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Project Number #18043.000.001

Preliminary Environmental Site Investigation

118 Montgomerie Road, Manukau, Auckland

Submitted to:
Goodman Nominee (NZ) Limited
Level 2, KPMG Centre
18 Viaduct Harbour Avenue
Auckland 1010

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SQEP Certifying Statement

I certify that the site has been assessed in accordance with current New Zealand Regulations and guidance documents and that this report has been prepared in general accordance with the Ministry for the Environment's Contaminated Land Management Guidelines No. 1: Reporting on Contaminated Sites in New Zealand, 2021.

I am considered by ENGEO Limited to be a suitably qualified and experienced practitioner (SQEP) able to certify reports pursuant to the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011, based on the company's definition of a SQEP as given below.

Erika McDonald

8 March 2024

ENGEO Limited requires that a SQEP has the following Qualifications / Experience:

- *Tertiary science or engineering qualification relevant to environmental assessment.*
- *A minimum of 10 years of relevant experience.*
- *Registration with a professional body that assess and certifies environmental professionals in the competency criteria of training, experience, professional conduct, and ethical behaviour.*

1 Introduction

ENGEO Ltd was requested by Goodman Nominee (NZ) Limited to prepare a preliminary environmental site investigation (PSI) for 118 Montgomerie Road, Manukau, Auckland (herein referred to as 'the site', shown on Figure 1).

This environmental investigation was prepared to support the proposed plan change for the site – refer to the attached Precinct Plan 3 in Appendix 1. ENGEO was engaged by Tourism Holding Limited to prepare a Preliminary and Detailed Site Investigation to support a Resource Consent application for redevelopment works proposed in this area (sub-precinct D on the attached Precinct Plan 3 in Appendix 1). Therefore, information specific to this sub-precinct is not discussed herein. Refer to ENGEO's PSI/DSI for additional information (ENGEO, 2024a).

We understand that the zoning will remain Light Industry; however, the proposed plan change will allow for additional activities within sub-precinct C (central area of site). The additional activities relevant to this assessment as they represent potentially more sensitive land uses than Light Industry are:

- Visitor accommodation,
- Recreational facilities,
- Community facilities, and
- Care Centres.

This report provides information regarding the potential presence of contaminants that may pose a risk to future site users under the proposed land use. This investigation also addresses the requirements of regional regulations covering discharges to the environment from contaminated sites during and following future development works; namely, the Auckland Unitary Plan.

This investigation was undertaken in general accordance with the Ministry for the Environment (MfE) Contaminated Land Management Guidelines (CLMG) No. 1: Reporting on Contaminated Sites in New Zealand (MfE, 2021a). This report has been reviewed and approved by a suitably qualified and experienced contaminated land practitioner in accordance with national environmental regulations for soil contamination.

2 Objectives of the Assessment

The objective of the preliminary site investigation (PSI) was to gather information relating to the current and historical potentially contaminating activities at the site. The works comprised review of historical site information and review / assessment of information gathered during previous investigations across the site by ENGEO.

3 Site Information

Site information is summarised in Table 1.

Table 1: Site Information

Item	Description
Site Address / Legal Description (refer to Appendix 1 for the precinct boundaries)	Precinct A • 88 Pavilion Drive, Mangere 2022 – Lot 2 DP 581326 Precinct B: • 118 Montgomerie Road, Mangere 2022 (Precinct C included here) – Lot 5 DP 581326 • 350 Oruarangi Road, Mangere 2022 – Lot 3 DP 209528 • 400 Oruarangi Road, Mangere 2022 – Lot 1 DP 36092
Current Land Use	Currently unused grassed fields, residential at 400 Oruarangi Road
Proposed Land Use	Light Industry, with additional activities within sub-precinct C proposed as part of the Plan Change.
Site Area	34.3 ha
Territorial Authority	Auckland Council
Zoning	Light Industry zone
Geology	The site is mapped by GNS Science (GNS, 2001) as being underlain by Auckland Basalts tuff (Kerikeri Volcanic Group) of Auckland Volcanic Field, comprising *comminuted pre-volcanic materials with basaltic fragments, and unconsolidated ash and lapilli deposits of well-sorted basalt and basanite fragments*.
Topography	The majority of the site is in a topographic basin bounded by the Waitomokia volcanic crater to the north
Hydrology	The nearest water body is the Oruarangi Creek which bounds the site to the southwest. Oruarangi Creek flows north form the site and discharges to the Manukau Harbour approximately 100 metres west of the site.
Hydrogeology	Groundwater was recorded between 0.29 and 1.46 m bgl, and contours indicate that groundwater primarily flows towards the drain southeast of site and Oruarangi Creek. Refer to ENGEO's hydrogeological assessment reported under separate cover for additional information (ENGEO, 2022 and 2024b).

4 Site History

4.1 Aerial Photographs

This section presents a summary of the site use based on a review of historical aerial imagery and maps (attached in Appendix 2).

The site is located within the larger crater of Waitomokia, a volcanic crater with a tuff ring. This crater originally contained three volcanic cones on land to the north and east of the site (what is now the I H Wedding & Sons Ltd site). Pre-1940 the volcanic cones and the tuff ring were likely used for grazing purposes and the crater floor (which forms a large portion of the flat area of the site) was swamp land. This swamp area drained east and into Oruarangi Creek. At some stage (believed to be prior to 1940), drainage channels were formed within the present-day floor of the crater which resulted in draining of part of the swamp area, and enabled access to the scoria cones for quarrying. In the 1959 Auckland Council GIS image the site appears to be in pastoral use (there are large parts of the lower crater floor that still appear as swamp / unused).

By 1968 a large farm shed has been constructed in the northwest of the site, to the south of the dwelling at the 400 Oruarangi Road address (northern corner of the site). Standing water can be observed in the south of the remaining swamp area in the central north of the site.

By 1975, the volcanic cones have largely been removed, and the land which is now 350 Oruarangi Road appears to be being surface stripped / quarried (northern end of the site).

The 1975 image shows significant earthworks (cut) on the 470 Oruarangi Road property (not currently assessed), and there appears to be reinstatement of the former quarried areas at the eastern end of the property at 350 Oruarangi Road (north of the site)

The earthworks off site at 470 Oruarangi Road are ongoing in 1980, and in 1983 this can be seen to be expanding further south and east. There is heavy equipment on-site and extensive cutting and filling in this area is clear. Filling at the eastern tip of the current site (88 Pavilion Drive) is likely to be associated with Oruarangi Landfill.

By 1987, earthworks on-site have ceased, the drainage channels through the crater floor appear deeper and there has been significant increase in site activity. A large factory space with multiple buildings is present in the location of the buildings most recently occupied by Villa Maria with horticultural land use (including several greenhouses) evident across much of the balance of 470 Oruarangi Road. A building (possibly a greenhouse) is present within the 400 Oruarangi Road address in the north of the site. Commercial activity has commenced within the former volcanic cone area to the north of the site.

The 1996 image is of low resolution and it is difficult to identify changes to features on the site. In 2001, earthworks to the north of the existing buildings at 470 Oruarangi Road crosses over to include works in the current site, and the greenhouses near the middle of the site have been removed. The muddy surface of the central areas of the site suggest that the rows of vines may have been recently planted.

By 2003 / 2004, the site is planted in vines and additional buildings have been constructed at the north of 470 Oruarangi Road, adjacent to the site boundary. By 2006 stand of trees at the north of 350 Oruarangi Road have been removed, and earthworks are evident to the south of this area. The site remains largely unchanged between 2010 / 2011 and 2024 imagery.

4.2 Previous Reporting

Key environmental investigation reports reviewed as part of this assessment are listed below (in chronological order). To present the locations of previous investigations, the site has been partitioned to north, central, east, and south presented as Figures 2a – 2d, respectively.

Harrison Grierson Consultants Limited (2000a) – Oruarangi Creek Subsoil Investigation

Geotechnical investigation report which involved eight machine boreholes located in the current site, south and east of the existing commercial buildings (shown in appended Figure 2b). The balance of investigation locations was within the 470 Oruarangi Road (core site) address so are not considered here. Logs of the boreholes did not identify fill or other visual or olfactory indicators of potential contamination.

Harrison Grierson Consultants Limited (2000b) – Geotechnical Investigation Report 470 Oruarangi Road

This investigation report was included as an appendix to the 4Sight consulting report discussed below. It involved the excavation of 19 test pits across the northern portion of the site, shown on Figure 2a. Fill was encountered in several holes to a maximum depth of 2.1 metres near the southern half of the 350 Oruarangi Road property. Fill was described as containing various proportions of mixed topsoils, decomposed wood and vegetation, broken bricks, concrete, gravels, and in one location glass and steel. Based on this and the additional fill identified in the 4Sight Consulting (2019a) and CMW (2020) investigations below, an estimated fill extent polygon is shown on appended Figure 2a.

Later investigations did not encounter building debris, glass, or steel; these reports would comment that the fill was likely associated with recontouring and not indicative of potentially contaminating activities (4Sight, 2019a; CMW 2019).

4Sight Consulting (2019a) – 'Northern Block' Detailed Site Investigation

This investigation targeted surface soils associated with horticultural land use, storage of treated timber and site buildings.

A sample of soil was collected below the stockpile of treated timber fence posts in the north-western side of 350 Oruarangi Road (shown in a red circle on appended Figure 2a). Arsenic in this sample was detected at 71 mg/kg, just above the commercial / industrial guideline value of 70 mg/kg (MfE, 2011b). This minor soil impact is considered to be local to the area immediately beneath the stored timber and not representative of the wider site soils. The laboratory results summary table is included in Appendix 3 for reference.

Lead concentrations above background levels were identified in several locations across the investigation area. These are considered likely to be associated with historical use of lead-based paints on residential dwellings / sheds and were not expected to be extensive.

Asbestos was not detected in any of the six surface samples collected from around buildings, or from one sample from within the vineyard area with widely distributed reworked native material used as fill.

One composite sample made up of four samples from the vineyard area contained low levels of organochlorine pesticides (OCPs) namely 4,4'-DDE and 4,4'-DDT. Although other samples were analysed for OCPs they did not represent soils within the vineyard or other horticultural areas – no OCPs were detected in these samples.

Although the report states that there is no evidence of “landfill” activities at the site, one shallow soil sample collected contained fill material with bricks and plastic visible in the photolog. This soil sample was not analysed for contaminants of concern.

An Auckland Council contamination enquiry and database search identified the Oruarangi Road Esplanade Reserve as being subject to historical filling / importation of unverified-origin material and is described as a closed landfill (discussed further in Section 4.3).

The contamination enquiry also identified 100 Oruarangi Road as having been issued with a contaminated site discharge consent. The consent was not dated. This address is approximately 20 metres from the current site to the northeast (I H Weddings & Sons Limited).

4Sight Consulting (2019b) – ‘Montgomery Road Block’ Detailed Site Investigation

The investigation focused on the eastern end of the site (shown on appended Figure 2c)

Surface topsoil samples were collected from sixteen sample locations and composited into four samples. Samples were analysed for lead, arsenic, copper and OCPs. No OCPs were detected above the laboratory limit of reporting. The report assessed soils against both the non-volcanic and volcanic background levels for metals. The non-volcanic background levels for copper were exceeded, whereas the volcanic background levels were not. Recent geotechnical investigations (Initia, 2022) have identified Auckland Volcanic Field soils at the surface in this location (boreholes BH101 and BH102), indicating that the volcanic soil criterion for copper would be more appropriate for comparison against. A copy of the investigation location plan is included as Figure 2c.

CMW Geosciences (2019 + 2020) – Geotechnical Investigations

The geotechnical investigations involved 26 hand augers around the site. The areas immediately around the Villa Maria buildings were not included in this investigation.

Fill was identified in four locations within the northern area of site (Figure 2a):

- HA03-19 – silty sand fill to 0.3 metres depth (in the north of the investigation area);
- HA04-19 – silty sand fill to 0.5 metres depth (in the north of the investigation area);
- HA11-19 – clayey silt fill to 1.0 metres depth (suspected fill; in the centre of the investigation area); and
- HA14-19 – clayey silt fill to 0.4 metres depth (east of the dwelling shown in Figure 2a).

Within the borelogs, there appears to be similarities between material logged as fill and other material logged as alluvium. This report concludes that the fill material present in the northern block is site won material used for contouring rather than filling with off-site material.

Fill was not encountered in the other areas of site during this investigation.

ERM (2021) – ESG Due Diligence – Auckland Winery Site Report

Only one on-site potential sources of soil and groundwater contamination was identified by ERM: Current and historical use of pesticides and herbicides associated with cropping and viticulture.

ERM concluded that the potential for on-site activities to have resulted in material soil and groundwater impacts at the site was low.

The following off-site potential sources of soil and groundwater contamination were identified by ERM:

- Current and historical use of pesticides and herbicides associated with agricultural and horticultural land use.
- The historical closed landfill (Oruarangi Road Esplanade Reserve) located directly west of the site.
- A bus depot located directly south (and likely up-gradient) of the site. *ENGEO considers this to be low or negligible risk of contamination as Auckland Council GeoMaps shows that the bus depot was constructed between 2016 and 2017.*
- The fill depot facility, 150 m north of the site, which holds a consent for the diffuse discharge of contaminants to ground and groundwater.

ERM concluded that the potential for off-site activities to have resulted in material soil and groundwater impacts at the site to be moderate.

ENGEO (2021) Environmental Due Diligence Investigation

ENGEO undertook a due diligence soil investigation to generally characterise the site and to delineate previously identified contamination (4Sight 2019a). The investigation results are summarised below. The sample data summary table is included in Appendix 2.

- Four shallow soil samples were collected from the relatively flat land at the top of the tuff ring in the southeast of the site (labelled S1 – S3 on Figure 2d). Based on historical aerial imagery, this area was subject to horticultural / orcharding land use between 1987 and 2001. Three samples of shallow topsoil were selected for analysis of heavy metals / metalloids and OCPs. Concentrations of heavy metals / metalloids were within naturally occurring background ranges for volcanic soils (AC, 2016) and OCPs were not detected above the lower laboratory limit of reporting.
- Two shallow soil samples were collected from the paddock at 400 Oruarangi Road (labelled S5 and S6 in Figure 2a) to provide site coverage and assess potential impacts from buildings / building use in this area.
- Two shallow soil samples were collected from the landscaped area south of the present Villa Maria buildings, on the crater floor (samples labelled S7 and S8 in Figure 2b). This area was subject to horticultural land use from the mid-1980s till early 2000s. Both samples were analysed for heavy metals / metalloids (including mercury) which were identified to be below naturally occurring background concentrations for volcanic soils (AC, 2016).
- Twelve locations from the vineyard areas were sampled within the main crater floor and a subset of eleven were chosen for laboratory analysis (labelled S10, S11 – S22). A sample from the shallow topsoil was analysed for contaminants of concern while three locations were selected for analysis of the deeper horizon of topsoil (from 0.2 – 0.4 m bgl). These areas were used for pastoral purposes prior to 1983. From 1987 they were used for a mixture of horticultural and pastoral purposes, and from 2005 have been used as vineyards. Samples were analysed for heavy metals / metalloids (including mercury) and OCPs.

Four samples from two locations (S14 and S17 on Figure 2b) contained concentrations of contaminants above naturally occurring background levels.

As part of this assessment, no evidence was reviewed that suggested the closed landfill on Oruarangi Road Reserve (west of the site) had impacted the site.

Initia (2021) Geotechnical Assessment

Of the five borehole locations investigated by Initia within the current site boundaries in their 2021 investigation, none identified fill material (locations labelled BH01 – BH05 on shown on appended Figures 1b – 1d).

Initia (2022) Geotechnical Investigation Report

Investigation location labelled BH110 on Figure 2a (in the north of the site) identified fill to 2.5 metres below ground level which comprised of clayey silts with minor gravel of basalt. No anthropogenic material was logged and the location suggests that it is reworked native soil used to fill in the former swamp in this location.

4.3 Oruarangi Landfill Investigations

Previous investigation reports and assessments of the landfill reviewed did not include investigation locations on the site (Manukau City Council, 1995; 1997; PDP, 2007). However, based on a review of topographical contours, one area of landfill possibly crosses the site boundary (Figure 3). This section of the landfill was understood to have predominantly received spoil from surplus road excavations (Manukau City Council, 1997, 1999; Manukau Consultants Limited, 1999). Other areas of the landfill have received higher risk types of refuse, including asphalt, car parts, tyres, bricks, soil, and assorted rubbish (PDP, 2007).

It is understood that the landfill first accepted material in the 1960s, and filling ceased in 1990 (Manukau City Council, 1997, 1999; Manukau Consultants Limited, 1999). The information summarised below can generally be applied to the landfill as a whole.

Manukau City Council (1995) Closed Landfill Leachate Strength

Groundwater samples were collected from two boreholes in the Oruarangi Landfill and analysed for a wide suite of metals / metalloids, although it was noted that these samples were not filtered prior to analysis. The locations of these boreholes was not presented in the report. Sample results were conservatively compared against the Drinking Water Standards for New Zealand (MoH, 1995). The data summary table has been reproduced below (Table 2) showing analytes compared to current criteria based on environmental risk (ANZECC, 2000).

Table 2: Analytes Measured from Oruarangi Landfill leachate (Manukau City Council, 1995)

	Metals / Metalloids (ppm)									
	Boron	Calcium	Cadmium	Chromium	Copper	Iron	Potassium	Magnesium	Manganese	Sodium
ANZECC, 2000[1]	**2.5[2]**	**-**	**0.036**	**1.9**	**0.008**	**-**	**-**	**-**	**3.6[2]**	**-**
Oruarangi 1	0.32	16	0.0003	0.001	0.01	**1.3**	4.5	12	0.083	32
Oruarangi 2	0.28	18	0.0002	0.001	0.011	**0.98**	4.5	12	0.1	33

Bold values exceeded the Drinking Water Standard (MoH, 1995).

1 Values for the protection of 80% of specifies were used for comparison to site data.

2 Freshwater criteria used in lieu of marine water as criteria are not presented in ANZECC (2000).

The adopted ANZECC (2000) criteria were not exceeded even though the samples were not filtered (criteria are based on dissolved concentrations, which for hydrophobic contaminants such as metals should be lower).

Manukau City Council (1997) Old Landfills Investigation

Seven bores were installed across the landfill, presumably in 1996 although based on data collected by GHD (2000), this may have been as early as 1994 (Figure 3). Three of these bores were on the north-eastern bank (although not within the current site boundary). The report has likely confused the orientation of the site plan as it refers to the location of the three wells as the 'south-western bank.' The report mentions that a three-metre-thick basalt flow was encountered in the 'southern part of the south-western side of the site.'

It is understood that one of the seven bores encountered refuse during excavation, although it is unclear which bore this was as the borehole logs were not included in the version of the document reviewed by ENGEO.

Manukau Consultants Limited (1999) Assessment of Environmental Effects

None of the seven bores contained landfill gas > 10% of the lower explosive limit during installation (Manukau Consultants Limited, 1999). Three piezometers were reportedly installed in the boreholes which had been excavated, although it is unclear which ones these were.

Yearly monitoring of Oruarangi Creek for metals, nitrate species, chloride, and total organic carbon (TOC) did not identify statistically significant differences in the sample upstream of the landfill compared to the downstream sample (Figure 4 below). As the testing of surface water indicated no discernible contamination at the site, stream sampling was ceased in 1999.

Figure 4: Oruarangi Road – Creek Testing (Manukau Consultants Limited, 1999)

Parameter	Units	Results	
Site			
Type of Site		Up Stream	Down Stream
SAMPLE			
Lab sample No		064AN	065AN
Method of collection		Bailer	Bailer
Lab Used		SGS	SGS
ANALYSIS			
Boron	mg/L	0.055	0.057
Chromium	mg/L	<0.0005	<0.0005
Copper	mg/L	0.0031	0.0032
Lead	mg/L	0.0004	0.0003
Manganese	mg/L	0.0735	0.0759
Zinc	mg/L	0.016	0.016
Iron	mg/L	0.37	0.36
Cadmium	mg/L	<0.00005	<0.00005
TOC	ppm	13.6	13.6
Nitrate - N	mgNO_3-N/L	0.2	0.2
Nitrite - N	mgNO_2-N/L	<0.01	<0.01
Total Ammoniacal Nitrogen	mgNH_3-N/L	<0.2	0.6
Chloride	mg/L	53	46

GHD (2000) Assessment of Old Landfills

To undertake an environmental risk assessment for the Oruarangi Landfill, GHD compiled landfill leachate data from samples collected between 1994 and 1999. Leachate samples from the Oruarangi Landfill had been analysed for contaminants commonly associated with landfill discharges, cadmium, chromium, lead, ammonia-nitrogen and total nitrate. These contaminants were selected to determine a leachate risk factor (LRF). The criteria selected for these parameters were based on the fact that:

- They are indicators of leachate toxicity to the environment and public health;
- Reliable standards or guidelines are available for these contaminants; and
- The borehole leachate data for these parameters were available for the assessment.

Measured concentrations of contaminants in the landfill leachate were expressed as a ratio of relevant standards or guidelines, to assess relative risk from the landfill. For example, a measured concentration of a contaminant below the guideline value would give a value of < 1. Table 3 below shows that the LRF for the measured contaminants are at least two orders of magnitude less than one.

Table 3: Calculation of Leachate Risk Factors for Oruarangi Road Landfill (GHD, 2000)

Leachate Toxicity Risk Factors[1]					
Cadmium[2]	Chromium	Lead	Ammonia-Nitrogen	Nitrate	**TOTAL**
-	0.007	0.0094	0.086	0.085	0.19

1 For comparison with ANZECC (2000) Guidelines, GHD allowed for a dilution factor of 100 times the leachate for the receiving waters as the guidelines are for levels in receiving waters. For coastal sites, like Oruarangi Landfill it was noted that this is still conservative as the dilution factor is likely to be significantly greater than 100 times when accounting for tidal influences.

2 Cadmium was not considered as previous monitoring results identified it below the laboratory limit of reporting.

Multiple layers of conservatism were built into the LRF model. For example, 1) the samples were unfiltered prior to laboratory analysis and therefore likely to provide higher contaminant concentrations than that actually present in soluble form and 2) The highest measured value for each contaminant during the five-year monitoring period was chosen to provide a 'worst case scenario.' As an LRF for an individual contaminant of greater than one was considered significant for an adverse effect on the environment, GHD considered a combined LRF from all measured contaminants of greater than five to be significant.

GHD concluded that Auckland Regional Council had accepted the environmental risk-based assessment methodology and had declared that Oruarangi Landfill had 'no significant adverse environmental effects.' No further requirement for regulatory consent or compliance monitoring was considered necessary.

ENGEO were also provided with what is presumed to be a draft of the Assessment of Old Landfills (GHD, 2000) named titled Environmental Risk Based Assessment of Municipal Landfills in New Zealand. No additional information relevant to this assessment was included in this report.

5 Potential HAIL Activities

If current or historical activities included on the Hazardous Activities and Industries List (HAIL; MfE, 2011b) are identified at a site the NESCS may apply. An intrusive contaminated land investigation (DSI) is then required prior to redevelopment to determine the actual impact of these activities on the ground conditions at the site and to determine if a resource consent under the NESCS is required for the proposed redevelopment works. Based on the information reviewed as part of this environmental investigation and observations during the site walkovers, the following activities listed on the HAIL may have been historically and / or are currently present at the site:

- HAIL ID A10: *Persistent pesticide bulk storage or use, including sport turfs, market gardens, orchards, glass houses or spray sheds* – Glass houses were on site from at least 1987 until 2001. Orcharding has been present in the south of the site (88 Pavilion Drive address) since at last 1987, which had ceased by 2001.

- HAIL ID A18: *Bulk storage of treated timber outside* – Soil below one area of stockpiled treated timber posts showed low-level arsenic impacts.

- HAIL ID E1: *Asbestos product manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition* – Due to the age of the site buildings, it is likely that asbestos products are present within building materials. Construction materials containing asbestos may result in contamination of adjacent soils during cutting of asbestos-containing building material (e.g., for service installation) and weathering of exterior building material.

- HAIL ID G3: Landfill Sites – Historical aerial images (from 1987) show earthworks occurring in the far west of the site (88 Pavilion Road address). It is presumed that these earthworks are filling operations from the Oruarangi Landfill.

    - G3: Fill – During intrusive investigations, fill material has been identified in the north of the site, presumed to be associated with the filling of the former swamp. It is understood that this material was site won and reviewed logs have not described significant visual or olfactory indicators of contamination.

- HAIL ID I: *Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment* – It is likely, that due to the age of buildings currently or formerly on site that lead-based paint was used, which has the potential to contaminate surrounding soils during maintenance activities (e.g. for service installation) and / or weathering of exterior building material. Bulk storage of treated timber posts in the north of the site were identified by 4Sight (2019a) as impacting the soils beneath it above commercial / industrial human health criteria.

6 Conceptual Site Model

A conceptual site model (CSM) has been developed to assess the potential exposure pathways present at the site. A contamination conceptual site model consists of three primary components. For a contaminant to present a risk to human health or an environmental receptor, all three components are required to be present and connected. The three components of a conceptual site model are:

- Source of contamination.

- An exposure route, where the receptor and contaminants come into contact (e.g., ingestion, inhalation, dermal contact).

- Receptor(s) that may be exposed to the contaminants.

The CSM based on the findings of the desktop investigation and former intrusive investigations undertaken on site by ENGEO. The CSM is summarised in Table 4.

Table 4: Conceptual Site Model

Potential Source of Contamination	Primary Contaminants of Concern	Possible Extent of Contamination	Potential Pathway	Potential Receptor	Acceptable Risk?
Persistent pesticide use in horticultural areas *(HAIL ID: A10)*	Heavy metals / metalloids and organochlorine pesticides (OCPs)	Shallow soil	Soil ingestion, inhalation of dust, and / or dermal contact	Future site users / site redevelopment workers Surrounding residents	**Yes** Concentrations of contaminants of concern were identified to be below adopted remedial criteria.
Treated timber storage *(HAIL ID: A18)*	Copper, chromium, arsenic primarily, also potential for other treatment chemicals (OCPs, PAHs)	Shallow soil beneath stockpiled treated timber	Soil ingestion, inhalation of dust, and / or dermal contact	Future site users / site redevelopment workers Surrounding residents	**Likely** Minor exceedance of commercial / industrial human health criterion on 350 Oruarangi Road address – limited in extent to shallow soil beneath stockpiled treated timber, which can be addressed as part of future redevelopment works.
Building materials containing asbestos *(HAIL ID: E1)*	Asbestos fines and fibrous asbestos	Shallow soil within and adjacent to the former dwelling footprint	Inhalation of asbestos fibres released from impacted soils / dust	Future site users / site redevelopment workers Surrounding residents	**Yes** Asbestos was not detected in the seven samples analysed for it from around the 350 – 400 Oruarangi Road address.

Potential Source of Contamination	Primary Contaminants of Concern	Possible Extent of Contamination	Potential Pathway	Potential Receptor	Acceptable Risk?
Undocumented filling *(HAIL ID: G3)*	Metals / metalloids, polycyclic aromatic hydrocarbons (PAHs) and asbestos fines and fibrous asbestos	Fill material	Soil ingestion, inhalation of dust, and / or dermal contact	Future site users / site redevelopment workers Surrounding residents	**Uncharacterised** Soil sampling in the area suspected of being part of Oruarangi Landfill has not been assessed. Although other fill areas have been identified as reworked native material, some testing of this material is recommended to inform handling procedures and disposal options prior to redevelopment.
			Leaching of contaminants	Surrounding environment	
Potential lead-based paint on former and existing buildings *(HAIL ID: I)*	Lead	Shallow soil within and adjacent to the former dwelling footprint	Soil ingestion, inhalation of dust, and / or dermal contact	Future site users / site redevelopment workers Surrounding residents	**Requires Further Assessment** Lead was identified above residential human health and environmental discharge criteria in soils adjacent to the dwelling at 400 Oruarangi Road. The lead concentration was below the commercial / industrial human health criterion, as such there is not considered to be a risk to future light industry land users. The lead concentration (280 mg/kg) is only slight elevated above the environmental discharge criterion (250 mg/kg) as such is unlikely to be a discharge risk when considering the wider site area.
			Leaching of contaminants	Surrounding environment	

7 Conclusions

Previous investigation works have indicated isolated detections of heavy metals (arsenic) above the soil contaminant standards for protection of human health under commercial / industrial land use beneath a treated timber stockpile (350 Oruarangi Road), and lead above the environmental discharge and residential human health criteria in surface soils surrounding old dwellings (400 Oruarangi Road). We note that the exceedances are minor, both in regard to magnitude and lateral extent, as such the risk to human health or environmental receptors is low and can be managed as part of future redevelopment works.

The concentration of contaminants of concern in soil samples representing larger areas of site (vineyards, former agricultural areas) are less than the soil contaminant standards for a commercial and industrial land use, and the permitted activity criteria from the AUP (2016).

8 Recommendations

8.1 Additional Investigation

Ahead of future redevelopment work, additional investigation is recommended to:

- Delineate the lateral extent of the Oruarangi Road landfill and assess contaminant concentrations in this material.
- Investigate contaminants of concern from the suspected reworked native soils in the north of the site (in the former swamp area).

8.2 Additional Risk Assessment for Plan Change Activities

The results relevant to sub-precinct C appear to support the additional activities proposed in the plan change. However, once the specific activities outside of Light Industry zoning use are known for sub-precinct C, a contaminated land specialist shall be engaged to confirm that the site is suitable for these activities with respect to human health risk. This assessment may include additional testing and, if warranted, remediation to ensure this portion of the site is suitable for more sensitive use than Light Industry.

8.3 Remediation Action Plan

Earthworks associated with future redevelopment shall be managed in accordance with a Remediation Action Plan (RAP) targeting small areas that may require remediation (e.g. shallow soil beneath stockpiled timber, filled areas if identified as contaminated). The RAP will also include monitoring and management procedures for the balance of the earthworks due to the detection of contaminants above background levels and potential for encountering unidentified contamination.

8.4 Closure Reporting

Following completion of remediation works a Site Validation Report (SVR) should be prepared to document remediation works and to confirm that they have been undertaken in general accordance with the RAP.

9 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Goodman Nominee (NZ) Limited, their professional advisers, and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the Engineering NZ/ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (09) 972 2205 if you require any further information.

Report prepared by

Vincent Pettinger, CEnvP

Environmental Scientist

Report reviewed by

Erika McDonald, CMEngNZ

Principal Environmental Engineer

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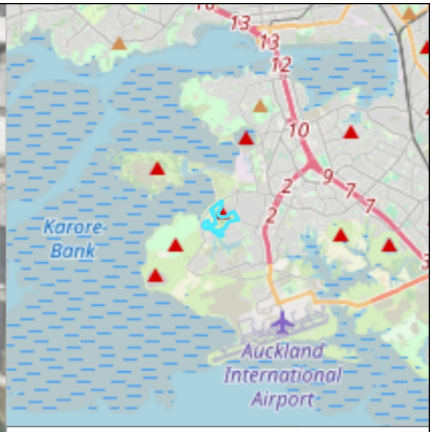
FIGURES



Legend

Area Boundaries

0 100 m 200 m

© Nearmap

ENGEO

Produced by **Datanest.earth**

Title: Site Plan		
Client: Goodman Nominee (NZ) Limited		Size: A4
Project: Oruarangi Road, Mangere	Drawn: VP	Figure No.: 1
Date: 07-03-2024	Checked: EM	
Proj No: 18043.000.001 Plan Change	Scale: 1:5800	Version: 1.0

Legend

- Site Boundary
- Harrison Grierson (2000b) Subsoil Investigation
- ENGEO (2020) Sample Locations
- CMW (2020) Geotechnical Investigation
- Initia (2021, 2022) Borehole Investigation Locations
- 4Sight (2019a) Arsenic Above Commercial Human Health
- 4Sight (2019b) Non-cleanfill Topsoil Areas
- 4Sight (2019a) Lead Above Residential Human Health and Environmental Criteria
- ENGEO (2020) Estimated Extent of Soils Exceeding Cleanfill Criteria
- Known Filled Areas

0 25 m 50 m

ENGEO

Produced by **Datanest.earth**

Title:
Previous Investigation Location Plan - North

Client: Goodman Nominee (NZ) Limited		Size: A4
Project: Oruarangi Road, Mangere	Drawn: VP	Figure: 2a
Date: 07-03-2024	Checked: EM	
Proj No: 18043.000.001 Plan Change	Scale: 1:2100	Version: 2.0

Legend

- Site Boundary
- Harrison Grierson (2000a) Geotechnical Investigation Locations
- ENGEO (2020) Sample Locations
- CMW (2020) Geotechnical Investigation
- Initia (2021, 2022) Borehole Investigation Locations
- ENGEO (2020) Estimated Extent of Soils Exceeding Cleanfill Criteria
- 4Sight (2019b) Non-cleanfill Topsoil Areas

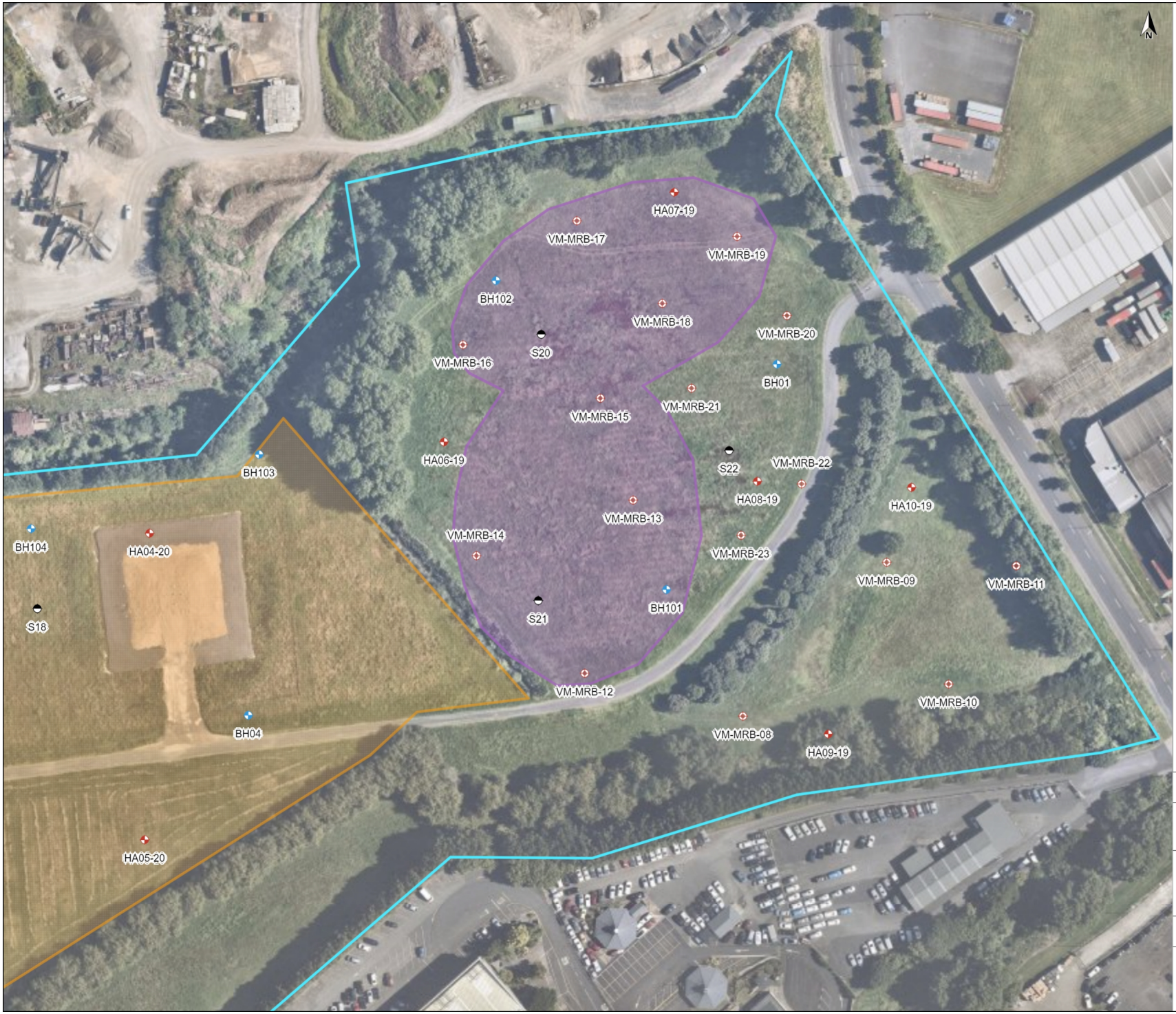
0 25 m 50 m

ENGEO

Produced by **Datanest.earth**

Title:
Previous Investigation Location Plan - Central

Client: Goodman Nominee (NZ) Limited		Size: A4
Project: Oruarangi Road, Mangere	Drawn: VP	Figure: 2b
Date: 07-03-2024	Checked: EM	
Proj No: 18043.000.001 Plan Change	Scale: 1:2143	Version: 2.0



Legend

- Site Boundary
- 4Sight (2019a,b) Detailed Site Investigations
- ENGEO (2020) Sample Locations
- CMW (2020) Geotechnical Investigation
- Initia (2021, 2022) Borehole Investigation Locations
- ENGEO (2020) Estimated Extent of Soils Exceeding Cleanfill Criteria
- 4Sight (2019b) Non-cleanfill Topsoil Areas

0 25 m 50 m

ENGEO

Produced by **Datanest.earth**

Title: Previous Investigation Location Plan - East		
Client: Goodman Nominee (NZ) Limited		Size: A4
Project: Oruarangi Road, Mangere	Drawn: VP	Figure: 2c
Date: 07-03-2024	Checked: EM	
Proj No: 18043.000.001 Plan Change	Scale: 1:1800	Version: 2.0

Legend

- Site Boundary
- Harrison Grierson (2000a) Geotechnical Investigation Locations
- ENGEO (2020) Sample Locations
- CMW (2020) Geotechnical Investigation
- Initia (2021, 2022) Borehole Investigation Locations
- ENGEO (2020) Estimated Extent of Soils Exceeding Cleanfill Criteria

0 50 m 100 m

© Nearmap

ENGEO

Produced by **Datanest.earth**

Title: Previous Investigation Location Plan - South		
Client: Goodman Nominee (NZ) Limited		Size: A4
Project: Oruarangi Road, Mangere	Drawn: VP	Figure: 2d
Date: 07-03-2024	Checked: EM	
Proj No: 18043.000.001 Plan Change	Scale: 1:3000	Version: 2.0

Legend

- Site Boundary
- Presumed Additional Landfill Extent
- Manukau City Council - Groundwater Monitoring Bores
- Manukau City Council Inferred Landfill Area
- PDP (2007) Landfill Investigation Area

0 25 m 50 m

ENGEO

Produced by **Datanest.earth**

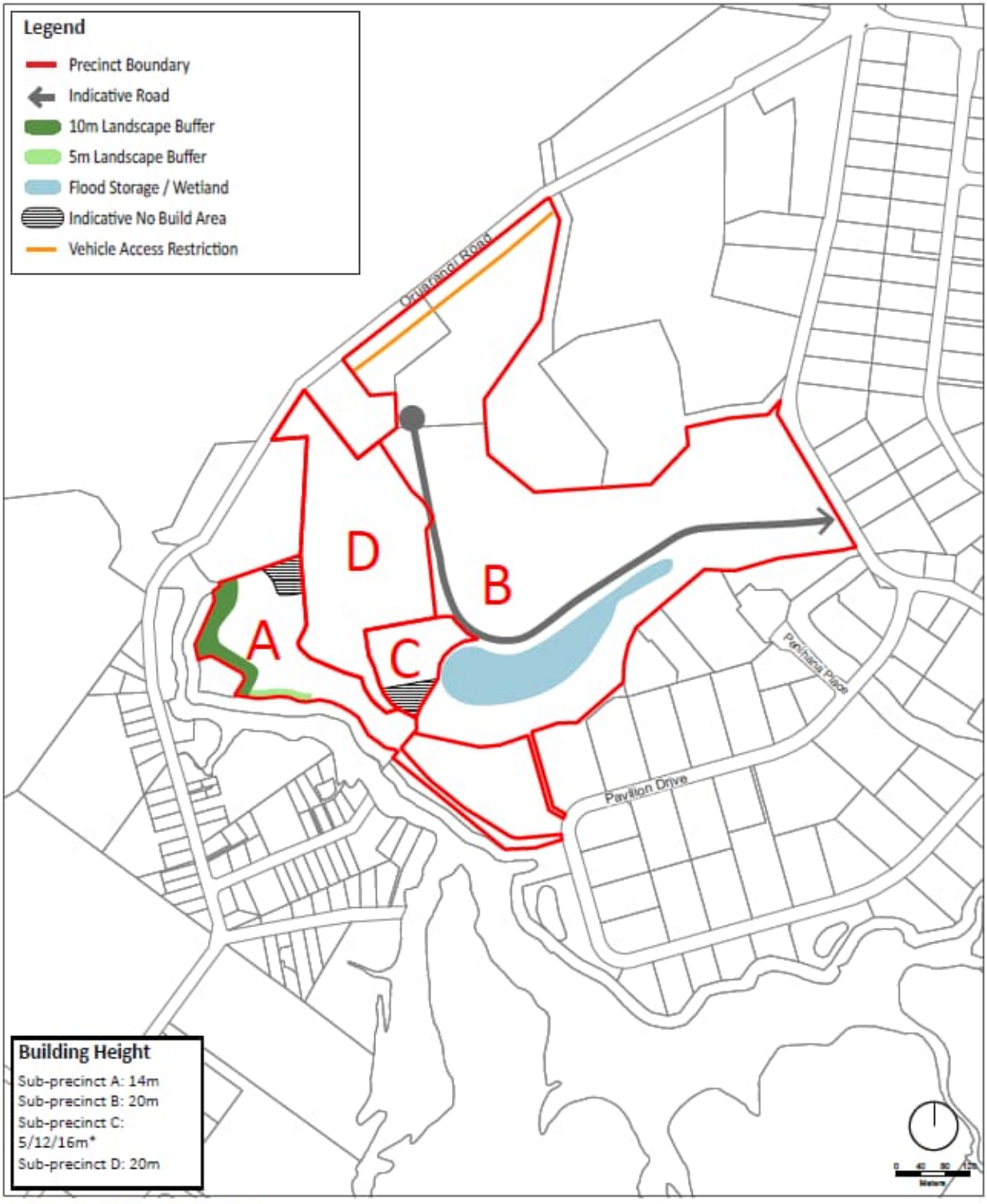
Title: Oruarangi Landfill Plan		
Client: Goodman Nominee (NZ) Limited		Size: A4
Project: Oruarangi Road, Mangere	Drawn: VP	Figure No.: 3
Date: 07-03-2024	Checked: EM	
Proj No: 18043.000.001 Plan Change	Scale: 1:1892	Version: 2.0

APPENDIX 1:

Precinct Plan

Precinct plan 3 – Structuring Elements, Sub-precincts and Building Height

Waitomokia Precinct Plan 3 – Stucturing Elements, Sub-precincts and Building Height

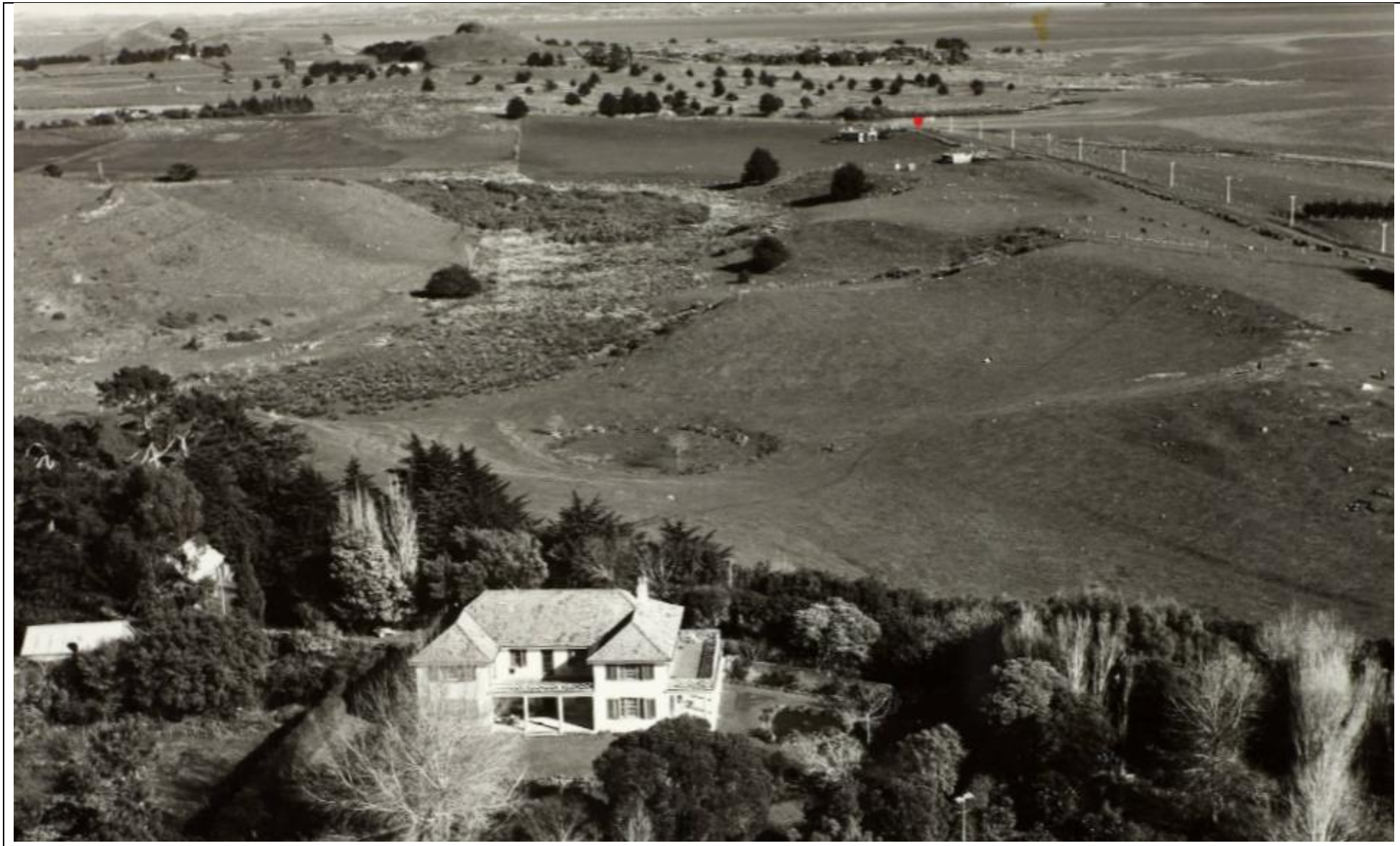


*Refer to Standard I1.6.1. Building Height

APPENDIX 2:

Historical Aerials

ENGEO Ltd	Historical Imagery – 1939 Source: Retrolens	Project Ref: 18043.000.001



View facing southwest overlooking crater floor (swamp). Mt Gabriel (scoria Cone) on left. Dwelling in foreground visible in top right hand side of 1959 image

ENGEO Ltd	Historical Imagery – 1959 Source: Auckland Council GeoMaps	Project Ref: 18043.000.001

ENGEO Ltd	Historical Imagery – 1968 Source: Retrolens	Project Ref: 18043.000.001

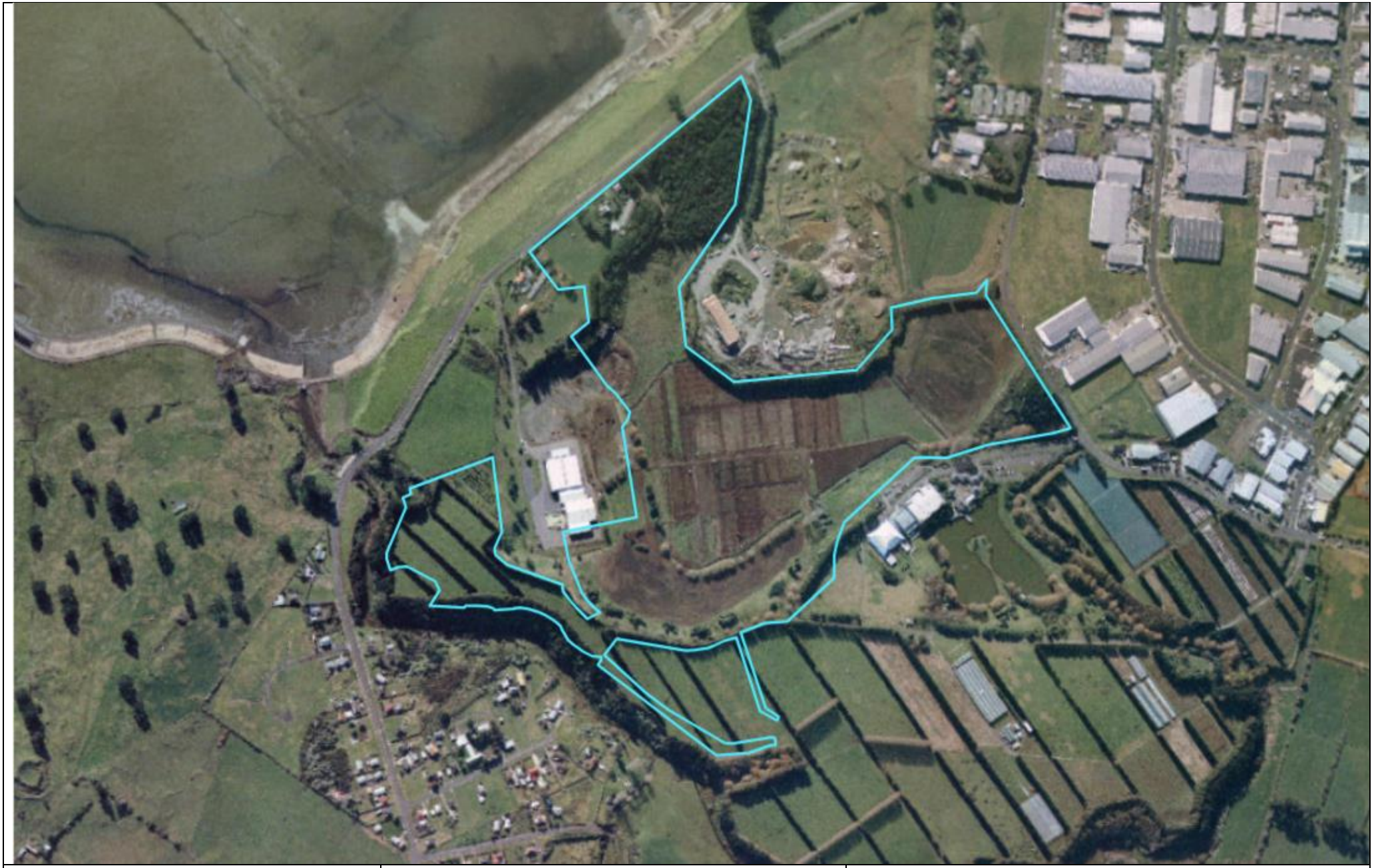
ENGEO Ltd	Historical Imagery – 1975 Source: Retrolens	Project Ref: 18043.000.001

ENGEO Ltd	Historical Imagery – 1980 Source: Retrolens	Project Ref: 18043.000.001

ENGEO Ltd	Historical Imagery – 1983 Source: Retrolens	Project Ref: 18043.000.001

ENGEO Ltd	Historical Imagery – 1987 Source: Retrolens	Project Ref: 18043.000.001

ENGEO Ltd	Historical Imagery – 1996 Source: Auckland Council GIS	Project Ref: 18043.000.001



ENGEO Ltd	Historical Imagery – 2001 Source: Auckland Council GIS	Project Ref: 18043.000.001

ENGEO Ltd	Historical Imagery – 2003 - 2004 Source: Auckland Council GIS	Project Ref: 18043.000.001

ENGEO Ltd	Historical Imagery – 2006 Source: Auckland Council GIS	Project Ref: 18043.000.001

ENGEO Ltd	Historical Imagery – 2010 - 2011 Source: Auckland Council GIS	Project Ref: 18043.000.001

ENGEO Ltd	Historical Imagery – 2024 Source: Nearmaps	Project Ref: 18043.000.001

APPENDIX 3:

DSI Data Summary Tables

Table 4: Soil Analytical Results

		Evaluation Criteria																
Sample Name:		Auckland Background Non-Volcanic Range[1]	Auckland Background Volcanic Range[1]	AUP: OP Discharge Criteria[2]	NES CS - Commercial / Industrial[3]	NES CS - Residential[3]	BRANZ - Semi Quantitative Asbestos[4]	VM-NB-05	VM-NB-06	VM-NB-07	Composite of VM-NB-01, VM-NB-02, VM-NB-03 and VM-NB-04	VM-NB-28	VM-NB-29	VM-NB-30	VM-NB-31	VM-NB-32	VM-NB-33	VM-NB-34	Composite of VM-NB-24, VM-NB-25, VM-NB-26 and VM-NB-27
Sample Depth (m):								0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Date:								19-Jul-19	19-Jul-19	19-Jul-19	19-Jul-19	12-Aug-19	12-Aug-19	12-Aug-19	12-Aug-19	12-Aug-19	12-Aug-19	12-Aug-19	12-Aug-19
Lab Number:								2212275.25	2212275.26	2212275.27	2212275.36	2223838.5	2223838.6	2223838.7	2223838.8	2223838.9	2223838.1	2223838.11	2223838.16
Nature of Soils:								Volcanic	Volcanic	Volcanic	Volcanic	Non-Volcanic	Volcanic	Volcanic	Volcanic	Volcanic	Volcanic	Volcanic	Non-Volcanic
Dry Matter	g/100g as rcvd							83	56	76	64	-	-	-	63	68	-	-	63
Heavy Metals, Screen Level																			
Total Recoverable Arsenic (As)	mg/kg dry wt	0.4-12	0.4-12	100	70 (17.5)	20 (5)		6.0	71.0	5.0	4.0	4	-	-	5	8	-	-	5
Total Recoverable Copper (Cu)	mg/kg dry wt	1.0-45	20-90	325	>10,000 (>2,500)	>10,000 (>2,500)		39.0	64.0	44.0	40.0	28	-	-	47	42	-	-	56
Total Recoverable Lead (Pb)	mg/kg dry wt	<1.5-65	<1.5-65	250	3,300 (825)	210 (52.5)		49.0	23.0	26.0	14.1	18.7	65	139	25	36	280	72	55
Asbestos																			
Presence/Absence							Absent	-	-	-	-	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	-
Description of Asbestos Form																			
Asbestos in ACM as % of Total Sample	% w/w						0.01	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Combined FA+AF as % of Total Sample	% w/w						0.001		-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Organochlorine Pesticides Screening in Soil																			
Aldrin	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
alpha-BHC	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
beta-BHC	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
delta-BHC	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
gamma-BHC (Lindane)	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
cis-Chlordane	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
trans-Chlordane	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
Total Chlordane [(cis+trans)*100/42]	mg/kg dry wt	BD	BD					< 0.04	< 0.04	< 0.04	< 0.04	-	-	-	< 0.04	< 0.04	-	-	< 0.04
2,4'-DDD	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
4,4'-DDD	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
2,4'-DDE	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
4,4'-DDE	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	0.02
2,4'-DDT	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
4,4'-DDT	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	0.02
Total DDT Isomers	mg/kg dry wt	BD	BD		1,000	70		< 0.07	< 0.11	< 0.08	< 0.10	-	-	-	< 0.10	< 0.09	-	-	< 0.10
Dieldrin	mg/kg dry wt	BD	BD		160	2.6		< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
Endosulfan I	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
Endosulfan II	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
Endosulfan sulphate	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
Endrin	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
Endrin aldehyde	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
Endrin ketone	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
Heptachlor	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
Heptachlor epoxide	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
Hexachlorobenzene	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016
Methoxychlor	mg/kg dry wt	BD	BD					< 0.012	< 0.018	< 0.013	< 0.016	-	-	-	< 0.016	< 0.015	-	-	< 0.016

Notes:
All results and criteria are expressed in mg/kg dry weight.
Any results exceeding adopted criteria are shaded accordingly.

BD = Below Laboratory Detection Limits

1: Auckland Background Soil Concentrations (Non-Volcanic Range) from Table E30.6.1.4.2, based on soil sources from Table 3 of TP153:2001 Background Concentrations of Inorganic Elements in Soils from the Auckland Region - using 'Non-Volcanic Range' and 'Volcanic Range'. Exceedances are in yellow (Non-Volcanic) and red (Volcanic).
2: Auckland Council permitted activity discharge criteria from Table E30.6.1.4.1 - Permitted activity soil acceptance criteria. Exceedances are in blue.
3: National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NESCS) Soil Contamination Standards (SCS) from Table B2 for inorganic substances and Table B3 for organic compounds - using the 'Commercial/Industrial' and 'Residential' land use scenarios. Adjusted guidline values (adjusted by dividing actual SCS by four, given soil samples are a composite of four primary samples (in accordance with requirments of the MfE CLMG No.5)) are denoted by brackets . Exceedances are in red (Commercial/Industrial) and purple (Residential).
4: BRANZ Assessing and Managing Asbestos in Soil from Table 5. Soil Guideline Values for asbestos in New Zealand using the Residential land use scenario for ACM and the all land use scenario for asbetos fine and fibrous asbestos. Exceedances are in grey.

Group			Heavy Metals								Organochlorine Pesticides				
Analyte	**Soil Depth**	**Sample Date**	**Arsenic**	**Cadmium**	**Chromium (total)**	**Copper**	**Lead**	**Mercury (inorganic)**	**Nickel**	**Zinc**	**4,4'-DDD**	**4,4'-DDE**	**4,4'-DDT**	**Dieldrin**	**Endrin**
Units			**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
Background (bl) - Auckland			0.4 - 12	0.1 - 0.65	3 - 125	20 - 90	5 - 65	0.03 - 0.45	4 - 320	54 - 1160	-	-	-	-	-
AUP Permitted Activity Standard (D)			100	7.5	400	325	250	0.75	320	400	12 (∑ DDTs)			190 (E)	-
Industrial SCS			70 (A)	1,300 (A)	6,300 (A)	10,000 (A)	3,300 (A)	4,200 (A)	6,000 (B)	400,000 (B)	1,000 (A) (∑ DDTs)			160 (A)	100 (B)
HA01	surface - 0.2m	30-11-2020	3.7	< 0.4	72	38	9.3	< 0.1	130	78	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
HA01	0.2m - 0.5m	30-11-2020	3.2	< 0.4	53	35	8.2	< 0.1	120	72	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
HA01	0.5m - 0.8m	30-11-2020	3.9	< 0.4	76	37	8	< 0.1	150	76					
HA02	surface - 0.2m	30-11-2020	2.9	< 0.4	53	31	6.7	< 0.1	110	66	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
HA02	0.5m - 0.8m	30-11-2020	3.3	< 0.4	51	34	5.7	< 0.1	100	70					
HA03	0.2m - 0.4m	30-11-2020													
HA05	surface - 0.3m	30-11-2020	3.7	< 0.4	76	33	6.6	< 0.1	150	71	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
HA05	0.6m - 0.7m	30-11-2020	3.3	< 0.4	50	32	5.5	< 0.1	110	70					
HA06	surface - 0.15m	30-11-2020									< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
S1	surface - 0.2m	30-11-2020	4.8	< 0.4	71	27	10	< 0.1	75	53	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
S2	surface - 0.05m	30-11-2020	3.8	< 0.4	60	31	7.7	< 0.1	90	65	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
S4	surface - 0.2m	30-11-2020	7.1	0.5	98	82	17	0.1	160	88	< 0.01	0.01	< 0.01	< 0.01	< 0.01
S5	surface - 0.15m	30-11-2020	4	< 0.4	82	37	11	0.1	160	100					
S6	surface - 0.1m	30-11-2020	4.8	0.4	81	40	15	0.1	130	120					
S6	0.1m - 0.3m	30-11-2020	4.7	< 0.4	98	40	8.6	0.2	150	100					
S7	surface - 0.2m	01-12-2020	4.8	< 0.4	20	10	15	0.1	17	34	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
S8	surface - 0.2m	01-12-2020	3	< 0.4	54	40	7.4	< 0.1	110	71	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
S8	0.2m - 0.4m	01-12-2020	4.3	< 0.4	73	48	11	< 0.1	130	83	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
S9	surface - 0.2m	01-12-2020	2.8	< 0.4	43	39	9.2	< 0.1	93	73	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
S10	surface - 0.35m	30-11-2020	4.6	< 0.4	31	42	21	0.2	41	62	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
S12	surface - 0.3m	01-12-2020	< 2	0.5	12	40	20	0.3	11	51	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
S13	surface - 0.2m	30-11-2020	8.6	< 0.4	46	43	19	0.1	47	95	< 0.01	< 0.01	< 0.01	< 0.01	0.01
S14	surface - 0.2m	01-12-2020	5.1	**0.7**	79	59	42	**0.6**	59	160	< 0.01	**0.03**	0.01	**0.04**	**0.04**
S14	0.2m - 0.4m	01-12-2020	5	0.6	79	53	43	**0.6**	62	140	< 0.01	**0.03**	< 0.01	**0.04**	**0.05**
S15	surface - 0.25m	30-11-2020	5.2	0.5	98	57	38	0.2	130	140	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
S15	0.25m - 0.45m	30-11-2020	4.2	< 0.4	64	39	34	< 0.1	110	110	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
S16	surface - 0.3m	01-12-2020	2.6	< 0.4	25	58	16	< 0.1	71	71	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
S17	surface - 0.2m	01-12-2020	**60**	< 0.4	120	49	20	0.2	34	130	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
S17	0.2m - 0.4m	01-12-2020	**35**	0.4	69	42	12	0.3	18	69	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
S18	surface - 0.25m	01-12-2020	< 2	0.4	16	40	15	0.3	25	33	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
S18	0.25m - 0.45m	01-12-2020	< 2	< 0.4	9.7	28	9.3	0.3	13	18	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
S20	surface - 0.15m	30-11-2020	3.3	< 0.4	46	55	8.7	< 0.1	90	87					
S21	surface - 0.2m	30-11-2020	4.1	< 0.4	50	41	11	0.2	72	62					
S22	surface - 0.2m	30-11-2020	3.3	< 0.4	45	58	13	0.1	86	88					

This table does not represent the full analytical results, please refer to the laboratory results for full details.
Values in bold exceed the adopted background concentrations.
Assumes soil pH of 5.
Criteria for Chromium VI were conservatively selected.
No contaminants of concern were identified above the adopted assessment criteria for risks to human health for industrial land use

Guideline Notes:
A- Methodology for Deriving Soil Guideline Values Protective of Human Health (NES, 2011),
B- National Environment Protection (Assessment of Site Contamination) Measure (NEPM, 2013),
C- Regional Screening Levels Targeted Hazard Quotient 1.0 (US EPA, 2020),
D- Auckland Unitary Plan, Operative In Part 15 November 2016. Permitted Activity Standards from Table E30.6.1.4.1
E- Table A.5 Identifying and Managing Risks Associated with Former Sheep Dip Sites: A Guide for Local Authorities (MfE, 2006).