REPORT

Tonkin+Taylor

Central Park, 666 Great South Road, Greenlane

Ground Contamination Assessment for Proposed Plan Change and Rezoning

Prepared for
Oyster Management Ltd
Prepared by
Tonkin & Taylor Ltd
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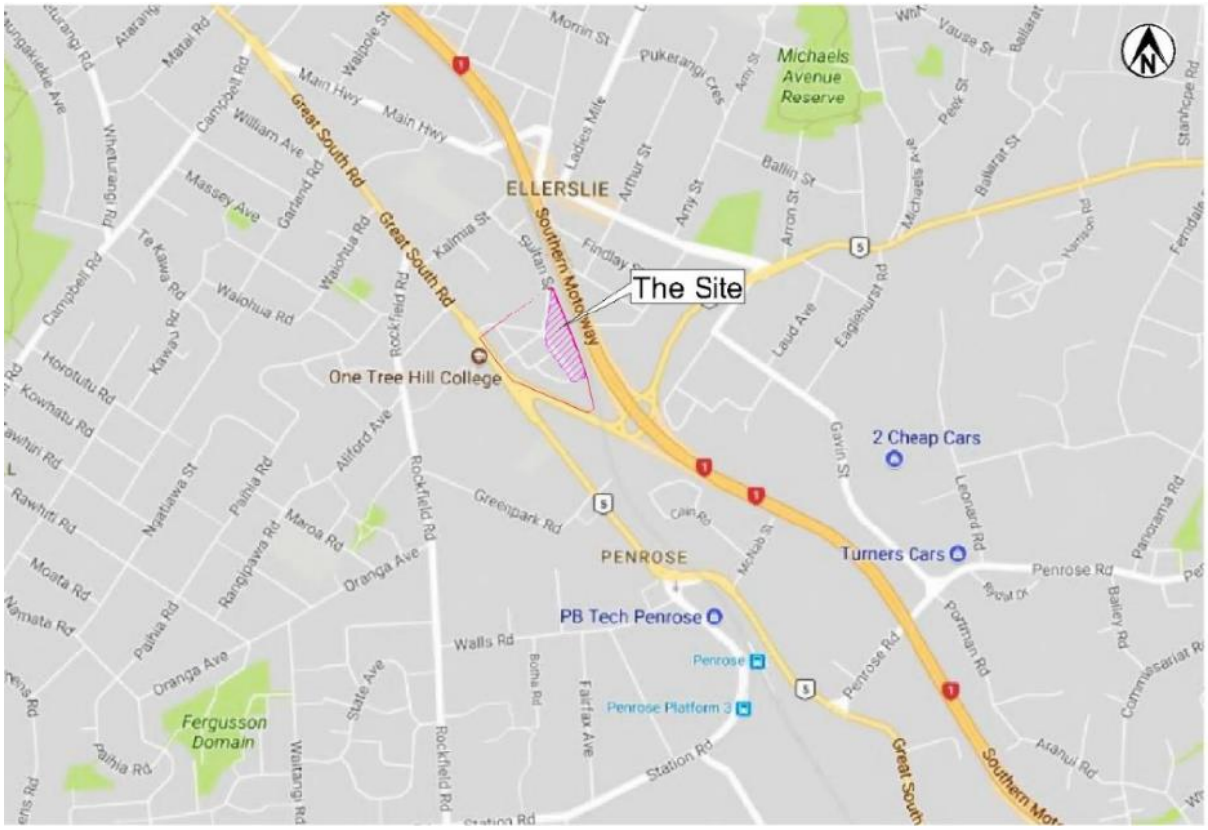
1 Introduction

Tonkin & Taylor Ltd (T+T) has been engaged by Oyster Management Ltd (Oyster) to prepare an updated ground contamination assessment for 666 Great South Road, Greenlane, Auckland. The location of the site is shown as the hatched area presented in Map 1.1 below.

This report has been prepared in general accordance with the requirements for a Preliminary Site Investigation (PSI) and Detailed Site Investigation (DSI) referred to in the NES Soil Regulation[1], and as outlined in the MfE's Contaminated Land Management Guidelines No 1[2].

The persons undertaking, managing reviewing and certifying this investigation are suitably qualified and experienced practitioners (SQEP), as required by the NES Soil and defined in the NES Soil Users' Guide (April 2012).



Map 1.1: Site location plan. The hatched area shows the site relative to the greater Central Park Corporate Centre outlined in red (base map source: Land Information New Zealand).

1.1 Background

The site is located within the eastern portion of the business park known as Central Park Corporate Centre (red outline area as shown in Map 1.1). The majority of Central Park Corporate Centre is already established with numerous multi-level commercial office buildings and amenities. While the site is currently used for vehicle parking, and represents a future developable space. Oyster propose to develop the site for mixed use including commercial and / or high density residential. To achieve this, a private plan change to rezone the site to Business Mixed Use is being sought.

[1] Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.
[2] Ministry for the Environment, updated 2011. Contaminated land management guidelines No. 1: *Reporting on Contaminated Sites in New Zealand*.

T+T have been involved in the development of the Central Park Corporate Centre since 1987, and have conducted geotechnical and contaminated land investigations for at least five of the buildings currently constructed at the business park. The work undertaken by T+T has also included historical review of the area including the current site proposed to be developed. The historical review showed that the area of the Central Park Corporate Centre was occupied by a rubber and plastic manufacturing facility since the early 1960s until the late 1980s when redeveloped into the Central Park Corporate Centre commenced.

The area of the Central Park Corporate Centre is also listed on Auckland Council's hazards register as potentially contaminated because an activity or industry described in the MfE Hazardous Activities and Industries List (HAIL) has been undertaken on the site. The HAIL is a compilation of activities and industries that are considered to have the potential to cause land contamination resulting from hazardous substance use, storage or disposal. However the list merely indicates that such activities and industries have a greater probability of ground contamination occurring than other uses or activities, not that hazardous substances are definitely present in the land.

T+T prepared a Ground Contamination Assessment (GCA[3]) for the site in 2017 based on a specific brief as part of a purchasing agreement. This updated GCA has been prepared to support the private plan change application to rezone the site and includes details of the site history and investigation data relevant to the site.

1.2 Scope of works

The scope of work for this investigation comprised review of and updating the 2017 GCA based on the current proposed private plan change and available investigation data relevant to the site.

The 2017 GCA comprised the following.

- Review of previous T+T reports to establish the history of the site;
- A brief site walkover inspection;
- Advancing eight boreholes of which 6 (BH01, BH02 and BH05-BH08) are located within the current site area;
- Collection of sediment samples from beneath the suspended concrete slab via hand auger at six locations (HA01-HA06);
- Laboratory testing of soil and sediment samples for contaminants identified by the client brief and the desk based study including a suite of metals, polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPHs), polychlorinated biphenyls (PCBs) and volatile organic compounds (VOCs) including benzene, toluene, ethylbenzene and xylene (BTEX);
- Preparation of the 2017 GCA documenting findings and commenting on ground contamination-related implications for future expansion of commercial facilities or development of high-density residential buildings at the site.

This updated GCA report documents our findings and comments on the potential for ground contamination at the site, in the context of the current proposal to develop the site for mixed use including commercial and / or high density residential. This updated GCA has been prepared to support the private plan change application to rezone the site and discusses implications for the redevelopment works with regard to ground contamination.

[3] T+T, 2017. Central Park, 666 Great South Road, Penrose – Preliminary and Detailed Site Investigation (ground contamination). Prepared for Oyster Management Ltd by Tokin & Taylor Ltd, dated November 2017. Reference: 1005001.v2.

2 Site description

2.1 Site Identification

The site is a portion of the wider developed business centre known as Central Park. The site is located along the eastern boundary of Central Park adjacent to the North Island Main Trunk railway line that abuts the eastern boundary of the site along with State Highway 1 (southern motorway) which runs parallel to the railway line. The wider area is comprised of commercial land to the north and south while directly across Great South Road to the west of site is One Tree Hill College School. An aerial photograph of the site and surrounds is presented in Map 2.1 below

Map 2.1: Site setting. The pink dashed line indicates the site with respect to the greater Central Park Business Centre outlined in red (aerial source: Auckland Council GeoMaps).

Further site identification details are provided Table 2.1 below.

Table 2.1: Site Identification

Street address	666 Great South Road, Greenlane
Legal description	proposed Lot 15 (the site) Lot 1-2 DP 126867 (Central Park Business Centre)
Certificates of title	NA74A/263
Site owner	Oyster Management Limited
Site area	1.3577 hectares (ha)
Current zoning	Business - Business Park Zone

2.2 Site condition

An environmental consultant from T+T completed a walkover inspection of the site on 16 December 2018. As noted in Section 1.1, the wider property is a developed business park while the site is predominately used for car parking.

Key features of the site are shown on Map 2.2 below and in Photograph 2.1 and Photograph 2.2 overleaf, as summarised below:

- The northern portion of the site is an asphalt sealed carpark. The asphalt is in a fair condition;
- The southern portion of the site is also used for vehicle parking over a suspended concrete slab. The southern carpark contains two levels, asphalted on-grade and raised areas for the suspended slab;
- The void beneath the suspended slab is between 0.5 and 2.5 m to ground. Several cored holes were evident in the suspended slab, capped with steel lids;
- Beneath the concrete slab is a stormwater detention area that was relatively dry at the time of the inspection, with the surface covered by dry silt. The silt is underlain with gravelly soil;
- Steep vegetated batters are present along the eastern boundary of the site abutting the main-trunk railway line.

A detailed inspection of the balance of the business park was not undertaken as part of the 2017 investigation.

Map 2.2: Site features. The pink dashed line indicates the site with respect to the greater Central Park Business Centre outlined in red (aerial source: Auckland Council GeoMaps).

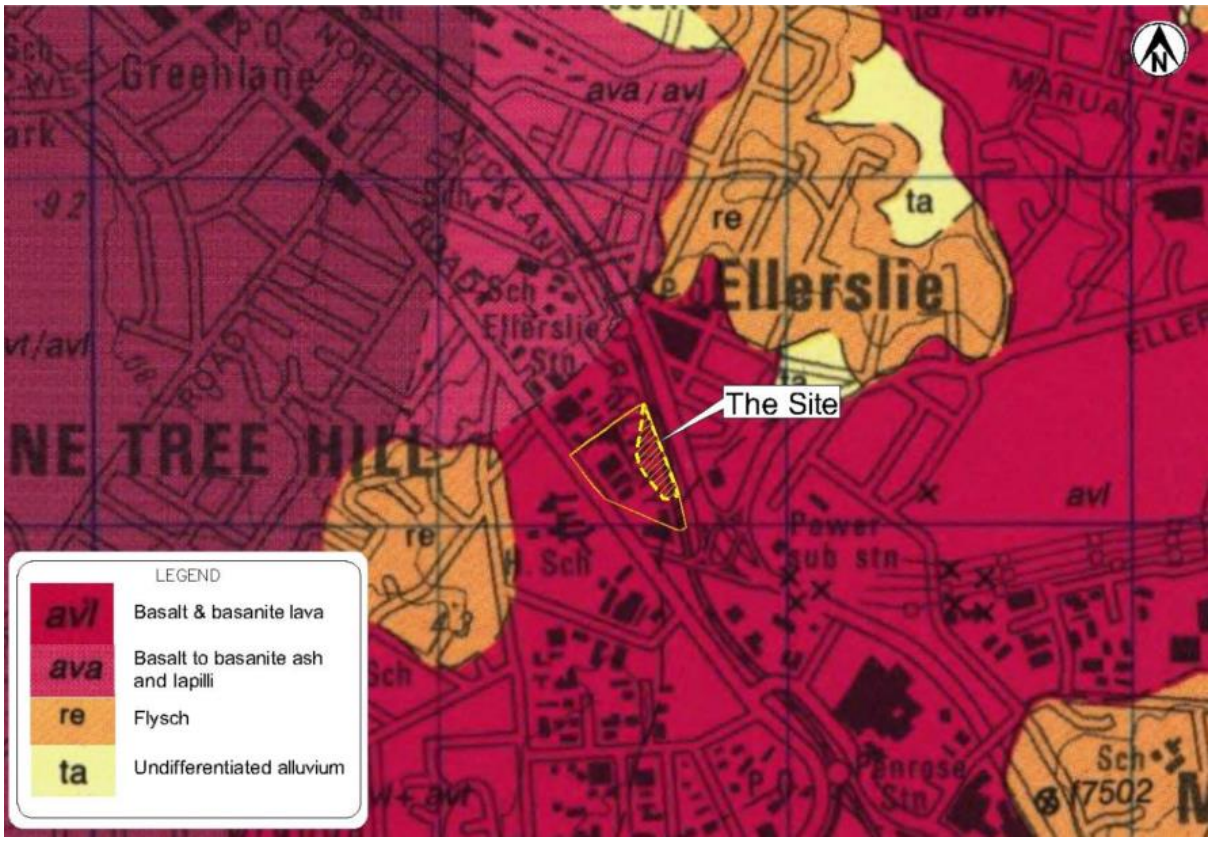
Photograph 2.1: Northern end of the asphalted carpark looking south.

Photograph 2.2: Surface of the suspended concrete slab in the south of the carpark.

2.3 Geology

The published geology[4] for the site, as shown on Map 2.3 below, indicates that the underlying geology comprises fine grained basalt and basanite lava from the Mt Smart volcanic centre within the Auckland Volcanic Field.

Soil conditions, based on previous investigations, include a capping layer of fill of varying thickness (if present) over basaltic ash and rock.



Map 2.3: Geological map (source: refer footnote 4).

2.4 Hydrogeology and hydrology

An Auckland Council groundwater bore is location within the site, refer (refer Map 2.2, Section 2.2). Previously reviewed information for the bore indicates groundwater is at approximately 5 m below ground level (bgl) within the underlying basalt rock. The site is positioned close to the boundary of the Mt Wellington and Onehunga aquifers, a High Use Aquifer Management Area with water drawn for industrial and drinking water supply purposes. Groundwater beneath the site is expected to flow in a south to south-westerly direction towards the Manukau Harbour, located about 3 km south.

Published[5,6] information indicates that the hydraulic conductivity of the aquifer is high ranging between 0.45 and 1000 m/d.

[4] Kermode, L.O. 1992*: Geology of the Auckland urban area*. Scale 1:50,000. Institute of Geological & Nuclear Sciences geological map 2. 1 sheet + 63 p. Institute of Geological & Nuclear Sciences Ltd., Lower Hutt, New Zealand.

[5] Auckland Regional Council, 1993, Auckland Isthmus Groundwater Study – One Tree Hill – Onehunga Groundwater Resource Report and Management Plan

[6] GCNZ Woodward Clyde Ltd (May 1991), Water right application to regularise existing condition at Craigs Quarry Landfill

3 Site history summary

The history for the area which makes up the Central Park Corporate Centre has been established through review of historical and current aerial photographs, the Auckland Council property file, historical certificates of title and review of Auckland Council's pollution records. The history has not changed since it was initially documented by T+T in 2014.

In summary:

- Residential dwellings occupied the area from the 1940s to the 1960s, earlier photographic records were not available;
- Reid New Zealand Rubber Mills followed by Feltex Reidrubber Ltd operated a rubber manufacturing operation for approximately 20 years commencing in the early 1960s. The layout of the former rubber manufacturing operation is provided in Figure 1 (Appendix A). The following were known to be present:
  - Rubber factory, warehouse and store;
  - Tyre factory, warehouse and store;
  - Plastic factory;
  - Ancillary infrastructure including blackmill, offices, cafeteria, workshop, boiler house and underground diesel storage tank;
  - A settlement pond was also documented to be present. It has been documented that during operation of the manufacturing operations the remaining bulk of the area was extensively sealed/paved;
- In 1987, Goodman acquired the land and commenced development of the business park;
- Between 1987 and 2016, all existing buildings were constructed.

4 Potential for contamination

Based on the history of the site and our knowledge of the history and ground conditions in the surrounding area, a number of potentially contaminating activities have been identified. These activities include those listed on the MfE HAIL. The activities, potential contaminants and an assessment of the potential magnitude of the effects across the site as a whole and for the investigation area are presented in Table 4.1.

Table 4.1: Potentially contaminating activities

Potentially contaminating activity	Potential contaminants	Possible magnitude and extent
Landfilling associated with development	Broad range of contaminants possible, depending on the source of fill. Demolition materials from former structures. May be present. Typical contaminants include asbestos, metals and Polycyclic Aromatic Hydrocarbons (PAHs).	Fill is generally documented in investigations across the entire Central Park Corporate Centre. Variability in the surface of the underlying rock and possible historic rock removal during development of past activities means fill depths will vary across the site. Localised deeper areas of fill may also occur around old or removed building foundations. There were significant structures across the site prior to development by Reid/Feltex and the demolition waste from these structures may have been placed as fill on the site. The contaminant levels encountered to date during previous contaminant testing investigations (refer Section 5) are unlikely to pose a risk to human health for commercial or high density residential type activities or to leach to cause a risk to underlying groundwater.
Tyre/plastic/rubber manufacturing and storage of hazardous materials.	Acids, solvents, hydrocarbons and metals.	Any surface spills of hazardous materials is likely to be confined to near surface soils beneath the former manufacturing buildings. The close proximity of rock to the surface means any spills have potential to have migrated to the water table. Any contamination, given the high permeability of the underlying rock is likely to have diluted and dispersed some time ago.
Buildings containing asbestos, and demolition of buildings containing asbestos.	Asbestos	The rubber manufacturing plant was developed in the 1960s a time when asbestos products were commonly used in New Zealand. There is potential for friable asbestos to be present in near surface natural soil or fill as a result of past poor demolition practices or degradation and release of fibres from existing building materials. Asbestos containing material (ACM) was recorded to have been encountered during the development in the southern part of the Central Park Corporate Centre area.
Stormwater detention.	Hydrocarbons and metals from the site and the from upgradient catchment.	Isolated to the sediment layer beneath the suspended concrete slab in the southern half of the carpark/investigation area. The land uses in the upper part of the catchment are from similar

Potentially contaminating activity	Potential contaminants	Possible magnitude and extent
		commercial and residential land uses and the road network.
Bulk storage of fuel (diesel) for the boiler)	Hydrocarbons including benzene, toluene, ethylbenzene and xylenes (BTEX), PAHs, lead and other metals particularly if waste oil was handled.	A diesel UST is noted to have been present directly east and adjacent to the centrally located boiler (refer Map 2.2, Section 2.2). Hydrocarbon contamination arising from the storage of fuel is likely localised and anecdotal evidence documented in the T+T 2008 report suggests the UST was removed and no residual contamination noted. Given the close proximity of rock to the surface it is likely the UST was founded in rock and thus supports the anecdotal evidence as very little soil profile is likely to be present. Groundwater in the vicinity is expected to be relatively fast moving and thus any past leaks are unlikely to be reflected in current groundwater quality.
Electrical transformers.	Polychlorinated biphenyls (PCBs), hydrocarbons, copper, tin, lead and mercury.	The position of electrical transformers associated with the former manufacturing operation is shown on (refer Map 2.2, Section 2.2) along the northern boundary of the area. As the area was formerly sealed and the soil profile thin, the potential for significant soil contamination associated with historic or current transformers is low.

5 Summary of contamination investigations

Between 2003 and 2017, T+T carried out 6 soil contaminant testing investigations at various locations across the entire Central Park Corporate Centre area. The investigations related to the development or proposed development of the following buildings (locations as shown on Figures 1 and 2, Appendix A):

- Building 8;
- Building H;
- Buildings 7/F/A;
- Building B
- Building 1; and
- Building 6 and additional investigations at Building 7/D/F/G.

All six investigations included the collection of soil samples at various depths to analyse for potential contaminants related to the former rubber/tyre manufacturing activities comprising metals, TPHs. In addition, a number of the investigations also included the testing of PAHs, other VOCs and SVOCs, PCBs and/or asbestos.

The location of the investigation locations where the samples were collected are plotted on a current aerial photograph attached as Figure 2, Appendix A. A table that summarises the analytical results from the 6 investigations is attached as Table B, Appendix B. Laboratory reports from the investigations can be provided upon request.

To date, a total of 13 boreholes or hand augers have been advanced within the site area and 13 soil samples analysed for various contaminants. These site specific results and those of the surrounding investigations provide an indication of the overall condition of the site in the context of the proposed future expansion of commercial facilities or development of high-density residential buildings at the site.

5.1 Sampling procedures and data quality

The 6 previous ground contamination investigations comprised sample collection facilitated through machine drilled boreholes or collected through hand augering. In all cases, soil samples were collected in accordance with MfE Contaminated Land Management Guidelines No. 5[7] using the following sampling procedure:

- Soil samples were collected using a trowel or freshly gloved hand directly from the drill core or hand auger head and placed into laboratory-prepared glass sample jars;
- The materials encountered were logged in general accordance with the NZ Geotechnical Society guidance;
- The sampling equipment was decontaminated between each sample location using Decon-90 (a phosphate-free detergent) and fresh water rinses;
- Samples were shipped in chilled containers to an IANZ accredited laboratory under chain of custody documentation.

Quality assurance and quality control (QA/QC) programmes were implemented as part of field procedures for each of the investigations to confirm data was fit for purpose and included:

- Decontamination of sampling equipment between sampling locations;

[7] Ministry for the Environment, updated 2011, Contaminated land management guidelines No. 5: *Investigation and Analysis of Soils*.

- Collection of duplicate samples for testing and results confirming the data suitable for interpretation in all cases where duplicates were collected;
- Preservation of samples with ice during transport from the field to the laboratory;
- Transportation of samples with accompanying Chain of Custody documentation;
- Compliance with sample holding times;
- Laboratory analysis of the samples would also be subject to standard laboratory QA/QC. No, non-conformances were reported by the laboratories for the analyses undertaken for these investigations.

5.2 Observations

Ground conditions underlying the site comprise the stratigraphic units described in Table 5.1 below.

Table 5.1: Stratigraphy

Geological unit	Description
Fill	Fill, previously encountered, is variable in thickness occurring between 0.5 and 1.8 m depth below the concrete or other surfacing materials. Fill was typically a mixture of silt, sand and gravel. Demolition material inclusions were also present in places. In the southern-most corner of the site, silt up to 1.4 m thick was encountered, thought to be sediment associated with stormwater detention.
Auckland Volcanic Field	Basaltic ash (brown silt) and rock.

Borehole logs from the 2017 investigation are included in Appendix D.

5.3 Assessment criteria

The soil and sediment testing data have been evaluated according to the requirements of the regulatory framework (refer Appendix C) applicable to the site as set out below.

- For the protection of human health:
  - The NES Soil contaminant standards for commercial/industrial land use;
  - The NES Soil contaminant standards for a high-density residential land use;
  - For asbestos in soil contamination, the criteria defined in the NZ Asbestos in Soil Guidelines[8] have been adopted;
- For discharges to the environment:
  - The Auckland Unitary Plan - Operative in Part (AUP) permitted activity soil acceptance criteria;
  - Australia and New Zealand Environment and Conservation Council *Guidelines for Fresh and Marine Waters* (2000), interim sediment quality guidelines for both high and low level of protection;
- Background/cleanfill disposal criteria:
  - Published background concentrations for Auckland as specified in the *Auckland Regional Council Technical Publication 153 – Background Concentrations of Inorganic Elements in Soils from the Auckland Region*. These are also used as the criteria for acceptance of soil to cleanfill sites in Auckland.

[8] BRANZ, 2017. New Zealand Guidelines for Assessing and Managing Asbestos in Soil.

The various assessment criteria based on the above are displayed along with the soil results in the Table B, Appendix B. The results specific to the site area are listed with an asterisk.

For discharges to the environment the sediment results have also been considered against the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZAST, August 2018), default guideline values for sediment quality.

5.4 Analytical results

Across the entire Central Park Corporate Centre area fill materials and sediment (silt) sampled beneath the concrete suspended slab located through the south portion of the site contained generally low levels of contaminants. Insitu natural soils (volcanic ash-derived) contained contaminant levels generally consistent with published background levels for volcanic soils.

The laboratory results (refer Table B in Appendix B) show:

- Where exceedances of background levels were reported they were commonly reported for metals, PAHs and TPHs (most commonly the fraction C_{15}-C_{36}). Also, trace concentrations of chlorinated solvents (tetrachloroethene (PCE)/trichloroethene (TCE) and derivatives) and PCB were reported in 7 of 24 samples analysed for these parameters;
- Various exceedance of the AUP criteria for discharges were noted:
  - PCE/TCE chlorinated solvents, possibly used as cleaning agents in former workshops, slightly exceed AUP criteria for discharges. The samples where PCE/TCE were detected above the AUP criteria for discharges where located along the western boundary of the current site area (BH02 and BH03 of the 2017 investigation);
  - Lead and zinc concentrations within four out of seven of the sediment samples collected within the current site area exceed the AUP criteria for discharges;
  - Chromium, lead, nickel and zinc concentrations that exceed the AUP criteria for discharges were also reported in results from investigations outside the current site area;
- With the exception of lead concentrations at two locations no results exceeded the human health based criteria for high-density residential land use;
  - One of the lead exceedances is from a sediment sample collected within the site area (HA04);
  - The other lead exceedance is associated with a topsoil sample collect from offsite in an area where the topsoil has since been stripped as part of developing the area;
- No results exceeded the human health based criteria for commercial land use;
- No asbestos was detected in the three samples tested but ACM was recorded to have been encountered during the development in the southern part of the site associated with Building H in 2015/2016. As well as a piece of ACM pipe fragment was recovered during the drilling of BH04 in 2017 (located outside the current site area).

6 Conceptual site model and risk assessment

A conceptual site model as defined by the MfE Contaminated Land Management Guidelines No. 5[9], sets out known and potential sources of contamination, potential exposure pathways, and potential receptors. For there to be an effect from the proposed activity there has to be a contamination source and a mechanism (pathway) for contamination to affect human health or the environment (receptor).

Laboratory testing specific to the site of the proposed private plan change, has confirmed low levels of contaminants in soil well below human health and AUP "discharge" levels. Sediment within the detention area is affected by metals, namely copper, lead and zinc, with some organic compounds also detected at trace levels. Contaminants in sediment are expected to have arisen from the detention of stormwater from the upstream catchment and are not unexpected given the commercial/industrial land uses within the catchment. TCE/PCE concentrations in soil are present to the west of the development area, likely to be associated with the former workshop activities. These contaminants appear to be in two isolated areas, outside of the currently proposed development and are concentrations that do not pose a risk to human health.

The **source** of contamination is within fill and the sediment within the stormwater detention area. Ongoing inputs to contaminants in sediment are expected given the stormwater is sourced from an urban environment. Ongoing sources of soil contamination within the site itself are unlikely, based on the available data.

Receptors of contamination in the fill materials and sediment may include:

i People – site workers, adjacent site workers, disposal site operators, the general public and future users of the site; and

ii Environment – ecological receptors at stormwater and groundwater discharge points, and those at disposal destinations if they are not appropriate for the type of material.

The **pathways** by which the source materials can affect the receptors are related to earthworks activities during development of the site, including:

- Direct contact by workers;
- Direct contact by the public offsite during any offsite transport/disposal of contaminated material;
- Contaminant migration to the environment via dust and air;
- Contaminant migration to the environment via sediment entrainment in stormwater on site or at a disposal site.

Exposure to users of the site and effects on the environment post any development of the currently undeveloped portion, either in a commercial or high-density residential context, will be negligible as the site is to be largely paved and covered by buildings.

Therefore, the model confirms the following ground contamination-related aspects will need to be managed during the development of the site:

<u>During future development</u>:

- At the time of future development of the site, additional testing to the east of the 2017 investigation location of BH02 within the proposed development area is likely to be necessary to confirm the conceptual site model. If contamination is encountered, the existing provisions

[9] Ministry for the Environment, updated 2011, *Contaminated Land Management Guidelines No. 5 Site Investigation and Analysis of Soils*

in the NES and Chapter E30 of the AUP will trigger the need for a resource consent and there are methods that can be implemented to mitigate potential risks to human health;

- Earthworks controls and mitigation measures are required during disturbance of all cohesive materials;
- Bonded ACM in the form of an abandoned pipe was identified in fill materials, although at considerable depth during the 2017 investigations in a borehole adjacent to the site (BH04). Given the history of the site it is not reasonable to assume more may be encountered. Any materials containing ACM that require disturbance shall be managed in accordance with the requirements of the Health and Safety at Work (Asbestos) Regulations 2016 and the Worksafe Approved Code of Practice: Management and Removal of Asbestos (ACoP) (refer Appendix C);
- To manage environmental effects, sediment and surface water will need to be treated to remove sediment and managed so that contaminants are not entrained in it compromising its ability to be disposed to stormwater;
- During future soil disturbance there is expected to be minimal offsite soil disposal given that the soil profile is thin. The data from the investigation area can be used to support offsite soil disposal permitting. Based on the data it is expected that for soils (excluding those containing demolition materials) managed fill disposal will be appropriate. There is limited opportunity for disposal to cleanfill and given the thin layer of soil separation is expected to be difficult;
- Sediment would require disposal to licenced landfill.

The above requirements will need to be set out in Site Management Plan for ground contamination, prepared to support the resource consent and construction process.

The above matters are addressed and regulated by the NES and AUP for contamination, land disturbance and environmental discharge. These will be assessed at the time of the future development proposal and resource consents triggered if permitted activity requirements are not met.

Post development:

- The site will be largely sealed or covered by buildings on completion thus the potential for site users and surface water runoff to contact any residual contamination will be limited. Under a high-density residential development scenario, sediment must be encapsulated to prevent contact;
- A long term monitoring and management plan, setting out how future ground breaking works shall be managed should be prepared. The LTMMP is not expected to include any requirement for ongoing monitoring of the site given the levels of contamination identified. The LTMMP will set a framework for works-specific site management plans for new building development works, specifically requirements for offsite disposal of surplus soil.

7 Development implications

The implications on consents and earthworks for the site of the proposed private plan change are discussed below.

7.1 Regulatory implications

7.1.1 Overview

In the Auckland Region the key legislation and planning controls around contaminated sites are specified in the following documents and in **Appendix C**:

- The National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES Soil) Regulations (2011);
- The Auckland Unitary Plan – Operative in Part (AUP); and
- Health and Safety at Work (Asbestos) Regulations (2016).

The NES Soil regulations consider issues relating to land use and the protection of human health. The AUP has regard to issues relating to the protection of the general environment, including ecological receptors. The Asbestos Regulations also have implications for this site given that a suspected ACM pipe was noted at one location.

The need, or otherwise, for contamination-related resource consents for the site redevelopment is assessed against these regulatory requirements in the following sections.

7.1.2 NES Soil

In terms of the NES Soil, this report indicates that the site has been subjected to HAIL activities thus the regulations apply. The need for consent will be dictated by the volume and duration of disturbance associated with future development proposal. Consideration of the regulation will also be required should future subdivision be proposed.

Based on the results of the testing in the investigation area and historic data for the balance of the Central Park Corporate Centre, consents, if required, would likely be on a controlled or restricted discretionary activity basis under a commercial land use or high density residential scenario.

A Site Management Plan (SMP) for ground contamination will need to be prepared to support future resource consent applications associated with soil disturbance.

7.1.3 AUP

Contaminant levels in soil are below the AUP permitted activity criteria, only sediment in the detention area exceeds the permitted activity criteria. Thus, works will likely require AUP consent.

Consent on a controlled activity basis is likely to be required. Mitigation measures during any disturbance of these materials and measures to ensure it is disposed appropriately will need to be document in an SMP to support an AUP consent application.

7.1.4 Asbestos Regulations

While no other evidence of ACM was found during investigations within the site area it is possible, given the age of the former buildings and demolition practices in place during their removal in the 1980s, further ACM may be found incorporated into the underlying soil or placed as fill. No actions are required in respect of ACM under the present site conditions however, during ground breaking works to develop the site allowance should be made in regard to possible ACM encounters. These considerations include:

1 Ensuring procedures are in place in the SMP to enable appropriate measures to be put in place to protect workers and the surrounding building users should it be found. The measures will aim to prevent the spread of materials thus limiting cost associated with its management and disposal;

2 Removal of asbestos may be notifiable to Worksafe NZ depending on the magnitude and deterioration of ACM. The contractor will need to have the necessary qualifications under the Asbestos Regulation to undertake the works; and

3 In-ground asbestos, both bonded ACM and asbestos fines/fibres, will have potential to generate airborne fibres but good dust management will mitigate against this.

7.1.5 Summary

The NES, AUP and Asbestos Regulations provide standards for contamination and any future development proposals will be assessed against these standards and resource consents triggered if permitted activity standards are not met.

7.2 Construction implications

During earthworks, standard earthworks controls will need to address possible discharge of contaminants. In particular dust, sediment and stormwater discharges may contain contaminants that could migrate from site and affect surrounding properties and the general public. To mitigate potential effects associated with the site development works a SMP will be required. The SMP will need to include:

- Additional testing of soil depending on the proposed development plan;
- Soil handling and disposal requirements;
- Sediment handling and disposal requirements;
- Unexpected contamination management and notification practices;
- An erosion and sediment controls (ESC) specific to contaminated land to augment the ESC plan;
- Requirements for accumulated water monitoring and disposal;
- Health and safety provisions for workers and measures to protect the general public and surrounding site users; Mitigation measures;
- Contingency measures;
- Validation post the works; and
- Future ground breaking works and consenting requirements (if any).

8 Conclusion

This GCA has been undertaken to confirm what current and historic activities have occurred at the site and whether the activities have resulted in ground contamination that would pose a risk to human health for the proposed subdivision and rezoning.

The historical review shows that the site was used for residential purposes prior to 1960. For approximately 20 years commencing in the early 1960s the site was occupied by a rubber manufacturing operation. In the 1980's the site was acquired by Goodman and development of the business park commenced.

Based on the history of the site and our knowledge of the history and ground conditions in the surrounding area, a number of potentially contaminating activities have been identified. These activities include those listed on the MfE HAIL.

A number of contamination investigations have been undertaken at the site and various locations across the balance of the Central Park Corporate Centre. Across the entire Central Park Corporate Centre area fill materials and sediment (silt) sampled beneath the concrete suspended slab located through the south portion of the site contained generally low levels of contaminants. Insitu natural soils (volcanic ash-derived) contained contaminant levels generally consistent with published background levels for volcanic soils. The laboratory results show:

- Exceedances of background levels for metals, PAHs and TPHs. Also, trace concentrations of chlorinated solvents (tetrachloroethene (PCE)/trichloroethene (TCE) and derivatives) and PCB were reported;
- Various exceedance of the AUP criteria for discharges were noted;
  - PCE/TCE along the western boundary of the current site area;
  - Chromium, lead, nickel and zinc concentrations from investigations outside the current site area;
  - Lead and zinc within the sediment samples collected within the current site area;
- With the exception of lead concentrations at two locations (one located within the current site area and within the surrounding area) no results exceeded the human health based criteria for high-density residential land use;
- No results exceeded the human health based criteria for commercial land use.

The conceptual site model, based on testing undertaken to date, indicates that contamination is unlikely to preclude the development of the site for high density residential land use.

Based on the results of the testing in the investigation area and historic data for the balance of the Central Park Corporate Centre, consents under the NES Soil will be dictated by the volume and duration of disturbance associated with future development proposal.

Consent on a controlled activity basis is likely to be required under the contamination rules of the AUP.

A Site Management Plan (SMP) for ground contamination will need to be prepared to support any consent applications associated with soil disturbance.

While no other evidence of ACM was found during investigations within the site area it is possible, given the age of the former buildings and demolition practices in place during their removal in the 1980s, further ACM may be found incorporated into the underlying soil or placed as fill. No actions are required in respect of ACM under the present site conditions however, during ground breaking works to develop the site allowance should be made in regard to possible ACM encounters.

9 Applicability

This report has been prepared for the exclusive use of our client Oyster Management Ltd, with respect to the particular brief given to us (proposal and variation dated 26 October 2017 and 21 June 2019) and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Recommendations and opinions in this report are based on discrete sampling data. The nature and continuity of subsoil away from the sampling points are inferred and it must be appreciated that actual conditions could vary from the assumed model.

Report certified by a suitably qualified and experienced practitioner as prescribed under the NES (soil) users guide (April 2012).

Tonkin & Taylor Ltd

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
	
.....	.....
Elyse LaFace	Lean Phuah
Environmental Consultant	Project Director

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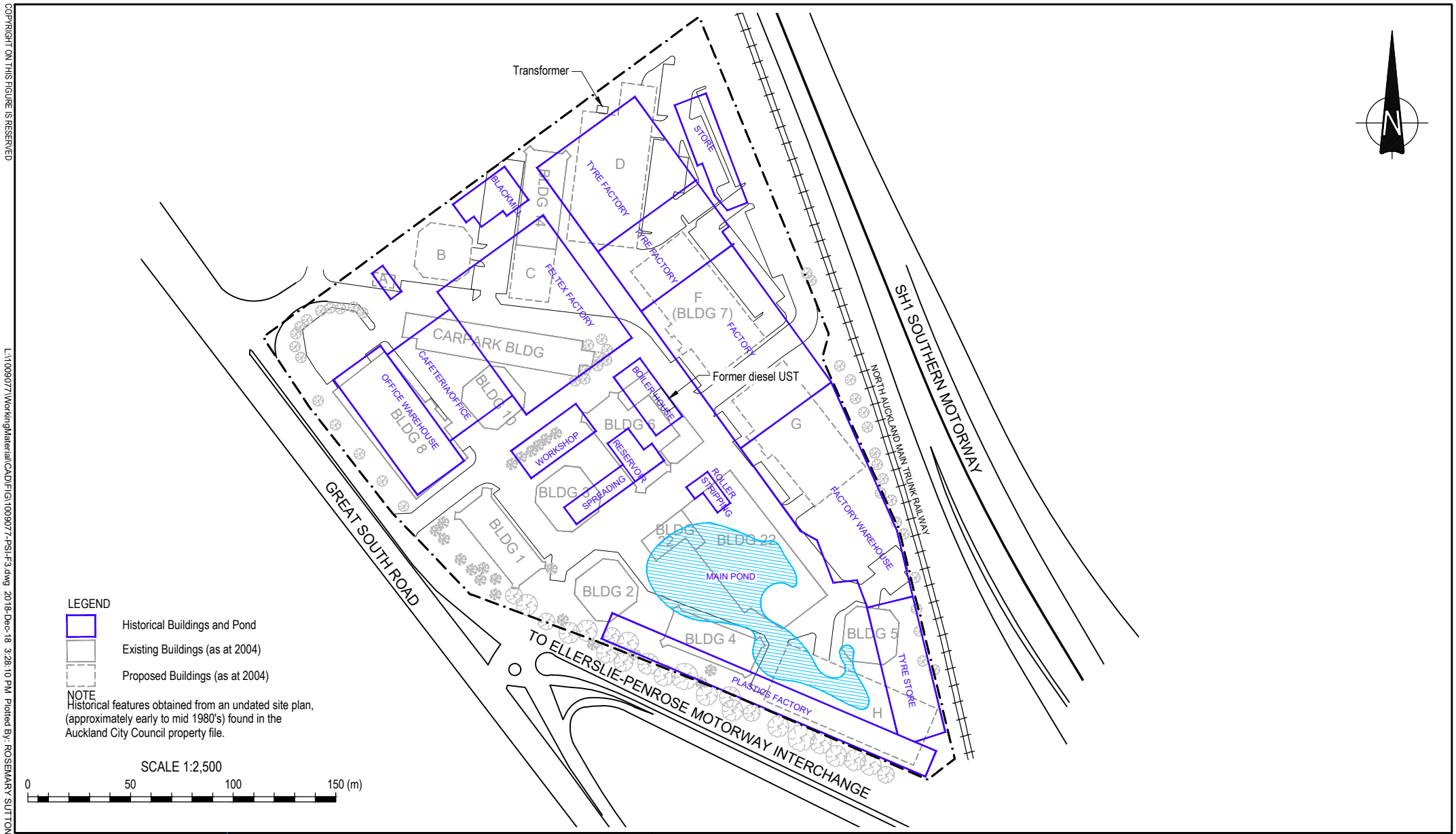
Appendix A: Figures

- **Figure 1 – Historical site layout**
- **Figure 2 – Sample location plan**



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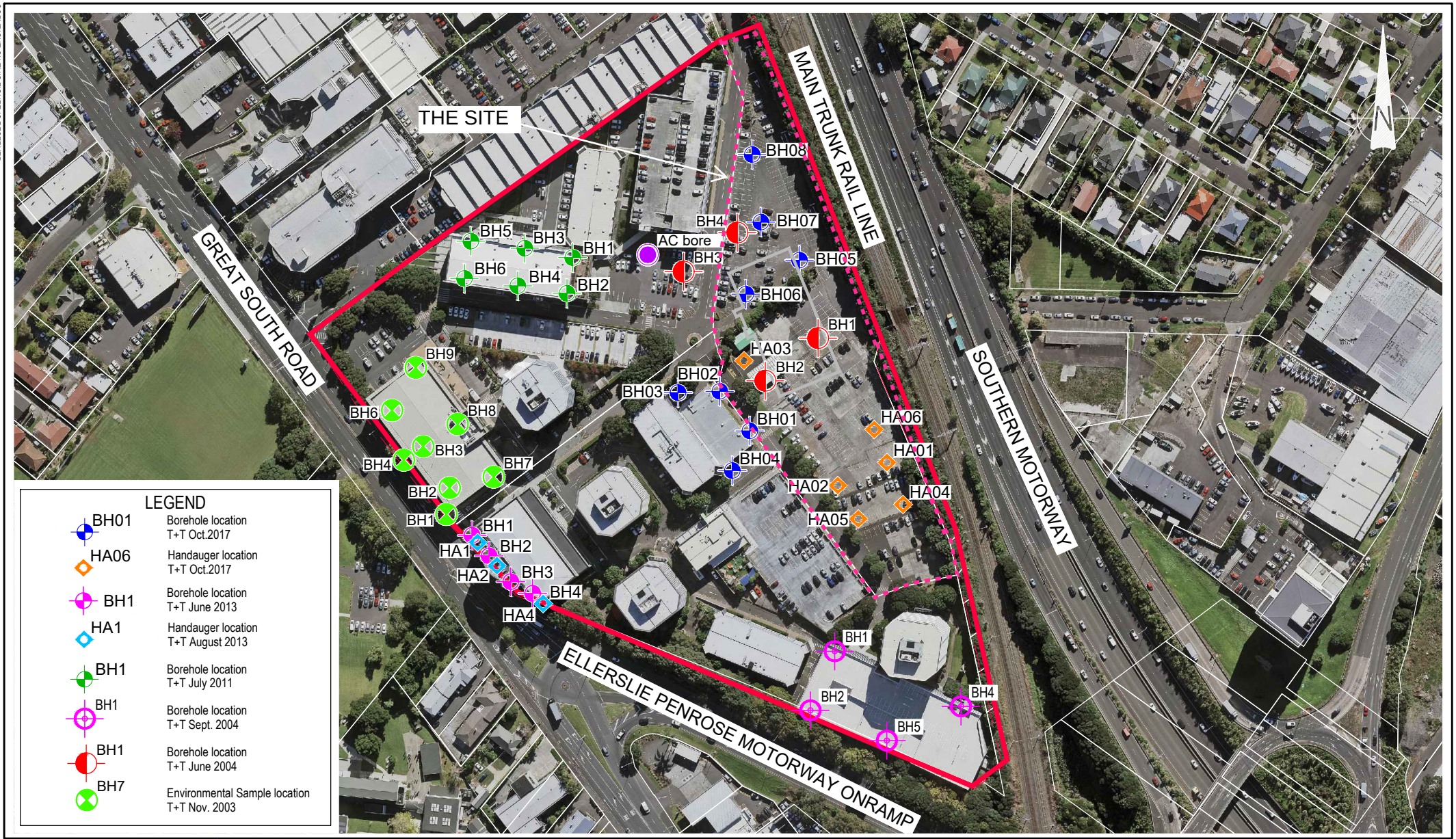
CLIENT **OYSTER MANAGEMENT LIMITED**

PROJECT **666 GREAT SOUTH ROAD, PENROSE**

TITLE GROUND CONTAMINATION ASSESSMENT
Historical Site Plan

SCALE (A4) 1:2500 FIG No. Figure 1 REV 1



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SCALE 1:2,500

0 50 100 150 (m)

Aerial photo and property boundaries sourced from Auckland Council GeoMaps

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CHECKED	EAL	Dec.18
APPROVED	DATE	

CLIENT **OYSTER MANAGEMENT LIMITED**

PROJECT **666 GREAT SOUTH ROAD, PENROSE**

TITLE GROUND CONTAMINATION ASSESSMENT
Sample Location Plan

SCALE (A4) 1:2500 FIG No. Figure 2 REV 1

Appendix B: Summary result table

Table B. Summary of contamination soil results for Central Park Corporate Centre from 2003-2017 (those marked with ** indicates locations within the site area of this investigation)

Building Site Investigation	Sample ID	Soil type	Metals								Total Petroleum Hydrocarbons			Polycyclic aromatic hydrocarbons			Other SVOC/VOC (where analysed only those >LoR are reported)						Polychlorinated Biphenyls (where analysed only those >LoR are reported)	Asbestos
			Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	C7-C9	C10-C14	C15-C36	Naphthalene	Pyrene	Benzo(a)pyrene equivalence	p-Isopropyltoluene	1,1-Dichloroethane	Trans-1,2-Dichloroethene	Cis-1,2-Dichloroethene	Trichloroethene	Tetrachloroethene	PCB-138	
Building 7 /F/A	BH4 2.7 m	Ash	7	0.1	103	44	9.6	-	182	80	<7	<10	<30	-	-	-	-	-	-	-	-	-	-	-
	BH1 0.1 m **	Gravel fill	4	<0.1	13	37	9.6	-	29	59	<5	<9	<20	-	-	-	-	-	-	-	-	-	-	-
	BH1 1.0 m **	Ash	7	0.2	63	44	31	-	46	136	<6	<10	<30	-	-	-	-	-	-	-	-	-	-	-
	BH2 0.5 m **	Gravel fill	3	<0.1	46	**94**	36.1	-	128	108	<5	<9	<20	-	-	-	-	-	-	-	-	-	-	-
	BH3 0.15 m	Topsoil	**32**	**9.1**	**1420**	**717**	**726**	-	224	**2030**	<9	<20	**190**	-	-	-	-	-	-	-	-	-	-	-
	BH3 0.5 m	Gravel fill	5	0.2	54	49	7.7	-	105	78	<5	<9	<20	-	-	-	-	-	-	-	-	-	-	-
Building H	BH1 0.3m	Silty Gravel Fill	<2	<0.1	67	53	4.1	-	223	69	<4	<9	**30**	-	-	-	-	-	-	-	-	-	-	-
	BH2 0.2m	Gravelly Silt Fill	-	-	52	19	6.7	-	34	53	<5	<10	<20	<LoR	<LoR	NC	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	-	-
	BH2 0.7m	Ash	-	0.1	49	15	6.6	-	35	48	<5	<10	<20	-	-	-	-	-	-	-	-	-	-	-
	BH2 1.0m	Ash	4	0.2	54	30	26.1	-	55	103	<5	<10	<20	-	-	-	-	-	-	-	-	-	-	-
	BH4 0.2m	Ash	3	-	39	36	4.4	-	106	48	<4	<9	<20	<LoR	<LoR	NC	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	-	-
	BH5 1.7m	Ash	4	0.3	122	49	16.6	-	89	92	<6	<10	<30	-	-	-	-	-	-	-	-	-	-	-
	SW detention pond 1	Sediment	**16**	**1.1**	79	**266**	58	-	**524**	**2080**	<8	<20	**1310**	-	-	-	-	-	-	-	-	-	-	-
	SW detention pond 2	Sediment	**19**	**1.1**	78	**293**	59	-	**589**	**1990**	<7	<10	**1550**	-	-	-	-	-	-	-	-	-	-	-
Building 8	BH1 0.3m	Clay Fill	11	0.6	54	63	**244**	-	44	323	<5	<10	<40	-	-	-	-	-	-	-	-	-	-	-
	BH2 0.3m	Clay Fill	11	0.5	51	60	**247**	-	40	276	<5	<10	**120**	-	-	-	-	-	-	-	-	-	-	-
	BH3 0.3m	Clay Fill	**13**	**0.8**	52	64	**263**	-	42	338	<5	<10	**50**	-	-	-	-	-	-	-	-	-	-	-
	BH4 0.3m	Clay Fill	11	0.6	51	60	**257**	-	41	289	<5	<10	**210**	-	-	-	-	-	-	-	-	-	-	-
	BH6 0.3m	Scoria Fill	6	0.2	18	55	**442**	-	66	211	<7	<10	240	-	-	-	-	-	-	-	-	-	-	-
	BH7 0.5m	Scoria Fill	<2	<0.1	15	45	4.9	-	68	43	<5	<10	<40	-	-	-	-	-	-	-	-	-	-	-
Building B	BH1 - 0.25m	Gravelly silt (fill)	3	0.17	62	**111**	21	-	99	147	< 9	< 20	< 40	< 0.15	< 0.03	NC	-	-	-	-	-	-	-	-
	BH1 - 0.4m	Gravelly silt (fill)	4	0.18	58	48	36	-	99	156	< 9	< 20	< 40	< 0.15	< 0.03	NC	-	-	-	-	-	-	-	-
	BH1-0.6m	Gravelly silt (natural volcanic)	3	0.35	64	45	9.5	-	62	122	< 10	< 20	< 40	< 0.16	< 0.04	NC	-	-	-	-	-	-	-	-
	BH2 - 0.23m	Gravelly silt (fill)	3	0.26	40	55	47	-	97	126	< 8	< 20	< 40	< 0.14	**0.28**	**0.24**	-	-	-	-	-	-	-	-
	BH2 - 0.45m	Gravelly silt (fill)	< 2	0.18	34	58	20	-	148	82	< 8	< 20	< 40	< 0.13	**0.32**	**0.31**	-	-	-	-	-	-	-	-
	BH3 - 0.15m	Gravelly silt (fill)	6	0.11	36	39	32	-	93	88	< 8	< 20	**260**	< 0.12	**0.72**	**0.67**	-	-	-	-	-	-	-	-
	BH3 - 0.3m	Gravelly silt (natural volcanic)	4	0.25	76	49	24	-	103	124	< 9	< 20	**67**	< 0.15	**0.1**	**0.096**	-	-	-	-	-	-	-	-
	BH4 - 0.2m	Gravelly silt (fill)	3	0.12	**134**	42	21	-	113	96	< 9	< 20	< 40	< 0.14	**0.06**	**0.067**	-	-	-	-	-	-	-	-
	BH4 - 0.7m	(fill)	**15**	< 0.10	26	13	5.4	-	32	42	< 8	< 20	< 40	< 0.13	< 0.03	NC	-	-	-	-	-	-	-	-
	BH5 - 0.3m	Silty gravel (fill)	4	0.11	32	33	16.6	-	74	91	< 8	< 20	**280**	< 0.12	**2.4**	**1.64**	-	-	-	-	-	-	-	-
	BH5 - 0.8m	Gravelly silt (fill)	11	**2.5**	**440**	**220**	**260**	-	155	750	< 9	< 20	**290**	< 0.15	**2**	**1.96**	-	-	-	-	-	-	-	-
	BH5 - 1.0 m	Silt (natural volcanic)	2	0.15	64	51	18.3	-	77	95	< 10	< 20	< 40	< 0.17	**0.11**	**0.14**	-	-	-	-	-	-	-	-
	BH5 - 1.4m	Silt (natural volcanic)	2	0.12	81	43	19.1	-	91	87	< 11	< 30	< 50	< 0.19	**0.09**	**0.08**	-	-	-	-	-	-	-	-
	BH6 - 0.55m	Gravelly silt (fill)	< 2	< 0.10	11	10	10.8	-	18	19	< 8	< 20	< 40	< 0.14	< 0.03	NC	-	-	-	-	-	-	-	-
	BH6 - 0.8m	Silt (natural volcanic)	4	0.16	74	46	**96**	-	98	162	< 9	< 20	< 40	< 0.15	**0.06**	NC	-	-	-	-	-	-	-	-
Building 1	HA1 - 0.3m	Silt, sand and gravel (fill)	4	0.25	36	22	**28**	-	34	67	<9	<20	<40	<0.14	**0.06**	**0.055**	-	-	-	-	-	-	-	ND
	HA2 - 0m	Silt, sand and gravel (fill)	3	0.43	83	34	**15.8**	-	67	92	<10	<20	<40	<0.17	<0.04	NC	-	-	-	-	-	-	-	ND
	HA2 - 0.5m	Silt, sand and gravel (fill)	8	0.2	56	39	**39**	-	82	86	<9	<20	<40	<0.14	**0.2**	**0.19**	-	-	-	-	-	-	-	-
	HA4 - 0.3m	Silt, sand and gravel (fill)	5	0.26	35	18	27	-	24	56	<9	<20	<40	<0.15	<0.3	NC	-	-	-	-	-	-	-	ND
Building 6	BH1 2.3-2.4m	Volcanic Ash	2.9	0.25	54.1	38	8.64	0.14	80.1	103	<10	<15	**87**	**<0.01**	**0.08**	**0.12**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.005	-
	BH1 2.9-3.0m	Volcanic Ash	4.04	0.12	95.9	38.8	11.5	0.21	142.0	92.9	<10	<15	<25	<0.01	<0.02	**0.04**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.005	-
	BH2 0.15-0.25m	Volcanic Ash	2.75	0.11	68.5	55.6	**69.7**	0.079	150.0	87.7	<10	<15	**57**	**<0.01**	**0.04**	**0.09**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.005	-
	BH2 0.4-0.55m	Fill	3.64	0.18	72	41.6	27.8	0.12	95.2	165	<10	<15	**35**	<0.01	<0.02	<0.03	<0.05	<0.05	<0.05	<0.05	<0.05	**0.21**	<0.005	-
	BH2 0.75-0.9m	Fill	4.49	0.047	11.5	78.6	18	0.06	23.6	31.9	<10	<15	**189**	**0.02**	**0.03**	**0.05**	<0.05	<0.05	<0.05	<0.05	<0.05	**0.26**	<0.005	-
	BH2 1.3-1.4m	Volcanic Ash	3.89	0.19	79.7	37.8	19.4	0.14	71.6	110	<10	<15	<25	<0.01	<0.02	**0.03**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.005	-
	BH3 1.55-1.65m	Volcanic Ash	3.95	0.091	103	37.8	10.1	0.14	137	78.9	<10	<15	<25	<0.01	<0.02	<0.03	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.005	-
	BH3 2.15-2.25m	Volcanic Ash	4.59	0.07	**206**	42.2	12.2	0.29	112	64.7	<10	<15	<25	<0.01	<0.02	<0.03	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.005	-
	BH4 2.5-2.6m	Fill	2.7	0.058	24.9	63.7	**79.2**	0.11	21.8	53.5	<10	<15	<25	0.01	**0.13**	**0.13**	<0.05	**0.07**	**0.07**	**0.95**	**0.46**	**0.39**	<0.005	-
	BH4 3.8-3.9m	Volcanic Ash	4.02	0.088	82.9	32.3	11.5	0.16	112	70.7	<10	<15	<25	<0.01	<0.02	<0.03	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.005	-
Building 7/D/F/G (2017)	HA01 0m **	Sediment	**23.5**	**1.00**	69.8	67.3	**277**	0.43	89.6	377	<10	<15	**112**	**0.02**	**1.22**	**1.26**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	**0.008**	-
	HA01 0.1m **	Sediment	**17.3**	**0.69**	74.2	64.5	**221**	**0.49**	94.9	343	<10	<15	**73**	**0.02**	**0.44**	**0.61**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.005	-
	HA02 0m **	Sediment	**18.7**	0.540	80.4	**161.0**	**353**	0.17	66.2	**1350**	10	45	**1776**	**0.03**	**2.63**	**3.25**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	**0.013**	-
	HA02 0.1m **	Sediment	5.01	0.50	74.9	39.1	14.4	0.17	53.7	373	<10	<15	**40**	<0.01	<0.02	**0.04**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.005	-
	HA04 0m **	Sediment	**19.2**	**1.22**	86.6	**291**	**874**	0.25	71.9	**1350**	<10	**19**	**1027**	**0.03**	**6.03**	**5.61**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	**0.015**	-
	HA05 0m **	Sediment	**19.2**	0.64	73.3	**182**	**326**	0.16	53.2	**1510**	**14**	**57**	**2591**	**0.03**	**3.51**	**3.42**	**0.13**	<0.05	<0.05	<0.05	<0.05	<0.05	**0.01**	-
	HA06 0m **	Sediment	10.1	0.360	63.3	86.9	**237**	0.09	88.3	652	<10	<15	**1172**	**0.01**	**1.98**	**2.56**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.005	-
	BH5 2.5-2.7m **	Volcanic Ash	5.84	0.15	**135**	37.4	13.4	0.33	101	70.1	<10	<15	<25	<0.01	<0.02	<0.03	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.005	-
	BH5 3.5-3.6m **	Volcanic Ash	6.49	0.093	**247**	40	11.1	0.28	120	57	<10	<15	<25	<0.01	<0.02	<0.03	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.005	-
	BH6 2.6-2.8m **	Auckland Volcanic Field	1.17	0.065	28.8	38.0	3.32	0.078	90.5	44.2	<10	<15	<25	<0.01	<0.02	<0.03	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.005	-
Minimum			<LoR	<LoR	11	10	3.32	0.06	18	19	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	ND
Maximum			**32**	**9.1**	**1420**	**717**	**874**	**0.49**	**589**	**2080**	**14**	**57**	**2591**	**0.03**	**6.03**	**5.61**	**0.13**	**0.07**	**0.07**	**0.95**	**0.46**	**0.39**	**0.015**	
Soil acceptance criteria	NES (Soil) SCS[1] for commercial land use		70	1,300	6,300	NL	3,300	4,200	6,000 [2]	NL [2]	NL [3]	8,900 [3]	NL [3]	1,100 [3]	NL [3]	35	-	160 [4]	NL [4]	NL [4]	60 [4]	1000 [4]	7 [2a]	<0.001% [5]
	NES (Soil) SCS[1] for high density residental land use		45	230	1,500	NL	500	1,000	1,200 [2]	NL [2]	7,300 [3]	2,700 [3]	NL [3]	330 [3]	NL [3]	24	-	36 [4]	NL [4]	1,600 [4]	9.4 [4]	240 [8d]	1 [2a]	<0.001% [5]
	AUP Permitted Activity Criteria (Discharge) [6]		100	7.5	400	325	250	0.75	320 [7]	1,160 [7]	NL [8]	NL [8]	NL [8]	NL [8]	NL [8]	20	-	-	-	-	0.16 [19a]	0.2 [9b]	1.3 [9c]	-
	Background Auckland volcanic soils [7] (Adopted Cleanfill Criteria)		12	0.65	125	90	65	0.45	320	1,160	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR	<LoR

Notes:

** indicates samples collected within the site area

All values in mg/kg. NL = No limit (i.e. >10,000) '-' = Not analysed NC = Not calculated <LoR = Less than laboratory limit of reporting ND = not detected

Bold values indicate that results exceed volcanic background levels for Auckland (default cleanfill disposal criteria) Underlined values indicate that the results exceed AUP Permitted Activity criteria Shaded values indicate that the results exceed NES Soil criteria: high density residental Red values indicate that the results exceed NES Soil criteria: commercial/industrial

1 - Ministry for the Environment (MfE), April 2012. Users Guide: National Environmental Standard for assessing and managing contaminants in soil to protect Human Health: for the stated land use unless otherwise stated.

2 - NEPM, 2013. Guideline on the Investigation Levels for Soil and Groundwater: for the applicable land use (i.e. commercial/industrial D, residential B)

2a - Value for 'Sum of PCB' as per NEPM (2013). Guideline on the Investigation Levels for Soil and Groundwater: for the applicable land use (i.e. commercial/industrial D, residential B)

3 - MfE, June 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Tier 1 Soil acceptance criteria: for the stated land use, silty clay, 1-4 m.

4 - USEPA Regional Screening Level - https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017: Composite indoor and outdoor worker values multiplied by 10 for the stated land use

5 - BRANZ, November 2017. New Zealand Guidelines for Assessing and Managing Asbestos in Soil: fines and/or fibres all site uses.

6 - Auckland Unitary Plan: Operative in Part Version (AUP). Permitted Activity Soil Criteria Table E30.6.1.4.1 (unless otherwise stated).

7 - ARC Technical Publication 153 - Background concentrations of Inorganic Elements in Soils from the Auckland Region: volcanic range

8 - MfE, June 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand - Groundwater Protection, silty clay, contamination at 1-4 m, groundwater at 8 m depth.

9a - Canadian Council of Ministers of the Environment (CCME, 2006). Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Protection - Trichloroethylene: SQG_E, fine soils.

9b - CCME (2007). Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health: residential use. A value of 0.6 mg/kg is provided for commercial/industrial use while the more conservative use (residental) has been include within the table.

9c - Value for the 'Sum of PCBs' as per the CCME (2007): residential use. A value of 33 mg/kg is provided for commercial/industrial use while the more conservative use (residental) has been include within the table.

Table B1. Sediment data summary of analytical results for sampling undertaken on 30/10/2017 for the site

Sample ID/Guidelines	ANZAST for sediment quality [1]		**Minimum**	**Maximum**	**HA01**	**HA01**	**HA02**	**HA02**	**HA04**	**HA05**	**HA06**
Depth (m)	Default Guideline Value (DGV)	Guideline Value-High (GV-High)			0.0	0.1	0.0	0.1	0.0	0.0	0.0
Soil type					Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Date					30/10/2017	30/10/2017	30/10/2017	30/10/2017	30/10/2017	30/10/2017	30/10/2017
Metals											
Arsenic	20	70	5.01	23.5	**23.5**	17.3	18.7	5.01	19.2	19.2	10.1
Cadmium	1.5	10	0.36	1.22	1.00	0.69	0.540	0.50	1.22	0.64	0.360
Chromium	80	370	63.3	86.6	69.8	74.2	**80.4**	74.9	**86.6**	73.3	63.3
Copper	65	270	39.1	291	**67.3**	64.5	**161.0**	39.1	**291**	**182**	**86.9**
Lead	50	220	14.4	874	**277**	**221**	**353**	14.4	**874**	**326**	**237**
Mercury	0.15	1	0.09	0.49	**0.43**	**0.49**	**0.17**	**0.17**	**0.25**	**0.16**	0.09
Nickel	21	52	53.2	94.9	**89.6**	**94.9**	**66.2**	**53.7**	**71.9**	**53.2**	**88.3**
Zinc	200	410	343	1510	**377**	**343**	**1350**	**373**	**1350**	**1510**	**652**
Polycyclic Aromatic Hydrocarbons (PAHs)											
Acenaphthene	10000 [2]	50000 [2]	<0.01	0.08	0.02	<0.01	0.06	<0.01	0.08	0.07	0.03
Acenaphthylene			<0.01	0.75	0.12	0.06	0.24	<0.01	0.75	0.33	0.15
Anthracene			<0.01	0.81	0.15	0.05	0.28	<0.01	0.81	0.41	0.21
Benzo[a]anthracene			<0.02	4.28	0.65	0.19	1.65	<0.02	4.28	2.78	1.29
Benzo[a]pyrene (BAP)			<0.01	3.85	0.87	0.45	2.46	0.03	3.85	2.38	1.98
Benzo[b]fluoranthene + Benzo[j]fluoranthene			<0.02	3.79	0.73	0.33	1.79	0.02	3.79	2.13	1.33
Benzo[g,h,i]perylene			<0.02	1.84	0.5	0.22	0.82	<0.02	1.84	1.14	0.56
Benzo[k]fluoranthene			<0.01	1.66	0.23	0.1	0.71	<0.01	1.66	0.87	0.52
Chrysene			<0.01	2.59	0.53	0.18	0.81	<0.01	2.59	1.17	0.54
Dibenzo[a,h]anthracene			<0.01	0.56	0.17	0.07	0.27	<0.01	0.56	0.33	0.2
Fluoranthene			<0.02	5.37	1.11	0.4	2.39	<0.02	5.37	3.06	1.75
Fluorene			<0.01	0.1	0.02	<0.01	0.05	<0.01	0.1	0.06	0.02
Indeno(1,2,3-c,d)pyrene			<0.01	1.45	0.41	0.18	0.66	<0.01	1.45	0.89	0.5
Naphthalene			<0.01	0.03	0.02	0.02	0.03	<0.01	0.03	0.03	0.01
Phenanthrene			<0.01	1.48	0.35	0.14	0.76	<0.01	1.48	0.95	0.47
Pyrene			<0.02	6.03	1.22	0.44	2.63	<0.02	6.03	3.51	1.98
BaP equivelant			<0.03	5.61	1.26	0.61	3.25	0.04	5.61	3.42	2.56
Volatile Organic Compounds (VOCs)											
Benzene	-	-	<0.025		<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Toluene	-	-	<0.025		<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Ethylbenzene	-	-	<0.025		<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
m&p-Xylene	-	-	<0.025		<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
o-Xylene			<0.025		<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
p-Isopropyltoluene	-	-	<0.05	0.13	<0.05	<0.05	<0.05	<0.05	<0.05	0.13	<0.05
1,1-Dichloroethane	-	-	<0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Trans-1,2-Dichloroethene	-	-	<0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cis-1,2-Dichloroethene	-	-	<0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Trichloroethene	-	-	<0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,1-Dichloroethene	-	-	<0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Tetrachloroethene	-	-	<0.05	0.00	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
All other VOCs reported at or below laboratory detection level											
Total Petroleum Hydrocarbons											
C7 - C9	-	-	<10	14	<10	<10	10	<10	<10	14	<10
C10 - C14	-	-	<15	57	<15	<15	45	<15	19	57	<15
C15 - C36	-	-	<25	2591	112	73	1776	40	1027	2591	1172
Total	-	-	<50	2662	112	73	1832	<50	1047	2662	1172
Polychlorinated Biphenyls (PCBs)											
PCB-138	34 [3]	280 [3]	<0.005	0.015	0.008	<0.005	0.013	<0.005	0.015	0.01	<0.005
All other PCBs reported at or below laboratory detection level											

Notes:

Bold values indicate that results exceed ISQG-Low values

Underlined values indicate that results exceed ISQG-High values

All values are reported in mg/kg (ppm) unless otherwise stated.

1 - ANZAST, August 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality: default guideline values (DGV) for sediment quality.

2 - Value for 'Total PAHs'

3 - Value for 'Total PCBs'

Appendix C: Regulatory framework

C1 Introduction

The rules and associated assessment criteria relating to the control of contaminated sites in the Auckland region are specified in the following documents:

- The National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health (NES Soil);
- The Auckland Unitary Plan – Operative in part (AUP);
- Health and Safety at Work (Asbestos) Regulation 2016 (Asbestos Regulations).

The NES Soil considers issues relating to land use and the protection of human health while the AUP has regard to issues relating to the protection of the general environment. The management of asbestos in soils is regulated under Asbestos Regulations. As asbestos is principally considered to be a human health contaminant the Asbestos Regulations (like the NES Soil) currently only considers issues relating to the protection of human health.

In order to help achieve compliance with the Asbestos Regulations, WorkSafe New Zealand has prepared an Approved Code of Practice (ACoP): Management and Removal of Asbestos (September 2016). The ACoP refers readers to the *"New Zealand Guidelines for Assessing and Managing Asbestos in Soil"* (herein referred to as the NA Asbestos in Soil Guidelines) which were published in November 2017 by BRANZ Ltd.

The requirement under each regulatory system (the NES Soil, AUP and Asbestos Regulations) for contaminated sites are described in this appendix.

C2 NES Soil

The NES Soil came into effect on 1 January 2012. This legislation sets out nationally consistent planning controls applicable to all district and city councils for assessing contaminants in soil with regard to human health.

The NES Soil regulations apply to specific development activities on land where a HAIL activity has, or is more likely than not to have, occurred. Activities covered under the NES Soil include soil disturbance, soil sampling, fuel systems removal, subdivision and land use change, of which the current proposal includes soil disturbance and land use change.

If all of the conditions of a Permitted Activity can be met then resource consent is not required. If the Permitted Activity provisions cannot be met then consent will be required as either a Controlled Activity or Restricted Discretionary Activity, determined by the degree of ground contamination present. If investigations to quantify contamination are not carried out then a discretionary consent will be required.

The conditions for the soil disturbance as a permitted activity are presented in **Table C.1**. While the conditions related to subdividing land or changing the land use are presented in **Table C.2**.

Table C.1: NES Soil Permitted Activity conditions for soil disturbance

NES Soil – Soil disturbance permitted activity conditions (Regulation 8(3))	
a	Implementation of controls to minimise exposure of humans to mobilised contaminants.
b	The soil must be reinstated to an erosion free state within one month of completing the land disturbance.
c	The volume of the disturbance of the piece of land must be no more than 25 m^3 per 500 m^2.

NES Soil – Soil disturbance permitted activity conditions (Regulation 8(3))	
d	Soil must not be taken away unless it is for laboratory testing or, for all other purposes combined, a maximum of 5 m^3 per 500 m^2 of soil may be taken away per year.
e	Soil taken away must be disposed of at an appropriately licensed facility.
f	The duration of land disturbance must be no longer than two months.
g	The integrity of a structure designed to contain contaminated soil or other contaminated materials must not be compromised.

Table C.2: NES Soil Permitted Activity conditions for subdividing or changing land use

NES Soil – Subdividing or changing land use permitted activity conditions (Regulation 8(4))	
a	A preliminary site investigation of the land or piece of land must exist.
b	The report on the preliminary site investigation must state that it is highly unlikely that there will be a risk to human health if the activity is done to the piece of land.
c	The report must be accompanied by a relevant site plan to which the report is referenced.
d	The consent authority must have the report and plan.

C3 Auckland Unitary Plan – Operative in Part

The Auckland Unitary Plan – Operative in part (AUP) was released on 15 November 2016. This version supersedes the Decisions Version, the Independent Hearings Panel Recommended Version and the original proposed version.

The contaminated land rules, set out in Chapter E Environmental Risk Section E30, are not subject to any appeal, hence, the rules can now be 'treated as operative' under section 86F of the Resource Management Act 1991. Additionally, the provisions in the Auckland Council Regional Plan: Air Land and Water no longer need to be considered.

The contaminated land rules are set out in Chapter E Environmental Risk Section E30. To meet Permitted Activity provisions for:

- Disturbance of land: The controls in Rule E30.6.1.2 of the AUP must be complied with. The controls include advising Council prior to commencing the work, implementing measures and controls to minimise discharges of contaminants to the environment, the land is not to contain separate phase liquid contaminants. There is a restriction on the volume of soil to be disturbed (200m^3 per site) and the duration of land disturbance (two months). If the permitted activity requirements cannot be met, then a resource consent for land disturbance is required as a controlled activity under Rule E30.6.2. To be a controlled activity, the controls identified in Rule E30.6.2 must be complied with, these include the requirement for a DSI and remedial action plan (RAP, also known as a SMP) to support the consent application. If these are not provided, then consent will be required on a discretionary activity basis;
- Long term discharges: Rule E30.6.1.4 states that if soil concentrations or the 95% upper confidence limit (UCL) of soil concentrations are below the specified permitted activity criteria detailed in Table E30.6.1.4.1, then a resource consent is not required for the site. If soil contaminant concentrations exceed these relevant guidelines or separate phase is present, then a controlled activity consent for the ongoing discharge of contaminants is required.

C4 Health and Safety at Work (Asbestos) Regulations 2016

The Health and Safety at Work (Asbestos) Regulations 2016 was enacted on 1 April 2016. The regulations set out requirements for manufacturing, supplying, transporting, storing, removing, using, installing, handling, treating, disposing of, or disturbing asbestos or ACM. Worksafe New Zealand has prepared an Approved Code of Practice (ACoP): Management and Removal of Asbestos (November 2016). The key requirements of the regulations and ACoP are that works involving asbestos contaminated soils must be undertaken with appropriate asbestos controls in place and that contaminated soil removed from site must be taken to an approved disposal site.

For asbestos in soils, the ACoP refers to the NZ Asbestos in Soil Guidelines which were released in November 2017. The document provides guideline values for assessing risk to human health as well as the controls required when undertaking disturbance of asbestos in soils. **Table C.3** (overleaf) summarises the controls indicated in the NZ Asbestos in Soil Guidelines for different concentrations of asbestos fines (AF), fibrous asbestos (FA) and bonded asbestos-containing material (ACM).

Table C.3: Summary of consent and control requirements for work involving asbestos

Asbestos concentrations	Airborne contamination	Requirements in NZ Asbestos in Soil Guidelines
>1% w/w FA and AF in soil	May to lead to airborne contamination that exceeds trace level (i.e. >0.01 fibres/mL)	**Class A asbestos removal works** Work must be carried out by a Class A licenced asbestos removalist. Works are subject to an Asbestos Management Plan, asbestos controls, air monitoring, clearance. Resource consent may be required under the NES Soil as a restricted discretionary activity.
> 0.01% but ≤ 1% FA and AF > 1% w/w ACM	May to lead to airborne contamination that exceeds trace level (i.e. >0.01 fibres/mL)	**Class B asbestos removal works** Work must be carried out by a Class A or B licenced asbestos removalist. Works are subject to an Asbestos Management Plan, asbestos controls, air monitoring, clearance. Resource consent may be required under the NES Soil as a restricted discretionary activity.
> 0.001% w/w but ≤ 0.01% w/w FA and AF > 0.01% w/w but ≤1% ACM	May to lead to airborne contamination that exceeds trace level (i.e. >0.01 fibres/mL)	**Asbestos-related works** Work does not need to be carried out by a Class A or B licenced asbestos removalist. Asbestos controls, PPE, air monitoring, clearance inspections as required and basic decontamination requirements. Resource consent may be required under the NES Soil as a restricted discretionary activity.
≤ 0.001% w/w FA and AF ≤ 0.01% w/w ACM	Not likely to lead to airborne contamination that exceeds trace level (i.e. <0.01 fibres/mL)	**Unlicensed asbestos removal work** Standard earthworks controls required. No asbestos specific PPE if SQEP confirms unlikely to exceed trace levels in air monitoring (0.01 f/ml) and/or if air monitoring confirms asbestos below 0.01 f/ml. Air monitoring/clearance not required. Foot wash and used PPE collection area required. Resource consent may be required under the NES Soil as a controlled activity.

Appendix D: Borehole logs (2017 investigations)

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: BH1

SHEET: 1 OF 1

PROJECT: Central Park contamination testing
JOB No.: 1005001
LOCATION: 666 Great South Road

CO-ORDINATES: (NZTM)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND:
R.L. COLLAR:
DATUM:
SURVEY:

DRILLED BY: Geotech Drilling
LOGGED BY: EAL
CHECKED: WMW
START DATE: 30/10/2017
FINISH DATE: 30/10/2017
CONTRACTOR: Geotech Drilling l

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	Fine - coarse GRAVEL (basalt); 50mm Brick paving stone.																
	Fine - coarse GRAVEL (basalt) with some fines; recovered at ~0.35 - 0.5m					BH1 Sample 1 @ 0.4m											
	sandy SILT; blackish brown						1 2										
	2.00m: Rock jammed and removed					BH1 Sample 2 @ 2.3m											
VA	SILT; brownish orange																
	3m: END OF BOREHOLE					BH1 Sample 3 @ 2.9m	3 4										

COMMENTS:

Hole Depth 3m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: BH2

SHEET: 1 OF 1

PROJECT: Central Park contamination testing
JOB No.: 1005001
LOCATION: 666 Great South Road

CO-ORDINATES: (NZTM)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND:
R.L. COLLAR:
DATUM:
SURVEY:

DRILLED BY: Geotech Drilling
LOGGED BY: EAL
CHECKED: WMW
START DATE: 30/10/2017
FINISH DATE: 30/10/2017
CONTRACTOR: Geotech Drilling l

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Fill	50mm Brick Paving Stone GRAVEL; angular, redish brown gravelly SAND with some silt; black					BH2 Sample 1 @ 0.2m BH2 Sample 2 @ 0.4m BH2 Sample 3 @ 0.6m BH2 Sample 4 @ 0.8m	0										
AkldVolc	BASALT; moderately vesicular, some joints						1										
VA	SILT; light brown					BH2 Sample 5 @ 1.3m											
Avf	BASALT; moderately vesicular																
	SILT; orangey brown																
Vla	BASALT; moderately vesicular, some joints						2										
Auckland Volcanic Field	3m: END OF BOREHOLE						3										
							4										

COMMENTS:

Hole Depth 3m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: BH3

SHEET: 1 OF 1

PROJECT: Central Park contamination testing
JOB No.: 1005001
LOCATION: 666 Great South Road

CO-ORDINATES: (NZTM)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND:
R.L. COLLAR:
DATUM:
SURVEY:

DRILLED BY: Geotech Drilling
LOGGED BY: EAL
CHECKED: WMW
START DATE: 30/10/2017
FINISH DATE: 30/10/2017
CONTRACTOR: Geotech Drilling l

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	25mm asphalt seal				100												
	fine-coarse GRAVEL (mainly basalt); some concrete pieces in top 0.5m																
	0.70m: No environmental sample taken due to insufficient core recovery				10		1										
	300mm Concrete Slab																
Volcanic Ash	SILT with some gravels (basalt); brown					BH3 Sample 1 @ 1.6m											
Auckland Volcanic Field	BASALT; moderately vesicular, some joints				100	BH3 Sample 2 @ 2.2m BH3 Sample 3 @ 2.3m	2										
	3m: END OF BOREHOLE						3										
							4										

COMMENTS:

Hole Depth 3m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: BH4

SHEET: 1 OF 1

PROJECT: Central Park contamination testing
JOB No.: 1005001
LOCATION: 666 Great South Road

CO-ORDINATES: (NZTM)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND:
R.L. COLLAR:
DATUM:
SURVEY:

DRILLED BY: Geotech Drilling
LOGGED BY: EAL
CHECKED: WMW
START DATE: 30/10/2017
FINISH DATE: 30/10/2017
CONTRACTOR: Geotech Drilling l

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation
Fill	30mm Asphalt fine to coarse GRAVEL(Basalt) *0.30m:* No environmental sample taken due to insufficient core recovery
	150mm Concrete Slab
	COBBLES (basalt); well fused
	Concrete Slab
	clayey SILT; brownish grey
	GRAVEL (Basalt)
	clayey SILT; brownish grey *3.10m:* Abandoned ACM Pipe encountered
Volcanic Ash	SILT; reddish brown *3.75m:* changing to light brown
AkldVolc	BASALT; moderately vesicular, jointed
	4.5m: END OF BOREHOLE

Rock Weathering: UW, EW, HW, MW, HW, CW
Rock Strength: ES, VS, WS, MS, W, VW, EW

Sampling Method / Core Recovery (%): 10, 20, 100

Testing:
- BH4 Sample 1 @ 2.5m
- BH4 Sample 2 @ 3.4m
- BH4 Sample 3 @ 3.8m

RL (m) / Depth (m): 1, 2, 3, 4

Graphic Log

ROCK DEFECTS
- Defect Log
- Fracture Spacing (mm): 2000, 600, 200, 60, 20
- RQD (%)
- Description & Additional Observations

Fluid Loss (%): 25, 50, 75

Water Level | Casing | Installation | Core Box No

COMMENTS:

Hole Depth 4.5m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: BH5

SHEET: 1 OF 1

PROJECT: Central Park contamination testing
JOB No.: 1005001
LOCATION: 666 Great South Road

CO-ORDINATES: (NZTM)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND:
R.L. COLLAR:
DATUM:
SURVEY:

DRILLED BY: Geotech Drilling
LOGGED BY: EAL
CHECKED: WMW
START DATE: 30/10/2017
FINISH DATE: 30/10/2017
CONTRACTOR: Geotech Drilling l

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Depth (m)
Fill	25mm ASPHALT Layer GRAVEL (Basalt)	
Auckland Volcanic Field	BASALT; moderately vesicular, vertically fractured	1
VA	SILT some gravel; light brown	2
AkldVolc	BASALT; moderately vesicular, heavily fractured vertically	3
Vla	SILT; light brown	
Avf	BASALT; moderately vesicular, vertical fractures 3.75m: END OF BOREHOLE	4

Rock Weathering: UW, EW, HW, MW, CW
Rock Strength: ES, VS, WS, MS, HW, VW, EW
Sampling Method
Core Recovery (%): 10, 88
Testing: BH5 Sample 1 @ 2.5m; BH5 Sample 2 @ 3.5m
RL (m)
Graphic Log
ROCK DEFECTS: Defect Log; Fracture Spacing (mm): 2000, 600, 200, 60, 20; RQD (%); Description & Additional Observations
Fluid Loss (%): 25, 50, 75
Water Level
Casing
Installation
Core Box No

COMMENTS:

Hole Depth 3.75m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: BH6

SHEET: 1 OF 1

PROJECT: Central Park contamination testing
JOB No.: 1005001
LOCATION: 666 Great South Road

CO-ORDINATES: (NZTM)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND:
R.L. COLLAR:
DATUM:
SURVEY:

DRILLED BY: Geotech Drilling
LOGGED BY: EAL
CHECKED: WMW
START DATE: 30/10/2017
FINISH DATE: 30/10/2017
CONTRACTOR: Geotech Drilling l

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	Thin Asphalt layer GRAVEL (greywacke); angular																
	150mm Concrete Slab																
Auckland Volcanic Field	fine to coarse GRAVEL (basalt)				10		1										
					86	BH6 Sample 1 @ 2.6m	2										
	gravelly SAND (Basalt) *2.90m:* Gravel (Basalt) Inclusions, reddish brown						3										
	3m: END OF BOREHOLE						4										

COMMENTS:

Hole Depth 3m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: BH7

SHEET: 1 OF 1

PROJECT: Central Park contamination testing
JOB No.: 1005001
LOCATION: 666 Great South Road

CO-ORDINATES: (NZTM)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND:
R.L. COLLAR:
DATUM:
SURVEY:

DRILLED BY: Geotech Drilling
LOGGED BY: EAL
CHECKED: WMW
START DATE: 30/10/2017
FINISH DATE: 30/10/2017
CONTRACTOR: Geotech Drilling l

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, EW, HW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	Thin Layer of Asphalt, Gravel (greywacke) BASALT; moderately Vesicular, some joints																
	0.7m: Other - see notes						1 2 3 4										

COMMENTS: Abandon Hole - asphalt started to heave from the casing. Thin Layer of asphalt with gravel (greywacke)

Hole Depth 0.7m

Scale 1:25

Rev.: A

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: BH8

SHEET: 1 OF 1

PROJECT: Central Park contamination testing
JOB No.: 1005001
LOCATION: 666 Great South Road

CO-ORDINATES: (NZTM)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND:
R.L. COLLAR:
DATUM:
SURVEY:

DRILLED BY: Geotech Drilling
LOGGED BY: EAL
CHECKED: WMW
START DATE: 30/10/2017
FINISH DATE: 30/10/2017
CONTRACTOR: Geotech Drilling l

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Fill	Thin layer of Asphalt GRAVEL																
	0.4m: Other - see notes						1 2 3 4										

COMMENTS: Abandon Hole - asphalt started to heave from the casing. Thin Layer of asphalt with gravel (greywacke), chunk of timber and basalt gravel

Hole Depth 0.4m

Scale 1:25

Rev.: A

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