REPORT

Tonkin+Taylor

Kyle Park

Geotechnical Assessment Report

Prepared for
Christchurch City Council
Prepared by
Tonkin & Taylor Ltd
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Nov 2018	1	Draft for CCC review	HJB	GGA	GGA
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Christchurch City Council	1 PDF copy
Tonkin & Taylor Ltd (FILE)	1 copy

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1 Introduction and Objectives

1.1 General

Tonkin & Taylor Ltd (T+T) was commissioned by the Christchurch City Council (CCC) to carry out a geotechnical assessment for the proposed combined Hornby Library, Customer Services and South West Leisure Facility (the Centre). This work has been completed in accordance with the CCC Statement of Work as agreed with T+T and dated 17 August 2018.

Kyle Park is located immediately adjacent to Waterloo Road in Hornby, which is in the south-west of Christchurch. The whole of Kyle Park was formerly a gravel pit that has been backfilled over a large number of years with a mix of uncontrolled fill materials (i.e. domestic, commercial and industrial waste materials).

CCC is considering developing the Centre on the eastern part of Kyle Park, with a preferred option being the eastern corner of the site, within the development area identified on Figure 1 (below), which identifies the following areas referred to in this report:

- Kyle Park – red polygon below.
- The *site* (i.e. subject of this investigation and assessment) – green polygon below.
- The *development area* (i.e. preferred location for the centre) – blue polygon below.

This report is generally focussed on the development area.

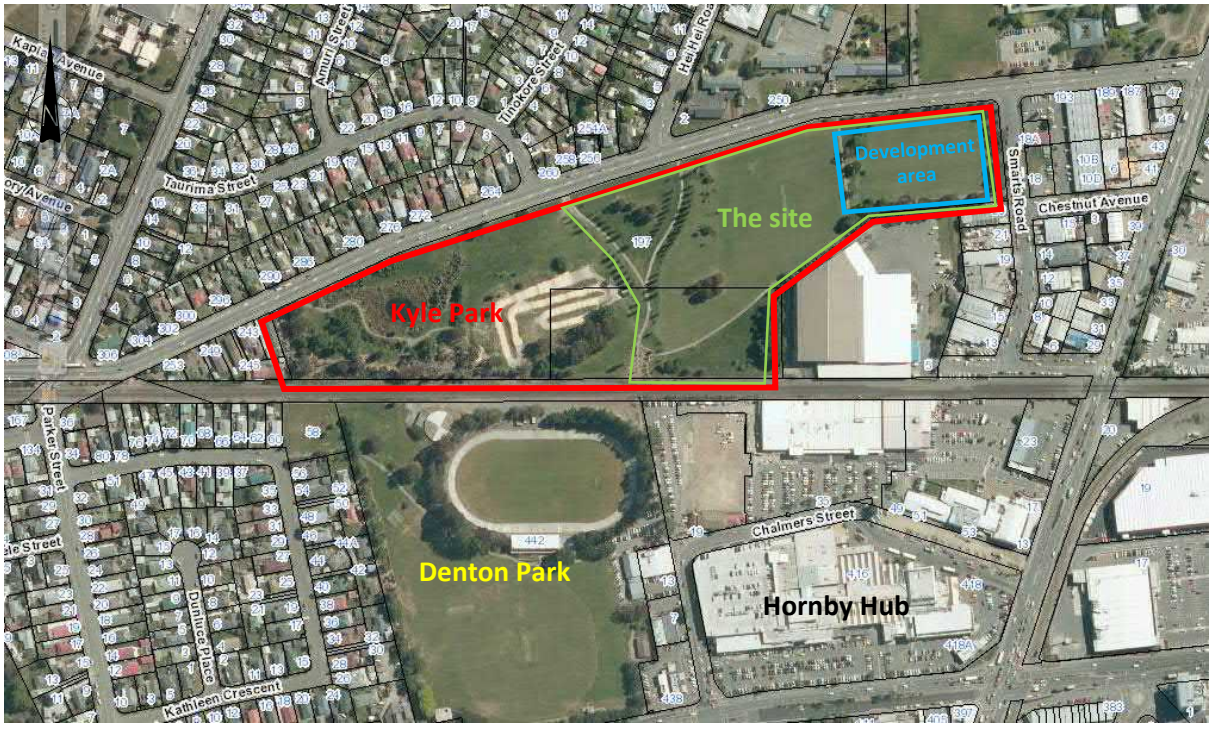


Figure 1 – Kyle Park location (source - https://apps.canterburymaps.govt.nz/CanterburyHistoricAerialImagery/).

1.2 Proposed development

Detailed design of the Centre has not been finalised at the time of writing this report. However, at a concept level the Centre is expected to include the following:

- Two storey service building and library, including community meeting rooms and offices.
- Leisure facility including swimming pools, courts and a sport hall.
- Car parking, landscaping areas and footpaths connecting the Centre to the remainder of Kyle Park and an underpass beneath the railway along the southern boundary with connection to the transport links at Hornby Hub.
- Provision of utilities/services to the development (e.g. water, power, telecommunications), which may include trenching across the current park.

The elevation of the existing ground level is approximately 36 m relative to the 1937 Lyttelton vertical datum (LVD). We understand that the ground floor level is to be set at approximately 38 mLVD to be consistent with the adjacent street level.

1.3 Objective and scope of work

The following scope of work has been completed by T+T for the purposes of this geotechnical assessment:

- Drilling of 20 boreholes to depths of up to 15.65 m.
- Assessment of geotechnical issues affecting the proposed development.
- Geotechnical engineering parameters for concept foundation design (by others).
- Geotechnical parameters for pavement design (by others).

The objective of this work is to assist CCC develop their understanding of the geotechnical implications and constraints on developing the proposed facility on this site, and to assess the likely extra costs that may be incurred when compared to land underlain by relatively competent natural ground.

2 Site Description

2.1 General

Kyle Park is located at 197 Waterloo Road, which is approximately 9 km west of the Christchurch Central Business District. The 8.7 hectare site is bounded by:

- Waterloo Road, residential housing and Hornby Primary School to the north.
- Residential housing to the west.
- Rail lines, Denton Park, and "The Hub" shopping centre to the south.
- Varied commercial / industrial properties along Smarts Road to the east.

The site comprises two property parcels with legal titles of Lot 1 DP 78681 and Lot 2 DP 34558.

2.2 Current site usage

Kyle Park currently hosts various features and uses comprising:

- A pocket of trees surrounding a grassed bank adjacent to the western boundary.
- A stormwater retention pond that is surrounded with vegetation.
- Grassed recreational areas with sporadic trees and a BMX track in the central portion.
- Meandering footpaths that converge at the south into a pedestrian railway underpass link to Denton Park.
- Sports fields and grassed recreational areas with sporadic trees in the eastern portion.

2.3 Topography

The topography of the area surrounding the site is essentially flat. The ground beneath the site itself has been heavily modified over several decades and comprises a mixture of flat areas (sports fields), undulating terrain (BMX track and area surrounding the stormwater retention pond) and terraces / embankments.

The central area of the site is relatively flat and lies at an elevation of approximately 30 mLVD. The stormwater retention pond lies at approximately 27 mLVD, while the eastern end of the site lies at approximately 28 mLVD. The stormwater retention pond is bounded to the west and south by a raised embankment walkway, and to the north and east by grassed embankments (refer Photograph 1 in Appendix A). Generally, the site boundaries along Waterloo Road, Smarts Road and the rail lines comprise grassed embankments (Photograph 2, Appendix A).

2.4 Geological setting

The published geology[1] of the area indicates that the site is underlain by Holocene-age (less than 10,000 years old) alluvial gravel, sand and silt of historic Waimakariri River flood channels. This is collectively referred to as the Yaldhurst Member of the Springston Formation. There are no currently known or mapped earthquake fault lines in the vicinity of the site. Recent experience has highlighted that Christchurch lies within a seismically active area and earthquake hazard will be one of the main development considerations, from an engineering design perspective.

[1] Brown, L.J., Weeber, J.H. 1992: Geology of the Christchurch Urban Area. Institute of Geological & Nuclear Sciences Geological Map 1. Scale 1:25 000.

3 Ground and Groundwater Conditions

3.1 Geotechnical investigations

The field investigations were carried out between 19 September and 11 October 2018 and comprised 20 boreholes (labelled BH100 to BH120) to a maximum depth of 15.5 m below the existing ground surface, with Standard Penetration Tests (SPTs) at 1.5 m depth increments. The boreholes were drilled by Prodrill Limited under the direction of T+T using sonic drilling methodology with a water flush. BH113 was terminated at 7.6 m depth after refusal on a buried metal object.

The investigation locations are shown on Figure A1 in Appendix A. The borehole locations were surveyed by CCC to record their reduced level along with northing and easting coordinates (see Figure A2, Appendix A). Summary borehole logs are provided in Appendix C.

3.2 Geotechnical model

The geotechnical model for the site has been interpreted using the geotechnical investigation information collected as part of this commission and is summarised in Table 1 (below). In the development area the lowest elevation where landfill materials were observed in the boreholes varies from 25.8 mLVD to 28.6 mLVD, with an average elevation of 26.5 mLVD. Existing ground level is approximately 36 mLVD. Further discussion of each of the main soil layers is provided thereafter.

Table 1 – Interpreted geotechnical model

Soil layer	Extent of layer (typical)	Description	SPT N values
Capping materials	0 – 0.7 m	Sandy silt with some gravel	-
Landfill	0.7 – 10 m	Silt, sand, gravel, waste, organics	0 to 25
Dense gravel	10 m +	Sandy, dense to very dense gravel with some silt	> 50

3.2.1 Capping materials

Capping materials comprising sandy silt with variable quantities of gravel with fibrous organics and rootlets, all of which were encountered in the boreholes across the site. These materials ranged in thickness from 0.4 to 0.9 m. They generally graded into the underlying landfill materials with an increasing man-made material content and presence of organic materials rather than exhibiting a distinct change of strata. No evidence was observed of a geotextile fabric separating the capping materials from the landfill material.

3.2.2 Landfill

Landfill materials were encountered in all boreholes and exhibited highly variable content both laterally and vertically. The landfill materials comprised of a variable matrix of silt, sand and gravel with differing quantities of man-made materials and/or waste including:

- Asbestos Containing Material (ACM) including asbestos cement sheet fragments.
- Ash.
- Brick and concrete.
- Ceramic.
- Glass.

- Leather (including parts of a child's shoe).
- Paper.
- Plastic, including food wrapping.
- Roots, wood and partly decomposed vegetative matter.
- Rubber/tyre.
- Sawdust.
- Shell.
- Wire and metal.

Photographs 3 to 6 inclusive (Appendix B) illustrate some of the landfill materials observed and sampled across the site. In some instances it was noted that the vegetative/organic content of the landfill materials was high, in the approximate order of 50% by volume of material sampled.

3.2.3 Dense gravel layer

Natural strata were encountered in all boreholes (with the exception of BH113) and comprised of sandy fine to coarse gravels with minor cobbles and a trace of silt. SPT blow counts were greater than 50.

3.3 Groundwater

Groundwater was encountered in all boreholes (except for Borehole 113) at depths ranging from 9.2 to 11.3 m below the existing ground surface (approximately 29 mLVD and 24.5 mLVD).

With the exception of BH102 and BH106, groundwater was encountered within the underlying natural strata. For these two boreholes, the groundwater was encountered within landfill materials and within 1 m of the change of strata to the underlying natural materials.

4 Geotechnical Issues Identified

Table 2 (below) summarises the identified geotechnical engineering issues associated with the proposed development at this site. The main issues are the relatively low bearing capacity and potentially large consolidation settlements associated with the landfill. If not addressed appropriately in design these issues could result in damage to the proposed building and car park (and associated infrastructure). These considerations are not dissimilar to development on other sites where uncontrolled fill is present, e.g. ports and harbours and engineering solutions proposed to manage them would be relatively common.

Table 2 – Geotechnical issues identified

Issue	Comments	Proposed mitigation measures
Landfill materials	Low bearing capacity for shallow foundations. Large consolidation settlements which could lead to building damage and damage to carpark pavement, and other buried services.	Pile foundations driven through to the natural gravel layer.
Pile design – negative skin friction	Negative skin friction resulting in increased vertical downward loads on the piles is expected to occur due to settlement of the landfill materials over time.	Negative skin friction loads have been estimated and will need to be included in the pile design, with piles appropriately founded within the underlying dense naturally occurring gravelly soil.
Pile construction – refusal on landfill materials	Piles may refuse on obstructions or hard layers within landfill. The presence of obstructions other than at the location of BH113 cannot be discounted.	Use steel piles, with a large section size (for example 310UC158). Allow for some pile re-driving and re-positioning.
Noise and vibration associated with driven piles	May cause a nuisance during construction. Could result in damage to neighbouring structures – but not expected at this site.	Engagement with neighbouring properties. Vibration monitoring. Pre-construction dilapidation surveys. Pre-drilling the first 1-2 m could be contemplated.
Pile corrosion	Landfill material may accelerate corrosion of steel piles.	Epoxy coating. Use heavy steel section to accommodate a sacrificial corrosion allowance.
Car park – pavement damage	Ongoing landfill settlements may result in damage to the car park, for example resulting in cracking, potholes.	Place hardfill above landfill to build up to street level. Use thicker subbase to increase pavement strength. Use thicker asphalt layer to increase resilience. Create final landforms that facilitates surface drainage under gravity for stormwater (rather than below ground elements such as pipelines). Increase drainage grades to allow for some settlement.

5 Foundation Assessment

5.1 Foundation options

A number of foundations options were considered for the proposed development, including:

- Piles – these are recommended as they transfer the building loads through the landfill material into the dense gravel layer below.
- Shallow foundations - not recommended due to the low bearing capacity of the landfill material and the potential for ongoing consolidation settlements (although re-levellable shallow foundations could be considered if Council are prepared to consider a higher degree of tolerable building disruption and periodic future repair/relevelling).
- Ground improvement methods such as dynamic compaction, stone columns or soil mixing may be feasible. However due to the relatively high organic content and the 10 m+ depth of the landfill materials the foundation performance of ground improvement methods is considered to be less certain than piles.

On the basis of the above high-level assessment we propose that pile foundations be considered for this development, which are discussed below.

Based on the high proportion of organic materials in the landfill, the potential for landfill gas generation cannot be discounted. The inclusion of protection measures in foundation selection and design to prevent landfill gas migration into the Centre will be required, depending upon the findings of a landfill gas investigation and assessment, which is discussed further in the accompanying T+T ground contamination report. Piling through landfill materials and inclusion of landfill gas protection measures in the construction of the centre are relatively commonplace in New Zealand.

5.2 Pile foundations

5.2.1 Pile type

Driven piles are the recommended pile option for the proposed development. Other pile types, such as bored piles or CFA piles, are not expected to be as economical due to the potential costs associated with spoil management. Screw piles may also be considered, but experience suggests that these are more likely to encounter refusal on obstructions within the landfill.

Steel H-piles are expected to be the most feasible option since they should be drivable through some potential hard layers or obstructions within the landfill. A heavy steel section, such as a 310UC158, is expected to be suitable.

5.2.2 Pile design parameters and capacity

Initial pile analysis indicates that an ultimate limit state (ULS) capacity of 1300 kN can be used for concept design for an 18 m long, 310UC158 steel pile driven to effective refusal into the dense gravel layer. The ULS capacity is based on the following:

- Geotechnical ultimate capacity (R_{drive}) of 2600 kN may be assumed for 18 m long, 310UC158 steel piles driven to effective refusal.

- Negative skin friction load (NSF) of 750 kN, caused by potential settlement of the landfill material over time. Research[2] suggests that NSF in landfill materials can vary between 5 to 30 kPa. Taking a conservative value of 40 kPa, and including a skin friction of 100 kPa in a 2 m thick layer of compacted hardfill placed on top of the landfill material, results in a NSF of 750 kPa.
- A strength reduction factor of ϕ_g = 0.7. This strength reduction factors assume that 10% of all piles are proven by dynamic pile testing (PDA).
- Using the relationship below, the available ultimate limit state capacity (ULS) can be taken as 1300 kN.

$$R_{Drive} = \frac{ULS}{\varphi_g} + NSF$$

5.2.3 Durability

Corrosion of the steel will need to be considered in the pile design, as landfill material presents special circumstances around durability due to the presence of certain aggressive acids (both organic and inorganic), salts and solvents, which can chemically attack steel. A high performance epoxy coating should be applied to the piles to increase the durability. Alternatively, a corrosion allowance could be incorporated into the design of the pile cross-section. The Australian Piling Code, AS 2159 (2009), recommends that a uniform corrosion allowance of 0.04 – 0.1 mm/year for untreated steel should be adopted.

5.2.4 Construction considerations

Pile driving can cause noise and vibration that may affect the surrounding community. Noise and vibration effects decrease rapidly with distance from the piling rig, and given that there are no close neighbours it is expected that these effects can be effectively managed. Mitigation options could include:

- Engagement with neighbouring properties.
- Vibration monitoring to ensure vibration levels are below target values appropriately set to limit potential damage to structures.
- Pre-construction dilapidation surveys.
- Pre-drilling the first 1-2 m could also be contemplated.

Due to the potential to encounter unplanned obstructions within the landfill material, we recommend allowing an extra 10% to the piling costs to allow for re-driving and/or re-positioning of piles.

5.3 Seismic site subsoil class

We have assessed the soil profile at the site in accordance with Section 3.1.3 of NZS1170.5:2004. While the exact depth to rock is not known, deep groundwater bores in the area indicate in excess of 100 m thickness of interbedded silts, sands and gravels. The site subsoil class is therefore assessed to be Class D – Deep or Soft Soil.

[2] Bouazza & Kavazanjiam, State of the Art Paper, Construction on Old Landfills, 2nd Australian/New Zealand Conference on Environmental Geotechnics, Newcastle, November 2001.

5.4 Liquefaction assessment

Ground disruption at or close to the ground surface due to liquefaction is not expected to occur at this site. This is due to the 10 m depth to groundwater, the soils below the groundwater table comprising dense gravels that are not susceptible to liquefaction and the absence of ground surface disruption at the site following the 2010-2011 Canterbury Earthquakes.

6 Pavement Design

Consolidation and settlement of landfill material, either due to decomposition of organic material within the fill and/or under traffic loads, may occur that could damage overlying pavement and buried pipelines.

We understand that the proposed car park area will be built up from the existing ground level (approximately 36 mLVD) by approximately 2 m to be consistent with the adjacent street level (approximately 38 mLVD). If a well-compacted engineered hardfill is used to do this it will enhance the pavement subgrade. Therefore the pavement requirements are not expected to be a significant extra/over cost compared to a non-landfill site.

A concept pavement detail (subject to further detailed design and confirmation of anticipated traffic loading) could comprise:

- 40 mm NZTA: M10/AC14 layer, overlying
- 150 mm NZTA: M/4 AP40 layer, overlying
- 2000 mm compacted AP65 hardfill overlying the landfill capping layer.

The carpark drainage should be designed to reduce the need for buried drainage pipes, with the goal of reducing future maintenance requirements. This can be achieved by creating a final landform such that surface gravity drainage is used to direct surface water runoff to the required collection points prior to discharge off the site. This may involve some additional filling. However, given that the site will be filled anyway, there is not expected to be any significant extra/over costs compared to a non-landfill site.

7 Further Work

The following further geotechnical work is proposed based on piled building foundations:

Developed Design Services

- Specific analysis in conjunction with the project structural engineer to develop the soil-structure interaction model and specifically size the foundations.

Detailed Design Services

- Prepare a detailed design report, including design of landfill gas protection measures, if required.
- Prepare pile design and construction specification.
- Review and comment on geotechnical aspects of the structural engineering drawings and specifications.

Construction Phase Services

- Site monitoring and PDA testing during pile installation.
- Review earthworks placement and compaction.
- Prepare completion report presenting as built records for the geotechnical aspects of shallow foundations and piles.

Careful civil engineering design of the final site landform will be needed to facilitate surface water drainage and reduce the need for buried stormwater pipework. The civil engineering associated with the development will also need to consider potential differential movement at transitions between areas with different depths of underlying fill, and also at the entrance to buildings founded on piles.

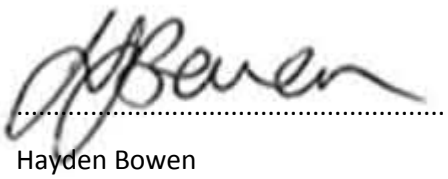
8 Applicability

This report has been prepared for the exclusive use of our client Christchurch City Council, with respect to the particular brief given to us 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 data from a discrete number of boreholes. The nature and continuity of subsoil away from the borehole locations are inferred and it must be appreciated that actual conditions could vary from the assumed model.

Tonkin & Taylor Ltd

Report prepared by:



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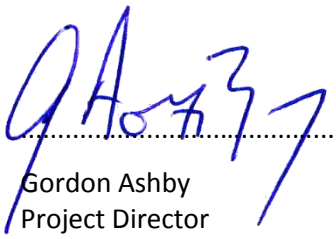
Hayden Bowen
Geotechnical Engineer

Authorised for Tonkin & Taylor Ltd by:



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Gordon Ashby
Project Director

HJB
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Appendix A: Figures

- Figure 2 – Site Plan
- Figure 3 – Cross Section A-A’
- Figure 4 – Cross Sections B-B’ and C-C’

LEGEND

- BH101 — Borehole investigation location
- Development area
- Site boundary
- Kyle Park property boundary
- 1 F3 — Cross section transects

APPROXIMATE A3 SCALE 1:2,500

0 50 100 150 (m)

Notes:
1. Aerial image sourced from LINZ Data Service, CC-BY 4.0. Imagery date: summer period 2015-16. Copyright Mapbox OpenStreetMap.
2. Cross-section transects: top number refers to Section title, bottom number refers to Figure number.

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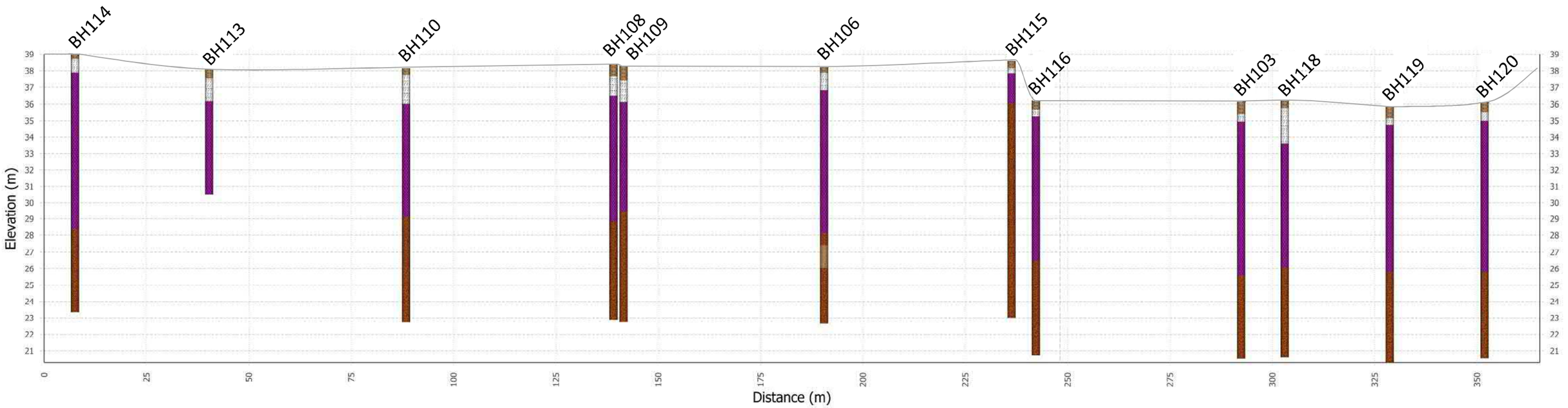
APPROX. SCALE (AT A3 SIZE) AS SHOWN		
PROJECT No. 1003207.0000		

CHRISTCHURCH CITY COUNCIL
KYLE PARK
WATERLOO ROAD, HORNBY
INVESTIGATION LOCATION PLAN

FIG. No. Figure 2

REV. 1



Section 1

LEGEND

- Cap material
- Transition material
- Fill
- Natural
- Indicative ground level

Notes:
1. Elevation in metres above Christchurch City Datum.
2. Distance in horizontal metres from southern section start point.

0 10 20 30 40 50 60 70 80 90 100
H (1:1000)
V (1:250)
0 10 20

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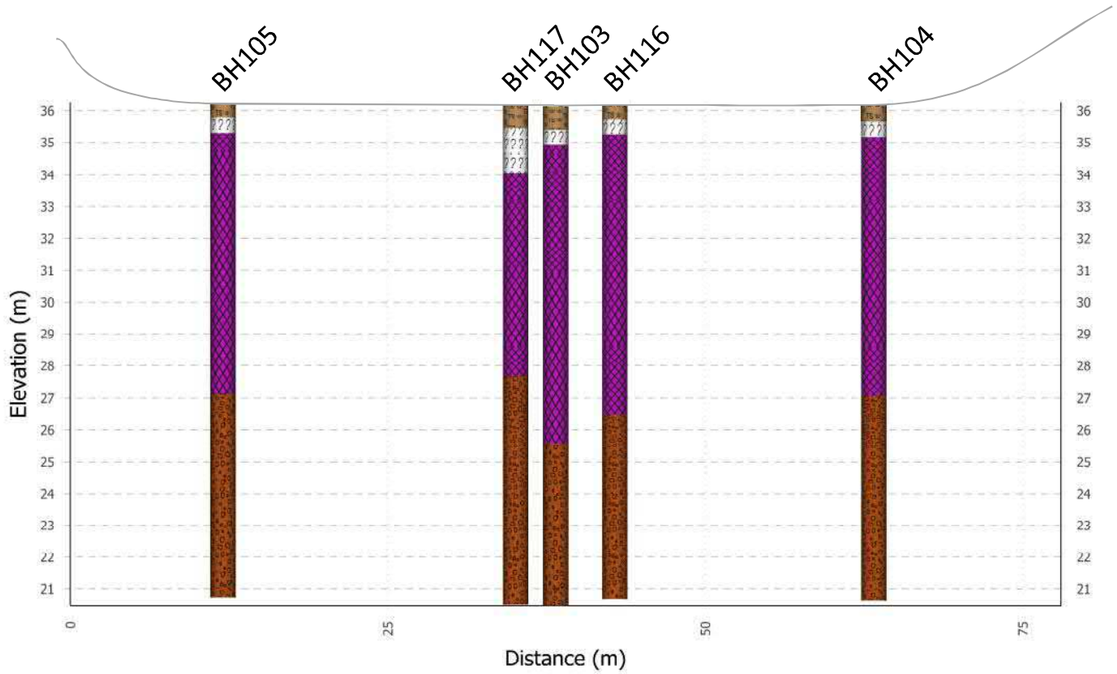
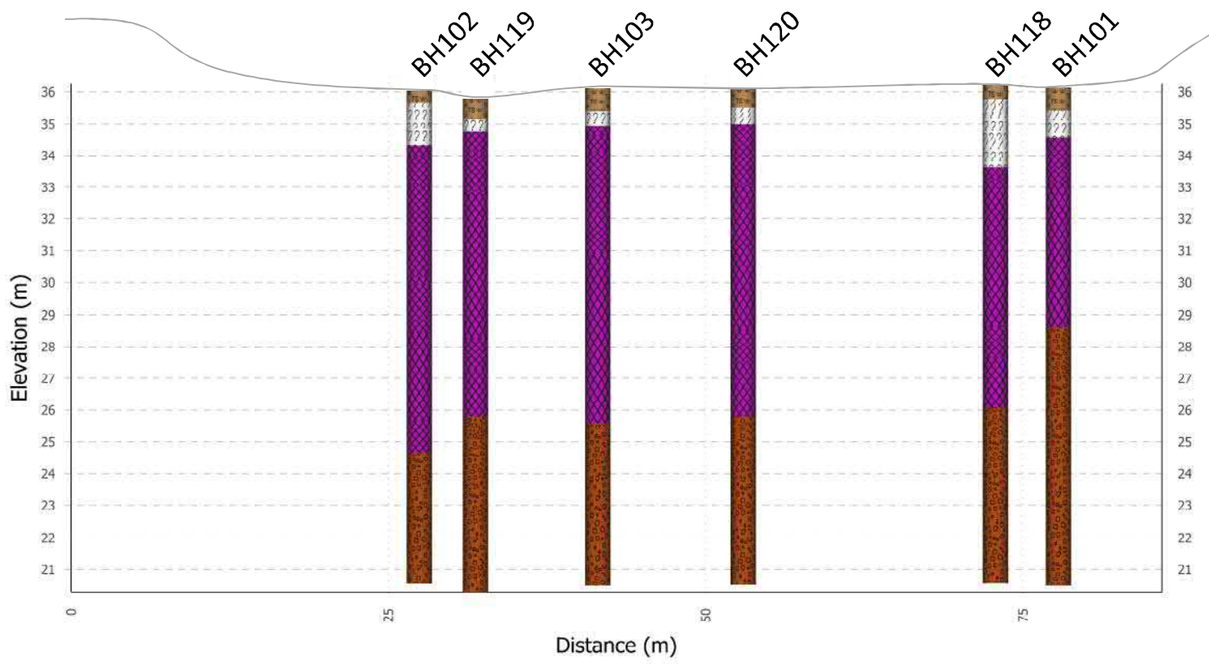
CHRISTCHURCH CITY COUNCIL
KYLE PARK
WATERLOO ROAD, HORNBY
CROSS-SECTION 1

FIG. No. Figure 3
REV. 1

Section 2



Section 3



LEGEND

- Cap material
- Transition material
- Fill
- Natural
- Indicative ground level

Notes:
1. Elevation in metres above Christchurch City Datum.
2. Distance in horizontal metres from southern section start point.

H (1:500)
V (1:200)

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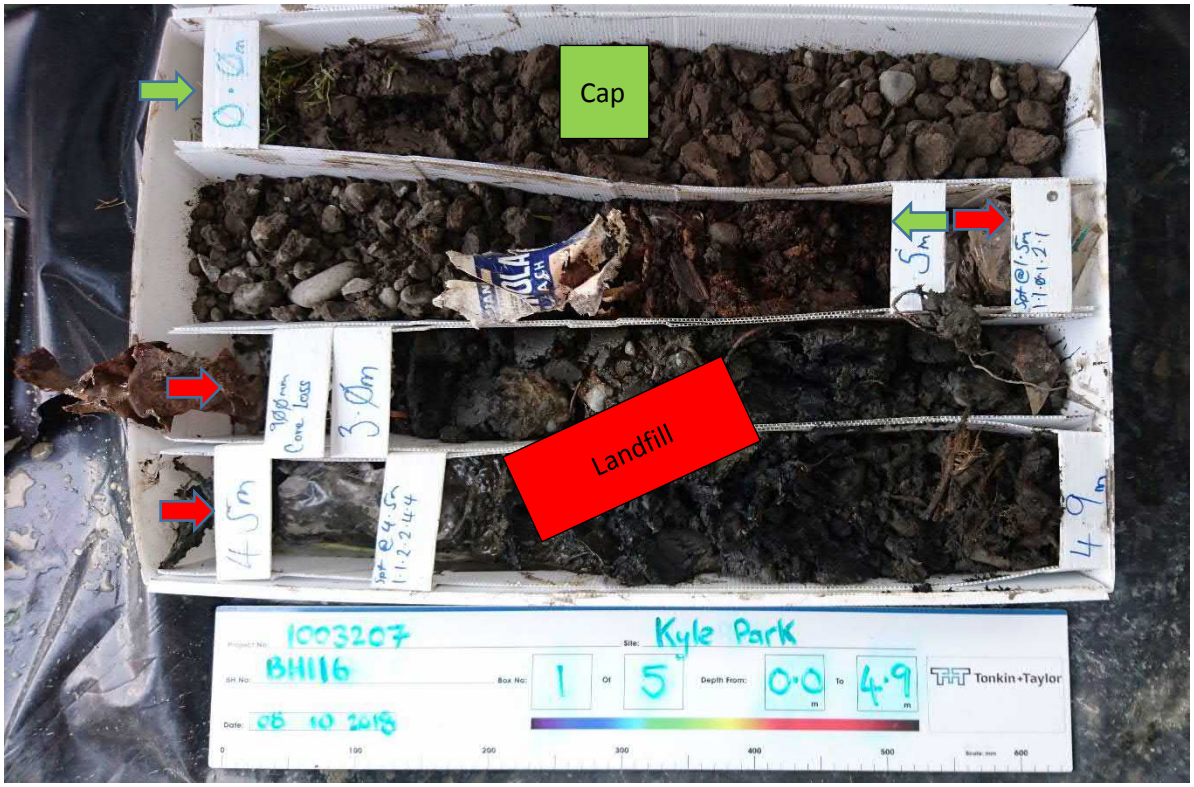
CHRISTCHURCH CITY COUNCIL
KYLE PARK
WATERLOO ROAD, HORNBY
CROSS-SECTIONS 2 & 3

FIG. No. Figure 4
REV. 1

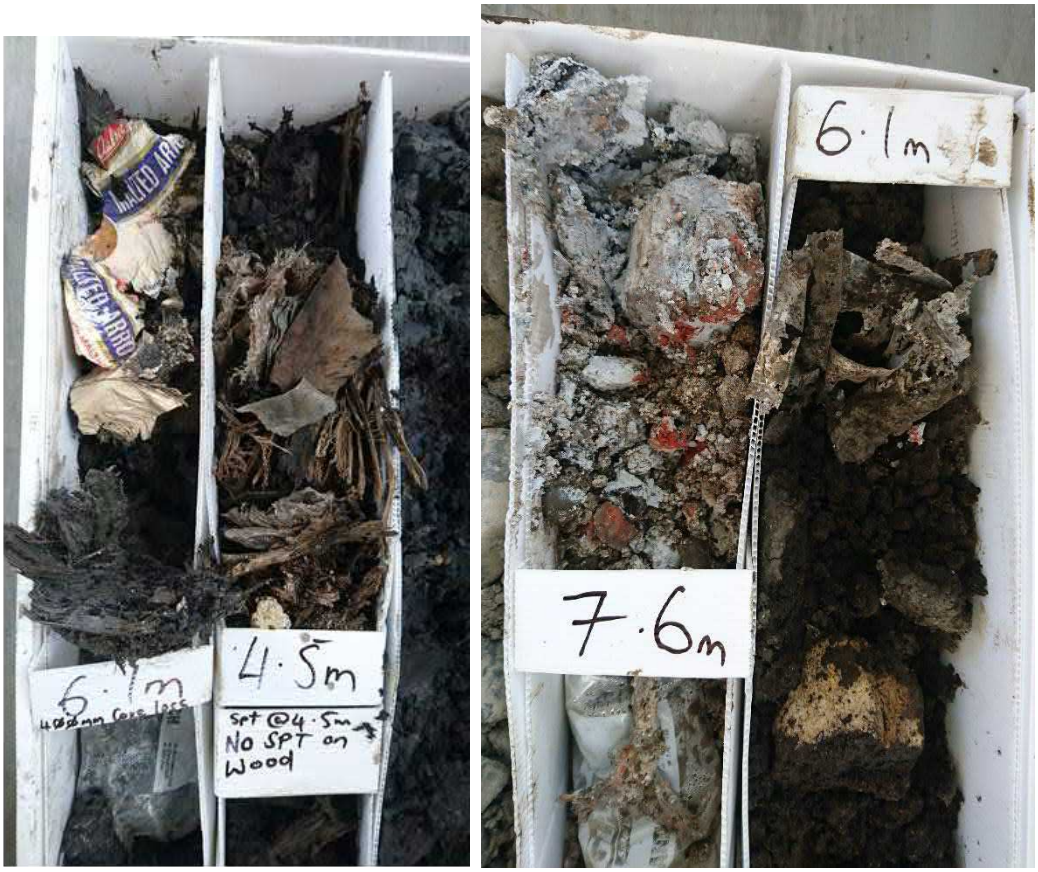
Appendix B: Site Photographs

Photograph 1 –centre of the site looking south-west.

Photograph 2 – development area looking easterly (Waterloo Road left of frame).

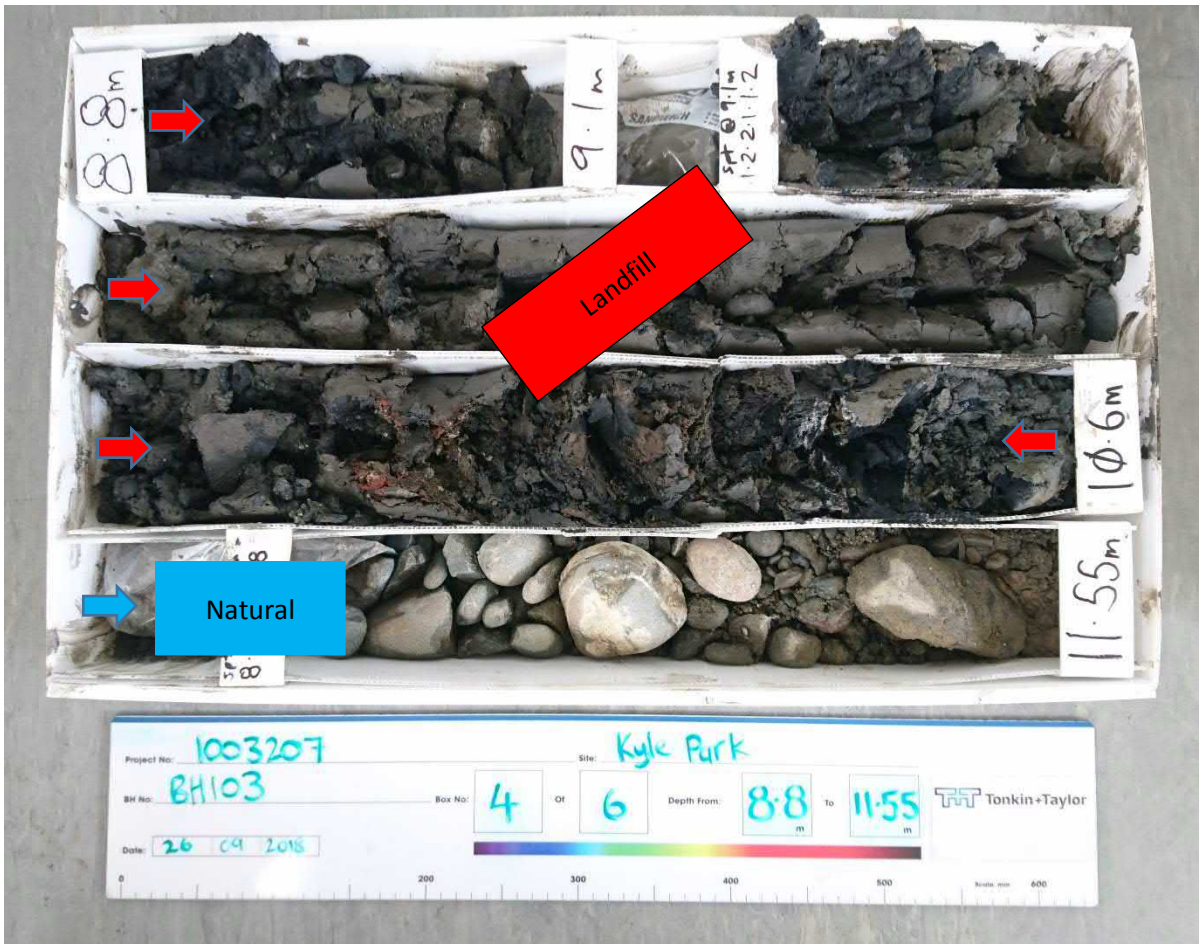


Photograph 3 – example of capping materials and their transition into landfill materials.



Photograph 4 – examples of landfill materials.

Photograph 5 – example of asbestos containing material (cement board materials) (Borehole 111 at 0.7 m bgl).



Photograph 6 - example of landfill and natural material change.

Appendix C: Borehole Logs

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BOREHOLE LOG

BOREHOLE No.: **BH101**

SHEET: 1 OF 1

PROJECT: Kyle Park		LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000
CO-ORDINATES: (NZTM2000)	5179231.00 mN 1561662.00 mE	DRILL TYPE: MS 1000	HOLE STARTED: 20/09/2018 HOLE FINISHED: 20/09/2018
R.L.:	36.16m	DRILL METHOD: SNC	DRILLED BY: ProDrill
DATUM:	CCD	DRILL FLUID: WATER	LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL Box 1, 0.0-3.8m Box 2, 3.8-6.0m			66	PQ HFS				36			M	F				Capping material: Sandy SILT with amorphous organics; dark brown. "Firm", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium.
								35	1		M-W					Transition material: Sandy fine to coarse GRAVEL with minor silt and trace cobbles; brown. Moist to wet, well graded. Contains some coal (0.75 to 0.8m only); gravel, subangular to subrounded; sand, fine to medium.
			73	PQ HFS				34	2		W					1.0 to 1.5m - no recovery.
																No SPT @ 1.5m (bouncing).
			100	SPT		7/8 6/3 2/1 **N=12**		33	3			MD				Fill: organic and/or granular soils mixed with refuse.
			100	PQ HFS				32	4							2.6 to 3.0m - no recovery.
			100	SPT		2/1 4/4 2/2 **N=12**		31	5							For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
			100	PQ HFS												
			100	SPT		1/3 2/2 3/3 **N=10**		30	6							
			100	PQ HFS				29	7							
NATURAL Box 3, 6.0-8.4m Box 4, 8.4-10.9m Box 5, 10.9-13.5m Box 6, 13.5-15.7m			100	SPT		4/2 2/2 1/2 **N=7**		28	8			L				Silty sandy fine to coarse GRAVEL with trace cobbles; dark brownish grey. Loose, wet, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
			71	PQ HFS												8.1 to 8.3m - no recovery.
			100	SPT		13/13 10/12 16/12 for 65mm **N>=50** Bouncing		27	9		M-W	VD				9.1m - grey; moist to wet, very dense.
		20/09/2018 10.6 m bgl	100	PQ HFS				26	10							
			100	SPT		7/5 6/6 14/18 **N=34** Solid		25	11		W-S	D				Sandy fine to coarse GRAVEL with minor silt and trace cobbles; brown. Dense, wet to saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse. 10.6 to 11.05m - no recovery from SPT; sample obtained from overcore.
			100	PQ HFS												
			100	SPT		8/12 16/18 16 for 55mm **N>=50** Solid Bouncing		24	12			VD				12.2m - very dense. 12.2 to 12.56m - no recovery from SPT; sample obtained from overcore.
			100	PQ HFS				23	13							
			100	SPT		4/4 5/6 10/15 **N=36** Solid		22	14							13.7 to 14.15m - no recovery from SPT; sample obtained from overcore.
			100	PQ HFS												
			0	SPT		3/5 7/9		21	15			D				15.2m - dense. 15.2 to 15.65m - no recovery from SPT.
						15/18 **N=49** Solid		20	16							End of borehole at 15.65 m bgl (target depth).

COMMENTS:

Hole Depth 15.65m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:33:16 PM - Produced with Core-GS by GeRoc

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH102**

SHEET: 1 OF 1

PROJECT: Kyle Park		LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000
CO-ORDINATES: (NZTM2000)	5179181.00 mN 1561663.00 mE	DRILL TYPE: MS 1000	HOLE STARTED: 20/09/2018 HOLE FINISHED: 20/09/2018
R.L.:	36.07m	DRILL METHOD: SNC	DRILLED BY: ProDrill
DATUM:	CCD	DRILL FLUID: WATER	LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL Box 1, 0.0-4.5m Box 2, 4.5-7.6m Box 3, 7.6-10.4m		20/09/2018 11.0 m bgl	80 100 14 100 9 59 100 61 100 100 52 100 100	PQ HFS SPT PQ HFS SPT PQ HFS PQ HFS SPT PQ HFS SPT PQ HFS SPT		2/1 2/1 0/0 **N=3** 4/4 6/5 17/7 **N=35** 2/1 1/1 1/1 **N=4** 1/1 1/1 1/1 **N=4** 1/1 1/1 0/2 for 65mm **N>=50** 7/10 12/18 20 for 65mm **N>=50** Bouncing		35 34 33 32 31 30 29 28 27 26 25	1 2 3 4 5 6 7 8 9 10 11		M M-W	S F-St				Capping material: SILT with some sand, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium. Transition material: Sandy fine to medium GRAVEL with some silt, brown to dark brown. "Loose", wet, well graded. Contains minor coal; organic odour; gravel, subangular to subrounded; sand, fine to coarse. 0.7m - sandy SILT with some gravel; brown. "Soft to firm", moist to wet, low plasticity, very slow dilatancy. 0.95m - thin rust layer. 1.0m - "firm to stiff", trace glass. 1.2 to 1.5m - no recovery. 1.5 to 1.95m - no recovery from SPT; sample obtained from overcore. 1.5m - gravelly, trace cobble. Fill: organic and/or granular soils mixed with refuse. 2.1 to 3.0m - no recovery. 3.55 to 4.5m - no recovery. No SPT @ 4.5m (wood). 5.9 to 6.1m - no recovery. 7.2 to 7.6m - no recovery. 7.6 to 8.05m - no recovery from SPT; sample obtained from overcore. For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request. 10.1 to 10.4m - no recovery.
NATURAL Box 4, 10.4-12.7m Box 5, 12.7-15.5m			100 100 0	PQ HFS SPT PQ HFS SPT		17/33 for 75mm **N>=50** Solid Bouncing 8/19 36/14 for 20mm **N>=50** Solid Bouncing 7/13 19/31 for 75mm **N>=50** Solid Bouncing		24 23 22 21 20	12 13 14 15 16		W W-S	VD				Sandy fine to coarse GRAVEL with minor silt and trace cobbles; brownish grey. Very dense, wet, well graded. Gravel, subangular to subrounded; sand, fine to coarse. 12.2 to 12.35m - no recovery from SPT; sample obtained from overcore. 12.7m - brown; wet to saturated. 13.7 to 13.95m - no recovery from SPT; sample obtained from overcore. 15.2 to 15.5m - no recovery from SPT. End of borehole at 15.5 m bgl (target depth).

COMMENTS:

Hole Depth 15.5m

Scale 1:83

Rev.: A

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BOREHOLE LOG

BOREHOLE No.: **BH103**

SHEET: 1 OF 1

PROJECT: Kyle Park		LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000
CO-ORDINATES: (NZTM2000)	5179195.00 mN 1561605.00 mE	DRILL TYPE: MS 1000	HOLE STARTED: 21/09/2018 HOLE FINISHED: 21/09/2018
R.L.:	36.14m	DRILL METHOD: SNC	DRILLED BY: ProDrill
DATUM:	CCD	DRILL FLUID: WATER	LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	TESTS	SAMPLES	RL (m)	DEPTH (m)	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	Description and Additional Observations
FILL		93	PQ HFS		Box 1, 0.0-3.5m	36		M	S	Capping material: SILT with some sand, amorphous organics; brown to dark brown. "Soft", moist, low to moderate plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium.
		100	SPT	2/1 1/1 1/1 **N=4**		35	1		L	Transition material: Sandy fine to coarse GRAVEL with some silt, amorphous organics; dark brown. Loose, moist, well graded; low to moderate plasticity, no dilatancy. Organic odour; gravel, subangular to subrounded; sand, fine to medium.
		71	PQ HFS			34	2	W-S		Fill: organic and/or granular soils mixed with refuse.
		100	SPT	2/1 0/1 2/1 **N=4**		33	3			1.4 to 1.5m - no recovery. 2.0m - wet to saturated. 2.7 to 3.0m - no recovery.
		100	PQ HFS			32	4			
		56	PQ HFS			31	5			No SPT @ 4.5m (steel). 4.5 to 5.2m - no recovery.
		100	SPT	13/2 2/1 1/1 **N=5**	Box 2, 3.5-6.5m	30	6			For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
		100	PQ HFS			29	7			
		100	SPT	2/2 1/1 1/1 **N=4**	Box 3, 6.5-8.8m	28	8			
		100	PQ HFS			27	9			
		100	SPT	1/2 2/1 1/2 for 65mm **N>=50**		26	10			
	21/09/2018 10.9 m bgl	82	SPT	8/10 12/8 8/8 **N=28**	Box 4, 8.8-11.8m	25	11		D	Sandy fine to coarse GRAVEL with minor cobbles and trace silt; brownish grey. Dense, wet to saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
		100	PQ HFS			24	12			
NATURAL		33	SPT	8/9 125/10 18/10 for 70mm **N>=50** Bouncing		23	13	S	VD	12.2m - cobbles absent; brown. Very dense, saturated. 12.2 to 12.65m - no recovery from SPT; sample obtained from overcore. 13.7 to 14.15m - no recovery from SPT; sample obtained from overcore.
		100	PQ HFS			22	14			
		55	SPT	7/13 14/12 14/10 for 70mm **N>=50** Solid Bouncing		21	15			
		100	PQ HFS		Box 5, 11.6-15.6m					
		0	SPT	6/11 15/15 10/10 for 50mm **N>=50** Solid Bouncing		20	16			15.2 to 15.63m - no recovery from SPT. End of borehole at 15.63 m bgl (target depth).

COMMENTS:

Hole Depth 15.63m

Scale 1:83

Rev.: A

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Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH104**

SHEET: 1 OF 1

PROJECT: Kyle Park

LOCATION: Kyle Park, Waterloo Road, Hornby JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179220.00 mN 1561559.00 mE

R.L.: 36.17m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 26/09/2018

HOLE FINISHED: 26/09/2018

DRILLED BY: ProDrill

LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL			80	PQ HFS			Box 1, 0.0-3.0m	36			M	S				Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			44	SPT		2/0 0/1 1/1 **N=3**		35	1							Transition material: SILT with some sand and trace gravel; brown mottled greyish brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace red plastic; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			61	PQ HFS				34	2		M-W					0.6 to 0.9m - no recovery.
			100	SPT		3/3 2/2 1/2 **N=7**		33	3							Fill: organic and/or granular soils mixed with refuse.
			61	PQ HFS				32	4							1.7 to 1.95m - no recovery. 2.1m - moist to wet. 2.6 to 3.0m - no recovery.
			100	SPT		1/3 10/40 for 70mm **N>=50** Bouncing	Box 2, 3.0-6.0m	31	5							4.8 to 5.0m - no recovery.
			88	PQ HFS				30	6							For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
			100	PQ HFS				29	7							
			0	SPT		2/1 0/0 1/2 **N=3**		28	8							7.6 to 8.05m - no recovery in SPT.
			47	PQ HFS			Box 3, 6.0-9.4m	27	9							8.55 to 9.1m - no recovery.
NATURAL		26/09/2018 10.4 m bgl	100	SPT		3/2 3/4 5/5 **N=17** Solid		26	10		W-S	MD				Sandy fine to coarse GRAVEL with minor cobbles and trace silt; bluish grey. Medium dense, wet to saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
			100	PQ HFS							S	L				9.1 to 9.55m - no recovery from SPT; sample obtained from overcore.
			44	SPT		2/1 2/2 2/2 **N=8**		25	11							10.0m - reddish brown; saturated, loose. 10.8 to 11.05m - no recovery.
			100	PQ HFS			Box 4, 9.4-12.7m	24	12							12.0m - trace to minor silt, trace cobbles; brownish grey.
			100	SPT		9/12 10/10 12/6 **N=38**						D				12.2m - dense.
			100	PQ HFS				23	13							12.7m - sandy, trace to minor silt; brown.
			100	SPT		7/13 19/11 10/10 **N>=50**		22	14			VD				13.7m - very dense.
			100	PQ HFS			Box 5, 12.7-15.6m	21	15							
			0	SPT		9/17 21/23 6 for 70mm **N>=50** Solid Bouncing		20	16							15.2 to 15.1m - no recovery from SPT. End of borehole @ 15.51m bgl (target depth).

COMMENTS:

Hole Depth 15.51m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:33:33 PM - Produced with Core-GS by GeRoc

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BOREHOLE LOG

BOREHOLE No.: **BH105**

SHEET: 1 OF 1

PROJECT: Kyle Park

LOCATION: Kyle Park, Waterloo Road, Hornby JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179169.00 mN 1561561.00 mE

R.L.: 36.34m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 26/09/2018

HOLE FINISHED: 26/09/2018

DRILLED BY: ProDrill

LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL

ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL			93	PQ HFS			Box 1, 0.0-3.0m	36	0		M	S				Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded. 0.35m - yellowish brown.
			100	SPT		2/1 0/0 1/0 **N=1**		35	1			L				Transition material: sandy fine to coarse GRAVEL with minor to some silt, amorphous organics; dark brown. "Loose", moist, well graded. Contains trace glass, white paint/plaster chips; organic odour; gravel, subangular to subrounded; sand, fine to medium.
			100	PQ HFS				34	2							
			100	SPT		1/1 3/2 2/2 **N=9**		33	3							Fill: organic and/or granular soils mixed with refuse. 1.4 to 1.5m - no recovery.
			100	PQ HFS				32	4							
			100	SPT		3/3 2/2 2/2 for 70mm **N>=50**	Box 2, 3.0-6.1m	31	5							For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
			100	PQ HFS				30	6							
			100	SPT		1/2 2/2 1/2 **N=7**		29	7		W					6.5m - wet.
			100	PQ HFS				28	8							
			100	SPT		4/4 3/7 3/1 **N=14**	Box 3, 6.1-9.1m	27	9							
			100	SPT		3/4 4/16 20/10 for 10mm **N>=50** Bouncing		26	10		W-S	VD				Sandy fine to coarse GRAVEL with minor silt and trace cobbles; brown. Very dense, wet to saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
		26/09/2018 10.3 m bgl	100	PQ HFS				25	11		S					9.7m - greyish brown; saturated.
			100	PQ HFS		20/30 for 70mm **N>=50** Solid Bouncing	Box 4, 9.1-12.2m	24	12							10.6 to 11.05m - no recovery from SPT; sample obtained from overcore. 10.8m - trace silt; bluish grey.
NATURAL			100	SPT		12/19 25/25 for 70mm **N>=50** Solid Bouncing		23	13							12.0m - brownish grey. 12.2m - trace to minor silt; brown. 12.2 to 12.35m - no recovery from SPT; sample obtained from overcore.
			100	PQ HFS				22	14							13.7 to 14.06m - no recovery from SPT; sample obtained from overcore.
			100	SPT		11/17 18/18 14 for 60mm **N>=50** Solid Bouncing		21	15							
			0	PQ HFS		13/21 27/23 for 65mm **N>=50** Solid Bouncing	Box 5, 12.2-15.5m	20	16							15.2 to 15.49m - no recovery from SPT. End of borehole @15.49m bgl (target depth).

COMMENTS:

Hole Depth 15.49m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:33:38 PM - Produced with Core-GS by GeRoc

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH106**

SHEET: 1 OF 1

PROJECT: Kyle Park

LOCATION: Kyle Park, Waterloo Road, Hornby JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179177.00 mN 1561504.00 mE

R.L.: 38.23m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 27/09/2018

HOLE FINISHED: 27/09/2018

DRILLED BY: ProDrill

LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL / ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	Box	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL	Box 1, 0.0-2.6m			100	PQ HFS				38	0		M	S				Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
				100	SPT		3/2 2/2 2/2 N=8			1							
				71	PQ HFS				37								Transition material: SILT with some sand and trace gravel; brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace brick; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
				100	SPT		2/1 3/2 2/2 N=9			2							
	Box 2, 2.6-5.8m			76	PQ HFS				36								Fill: organic and/or granular soils mixed with refuse.
				100	SPT		1/2 2/1 0/1 N=4			3							2.7 to 3.0m - no recovery.
				100	PQ HFS				35								
				100	SPT		2/4 4/4 6/4 N=18			4							
	Box 3, 5.8-8.0m			100	PQ HFS				34								
				100	SPT		2/2 6/4 3/3 N=16			5							
			27/09/2018 9.2 m bgl	100	PQ HFS				33								
				100	SPT		9/9 11/7 5/5 N=28			6							
	Box 4, 8.0-10.8m			80	PQ HFS				32								
				100	SPT		10/6 3/3 2/2 N=10			7							
NATURAL				4	PQ HFS				31								
				100	SPT		12/12 15/20 15 for 20mm N>=50 Bouncing			8							
	Box 5, 10.8-14.7m			100	PQ HFS				30								
				100	SPT		4/5 8/12 12/12 N=44 Solid			9							
	Box 6, 14.7-15.6m			100	PQ HFS				29								
				0	SPT		6/8 15/15 18/2 for 5mm N>=50 Solid Bouncing			10		S	L				9.9 to 10.1m - no recovery.
									28								Fine to coarse GRAVEL with trace sand and silt; brownish grey. Loose, saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse. 10.3m - sandy.
										11							Silty fine to medium SAND; grey. Loose, saturated, poorly graded.
									27								11.1 to 12.2m - no recovery.
										12			VD				Sandy fine to coarse GRAVEL with trace cobbles and silt; brownish grey. Very dense, saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse. 12.2 to 12.52m - no recovery from SPT; sample obtained from overcore.
									26								
										13							13.2m - minor silt; brown.
									25				D				13.7m - dense. 13.7 to 14.15m - no recovery from SPT; sample obtained from overcore.
										14							
									24								
										15			VD				15.2m - very dense. 15.2 to 15.58m - no recovery from SPT.
									23								
										16							End of borehole @ 15.58m bgl (target depth).
									22								

For a general description of the landfill materials see the Geotechnical Assessment Report.
Detailed field observations of the landfill material are available on request.

COMMENTS:

Hole Depth 15.58m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:33:43 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: **BH107**

SHEET: 1 OF 1

PROJECT: Kyle Park | LOCATION: Kyle Park, Waterloo Road, Hornby | JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179215.00 mN, 1561475.00 mE
R.L.: 38.61m
DATUM: CCD

DRILL TYPE: MS 1000
DRILL METHOD: SNC
DRILL FLUID: WATER

HOLE STARTED: 27/09/2018
HOLE FINISHED: 27/09/2018
DRILLED BY: ProDrill
LOGGED BY: KPS
CHECKED: HJB

GEOLOGICAL

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.

- FILL (Box 1, 0.0-2.6m; Box 2, 2.6-6.1m)
- NATURAL (Box 3, 6.1-9.1m; Box 4, 9.1-11.9m; Box 5, 11.9-14.6m; Box 6, 14.6-15.5m)

Water: 27/09/2018 10.1 m bgl

Core recovery (%)	Method	Tests	RL (m) / Depth (m)
100	PQ HFS		
100	SPT	2/3 3/2 2/1 **N=8**	
90	PQ HFS		
100	SPT	3/3 2/2 1/2 **N=7**	
85	PQ HFS		
75	PQ HFS		
100	SPT	15/15 12/12 14/12 **N>=50** Bouncing	
100	PQ HFS		
66	SPT	14/16 16/14 12/8 for 70mm **N>=50** Solid Bouncing	
100	PQ HFS		
2	SPT	16/18 18/18 14 for 65mm **N>=50** Solid Bouncing	
100	PQ HFS		
		24/26 for 75mm **N>=50** Solid Bouncing	
100	PQ HFS		
		30/20 for 70mm **N>=50** Solid Bouncing	
100	PQ HFS		
100	SPT	10/10 14/12 14/10 for 70mm **N>=50** Solid Bouncing	
100	PQ HFS		
0	SPT	18/27 32/18 for 40mm **N>=50** Solid Bouncing	

RL (m): 38, 37, 36, 35, 34, 33, 32, 31, 30, 29, 28, 27, 26, 25, 24, 23
Depth (m): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

ENGINEERING DESCRIPTION

Moisture condition / Weathering	Strength/Density classification	Description and Additional Observations
M	S	Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
W	L	Transition material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown mottled light grey and orange. "Soft", moist, low plasticity, very slow dilatancy. Contains trace brick; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded. 0.65m - organic sandy fine to coarse GRAVEL with minor to some silt; brown to dark brown. "Loose", wet, well graded. Contains trace brick; organic odour; gravel, angular to subrounded; sand, fine to coarse; organics, amorphous. 0.9m - trace white paint/plaster chips. 1.05m - light grey and orange bands. Fill: organic and/or granular soils mixed with refuse. 2.9 to 3.0m - no recovery. 4.35 to 4.5m - no recovery. No SPT at 4.5m (wood).
M, W	VD	Sandy fine to coarse GRAVEL with minor to some silt and amorphous organics; dark brownish grey. Very dense, moist, well graded. Gravel, subangular to subrounded; sand, fine to coarse. 5.2m - trace silt, organics absent; grey. 5.3m - minor cobbles. 5.7 to 6.1m - no recovery. 7.0m - trace cobbles; grey, wet. 7.6 to 7.85m - no recovery from SPT; 200mm sample obtained from overcore. 7.85 to 8.0m - sand and silt absent. 9.1 to 9.47m - no recovery from SPT; 170mm sample obtained from overcore. 9.3m - minor silt. 12.2 to 12.35m - no recovery from SPT; sample obtained from overcore. 13.7m - brown. 13.7 to 14.15m - no recovery from SPT; sample obtained from overcore. 15.2 to 15.47m - no recovery from SPT.
		End of borehole @ 15.47m bgl (target depth).

For a general description of the landfill materials see the Geotechnical Assessment Report.
Detailed field observations of the landfill material are available on request.

COMMENTS:

Hole Depth 15.47m

Scale 1:83

Rev.: A

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH108**

SHEET: 1 OF 1

PROJECT: Kyle Park

LOCATION: Kyle Park, Waterloo Road, Hornby JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179119.00 mN 1561487.00 mE

R.L.: 38.43m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 02/10/2018

HOLE FINISHED: 02/10/2018

DRILLED BY: ProDrill

LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL

ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	Box	WATER	CORE RECOVERY (%)	METHOD	TESTS	RL (m)	DEPTH (m)	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	Description and Additional Observations
FILL	Box 1, 0.0-2.6m		100	PQ HFS	8/42 for 50mm **N>=50** Bouncing	38	1	M	S	Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded. 0.3m - brown mottled light yellowish brown.
			100	PQ HFS		37	2			Transition material: SILT with some sand and trace gravel; brown mottled light yellowish brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace brick, white paint chips, and timber; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			100	SPT	2/3 3/3 1/2 **N=9**	36	3	W-S		Fill: organic and/or granular soils mixed with refuse. 2.4m - wet to saturated.
	Box 2, 2.6-6.5m		100	PQ HFS		35	4			For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
			82	PQ HFS		34	5			
			100	SPT	2/1 0/1 1/2 **N=4**	33	6			5.9 to 6.1m - no recovery.
			14	PQ HFS		32	7			6.7 to 7.6m - no recovery (rubbish blocking barrel). No SPT @ 7.6m.
			73	PQ HFS		31	8			
	Box 3, 6.5-10.2m		100	SPT	1/1 3/5 9/3 **N=20**	30	9			8.7 to 9.1m - no recovery.
			100	PQ HFS		29	10		VD	Sandy fine to coarse GRAVEL with minor cobbles and silt; brownish grey mottled orange. Very dense, wet to saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse. 9.7m - reddish orange. 9.8m - bluish grey.
		02/10/2018 10.7 m bgl	100	SPT	8/10 6/5 5/5 **N=21**	28	11			11.0m - grey.
NATURAL	Box 4, 10.2-13.1m		100	PQ HFS		27	12			
			100	SPT	13/13 20/22 8 for 5mm **N>=50** Bouncing	26	13			12.2 to 12.43m - no recovery from SPT; sample obtained from overcore. 12.7m - trace silt; bluish grey.
			100	PQ HFS		25	14			
	Box 5, 13.1-15.6m		100	SPT	10/21 26/14 for 5mm **N>=50** Solid Bouncing	24	15			13.7 to 14.15m - no recovery from SPT; sample obtained from overcore. 14.0m - brown. 15.2 to 15.57m - no recovery from SPT.
			100	PQ HFS		23	16			
			0	SPT	4/6 9/7 11/18 **N=45** Solid 5/7 14/16 20 for 65mm **N>=50** Solid Bouncing	22				End of borehole @ 15.57m bgl (target depth).

COMMENTS:

Hole Depth 15.57m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:33:54 PM - Produced with Core-GS by GeRoc

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH109**

SHEET: 1 OF 1

PROJECT: Kyle Park		LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000
CO-ORDINATES: (NZTM2000)	5179153.00 mN 1561456.00 mE	DRILL TYPE: MS 1000	HOLE STARTED: 28/09/2018 HOLE FINISHED: 28/09/2018
R.L.:	38.31m	DRILL METHOD: SNC	DRILLED BY: ProDrill
DATUM:	CCD	DRILL FLUID: WATER	LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL

ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL			100	PQ HFS			Box 1, 0.0-2.6m	38	1		M	S				Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			100	SPT		5/4 3/4 3/1 **N=11**		37			W					0.6m - orange and black mottles.
			100	PQ HFS				36	2							0.8m - wet.
			100	SPT		2/4 3/9 38 for 70mm **N>=50** Bouncing		35	3		M-W					Transition material: layered organic silty fine to medium SAND with minor gravel, and organic sandy SILT; dark grey. Wet; sharp organic odour.
			100	PQ HFS				34	4							Fill: organic and/or granular soils mixed with refuse. Moist to wet.
			100	SPT		2/4 4/2 2/4 **N=12**	Box 2, 2.6-5.6m	33	5							
			100	PQ HFS				32	6							
			100	SPT		1/0 1/1 1/1 **N=4**		31	7							
			100	PQ HFS				30	8							
			100	SPT		0/0 1/0 1/1 **N=3**	Box 3, 5.6-8.9m	29	9		S	VD				Sandy fine to coarse GRAVEL with minor silt and amorphous organics; dark grey. Very dense, wet to saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
			100	PQ HFS				28	10							9.8m - organics absent; greyish brown.
		28/09/2018 10.3 m bgl	100	SPT		3/15 20/15 15 for 75mm **N>=50** Bouncing		27	11		W					
NATURAL			100	PQ HFS			Box 4, 8.9-11.7m	26	12							10.6m - grey; wet. 10.6 to 10.91m - no recovery from SPT; sample obtained from overcore.
			1164	SPT		7/10 15/18 17 for 5mm **N>=50** Solid Bouncing		25	13							
			100	PQ HFS				24	14							12.2 to 12.51m - no recovery from SPT; sample obtained from overcore. 12.3m - greyish brown.
			100	SPT		6/12 15/22 13 for 10mm **N>=50** Solid Bouncing	Box 5, 11.7-14.6m	23	15		S	D		
			71	PQ HFS				22	16							13.7m - trace silt; reddish brown. Saturated, dense. 14.8m - minor silt.
			0	SPT		4/4 6/9 13/18 **N=46** Solid 5/9 13/17 20 for 65mm **N>=50** Solid Bouncing	Box 6, 14.6-15.6m									14.9 to 15.2m - no recovery. 15.2m - very dense. 15.2 to 15.57m - no recovery from SPT.
																End of borehole @ 15.51m bgl (target depth).

For a general description of the landfill materials see the Geotechnical Assessment Report.
Detailed field observations of the landfill material are available on request.

COMMENTS:

Hole Depth 15.57m

Scale 1:83

Rev.: A

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Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH110**

SHEET: 1 OF 1

PROJECT: Kyle Park

LOCATION: Kyle Park, Waterloo Road, Hornby JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179101.00 mN 1561435.00 mE

R.L.: 38.22m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 01/10/2018

HOLE FINISHED: 01/10/2018

DRILLED BY: ProDrill

LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL / ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	TESTS	SAMPLES	RL (m)	DEPTH (m)	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	Description and Additional Observations
		100	PQ HFS			38		M	S	Capping material: SILT with some sand, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium.
							1			0.4m - minor gravel; dry to moist, "firm to stiff". Gravel, fine to coarse, subangular to subrounded.
		100	SPT	2/5 9/7 7/6 **N=29**		37		W		Transition material: SILT with some sand, minor gravel, amorphous organics; brown to dark brown. "Firm to stiff", moist, low plasticity, very slow dilatancy. Contains trace brick and timber; organic odour; sand, fine to medium.
		100	PQ HFS				2			1.0m - interbedded silty fine to medium SAND with minor gravel, fine to medium SAND, and organic sandy SILT. Wet.
Box 1, 0.0-2.8m						36				
		100	SPT	2/1 1/1 2/2 **N=6**			3			Fill: organic and/or granular soils mixed with refuse. Moist to wet.
		100	PQ HFS			35				
							4			
		0	SPT	2/1 0/1 2/3 **N=6**		34				4.5 to 5.0m - no recovery from SPT; sample not recovered from overcore.
		100	PQ HFS				5			
Box 2, 2.8-6.1m						33				For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
		100	SPT	1/7 4/3 4/3 **N=14**			6			
		100	PQ HFS			32				
							7			
		100	SPT	4/2 3/3 3/4 **N=13**		31				7.6 to 8.05m - no recovery in SPT.
Box 3, 6.1-8.6m		100	PQ HFS				8			
FILL						30				8.55 to 9.1m - no recovery.
							9			
		100	SPT	3/5 4/5 7/19 **N=50**		29		S	D	Sandy fine to coarse GRAVEL with minor cobbles and trace silt; bluish grey. Dense, saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
		100	PQ HFS				10			9.4 to 9.6m - wood pieces.
	01/10/2018 11.1 m bgl					28				9.6m - minor cobbles, trace silt.
Box 4, 8.6-11.1m		100	PQ HFS	35/15 for 60mm **N>=50** Solid Bouncing		27	11		VD	10.6m - very dense. 10.6 to 10.74m - no recovery from SPT; sample obtained from overcore. 12.0m - minor silt, trace cobbles; greyish brown.
		100	SPT	20/37 50 for 55mm **N>=50** Solid Bouncing		26	12			12.2 to 12.41m - no recovery from SPT; sample obtained from overcore. 12.6m - brown. 13.1m - orange-brown.
NATURAL		100	PQ HFS			25	13			
Box 5, 11.1-13.7m		100	SPT	15/25 20/22 8 for 40mm **N>=50** Solid Bouncing		24	14			13.7 to 14.04m - no recovery from SPT; sample obtained from overcore.
Box 6, 13.7-15.5m		0	SPT	11/17 24/26 for 65mm **N>=50** Solid Bouncing		23	15			15.2 to 15.49m - no recovery from SPT.
						22	16			End of borehole @ 15.49m bgl (target depth).

COMMENTS:

Hole Depth 15.49m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:34:05 PM - Produced with Core-GS by GeRoc

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH111**

SHEET: 1 OF 1

PROJECT: Kyle Park		LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000
CO-ORDINATES: (NZTM2000)	5179042.00 mN 1561448.00 mE	DRILL TYPE: MS 1000	HOLE STARTED: 04/10/2018 HOLE FINISHED: 04/10/2018
R.L.:	38.61m	DRILL METHOD: SNC	DRILLED BY: ProDrill
DATUM:	CCD	DRILL FLUID: WATER	LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	Box	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL	Box 1, 0.0-3.0m			86	PQ HFS				38	1		M	S				Capping material: SILT with some sand, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium. 0.35m - trace gravel, fine to medium, subangular to subrounded.
				100	SPT		1/1 0/1 2/3 **N=6**		37			M-W					Fill: organic and/or granular soils mixed with refuse. 1.0m - moist to wet.
				100	PQ HFS				36	2							1.3 to 1.5m - no recovery.
				83	PQ HFS				35	3							No SPT @ 3.0m (core slipped out of barrel).
	Box 2, 3.0-5.9m			100	SPT		1/2 1/2 3/5 **N=11**		34	4							4.25 to 4.5m - no recovery.
				100	PQ HFS				33	5							For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
				100	SPT		2/2 2/6 5/3 **N=16**		32	6							
				100	PQ HFS				31	7		W-S					7.4m - wet to saturated.
	Box 3, 5.9-8.9m			100	SPT		4/3 4/6 4/5 **N=19**		30	8			VD				
				100	PQ HFS				29	9							Sandy fine to coarse GRAVEL with trace to minor silt and trace cobbles; yellowish brown. Very dense, wet to saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
			20/09/2018 10.4 m bgl	100	SPT		11/20 50 for 65mm **N>=50** Bouncing		28	10							
				100	PQ HFS				27	11							10.6m - greyish brown. 10.6 to 10.83m - no recovery from SPT; sample obtained from overcore.
NATURAL	Box 4, 8.8-11.1m			100	SPT		13/27 42/8 for 2mm **N>=50** Solid Bouncing		26	12							
				100	PQ HFS				25	13							12.2 to 12.65m - no recovery from SPT; sample obtained from overcore.
	Box 5, 11.1-13.7m			0	SPT		7/7 8/12 15/15 **N>=50** Solid		24	14							13.7m - saturated, medium dense. 13.7 to 14.15m - no recovery from SPT; sample not obtained.
				95	PQ HFS				23	15		S	MD				
	Box 6, 13.7-15.7m			0	SPT		6/6 8/5 3/3 **N=19** Solid 5/4 5/7 7/6 **N=25** Solid			16							15.2 to 15.65m - no recovery from SPT; sample obtained from overcore. End of borehole @ 15.65m bgl (target depth).

COMMENTS:

Hole Depth 15.65m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:34:11 PM - Produced with Core-GS by GeRoc

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH112**

SHEET: 1 OF 1

PROJECT: Kyle Park

LOCATION: Kyle Park, Waterloo Road, Hornby JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179173.00 mN 1561390.00 mE

R.L.: 38.48m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 04/10/2018

HOLE FINISHED: 04/10/2018

DRILLED BY: ProDrill

LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL / ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL			100	PQ HFS			Box 1, 0.0-2.5m	38	1		M	S				Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			100	SPT		1/3 3/3 2/2 **N=10**		37	2		D-M	L				Transition material: sandy fine to coarse GRAVEL with trace silt; brown. "Loose", dry, well graded. Gravel, angular to subrounded; sand, fine to coarse. 0.6m - minor to some silt, trace wood fibres; moist. 0.95 to 1.05m - orange mottles. 1.5m - organic; dark brown to black. Organics amorphous and fibrous.
			100	PQ HFS				36								
			53	PQ HFS				35	3							Fill: organic and/or granular soils mixed with refuse. No SPT @ 3.0m (wood). 3.8 to 4.5m - no recovery.
			100	SPT		1/1 1/1 1/1 **N=4**	Box 2, 2.5-6.1m	34	4							
			100	PQ HFS				33	5							
			100	SPT		3/4 2/2 2/2 **N=8**		32	6							
			100	PQ HFS				31	7							
			100	SPT		4/6 8/7 6/5 **N=26**		30	8		W-S	VD				
			61	PQ HFS			Box 3, 6.1-9.4m	29	9		S					Sandy fine to coarse GRAVEL with minor cobbles and trace silt, amorphous organics; dark brownish grey. Very dense, wet to saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse. 8.6m - organics absent.
			100	PQ HFS		7/43 for 65mm **N>=50** Bouncing		28	10							8.7 to 9.1m - no recovery.
		04/10/2018 10.8 m bgl	100	SPT		18/18 25/25 for 75mm **N>=50** Solid Bouncing		27	11							9.2m - silty; golden brown staining, petrol odour. Silt is plastic. 9.3m - trace silt. 9.6 to 9.8m - bluish grey; saturated. Strong petrol odour. 10.5m - bluish grey. 10.6 to 10.9m - no recovery from SPT; sample obtained from overcore. 10.8 to 11.2m - silty; golden brown staining, petrol odour. Silt is plastic. 11.0m - trace silt; bluish grey.
NATURAL			100	PQ HFS			Box 4, 9.4-12.5m	26	12							
			100	SPT		7/10 18/12 14/6 for 25mm **N>=50** Solid Bouncing		25	13							12.2 to 12.6m - no recovery from SPT; sample obtained from overcore. 12.7m - brown.
			100	PQ HFS				24	14							13.7 to 14.08m - no recovery from SPT; sample obtained from overcore.
			100	SPT		10/17 15/10 20/5 for 5mm **N>=50** Solid Bouncing	Box 5, 12.5-15.2m	23	15							SPT not recorded @ 15.2m.
			100	PQ HFS				22	16							End of borehole @ 15.2m bgl (target depth).

For a general description of the landfill materials see the Geotechnical Assessment Report.
Detailed field observations of the landfill material are available on request.

COMMENTS:

Hole Depth 15.2m

Scale 1:83

Rev.: A

BoreLog - 28/11/2018 2:34:15 PM - Produced with Core-GS by GeRoc

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH113**

SHEET: 1 OF 1

PROJECT: Kyle Park

LOCATION: Kyle Park, Waterloo Road, Hornby JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179090.00 mN 1561380.00 mE

R.L.: 38.12m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 02/10/2018

HOLE FINISHED: 02/10/2018

DRILLED BY: ProDrill

LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL			100	PQ HFS				37	1		M	S				Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded. 0.2m - sandy; brown mottled yellowish brown.
Box 1, 0.0-2.5m			100	SPT		1/1 2/2 5/4 **N=13**		36	2			F-St				Transition material: Gravelly sandy SILT; brown. Moist, low plasticity. Contains trace brick; gravel, fine to coarse, subangular to subrounded; sand, fine to coarse. 0.8m - gravel absent; dark brown. "Firm to stiff". 1.2 to 1.4m - trace sand; grey mottled orange and dark brown. Moderate plasticity, no dilatancy. 1.4m - trace gravel, medium to coarse, subangular to subrounded.
			100	PQ HFS				35	3							Fill: organic and/or granular soils mixed with refuse.
			100	SPT		1/1 1/1 1/1 **N=4**		34	4							No SPT @ 4.5m (wood).
			100	PQ HFS				33	5							5.1 to 6.1m - no recovery (timber blocked barrel).
Box 2, 2.5-6.8m			50	PQ HFS				32	6		S					6.1m - saturated. 6.55 to 6.95m - no recovery.
Box 3, 6.6-7.6m			100	SPT		2/1 3/4 4/4 **N=15**		31	7		W					6.95m - wet.
			61	PQ HFS												End of borehole @7.6m bgl (refusal on steel).
								30	8							For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
								29	9							
								28	10							
								27	11							
								26	12							
								25	13							
								24	14							
								23	15							
								22	16							

COMMENTS:

Hole Depth 7.6m

Scale 1:83

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH114**

SHEET: 1 OF 1

PROJECT: Kyle Park

LOCATION: Kyle Park, Waterloo Road, Hornby JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179034.00 mN 1561387.00 mE

R.L.: 39.00m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 03/10/2018

HOLE FINISHED: 03/10/2018

DRILLED BY: ProDrill

LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL / ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL			86	PQ HFS				38	1		M	S				Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			100	SPT		3/3 3/2 2/2 **N=9**					M-W					Transition material: gravelly SILT with some sand; brown. "Soft", moist, low plasticity, no dilatancy. Contains trace timber, metal, brick, plastic, white paint/plaster chips.
			100	PQ HFS				37	2							0.9 to 1.1m - no recovery.
			100	SPT		5/8 5/4 5/3 **N=17**		36	3							Fill: organic and/or granular soils mixed with refuse.
			100	PQ HFS				35	4							
			100	SPT		32/2 3/4 4/2 **N=13**		34	5							For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
			100	PQ HFS				33	6							
			22	SPT		4/11 25/12 5/8 **N>=50** Bouncing										6.1 to 6.55m - no recovery from SPT; 100mm obtained from overcore.
			80	PQ HFS				32	7							
			100	SPT		3/4 4/4 5/5 **N=18**		31	8							7.4 to 7.6m - no recovery.
			100	PQ HFS				30	9							
			0	SPT		10/40 for 75mm **N>=50** Bouncing										9.1 to 9.25m - no recovery from SPT; sample not obtained. 9.1 to 10.6m - drilling equipment damaged; retrieval of equipment lost downhole may have resulted in mixed core.
			100	PQ HFS				29	10							
NATURAL		03/10/2018 11.1 m bgl	100	SPT		12/16 14/26 10 for 30mm **N>=50** Solid Bouncing		28	11		W-S	VD				Sandy fine to coarse GRAVEL with trace silt; greyish brown. Very dense, wet to saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse. 10.6 to 10.93m - no recovery from SPT; sample obtained from overcore.
			100	PQ HFS				27	12							
			100	SPT		9/10 10/10 11/11 **N=42** Solid						D				12.2m - dense. 12.2 to 12.65m - no recovery from SPT; sample obtained from overcore.
			100	PQ HFS				26	13							
			100	SPT		7/5 4/5 5/4 **N=18** Solid		25	14			MD				13.7m - medium dense. 13.7 to 14.15m - no recovery from SPT; sample obtained from overcore.
			100	PQ HFS				24	15							
			0	SPT		5/12 19/5 8/9 **N=41** Solid										15.2m - dense. 15.2 to 15.65m - no recovery from SPT.
								23	16							End of borehole @ 15.65m bgl (target depth).

Box 1, 0.0-3.0m | Box 2, 3.0-6.1m | Box 3, 6.1-9.3m | Box 4, 9.3-11.9m | Box 5, 11.9-15.7m

COMMENTS:

Hole Depth 15.65m

Scale 1:83

Rev.: A

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Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH115**

SHEET: 1 OF 1

PROJECT: Kyle Park | LOCATION: Kyle Park, Waterloo Road, Hornby | JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179221.00 mN, 1561525.00 mE

R.L.: 38.66m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 05/10/2018

HOLE FINISHED: 05/10/2018

DRILLED BY: ProDrill

LOGGED BY: KPS | CHECKED: HJB

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	RL (m)	DEPTH (m)	Description and Additional Observations
FILL	38	1	Capping material: SILT with some sand, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium. 0.3m - trace gravel, fine to medium, subangular to subrounded.
	37	2	Transition material: SILT with some sand and trace gravel, amorphous organics; dark brown mottled light brown and orange. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, medium to coarse, subangular to subrounded. 0.75m - some organics, spongy, brown.
	36	3	Fill: organic and/or granular soils mixed with refuse. 0.9 to 1.5m - no recovery. No SPT @ 1.5m (wood). 2.25 to 2.6m - no recovery.
	35	4	
	34	5	Sandy fine to coarse GRAVEL with trace to minor silt and trace cobbles; grey. Medium dense, wet, well graded. Gravel, subangular to subrounded; sand, fine to coarse. 4.5m - dense. 4.5 to 4.95m - no recovery from SPT; sample obtained from overcore.
	33	6	
	32	7	6.1m - very dense. 6.1 to 6.48m - no recovery from SPT; sample obtained from overcore.
NATURAL	31	8	7.6 to 7.97m - no recovery from SPT; sample obtained from overcore.
	30	9	8.5 to 9.1m - no recovery.
	29	10	9.1m - greyish brown. 9.1 to 9.34m - no recovery from SPT; sample obtained from overcore.
	28	11	10.6m - dense. 10.6 to 11.05m - no recovery from SPT; sample obtained from overcore.
	27	12	11.9m - brown. 12.2m - saturated. 12.2 to 12.65m - no recovery from SPT; sample obtained from overcore.
	26	13	13.3 to 13.7m - no recovery.
	25	14	13.7 to 14.15m - no recovery from SPT; sample obtained from overcore.
	24	15	15.2 to 15.65m - no recovery from SPT.
	23	16	End of borehole @ 15.65m bgl (target depth).

Box 1, 0.0-3.9m | Box 2, 3.9-6.4m | Box 3, 6.4-9.6m | Box 4, 9.6-12.2m | Box 5, 12.2-15.7m

WATER: 05/10/2018 11.1 m bgl

CORE RECOVERY (%)	METHOD	TESTS	SAMPLES
60	PQ HFS		
76	PQ HFS		
100	SPT	4/3, 5/5, 4/4, **N=18**	
100	PQ HFS		
100	SPT	6/17, 12/8, 12/11, **N=43**, Solid	
100	PQ HFS		
100	SPT	14/14, 14/16, 20 for 75mm, **N>=50**, Solid, Bouncing	
100	PQ HFS		
100	SPT	12/14, 18/18, 14 for 70mm, **N>=50**, Solid, Bouncing	
46	PQ HFS		
100	SPT	6/16, 35/15 for 15mm, **N>=50**, Solid, Bouncing	
100	PQ HFS		
100	SPT	8/8, 10/10, 11/13, **N=44**, Solid	
100	PQ HFS		
100	SPT	8/16, 11/8, 8/10, **N=37**, Solid	
61	PQ HFS		
100	SPT	5/6, 5/8, 10/12, **N=35**, Solid	
100	PQ HFS		
0	SPT	6/6, 5/7, 9/13, **N=34**, Solid	

MOISTURE CONDITION	STRENGTH/DENSITY CLASSIFICATION
M	S
M-W	
W	MD
	D
	VD
	D
S	

COMMENTS:

For a general description of the landfill materials see the Geotechnical Assessment Report.
Detailed field observations of the landfill material are available on request.

Hole Depth 15.65m

Scale 1:83

Rev.: A

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Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH116**

SHEET: 1 OF 1

PROJECT: Kyle Park

LOCATION: Kyle Park, Waterloo Road, Hornby JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179199.00 mN 1561554.00 mE

R.L.: 36.20m

DATUM: CCD

DRILL TYPE: MS 1000

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 05/10/2018

HOLE FINISHED: 05/10/2018

DRILLED BY: ProDrill

LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL

ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING / MOISTURE CONDITION	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL			76	PQ HFS				36			M	S				Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			100	SPT		1/1 0/1 2/1 **N=4**		35	1		W-S					Transition material: SILT with some sand and minor gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace concrete and bark; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
			0	PQ HFS				34	2							0.95 to 1.3m - no recovery.
			30	PQ HFS				33	3							Fill: organic and/or granular soils mixed with refuse. Wet to saturated.
			100	SPT		1/1 2/2 4/4 **N=12**		32	4							1.95 to 3.0m - no recovery.
			100	PQ HFS				31	5							No SPT @ 3.0m (metal, core loss).
Box 1, 0.0-4.9m																3.45 to 4.5m - no recovery.
			100	SPT		5/7 5/4 2/2 **N=13**		30	6							For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
Box 2, 4.9-7.1m			100	PQ HFS				29	7							
			33	SPT		2/2 1/2 0/1 **N=4**		28	8							7.6 to 7.9m - no recovery in SPT; 150mm obtained from overcore.
			100	PQ HFS				27	9							
Box 3, 7.1-9.7m			100	SPT		2/0 1/2 12/35 for 70mm **N>=50** Bouncing		26	10		W	D				Sandy fine to coarse GRAVEL with minor silt and trace cobbles; bluish grey. Dense, wet, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
		05/10/2018 10.6 m bgl	100	PQ HFS				25	11		S					10.4m - brownish grey.
			100	SPT		7/7 8/10 10/10 **N=38** Solid		24	12							10.6m - trace silt; saturated, brown. 10.6 to 11.05m - no recovery from SPT; 50mm obtained from overcore.
NATURAL			100	PQ HFS				23	13			VD				12.2m - very dense. 12.2 to 12.59m - no recovery from SPT; sample obtained from overcore.
Box 4, 9.7-12.7m			100	SPT		9/12 14/14 16/6 for 15mm **N>=50** Solid Bouncing		22	14							13.7 to 14.08m - no recovery from SPT; sample obtained from overcore.
			100	PQ HFS				21	15							15.2 to 15.5m - no recovery from SPT.
Box 5, 12.7-15.5m			0	SPT		7/10 16/16 16/2 for 5mm **N>=50** Solid Bouncing 19/20 25/25 for 75mm **N>=50** Solid Bouncing		20	16							End of borehole @ 15.50m bgl (target depth).

COMMENTS:

Hole Depth 15.5m

Scale 1:83

Rev.: A

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH117**

SHEET: 1 OF 1

PROJECT: Kyle Park		LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000
CO-ORDINATES: (NZTM2000)	5179182.00 mN 1561591.00 mE	DRILL TYPE: Fraste XL1	HOLE STARTED: 06/10/2018 HOLE FINISHED: 06/10/2018
R.L.:	36.19m	DRILL METHOD: SNC	DRILLED BY: ProDrill
DATUM:	CCD	DRILL FLUID: WATER	LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL Box 1, 0.0-3.8m Box 2, 3.8-7.0m Box 3, 7.0-9.8m Box 4, 9.8-12.2m Box 5, 12.2-14.4m Box 6, 14.4-15.7m		06/10/2018 11.0 m bgl	83 0 80 22 100 44 69 100 100 76 100 100 100 100 100 100 0	PQ HFS SPT PQ HFS SPT PQ HFS SPT PQ HFS SPT PQ HFS SPT PQ HFS SPT PQ HFS SPT PQ HFS SPT		0/0 0/0 0/1 **N=1** 0/1 1/0 1/5 **N=7** 4/2 2/1 1/2 **N=6** 1/1 1/1 1/2 **N=5** 3/4 3/3 2/2 **N=10** 8/10 14/21 15 for 50mm **N>=50** Bouncing 4/4 4/4 3/5 **N=16** 5/5 4/4 6/7 **N=21** 6/6 7/7 4/5 **N=23** 3/4 4/5 5/7 **N=21**		36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16		M M-W W S	S VD MD				Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded. Transition material: gravelly SILT with some sand, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded. 0.75 to 1.0m - no recovery. 1.5 to 2.15m - no recovery. Fill: organic and/or granular soils mixed with refuse. Moist to wet. 3.1 to 3.45m - no recovery. 4.7 to 5.3m - no recovery. For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request. 8.05 to 8.3m - no recovery. Sandy fine to coarse GRAVEL with trace to minor cobbles and silt; dark grey. Very dense, wet, well graded. Gravel, subangular to subrounded; sand, fine to coarse. 8.8m - grey. 10.6m - medium dense, saturated. 11.0m - brown. End of borehole @ 15.65m bgl (target depth).

COMMENTS:

Hole Depth 15.65m

Scale 1:83

Rev.: A

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BOREHOLE LOG

BOREHOLE No.: **BH118**

SHEET: 1 OF 1

PROJECT: Kyle Park | LOCATION: Kyle Park, Waterloo Road, Hornby | JOB No.: 1003207.0000

CO-ORDINATES: (NZTM2000) 5179226.00 mN 1561614.00 mE

R.L.: 36.23m

DATUM: CCD

DRILL TYPE: Fraste XL1

DRILL METHOD: SNC

DRILL FLUID: WATER

HOLE STARTED: 06/10/2018

HOLE FINISHED: 06/10/2018

DRILLED BY: ProDrill

LOGGED BY: KPS

CHECKED: HJB

GEOLOGICAL / ENGINEERING DESCRIPTION

Geological unit	Core recovery (%)	Method	Tests	Moisture / Weathering	Strength/Density	Description and Additional Observations
FILL (Box 1, 0.0-4.0m; Box 2, 4.0-6.9m; Box 3, 6.9-9.1m)	66	PQ HFS		M	S	Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
	100	SPT	0/0 1/1 0/1 **N=3**			Transition material: gravelly SILT with some sand, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace clinker; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded. 0.9m - contains trace brick. 1.0 to 1.5m - no recovery. 2.0 to 2.4m - no recovery.
	61	PQ HFS				Fill: organic and/or granular soils mixed with refuse.
	100	SPT	0/0 0/0 2/2 **N=4**			For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
	100	PQ HFS				
	100	SPT	1/1 0/1 0/0 **N=1**			
	82	PQ HFS				5.9 to 6.1m - no recovery.
	100	SPT	1/1 1/0 0/0 **N=1**			
	100	PQ HFS				
	100	SPT	2/2 1/2 3/4 **N=10**			
	100	PQ HFS				
	100	SPT	2/3 3/2 3/3 **N=11**			
	100	PQ HFS				
NATURAL (Box 4, 9.1-11.4m; Box 5, 11.4-14.2m; Box 6, 14.2-15.7m)	100	SPT	14/12 10/10 10/12 **N=42**	W S	D	Sandy fine to coarse GRAVEL with trace to minor silt and trace cobbles; bluish grey. Dense, wet, well graded. Gravel, subangular to subrounded; sand, fine to coarse. 10.3m - saturated. 11.0m - brown.
	100	PQ HFS				11.8m - minor sand, trace silt.
	100	SPT	7/10 12/13 20/5 for 10mm **N>=50** Bouncing		VD	12.2m - very dense.
	100	PQ HFS				
	100	SPT	7/7 7/7 8/8 **N=30**		D	13.7m - dense.
	100	PQ HFS				
	0	SPT	6/6 8/9 8/10 **N=35**			
						End of borehole @ 15.65m bgl (target depth).

Water: 06/10/2018 10.8 m bgl

COMMENTS:

Hole Depth 15.65m

Scale 1:83

Rev.: A

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: **BH119**

SHEET: 1 OF 1

PROJECT: Kyle Park	LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000	
CO-ORDINATES: (NZTM2000) 5179185.00 mN 1561641.00 mE	DRILL TYPE: MS 1000	HOLE STARTED: 06/10/2018	
R.L.: 35.85m	DRILL METHOD: SNC	HOLE FINISHED: 06/10/2018	
		DRILLED BY: ProDrill	
DATUM: CCD	DRILL FLUID: WATER	LOGGED BY: KPS	CHECKED: HJB

GEOLOGICAL

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.

FILL (Box 1, 0.0-2.8m; Box 2, 2.8-6.4m; Box 3, 6.4-8.8m)

NATURAL (Box 4, 8.8-11.2m; Box 5, 11.2-14.8m; Box 6, 14.8-15.6m)

Columns: FLUID LOSS (%) 25 50 75 | WATER | CORE RECOVERY (%) | METHOD | CASING | TESTS | SAMPLES | RL (m) | DEPTH (m)

CORE RECOVERY (%)	METHOD	TESTS
100	PQ HFS	
100	SPT	3/2 1/0 1/1 **N=3**
100	PQ HFS	
100	SPT	2/11 8/6 2/2 **N=18**
66	PQ HFS	
0	SPT	1/1 0/1 1/2 **N=4**
100	PQ HFS	
100	SPT	1/1 2/2 3/8 **N=15**
100	PQ HFS	
100	SPT	3/1 2/2 3/3 **N=10**
100	PQ HFS	
100	SPT	5/4 5/7 5/5 **N=22**
100	PQ HFS	
100	SPT	18/18 18/18 14 for 55mm **N>=50** Solid Bouncing
100	PQ HFS	
100	SPT	10/12 24/26 for 35mm **N>=50** Solid Bouncing
100	PQ HFS	
100	SPT	5/12 12/9 12/15 **N=48** Solid
100	PQ HFS	
0	SPT	7/10 15/15 20 for 65mm **N>=50** Solid Bouncing

WATER: 06/10/2018 11.3 m bgl

RL (m): 35, 34, 33, 32, 31, 30, 29, 28, 27, 26, 25, 24, 23, 22, 21, 20

DEPTH (m): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

ENGINEERING DESCRIPTION

Columns: GRAPHIC LOG | MOISTURE CONDITION / WEATHERING | STRENGTH/DENSITY CLASSIFICATION | SHEAR STRENGTH (kPa) 10 25 50 100 200 | COMPRESSIVE STRENGTH (MPa) 1 5 20 50 100 250 | DEFECT SPACING (cm) 20 60 200 600 2000 | Description and Additional Observations

Moisture	Strength/Density	Description and Additional Observations
M	S	Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
		Transition material: SILT with some sand and minor gravel, amorphous organics; brown to dark brown mottled yellowish brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace brick; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
		Fill: organic and/or granular soils mixed with refuse.
		3.45 to 3.8m - no recovery.
		4.5 to 5.0m - no recovery.
		For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
W / S	VD	Sandy fine to coarse GRAVEL with trace to minor silt and trace cobbles; bluish grey. Very dense, wet, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
		10.6m - brownish grey; saturated. 10.6 to 10.96m - no recovery from SPT; sample obtained from overcore. 11.2m - brown.
		12.2 to 12.46m - no recovery from SPT; sample obtained from overcore.
		13.7 to 14.15m - no recovery from SPT; sample obtained from overcore.
		15.2 to 15.57m - no recovery from SPT.
		End of borehole @ 15.57m bgl (target depth).

COMMENTS:

Hole Depth 15.57m

Scale 1:83

Rev.: A

BOREHOLE LOG

BOREHOLE No.: **BH120**

SHEET: 1 OF 1

PROJECT: Kyle Park		LOCATION: Kyle Park, Waterloo Road, Hornby	JOB No.: 1003207.0000
CO-ORDINATES: (NZTM2000)	5179207.00 mN 1561664.00 mE	DRILL TYPE: MS 1000	HOLE STARTED: 06/10/2018 HOLE FINISHED: 06/10/2018
R.L.:	36.10m	DRILL METHOD: SNC	DRILLED BY: ProDrill
DATUM:	CCD	DRILL FLUID: WATER	LOGGED BY: KPS CHECKED: HJB

GEOLOGICAL																ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.		FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
FILL	Box 1, 0.0-3.0m			93	PQ HFS				35	1		M	S				Capping material: SILT with some sand and trace gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Contains trace rootlets; organic odour; sand, fine to medium; gravel, fine to medium, subangular to subrounded.
				100	SPT		2/1 2/1 1/1 **N=5**										Transition material: SILT with some sand and minor to some gravel, amorphous organics; brown to dark brown. "Soft", moist, low plasticity, very slow dilatancy. Sand, fine to medium; gravel, fine to medium, subangular to subrounded.
				100	PQ HFS				34	2							Fill: organic and/or granular soils mixed with refuse.
				73	PQ HFS				33	3							1.4 to 1.5m - no recovery.
																	No SPT @ 3.0m (wood).
									32	4							3.0 to 3.4m - no recovery.
				0	SPT		2/2 1/0 2/2 **N=5**										4.5 to 5.1m - no recovery.
	Box 2, 3.0-6.9m			86	PQ HFS				31	5							For a general description of the landfill materials see the Geotechnical Assessment Report. Detailed field observations of the landfill material are available on request.
				100	SPT		4/2 2/1 2/3 **N=8**		30	6							
				100	PQ HFS				29	7							
				100	SPT		2/2 1/2 1/1 **N=5**										7.6 to 8.05m - no recovery in SPT.
				100	PQ HFS				28	8		W					8.05m - wet.
				0	SPT		7/6 7/5 5/5 **N=22**		27	9							9.1 to 9.7m - no recovery.
	Box 3, 6.9-10.6m			85	PQ HFS				26	10							
			06/10/2018 10.9 m bgl	100	SPT		14/18 15/18 17 for 70mm **N>=50** Solid Bouncing					S	VD				Sandy fine to coarse GRAVEL with trace to minor silt and trace cobbles; grey. Very dense, saturated, well graded. Gravel, subangular to subrounded; sand, fine to coarse.
				67	PQ HFS				25	11							10.6 to 10.97m - no recovery from SPT; sample obtained from overcore.
																	11.1m - brown.
									24	12							11.2 to 11.8m - no recovery.
				100	SPT		14/16 15/15 15/5 for 5mm **N>=50** Solid Bouncing										12.2 to 12.58m - no recovery from SPT; sample obtained from overcore.
NATURAL	Box 4, 10.6-13.7m			100	PQ HFS				23	13							
				100	SPT		6/14 16/15 15/4 for 6mm **N>=50** Solid Bouncing		22	14							13.7 to 14.08m - no recovery from SPT; sample obtained from overcore.
	Box 5, 13.7-15.6m			100	PQ HFS				21	15							
				0	SPT		16/16 16/18 16 for 70mm **N>=50** Solid Bouncing										15.2 to 15.57m - no recovery from SPT.
									20	16							End of borehole at 15.57m bgl (target depth).

COMMENTS:

Hole Depth 15.57m

Scale 1:83

Rev.: A

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