

Separate *Phase Ltd*

Practical Earth Science

REPORT

**BP Connect Mosgiel
Detailed Site Investigation
70-76 Gordon Road, Mosgiel**



Prepared for:

BP Oil New Zealand Ltd

Document Reference:

J17211_001a

Issue Date:

15 June 2017

Executive Summary

Separate Phase Ltd has prepared this report for **BP Oil New Zealand Ltd**, as part of the redevelopment of their service station of **BP Connect Mosgiel**, currently operating as BP Alco Motors, located at 70-76 Gordon Road ('the site'). The site has been a service station since at least 1982, and a motor vehicles garage since at least 1979 with several petroleum storage and handling layouts.

The objectives of this investigation were to identify potential contaminant sources in soil and groundwater, identify the shallow geology in the proposed tank and shop locations, and to identify any constraints that may occur during redevelopment.

Two test pit excavations and three cone penetrometer tests (CPTs) were performed at the site during the June 2017 investigation. This investigation did not identify evidence of TPH or heavy metal compounds in soil beneath the site. Soil samples collected comply with the MfE guidelines and standards selected for comparison. The CPT logs provided by McMillan Drilling Group can be used to inform geotechnical decisions (e.g., foundation design).

Separate Phase Ltd. recommends that environmental hazards should be managed using a site-specific Environmental Management Plan (EMP). This EMP can be used as part of resource consent and building consent applications and further utilised on site during future construction.

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Limitations

This document was prepared by Separate Phase Ltd for the use of **BP Oil New Zealand Ltd**. Any advice, opinions or recommendations are considered current to the date of this document and should be read and relied upon only in the context of the whole document. Any other party should satisfy themselves that the scope of work conducted and reported herein meets their specific needs. Separate Phase Ltd cannot be held liable for third party reliance on this document, as Separate Phase Ltd is not aware of the specific needs of the third party.

Separate Phase has limited its investigation to the scope agreed with the client in accordance with IPENZ short form terms and conditions.

From a technical perspective, the subsurface environment at any site may present substantial uncertainty. It is a heterogeneous, complex environment, in which small subsurface features or changes in geologic conditions can have substantial impacts on water and chemical movement. Uncertainties may also affect source characterisation assessment of chemical fate and transport in the environment, assessment of exposure risks and health effects, and remedial action performance.

Separate Phase believes that the signatory of this document is a suitably qualified environmental practitioner (SQEP), and is competent to supervise and/or undertake this scope of work. Separate Phase holds professional indemnity insurance covering the services provided. Separate Phase's professional opinions are based upon its professional judgment, experience, and training. These opinions are also based upon data derived from previous reports and the testing and analysis described in this document. This document is subject to modification if additional information is obtained through further investigation, observations, or validation testing and analysis during remedial activities. It is possible that additional investigations might produce different results and/or different opinions. Separate Phase believes that its opinions are supported by the testing and analysis that have been done, and that those opinions have been developed according to the professional standard of care for the environmental consulting profession in this area at this time. That standard of care may change and new methods and practices of exploration, testing, analysis and remediation may develop in the future, which might produce different results.

1 Introduction

Separate Phase Ltd has prepared this report for **BP Oil New Zealand Ltd**, as part of the redevelopment of their service station of **BP Connect Mosgiel**, currently operating as BP Alco Motors, located at 70-76 Gordon Road ('the site'). The objectives of this investigation were to identify potential contaminant sources in soil and groundwater, identify the shallow geology in the proposed tank and shop locations, and to identify any constraints that may occur during redevelopment.

The scope of this detailed site investigation report consists of:

1. Preliminary Site Investigation
 - a. Review of previous environmental investigations and resource consents; and,
 - b. Geology, hydrogeology, and groundwater sensitivity;
2. Detailed Site Investigation
 - a. Site walkover; and,
 - b. Soil sampling via test pitting.
3. Development of a conceptual site model, and identification of key sources of potential soil and groundwater contamination.

In addition, geotechnical investigations were conducted in conjunction with this environmental investigation. Cone penetration tests (CPTs) were performed, interpreted and reported by McMillan Drilling Group to determine geotechnical engineering properties of the soils.

2 Preliminary Site Investigation

The site has been a service station since at least 1982, and a motor vehicles garage since at least 1979. BP Alco Motors upgraded the tank systems in 1998 and 2005, and it is now proposed for redevelopment into a BP Connect service station. A site location plan is provided in **Appendix A: Figure 1**. A current site layout is provided in **Appendix A: Figure 2**.

Site identification details are provided below:

Table 1 – Site Identification Data

Item	Description
Site Identification	BP Connect Mosgiel
Site Location and Address	70-76 Gordon Road, Mosgiel
Legal Description	Lot 9 Block VII DP 471 (70 Gordon Road) Lot 7-8, Block VII, DP 471 (72 Gordon Road) Lot 6, Block VII DP 471 (76 Gordon Road)
Area	Approximately 3,005 m ²
Otago Regional Council (ORC) Site Identification Number	HAIL.00189.01 (per personal communications with Simon Beardmore of ORC on 17 May 2017).

2.1 Environmental Site Setting

The site is located at in a primarily residential and commercial setting on Gordon Road in central Mosgiel. The site currently consists of a workshop, office, shop, store, forecourt, liquid petroleum gasoline (LPG) aboveground storage tank and barrier, five dispensing bowsters under canopy, and two underground storage tanks (USTs) along with associated pipework and underground services. Following the purchase of 70 Gordon Road, the site also includes a former residential lot (the former home has been demolished) and a garage which is to be demolished. 76 Gordon Road consists of a gravel drive which is used by tanker trucks when tracking through the site following fuelling of the USTs.

The proposed upgrade of the site to a BP Connect will include the demolition of all current buildings and decommissioning of the underground petroleum storage system, and construction of a new BP Connect Shop, eight dispensing bowsters under canopy, a forecourt, a new Superwash car wash, and installation of two new 100,000-litre USTs and associated piping.

Table 2 presents a summary of environmental data considered relevant to this investigation.

Table 2: Environmental Site Setting Summary

Site Land Use	Commercial – Service Station	
Neighbouring land uses:	North	Commercial – VetEnt
	South	Residential
	East	Gordon Road, Residential/Commercial including Chapel Hall
	West	Residential
Site Topography:	Flat	
Site surface drainage/runoff patterns:	• Workshop and forecourt areas drain via an interceptor. • According to as-built drawings provided by BP, stormwater runs from the workshop and forecourt to a stormwater drain and oil/water interceptor. • Stormwater drains off-site to the kerb and channel on Gordon Road. • During construction, stormwater will discharge to the stormwater network along Gordon Road, or to Mure or Irvine Streets; alternatively, the stormwater could potentially be discharged to ground (TBC).	
Are there underground services present?	☒ Yes ☐ No ☐ Unknown	
Could services affect contaminant migration?	☒ Yes ☐ No ☐ Unlikely	
If yes, to what extent:	Due to the high groundwater level, underground service trenches could potentially act as preferential pathways for contaminants.	
Nearby surface water bodies and distance to:	The Owhiro Stream is located approximately 700 metres to the south of the site and the Silver Stream is located 1.2 km to the north.	
Are there any onsite wells?	☐ Yes ☐ No ☒ Unknown No wells were observed during the site visit on 1 June 2017.	
Are there any offsite wells within 1 km of the site?	☒ Yes ☐ No ☐ Unknown According to correspondence with Otago Regional Council (ORC) on 26 May 2017, there are four groundwater wells used for abstraction within a 1 km radius of the site: • Wells I44/0744 and I44/0786, located 570 west of the site, have a current groundwater take permit for potable use. • Well I44/0742, located 170m north of the site, has a current groundwater permit for potable use. • Well I44/0929, located 630m southwest (down hydraulic gradient) of the site, does not have a current permit, but has a recorded use for domestic purposes, which could take place as a permitted activity. • Depth to water is not recorded for these wells.	
Likely regional groundwater flow direction:	West and south-west towards the Taieri River (refer to Appendix A: Figure 2).	
Historic Aerial Photographs and historical information:	Historical aerial images were not available for review according to ORC. Separate Phase have contacted Dunedin City Council and are awaiting property file information to inform history of the site. In the meantime, the Dunedin City Council indicates the following information (sourced from Incite Planning Scoping Report):	

	<i>The site is an existing service station which has been established on the site for some time. The Council has records of the following resource consents for the site:</i> <i>• 2005 – Replace three existing tanks of 41,000 litre petrol and 9,000 litre diesel with three new double skin tanks of 50,000 litres petrol 91, 20,000 litres petrol 96 and 30,000 litres diesel;</i> <i>• 2004 – New freestanding sign;</i> <i>• 1988 – Illuminated sign;</i> <i>• 1982 – Forecourt canopy;</i> <i>• 1979 – Erect a versatile garage; and</i> <i>• 1968 – Sale of new and second hand motor vehicles.</i>
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2.2 Previous Environmental Investigations

Three environmental investigations have taken place at the site according to site files reviewed to date. These are summarised in the paragraphs that follow. **Figure 3 of Appendix A** (general conceptual site model for the current configuration) indicates the location of the removed tanks during the investigations.

- The first investigation was performed by BP in May 1995¹ and consisted of four soil samples associated with the remaining soil following removal of one 4,000-Litre diesel UST to the northwest of the current shop. The samples were collected by NIWA and analysed for total petroleum hydrocarbons (TPH). The results returned TPH concentrations of 3 to 10 parts per million (ppm). The report indicates the results are equivalent to “oil and grease”.
- The second investigation was performed by Montgomery Watson in August 1998² and consisted of five soil samples collected from the soil remaining in the tank pit following removal of one 2,500-litre 91 petrol UST located between the workshop and Gordon Road. The analysis returned four results for TPH less than the laboratory detection limit and one result of 122 milligram per kilogram (mg/kg) for TPH.
- The third and most recent investigation was conducted by URS in May 2005³ and consisted of 53 soil samples collected during excavation and removal of the underground petroleum storage system (UPSS) in place at the time. The removed USTs included one 21,000-litre 96 petrol UST, one 20,000-litre 91 petrol UST, and one 9,000-litre diesel UST in varying condition from poor with some holes to moderate/pitted. For the samples collected from the soil remaining on site, the TPH concentrations ranged from <3 mg/kg to 638 mg/kg. Eight samples were further analysed for benzene, toluene, ethylene, and xylenes (BTEX), and two samples for polycyclic aromatic hydrocarbons (PAHs). According to the URS letter report, all sample analytical results for soil remaining on site complied with the applicable Oil Industry Guideline Tier 1 Acceptance Criteria for Commercial/Industrial and Residential land use criteria.

2.3 Resource Consents

Separate Phase contacted Otago Regional Council to enquire about any active resource consents for the site (personal communication with Simon Beardmore - Senior Environmental Officer). ORC reported the only ORC

¹ BP Oil (1995). Laboratory Test Report. Dated 28 April 1995.

² Montgomery Watson (1998). Screening Level Site Report Form. Dated 7 September 1998.

³ URS (2005). Underground Petroleum Storage System (UPSS) Decommissioning at BP Alco Motors, Mosgiel, Dunedin. Dated 28 September 2005.

consent is to install up to six monitoring wells for soil and groundwater investigation (expired 7 February 2013). The Dunedin City Council (DCC) has issued the following consents:

- 2005 – Replace three existing tanks of 41,000 litre petrol and 9,000 litre diesel with three new double skin tanks of 50,000 litres petrol 91, 20,000 litres petrol 96 and 30,000 litres diesel;
- 2004 – New freestanding sign;
- 1988 – Illuminated sign;
- 1982 – Forecourt canopy;
- 1979 – Erect a versatile garage; and
- 1968 – Sale of new and second-hand motor vehicles.

2.4 Geology, Hydrogeology and Groundwater Sensitivity

Groundwater was not encountered during any of the investigations completed at the site in 1995, 1998 or 2005; however, according to Otago Regional Council, groundwater at the former Caltex Mosgiel Site (HAIL.00504.01 on Figure 1 below) has been measured between 1.5 and 3 metres below ground level (mbgl) over the last few years.

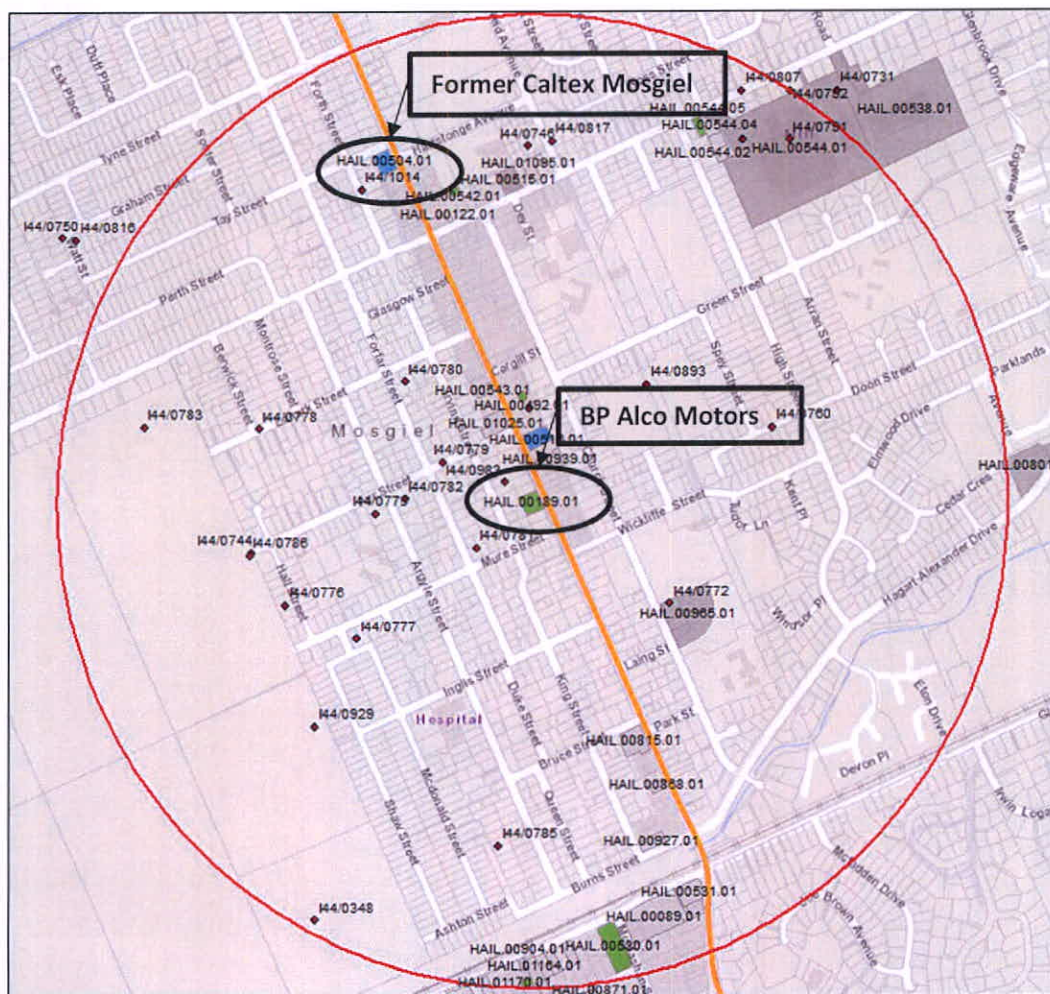


Figure 1 - Location of Former Caltex Mosgiel in relation to the current BP Alco Motors and location of wells within a 1 kilometre radius of the site.

Due to the groundwater level data from the former Caltex Mosgiel site, and Separate Phase Ltd.'s experience with sites within Mosgiel, it is anticipated that groundwater will be encountered during the excavation of the

tanks in the BP Connect Mosgiel upgrade works and that dewatering will be required. This was confirmed by the detailed site investigation (DSI) portion of this work described in **Section 3** below.

According to the 2005 URS report, shallow groundwater in this area is not used, and there were no shallow groundwater uses within 500m radius of the site at the writing of the report. According to the URS report, groundwater is abstracted from the deep semi-confining layer i.e., >10m bgl and is utilised for potable water supply.

According to ORC, the site is located on the edge of Groundwater Protection Zone B of the Lower Taieri Aquifer (the hydrogeological nomenclature for the aquifer in this area is the Stratified Mosgiel-Momona Aquifer). ORC considers this aquifer to be sensitive in other assessments (e.g., the Caltex Mosgiel passive discharge permit) and therefore would be reluctant to classify the groundwater as not sensitive.

Shallow Aquifer Sensitivity

To confirm the classification of groundwater sensitivity, the site was assessed based on Section 5.2.3 of the MfE Oil Industry Guidelines⁴. A sensitive aquifer is described as one that “might be contaminated by a leak or spill of petroleum hydrocarbons” and is defined using the following table:

Criteria for aquifer	Criteria met for this site?	Comment
<i>a) Not artesian; and</i>	YES	Shallow water table is not under artesian pressure
<i>b) Less than 10m below the source or suspected source of contamination (or greater depth below ground surface where the geology suggests contamination may readily migrate to greater depth, e.g. clean sands or gravels, fractured basalts); and</i>	YES	Static water level around 1.5 to 3 mbgl
<i>c) Is of a quality appropriate for use, can yield water at a useful rate and is in an area where extraction and use of groundwater may be reasonably foreseen; or</i>	YES	Three wells within 1 km currently or previously used for abstraction
<i>d) Where the source of contamination is less than 100m from a sensitive surface water body</i>	NO	The Owhiro Stream, located approximately 700 m to the south of the site, is the closest surface water body

An aquifer is considered sensitive when either all of the first three criteria (a, b, and c) are met, or the fourth criterion (d) is met. Therefore, the shallow unconfined aquifer underlying the site has been assessed as “SENSITIVE”.

2.5 Contaminants of Concern and Applicable Guidelines

Based on the fuel infrastructure at the site, and the historical information search, the following contaminants of potential concern in soil and groundwater were considered during this investigation:

- Total petroleum hydrocarbons (TPH);
- Benzene, Toluene, Ethylbenzene, Xylenes (BTEX); and,
- Heavy metals.

⁴ Ministry for the Environment (MfE). Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand, updated 2011.

Based on the environmental setting along with the soil types and groundwater levels observed in the field (in test pit TP005 and cone penetrometer tests CPT001 through CPT003), the following tier one guidelines are considered suitable for comparing analytical data:

- Soils: Commercial / industrial land use, all exposure pathways, sandy silt soil type.

3 Detailed Environmental Site Investigation

An environmental detailed site investigation (DSI) was performed at the site on 1 June 2017. The investigation consisted of a site walkover and assessment/scan for underground utilities, test pit excavations including soil sampling, and cone penetrometer tests (CPTs). Site photographs taken during this investigation are included in Appendix B.

3.1 Test Pit Excavations

Nash & Ross Ltd. was contracted to undertake the excavation of two test pits (TP004 and TP005) to enable Separate Phase Ltd. to observe ground conditions and the groundwater level at the site, and for collection of soil samples on 1 June 2017.

During the excavation of two test pits, soil sampling was undertaken by an experienced environmental consultant, considered suitably qualified and experienced (SQEP) to undertake this work.

All test pit and sample locations are shown in Appendix A: Figure 4. Test pit logs are included as Appendix C.

Soil samples were collected at between 0.8 and 3.3 metres above and at the static water level due to the likely contaminant transport mechanism.

A summary of field activities undertaken onsite is provided in Section 3.3 below.

3.2 Cone Penetrometer Tests (CPTs)

McMillan Drilling Group was contracted to undertake three cone penetration tests (CPT001, CPT002, and CPT003) simultaneous to the test pit excavation on 1 June 2017.

The CPT report produced for the site investigation is included as Appendix D. Locations of the CPTs are shown alongside the test pit locations in Appendix A: Figure 4.

3.3 Summary

A summary of the field investigation is included below.

Date	Field Activity	Method
1 June 2017	Test Pitting, Soil Sampling and Cone Penetrometer Tests	Excavation to 2.0 mbgl (TP004) and to 4.0 mbgl (TP005). Soil samples collected using the digger bucket. Analysed for heavy metals, TPH and BTEX. Cone Penetrometer Tests (CPT001, CPT002, CPT003) to maximum of 15 mbgl.
	Site Access Approval	BP work clearance form provided by BP Alco Motors Manager Allan Fiddes.
	Weather Conditions	Drizzle and cold (~5°).
	Initial Walkover	Photographs and visual inspection. Compare maps of utilities (BP as-built drawings and network-specific drawings) to observations of services coming in/out of site. CAT Scan of perimeter and individual test pit and CPT locations.
	Total Soil Samples Collected	Four samples in total (one from TP004, three from TP005).
	Sample Handling	To Hills Laboratories Limited in Hamilton via sample reception in Christchurch under standard sample handling and chain of custody protocol. The chain of custody form is shown along with the analytical laboratory results in Appendix E.

4 Investigation Results

4.1 Field Observations

Soils within the two test pit excavations generally consisted of grey and brown, moist, sandy SILT and silty SAND with horizons of coarse sand with minor gravel to 4mbgl (refer to **Appendix C** for test pit logs and to **Appendix D** for CPT logs). During excavation and soil sampling, no hydrocarbons odours were detected. The photoionization detector (PID) reading for soil samples collected did not exceed 0.3 parts per million volume (ppmv).

Site photographs taken during the site walkover and drilling are shown in **Appendix B**.

4.2 Analytical Results

The analytical laboratory results for the soil samples are summarised in **Appendix F: Table 1**. A comparison to applicable petroleum hydrocarbon and heavy metals guidelines are provided.

No petroleum hydrocarbons were detected in the soil and groundwater samples collected. Therefore, all samples comply with the applicable comparison criteria.

4.3 Data Validity

No field sampling errors or decontamination issues were noted during site works.

Analytical samples were collected into appropriate container types, i.e. soil for organic hydrocarbon analyses (TPH) into glass jars, and soil for heavy metals into plastic tubs.

Chemistry samples were delivered to the Hills Laboratory reception in Christchurch on the day following the sampling, before being sent to the laboratory in Hamilton for analysis. The samples were chilled for transport to the Hamilton laboratory. Hills Laboratory did not report any issues with analytical quality. The chain of custody forms for both the soil and groundwater testing are shown in **Appendix E** along with the laboratory analytical report. Hill Laboratories Ltd holds IANZ accreditation (ISO 17025) for the soil chemistry tests in this investigation. Hills undertake internal quality control programmes, and participate in routine external inter-laboratory comparison programmes to maintain accreditation. Copies of quality control reports including method detection levels and error measurements are available on request.

The investigation data is considered acceptable and appropriate for the objectives of this report.

5 Conceptual Site Model

Using the source|pathway|receptor approach, which is considered 'industry best practice,' the conceptual site model forms the basis of the investigation. It includes potential contaminant sources, likely contaminant deposition and migration pathways, along with relevant human health and / or environmental receptors.

A visual representation of the conceptual site model is included in **Appendix A: Figure 3**. Figure 3 uses a simple colour code where:

Green = Verified and OK

Orange = Caution – an unknown or unverified item

Red = Warning – item of concern

Some potential exposure pathways remain open at the site. However, based on the current soil contamination status, any human health and environmental receptors are unlikely to be at risk of exposure to unacceptable levels of these contaminants. Should this status change (i.e., evidence of contamination arises), then exposure may need to be addressed.

6 Conclusions

The objectives of this investigation were to identify potential contaminant sources in soil and groundwater, identify the shallow geology in the proposed tank and shop locations, and to identify any constraints that may occur during redevelopment.

Petroleum hydrocarbons (TPH and BTEX) and heavy metals were identified as the potential contaminants of concern.

The site has been a service station since at least 1982, and a motor vehicles garage since at least 1979 with several petroleum storage and handling layouts. One test pit to 4mbgl and one CPT to 12+ mbgl in the vicinity of the proposed new tank pit, and one test pit to 2mbgl and two CPTs to 15+ mbgl in the footprint proposed new shop were performed on 1 June 2017. This investigation did not identify evidence of TPH or heavy metal compounds in soil beneath the site. Soil samples comply with the MfE guidelines and standards selected for comparison.

The following conclusions have been made following this investigation:

- The geology observed in the two test pits and the three CPTs associated with the 1 June 2017 investigation consisted of mainly silty SAND and sandy SILT with some clay and minor gravel present.
- The depth to shallow groundwater was measured to be approximately 3.3 mbgl in test pit TP005. This depth was confirmed by the three CPTs performed on site.
- There were no visual or olfactory observations of petroleum hydrocarbon or other contamination in the test pits excavated on 1 June 2017.
- Soil samples from the two test pits (TP004 and TP005) did not identify the contaminants of concern identified in this investigation above laboratory detection limits (TPH). The concentrations of heavy metals were well below national guidelines for commercial/industrial soils.
- Based on previous environmental reports and the data obtained in this investigation, it is unlikely that soil and groundwater have been impacted by contaminants of concern.
- Hazardous materials, such as asbestos and lead paint on the site buildings, were not assessed and may require testing before demolition for waste management purposes.
- The CPT logs provided by McMillan Drilling Group can be used to inform geotechnical decisions (e.g., foundation design).

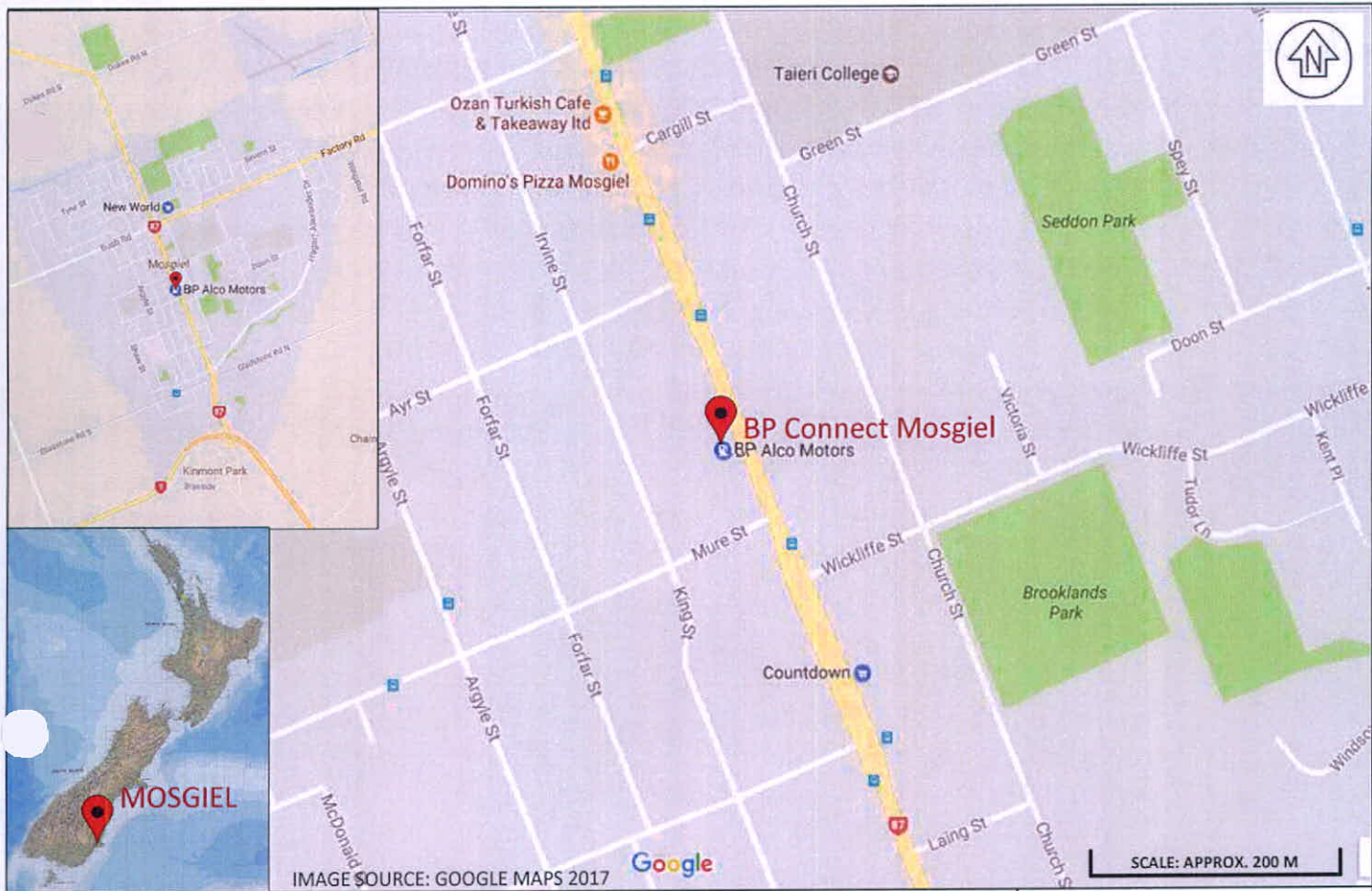
7 Recommendations

- Separate Phase Ltd. Recommends that environmental hazards should be managed using a site-specific Environmental Management Plan (EMP). This EMP can be used as part of resource consent and building consent applications and further utilised on site during future construction.

8 References

1. BP Oil (1995). Laboratory Test Report. Dated 28 April 1995.
2. Montgomery Watson (1998). Screening Level Site Report Form. Dated 7 September 1998.
3. URS (2005). Underground Petroleum Storage System (UPSS) Decommissioning at BP Alco Motors, Mosgiel, Dunedin. Dated 28 September 2005.
4. Ministry for the Environment (MfE). Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand, updated 2011.

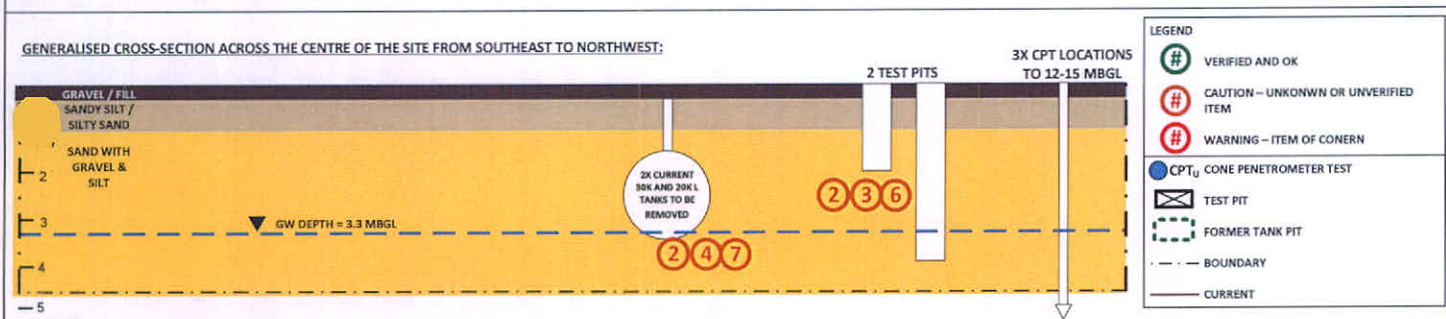
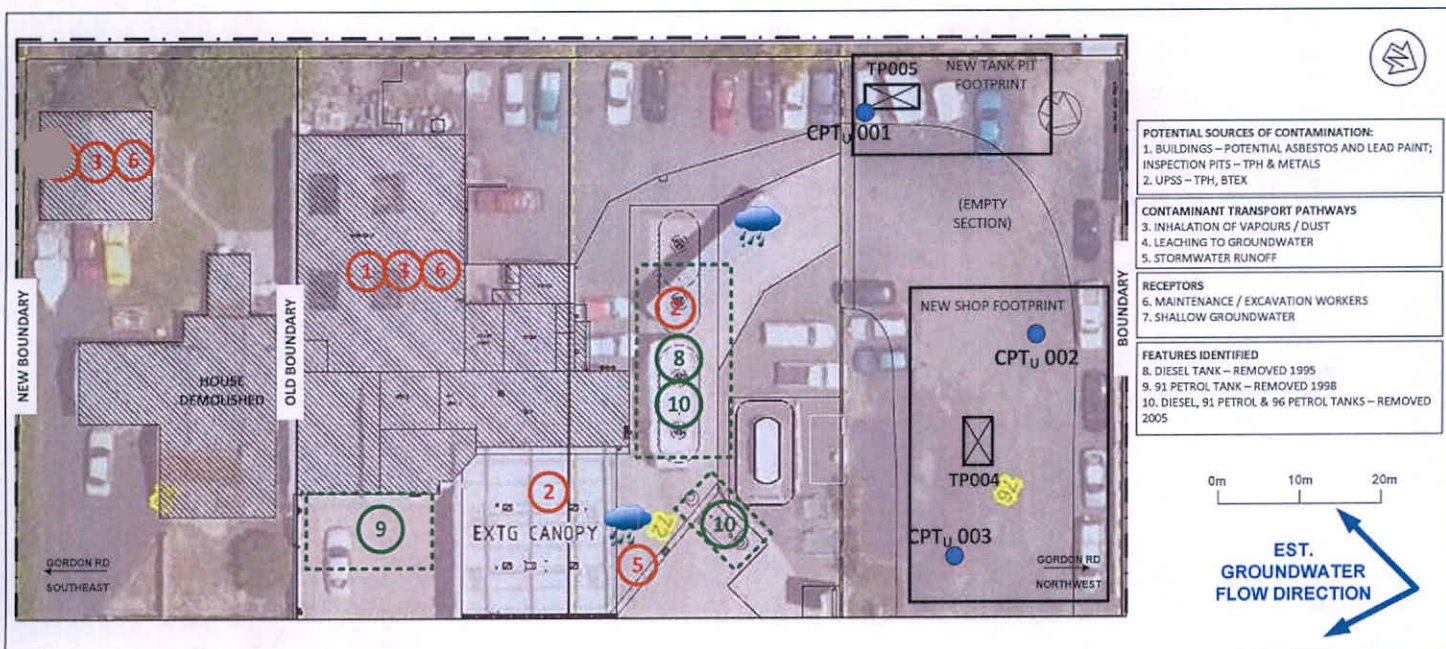
Appendix A - Site Figures



Separate Phase Ltd Practical Earth Science	FUTURE BP CONNECT MOSGIEL, 70-76 GORDON ROAD, MOSGIEL			FIGURE 1 SITE LOCATION PLAN
	DRAWING CREATED BY:RMK	PROJECT ID: 17211	DRAWING DATE: 24 MAY 2017	



Separate Phase Ltd Practical Earth Science	CURRENT SITE LAYOUT			FIGURE 2 BP CONNECT MOSGIEL	SCALE: APPROX. 30 METRES IMAGE SOURCE: GOOGLE MAPS 2017
	DRAWING CREATED BY: RMK	PROJECT ID: 17211	DRAWING DATE: 24 MAY 2017		



Separate Phase Ltd Practical Earth Science	CONCEPTUAL SITE MODEL DRAWING CREATED BY: RMK PROJECT ID: 17211 DRAWING DATE: 13 JUNE 2017	FIGURE 3 BP CONNECT MOSGIEL	NOTES 1. SCALE IS APPROXIMATE. 2. BASE DRAWING FROM SPENCER HOLMES DWG 3ALC1-11 REV C.
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Appendix B – Site Investigation Photographs



Site Photograph 1: BP Mosgiel from Gordon Road facing southwest
(Source: Google Maps 2017, captured June 2017).



Site Photograph 2: McMillan Drilling Group cone penetrometer rig at location CPT001.



Site Photograph 3: Nash & Ross clearing for underground services prior to McMillan Drilling Group's cone penetrometer rig at location CPT002 (taken 01/06/2017).



Site Photograph 4: CPT002 clearance (taken 01/06/2017).



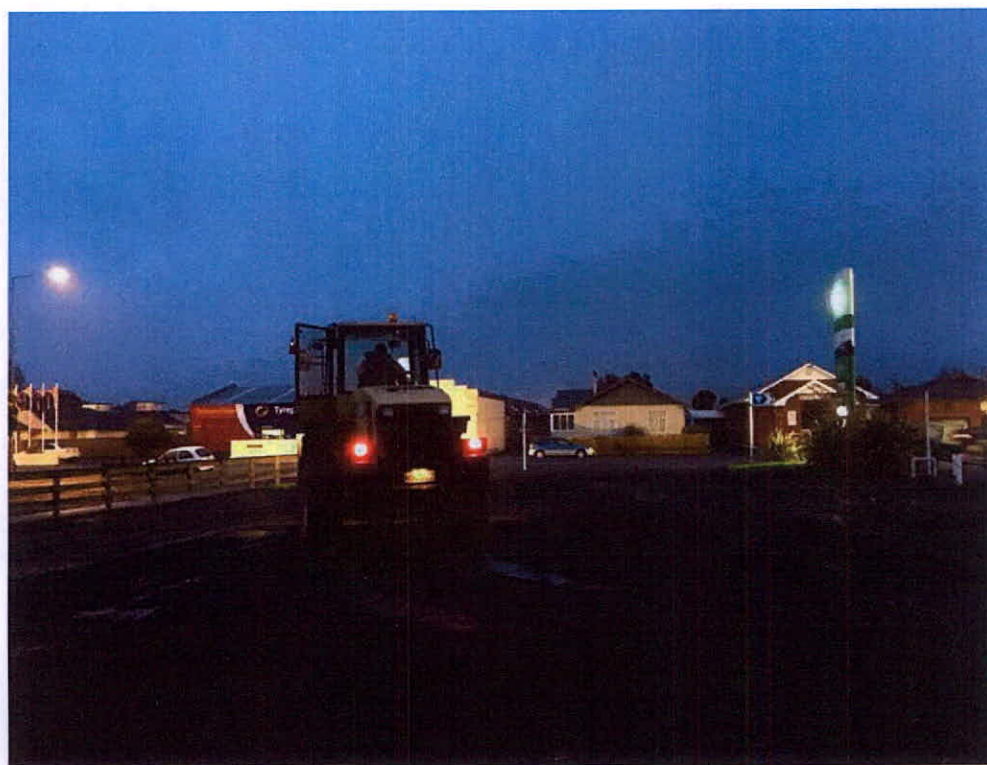
Site Photograph 5: Nash & Ross clearing for underground services prior to McMillan Drilling Group's cone penetrometer rig at location CPT003 (taken 01/06/2017).



Site Photograph 6: Nash & Ross digging first test pit at location TP004 (taken 01/06/2017).



Site Photograph 7: Nash & Ross digging second test pit at location TP005 (taken 01/06/2017).



Site Photograph 8: Gravel delivery and grading following site investigation (taken 01/06/2017).

Appendix D – McMillan Drilling Cone Penetrometer Test (CPT) Logs

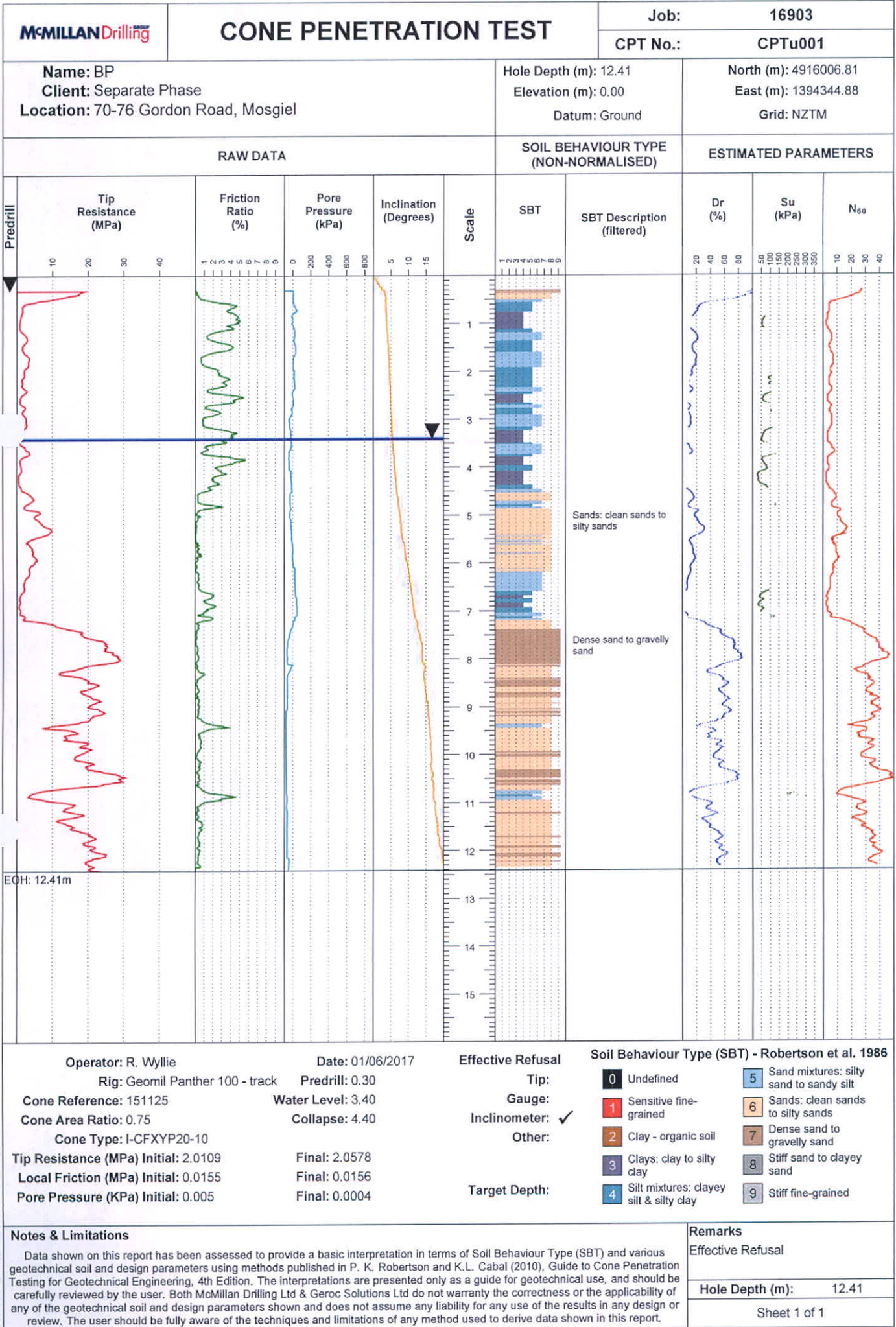
CONE PENETRATION TEST (CPT) REPORT



Client: Separate Phase

Location: BP
70-76 Gordon Road, Mosgiel

Printed: 02/06/2017



TEST DETAIL

PointID:	CPTu001				
Sounding:	1				
	Operator: R. Wyllie	Date: 01/06/2017	Effective Refusal		
	Cone Reference: 151125	Predrill: 0.30	Tip:		
	Cone Area Ratio: 0.75	Water Level: 3.40	Gauge:		
	Cone Type: I-CFXYP20-10	Collapse: 4.40	Inclinometer: ✓		
			Other:		
	Tip Resistance (MPa) Initial: 2.0109	Final: 2.0578			
	Local Friction (MPa) Initial: 0.0155	Final: 0.0156			
	Pore Pressure (kPa) Initial: 0.005	Final: 0.0004	Target Depth:		
PointID:	CPTu002				
Sounding:	2				
	Operator: R. Wyllie	Date: 01/06/2017	Effective Refusal		
	Cone Reference: 100992	Predrill: 0.30	Tip:		
	Cone Area Ratio: 0.75	Water Level: 3.40	Gauge:		
	Cone Type: I-CFXYP20-10	Collapse: 6.50	Inclinometer:		
			Other:		
	Tip Resistance (MPa) Initial: 1.7545	Final: 1.8186			
	Local Friction (MPa) Initial: 0.0442	Final: 0.0413			
	Pore Pressure (kPa) Initial: -0.0005	Final: -0.005	Target Depth: ✓		
PointID:	CPTu003				
Sounding:	3				
	Operator: R. Wyllie	Date: 01/06/2017	Effective Refusal		
	Cone Reference: 111007	Predrill: 0.30	Tip:		
	Cone Area Ratio: 0.75	Water Level: 3.50	Gauge:		
	Cone Type: I-CFXYP20-10	Collapse: 8.00	Inclinometer:		
			Other:		
	Tip Resistance (MPa) Initial: 0.1593	Final: 0.195			
	Local Friction (MPa) Initial: 0.0063	Final: 0.006			
	Pore Pressure (kPa) Initial: -0.0004	Final: -0.001	Target Depth: ✓		

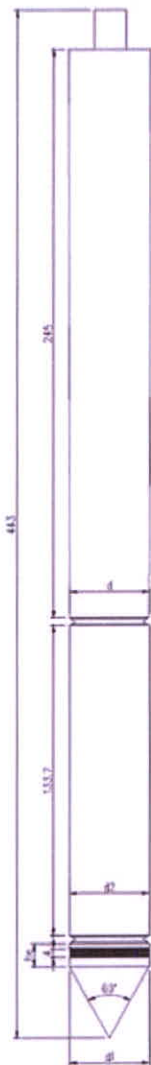
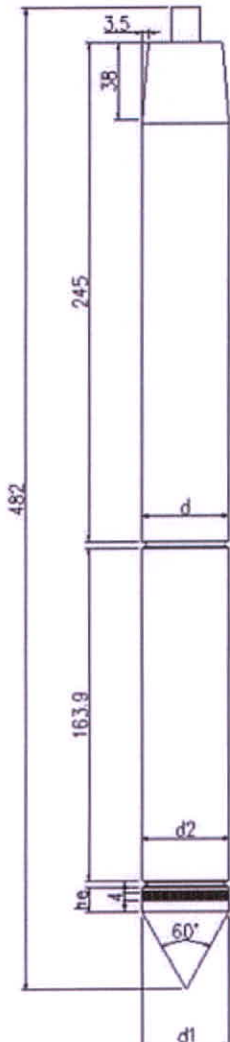
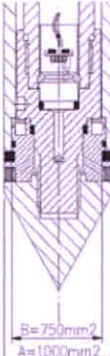
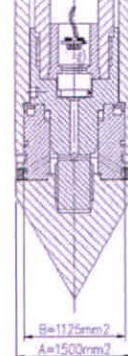
CPT CALIBRATION AND TECHNICAL NOTES

These notes describe the technical specifications and associated calibration references pertaining to the following cone types:

- I-CFXY-10 measuring cone resistance, sleeve friction and inclination (standard cone, 10cm²);
- I-CFXY-15 measuring cone resistance, sleeve friction and inclination (standard cone, 15cm²);
- I-CFXYP20-10 measuring cone resistance, sleeve friction, inclination and pore pressure (piezocone, 10cm²);
- I-CFXYP20-15 measuring cone resistance, sleeve friction, inclination and pore pressure (piezocone, 15cm²);
- I-C5F0p15XYP20-10 measuring sensitive cone resistance, sleeve friction, inclination and pore pressure (piezocone, 10cm²).

Dimensions

Dimensional specifications for all cone types are detailed below. All tolerances are routinely checked prior to testing and measurements taken are manually recorded on CPT field sheets. All field sheets are kept on file and available on request.

A.P. van den Berg Machinefabriek tel.: +31 (0)513-631355 info@apvandenbergh.com		DEVIATION of Straightness + MINIMUM Dimensions tip, friction jacket, cone adapter		Standards: EN ISO 22476-1 APB-standard	
Type of cone:	Icone 10 cm ²			Icone 15 cm ²	
<u>ALLOWABLE SIZE VARIATION</u>					
Diameter of tip:	35,3 ≤ d ₁ ≤ 36,0			43,2 ≤ d ₁ ≤ 44,1	
Diameter of centering ring CFP	35,3 ≤ d ₁ ≤ 36,0			43,2 ≤ d ₁ ≤ 44,1	
Diameter of friction jacket:	d ₁ ≤ d ₂ < d ₁ + 0,35			d ₁ ≤ d ₂ < d ₁ + 0,43	
Height dimension of tip edge:	7 ≤ h _e ≤ 10			9 ≤ h _e ≤ 12	
<u>PRODUCTION DIMENSIONS</u>					
Tip:	d ₁ = 35,7 ^{+0,2} ₀			d ₁ = 43,8 ^{+0,2} ₀	
Jacket (C-cone):	d ₂ = 35,7 ^{+0,2} ₀			d ₂ = 43,7 ^{+0,2} ₀	
Friction jacket (CF-cone):	d ₂ = 35,9 ^{+0,1} ₀			d ₂ = 44,0 ^{+0,1} ₀	
Tip for used cone:	d ₁ = 35,5 ^{+0,1} ₀			d ₁ = 43,5 ^{+0,1} ₀	
<u>MINIMUM DIMENSIONS</u>					
Minimum diameter jacket (C-cone):	d ₂ = 35,2 (APB standard)			d ₂ = 43,0 (APB standard)	
Minimum diameter friction jacket (CF-cone):	d ₂ = 35,3			d ₂ = 43,2	
Jse "used cone"-tip when friction jacket diameter:	d ₂ ≤ 35,65			d ₂ ≤ 43,7	
Minimum diameter of cone adaptor:	d = 35,3			d = 43,8	
Maximum deviation of straightness:	1 mm on a length of 1000 mm (max. oscillation 1,0 mm.)			1 mm on a length of 1000 mm (max. oscillation: 2.0 mm)	
				Cone area ratio $\alpha = A / B = 0.75$ $\beta = 1 - A / B = 0.25$ 	

CPT CALIBRATION AND TECHNICAL NOTES (cont.)

Calibration

Each cone has a unique identification number that is electronically recorded and reported for each CPT test. The identification number enables the operator to compare 'zero-load offsets' to manufacturer calibrated zero-load offsets.

The recommended maximum zero-load offset for each sensor is determined as $\pm 5\%$ of the nominal measuring range.

In addition to maximum zero-load offsets, McMillan Drilling also limits the difference in zero load offset before and after the test as $\pm 2\%$ of the maximum measuring range. See table below:

	Tip (MPa)	Friction (MPa)	Pore Pressure (MPa)
Maximum Measuring Range:	150	1.50	3.00
Nominal Measuring Range:	75	1.00	2.00
Max. 'zero-load offset':	7.5	0.10	0.20
Max 'before and after test':	3	0.03	0.06

Note: The zero offsets are electronically recorded and reported for each test in the same units as that of each sensor.

TEST CERTIFICATE Icone (all versions)		
Supplier:	A.P. v.d. Berg Machinefabriek, Heerenveen The Netherlands	
Production-order:	73868	
Client:	Mc Millan	
Cone-type:	I-CFXYP 20-10	
Cone-number:	100992	
To test / To check item	Required value	Checked value
Check Quad-ring groove behind friction sleeve with check ring; Sample testing: 1 of every 5 Icones is tested.	Sleeve fixed	✓
Isolation-resistance.	>0.5 GΩ	205 GΩ
Straightness: Icone 5, 10 and 15 cm ² S < 2.2. mm. At Icone base: S < 0,2 mm	S ≤ 2,2 mm	0,2 mm
"Classic calibration" NOT present!	O.K.	✓
Check of calibration-file: "Classic calibration" removed.	O.K.	✓
Check alarm-settings Icone. Alarm values are set. (Kill Shutdown).	O.K.	✓
Software version - check at opening screen.	version:	2.0
Calibration date of Icone; check cone data [F1]..[F1].	O.K.	✓
Initial zero-Value Tip after calibration – within 1.0 % of nominal load.	Value:	0.007 MPa
Initial zero-Value Local Friction after calibration – within 1.0% of nominal load.	Value:	0.001 MPa
Initial zero-Value Pore Pressure after calibration – within 1.0% of nominal load.	Value:	-13.2 kPa
Initial zero-Value Inclination X. -1° < X < +1°	Value:	-0,2 °
Initial zero-Value Inclination Y. -1° < Y < +1°	Value:	0,0 °
Measurements Tip resistance OK?	Tested range	0-75 MPa
Influence Tip load on Local Friction and Pore Pressure: Max. tip load: 5 cm ² : 65 MPa; 10 cm ² : 100 MPa; 15 cm ² : 75 MPa.	LF < 10 kPa PP < 1/2% nom	4 kPa 1 kPa
Measurements local friction OK?	Tested range:	0-1 MPa
Local friction at max. load.	Tested value:	15 MPa
Measurements Pore Pressure OK?	Tested range:	2000 kPa
Measure Pore Pressure to 150%.	Tested value:	8300 kPa
Measurements Inclination OK?	Tested range:	± 24°
Cone recognition on disconnecting and connecting Icone again?	Yes	✓
Remarks:		
Calibrated by: C. Ouwejan	Date: 05-01-2017	Sign.: [Signature]
Final check: E. v.d. Duim	Date: 05-01-2017	Sign.: [Signature]

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TEST CERTIFICATE		
Icone (all versions)		
Supplier:	A.P. v.d. Berg Machinefabriek, Heerenveen The Netherlands	
Production-order:	73444	
Client:	McMillan	
Cone-type:	I-CFXYP20-10	
Cone-number:	111007	
To test / To check item	Required value	Checked value
Check Quad-ring groove behind friction sleeve with check ring; Sample testing: 1 of every 5 Icones is tested.	Sleeve fixed	
Isolation-resistance.	>0.5 GΩ	0,6 GΩ
Straightness: Icone 5, 10 and 15 cm ² S < 2.2. mm. At Icone base: S < 0,2 mm	S <= 2,2 mm	0,9 mm
"Classic calibration" NOT present! Check of calibration-file: "Classic calibration" removed.	O.K.	
Check alarm-settings Icone. Alarm values are set. (Kill Shutdown).	O.K.	OK
Software version - check at opening screen.	version:	2.0
Calibration date of Icone; check cone data [F1]..[F1].	O.K.	OK
Initial zero-Value Tip after calibration – within 1.0 % of nominal load.	Value:	-0,003 MPa
Initial zero-Value Local Friction after calibration – within 1.0% of nominal load.	Value:	0,0002 MPa
Initial zero-Value Pore Pressure after calibration – within 1.0% of nominal load.	Value:	0,1 kPa
Initial zero-Value Inclination X. -1° < X < +1°	Value:	0,3 °
Initial zero-Value Inclination Y. -1° < Y < +1°	Value:	0,0 °
Measurements Tip resistance OK?	Tested range	0-75 MPa
Influence Tip load on Local Friction and Pore Pressure : Max. tip load: 5 cm ² : 65 MPa; 10 cm ² : 100 MPa; 15 cm ² : 75 MPa.	LF < 10 kPa PP < 1/2% nom	1 MPa 0,1 kPa
Measurements local friction OK?	Tested range:	0-1 MPa
Local friction at max. load.	Tested value:	1,5 MPa
Measurements Pore Pressure OK?	Tested range:	0-2000 kPa
Measure Pore Pressure to 150%.	Tested value:	3000 kPa
Measurements Inclination OK?	Tested range:	24-0-24
Cone recognition on disconnecting and connecting Icone again?	Yes	OK
Remarks:		

Calibrated by: <i>C.Y. Awejan</i>	Date: <i>28-10-2016</i>	Sign.: <i>[Signature]</i>
Final check: <i>J.W. van der Meer</i>	Date: <i>31-10-2016</i>	Sign.: <i>[Signature]</i>

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TEST CERTIFICATE Icône (all versions)		
Supplier:	A.P. v.d. Berg Machinefabriek, Heerenveen The Netherlands	
Production-order:	73444	
Client:	McMillan	
Cone-type:	I-CFXYP20-10	
Cone-number:	151125	
To test / To check item	Required value	Checked value
Check Quad-ring groove behind friction sleeve with check ring; Sample testing: 1 of every 5 Icones is tested.	Sleeve fixed	OK
Isolation-resistance.	>0.5 GΩ	1 GΩ
Straightness: Icone 5, 10 and 15 cm² S < 2.2. mm. At Icone base: S < 0,2 mm	S<= 2,2 mm	1,1 mm
"Classic calibration" NOT present! Check of calibration-file: "Classic calibration" removed.	O.K.	✓
Check alarm-settings Icone. Alarm values are set. (Kill Shutdown).	O.K.	OK
Software version - check at opening screen.	version:	2.0
Calibration date of Icone; check cone data [F1]..[F1].	O.K.	OK
Initial zero-Value Tip after calibration – within 1.0 % of nominal load.	Value:	-9000 MPa
Initial zero-Value Local Friction after calibration – within 1.0% of nominal load.	Value:	90001 MPa
Initial zero-Value Pore Pressure after calibration – within 1.0% of nominal load.	Value:	98 kPa
Initial zero-Value Inclination X. -1° < X < +1°	Value:	93 °
Initial zero-Value Inclination Y. -1° < Y < +1°	Value:	-0,1 °
Measurements Tip resistance OK?	Tested range	0-75 MPa
Influence Tip load on Local Friction and Pore Pressure: Max. tip load: 5 cm²: 65 MPa; 10 cm²: 100 MPa; 15 cm²: 75 MPa.	LF < 10 kPa PP < 1/2% nom	4 kPa 0,2 kPa
Measurements local friction OK?	Tested range:	0-1 MPa
Local friction at max. load.	Tested value:	1,5 MPa
Measurements Pore Pressure OK?	Tested range:	0-2000 kPa
Measure Pore Pressure to 150%.	Tested value:	3000 kPa
Measurements Inclination OK?	Tested range:	24-24
Cone recognition on disconnecting and connecting Icone again?	Yes	OK
Remarks:		

Calibrated by: C.J. Cuwegan	Date: 28-10-2016	Sign.: [Signature]
Final check: J.W. van der Meer	Date: 31-10-2016	Sign.: [Signature]

OK. [Signature]

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Appendix E – Analytical Laboratory Report and Chain of Custody



Hill Laboratories

TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
1 Clyde Street Hamilton 3216
Private Bag 3205
Hamilton 3240 New Zealand

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T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

ANALYSIS REPORT

Page 1 of 2

Client:	Separate Phase Limited	Lab No:	1786850	SPv1
Contact:	Reagan Knapp	Date Received:	02-Jun-2017	
	C/- Separate Phase Limited	Date Reported:	12-Jun-2017	
	PO Box 28148	Quote No:	52327	
	Beckenham	Order No:	17211	
	Christchurch 8242	Client Reference:	BP Mosgiel	
		Submitted By:	R Howard	

Sample Type: Soil					
Sample Name:	TP4 (0.8-0.9m)	TP5 (0.8-0.9m)	TP5 (2.0-2.2m)	TP5 (3.3m)	
	01-Jun-2017	01-Jun-2017	01-Jun-2017	01-Jun-2017	
	10:20 am	11:30 am	11:50 am	12:05 pm	
Lab Number:	1786850.1	1786850.2	1786850.3	1786850.4	
Individual Tests					
Dry Matter	g/100g as rcvd	92	83	83	79
Heavy Metals, Screen Level					
Total Recoverable Arsenic	mg/kg dry wt	7	7	7	6
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	13	21	17	16
Total Recoverable Copper	mg/kg dry wt	9	15	11	12
Total Recoverable Lead	mg/kg dry wt	6.3	9.3	7.8	10.3
Total Recoverable Nickel	mg/kg dry wt	13	16	11	14
Total Recoverable Zinc	mg/kg dry wt	48	55	37	41
Total Petroleum Hydrocarbons in Soil					
C7 - C9	mg/kg dry wt	< 8	< 8	< 8	< 8
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	< 40	< 40	< 40	< 40
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	< 70	< 70

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-4
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MFE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	1-4
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-4



IANZ
ACCREDITED LABORATORY

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.



Hill Laboratories

TRIED, TESTED AND TRUSTED

Quote No 52327

Primary Contact Reagan Knapp

Submitted By R Howard

Client Name Separate Phase Limited 183936

Address PO Box 28148, Beckenham

Christchurch 8242

Phone 03 421 6611 Mobile

Email reagan.knapp@separatephase.com

Charge To Separate Phase Limited 183936

Client Reference BP Mosgie

Order No 17211

Results To Reports will be emailed to Primary Contact by default.
Additional Reports will be sent as specified below.

☒ Email Primary Contact ☐ Email Submitter ☐ Email Client

☐ Email Other

☐ Other

ADDITIONAL INFORMATION

ANALYSIS REQUEST

R J Hill Laboratories Limited Job No: Date Recv: 02-Jun-17 17:13
1 Clyde Street Hamilton 3216
Private Bag 3205
Hamilton 3240 New Zealand

178 6850

T 0508 HILL LAB (44 555 ; Received by: Cristina Prats Bellmun
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com



CHAIN OF CUSTODY RECORD

Sent to
Hill Laboratories

Date & Time: 2/6 5.00

☒ Tick if you require COC
to be emailed back

Name: R HOWARD

Signature: [Signature]

Received at
Hill Laboratories

Date & Time:

Name: [Signature]

Signature: [Signature]

Condition

☐ Room Temp ☒ Chilled ☐ Frozen

Temp:

5.5°C

☐ Sample & Analysis details checked

Signature:

Priority ☐ Low ☐ Normal ☒ High

☐ Urgent (ASAP, extra charge applies, please contact lab first)

NOTE: The estimated turnaround time for the types and number of samples and analyses specified on this quote is by 4:30 pm, 5 working days following the day of receipt of the samples at the laboratory.

Requested Reporting Date:

Quoted Sample Types

Soil (Soil), Building Material (BM), 25mm cellulose ester membrane, 0.8µm gridded (cASF25CE), Ground Water (GW)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	TP4 - 0.8	1/6 10.20	ES	TPH HMscreen
2	TP5 - 0.8	1/6 11.30	ES	✓ ✓
3	TP5 - 2.0	1/6 11.50	ES	✓ ✓
4	TP5 - 3.3	1/6 12.05	ES	✓ ✓
5				
6				
7				
8				
9				
10				

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, appearing to be 'Ara Heron', with a stylized, overlapping loop structure.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

Appendix F – Table 1: Soil Sampling Analytical Results

Table 1
Soil Sampling Analytical Results

Separate *Phase Ltd*
Practical Earth Science

BP Connect Mosgiel: 70-76 Gordon Road, Mosgiel (J17211)

Sample Location	Test Pit 4	Test Pit 5			Contaminant Standard Guidelines	
Sample Name	TP4_0.8	TP5_0.8	TP5_2.0	TP5_3.3		
Sample Date	1-Jun-17	1-Jun-17	1-Jun-17	1-Jun-17		
Lab Number	1786850.1	1786850.2	1786850.3	1786850.4		
Depth (mbgl)	0.8	0.8	2.0	3.3	National Environmental Standard ¹ Commercial/Industrial	Soil Acceptance Criteria Commercial/Industrial Use (1-4m) (ALL PATHWAYS)
Sample Soil Type	Silty SAND	Silty SAND	Silty SAND	Silty SAND	N/A	SANDY SILT
Dry Matter, g/100g	92	83	83	79	-	-
Heavy Metals						
Arsenic	7	7	7	6	70	-
Cadmium	< 0.10	< 0.10	< 0.10	< 0.10	1,300	-
Chromium	13	21	17	16	>10,000	-
Copper	9	15	11	12	>10,000	-
Lead	6.3	9.3	7.8	10.3	3,300	-
Nickel	13	16	11	14	45 ²	-
Zinc	48	55	37	41	200 ²	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	< 8	< 8	< 8	< 8	-	500 ³
C10 - C14	< 20	< 20	< 20	< 20	-	2200 ³
C15 - C36	< 40	< 40	< 40	< 40	-	-
Total hydrocarbons (C7 - C36)	< 70	< 70	< 70	< 70	-	-

Notes

mbgl - Metres below ground level

All lab results units mg/kg dry weight, unless stated.

¹ Ministry for the Environment (2012). National Environmental Standard (NES) for assessing and managing contaminants in soil to protect human health (Users' Guide).

² Canadian Council of Ministers of the Environment (2007) Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health.

³ MfE Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites In New Zealand (2011). MODULE 4 Tier 1 Soil Acceptance Criteria. Table 4.14.

