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Dear Shane

Patea Freezing Works Tank Removal

1.0 Introduction

Taranaki Regional Council (TRC) engaged Pattle Delamore Partners Limited (PDP) to carry out an environmental site assessment during the removal of two petroleum underground storage tanks (USTs) and at the location of a previously removed petroleum UST at the former Patea Freezing Works (the 'site'). The assessment has been carried out to describe the extent of any petroleum impacts to soil in the vicinity of the former Underground Petroleum Storage Systems (UPSS), and to provide an assessment of the possible environmental effects of any residual petroleum hydrocarbons.

The assessment assumes a commercial or industrial land use at the site. The assessment is based on comparison of reported petroleum hydrocarbon concentrations in the soil with the Tier 1 soil acceptance criteria from the Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE, 1999).

The assessment included site visits by PDP on 12 and 13 March 2008 during the removal of the UPSS.

This letter report describes the methods and results of the assessment.

2.0 Site Description

The site is located at the southern end of Portland Quay, approximately 1 km south-east of Patea town centre (Figure 1). The former freezing works occupying the site has been derelict for a number of years. The overall site boundary is not clearly defined, either legally or physically. The site is located on relatively flat ground. The majority of buildings associated with the freezing works were located along the southern edge of the site. A large fire at the site on 6 February 2008 destroyed many of the buildings, although the USTs were not directly affected by the fire.

The surrounding land uses are as follows:

- the Marton – New Plymouth Railway Line runs along the western and south-western edge of the site;
- the Patea River lies immediately beyond the railway to the west, with Patea township beyond the river;
- part of the Patea River tidal estuary and mud flats lies adjacent to the southern edge of the site;

- to north are several residential properties, along the edge of Portland Quay, and farmland; and
- to the east is farmland at the top of an escarpment.

Historic site plans indicated that there were three USTs on the site (see Figure 1 for approximately locations): Tank 1 was located adjacent to the site entrance next to the gatehouse and was suspected to be a petrol tank; Tank 2 was a diesel tank located adjacent to an internal railway track, leading from the site to the main railway, and was used to supply a shunting engine; and Tank 3 was a petrol tank located next to the on-site fire station.

2.1 Future Use of the Site

The future use of the site is at this time uncertain. However a commercial/industrial land use has been assumed for purposes of this assessment as it is thought to be the most likely use for the site if is to be redeveloped. It is considered unlikely that the site would be redeveloped for residential purposes.

3.0 Site Investigation and Sampling

On 12 March 2008, two USTs and any associated pipe work were removed from the site by Petroleum Services Limited (PSL). In addition, sampling was undertaken in the vicinity of a previously removed UST. Details of the tanks, tank pits, and sampling undertaken are given below, along with any field observations of petroleum hydrocarbon impacts.

3.1 Tank 1 – Gatehouse

3.1.1 Tank Pit 1

The 5,000 L steel tank was removed from an unlined tank pit which was excavated to a depth of 1.7 m below ground level (bgl). Figure 1 shows the location and layout of the tank pit. The tank pit was approximately 6.5 m in length and 4 m wide. The area surrounding the tank pit was grassed and there were no pipes, dispensers, fill points or vents remaining in the vicinity of the tank pit. The geology observed in the tank pit consisted of grey fine sand extending to a depth of at least 1.4m. In the southern end of the tank pit, the sand was underlain by grey clay from 1.4 m depth to the base of the pit. The clay was not present in the northern part of the tank pit, where the fine sand extended to the base of the tank pit. Following the removal of the tank, groundwater was observed at a depth of approximately 1.6 m bgl. A detailed geological log and photos of the tank pit are appended.

3.1.2 Tank 1

5,000 L, suspected to be petrol, direct fill, steel UST. The tank, estimated at over 40 years old, was in good condition with moderate rust and minor pitting. No holes were observed in the tank (Photograph 2).

3.1.3 Soil Sampling

Six soil samples were collected on 12 and 13 March 2008, chilled and sent to RJ Hill Laboratory, Hamilton. The samples were analysed for total petroleum hydrocarbon (TPH) and benzene, toluene, ethylene and xylenes (BTEX).

Samples were taken from the walls and floor of the tank pit at depths between 0.5 and 1.6 m below ground level. The sampling locations are shown in Inset 1 on Figure 1. Portions of each sample were also screened in the field for

petroleum hydrocarbon vapours using a photo-ionisation detector (PID[1]) to measure headspace vapour concentrations. Sample depths and the results of the PID screening are presented in Table 1

3.1.4 Petroleum Hydrocarbon Observations.

There was no obvious petroleum hydrocarbon staining within the natural soils remaining in the walls and base of the tank pit. A maximum PID reading of 30 parts per million (ppm) was recorded in sample TP1/6, which was taken from the pit wall at 0.6 m depth. No evidence of petroleum hydrocarbon impacts was observed on the groundwater in the tank pit.

3.1.5 Soil Removed from Tank Pit

Sand that had been used as tank bedding in had a petroleum odour at the north-eastern corner of the tank pit. A sample of this material recorded a headspace reading of 118 ppm using the PID. As a precautionary measure, around one cubic meter of impacted soil was removed from Tank Pit 1 and temporarily stockpiled on-site with material removed from the other tank pits on site (see Section 6 for further discussion).

3.2 Tank 2 – Railway Shunting Yard

Tank 2 was a diesel tank located next to the railway shunting yard. The tank used to be within a disused shed but the shed was removed as part of the clean up operation after the fire on the site in February 2008. The tank had no fill point, pipework, dispensers or vents remaining at the time of this investigation.

3.2.1 Tank Pit 2

The 5000 L steel tank was removed from an unlined pit which was excavated to a depth of approximately 1.6 m. A concrete wall that was part of a railway platform formed the western wall for the tank pit (Photograph 3). The tank was under a 300mm reinforced concrete slab, which was broken out prior to the tank removal.

The geology observed in the tank pit appeared to be fill consisting of reworked natural sand and clay. Following the removal of the tank, groundwater was observed at a depth of approximately 1.5 m. A detailed geological log and photos of the tank pit are appended.

3.2.2 Tank 2

5000 L, diesel, direct fill, steel UST. The tank had some moderate pitting and rust, although no holes were observed.

3.2.3 Soil Sampling

Seven soil samples were collected on 12 and 13 March 2008, chilled and sent to RJ Hill Laboratory, Hamilton. The samples were analysed for total petroleum hydrocarbon (TPH).

Samples were collected from soils in the walls and base of the tank pit at depths of between 0.6 and 1.5 below ground level. The sampling locations are shown on Figure 1. Portions of each sample were also screened with the PID. Sample depths and results of PID screening are presented in Table 2. Two samples were also collected of tank bedding material that was subsequently removed from the tank pit (TP2/5 and TP2/6).

[1] A PID measures most volatile photo-ionisable compounds providing they have an ionisation potential below 10.6 eV. This includes most petroleum hydrocarbon compounds with a carbon range of between 1 and 10.

3.2.4 Petroleum Hydrocarbon Observations

There was no obvious petroleum hydrocarbon staining within the natural soils remaining in the walls and base of the tank pit. A maximum PID reading of 12 parts per million (ppm) was recorded in sample TP2/8, which was taken from the pit wall at 1.5 m depth. A mild petroleum odour was observed in the some of the excavated sand from the test pit (see below). No evidence of petroleum hydrocarbon impacts was observed on the groundwater in the tank pit.

3.2.5 Soil Removed from the Tank Pit

There was some mild petroleum odours observed in the sand/clay fill used to bed the tank. A maximum PID reading of 63 ppm (sample TP2/6) was recorded in samples of this material. Around two cubic metres of potentially impacted soil was removed from the tank pit as a precautionary measure and temporarily stockpiled on site along with material removed from the other tank pits (see Section 6 for further discussion).

3.3 Tank 3 – Former Site Fire Station

3.3.1 Tank Pit 3

Tank 3 was located next to the former site fire station, which was demolished as part of the site clean-up operations after the fire. A large test pit was excavated in the area where the tank was thought to be located. Figure 1 shows the location and layout of the tank pit. The pit was approximately 13 m in length varied in width between 3.5 and 6 m, with a maximum depth of approximately 4 m. The geology encountered consisted of sand and sandy gravel to a depth of 0.5 m, below which a layer of firm clay extended to the base of the excavation. No tank was discovered, although there was metal scraps in the soil that indicated fill and there was evidence of petroleum hydrocarbon impacts with strong odours and elevated PID readings. It is assumed that the UST had been removed prior to this investigation. The potentially impacted material was placed in a temporary stockpile for further testing (see Section 3.3.5 below). The excavation was extended until the odour and PID readings were significantly reduced.

Minor groundwater seeps in the clay were observed at around 1.8 m bgl in the test pit, although no groundwater was observed in the base of the pit. The test pit was excavated to a depth of 4 m bgl and no groundwater, other than minor inflows was observed. Given the low permeability of the strata, it is possible that the groundwater table is present at a depth of less than 4 m but was not evident during the investigation due to low inflow rates.

3.3.2 Tank 3

No information was available on the size, construction, contents, condition or date of removal of the UST.

3.3.3 Soil Sampling

Soil sampling was undertaken to benchmark conditions in the vicinity of the former UST. Ten soil samples were collected on 12 March 2008, chilled and sent to RJ Hill Laboratory, Hamilton. The samples were analysed for total petroleum hydrocarbon (TPH) and benzene, toluene, ethylene and xylene (BTEX). Samples were collected from the base and wall of the pit at depths between 0.6 and 3.0 m bgl to characterise the natural soils remaining at the edge of the excavation. Sample depths and PID results are presented in Table 3. The sampling locations are shown on Figure 1.

Two soil samples were also collected to represent impacted soil that was removed from the tank pit (TP3/1 and TP3/9).

3.3.4 Petroleum Hydrocarbon Observations

A strong petroleum odour was observed in soil removed from the test pit (see Section 3.3.5) with samples recording a headspace PID reading of up to 1480 ppm (sample TP3/9). No staining of the soils was noted. Slight hydrocarbon

odours were noted in the soil at the extents of the tank pit excavation. A maximum PID reading of 39 ppm was recorded in the soil remaining in the excavation (sample TP3/2).

3.3.5 Soil Removed from the Tank Pit

As a precautionary measure, approximately 100 cubic meters of potentially impacted soil was removed from Tank Pit 3 and stockpiled on site along with material from the other tank pits (see Section 6 for further discussion). Samples TP3/1 and TP3/9 represent this material.

4.0 Stratigraphy and Hydrogeology

The NZ Geological Survey Map (Sheet 10) map of the area (G.J Lensen, 1959) shows that the site is underlain with basal conglomerate, with overlying marine sand and dune sand. Observations during the current investigation indicate that the shallow geology consists of a mixture of sand and clay soils.

A bore search from TRC indicated that there are six wells within 800m of the centre of the site. Five of these wells are on-site and previously provided water for the freezing works. Only three of the on-site wells are in the near vicinity of the USTs (see Figure 1 for approximate locations). The wells range from 4.5 metres to over 100 metres in depth. The closest of these well to any of the former USTs is located approximately 10 metres from Tank Pit 2. The depth to water in this well was measured by PDP to be approximately 1.2 m bgl. None of the wells are understood to have been decommissioned.

The off-site groundwater well noted on the TRC records is also disused and is located approximately 450 m to the west of the site, on the opposite side of the Patea River. This well is around 120m in depth and was previously used for the Patea town water supply. The current Patea town water supply is from a series of groundwater bores, the nearest being approximately 1.3km to the north the site.

Groundwater was observed in the tank pits 1 and 2 at between 1.6 and 1.5 m bgl. Groundwater beneath the site is expected to flow in a general south-west direction towards the Patea River.

The nearest surface water body is the Patea River and associated estuary and tidal mudflats. Surface water is at its closest to any of the USTs at Tank Pit 2, where the tidal mudflats are located approximately 60 m to the south of the tank pit. There is a network of sub surface storm water pipes and sumps around the site, which drain to an outlet at the mudflats to the south of the site.

4.1 Sensitivity of the Underlying Aquifer

For the purposes of this assessment, the underlying shallow aquifer is considered to be sensitive with respect to groundwater use. The sensitivity of the underlying aquifer was assessed in accordance with Section 5.2.3 of the MfE, 1999 guidelines, using the following criteria:

- the shallow aquifer is not artesian;
- groundwater was encountered at a depth of less than 2 m below ground level; and
- there are groundwater abstractions on-site. While these are not used currently, they could potentially be utilised in the future if the site was re-developed.

In addition, the underlying aquifer considered to be sensitive with respect to the possible impact of contaminated groundwater on surface water and its associated ecosystems. The Patea River, and associated tidal mudflats, is a significant potential receptor and is located less than 100 m from Tank Pit 2.

5.0 Laboratory Results & Comparison to Applicable Criteria

The following soil samples were analysed by the laboratory from the tank pits:

- six soil samples were analysed TPH and BTEX compounds from Tank Pit 1;
- seven soil samples analysed for TPH compounds from Tank Pit 2; and
- ten soil samples were analysed for TPH and BTEX compounds from Tank Pit 3.

Results of the laboratory analyses are presented in Table 1-4. A copy of the laboratory report is appended.

5.1 Applicable Tier 1 Soil Acceptance Criteria

The Tier 1 soil acceptance criteria via All Pathways for commercial/industrial land use (MfE, 1999) are presented in tables 1-3 for comparison.

The MfE (1999) Tier 1 soil acceptance criteria have been developed on a risk-based approach with the primary consideration being the protection of human health for a range of land uses including commercial/industrial, residential and agricultural. The criteria have also been developed to account for the protection of maintenance/excavation workers and for the protection of groundwater. In addition to site usage the Tier 1 acceptance criteria take into consideration the environmental settings including soil type (permeability), depth to contamination, depth to groundwater, groundwater quality and yield and proximity to surface water and ecological receptors.

As such, the Tier 1 soil acceptance criteria via All Pathways are a reflection of the most stringent criteria associated with the protection of human health via several exposure routes. Comparison of analytical results to these criteria reveals whether a more in-depth review of the potential exposure pathways is required at the site. Where a detailed review is required, route specific criteria are determined based on a site-specific assessment of both potential receptors and exposure pathways.

“Sand” and “clay” soil types have been applied for comparison with the relevant criteria for the soil samples. These soil types are considered to be the most suitable based on the materials observed at the site.

Because the underlying groundwater aquifer has been defined as sensitive (see Section 4.1), the soil acceptance criteria for Protection of Groundwater Quality have also been included in Table 1.

5.2 Comparison of Analytical Results to Applicable Criteria

All analytical results from soil samples collected to represent soil remaining in-situ at the tank pits and soil removed from the tank pits were below the Tier 1 soil acceptance criteria via all pathways for commercial/industrial land.

All test results were also below the applicable Tier 1 Soil Acceptance Criteria for the Protection of Groundwater Quality (MfE, 1999).

6.0 Soil Removed from Tank Pits

Approximately 100 cubic metres of impacted soil was removed from the three tank pits on 12 and 13 March 2008. Around one cubic metre was removed each from tank pits 1 and 2, with the remainder of the soil removed from Tank Pit 3. This material was removed as a precautionary measure as PID readings and odour observations indicated potentially elevated levels of petroleum residues in the soil.

The soil was stockpiled immediately to the east of Tank Pit 3 (see Figure 1). Under the supervision of TRC, the soil was placed in windrows and, over a period of two weeks, occasionally turned over with an excavator. On 31 March 2008, TRC collected 20 soil samples from the stockpile. The samples were composited into a single sample and

analysed for metals TPH and BTEX compounds. The results were generally below laboratory detection limits with only a concentration of 0.15 mg/kg for total xylenes above the detection limits. Based on the additional testing by TRC, and the previous PDP test results for soil removed from the tank pits (see tables 1 – 3), TRC approved the on-site disposal of the soil. The soil was disposed of in the main former reservoir of the site, which is concrete lined, along with waste from the clean up after the fire.

7.0 Environmental Assessment

This section provides a preliminary assessment of the possible environmental effects of any petroleum residues in the vicinity of the removed UPSS.

7.1 Health Risk Assessment

As none of the soil samples had petroleum hydrocarbon concentrations above the Tier 1 soil acceptance criteria via All Pathways for commercial/industrial land use, a detailed human health risk assessment is not required. The sampling results indicate that there is considered to be no significant risk to future site occupants or to workers involved in subsurface excavations in the immediate vicinity of the removed UPSS from petroleum residues present in the underlying soils. The assessment assumes a commercial/industrial site use.

7.2 Ecological Risk Assessment

A Tier 1 ecological risk assessment has been conducted in accordance with the MfE, 1999 guidelines. Although significant ecological receptors have been identified within the immediate vicinity of the site, the concentrations of petroleum hydrocarbons in soil remaining at the former UST locations are low and are not considered likely to represent a significant risk to ecological receptors. A copy of the completed ecological checklist is appended.

8.0 Conclusions

On 12 and 13 March 2008, two petroleum hydrocarbon storage USTs were removed from site and an investigation was undertaken in the vicinity of a previously removed UST.

Soil sampling of the remaining natural soils in the vicinity of the three removed UPSS indicates that concentrations of petroleum hydrocarbons are below the Tier 1 soil acceptance criteria via All Pathways (for a commercial/industrial land use). There is considered to be no significant risk to assumed future site occupants or to workers involved in subsurface excavations in the vicinity of the removed UPSS from petroleum residues present in the underlying soils.

There is considered to be no significant risk to ecological receptors from the petroleum hydrocarbon residues remaining in the soils in the vicinity of the removed UPSS.

9.0 Limitations

This report has been prepared on the basis of visual observations of the excavation of two tank pits containing USTs and one pit where there tank had been previously removed, the surrounding topography, and the analysis of 23 soil samples for petroleum residues. The information has been used to describe the ground conditions in the vicinity of the soil sample locations. The hydrogeological and petroleum residue conditions away from these locations are unknown and should not be extrapolated from the results of this study without further investigation.

The information contained within this report applies to the date of the site inspection (March 2008). With time, the site conditions could change so that the reported assessment and conclusions are no longer valid. Thus, in the future, the report should not be used without confirming the validity of the report's information at that time.

The report has been prepared for Taranaki Regional Council. The use of this information by anyone else is at that party's own risk.

10.0 References

G.J Lensen (Compiler) 1959, *NZ Geological Survey Map 1:250,000, Sheet 10 Wanganui Department of Scientific and Industrial research, Wellington*.

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

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Yours faithfully

PATTLE DELAMORE PARTNERS LIMITED

Prepared by:	Checked by:	Directed, reviewed and approved by:
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Table 1: Soil Sample Results - Tank Pit 1 (Gatehouse) & Bedding Material - ALL PATHWAYS

Soil Samples Collected at a Depth of <1 m Below Ground Level						
Sample Name	TP1/1	TP1/2	TP1/6	TP1/7	Tier 1 Soil Acceptance Criteria[2,3] Commercial/ Industrial Land Use ALL PATHWAYS	Tier 1 Soil Acceptance Criteria[2,3] Protection of Groundwater Quality (a,b,c)
Laboratory Reference	634644.1	634644.2	634644.6	634644.7		
Sample Location	Tank pit 1	Tank pit 1	Tank pit 1	Tank pit 1		
Soil Fate	Remaining	Remaining	Remaining	Remaining	Sand	Sand
Soil Type - Field	Sand	Sand	Sand	Sand		
Soil Type - MfE (1999)	Sand	Sand	Sand	Sand		
Sample Depth (m bgl)	0.7	0.5	0.6	0.8	<1 m	Depth of Contamination < 1 m
PID Reading (ppm)	8.7	4.7	30	8.9		Depth to Groundwater - 2 m
C_7-C_9 hydrocarbons	< 8.0	< 8.0	< 8.3	< 8.0	120 (m)	NA (4)
C_{10}-C_{14} hydrocarbons	< 20	< 20	< 20	< 20	(1,500) (6,x)	NA (4)
C_{15}-C_{36} hydrocarbons	< 30	< 30	< 30	< 30	NA (4)	NA (4)
TPH	< 60	< 60	< 60	< 60	-	-
Benzene	< 0.050	< 0.050	< 0.051	< 0.050	3.0 (m)	0.17
Toluene	< 0.050	< 0.050	< 0.051	< 0.050	(94) (6,m)	(39)
Ethylbenzene	< 0.050	< 0.050	< 0.051	< 0.050	(180) (6,v)	(50)
Total xylenes [7]	<0.075	<0.075	0.196	<0.075	(150) (6,m)	(24)

Soil Samples Collected at a Depth of 1 - 4 m Below Ground Level						
Sample Name	TP1/3	TP1/4	Tier 1 Soil Acceptance Criteria[2,3] Commercial/ Industrial Land Use ALL PATHWAYS	Tier 1 Soil Acceptance Criteria[2,3] Commercial/ Industrial Land Use ALL PATHWAYS	Tier 1 Soil Acceptance Criteria[2,3] Protection of Groundwater Quality (a,b,c)	Tier 1 Soil Acceptance Criteria[2,3] Protection of Groundwater Quality (a,b,c)
Laboratory Reference	634644.3	634644.4				
Sample Location	Tank pit 1	Tank pit 1				
Soil Fate	Remaining	Remaining	Sand	Clay	Sand	Clay
Soil Type - Field	Sand	Clay				
Soil Type - MfE (1999)	Sand	Clay				
Sample Depth (m bgl)	1.3	1.6	1 - 4 m	1 - 4 m	Depth of Contamination 1 - 4 m	Depth of Contamination 1 - 4 m
PID Reading (ppm)	9.7	19.6			Depth to Groundwater - 4 m	Depth to Groundwater - 4 m
C_7-C_9 hydrocarbons	< 8.0	< 9.7	120 (m)	NA (4)	NA (4)	NA (4)
C_{10}-C_{14} hydrocarbons	< 20	< 20	(1,900) (6,x)	(9,700) (6,x)	NA (4)	NA (4)
C_{15}-C_{36} hydrocarbons	< 30	< 30	NA (4)	NA (4)	NA (4)	NA (4)
TPH	< 60	< 60	-	-	-	-
Benzene	< 0.050	< 0.062	3.0 (m)	(41) (v)	0.78	0.75
Toluene	< 0.050	< 0.062	(94) (6,m)	(7,900) (6,v)	(200)	NA (4)
Ethylbenzene	< 0.050	< 0.062	(300) (6,8,v)	NA (4)	(280)	NA (4)
Total xylenes [7]	<0.075	<0.096	(150) (6,m)	(6,000) (6,v)	(120)	(840)

Note:
1. All results in mg/kg.
2. Criteria from Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE, August 1999).
3. Criteria assume commercial/industrial land use, 'sand' and 'clay' soil types and contamination depths of <1 m and 1 - 4 m below ground level.
4. NA indicates contaminant is not limiting as health based criterion is significantly higher than may be encountered on site (i.e. 20,000 mg/kg for TPH, 10,000 mg/kg for other contaminants).
5. The following notes indicate the limiting pathway for each criterion: d - dermal, m - maintenance/excavation, p - produce, s - soil ingestion, v - volatilisation, x - PAH surrogate.
6. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons.
7. Total xylenes was calculated by adding the laboratory results of the individual xylene isomers. Where one of the xylene isomers was below the detection limit, a value of half the detection limit was used in the sum. Where all compounds in the sum are non-detects, the overall detection limit is the sum of the detection limits.
8. Due to the boundary conditions in volatilisation model, calculated criteria for sandy soils are higher than that for the sandy silt soil type. Therefore, the criteria for sand are set equal to the criteria for sandy silt.
9. Risk associated with mixture of carcinogenic PAHs assessed by comparison with criteria based on the benzo(a)pyrene equivalent concentration and is calculated by multiplying each of the seven PAH concentrations by toxic equivalence factors and summing the result. Where a laboratory result for an individual PAH compound is below the laboratory detection limit the concentration is taken to be half the detection limit.
10. ND - none of the individual PAH compounds were recorded above the laboratory limit of detection.
a. Contaminated soil layer is in direct contact with groundwater and hence no attenuation associated with vertical migration through the soil column occurs.
b. Based on Tier 1 groundwater acceptance criteria for potable use.
c. Criteria based on the assumption of adsorbed phase hydrocarbons only and 1st order biodegradation. Migration of separate phase hydrocarbons through soil profile may result in greater impact than indicated by above criteria.

Table 2: Soil Sample Results - Tank Pit 2 (Shunting Engine) & Bedding Material - ALL PATHWAYS

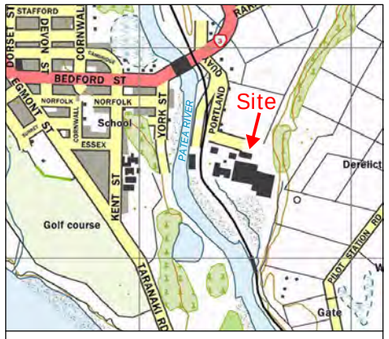
Soil Samples Collected at a Depth of <1 m Below Ground Level							
Sample Name	TP2/1	TP2/2	TP2/5		Tier 1 Soil Acceptance Criteria[2,3] Commercial/ Industrial Land Use ALL PATHWAYS	Tier 1 Soil Acceptance Criteria[2,3] Protection of Groundwater Quality (a,b,c)	
Laboratory Reference	634644.9	634644.10	634644.14				
Sample Location	Tank pit 2	Tank pit 2	Tank pit 2				
Soil Fate	Remaining	Remaining	Removed		Sand	Sand	
Soil Type - Field	Sand	Sand	Clay				
Soil Type - MfE (1999)	Sand	Sand	Clay				
Sample Depth (m bgl)	0.6	0.9	0.9		<1 m	Depth of Contamination < 1 m	
PID Reading (ppm)	9.5	9.7	17.8			Depth to Groundwater - 2 m	
C_7-C_9 hydrocarbons	< 8.0	< 8.0	< 11		120 (m)	NA (4)	
C_{10}-C_{14} hydrocarbons	< 20	< 20	< 20		(1,500) (6,x)	NA (4)	
C_{15}-C_{36} hydrocarbons	< 30	< 30	49		NA (4)	NA (4)	
TPH	< 60	< 60	< 60		-	-	
Soil Samples Collected at a Depth of 1 - 4 m Below Ground Level							
Sample Name	TP2/3	TP2/4	TP2/6	TP2/8	Tier 1 Soil Acceptance Criteria[2,3] Commercial/ Industrial Land Use ALL PATHWAYS	Tier 1 Soil Acceptance Criteria[2,3] Commercial/ Industrial Land Use ALL PATHWAYS	Tier 1 Soil Acceptance Criteria[2,3] Protection of Groundwater Quality (a,b,c)
Laboratory Reference	634644.11	634644.13	634644.15	634644.12			
Sample Location	Tank pit 2	Tank pit 2	Tank pit 2	Tank pit 2			
Soil Fate	Remaining	Remaining	Removed	Remaining	Sand	Clay	Sand
Soil Type - Field	Sand	Clay	Sandy Clay	Clay			
Soil Type - MfE (1999)	Sand	Clay	Sand	Clay			
Sample Depth (m bgl)	1.3	1.4	1.45	1.5m	1 - 4 m	1 - 4 m	Depth of Contamination 1 - 4 m
PID Reading (ppm)	6.1	9.1	63.1	12.4			Depth to Groundwater - 4 m
C_7-C_9 hydrocarbons	< 8.0	< 9.5	<9.6	< 9.9	120 (m)	NA (4)	NA (4)
C_{10}-C_{14} hydrocarbons	< 20	63	98	< 20	(1,900) (6,x)	(9,700) (6,x)	NA (4)
C_{15}-C_{36} hydrocarbons	< 30	210	450	< 30	NA (4)	NA (4)	NA (4)
TPH	< 60	280	540	< 60	-	-	-

Note:
1. All results in mg/kg.
2. Criteria from Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE, August 1999).
3. Criteria assume commercial/industrial land use, 'sand' and 'clay' soil types and contamination depths of <1 m and 1 - 4 m below ground level.
4. NA indicates contaminant is not limiting as health based criterion is significantly higher than may be encountered on site (i.e. 20,000 mg/kg for TPH, 10,000 mg/kg for other contaminants).
5. The following notes indicate the limiting pathway for each criterion: d - dermal, m - maintenance/excavation, p - produce, s - soil ingestion, v - volatilisation, x - PAH surrogate.
6. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons.
a. Contaminated soil layer is in direct contact with groundwater and hence no attenuation associated with vertical migration through the soil column occurs.
b. Based on Tier 1 groundwater acceptance criteria for potable use.
c. Criteria based on the assumption of adsorbed phase hydrocarbons only and 1st order biodegradation. Migration of separate phase hydrocarbons through soil profile may result in greater impact than indicated by above criteria.

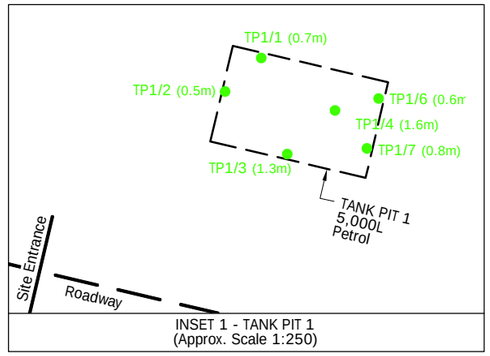
Table 3: Soil Sample Results - Tank Pit 3 (Fire Station) & Bedding Material - ALL PATHWAYS

Soil Samples Collected at a Depth of <1 m Below Ground Level										
Sample Name	TP3/2	TP3/8							Tier 1 Soil Acceptance Criteria[2,3] Commercial/ Industrial Land Use ALL PATHWAYS	Tier 1 Soil Acceptance Criteria[2,3] Protection of Groundwater Quality (a,b,c)
Laboratory Reference	634644.18	634644.24								
Sample Location	Tank pit 3	Tank pit 3								
Soil Fate	Remaining	Remaining								
Soil Type - Field	Clay	Clay							Clay	Clay
Soil Type - MfE (1999)	Clay	Clay								
Sample Depth (m bgl)	0.6	0.6							<1 m	Depth of Contamination < 1 m
PID Reading (ppm)	38.7	1.8								Depth to Groundwater - 2 m
C_7-C_9 hydrocarbons	40	< 11							NA (4)	(590)
C_{10}-C_{14} hydrocarbons	<20	< 20							(1,900) (6,x)	(1,400)
C_{15}-C_{36} hydrocarbons	130	45							NA (4)	NA (4)
TPH	180	< 60							-	-
Benzene	<0.053	< 0.053							11 (v)	0.0054
Toluene	<0.053	< 0.053							(1,000) (6,v)	1.0
Ethylbenzene	<0.053	< 0.053							(540) (6,v)	1.1
Total xylenes [7]	0.605	<0.097							(810) (6,v)	0.61
Soil Samples Collected at a Depth of 1 - 4 m Below Ground Level										
Sample Name	TP3/1	TP3/3	TP3/9	TP3/12	TP3/14	TP3/15	TP3/16	TP3/17	Tier 1 Soil Acceptance Criteria[2,3] Commercial/ Industrial Land Use ALL PATHWAYS	Tier 1 Soil Acceptance Criteria[2,3] Protection of Groundwater Quality (a,b,c)
Laboratory Reference	634644.17	634644.19	634644.24	634644.28	634644.3	634644.31	634644.32	634644.33		
Sample Location	Tank pit 3	Tank Pit 3	Tank Pit 3	Tank pit 3	Tank pit 3	Tank pit 3	Tank pit 3	Tank Pit 3		
Soil Fate	Removed	Remaining	Removed	Remaining	Remaining	Remaining	Remaining	Remaining		
Soil Type - Field	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay
Soil Type - MfE (1999)	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay		
Sample Depth (m bgl)	1.2	1.8	1.8	2.2	1.5	3	2	1.8	1 - 4 m	Depth of Contamination 1 - 4 m
PID Reading (ppm)	1480	1.1	1008	10.77	9.8	3.7	9.8	6.8		Depth to Groundwater - 4 m
C_7-C_9 hydrocarbons	12	9.9	95	< 12	< 8.7	< 12	< 9.5	< 11	NA (4)	NA (4)
C_{10}-C_{14} hydrocarbons	27	< 20	180	< 20	< 20	< 20	< 20	< 20	(9,700) (6,x)	NA (4)
C_{15}-C_{36} hydrocarbons	< 30	40	260	< 30	< 30	< 30	< 30	< 30	NA (4)	NA (4)
TPH	< 60	< 60	530	< 60	< 60	< 60	< 60	< 60	-	-
Benzene	< 0.058	< 0.065	<0.05	< 0.074	< 0.055	< 0.074	< 0.055	< 0.064	(41) (v)	0.75
Toluene	< 0.058	< 0.065	<0.05	< 0.074	< 0.055	< 0.074	< 0.055	< 0.064	(7,900) (6,v)	NA (4)
Ethylbenzene	0.31	< 0.065	<0.05	< 0.074	< 0.055	< 0.074	< 0.055	< 0.064	NA (4)	NA (4)
Total xylenes [7]	1.629	<0.098	1.28	3.74	<0.083	<0.112	<0.083	0.192	(6,000) (6,v)	(840)

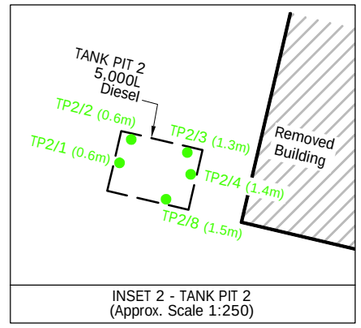
Note:
1. All results in mg/kg.
2. Criteria from Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE, August 1999).
3. Criteria assume commercial/industrial land use, 'sand' and 'clay' soil types and contamination depths of <1 m and 1 - 4 m below ground level.
4. NA indicates contaminant is not limiting as health based criterion is significantly higher than may be encountered on site (i.e. 20,000 mg/kg for TPH, 10,000 mg/kg for other contaminants).
5. The following notes indicate the limiting pathway for each criterion: d - dermal, m - maintenance/excavation, p - produce, s - soil ingestion, v - volatilisation, x - PAH surrogate.
6. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons.
7. Total xylenes was calculated by adding the laboratory results of the individual xylene isomers. Where one of the xylene isomers was below the detection limit, a value of half the detection limit was used in the sum. Where all compounds in the sum are non-detects, the overall detection limit is the sum of the detection limits.
a. Contaminated soil layer is in direct contact with groundwater and hence no attenuation associated with vertical migration through the soil column occurs.
b. Based on Tier 1 groundwater acceptance criteria for potable use.
c. Criteria based on the assumption of adsorbed phase hydrocarbons only and 1st order biodegradation. Migration of separate phase hydrocarbons through soil profile may result in greater impact than indicated by above criteria.



SITE LOCATION



INSET 1 - TANK PIT 1
(Approx. Scale 1:250)



INSET 2 - TANK PIT 2
(Approx. Scale 1:250)

INSET 3 - TANK PIT 3
(Approx. Scale 1:250)

KEY

TP1/1 (0.7m) Soil sample location and sample depth

Source: Aerial imagery derived from Google Earth Pro (may not be spatially accurate).

Figure 1 : SITE PLAN

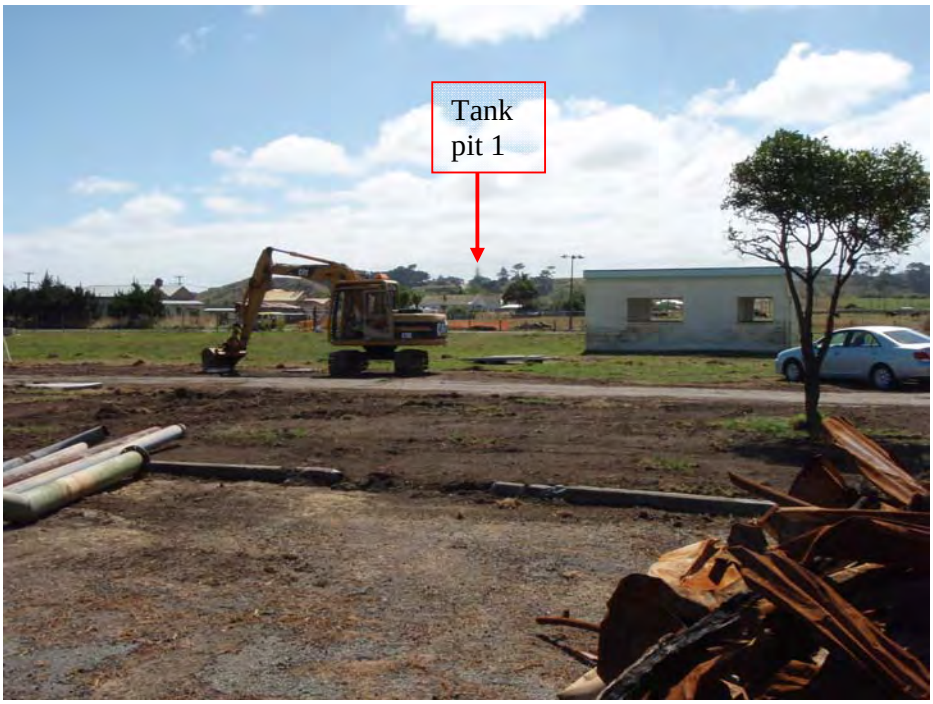
Photograph 1: Tank pit 1.

Photograph 2: Tank 1, 5000 L Diesel tank

Photograph 3: Tank pit 2.

Photograph 4: Tank pit 2. Groundwater can be seen in base of tank pit.

Photograph 5: Tank pit 3.



Photograph 6: View north towards site entrance and Tank Pit 1

PATTLE DELAMORE PARTNERS LTD

LOG OF TANK PIT
Patea Freezing Works Tank Removals

PIT NO. **TANK PIT 1**

JOB NO: W01658101

CLIENT: Taranaki Regional Council

LOCATION:

DATE: 12/03/2008

DATE BACKFILLED: 12/03/2008

LOGGED BY: DR

SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
SAND. Fine. Dark grey to black.		0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4	TP1/2 TP1/6 TP1/1 TP1/7 TP1/3		
CLAY. Firm. Dark grey.		1.6	TP1/4		▽
END OF TANK PIT AT 1.7m					

Notes: Groundwater encountered at 1.6 m below ground level. This log represents the southern wall of the tank pit. The clay layer was not present on the northern wall of the tank pit.

KEY

- ▽ Groundwater level
- Seepage inflow
- ● Grab sample
- × PID Reading (ppm)

Method: Excavator

Filename: W01658101 TP1

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

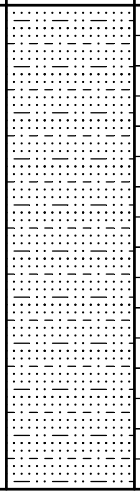
PATTLE DELAMORE PARTNERS LTD

LOG OF TANK PIT
Patea Freezing Works Tank Removals

PIT NO. **TANK PIT 2**

JOB NO: W01658101

CLIENT: Taranaki Regional Council		LOCATION:	
DATE: 12/03/2008	DATE BACKFILLED: 13/03/2008	LOGGED BY: DR	SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
SAND WITH SOME CLAY. Fine black sand with minor clay lenses. Dry and loose.		0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4	TP2/1 TP2/2 TP2/5 TP2/3 TP2/4 TP2/6 TP2/8		▽
END OF TANK PIT AT 1.6m					

Notes: Groundwater encountered at 1.5 m below ground level.

KEY

- ▽ Groundwater level
- Seepage inflow
- Grab sample
- × PID Reading (ppm)

Method: Excavator

Filename: W01658101 TP2

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

PATTLE DELAMORE PARTNERS LTD

LOG OF TANK PIT
Patea Freezing Works Tank Removals

PIT NO. **TANK PIT 3**

JOB NO: W01658101

CLIENT: Taranaki Regional Council

LOCATION:

DATE: 12/03/2008

DATE BACKFILLED: 13/03/2008

LOGGED BY: DR

SHEET 1 OF 1

DESCRIPTION OF SOIL	GRAPHIC LOG	DEPTH (m)	SAMPLE DETAILS	TESTS	WATER OBSERVATIONS
SILTY SAND. Light brown. Dry.		0.0			
SANDY GRAVEL. Some shells present.		0.5			
CLAY. Light brown. Firm. Damp.			TP3/2 TP3/8		
CLAY. Bluey grey. Firm. Damp. Some minor rust mottling.		1.0	TP3/1		
		1.5	TP3/14		
			TP3/3 TP3/9 TP3/17		
		2.0	TP3/16		
			TP3/12		
		2.5			
		3.0	TP3/15		
		3.5			
		4.0			

END OF TANK PIT AT 4.0m

Notes: Groundwater encountered at 1.5 m below ground level.

KEY

- Groundwater level
- Seepage inflow
- Grab sample
- PID Reading (ppm)

Method: Excavator

Filename: W01658101 TP3

Logs based on New Zealand Geomechanics Society Field Description Guidelines (2005)

Appendix 4I
Ecological assessment checklist

Tier 1 Ecological Assessment Checklist

Receptor (Non-Human) and Exposure Pathway Identification (adapted from Idaho RBCA Guidance, 1996 and ASTM draft RBCA guidance for Chemical Release Sites, 1997) Site Identification

Site Name: Patea freezing coy	Location Portland Quay Patea
Date: 13/3/08	Assessor: D. Roz

Background

Product released:	N/A	Approximate date of release:	—
Approximate volume of release:	N/A	Geology:	Sand + clay
Depth to groundwater:	>2m	Distance to nearest surface water:	>60m

Identification of receptors

1. Are marshes, swamps, tidal flats or other ecologically sensitive wetlands near[1] the site?	(Y)/N
2. Are other aquatic habitats such as rivers, lakes or streams near the site?	(Y)/N
3. Are ecologically important marine or estuarine environments near the site?	(Y)/N
4. Are ecologically important or sensitive environments such as national parks or nature reserves located near the site?	Y/(N)
5. Are habitats for rare, threatened or endangered species near the site?	Y/(N)
6. Are culturally important ecological receptors located the site?	Y/(N)
7. Are commercially or recreationally important ecological receptors near the site?	Y/(N)
8. Are forested, grassland or other habitats of significance located near the site?	Y/(N)

If a potentially significant ecological receptor has been identified proceed to the exposure pathway analysis.

[1] "Near" should be judged on a site-specific basis given the likely contaminant's transport by wind, surface run-off or groundwater transport

Exposure pathway analysis

	Receptors		
	1	2	3
1. **Could contaminants reach receptor via groundwater?**	Y/N	Y/N	Y/N
- Can contaminants leach or dissolve into groundwater?	Y		
- Are contaminants mobile in groundwater?	W		
- Does groundwater discharge into receiving environments such that it can impact on the receptor?	N		
2. **Could contaminants reach the receptor via the migration of separate phase hydrocarbons?**	Y/N	Y/N	Y/N
- Are separate phase hydrocarbons present at the site?	W		
- Is the separate phase migrating toward the receptor?	W		
- Could discharge of separate phase hydrocarbons to a receiving environment occur such that an impact on the receptor may occur?	N		
3. **Could contaminants reach the receptors via runoff?**	Y/N	Y/N	Y/N
- Are the contaminants present in the surface soil?	N		
- Is the surface soil exposed?	Y		
- Can the contaminants be leached from or eroded with the surface soils?	N		
- Is the receptor downhilll from the source?	Y		
4. **Could the receptors come in direct contact with contaminated soil at the site?**	Y/N	Y/N	Y/N
- Is the receptor located within a contaminated area?	Y		
- Is the contamination present at the surface or otherwise located so that receptors may come in contact with it?	W		
5. **Are there visible indications of stressed receptors or habitats for ecologically significant receptors at or near the site?**	Y/N	Y/N	Y/N

If a potentially complete exposure pathway is identified for an ecologically significant receptor, **proceed with more detailed, site-specific assessment (Tier 2).**

Receptor/habitat description

Receptor /habitat	Description
1	Mudflats - estuary & River.
2	
3	

Observed impacts on ecological receptors or habitats associated with the site

Receptor	Assessment of Impact		
	None	Limited	Significant
On-site vegetation	✓		
Off-site vegetation	✓		
On-site animal life (eg. invertebrates, birds, fish)	✓		
Off-site animal life (eg. invertebrates, birds, fish)	✓		
Other impacts	None.		

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Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	Pattle Delamore Partners Ltd	**Lab No:**	634644	SPv2
Contact:	Ross, Duncan	**Date Registered:**	14-Mar-2008	
	c/o Pattle Delamore Partners Ltd	**Date Reported:**	04-Apr-2008	
	P O Box 6136	**Quote No:**		
	Wellington	**Order No:**	W01658101	
		Client Reference:	W01658101	
		Submitted By:	Ross, Duncan	

Amended Report

This report replaces an earlier report issued on the 19 Mar 2008 6:03 pm
Extra analyses have been carried out at the request of the client.

Sample Type: Soil

	Sample Name:	TP1/1	TP1/2	TP1/3	TP1/4	TP1/5
	Lab Number:	634644.1	634644.2	634644.3	634644.4	634644.5
BTEX in Soil by Headspace GC-MS						
Dry Matter	g/100g as rcvd	98	96	94	71	83
Benzene	mg/kg dry wt	< 0.050	< 0.050	< 0.050	< 0.062	< 0.050
Toluene	mg/kg dry wt	< 0.050	< 0.050	< 0.050	< 0.062	< 0.050
Ethylbenzene	mg/kg dry wt	< 0.050	< 0.050	< 0.050	< 0.062	0.68
m&p-Xylene	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.13	3.2
o-Xylene	mg/kg dry wt	< 0.050	< 0.050	< 0.050	< 0.062	< 0.050
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	98	96	94	71	83
C7 - C9	mg/kg dry wt	< 8.0	< 8.0	< 8.0	< 9.7	13
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	42
C15 - C36	mg/kg dry wt	< 30	< 30	< 30	< 30	< 30
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 60	< 60	< 60	< 60	62

	Sample Name:	TP1/6	TP1/7	TP2/1	TP2/2	TP2/3
	Lab Number:	634644.6	634644.7	634644.9	634644.10	634644.11
BTEX in Soil by Headspace GC-MS						
Dry Matter	g/100g as rcvd	80	96	-	-	-
Benzene	mg/kg dry wt	< 0.051	< 0.050	-	-	-
Toluene	mg/kg dry wt	< 0.051	< 0.050	-	-	-
Ethylbenzene	mg/kg dry wt	< 0.051	< 0.050	-	-	-
m&p-Xylene	mg/kg dry wt	0.13	< 0.10	-	-	-
o-Xylene	mg/kg dry wt	0.066	< 0.050	-	-	-
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	80	96	96	85	95
C7 - C9	mg/kg dry wt	< 8.3	< 8.0	< 8.0	< 8.0	< 8.0
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	< 20
C15 - C36	mg/kg dry wt	< 30	< 30	< 30	< 30	< 30
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 60	< 60	< 60	< 60	< 60

	Sample Name:	TP2/8	TP2/4	TP2/5	TP2/6	TP3/1
	Lab Number:	634644.12	634644.13	634644.14	634644.15	634644.17
BTEX in Soil by Headspace GC-MS						
Dry Matter	g/100g as rcvd	-	-	-	-	74
Benzene	mg/kg dry wt	-	-	-	-	< 0.058

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The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Soil						
Sample Name:		TP2/8	TP2/4	TP2/5	TP2/6	TP3/1
Lab Number:		634644.12	634644.13	634644.14	634644.15	634644.17
BTEX in Soil by Headspace GC-MS						
Toluene	mg/kg dry wt	-	-	-	-	< 0.058
Ethylbenzene	mg/kg dry wt	-	-	-	-	0.31
m&p-Xylene	mg/kg dry wt	-	-	-	-	1.6
o-Xylene	mg/kg dry wt	-	-	-	-	< 0.058
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	68	69	72	76	74
C7 - C9	mg/kg dry wt	< 9.9	< 9.5	< 11	< 9.6	12
C10 - C14	mg/kg dry wt	< 20	63	< 20	98	27
C15 - C36	mg/kg dry wt	< 30	210	49	450	< 30
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 60	280	< 60	540	< 60

Sample Name:		TP3/2	TP3/3	TP3/8	TP3/9	TP3/12
Lab Number:		634644.18	634644.19	634644.24	634644.25	634644.28
BTEX in Soil by Headspace GC-MS						
Dry Matter	g/100g as rcvd	79	69	68	85	62
Benzene	mg/kg dry wt	< 0.053	< 0.065	< 0.064	< 0.050	< 0.074
Toluene	mg/kg dry wt	< 0.053	< 0.065	< 0.064	< 0.050	< 0.074
Ethylbenzene	mg/kg dry wt	< 0.053	< 0.065	< 0.064	< 0.050	< 0.074
m&p-Xylene	mg/kg dry wt	< 0.11	< 0.13	< 0.13	0.18	3.7
o-Xylene	mg/kg dry wt	0.55	< 0.065	< 0.064	1.1	< 0.074
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	79	69	68	85	62
C7 - C9	mg/kg dry wt	40	9.9	< 11	95	< 12
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	180	< 20
C15 - C36	mg/kg dry wt	130	40	45	260	< 30
Total hydrocarbons (C7 - C36)	mg/kg dry wt	180	< 60	< 60	530	< 60

Sample Name:		TP3/14	TP3/15	TP3/16	TP3/17	
Lab Number:		634644.30	634644.31	634644.32	634644.33	
BTEX in Soil by Headspace GC-MS						
Dry Matter	g/100g as rcvd	76	62	76	68	-
Benzene	mg/kg dry wt	< 0.055	< 0.074	< 0.055	< 0.064	-
Toluene	mg/kg dry wt	< 0.055	< 0.074	< 0.055	< 0.064	-
Ethylbenzene	mg/kg dry wt	< 0.055	< 0.074	< 0.055	< 0.064	-
m&p-Xylene	mg/kg dry wt	< 0.11	< 0.15	< 0.11	0.16	-
o-Xylene	mg/kg dry wt	< 0.055	< 0.074	< 0.055	< 0.064	-
Total Petroleum Hydrocarbons in Soil						
Dry Matter	g/100g as rcvd	76	62	76	68	-
C7 - C9	mg/kg dry wt	< 8.7	< 12	< 9.5	< 11	-
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	< 20	-
C15 - C36	mg/kg dry wt	< 30	< 30	< 30	< 30	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 60	< 60	< 60	< 60	-

Analyst's Comments

Appendix No.1 - Total Petroleum Hydrocarbon Chromatograms

Appendix No.2 - Total Petroleum Hydrocarbon Chromatograms

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**	**Samples**
BTEX in Soil by Headspace GC-MS*	Solvent extraction, Headspace GC-MS analysis	-	1-7, 17-19, 24-25, 28, 30-33
Total Petroleum Hydrocarbons in Soil*	Sonication extraction, Silica cleanup, GC-FID analysis	-	1-7, 9-15, 17-19, 24-25, 28, 30-33
Dry Matter (Org)	Dried at 103°C (removes 3-5% more water than air dry), gravimetry.	0.10 g/100g as rcvd	1-7, 9-15, 17-19, 24-25, 28, 30-33

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.

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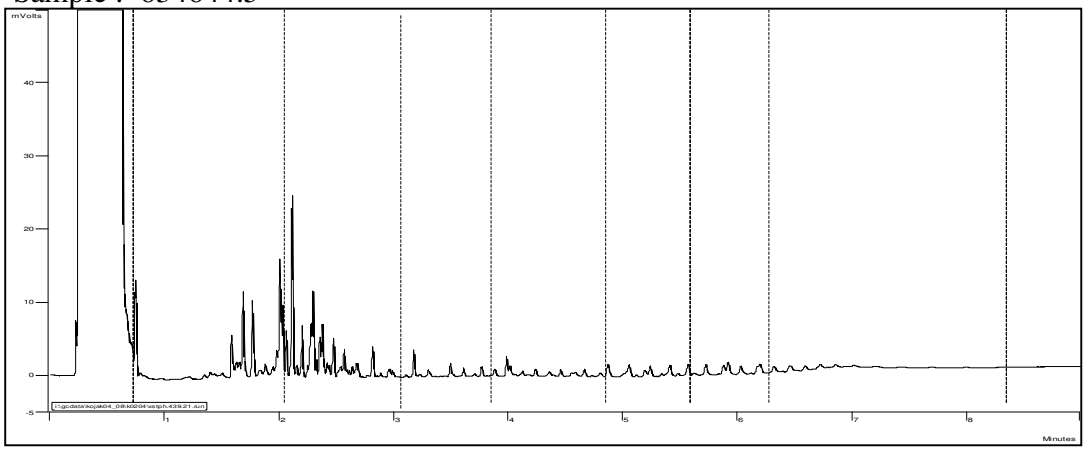
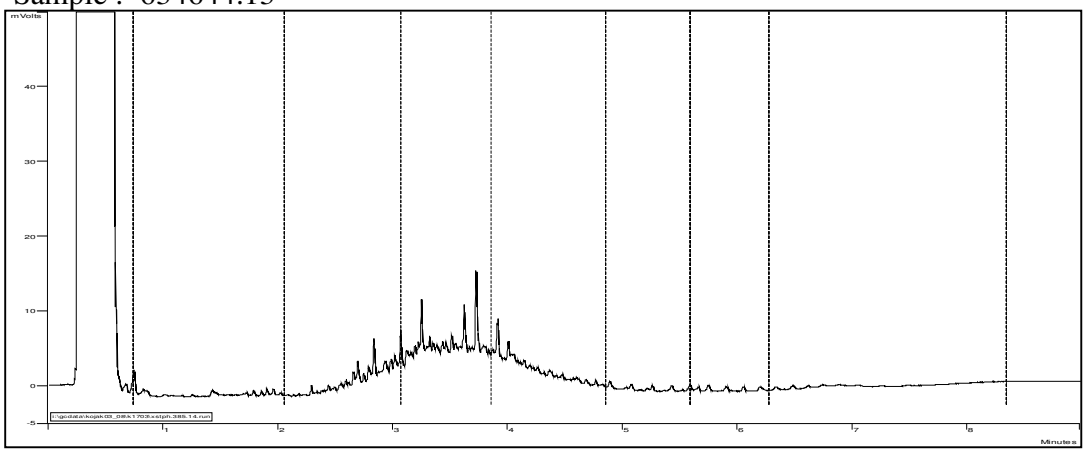
Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental Division

Sample : 634644.5

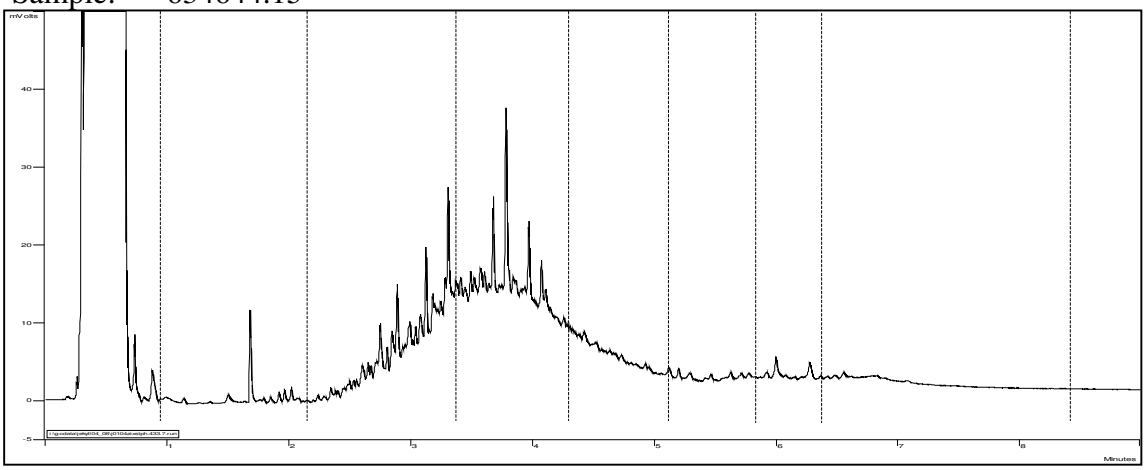


Sample : 634644.13

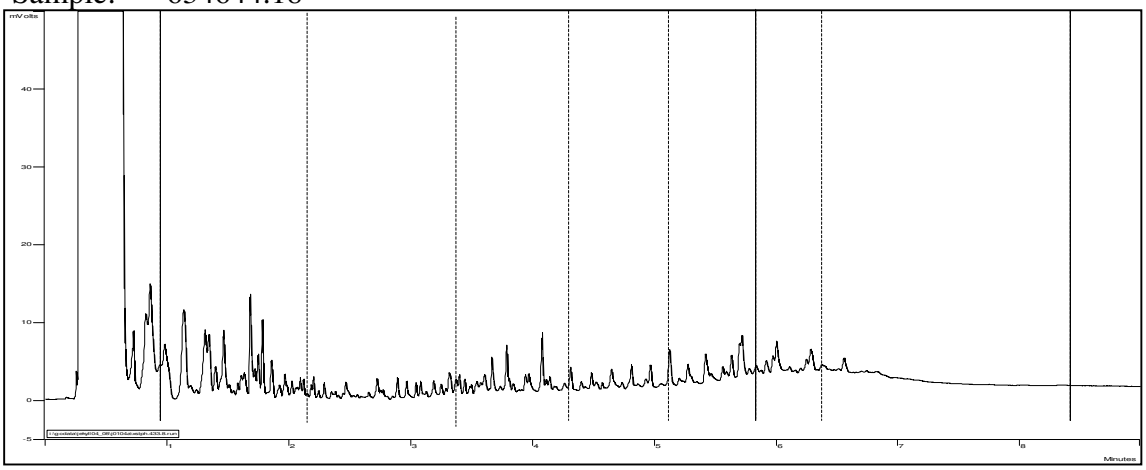


C7 C10 C15 C20 C25 C30 C34 C44

Sample: 634644.15



Sample: 634644.18



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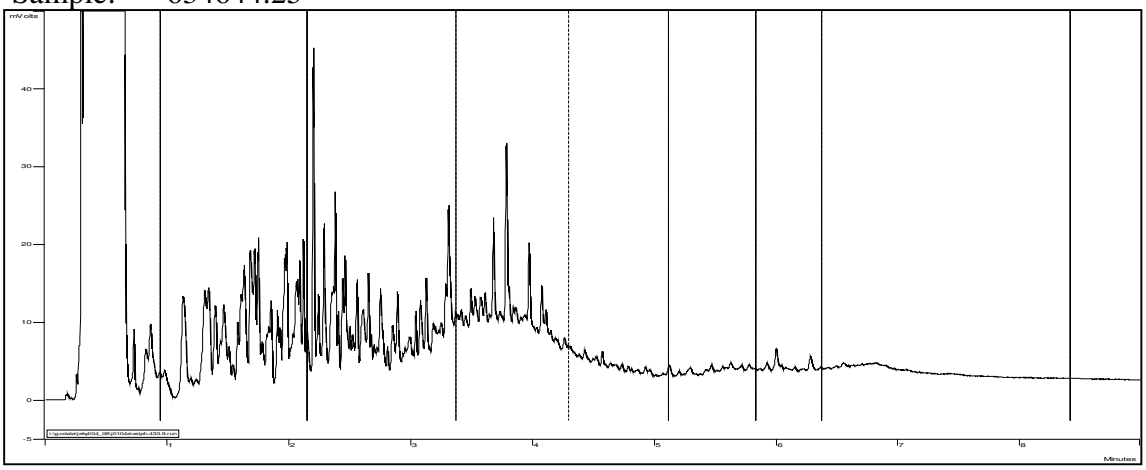

C7 C10 C15 C20 C25 C30 C34 C44