of the small asbestos fragment containing stockpile is recommended. It is noted that as the stockpile volume is less than 5 m^3, that removal of the stockpile would not require NES consent (for land disturbance). There are also a number of cement board (likely ACM containing) clad sheds on 474 Mandeville Road. These were observed to be in poor condition. To avoid potential future issues at the site, removal of these buildings is also recommended.

Due to the presence of soil concentrations in excess of background concentrations, potential future soils disturbance, if permitted activity volumes are exceeded, would require application for a controlled activity consent under the NES.

Table of contents

Tables

Figures

Appendices

Abbreviations

bgl	below ground level
CCC	Christchurch City Council
DSI	Detailed Site Investigation
ECan	Environment Canterbury
Ha	Hectares
HAIL	Hazardous Activities and Industries List
IANZ	International Accreditation New Zealand
LLUR	Listed Land Use Register
LOR	Limit of Reporting
mg/kg	milligrams per kilogram
NATA	National Association of Testing Laboratories
NES	Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011
NRRP	Natural Resources Regional Plan
OCPs	Organochlorine pesticides
OPPs	Organophosphate pesticides
PID	Photoionisation Detector
TRH	Total recoverable hydrocarbons
PAHs	Polycyclic aromatic hydrocarbons
QA	Quality Assurance
QC	Quality Control
SCS	Soil Contaminant Standard (as referenced in the NES)
SQEP	Suitably Qualified and Experienced Practitioner

1. Introduction

Coffey Geotechnics (NZ) Limited (Coffey) was commissioned by Waimakariri District Council (WDC) to conduct an environmental site assessment (ESA) and a geotechnical assessment for the properties included in the Mandeville North plan change area where a land use change from 'Rural' to 'Rural Residential 4A' and 'Business' is proposed.

This report presents the findings of the ESA. The results of the geotechnical assessment will be reported separately. This ESA was conducted in accordance with our proposal, dated 11 October 2013.

1.1. Background

The Mandeville North plan change area (the "site") lies east of Kaiapoi, south of Rangiora and approximately 18.3km northwest of the Christchurch business district. The properties included in the Mandeville North Plan change area cover approximately 6.5Ha and include 975 Tram Road, and 450, 460 and 474 Mandeville Road. A site location plan is provided as Figure 1.

The Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations (NES) apply to selected activities on sites where an activity or industry on the Ministry for the Environment (MfE) Hazardous Activities and Industries List (HAIL) is, has, or is more likely than not to have occurred.

Subdivision or change in land use is an activity covered by the NES, and preliminary review of publically available historical aerial photographs provided on the Environment Canterbury (ECan) GIS database indicated that some areas of the site may have been used for HAIL activities including market gardening, a car workshop and free range poultry farming. As such, assessment of the suitability of the site for the proposed new land use and future subdivision was required.

The ESA fieldwork was managed and this report reviewed, by a Suitably Qualified and Experienced Practitioner (SQEP), as required by the NES.

1.2. Objectives

The objectives of this ESA were to:

- Identify potentially contaminating (HAIL) activities or potential sources of contamination that might have occurred or exist at the site.
- Identify the extent and concentrations of contaminants at the site (if any) that may pose a risk to human health or the environment.
- Confirm the suitability of the land for Rural Residential and Business use and provide recommendations regarding any additional works required prior to development of any individual properties within the site.

1.3. Scope of Works

The following scope of works was undertaken:

- Review of ECan's listed land use register (LLUR) statement for the site and neighbouring properties.
- Review of Waimakariri District Council and ECan files related to the site.
- Inspection of historical aerial photographs for information related to the historical use of the site and any potentially relevant HAIL activities.
- Notification to ECan of the proposed site investigation in order to meet the requirement of their Natural Resources Regional Plan (NRRP) Rule WQL 46.
- A site walkover, to consider land contamination indicators (e.g. visual evidence of waste dumping/material spills, chemical storage and/or usage areas, sheep dip activities, anomalous die-back in vegetation, ground staining, market gardening and orchards).
- Interview with available current property owners to understand the type of farming and potential for agrichemical contamination.
- Attendance at site for the collection of seventeen shallow soil samples from locations across site.
- Screening of soil samples for volatile organic compounds (VOCs) using a photoionisation detector (PID).
- Analysis of samples at an independent laboratory for all or a subset of heavy metals, total recoverable hydrocarbons (TRH), organochlorine pesticides (OCPs), organophosphorous pesticides (OPPs) and triazines. Two samples were tested for asbestos only.
- Preparation of this report, including presentation and interpretation of results in accordance with the requirements of the NES.

2. Site Information

2.1. Site Description

The site consists of multiple land plots (975 Tram Road, and 450, 460 and 474 Mandeville Road) located in Swannanoa approximately 18.3km northwest of Christchurch city centre and 9.3km east of Kaiapoi Township. The site layout including property boundaries is shown on Figure 2. Photographs of the site are presented in Appendix B.

Site use currently comprises a council reserve and lifestyle blocks. Coffey staff conducted a site walkover on 5 September 2014. Site observations are discussed further in Section 2.4.

The site is bordered to the northeast by Tram Road, to the southwest by Mandeville Road, to the northwest by McHughs Road and to the southeast by lifestyle blocks. The wider area surrounding the site comprises a mix of rural, lifestyle blocks and standard residential land. A commercial orchard along with council reserve land is located north of the site. Adjacent to 460 Mandeville Road to the east of the site at 933 Tram Road is a former sewage waste water treatment plant.

The topographic map (Figure 3) shows that the site is located in a generally flat area. This was confirmed during the site walkover.

2.2. Geology and Hydrogeology

The Kaiapoi geological map (Brown, L.J., 1973) indicates that surface geology consists of "*Older post – glacial fluviatile gravel, sand and silt deposits*" of the Halkett Member of the Springston Formation.

As previously discussed, Coffey also conducted a geotechnical investigation at the site. The investigation comprised the excavation of multiple test pits. Geology encountered in the geotechnical test pits comprised shallow silt to between 3.1 to 4.8 m below ground level (bgl) overlying sandy gravel. According to the ECan GIS database, there are many groundwater wells in the area, with three known wells located on the site in the 450 and 474 Mandeville Road properties. The well 16.7 m deep at 474 Mandeville Road (M35/4680) is listed on the ECan database as being used for domestic purposes. The 24 m deep well at 450 Mandeville Road (M35/6817) is listed being used for irrigation purposes while the nearby identical depth well (M35/17875) is used for domestic and stock watering purposes, these wells were not inspected during the course of this investigation.

The geotechnical investigations encountered shallow groundwater between 3.9 to 4.8m bgl. According to ECan data regional groundwater flow direction is to the east - southeast, towards the coast. The nearest surface water body to the site is the "Old Bed Eyre River", approximately 2km south of the site.

2.3. Site History

The following sections summarise the known historical activities undertaken within or in the immediate vicinity of the site, as determined from the information sources reviewed during this ESA.

2.3.1. Environment Canterbury (ECan)

None of the properties making up the site are registered on ECan's Listed Land Use Register (LLUR). Copies of the LLUR statement for each property can be found in Appendix F.

A review was also undertaken of properties immediately surrounding the site. Two sites are registered on the LLUR; 965 Tram Road and 933 Tram Road which were used for hardfill and waste water treatment respectively. Details of these sites are discussed below.

The ECan LLUR indicates that filling has occurred over 965 Tram Road, immediately north of the site (refer Figure 2). The LLUR states that the Waimakariri District Council used the site as a hardfill from 1993 to 1995, with fill materials comprising building materials, concrete and soils. It is considered unlikely that this filling operation will have impacted the site.

The former Ohoka Meadows wastewater treatment plant (WWTP) was located at 933 Tram Road immediately east of the site (refer Figure 2). The WWTP ceased operations in May 2013. An environmental assessment comprising the excavation of test pits and collection of soil samples for analysis was carried out by CH2M Beca Ltd and is detailed in a report dated 13 August 2013. The report indicates that the WWTP comprised three tanks piping effluent to a sand filter system from where treated waste water would flow to two infiltration fields. One field was located immediately beside the WWTP at 933 Tram Road and the other at 422 Mandeville Road immediately southwest of the site. Sample analytical results indicated that there were no contaminants exceeding the relevant assessment criteria. Heavy metal concentrations were generally below or within the given range for background levels. Bacteria levels were generally below reporting limits and were considered to not pose a significant risk to the health of construction workers or future site users. Nutrient levels for all samples for the site were considered normal for a rural setting. It is considered unlikely that operation of the WWTP will have resulted in contamination of soils at the site.

A search of resource consents issued by ECan in relation to the site and surrounding land was undertaken using ECan's GIS portal. Two resource consents were identified, both related to installation of boreholes as follows:

- CRC922168: Water take for irrigation of 50.7 hectares of horticultural land and for installation of a well designated M35/6817 at 460 Mandeville Road. This was submitted by Mandeville Orchards Limited and was later withdrawn (i.e. not actioned).
- CRC092601: Installation of well M35/17875 at 450 Mandeville Road for domestic and stock water purposes.

2.3.2. Historical Aerial Photographs

ECan holds a collection of historical aerial photographs for the greater Christchurch area. Relevant historical aerial photographs are included in Appendix C.

Photographs of the area from 1941, 1973, 1984, 1994, 1995 and 2004 were reviewed. The primary use of the site in 1941 appears to be mainly grazing.

In 1973, trees were present on 975 Tram Road whilst five buildings, one which is the current residential dwelling, are present on 474 Mandeville Road. The largest building on 474 Mandeville Road is rectangular in shape and located in the middle of the western side of the property with what appears to be hay bales located south east of it. The other three buildings are small and appear to be sheds. There are also two rows of small sheds on the property indicating possibly hen or pig rearing activity. The 1973 photograph also suggests cropping or similar horticultural activities over 450 and 460 Mandeville Road.

In the 1984 photograph the rows of small sheds are no longer present. A square of cleared land is present between the residence and largest shed on 474 Mandeville Road. There is no evidence of cropping activities over the remainder of the site.

There are no identifiable changes in land use in the 1994 or 1995 photographs.

In the 2004 photograph, 495 Tram Road and 474 Mandeville Road are unchanged. 450 and 460 Mandeville Road now have residential dwellings on them with paddocks around. The wastewater treatment plant (refer Section 2.3.1) is present immediately east of the site.

Some wide-spread growing of hay or cereal crops may have occurred that has not been identified; however, such activities are difficult to distinguish from grazing land given the quality of the historical aerial photographs.

2.3.3. District Council

Coffey visited the Waimakariri District Council offices on 5 September 2014 prior to performing the site walkover. Property files for the site were reviewed with details provided in Appendix D. Information for each property is summarised below:

- 975 Tram Road: contained minimal data. The site was identified as a reserve with consent granted in 1955 for instillation of a road.
- 474 Mandeville Road: the current residential dwelling was built in 1970 along with a garage and fowl house. Building plans indicate concrete floor slab for the fowl house and garage.
- 460 Mandeville Road: No information was available prior to 2003 when the current dwelling was built. No information available from this time shows any evidence of a HAIL activity.
- 450 Mandeville Road: No information was available prior to 2004 when the current dwelling was built. No information available from this time shows any evidence of a HAIL activity.

2.3.4. Summary

On the basis of the historic data reviewed there is considered to be potential for HAIL activities to have occurred at 474 Mandeville Road due to its age and evidence of farming operations including fowl houses. While considered unlikely to have resulted in significant contamination, application of fertilisers, pesticides or herbicides may have occurred over the 450 Mandeville Road or 460 Mandeville Road properties. There is no evidence of HAIL activities having occurred on the 975 Tram Road property.

2.4. Site Walkover

Coffey conducted a site walkover on 5 September 2014. During this site visit, the following information regarding the site was recorded (refer to field notes in Appendix A and photographs in Appendix B):

975 Tram Road

- 975 Tram Road consisted of a forestry plot, with mature trees present. There was no evidence that this site has been used commercially.

474 Mandeville Road

- This property consisted of five sheds and one residential dwelling. Two sheds located at the northern end of the property were used mainly for the storage of cars, car parts and lubricants (oils), and possibly also for entertaining. A car inspection pit was located between the two sheds. The pit was approximately 1.5 m deep, had concrete block walls and no seal at the base. A strong hydrocarbon odour and black staining were noted on the lower parts of the side walls and over the base of the pit.
- Two sheds, one small and one large rectangular shed were located in the central part of the property. The smaller shed was locked and contained no windows whilst the larger shed was mainly empty. The cladding of both of these buildings appeared to be cement board.
- A small (approximately 3 m^3) stockpile consisting of brick and cement board fragments was located next to the smaller shed.
- A horse stable was present in the southwest corner of the property. The stable was constructed of cement board and corrugated iron.
- The sheds constructed out of cement board were in poor condition and had multiple cracks and sections missing.

460 Mandeville Road

- This property consisted of one residential dwelling and one large shed used for storage. Paddocks surrounding the house were used for horse grazing.

450 Mandeville Road

- The property consisted of one residential dwelling and one small shed near the house. The remainder of the site was laid out in paddocks.
- A stockpile of what appeared to be imported soil was located on the western side of the site.

2.5. Interviews

Interviews were conducted with the property owners of 460 and 450 Mandeville Road by phone on the 9 September 2014. An interview with the owner of 474 Mandeville Road was conducted on the 17 September. The interviews with the property owners are summarised below:

- Mr Steve Hammond has owned 450 Mandeville Road for approximately 14 years. Mr Hammond indicated and the land had been used for as grazing land for the period of his ownership of the property. No fertilisers, herbicides or pesticides had been applied to the land.
- Mr Gavin Bennett has owned 460 Mandeville Road for 9 years. He indicated that the property has been used for grazing horses and cattle. Fertilisers or pesticides have not been applied.
- Mrs Jennifer Kim indicated she has owned 474 Mandeville Road since 2006, with the property rented since 2007. Her tenants used the property as a domestic residence. She also believed the properties previous owners had used the site for chicken farming in the 1980's.

3. Site Characterisation

3.1. Potential HAIL Activities and Contaminants of Potential Concern

The information obtained as part of this ESA indicates that the site has generally been used for a mixture of rural and rural residential purposes including poultry farming and possibly cropping. On the basis of the background information reviewed, Coffey has identified several potential HAIL activities to have occurred on-site (Table 1).

Table 1: Potential HAIL Activities at the Site.

Potential HAIL Activities	Location	Land Use	Information Sources
Persistent pesticide bulk storage or use (item A10 of HAIL)	450 and 460 Mandeville Road	Historical potential cropping	Historical aerial photographs
Asbestos (item E1 of HAIL)	474 Mandeville Road	Historical and current, building materials	Site walkover observations
Pest control (item A11 of HAIL)	474 Mandeville Road	Historical Poultry farming	Historical aerial photographs, property files and site walkover observations.
Motor vehicle workshops (item F4 of HAIL)	474 Mandeville Road	Work shop inspection pit	Site walkover observations

Identified potential HAIL areas are indicated on Figure 2.

On the basis of the above identified potential HAIL activities and for the purposes of this investigation, the primary contaminants of potential concern (COPCs) were identified to be heavy metals (including mercury), OCPs, OPPs, triazines, TRH, polycyclic aromatic hydrocarbons (PAHs) and asbestos.

3.2. Relevant Receptors

The site walkover and review of site history information indicates the following potential receptors that may be relevant to the site:

- Current and future occupiers of the residential properties at the site; contact, ingestion, produce consumption.
- Earthworks contractors who may come into contact with potentially contaminated soil during any proposed development works.
- Users of groundwater in the immediate site vicinity and potentially down-gradient from the site.

No significant ecological receptors (e.g. surface water ecosystems associated with sensitive water bodies) are located on or in the immediate vicinity of the site.

4. Soil Investigation Programme

4.1. Soil Sampling Programme

The sample locations were selected to provide overall coverage of the site. For the purposes of this assessment, Coffey collected seventeen surface soil samples. A portion of the sample locations were selected to target areas where potential HAIL activities were identified, and the remaining sample locations were spread across the site area as part of a grid based characterisation programme. The soil sampling investigation was conducted on the 10 September 2014.

Approximate sample locations are shown on Figure 4. The majority of samples were collected from surface soils at 0.1 m to 0.2 m depth. One sample, S2, was collected from the base of the vehicle inspection pit at approximately 1.5 m depth.

Photographs taken during the investigation are presented in Appendix B.

4.2. Soil Sampling Procedure

The soil samples were collected using a shovel. The soil type at each sample location was recorded in general accordance with standard Coffey procedures (based on the New Zealand Geotechnical Society Field Description of Soil and Rock, NZGS 2005). Field notes are presented in Appendix A.

The following procedures were adopted during investigation works:

- All fieldwork was carried out in compliance with a project specific Health, Safety, Security and Environment (HSSE) Plan prepared for the site works.
- All works were conducted by trained Coffey staff with precautions including implementation of procedures for the appropriate handling of potentially contaminated material.
- Prior to sampling, and between sample locations, sampling equipment was cleaned by washing with deionised water, followed by a decontamination solution, and rinsing with deionised water.
- Soil samples were collected using a clean pair of nitrile gloves for each sample and then placed into laboratory supplied sample containers.
- Encountered soils were inspected for evidence of staining and odours.
- Each soil sample was screened for the presence of VOCs using a portable PID. The concentration measurement was monitored for approximately one minute and the maximum concentration recorded.
- Following collection, all samples were placed directly into chilled storage and then packaged for transport to the laboratory, under standard Coffey chain of custody procedures.
- The majority of the samples were analysed by Eurofins Laboratory in Victoria, Australia. Two samples were analysed by Precise Laboratory, Christchurch for the presence of asbestos.
- At each sample location, any remaining soil that was not collected into sample jars was placed back into the hole.

4.3. Laboratory Analysis

Fifteen samples were analysed by Eurofins laboratory for heavy metals. Of these samples nine were also tested for OCPs, two for TRH, two for PAHs, two for triazines and two for OPPs.

Two samples, S5 (collected from a soil stockpile that included cement board) and S6 (collected from soils making up the floor of a shed constructed of cement board) were analysed for the presence of asbestos.

4.4. Quality Assurance/Quality Control

The quality assurance/quality control (QA/QC) procedures employed during Coffey's intrusive investigation works are summarised in the following sections.

Use of Accredited Laboratory

Eurofins laboratory is an independent National Association of Testing Laboratories (NATA) accredited laboratory and Precise consulting has IANZ (International Accreditation New Zealand) member accreditation. As such, these laboratories are expected to comply with accreditation requirements, which include confirmation of the validity and suitability of results. Any such breaches in laboratory quality control would be notified at the time of release of the analytical results. There were no analyst's notes included in the laboratory reports.

Sample Handling and Holding Times

The chain of custody records show that the samples were sent to Eurofins on 11 September 2014 and registered by the lab on 12 September 2014. Analysis was completed and reported on 15 September 2014 except for samples that were tested for PAHs and TRHs which were completed on the 18 September 2014. This is within the holding time for each sample.

The soil samples to be tested for asbestos were submitted to the laboratory on 16 September 2014 and were reported on by 18 September 2014. This is within the sample holding time.

5. Applicable Soil Contaminant Standards

5.1. Background Concentrations

According to Regulation 5(9) of the NES, the NES regulations do not apply if contaminants are at, or below, background concentrations. Regional background concentrations for metals and PAHs published by ECan (2007) have been used to assist in making this assessment. Adopted background criteria are presented in Table 2. It should be noted that the laboratory detection limits (limit of reporting, LOR) for cadmium and some of the sixteen tested PAHs were slightly above the adopted background concentrations.

Gregory Beck of ECan indicated to Coffey on 17 September 2014, that ECan would accept mean values presented in Table F5 of the MfE Report (1998): *Ambient Concentrations of Selected Organochlorines in Soil*s as background. Those OCPs with mean concentrations presented in Table F5 include hexachlorobenzene, dieldrin, 4,4-DDE, 4,4-TDE, 2,4-DDT and 4,4-DDT. Background concentrations of other OCPs have not been adopted by ECan. It is understood that for OCPs for which there is no mean concentration in Table F5, ECan consider any concentrations above the laboratory limit of reporting (LOR) to be above background.

This site is located within the Canterbury soil group defined as Yellow Brown Stony (YBST), and accordingly background concentrations for this soil type have been adopted. However, the following statement contained within the ECan (2007) report needs to be considered; "the Yellow Brown Stony soil group covers a large area of the plains, and had a relatively low sample density" and that "additional samples in this soil group are considered a priority".

5.2. Priority Contaminants: Soil Contaminant Standards

The MfE's *User's Guide: National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health* (MfE 2012) details Soil Contaminant Standards (SCSs) for seven inorganic substances and five organic compounds (or groups of compounds). SCSs are available for these substances and compounds when present in land used for five land use scenarios. The contaminants analysed and detected at this site for which SCSs are available are arsenic, cadmium, chromium, copper, lead, and mercury. For this site, a rural residential / lifestyle block scenario was adopted, as well as the following source/pathway/receptor assumptions:

- SCSs developed for rural residential / lifestyle block land use will also be protective of site workers during any developmental construction works.
- The selected residential SCSs assume 25% of produce consumed will be grown on-site.
- It has been assumed that the soil pH is 5, and that all lead is present in inorganic form.
- As a conservative starting point, it has been assumed that chromium may be present in its hexavalent form.

Adopted SCSs are presented in Table 2.

5.3. Other Applicable Human Health Standards

For contaminants of concern that are not priority contaminants, the NES references the hierarchy defined in the MfE Contaminated Land Management Guideline No.2 – *Hierarchy and Application in New Zealand of Environmental Guideline Values* (MfE, 2011b). Below is a summary of the contaminant standards referenced from this MfE hierarchy.

- For two heavy metals (nickel and zinc), the Australian National Environment Protection Measure (NEPM) 2013 has been adopted for screening assessment purposes. Values for residential land use have been selected in accordance with the proposed end use of the site and as a conservative estimate to protect site workers during the redevelopment work. Residential A criteria are described in the NEPM as "Residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake (no poultry)), also includes childcare centres, preschools and primary schools". Adopted NEPM health screening criteria are presented in Table 2.
- For several PAHs, the MfE Guidelines for Assessing and Managing Contaminated Gasworks sites in New Zealand – Module 4 Soil Acceptance Criteria, have been selected (MfE 1997). Health risk based acceptance criteria for standard residential site use (50% produce consumed) have been selected and values for produce are being used as they are the most conservative of the values provided.
- For naphthalene, pyrene and benzo(a)pyrene (BAP) equivalent, the MfE Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Revised 2011): Module 4 – Tier 1 soil Screening Criteria have been selected (MfE 1999). Tier 1 soil acceptance criteria for total petroleum hydrocarbon (1.3.5.6) Residential use, All Pathways, Sandy silt, <1.0 depth have been used.

5.4. Asbestos

Asbestos is a known human carcinogen; the principal risk is caused when asbestos fibres are disturbed and become airborne. The health risk varies dependant on the respirability of asbestos fibres, which is determined by the fibre type, size and shape (Safe Work Australia, NOHSC, 1998).

Asbestos contamination in soil is therefore not inherently hazardous *unless* the asbestos is released from the source material into air where it can be inhaled (USEPA, *Framework for Investigating Asbestos-Contaminated Superfund Sites,* 2008). The relationship between the concentration of asbestos in soil and the concentration of fibres in air, which results when the soil is disturbed, is very complex and dependent on a wide range of variables including:

- Type of asbestos present
- The nature of the asbestos present (cement bound or as a free fibre)
- The concentration
- The type of disturbance
- The dryness of the soil

This investigation included a qualitative presence/absence testing for asbestos. There are no New Zealand guidelines for asbestos in soils. Accordingly, guideline criteria for asbestos in soils within the Australian NEPM have been adopted to assess the significance of asbestos analysis results.

6. Results

Hydrocarbon staining and odours were noted over the base of the vehicle inspection pit. Potential asbestos containing materials (ACM) were identified in the cladding of a number of buildings on the 474 Mandeville Road part of the site, and fragments of potential ACM containing materials were observed in a small stockpile located on the same part of the site.

A strong hydrocarbon odour and black staining were noted on the lower parts of the side walls and over the base of the former vehicle inspection pit in the north western part of 474 Mandeville Road. No other visual evidence of contamination was observed in the soil sampled during the investigation. PID readings were all less than 1ppm and as such can be considered as background, indicating an absence of ionisable volatile organic compounds in the soil samples collected. Summarised soil analytical results are presented in Table 2. Laboratory analytical reports are included in Appendix E.

In summary:

- Arsenic was detected at concentrations exceeding background concentrations in all samples, except for S8 (in the eastern part of 474 Mandeville Road). However, as stated in Section 5.1 of this report, additional sampling is required to determine the true background level for this soil type. Copper, lead and zinc were above background concentrations in samples S2 and S4 with lead and zinc above background in S7 (taken from the western part of 474 Mandeville Road).
- Arsenic in soil sample S2 (from the workshop area in the north western part of 474 Mandeville Road) was reported present at a concentration slightly above the SCS Human Health criteria (25% produce consumption).
- All other detected heavy metals were present at concentrations below SCS.
- Petroleum hydrocarbons in the C_{10}-C_{36} fraction range were detected in sample S2, collected from the base of the vehicle inspection pit. The detected concentrations suggest residual oil is present in the sample, expected given site observations.
- OCPs, OPPs and triazines were not detected above the laboratory LOR in the soil samples analysed for these parameters.
- PAHs were not detected above laboratory LOR in the soil samples analysed. Asbestos was identified to be present in sample S5, collected from a soil stockpile with broken cement board fragments in it. The presence of visible asbestos containing material at the surface exceeds NEPM human health criteria.
- Asbestos was not detected in soil sample S6.

7. Summary and Conclusions

WDC contacted Coffey to conduct an ESA and a geotechnical assessment for the site consisting of the properties 975 Tram Road, and 450, 460 and 474 Mandeville Road. It is understood that the investigations are being undertaken to confirm the suitability of the site for a land use change from 'Rural' to 'Residential 4A' and 'Business (zoning specific to the site)'.

The environmental investigation comprised a desk top review, site walkover inspection and collection of shallow soil samples. The results of the desk top review and site walkover indicated that the following HAIL activities may have been carried out on the site:

474 Mandeville Road

- G5 Waste disposal to land (Site walkover observations).
- A11 Pest control (Historical photographs, Property files and site walkover observations).
- E1 Asbestos (Site walkover observations).
- F4 Motor vehicle workshops (Site walkover observations).

460 Mandeville Road

- A10 Persistent pesticide bulk storage or use (historical aerial photographs).

450 Mandeville Road

- A10 Persistent pesticide bulk storage or use (historical aerial photographs).

Sixteen shallow soil samples (0.1 to 0.2 m bgl) and one sample from 1.5 m bgl were collected from locations across the site. Fifteen samples were analysed by Eurofins laboratory for heavy metals, nine for OCPs, two for TRH, two for PAHs and two for triazines, OCPs and OPPs. Two of the seventeen samples collected were tested by Precise Consulting and laboratories for asbestos only. Investigation results can be summarised as follows:

- Arsenic was detected above SCS human health levels for residential land use (25% produce consumption) in the soil sample collected from the base of the disused vehicle inspection pit (S2). Elevated petroleum hydrocarbon concentrations typical of oil were also detected in sample S2. However, given the sample was collected at a depth of 1.5 m, the concentrations of arsenic and TRH detected in this soil sample are considered unlikely to present a risk to human health for residential occupants of the site.
- Asbestos was confirmed to be present in sample S5, collected from a small stockpile with cement board fragments between two sheds on 474 Mandeville Road. This indicates the cement boards buildings on 474 Mandeville Road are likely to be asbestos containing material (ACM). The presence of visible ACM in the stockpile exceeds human health criteria for asbestos in soils. However, the asbestos detected is unlikely to present a risk to current occupants of the site unless the stockpile is disturbed.
- Arsenic was detected above background concentrations in all samples tested. Lead and zinc concentrations in samples S2, S4 and S7 and copper concentrations in samples S2 and S4, all from 474 Mandeville Road, also exceed background concentrations.

Due to the presence of HAIL activities on the site, it is considered that the NES regulations do apply to the site. Subdividing or changing land use is a permitted activity under section 8(4)(b) of the NES if the report on the preliminary site investigation states it is highly unlikely that there will be a risk to human health if the activity is done to the piece of land.

The detected arsenic and hydrocarbon contamination in soil at the vehicle inspection pit is considered unlikely to present a human health risk to residential site occupants following subdivision. The potential exists for this material to pose a risk to the health of site workers in the event that subsequent works on the site at this location were to penetrate to this depth and should be

adequately recorded on site documents to ensure safe work and to ensure that services installed in this location are appropriately protected.

It is possible that contaminated soil at the site may still be present that has not been identified through the ESA. In the event that further contamination is identified Coffey would be pleased to assist to characterise the soil and propose suitable management options.

Consideration may need to be made separately by the Regional Council regarding the potential risk to the environment through groundwater and to groundwater users.

However, the presence of visible asbestos containing material in the small stockpile on 474 Mandeville Road exceeds human health criteria. As such, under the NES the proposed land use change would require application for restricted discretionary consent.

If the asbestos were removed from the site it is considered that the proposed land use change and any further potential subdivision would be highly unlikely to present a risk to human health and as such would be a permitted activity under the NES.

Accordingly, it is recommended that the small asbestos fragment containing stockpile is removed from the site. It is noted that as the stockpile volume is less than 5 m^3, that removal of the stockpile would not require NES consent (for land disturbance). There are also a number of cement board (likely ACM containing) clad sheds on 474 Mandeville Road. These were observed to be in poor condition. To avoid potential future issues at the site, removal of these buildings is also recommended.

Due to the presence of soil concentrations in excess of background concentrations, potential future soils disturbance, if permitted activity volumes are exceeded, would require application for consent as a controlled activity under the NES.

8. Limitations

The findings of this report should be read together with "Important Information About Your Coffey Environmental Report" attached to this report.

9. References

Australian National Environment Protection Measure (NEPM) (Assessment of Site Contamination) (1999), updated 2013 Schedule B1, Health Investigation Levels (HIL) for soil contaminants based on residential land use (Class A).

Brown, L.J., (1973), Sheet S76 (1st Edition) Kaiapoi, Geological Map of New Zealand, 1:63 360 (scale is inches to miles).Ministry for the Environment (MfE) (1997). Guidelines for Assessing and Managing Contaminated Gasworks Sites in New Zealand. Ministry for the Environment, Wellington, New Zealand.

Environment Canterbury (ECan) (2007). Background Concentrations of Selected Trace Elements in Canterbury Soils. Addendum 1: Additional Samples and Timaru Specific Background Levels. Report R07/1/2.

Ministry for the Environment (MfE) (1998). Ambient Concentrations of Selected Organochlorines in Soils. Ministry for the Environment, Wellington, New Zealand.

Ministry for the Environment (MfE) (1999). Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Revised 2011). Ministry for the Environment, Wellington, New Zealand, August 1999.

Ministry for the Environment (MfE) (2011). Contaminated Land Management Guidelines No. 5. Site Investigation and Analysis of Soils (Revised 2011). October 2011.

Ministry for the Environment (MfE) (2011a). Hazardous Activities and Industries List. Ministry for the Environment, Wellington, New Zealand.

Ministry for the Environment (MfE) (2011b). Contaminated Site Management Guidelines No. 2. Hierarchy and Application in New Zealand of Environmental Guideline Values. Ministry for the Environment, Wellington, New Zealand.

Ministry for the Environment (MfE) (2012). Users' Guide. National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health. Ministry for the Environment, Wellington, New Zealand.

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

Sewell, R.J., Weaver, S.D., Reay, M.B. (1992). Geology of Banks Peninsula, Institute of Geological and Nuclear Sciences 1:100 000 geological map 3 sheet. Lower Hutt, New Zealand.

Waimakariri District Council (WDC). (2013). District Plan. 22 April 2013.

Safe Work Australia NOHSC (1998). Safe Work Australia National Occupational Health and Safety Commission, 1998. Code of Practice for the Safe Removal of Asbestos.

US Environmental Protection Agency (2008). Framework for Investigating Asbestos-Contaminated Superfund Sites. Prepared by the Asbestos Committee of the Technical Review Workgroup of the Office of Solid Waste and Emergency Response United States Environmental Protection Agency.

Limitations

Important information about your **Coffey** Environmental Report

Introduction

This report has been prepared by Coffey for you, as Coffey's client, in accordance with our agreed purpose, scope, schedule and budget.

The report has been prepared using accepted procedures and practices of the consulting profession at the time it was prepared, and the opinions, recommendations and conclusions set out in the report are made in accordance with generally accepted principles and practices of that profession.

The report is based on information gained from environmental conditions (including assessment of some or all of soil, groundwater, vapour and surface water) and supplemented by reported data of the local area and professional experience. Assessment has been scoped with consideration to industry standards, regulations, guidelines and your specific requirements, including budget and timing. The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry practice,

This interpretation is not a complete description of all material on or in the vicinity of the site, due to the inherent variation in spatial and temporal patterns of contaminant presence and impact in the natural environment. Coffey may have also relied on data and other information provided by you and other qualified individuals in preparing this report. Coffey has not verified the accuracy or completeness of such data or information except as otherwise stated in the report. For these reasons the report must be regarded as interpretative, in accordance with industry standards and practice, rather than being a definitive record.

Your report has been written for a specific purpose

Your report has been developed for a specific purpose as agreed by us and applies only to the site or area investigated. Unless otherwise stated in the report, this report cannot be applied to an adjacent site or area, nor can it be used when the nature of the specific purpose changes from that which we agreed.

For each purpose, a tailored approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible quantify, risks that both recognised and potential contamination pose in the context of the agreed purpose. Such risks may be financial (for example, clean up costs or constraints on site use) and/or physical (for example, potential health risks to users of the site or the general public).

Limitations of the Report

The work was conducted, and the report has been prepared, in response to an agreed purpose and scope, within time and budgetary constraints, and in reliance on certain data and information made available to Coffey.

The analyses, evaluations, opinions and conclusions presented in this report are based on that purpose and scope, requirements, data or information, and they could change if such requirements or data are inaccurate or incomplete.

This report is valid as of the date of preparation. The condition of the site (including subsurface conditions) and extent or nature of contamination or other environmental hazards can change over time, as a result of either natural processes or human influence. Coffey should be kept appraised of any such events and should be consulted for further investigations if any changes are noted, particularly during construction activities where excavations often reveal subsurface conditions.

In addition, advancements in professional practice regarding contaminated land and changes in applicable statues and/or guidelines may affect the validity of this report. Consequently, the currency of conclusions and recommendations in this report should be verified if you propose to use this report more than 6 months after its date of issue.

The report does not include the evaluation or assessment of potential geotechnical engineering constraints of the site.

Interpretation of factual data

Environmental site assessments identify actual conditions only at those points where samples are taken and on the date collected. Data derived from indirect field measurements, and sometimes other reports on the site, are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions.

Variations in soil and groundwater conditions may occur between test or sample locations and actual conditions may differ from those inferred to exist. No environmental assessment program, no matter how comprehensive, can reveal all subsurface details and anomalies. Similarly, no professional, no matter how well qualified, can reveal what is hidden by earth, rock or changed through time.

The actual interface between different 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, parties involved with land acquisition, management and/or redevelopment should retain the services of a suitably qualified and experienced environmental consultant through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other unrecognised features encountered on site. Coffey would be pleased to assist with any investigation or advice in such circumstances.

Recommendations in this report

This report assumes, in accordance with industry practice, that the site conditions recognised through discrete sampling are representative of actual conditions throughout the investigation area. Recommendations are based on the resulting interpretation.

Should further data be obtained that differs from the data on which the report recommendations are based (such as through excavation or other additional assessment), then the recommendations would need to be reviewed and may need to be revised.

Report for benefit of client

Unless otherwise agreed between us, the report has been prepared for your benefit and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendation and should make their own enquiries and obtain independent advice in relation to such matters.

Coffey assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report.

To avoid misuse of the information presented in your report, we recommend that Coffey be consulted before the report is provided to another party who may not be familiar with the background and the purpose of the report. In particular, an environmental disclosure report for a property vendor may not be suitable for satisfying the needs of that property's purchaser. This report should not be applied for any purpose other than that stated in the report.

Interpretation by other professionals

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, a suitably qualified and experienced environmental consultant should be retained to explain the implications of the report to other professionals referring to the report and then review plans and specifications produced to see how other professionals have incorporated the report findings.

Given Coffey prepared the report and has familiarity with the site, Coffey is well placed to provide such assistance. If another party is engaged to interpret the recommendations of the report, there is a risk that the contents of the report may be misinterpreted and Coffey disowns any responsibility for such misinterpretation.

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, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists or engineers based on their interpretation of field logs, field testing and laboratory evaluation of samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

This report should be reproduced 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.

Responsibility

Environmental reporting relies on interpretation of factual information using professional judgement and opinion and has a level of uncertainty attached to it, which is much less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. As noted earlier, the recommendations and findings set out in this report should only be regarded as interpretive and should not be taken as accurate and complete information about all environmental media at all depths and locations across the site.

Tables

coffey

Mandeville Plan Change
Table 2: Summary of Soil Analytical Results

Analyte	NES SCSs for Protection of Human Health based on a Rural Residential / Lifestyle Block Land-use (25% produce consumption) (mg/kg)[1]	Environment Canterbury's Background Concentrations (mg/kg)[3]	S1 10-Sep-2014 (mg/kg)	S2 10-Sep-2014 (mg/kg)	S3 10-Sep-2014 (mg/kg)	S4 10-Sep-2014 (mg/kg)	S7 10-Sep-2014 (mg/kg)	S8 10-Sep-2014 (mg/kg)	S9 10-Sep-2014 (mg/kg)	S10 10-Sep-2014 (mg/kg)	S11 10-Sep-2014 (mg/kg)	S12 10-Sep-2014 (mg/kg)	S13 10-Sep-2014 (mg/kg)	S14 10-Sep-2014 (mg/kg)	S15 10-Sep-2014 (mg/kg)	S16 10-Sep-2014 (mg/kg)	S17 10-Sep-2014 (mg/kg)
Property address			975 Tram Road	474 Mandeville Road							460 Mandeville Road				460 Mandeville Road		
Heavy Metals																	
Arsenic	17	5.8	9.5	20	11	9.3	9.6	<2	6.9	9.6	7.3	8.1	11	8.2	8.3	7.7	9.4
Cadmium	1	0.1	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium[4]	290	18.3	13	13	14	12	12	9.9	12	13	10	11	15	11	11	9.3	13
Copper	>10,000	10.2	<5	20	7.4	17	9.2	5.4	<5	5.2	<5	<5	5.4	<5	<5	<5	<5
Lead	160	18.7	12	130	16	35	22	9.9	11	11	10	11	14	11	9.9	9.4	13
Mercury	200	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	400[5]	12.8	7.8	8.8	10	7.1	5.7	7.2	6.2	8.2	6.1	6.9	8.9	7.3	6.5	5.4	8.2
Zinc	7,400[2]	64.0	50	180	53	80	780	49	39	53	38	53	59	46	54	38	48
Total Recoverable Hydrocarbons																	
TRH C6-C9	120[5]			<20	<20												
TRH C10-C14	560[5]			81	<20												
TRH C15-C28	*			12000	<50												
TRH C29-C36	*			12000	<50												
TRH C10-36 (Total)	N/A[5]			24000	<50												
Polycyclic Aromatic Hydrocarbons (PAHs)																	
None detected above laboratory reporting limit																	
Organochlorine Pesticides (OCPs)																	
None detected above laboratory reporting limit																	
Organophosphorous Pesticides																	
None detected above laboratory reporting limit																	
Triazines																	
None detected above laboratory reporting limit																	

Notes:

Underlined text =	data indicates level is above background concentration
Gray shaded =	value above SCS
mg/kg =	milligrams per kilogram
NA =	NA indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in soil matrix. Some aesthetic impact may be noted.
* =	criteria for these compounds are addressed TRH C10 -36 (total).

Footnotes:

1. Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES).
2. National Environment Protection Measure (Assessment of Site Contamination) 1999, updated 2013 Schedule B1, Health Investigation Levels (HIL) for soil contaminants based on residential land use (Cla
3. Environment Canterbury Level 1 Background Concentrations for metals are taken from ECan 2007. Background concentrations for Canterbury Rural "Yellow Brown Stony" soil have been used for this assessment.
4. Criteria presented are for Chromium (VI).
5. MfE (2011) Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand: Module 4 – Tier 1 Soil Screening Criteria, New Zealand Ministry for the Environment, Wellington, New Zealand. Criteria for Residential Use, all pathways for sandy soil (1 to 4m deep).

Figures

Basemap Source - Aerial Photograph Courtesy of Google Earth

Rev	description	drawn	approved	date
1	FINAL	NM	AH	23/09/2014

Scale

drawn	NM
approved	
date	23/09/2014
scale	NA
original size	A4

coffey

client:	Waimakarri District Council			
project:	Mandeville Plan Change			
title:	Figure 1 - Site Location Plan			
project no:	GENZCHR15611AA	figure no:	1	rev: