Patea Freezing Works
Detailed Site Investigation Report

Document No: 451931

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Executive summary

On 27 July 2007 the Taranaki Regional Council in conjunction with the South Taranaki District Council, submitted a Preliminary Site Inspection [PSI] Report and Contaminated Sites Remediation Fund application to the Ministry for the Environment. The Council received confirmation on 3 September 2007 that funding had been approved for costs associated with a detailed site investigation of the Patea Freezing Works.

The objectives of this investigation were to:

- determine whether potential contaminants identified in the PSI report were present,
- establish the locations and extent of such contamination,
- assess the potential for off-site effects, and
- assist in the development of appropriate options for site remediation.

Prior to commencing activities on site, a health and safety plan was prepared in consultation with the Department of Labour and the Ministry for the Environment.

Progress on the investigation was significantly delayed by a fire which broke out in the early hours of Waitangi Day, 6 February 2008. Subsequent remedial actions were conducted where deemed necessary because of the degree of imminent risk posed if situations were left unaddressed. The scope and scale of the site investigations were reviewed to take account of the changed nature and characteristics of the site.

In particular, actions were undertaken to:

- control the potential release of asbestos with the application of a polymer sealant,
- monitor the efficacy of the polymer sealant by conducting air quality sampling,
- cleanup on ground asbestos contamination in areas adjacent to the factory, and
- deal with electrical equipment and drums of chemicals left in a vulnerable state.

The scope of work for this investigation included completion of the following actions:

- The removal of two underground fuel storage tanks and contaminated soil from the previous location of a third tank.
- Inspection of fuel oil pipework to the Boiler House and cleanup of leaked oil.
- Investigation of fill areas.
- Groundwater monitoring.
- Contractor proposal for asbestos removal/disposal , demolition of buildings and reinstatement of the site.
- Inspection of safely accessible tanks and vessels.
- Inspection of reservoirs.
- Fellmongery soil sampling.
- Sampling of surface waters.
- Investigation of existing groundwater bores.
- Collection of road seal and dust/debris samples.

The results of analysis for samples collected in this investigation were assessed against specifically selected guideline values. In summary, surface water discharging from the site has concentrations of metals which exceed the conservatively applied guideline values for 95% protection of aquatic ecosystems. These concentrations should reduce once the site has been cleaned up, and in any case do not currently appear to be causing any adverse effects on the receiving environments i.e. estuary or the Patea River. With

the exception of asbestos, the concentrations of all on site contaminants are below the relevant guideline values. The risk from asbestos is currently minimised by the restriction of access to the site and the polymer sealant applied to fire damaged areas. Some electrical equipment containing polychlorinated biphenyls [PCBs] remain on the site.

The Taranaki Regional Council recommends that any further work on the site focus on the safe removal and disposal of asbestos and electrical equipment containing PCBs. A proposal for the removal of asbestos, demolition and reinstatement of the site has been included in this report. Consideration by the current landowners, of this proposal and the contents of this report are required prior to making recommendations regarding the future use of the site.

This report has been prepared by staff of the Taranaki Regional Council. The Council acknowledges the assistance of Graeme Proffitt (Director - Pattle Delamore Partners Limited) for his review and comment on laboratory results, and peer review of the conclusions and recommendations section of this report. The Taranaki Regional Council is happy to discuss any matters presented in this report. Contacts: Gary Bedford (Director-Environment Quality) or Shane Reynolds (Scientific Officer).

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1. Scope of work

1.1 Original scope as contracted with Ministry for the Environment

Underground fuel storage tanks – three identified, gatehouse (petrol), fire station (probably diesel) and shunting shed (diesel).

- Engage a competent tank removal contractor to remove the tanks.
- Inspect and sample the excavated pits in line with MfE guidelines.

Boiler fuel storage bund – the tanks have been removed.

- Sample soil in the vicinity of the drain valve.
- Expose pipework to the boilerhouse and sample soil at regular intervals and/or at joints.

Fill areas – two areas identified, eastern and western ends of the factory adjacent to the mudflats.

- Establish the current position of the front face of fill by GPS mapping.
- Estimate volume by comparing present position with historic aerial photographs.
- Use an excavator to trench through the fill in a number of locations, log and sample any areas of interest.
- Install six groundwater monitoring bores, at 5-8 m depth, along front face of fill.
- Analyse cuttings from installation of monitoring bores.
- Excavation of 25 testpits at 50-60 m intervals to determine other fill locations.

Asbestos

- Contract a licensed asbestos removal company to conduct a site assessment and report on options and costs for disposal.

Electrical and mechanical equipment

- Confirm possible locations of old transformers with past employees and sample for PCB's.
- Inspect all tanks and vessels on the site, particularly in the wastewater treatment plant and ensure there are no residues of concern.

Reservoirs – two identified, adjacent to workshop and the old coal bunkers.

- Sample water prior to release.
- Sample remaining sludge prior to disposal.

Fellmongery - paint mix tanks

- Test soil in the vicinity for pH to determine any impacts.

Surface Water – two identified, fellmongery stream and main stormwater discharge.

- Test to determine impacts.

Miscellaneous issues

- Core sample old sealed areas to determine the presence of coal tar.
- Secure old water well heads as required.

- Investigate use of water wells for groundwater monitoring.
- Sample dust/debris in selected buildings.

1.2 Actions in fire affected area

Progress on the investigation was significantly delayed by a fire which broke out in the early hours of Waitangi Day, 6 February 2008. The fire raged through most of the main body of buildings on the site. The Freezing and Cold Storage Buildings (predominantly timber) in the centre of the site were completely destroyed, the Slaughter House to the east was significantly damaged and a number of buildings west of the Boiler House were also completely destroyed.

The fire meant that further site work had to be postponed until (i) the fire was extinguished, including actions undertaken by the Fire Service to gain access to hotspots buried beneath fallen debris; (ii) the resultant asbestos risk was dealt with to the satisfaction of the Department of Labour-Workplace, to ensure that staff could continue working around the site in safety; and (iii) the scope and scale of the site investigations were reviewed to take account of the changed nature and characteristics of the site, particularly the likelihood that asbestos fibres had been released across the site due to shattering and fragmentation of asbestos sheeting and disintegration of asbestos lagging on pipework during the fire and consequent fire-fighting activities.

Remedial actions were conducted where deemed necessary because of the degree of imminent risk posed if situations were left unaddressed. In particular, actions were undertaken to deal with PCBs, waste oil, and drums of chemicals left in a vulnerable state. The scope of the investigation was reviewed in the light of the fire damage, with sampling of ash and airborne asbestos added. As part of the urgent site management, several measures were put into place to deal with the potential for release of friable asbestos and the significant health threat this posed to the residents of Patea (and site investigation workers).

Photograph 1 Remains of the Freezing and Cold Storage Buildings

Immediately following the fire, irrigation of fire affected areas was undertaken to extinguish any residual 'hotspots' (approximately four days), and then to minimise the risk of asbestos becoming airborne. To achieve this, water was pumped from the Patea River to a rotating irrigator, which was regularly moved to ensure that all fire damaged areas remained damp under deluge from the water cannon. Interceptor drains were dug along the downslope side of the site (adjacent to the estuary) to intercept surface run-off.

This operation continued for approximately two weeks until a polymer binder was selected, contracted, and applied, providing an encapsulating membrane which is preventing any asbestos from being released into the air. The polymer was applied to the remaining structures, ash and fire debris, and to the ground in the immediate vicinity of the building footprint. The integrity of this membrane is inspected on a regular basis (fortnightly, to date) and further polymer applied where necessary (to date, one additional application to areas damaged by stock or vehicle movement). The polymer degrades upon exposure to sunlight and is considered to have a life expectancy of less than twelve months.

The Taranaki Regional Council has conducted air quality sampling, consisting to date of five sampling runs each at twelve sites in the vicinity of the plant and within the Patea township (four runs during and in the first couple of days after the polymer application, and one a month later to confirm the on-going efficacy of the polymer sealant), that have confirmed the efficacy of this interim control measure for protecting residents' health.

Photograph 2 Main Reservoir and Storage building (prior to preparation as containment facility)

Twelve samples of ash were collected in a grid pattern covering the area of fire damage from the location of the Freezing and Cold Storage Buildings, and analysed for asbestos content.

The fire completely destroyed all except one of the buildings on Noel McColl's property (the area immediately west of the main factory). Only the Storage building remained standing, although severely damaged. The fire damage resulted in widespread asbestos contamination of the area.

Following the gaining of appropriate approvals from DoL, a cleanup was conducted by Noel McColl under the supervision of a certified asbestos expert.

This involved the demolition of severely fire damaged buildings, the removal of steel for recycling, and scraping up of all debris (capturing all asbestos), including material deposited on carriage ways around the property.

This material was placed in the Main Reservoir (photograph 2), which was pumped out of water during the fire and was identified by the Council as a suitable structure for long term containment.

Based on its observed water retention, the Council believes the reservoir to be impervious and structurally sound, and therefore a suitable secure long-term containment facility.

The measures described in this section were additional to the original scope of works.

1.3 Underground fuel storage tanks

Underground tanks were identified on an old site plan as having been located at the Covered Unloading Platform in the southwest corner of the site and at a site east of the Fire Station. A third tank location was identified at the Gatehouse by a former works employee. Petroleum Services Limited [PSL] were contracted to remove and dispose of the tanks and Pattle Delamore Partners Limited [PDP] undertook sampling of the tank pits and reporting in line with MfE guidelines.

The PDP report is attached in Appendix I.

1.3.1 Covered Unloading Platform

A 500 litre diesel tank was removed from outside the south west corner of the Carpenters' Workshop on the Covered Unloading Platform.

There was a minimal amount of product in the tank and no sign of obvious contamination in the pit (photograph 3). The tank appeared to be intact/unholed and was crushed on site and removed as scrap metal. Approximately 1-2 m^3 of potentially contaminated bedding material was removed from the tank pit under the instruction of PDP.

Photograph 3 Covered Unloading Platform tank and pit

1.3.2 Gatehouse

A 5,000 litre tank was removed from immediately inside the entrance gates on the northern side of the road (photograph 4). The tank appeared intact/unholed, and when lifted some rusty water drained from the tank onto the ground. There was no visible hydrocarbon sheen or odour associated with the water. The tank will be crushed and removed from site as scrap metal. Approximately 1-2 m^3 of potentially contaminated bedding material was removed from the tank pit under the instruction of PDP. The pit was backfilled with clean soil.

Photograph 4 Gatehouse tank

1.3.3 Fire Station

No tank was found at this site, although concrete slabs, pipework and tank straps indicated the location and purported site usage was correct. Excavation soon revealed what appeared to be extensive petrol residues (visual and odour observations), and approximately 100 m^3 of soil was removed under the instruction of PDP (photograph 5). This was stockpiled on site along with the contaminated bedding material from the other two tank pits. It was regularly turned by excavator to aid in degradation of the hydrocarbons. Almost three weeks later, approximately 20 samples were collected from the surface of the stockpiled soil and composited for analysis. The results showed that hydrocarbon concentrations had reduced to below detection limits. The stockpile will be placed in the Main Reservoir.

Photograph 5 Excavation of contaminated soil

1.4 Boiler fuel storage bund and pipework

The boiler fuel oil tanks had previously been removed from the site, the original objectives were to:

- Sample soil in the vicinity of the drain valve for previous leakage.
- Expose pipework to the Boiler House and sample soil at regular intervals and/or at joints.

Close inspection of the bund revealed a concrete pad outside the bund at the western end, where there was possibly a pump mounted. There were two holes near the bottom of the bund wall at both the eastern and western ends through which pipes appear to have passed. The exact location of a drain valve for the bund could not be determined. Soil in the vicinity of the bund wall was extremely stony and not suitable for sampling. Pipework from the eastern end of the bund appeared to go down to a small shed adjacent to the coal bunkers. The shed contained a pump skid and evidence of a pipe through the coal bunkers towards the Boiler House. Inspection from a hatch above the coal bunker did not reveal any pipework, which may have been removed or rusted away.

It was subsequently discovered that oil was leaking from a pipe further east next to the Pump House. This was in fact one of the pipes from the bund to the Boiler House. The following figure (figure 1) shows the pipework configuration, the dashed section of pipe is missing and the arrow indicates where an elbow on one of the lines had rusted through.

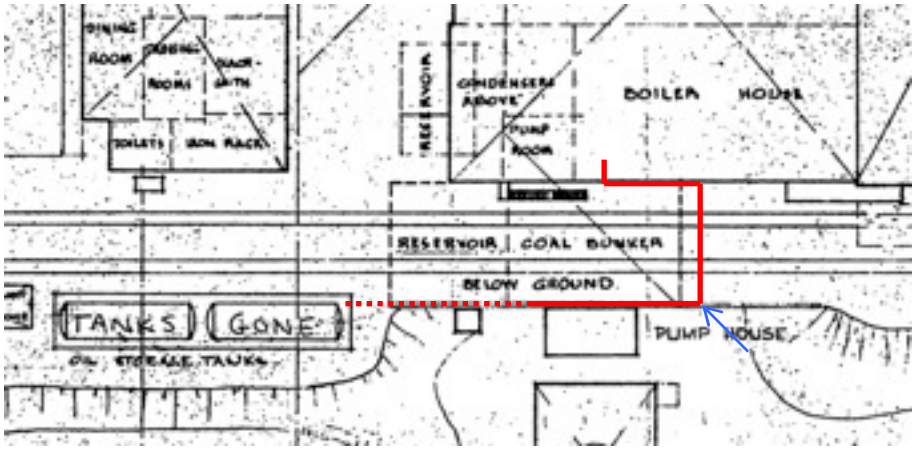

Figure 1 Fuel oil line to Boiler House

There was a large pool of oil on the concrete pad below the Boiler House (photograph 7). Oil was dripping into a drain pipe (through rust holes) and a small amount had entered a sump which discharges to the estuary. The drain pipe was removed to prevent further oil entering the sump. Stained soil on the concrete pad indicated that oil may have previously been leaking into a tile drain. Bedding material from the Gatehouse tank pit, excavated the previous day, was piled onto the pool of oil to absorb it. This soil was later added to the stockpile of contaminated soil which had been removed from the Fire Station tank pit and held on site for disposal.

Both pipes were open at each end and had an approximate length of 23 m. Judging by the amount of oil that had escaped on this occasion, there was probably not a significant volume remaining in the two pipes. As the pipes passed under a double set of rail lines it would have been a major undertaking to remove them and conduct

soil sampling. A decision was made to cut the second line at the intact elbow and chock up the western end of the pipes on the Pump House wall, allowing any oil remaining to drain into a container for disposal.

Photograph 6 Fuel oil pipework into the Boiler House

Photograph 7 Leaking fuel oil

1.5 Fill areas

The entire embankment area between the factory and estuary had been used for the disposal of waste materials from the site. Of particular interest was the dumping of ash and clinker from the early period when the boilers were coal fired, prior to fuel oil and then gas. The following photographs give some indication of the extent of this practice.

Photograph 8 Looking west across fill

Photograph 9 Fill in estuary

1.5.1 Mapping of fill

The front face of the entire fill area on the site was mapped by GPS, and a series of aerial photographs from 1949, 1962, 1973 and 1981 were studied to provide an estimated volume of fill material. The area of the site used for the disposal of waste materials is approximately 9,901 m^2, at an average depth of at least 1 m, giving an estimated minimum volume of fill material of approximately 10,000 m^3.

The aerial photographs are attached in Appendix II.

1.5.2 Trenching

A trench approximately 1 m wide, 1.5 m deep and 85 m long was excavated parallel to the estuary to capture water run off from fighting the fire (photograph 10). This provided a great opportunity to inspect spoil from the trench and the soil/fill profile, and to collect samples from areas of interest.

Photograph 10 Trench looking west

Inspection of the trench spoil revealed that extensive dumping of building rubble had occurred in this area. A band of dark material approximately 100 mm thick was present at a depth of around 1 m, along almost the entire length of the trench. Samples of this material were collected at 10 m intervals and clinker was present in most, upon visual inspection.

Complete details of sampling locations, including photographs, are attached in Appendix III.

1.5.3 Test pits

It was originally intended that up to 25 test pits would be excavated over the site to determine other fill locations. However, discussions with past employees indicated that the disposal of waste materials occurred exclusively in the area adjacent to the estuary. In addition, the site is flat and has a high water table so it was decided to concentrate resources on the investigation of fill areas not already covered by the trench. This comprised of terraces in the south east and south west corners of the site. A total of 13 test pits were excavated (photograph 11), noting the depth to natural ground and collecting samples from any areas of interest. Complete details of sampling locations, including photographs, are attached in Appendix III.

Photograph 11 Test pit spoil

1.5.4 Groundwater monitoring wells

Interdrill Limited was contracted to install five piezometers, four monitoring and one background (photograph 12). The location of the wells was determined after levelling of existing bores on the site by the Council's hydrologist gave an indication of the groundwater flow direction. Full details of this process can be found in section 5 of this report discussing geology and hydrology. The original scope of work had included the analysis of drill cuttings, however this was not completed. It was decided that the fill composition had already been adequately characterised, through investigation of the trench and test pits.

The Bore Log provided by Interdrill is attached in Appendix IV.

Photograph 12 Drilling MW1

1.6 Asbestos

A consultant to Contact Energy, supervising and auditing the removal of asbestos from the New Plymouth Power Station, was made available to the Council to visit and assess the asbestos risk from the site, following the fire.

The report "Review of Interim Asbestos Hazard Control Measures Following Fire" by ENSR Australia Pty Ltd (HLA ENSR) is attached in Appendix V.

Contract Environmental Limited staff visited the site to assess options and costs for the removal of asbestos, demolition of buildings and reinstatement of the site. Their proposal is based the right to retain revenue from recycling steel and leaving a completely clean site for future use. They anticipate that the entire project would take 30-40 weeks at an estimated cost of $1.6 million plus GST.

Contract Environmental's proposal is not endorsed or advocated as part of this scope of works.

Contract Environmental's proposal is attached in Appendix VI.

1.7 Electrical and mechanical equipment

1.7.1 PCBs and chemical drums

A first site visit by Council staff found that electrical switchgear had been removed from the site, and the provisional view was that polychlorinated biphenyls [PCBs] no longer remained present. The visit had not involved entry into all rooms because of the risk of structural collapse.

At a public meeting following the fire, a member of the public advised that electrical equipment containing PCBs, were located in the vicinity of the Boiler House and Engine Room. Council Officers located and removed one drum's volume (294 kg gross) of PCB containing equipment, which was subsequently disposed of by Transpacific Technical Services. It was confirmed with the member of the public concerned that there were the PCBs that had been referenced. Some PCB equipment could not be safely removed for disposal (photograph 13 and Figure 2), including numerous small wall-mounted units present in some of the buildings, fire damaged equipment, and areas that were too dangerous to enter. The quantity remaining would be similar to or less than that removed.

Photograph 13 Electrical equipment containing PCBs remaining on site

During close inspection of the buildings by Fire Service and Council personnel following the fire, several drums of materials were found, identified, and considered for treatment and disposal options. Subsequently the Fire Service removed three drums containing a small amount of oil from buildings on the site. Two drums containing sodium nitrate were moved outside of buildings and filled with water to dissolve the chemical. One severely corroded drum of nitric acid was punctured, allowing the acid to neutralise by reacting with the concrete floor. It was then diluted with approximately 2,000 litres of water. These activities were conducted in a manner which did not result in any adverse environmental effects. It is considered that no further action is required in respect of these drums.

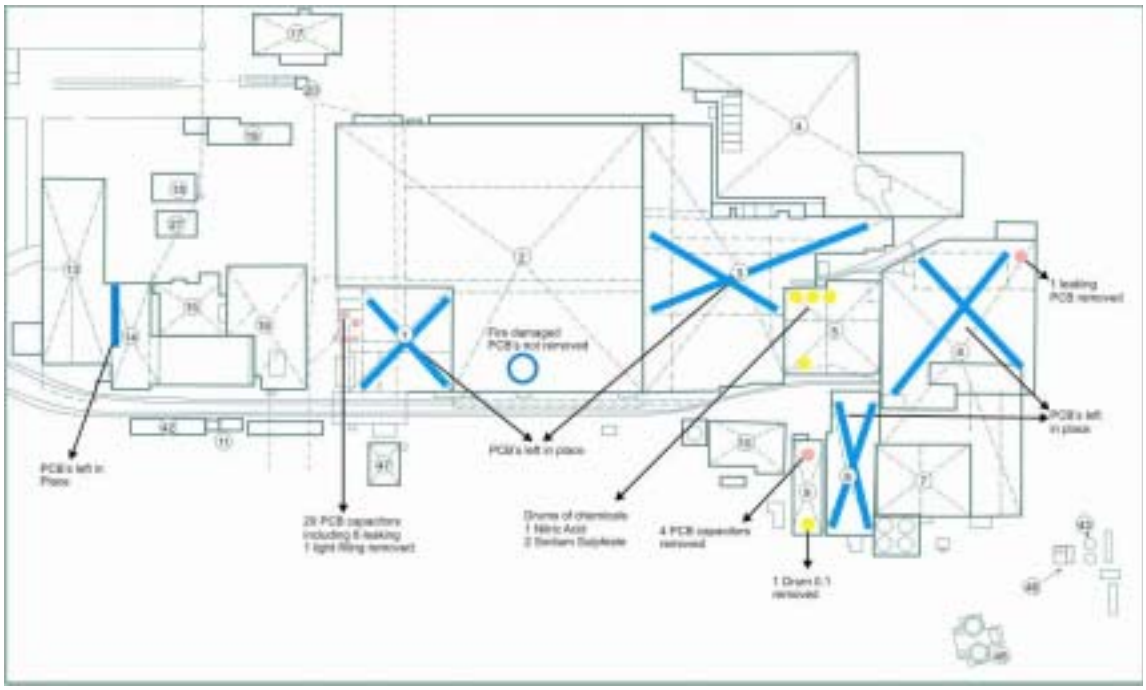

Figure 2 Location of PCB equipment and chemical drums

A file note describing these activities in detail is attached in Appendix VII.

1.7.2 Tanks and vessels

A number of tanks and vessels have been identified and viewed on the site. Inspection of those that were safely accessible, indicate that most have corroded to the point where they are holed. Taking into account the time lapsed since the plant was closed, it is considered reasonable to assume that none still contain any liquid residues. However the presence of solid chemical residues cannot be completely ruled out.

A file note with photographs which details the location and status of those tanks and vessels identified is attached in Appendix VIII.

1.8 Reservoirs

The Main Reservoir was supplied from the Patea River when the works was operational. It was pumped out of water during the fire for fire fighting supply, exposing a minimal amount of sludge in the bottom. The sludge would have

consisted of silts and sediments from river water, not on-site wastes. No sampling of the water or sludge was undertaken. A smaller reservoir partly beneath the south west corner of the Boiler House contains approximately 0.5 m of sludge/debris covered by approximately 0.5 m of water. It is expected that any potential contaminants would be present in higher concentrations in the sludge, and a sample of this was collected for analysis.

1.9 Fellmongery paint mix tanks

Two soil samples were collected from outside the Paint Mixing room in the Fellmongery and tested for pH, to determine impacts on soil in the area, from the chemicals used in paint preparation. Paint is a chemical depilatory applied to sheep skins to dissolve the fibre root allowing for easy removal of the wool. The active ingredient is sodium sulphide which is dissolved in water and thickened with a hydrated lime slurry. These ingredients react to form sodium hydrosulphide and caustic soda in the final product which is highly alkaline.

1.10 Surface water

Springs originating at the base of cliffs on the eastern boundary are the main source of surface water on the eastern side of the site. A stream flows southwards along the base of the cliffs beside the plant site, into the estuary mudflats.

A large pipe, in the south west corner of the site, appears to be the discharge point for the majority of the drains on the western side of the site, as it was observed to be discharging during each site visit.

All surface water from the site, drains to the mudflats to the south, and then into the Patea River.

Surface water sampling was timed to coincide with the irrigation operation, where water from the Patea River was being irrigated over fire damaged areas of the site to minimise the risk of asbestos becoming airborne. This resulted in a large volume of run off and made it possible to sample from a number of locations which otherwise may not have been discharging due to the extremely dry weather conditions prevailing at the time. In addition it would ensure an accurate assessment of any offsite effects from the irrigation operation. A total of 10 samples were collected from drains and surface flow, including background samples from the Patea River.

1.11 Miscellaneous issues

An investigation of the existing groundwater bores on the site was carried out to determine if any required secure capping to prevent possible contamination of groundwater and to assess suitability for groundwater monitoring. In most cases pumps and/or pipework were still in place. However, 3 wells were open to the environment and the landowner (Noel McColl) has undertaken to cap them. A water level probe was used to measure the depth of the 3 wells. 1 of them was blocked and the depth could not be established, the other 2 were in excess of 50 m deep. Consequently they were considered unsuitable for use as monitoring wells as

potential groundwater contamination was more likely to be affecting shallow groundwater.

Complete details of this investigation, including a report by the Council geo-hydrologist and existing bore logs are attached in Appendix IX.

Nine samples of road seal from across the site were collected to determine whether coal tar was present in the tar/bitumen chip binder.

Samples of dust/debris were collected from the floor of selected buildings to indicate the level of risk associated with any cleanup works, due to chemical contaminants.

2. Site identification

The site is located at 43 Portland Quay, Patea. It occupies a number of lots and is (according to LINZ information at the time of the investigation) under the ownership of the following three parties:

- South Taranaki District Council
  PT TIDAL MUDFLAT DP 879 -PATEA RIVER- SEC 10 BLK VII CARLYLE SD
  PT SEC 109 BLK VII CARLYLE SD - X REF 12360/16500

- Escada Enterprises Limited
  LOTS 140 149 158-162 PT LOTS 138 139 148 150 DP 26 SEC 138 PT SEC 137 WHENUAKURA DIST BLK VII CARLYLE SD

- Noel and Kathleen McColl
  LOTS 43 44 118 119 128 129 155 PT LOTS 120 154 DP 26 PT LOT 2 DP 625 SECS 115 116 143 157 PT SECS 110-114 122 & 2 PTS SEC 142 WHENUAKURA DIST BLK VII CARLYLE SD

Figure 3 Area of investigation and ownership

It should be noted that the current ownership of the land designated as belonging to Escada Enterprises, a company that was dissolved in date, is under consideration. This report is not taking any position on the question of the ownership of this part of the site.

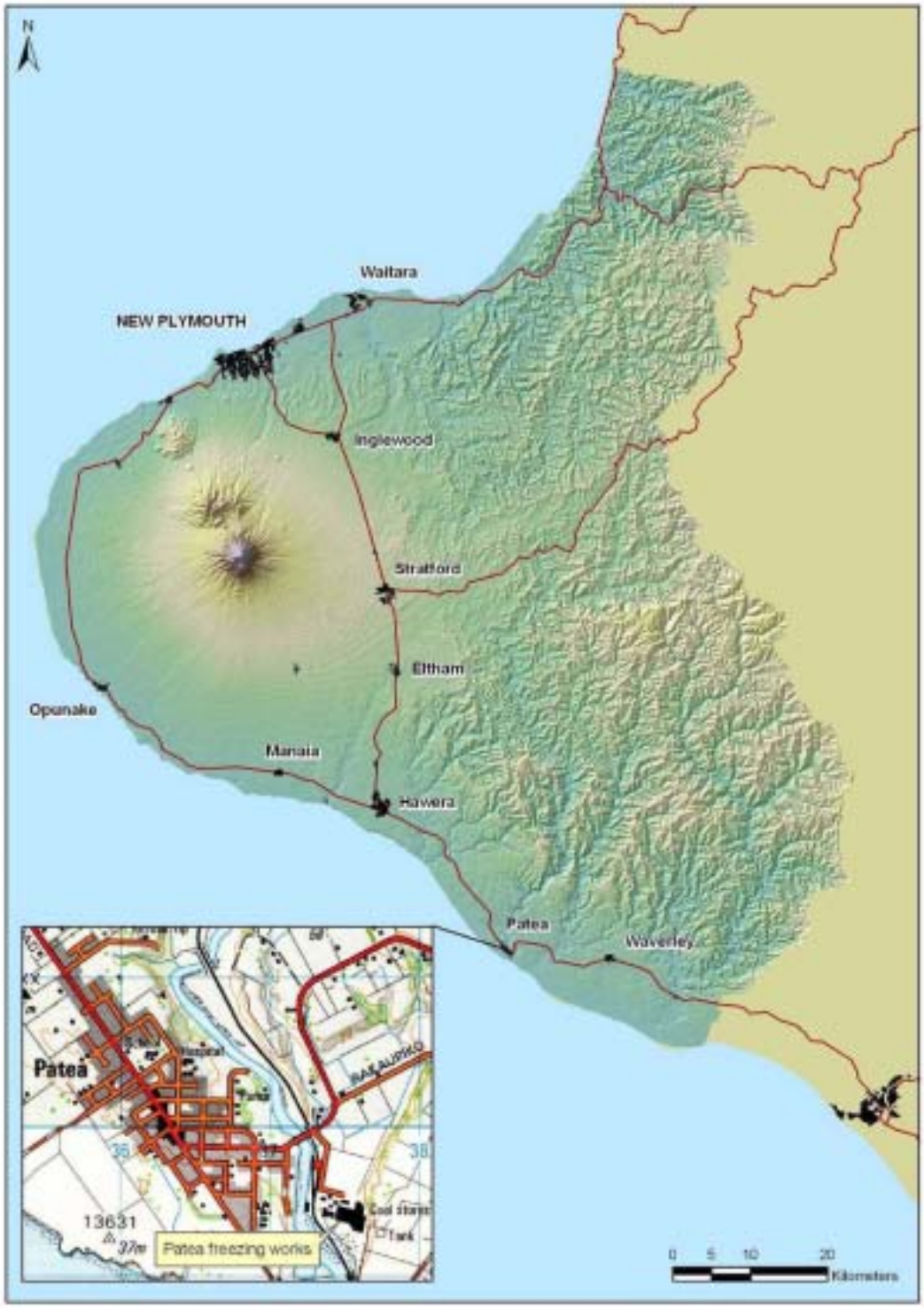

Figure 4 Locality map

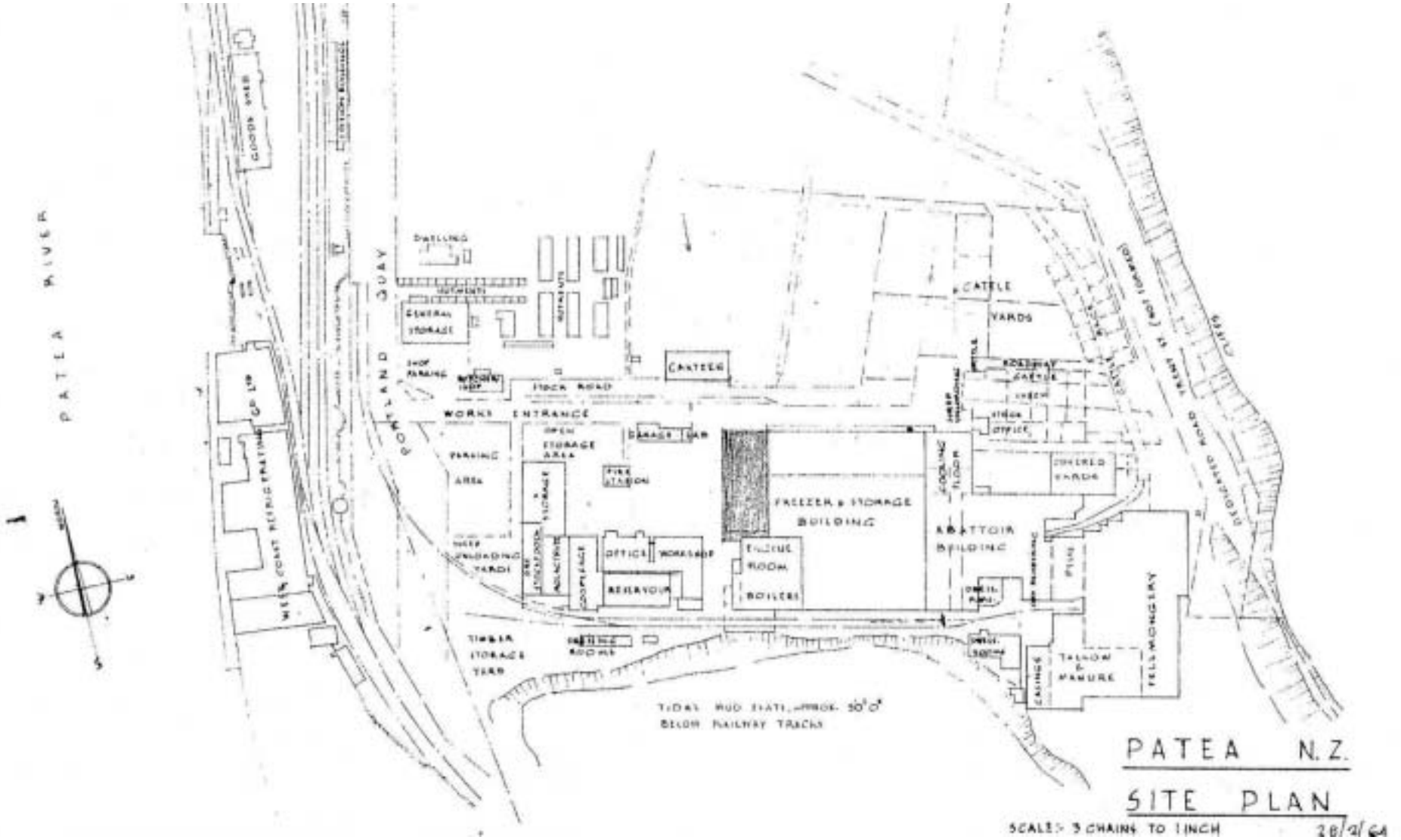

Figure 5 Site plan - 1964

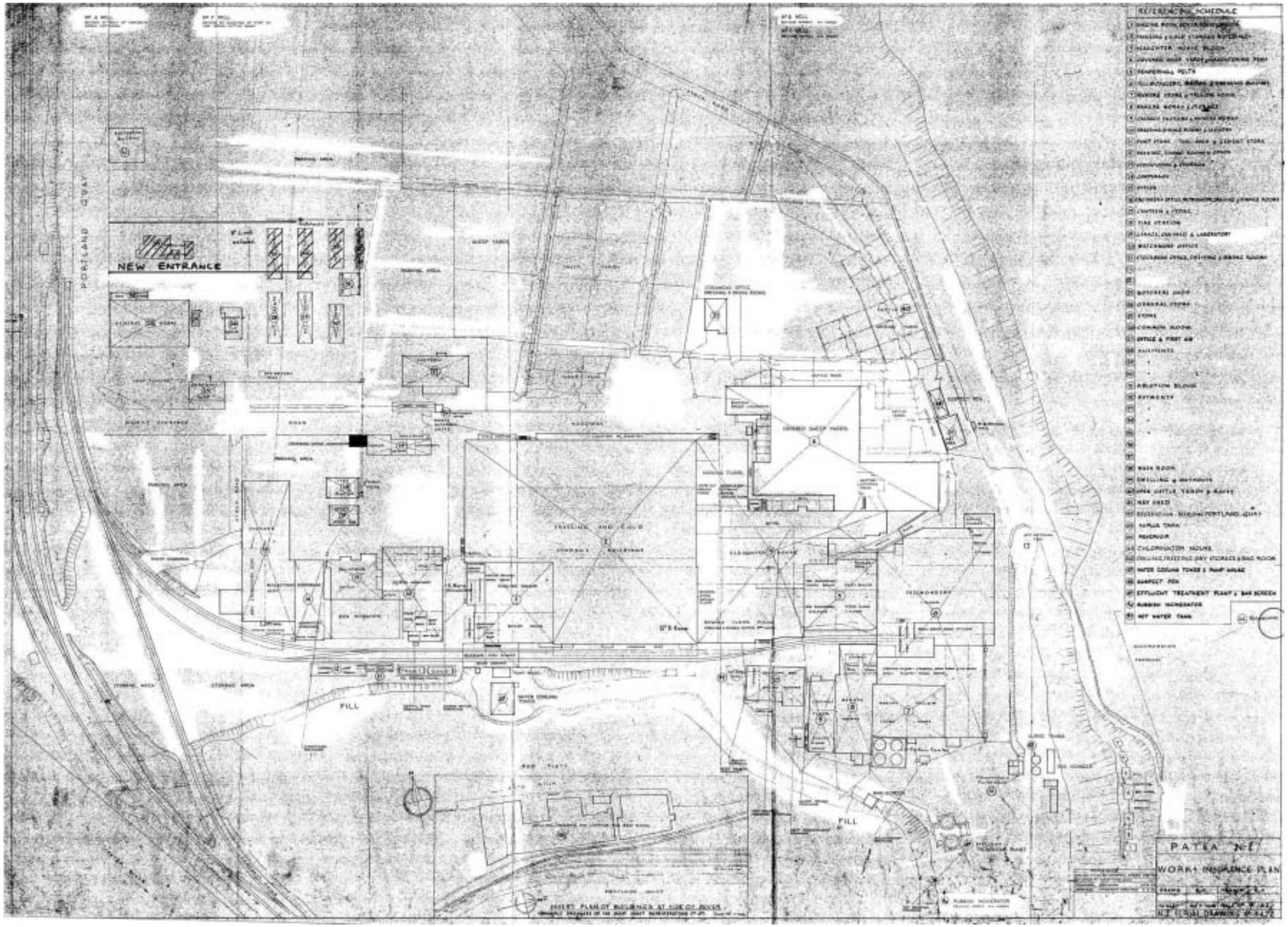

Figure 6 Site plan - 1973

3. Site history

The following is a summary of information previously included in the Preliminary Site Inspection Report.

The Patea Freezing Works began as a canning plant and tallow factory in the late 1800's. In 1904 freezing technology was introduced. From that time the factory was in continuous operation as a freezing works until it closed in 1982.

Table 1 Contaminants potentially associated with activities at the site

HAIL	Activity	Issue	Potential contaminants
6	Building materials	Roofing and cladding Paint Galvanising	Asbestos Lead Zinc
36	Fuel storage	Underground storage tanks and spills	TPH, BTEX, PAH
41	Rail shunting	Coal ash disposal Refuelling	Heavy metals, PAH Hydrocarbons
46	Fellmongery	Wool stripping, liming, neutralizing and pickling	Chromium, manganese, copper, ammonia, sulphides, acids, sodium hydroxide, lime, formaldehyde, solvents, cyanide
49	Waste disposal	Solids to fill areas, liquids to estuary	Various
	Boilers and engine room	Coal ash/clinker disposal Lagging	Heavy metals, PAH Asbestos
	Electrical equipment	Capacitors and transformers	PCBs
	Cool stores	Refrigeration plant	Ammonia or ammonium hydroxide (if contacted water)

HAIL: Hazardous Activities and Industries List

Land use

The site is zoned rural, and the current land uses are agricultural (cattle grazing on grassed areas-McColls) and vacant commercial/industrial. Table 2 below describes adjacent land uses.

Table 2 Adjacent land uses

Direction	Use	Description
North	Residential/rural	Private housing/grazing
South	DOC	Estuary
East	Agricultural	Farming
West	Commercial/industrial	Rail line/coolstores (historical)

4. Site condition and surrounding environment

Topography
The factory is situated on the true left bank of the Patea River. The land is river flats, so is relatively level. However, it rises gradually on the eastern side of the site to the base of cliffs on the boundary and has fairly steep terraces down to the estuary on the southern boundary. Site plans and aerial photographs are included in this report.

Site condition
Many buildings were destroyed in the Waitangi Day fire, some of those remaining have sustained varying degrees of fire damage. Buildings not affected by the fire are generally in a state of disrepair and/or collapse, as detailed in the site assessment for STDC conducted by Chapman Oulsnam Spiers Ltd (March 2005), included in the PSI Report. Roadways are in a reasonable condition, although many sealed areas are partially covered by grass or have moss growth on their surfaces.

Presence of drums/wastes/fill
These are detailed elsewhere in this report.

Odours
No odours were obvious during the site investigation.

Surface water
Springs at the base of cliffs on the eastern boundary, are the main source of surface water on the eastern side of the site, the water appears to be of good quality. The springs feed a small drain adjacent to the Fellmongery however it was not flowing during the dry summer months prevailing during this investigation. Water from the springs appears to discharge to the estuary through a number of piped drains on this side of the site and through an open water course. A large pipe in the south west corner of the site appears to be the discharge point for the majority of the piped drains on the western side of the site, as it was discharging during each site visit. All surface water from the site, drains to the estuary and then into the Patea River.

Flood potential
Flooding of the site is extremely unlikely due to the large flow capacity of the Patea River. No mention of site flooding has been made to Council staff during the course of this investigation. It is likely, given the flat nature of the site, that heavy rain might cause superficial slight surface flooding of the site before drainage occurs.

Boundary condition
Boundary fencing was in extremely poor condition prior to the fire. Following the fire, new security fencing was installed along the western boundary. Soil stability and erosion do not appear to be an issue as the site is level and well protected by cliffs to the east, the railway line to the west and the estuary to the south. However, areas of fill slope steeply to the estuary and some erosion and sediment transport is possible. Stormwater discharges to the estuary from a number of piped drains along the southern boundary. Many of these are marked on the site plan included with this report.

Visible contamination
Identifiable contamination has been detailed elsewhere in this report. There were no obvious signs of discolouration, staining, bare soil or signs of plant stress noted during the site investigation other than as discussed elsewhere, and such situations were extremely lcoalised.

Sensitive environments
The estuary is the receiving environment for discharges from the site. A survey of the estuary mudflats by a Council marine ecologist has shown healthy numbers of plants, birds, crabs and snails typically found in this type of environment. Discharges from the site are not considered to be having an adverse effect on the estuary.

A memorandum by the Council marine ecologist is attached in Appendix X.

5. Geology and hydrology

5.1 Background groundwater quality

The results of samples collected from two existing site bores and one background monitoring well can be used to assess background groundwater quality. Table 3 summarises the relevant data. The complete results can be found in section 10 of this report.

Table 3 Background groundwater quality

Name	Location	Depth (m)	Analysis	Results
No. 2 Well	Covered Unloading Platform	100 +	Heavy metals	Meets Drinking Water Standards for NZ (MoH, 2005)
No. 4 Well	East of yards (base of cliffs)	55	Heavy metals	Meets Drinking Water Standards for NZ (MoH, 2005)
MW5	North of main entrance road	5	Heavy metals	Meets Australian & NZ Guidelines for Fresh & Marine Water Quality (95% species protection)
			TPH & PAH	Below limits of detection

5.2 Existing groundwater bores

Details of investigations into existing groundwater bores on the site, including the following:

- File note with photographs, locations and current status,
- Geo-hydrologist's report,
- Bore logs, and
- Leveling survey,

are attached in Appendix IX. Many of these bores are marked on the site plan included in section 2 of this report.

5.3 Groundwater Assessment

The following groundwater assessment was provided by the Council's Geo-hydrology Officer, Andres Jaramillo.

Hydrogeological Setting
Two main aquifers underlay the Patea Freezing Works: aquifers in the Marine Terraces and the Whenuakura aquifer. The basal marine sediments grade up to non-marine sediments, its thickness is up to about 40 metres and includes multiple unconfined aquifers.

The water table in the Marine Terraces is generally encountered at depths between 1.5 and 10 m below ground level. Recharge of the Marine Terrace aquifers is primarily from rainfall infiltration.

The Whenuakura Formation comprises tertiary concretionary shelly blue-grey siltstones, mudstones and sandstones. Hydraulic conductivities in the Whenuakura aquifer have been measured at 1.3×10^{-5} to 5.8×10^{-5} ms^{-1}. There are no bores tapping into this aquifer down-gradient from the freezing works site. At and around the site,

the Whenuakura formation acts as a confined aquifer (there is even a flowing artesian well) which make obvious the fact that there is an aquitard between the Marine Terraces formation and the Whenuakura formation around this area.

In order to determine the best location for the groundwater zone monitoring wells, a topographical survey was carried out on 20-03-2008 on four existing bores tapping into the Whenuakura aquifer and groundwater levels were measured (depths at which these bores abstract water from varies between 61 and 120 metres);with this information, site specific direction of groundwater was determined. The bore logs and levelling survey data for these bores are attached to this report and can be found in Appendix IX.

Groundwater Flow System

Figure 7 depicts the groundwater flow system at Patea Freezing Works site. Groundwater travels along flow paths (red vector lines) which extend from areas of groundwater recharge to areas of groundwater discharge, in this case travelling S-SW towards the Patea River and the Tasman Sea farther downgradient. Equipotential lines are indicated as black lines.

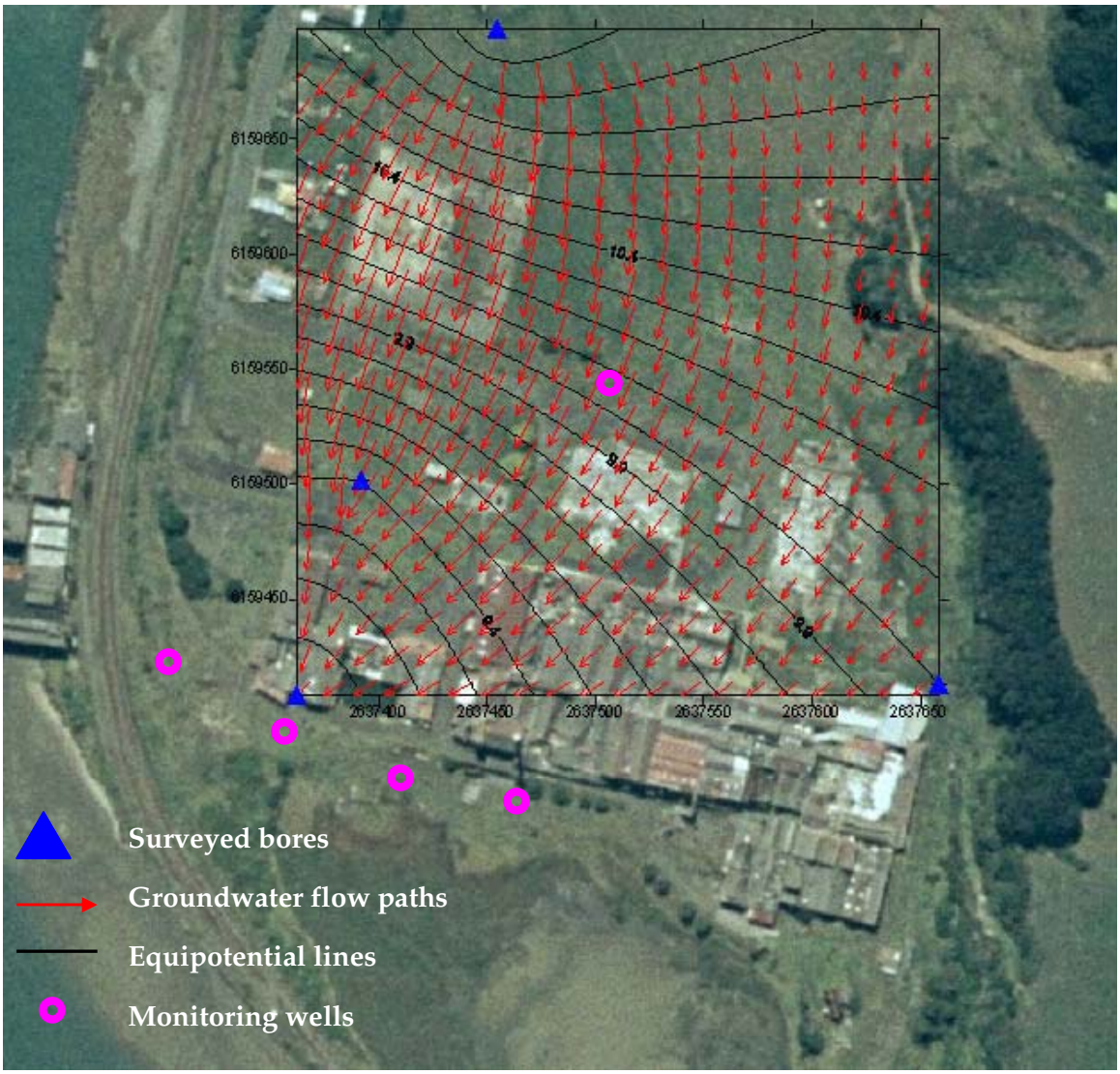

Figure 7 Surveyed bores, flow paths and monitoring wells

Groundwater use and development
There are no other users of groundwater resources south of the Patea Freezing works tapping into the Whenuakura aquifer. Potable water for residential areas around the site are served by the South Taranaki District Council's water supply scheme, therefore no shallow wells are expected to be needed and none appears to be registered with the Council.

Monitoring wells
Five monitoring wells were installed at the locations shown in Figure 7 above. The well characteristics are: well diameter 150mm, filter sock wrapped around a slotted PVC pipe, the filter pack used was gravel, bentonite was used for the plug and each was grouted-below Ground Toby Boxes.

Table 4 shows the details of the depths and water table levels found in the monitoring wells.

Table 4 Monitoring well depths and water levels

Well	Depth (m)	Water level (m) 10.04.08	Water level (m) 21.04.08
MW1	4.4	1.8	1.8
MW2	5.2	3.3	3.4
MW3	5.9	5.3	5.0
MW4	5.3	4.0	3.3
MW5	4.9	1.2	1.1

Full details of monitoring well levels during purging and sampling are attached in Appendix IV.

As mentioned above, monitoring wells were placed to capture the sub-superficial flows; the bores used for the determination of groundwater levels and flow lines are all cased to depths greater than 60 metres. For the assessment of shallow groundwater, an excavated pit for the removal of an underground tank was used to assess the depths of saturated layers; excavations up to 2.5 metres showed no indication of high water tables underlying the site.

The predominant soil types encountered during the drilling of the monitoring wells was Grey Clay, Blue Papa (Clayly), Silty Grey Clay and Fine Sands.

6. Sampling and analysis plan and methodology

The objectives of the sampling programme were:

- to establish the type and location of sources of contamination
- to establish the nature, degree and extent of contamination
- to determine the nature of material for waste characterisation
- to determine whether contaminants may be resulting in off-site effects
- to assist in the development of appropriate options for site remediation

The rationale for selection of the sampling density, pattern, locations and depths was based on information obtained during the preliminary site inspection, particularly the discussions with past employees of the factory (which also formed part of this investigation), and field observations during the course of this investigation. Consideration was also given to the fact that the cost of remediating any chemical contamination was likely to be minimal when compared to the cost of asbestos removal and disposal, building demolition and reinstatement of the site. Consequently the scope of this investigation was focused on the detection of gross contamination and characterisation of the site and was conducted with the application of professional judgment as being representative of the overall condition of the site. However, given the size of the site, the possibility cannot be excluded that there are undetected 'hotspots' or unidentified chemicals that the assessment has not revealed. Table 5 shows details of the sampling density, pattern, locations and depths.

Table 5 Sample analytes and selection details

Sample Type	No. collected	Analytes	Comments
Ash	12	Asbestos	Grid pattern from the surface of the area of fire damage (Freezing and Cold Storage Buildings).
Dust/debris	7 7	Asbestos Heavy metals	Samples from the floor of buildings safe to enter post fire and evenly spaced across the factory area.
Groundwater	7	Heavy metals PAH, TPH	Location of monitoring wells from establishing groundwater flow direction, wells installed to 2m below groundwater level.
Road seal	9	PAH	Samples from each area of seal across the site.
Soil	25	Heavy metals PAH	Trench samples collected at 10m intervals from ash/clinker deposits at 1m depth. Tests pits evenly spaced across fill terraces, samples collected from depth of dark material indicating possible ash/clinker deposits.
Surface water	10	Metals PAH, TPH	Dictated by the location of drains, seeps and surface flow to the estuary.

Details of the analytical methods used for each analyte are included with copies of the results, attached in Appendix XI.

All sample containers were labeled with the date, time and location at the time of collection. Samples were immediately placed in a chilli bin with ice (except samples for asbestos) and transferred to the Council offices at the conclusion of on-site activities for the day. On arrival at the Council laboratory, samples were received and assigned a unique sample identification number. They were then packaged with documentation and sent by courier to the appropriate external laboratory.

Asbestos samples went to Capital Environmental Services (2005) Limited [CES], all other samples were sent to R J Hill Laboratories Limited [RJH] for analysis.

Soil sampling of underground storage tank pits was conducted by PDP, and their report is attached in Appendix I.

Table 6 shows details of the sample collection methods.

Table 6 Sample collection methods

Sample Type	Equipment	Container	Decontamination
Dust/debris (asbestos)	Metal spoon	Snack size Glad-bag	Spoon wiped between samples with a damp paper towel.
Dust/debris (metals)	Plastic scoop	Lab supplied	Scoop wiped between samples with a damp paper towel.
Groundwater	Disposable bailer	Lab supplied	Dedicated bailer for each monitoring well.
Road seal	Cold chisel and hammer	Lab supplied	None
Soil – surface Soil –trench & test pits	Metal trowel Metal bucket on sample pole	Lab supplied	Adhering soil removed with a stiff plastic brush.
Surface water	Sample pole	Lab supplied	Samples collected in lab supplied containers.

All consumables used for equipment cleaning or sample collection, and used PPE (disposable) were left on site in a sealed bag for disposal.

7. Quality assurance and quality control

As previously discussed in section 6 of this report the scope of this investigation was focused on the detection of gross contamination and characterisation of the site. The collection of blind, split, rinsate and blank samples was therefore not considered necessary and none were collected. The discovery of significant widespread ground contamination would require a supplementary site investigation, at additional cost and with a more stringent sampling regime, to accurately determine the nature and extent of such contamination.

Chain of custody documentation and field sampling sheets are attached in Appendix XII.

The external laboratories engaged for analysis of samples are accredited by International Accreditation NZ and observe the appropriate QA/QC protocols.

8. Basis for guideline values

In evaluating the risk from airborne asbestos, the Council has noted the 2002 NZ workplace exposure standard, of 1 fibre per milliliter (crysotile) or 0.1 fibres per milliliter (amosite and crocidolite) averaged over a four hour exposure period.

Selected guidelines for contaminants other than asbestos are shown in Table 7. The selection of these guidelines is consistent with the principles of *Contaminated Land Management Guidelines No. 2: Hierarchy and Application in New Zealand of Environmental Guideline Values*.

Table 7 Selected guideline values

Sample type	Analytes	Selected Guideline
Dust/debris Soil	Heavy metals	*Guideline on the Investigation Levels for Soil and Groundwater (NEPC 1999)* *Soil Investigation Levels, Health Investigation Levels* - Commercial/Industrial
Groundwater (existing bores)	Heavy metals	*Drinking Water Standards for New Zealand* (MoH, 2005)
Groundwater (monitoring wells) Surface water	Metals	*Australian & NZ Guidelines for Fresh & Marine Water Quality* (ANZECC, 2000) Trigger values for freshwater 95% species protection
Soil	PAH & TPH	*Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand* (MfE, 1999) Tier 1 soil acceptance criteria ALL PATHWAYS Commercial/Industrial
Groundwater (monitoring wells) Surface water	PAH & TPH	Lack of reliable values available, almost all results are non-detects.
Road seal	PAH	Compared to typical PAH values for tar (60-70%) and bitumen (100-200 mg/kg).

9. Results

9.1 Sampling details and comments

Details recorded for each sample at the time of collection and the analysis schedule, are shown in Table 12. It should be noted that during this investigation the Council was in the process of converting their coordinate system from New Zealand Map Grid to New Zealand Transverse Mercator, consequently there are GPS values in Table 12 from both coordinate systems. The last 3 digits of the sample number have been used to denote the sampling location on the aerial photograph included in this section of the report (and as a separate file in electronic versions).

9.2 Results for soil samples

The results for heavy metals, on the soil samples collected are shown in Table 13, no results exceeded the selected values from the *Guideline on the Investigation Levels for Soil and Groundwater* (NEPC 1999).

The results for PAH, TPH and BTEX on the soil samples collected are shown in Table 14 and Table 15. While these samples are referred to as soils, in most cases the samples were actually of fill material. As a conservative approach they were assessed against selected values from the *Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand* (MfE, 1999) for the soil type SAND, which has the most stringent values of the different soil types. There were no results that exceeded these values.

Two soil samples were collected from outside the Paint Mixing room in the Fellmongery and tested for pH, to determine impacts on soil in the area. The results were:

- Sample 685 Sodium Storage 7.8
- Sample 686 outside Paint Mixing room 8.2

which indicates that the soil is slightly alkaline.

9.3 Results for water samples

Both surface water and groundwater (assumed) discharge from the site to the estuary, there is not a significant risk to human health and so the results were compared to the *Australian & NZ Guidelines for Fresh & Marine Water Quality* (ANZECC, 2000), trigger values for 95% species protection. This is a conservative approach as there is a large dilution factor/regular flushing of the receiving environment from tidal movement. In general, most groundwater results complied with the guideline values. All surface water samples exceeded the guideline values for at least one metal. It is expected that the concentrations of these metals should reduce once the site has been cleaned up and they indicate minimal risk to the aquatic environment of the estuary.

The results for samples taken from existing groundwater bores are shown in Table 8.

Table 8 Results for samples from existing groundwater bores

Sample Name	080861	080862	Drinking Water Standards for NZ (MoH, 2005)
Date	12/03/2008	12/03/2008	Maximum Acceptable Value [MAV]
Time	2.20pm	3.20pm	mg/L
Lab Number	634741.8	634741.9	
Location	No. 2 Well	No. 4 Well	
Dissolved Arsenic	<0.0010	0.0067	0.01
Dissolved Cadmium	<0.000050	<0.000050	0.004
Dissolved Chromium	<0.00050	<0.00050	0.05
Dissolved Copper	<0.00050	<0.00050	2
Dissolved Lead	<0.00010	<0.00010	0.01
Dissolved Nickel	<0.00050	<0.00050	0.02
Dissolved Zinc	0.0073	<0.0010	1.5

Notes:
1. Results in g/m^3

These results meet the criteria for heavy metals in drinking water.

9.4 Results for other samples

The results of asbestos analysis on the samples of dust/debris and ash are shown in Table 9.

Table 9 Results of asbestos analysis

Sample Name	Date	Time	Lab Number	Location	Result
TRC080605	20-Feb-08		35981	Tallow House	Chrysotile
TRC080606	20-Feb-08		35982	Paint Mixing room	Amosite & Chrysotile
TRC080607	20-Feb-08		35983	Fellmongery switch room	No asbestos detected
TRC080608	20-Feb-08		35984	Dry Rendering	Chrysotile
TRC080609	20-Feb-08		35985	Casings Floor	Chrysotile
TRC080610	20-Feb-08		35986	Boiler House	Amosite & Chrysotile
TRC080611	20-Feb-08		35987	Slaughter House-N side	No asbestos detected
TRC081271	21-Apr-08	1340	36798	Ash 1	No asbestos detected
TRC081272	21-Apr-08	1343	36799	Ash 2	No asbestos detected
TRC081273	21-Apr-08	1346	36800	Ash 3	Chrysotile (1-3%)
TRC081274	21-Apr-08	1349	36801	Ash 4	No asbestos detected
TRC081275	21-Apr-08	1352	36802	Ash 5	No asbestos detected
TRC081276	21-Apr-08	1400	36803	Ash 6	Chrysotile (8-10%)
TRC081277	21-Apr-08	1403	36804	Ash 7	Chrysotile (8-10%)
TRC081278	21-Apr-08	1406	36805	Ash 8	Chrysotile (8-10%)
TRC081279	21-Apr-08	1409	36806	Ash 9	Chrysotile (15-20%)
TRC081280	21-Apr-08	1412	36807	Ash 10	Chrysotile (8-10%)
TRC081281	21-Apr-08	1415	36808	Ash 11	No asbestos detected
TRC081282	21-Apr-08	1418	36809	Ash 12	No asbestos detected

Notes: 1. Percentage values are an estimate by volume.

A visual inspection of the Boiler House had already revealed the presence of amosite asbestos (typically used in older lagging) confirmed by these results. It was also detected in the Fellmongery Paint Mixing room, which indicates that asbestos lagging may also have been used in this area. Chrysotile asbestos forms approximately 20% content in the fibre cement cladding used extensively throughout the site. The results indicate that the distribution of asbestos is widespread across the site buildings and within ash from the fire.

The results for heavy metal analysis on the dust/debris samples collected from the floor of rooms within the factory and the Boiler House Reservoir sample are shown in Table 10.

Table 10 Heavy metal results for other samples

Sample Name	080655	080656	080657	080658	080659	080660	080683	Guideline on the Investigation Levels for Soil and Groundwater (NEPC 1999)
Date	25/02/2008	25/02/2008	25/02/2008	25/02/2008	25/02/2008	25/02/2008	26/02/2008	
Time	2.30pm	2.40pm	2.55pm	3.05pm	3.15pm	3.30pm	11.45am	Soil Investigation Levels
Lab Number	632059.2	632059.3	632059.4	632059.5	632059.6	632059.7	632062.5	Health Investigation Levels
Location	Paint Mix Room	Fellmongery Switch Room	Tallow House	Casings Floor	Dry Rendering	Boiler House	Boiler House Reservoir	Commercial/Industrial
Arsenic	41	80	61	140	92	78	20	500
Cadmium	1.5	3.7	4.9	4.7	4.4	**190**	1.1	100
Chromium	120	110	94	78	260	420	50	500
Copper	640	**16000**	1400	260	1500	4900	130	5000
Lead	**1600**	**2000**	**7100**	1200	**2000**	**9900**	390	1500
Nickel	100	62	73	14	1100	140	30	3000
Zinc	10000	8900	10000	1500	7000	7200	2700	35000

Notes:
1. Results are in mg/kg.
2. Exceedances are in bold type.

Although not soil samples, these results were conservatively assessed against health investigation levels for soil. The high copper result was possibly due to the presence of some copper wire in the sample from outside the switch room. The elevated levels of lead are undoubtedly due to the amount of flaked-off paint that was present in the samples. It is expected that these materials (both the dusts/debris, and their sources) would be disposed of as part of any cleanup of the on-site materials. If correct procedures are followed then workers' exposure during cleanup should be low and the detected concentrations should be no cause for concern. However, this material will need to be disposed of appropriately.

The results of PAH analysis on samples of road seal and the sample collected from the Boiler House Reservoir are shown in Table 11.

Table 11 Results of PAH analysis on samples of road seal

Sample Name	080834	080835	080842	080843	080844	080845	080846	080847	080848	080683	Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE, 1999) Tier 1 Soil acceptance criteria Commercial/Industrial use ALL PATHWAYS SAND <1m
Date	11/03/2008	11/03/2008	13/03/2008	13/03/2008	13/03/2008	13/03/2008	13/03/2008	13/03/2008	13/03/2008	26/02/2008	
Time	3.20pm	3.25pm	9.55am	10.00am	10.05am	10.10am	10.30am	10.40am	10.45am	11.45am	
Lab Number	634740.1	634740.2	634740.3	634740.4	634740.5	634740.6	634740.7	634740.8	634740.9	632062.5	
Location	Seal 1	Seal 2	Seal 3	Seal 4	Seal 5	Seal 6	Seal 7	Seal 8	Seal 9	Boiler House Reservoir	
Dry Matter	100	100	100	100	100	100	100	100	100	27	
Acenaphthene	<0.025	<0.024	<0.024	0.4	<0.025	<0.025	<0.024	<0.024	<0.025	<0.16	
Acenaphthylene	<0.025	<0.024	<0.024	<0.025	<0.025	<0.025	<0.024	<0.024	<0.025	<0.16	
Anthracene	<0.025	<0.024	<0.024	0.12	<0.025	<0.025	<0.024	0.033	<0.025	<0.16	
Benzo[a]anthracene	<0.025	0.086	<0.024	0.027	<0.025	<0.025	<0.024	0.047	<0.025	<0.16	
Benzo[a]pyrene (BAP)	<0.025	0.058	<0.024	0.026	<0.025	<0.025	<0.024	0.039	<0.025	<0.16	(11)
Benzo[b+j]fluoranthene	<0.025	0.099	<0.024	0.050	<0.025	<0.025	<0.024	0.050	<0.025	<0.16	
Benzo[g,h,i]perylene	<0.025	0.21	0.12	0.045	0.074	0.084	0.059	0.13	0.050	<0.16	
Benzo[k]fluoranthene	<0.025	0.069	<0.024	0.043	<0.025	<0.025	<0.024	0.028	<0.025	<0.16	
Chrysene	<0.025	0.072	<0.024	0.035	<0.025	<0.025	<0.024	0.056	<0.025	<0.16	
Dibenzo[a,h]anthracene	<0.025	<0.024	<0.024	<0.025	<0.025	<0.025	<0.024	0.034	<0.025	<0.16	
Fluoranthene	0.047	0.16	<0.024	0.17	<0.025	<0.025	<0.024	0.083	<0.025	<0.16	
Fluorene	<0.025	<0.024	<0.024	0.16	<0.025	<0.025	<0.024	<0.024	<0.025	<0.16	
Indeno[1,2,3,-c,d]pyrene	<0.025	0.058	<0.024	0.024	<0.025	<0.025	<0.024	0.035	<0.025	<0.16	
Napthalene	<0.13	<0.12	<0.12	<0.13	<0.13	<0.13	<0.12	<0.12	<0.13	<0.78	(190)
Phenanthrene	<0.025	0.037	<0.024	0.15	<0.025	<0.025	<0.024	0.057	<0.025	<0.16	
Pyrene	0.048	0.14	<0.024	0.15	<0.025	<0.025	<0.024	0.067	<0.025	<0.16	NA
C7-C9										<47	120
C10-C14										<66	(1,500)
C15-C36										740	NA
Total petroleum hydrocarbons										780	

Notes:
1. Results are in mg/kg.
2. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons.
3. NA indicates contaminant not limiting as estimated health based criterion is significantly higher that that likely to be encountered on site.

The PAH results for samples of road seal are exceptionally low (even for bitumen based seal) and rule out the presence of tar. Results for the Boiler House Reservoir sample are well below the guideline values for sand at less than 1m. Consequently, if this reservoir was drained the sludge would be acceptable for disposal to land on the site.

Table 12 Sampling details and comments

Sample No.	Date	Time	Location	GPS	Asbestos	Metals	BTEX	PAH	TPH	Comments
TRC080605	20-Feb-08		Tallow House	1727566-5597583	X					Taken from SE entranceway, concrete walls, asbestos roof completely fallen in, a lot of peeling paint & a little rust.
TRC080606	20-Feb-08		Paint Mixing room	1727602-5597649	X					Upstairs in Fellmongery, taken from middle of room. Two concrete walls, other 2 asbestos cladding and asbestos roof, a lot of rusting metal.
TRC080607	20-Feb-08		Fellmongery switch room	1727559-5597626	X					Outside switch room, downstairs SW cnr. Open area, predominantly concrete, a lot of asbestos cladding in the vicinity and peeling paint.
TRC080608	20-Feb-08		Dry Rendering	1727530-5597634	X					Downstairs small room in SW cnr, concrete with small amt of asbestos cladding & peeling paint from the fire.
TRC080609	20-Feb-08		Casings Floor	1727518-5597590	X					Taken from SW cnr of room, more modern with formica lining, no asbestos/paint/rust.
TRC080610	20-Feb-08		Boiler House	1727400-5597665	X					Taken from inside entrance on SW cnr. Predominantly concrete with small amt of asbestos cladding, also asbestos lagging, a lot of rust & peeling paint.
TRC080611	20-Feb-08		Slaughter House-N side	1727540-5597679	X					Taken from N side of a small room on N side of Slaughter House. Concrete room with asbestos cladding on 1 wall, also peeling paint & rusting pipes/beams.
TRC080648	25-Feb-08	1048	Patea River background			X		X	X	From hole in discharge hose.
TRC080649	25-Feb-08	1120	Surface flow from freezers	2637467-6159351		X		X	X	Entering trench below chimney, ~0.2 l/s (river water)
TRC080650	25-Feb-08	1140	Seep from freezers	2637522-6159327		X		X	X	Entering mudflat at eastern end of freezers below palm (river water?)
TRC080651	25-Feb-08	1230	SE drain	2637615-6159210		X		X	X	On top of bank in SE cnr next to Norfolk/Taupata, ~0.1l/s (spring fed?)
TRC080652	25-Feb-08	1245	Fellmongery drain	2637584-6159278		X		X	X	Just trickling (spring fed?)
TRC080653	25-Feb-08	1250	Bar screen drain	2637581-6159283		X		X	X	~0.2 l/s (spring fed?)
TRC080654	25-Feb-08	1405	Slaughter House-N side	1727540-5597679		*				Taken from SW cnr of a small room on N side. Concrete room with asbestos cladding on 1 wall, also peeling paint & rusting pipes/beams.
TRC080655	25-Feb-08	1430	Paint Mix Room	1727602-5597649		X				Upstairs in Fellmongery, taken from SE cnr. Two concrete walls, other 2 asbestos cladding and asbestos roof, a lot of rusting metal.
TRC080656	25-Feb-08	1440	Fellmongery switch room	1727559-5597626		X				Outside switch room, downstairs, composite. Open area, predominantly concrete, alot of asbestos cladding in the vicinity and peeling paint.
TRC080657	25-Feb-08	1455	Tallow House	1727566-5597583		X				Taken from SE entranceway, concrete walls, asbestos roof completely fallen in, a lot of peeling paint & a little rust.
TRC080658	25-Feb-08	1505	Casings Floor	1727518-5597590		X				Taken from SW cnr of room, more modern with formica lining, no asbestos/paint/rust.
TRC080659	25-Feb-08	1515	Dry Rendering	1727530-5597634		X				Downstairs small room in SW cnr, concrete with small amt of asbestos cladding & peeling paint from the fire.
TRC080660	25-Feb-08	1530	Boiler House	1727400-5597665		X				Taken from inside entrance on SW cnr. Predominantly concrete with small amt of asbestos cladding, also asbestos lagging, a lot of rust & peeling paint.
TRC080679	26-Feb-08	900	Patea River background			X		X	X	From hole in discharge hose.
TRC080680	26-Feb-08	925	SW drain	2637356-6159372		X		X	X	Approx 0.5m dia pipe in SW cnr of site, ~ 2 l/s. On each occasion I have seen this pipe there has been a discharge, possible g/w entry?
TRC080681	26-Feb-08	935	Stockyard drain	2637370-6159375		X		X	X	Run-off from wetting of McColls site, ~ 3 l/s discharging to bunded pond.
TRC080682	26-Feb-08	1040	Seep from trench	2637441-6159335		X		X	X	Entering mudflats, possibly flowing through from septic tank and stormwater drainage (destroyed in digging trench) &/or seeping from trench.
TRC080683	26-Feb-08	1145	Boiler House Reservoir	1727398-5597665		X		X	X	Sample of sludge from cnr next to b/h entrance, black sludge, oily sheen released. Est 0.5m sludge/debris covered by 0.5m water.
TRC080684	26-Feb-08	1300	pump shed	1727399-5597649				X	X	Soil sample from entrance, originally thought to be for fuel oil.
TRC080685	26-Feb-08	1310	Sodium Storage	1727607-5597659						Building on N side of Fellmongery gone, sample taken from soil on concrete floor.
TRC080686	26-Feb-08	1310	Paint Mixing room	1727608-5597649						Taken from outside roller door entrance on E side, normal grass coverage in this area.
TRC080821	11-Mar-08	1040	Pit 1 SW	2637361-6159383				X		Natural ground at 2.5m, sampled dark material at 1.5m, noted rubble/debris.
TRC080822	11-Mar-08	1120	Pit 4 SW	2637396-6159372		X		X		Natural ground at 1.5m, sampled dark material at 0.5m.
TRC080823	11-Mar-08	1140	Pit 5 SW	2637394-6159364		X		X		Building rubble to 2m, sampled dark material at 1.5m.
TRC080824	11-Mar-08	1210	Rail line	2637348-6159410		X		X		Sample of blackened soil below rail line.
TRC080825	11-Mar-08	1215	Pit 7 SW	2637370-6159394		X		X		Under rail line, blackened gravel to 0.4m then natural ground, sampled dark material at 0.3-0.4m
TRC080826	11-Mar-08	1225	Pit 8 SW	2637388-6159422		X		X		Sampled dark band at 0.2-0.3m, hole had been dug N of NW cnr of main reservoir.
TRC080827	11-Mar-08	1235	Machine Shop	2637431-6159389				X	X	Sample of soil that appeared to be soaked with oil.
TRC080828	11-Mar-08	1345	Pit 1 SE	2637624-6159206		X		X		Fill (ash, bottles, steel, building rubble etc) to 3m, sampled dark material at 1.5m.
TRC080829	11-Mar-08	1410	Pit 2 SE	2637622-6159215		X		X		Layer of pumice 0.2-0.3m, then dark layer 0.3-0.5m sampled.
TRC080830	11-Mar-08	1415	Pit 2 SE	2637622-6159215		X		X		Sample of red friable material at 1.2m.
TRC080831	11-Mar-08	1415	Pit 2 SE	2637622-6159215		X		X		Sample of white puggy material from bucket.
TRC080832	11-Mar-08	1445	Pit 4 SE	2637611-6159235		X		X		Natural ground 1.5m, sampled dark material at 0.3m.
TRC080833	11-Mar-08	1510	Pit 5 SE	2637600-6159273		X		X		Natural ground at 0.4m, sampled dark material at 0.3-0.4m, evidence of clinker in spoil.
TRC080834	11-Mar-08	1520	Seal 1	2637540-6159354				X		Sample of roading seal
TRC080835	11-Mar-08	1525	Seal 2	2637518-6159355				X		Sample of roading seal
TRC080861	12-Mar-08	1420	No. 2 Well	1727318-5597684		X				Sample of roading seal
TRC080862	12-Mar-08	1520	No. 4 Well	1727609-5597696		X				Water level 4.3m to top of plinth, purged 50 L at 10 m then took sample, turbid brown.
TRC080942	13-Mar-08	955	Seal 3	2637348-6159458				X		Sample of roading seal
TRC080943	13-Mar-08	1000	Seal 4	2637364-6159490				X		Sample of roading seal
TRC080944	13-Mar-08	1005	Seal 5	2637412-6159439				X		Sample of roading seal
TRC080945	13-Mar-08	1010	Seal 6	2637429-6159379				X		Sample of roading seal
TRC080946	13-Mar-08	1030	Seal 7	2637550-6159313				X		Sample of roading seal
TRC080947	13-Mar-08	1040	Seal 8	2637560-6159456				X		Sample of roading seal
TRC080948	13-Mar-08	1045	Seal 9	2637469-6159460				X		Sample of roading seal

Sample No.	Date	Time	Location	GPS	Asbestos	Metals	BTEX	PAH	TPH	Comments
TRC080949	13-Mar-08	1310	Trench 1	2637427-6159359		X		X		Sampled dark material at 1m, clinker evident in sample.
TRC080950	13-Mar-08	1325	Trench 2	2637439-6159353		X		X		Sampled dark material at 1m.
TRC080951	13-Mar-08	1330	Trench 3	2637446-6159350		X		X		Sampled dark material at 1m, clinker evident in sample.
TRC080952	13-Mar-08	1400	Trench 4	2637457-6159349		X		X		Sampled dark material at 1m.
TRC080953	13-Mar-08	1410	Trench 5	2637469-6159348		X		X		Sampled dark material at 1m, clinker evident in sample.
TRC080954	13-Mar-08	1420	Trench 6	2637490-6159347		X		X		Sampled dark material at 1m, clinker evident in sample, 20m from previous sample due to extensive area of bricks.
TRC080955	13-Mar-08	1430	Trench 7	2637500-6159345		X		X		Sampled dark material at 1.2m, clinker evident in sample.
TRC081106	31-Mar-08	1000	Fire Station stockpile			X	X	X	X	Composite of samples collected from surface of contaminated soil removed from tank pit.
TRC081271	21-Apr-08	1340	Ash 1	2637536-6159444	X					Sampled from north side of burnt out freezer section.
TRC081272	21-Apr-08	1343	Ash 2	2637524-6159449	X					Sampled from north side of burnt out freezer section.
TRC081273	21-Apr-08	1346	Ash 3	2637516-6159453	X					Sampled from north side of burnt out freezer section.
TRC081274	21-Apr-08	1349	Ash 4	2637503-6159451	X					Sampled from north side of burnt out freezer section.
TRC081275	21-Apr-08	1352	Ash 5	2637488-6159450	X					Sampled from north side of burnt out freezer section.
TRC081276	21-Apr-08	1400	Ash 6	2637484-6159368	X					Sampled from south side of burnt out freezer section.
TRC081277	21-Apr-08	1403	Ash 7	2637497-6159367	X					Sampled from south side of burnt out freezer section.
TRC081278	21-Apr-08	1406	Ash 8	2637500-6159379	X					Sampled from south side of burnt out freezer section.
TRC081279	21-Apr-08	1409	Ash 9	2637508-6159365	X					Sampled from south side of burnt out freezer section.
TRC081280	21-Apr-08	1412	Ash 10	2637519-6159359	X					Sampled from south side of burnt out freezer section.
TRC081281	21-Apr-08	1415	Ash 11	2637525-6159377	X					Sampled from south side of burnt out freezer section.
TRC081282	21-Apr-08	1418	Ash 12	2637527-6159397	X					Sampled from south side of burnt out freezer section.
TRC081283	21-Apr-08	1515	MW1	2637472-6159350		X		X	X	Fairly clean & clear sample, water dirty at bottom.
TRC081284	21-Apr-08	1525	MW2	2637421-6159366		X		*	X	Very slow recharge, not enough for PAH sample, very dirty at bottom.
TRC081285	21-Apr-08	1545	MW3	2637361-6159383		X		X	X	Fairly clean & clear sample to bottom.
TRC081286	21-Apr-08	1600	MW4	2637323-6159391		X		X	X	Yellowish, fairly clean sample, slightly dirty at bottom.
TRC081287	21-Apr-08	1615	MW5 (Backround)	2637490-6159528		X		X	X	Fairly clean & clear sample, dirty at bottom.

Notes:
1. Sample 654 no metals result received.
2. Sample 284 not enough water in well for PAH.

Table 13 Heavy metals results for soil samples

Sample Name	080822	080823	080824	080825	080826	080828	080829	080830	080831	080832	080833	080949	080950	080951	080952	080953	080954	080955	081106	Guideline on the Investigation Levels for Soil and Groundwater (NEPC 1999) Soil Investigation Levels Health Investigation Levels Commercial/Industrial
Date	11/03/2008	11/03/2008	11/03/2008	11/03/2008	11/03/2008	11/03/2008	11/03/2008	11/03/2008	11/03/2008	11/03/2008	11/03/2008	13/03/2008	13/03/2008	13/03/2008	13/03/2008	13/03/2008	13/03/2008	13/03/2008	31/03/2008	
Time	1120	1140	1210	1215	1225	1345	1410	1415	1415	1445	1510	1310	1325	1330	1400	1410	1420	1430	1000	
Lab Number	634664.2	634664.3	634664.4	634664.5	634664.6	634664.8	634664.9	634664.10	634664.11	634664.12	634664.13	634741.1	634741.2	634741.3	634741.4	634741.5	634741.6	634741.7	636832.1	
Location	Pit 4 SW	Pit 5 SW	Under rail line	Pit 7 SW	Pit 8 SW	Pit 1 SE	Pit 2 SE	Pit 2 SE	Pit 2 SE	Pit 4 SE	Pit 5 SE	Trench 1	Trench 2	Trench 3	Trench 4	Trench 5	Trench 6	Trench 7	Fire Station stockpile	
Arsenic	21	3.9	6.9	7.5	5.6	11	16	8.6	14	16	48	13	11	7.0	9.1	13	8.2	7.6	3.3	500
Cadmium	2.5	<0.10	0.11	0.91	0.13	1.2	0.28	0.8	1.6	0.8	0.39	0.47	0.32	0.42	0.27	0.38	0.21	0.24	0.16	100
Chromium	29	30	6.6	9.8	5.7	38	19	23	4.3	22	26	20	16	15	15	23	14	20	24	500
Copper	220	11	18	81	28	190	57	130	10	160	69	160	37	110	53	67	60	64	25	5000
Lead	870	18	12	61	91	470	250	470	6.5	290	130	170	78	89	31	100	73	130	30	1500
Nickel	24	15	6.3	40	37	27	12	20	15	16	21	18	12	16	20	24	12	14	17	3000
Zinc	2200	76	28	1400	190	960	140	1100	39	970	310	470	230	310	120	260	130	230	130	35000

Notes:
1. Results in mg/kg

Table 14 PAH, TPH and BTEX results for soil samples (<1m depth)

Sample Name	080684	080822	080824	080825	080826	080827	080829	080832	080833	081106	Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE, 1999) Tier 1 Soil acceptance criteria Commercial/Industrial use ALL PATHWAYS SAND (<1m)
Date	26/02/2008	11/03/2008	11/03/2008	11/03/2008	11/03/2008	11/03/2008	11/03/2008	11/03/2008	11/03/2008	31/03/2008	
Time	1300	1120	1210	1215	1225	1235	1410	1445	1510	1000	
Lab Number	632062.6	634664.2	634664.4	634664.5	634664.6	634664.7	634664.9	634664.12	634664.13	636832.1	
Location	pump shed	Pit 4 SW	Under rail line	Pit 7 SW	Pit 8 SW	Machine Shop	Pit 2 SE	Pit 4 SE	Pit 5 SE	Fire Station stockpile	
Sample depth (m bgl)	0	0.5	0	0.3	0.3	0	0.4	0.3	0.3	-	
Dry Matter	73	74	77	69	65	58	74	82	83	78	
Acenaphthene	<0.056	0.048	<0.029	<0.035	<0.037	0.45	<0.029	<0.026	<0.031	<0.028	
Acenaphthylene	<0.056	0.17	<0.029	0.060	0.061	<0.041	<0.029	<0.026	<0.031	<0.028	
Anthracene	0.13	0.53	<0.029	0.22	0.16	0.21	<0.029	0.099	0.17	<0.028	
Benzo[a]anthracene	0.088	1.4	<0.029	0.15	0.18	0.72	<0.029	<0.026	0.12	<0.028	
Benzo[a]pyrene (BAP)	0.11	1.0	<0.029	<0.035	<0.037	0.66	<0.029	<0.026	0.12	<0.028	(11)
Benzo[b+j]fluoranthene	0.14	1.8	<0.029	0.090	0.21	0.62	<0.029	<0.026	0.088	<0.028	
Benzo[g,h,i]perylene	0.098	0.86	<0.029	<0.035	0.14	0.48	<0.029	<0.026	0.13	<0.028	
Benzo[k]fluoranthene	0.16	0.62	<0.029	0.069	0.15	0.38	<0.029	<0.026	0.064	<0.028	
Chrysene	0.26	2	<0.029	0.19	0.32	0.89	<0.029	<0.026	0.11	<0.028	
Dibenzo[a,h]anthracene	<0.056	<0.033	<0.029	<0.035	<0.037	<0.041	<0.029	<0.026	<0.031	<0.028	
Fluoranthene	0.46	2.4	<0.029	0.43	0.51	2.4	<0.029	0.13	0.16	<0.028	
Fluorene	<0.056	<0.033	<0.029	<0.035	<0.037	0.28	<0.029	<0.026	<0.031	<0.028	
Indeno[1,2,3,-c,d]pyrene	0.086	0.74	<0.029	<0.035	0.11	0.42	<0.029	<0.026	0.11	<0.028	
Napthalene	<0.28	1.3	<0.15	0.18	0.36	0.86	<0.15	0.15	0.26	<0.14	(190)
Phenanthrene	0.34	1.5	<0.029	0.64	0.84	1.6	<0.029	0.15	0.37	<0.028	
Pyrene	0.32	3.1	<0.029	0.39	0.34	1.8	<0.029	0.10	0.19	0.03	NA
C7-C9	<17					<13				<8.2	120
C10-C14	<24					<20				<20	(1,500)
C15-C36	590					66				<30	NA
Total petroleum hydrocarbons	610					73				<60	
Benzene										<0.053	3.0
Toluene										<0.053	(94)
Ethylbenzene										<0.053	(180)
m&p-Xylene										0.11	(150)
o-Xylene										<0.053	(150)

Table 15 PAH results for soil samples (1-4m depth)

Sample Name	080821	080823	080828	080830	080831	080949	080950	080951	080952	080953	080954	080955	Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE, 1999) Tier 1 Soil acceptance criteria Commercial/Industrial use ALL PATHWAYS SAND 1m - 4m
Date	11/03/2008	11/03/2008	11/03/2008	11/03/2008	11/03/2008	13/03/2008	13/03/2008	13/03/2008	13/03/2008	13/03/2008	13/03/2008	13/03/2008	
Time	1040	1140	1345	1415	1415	1310	1325	1330	1400	1410	1420	1430	
Lab Number	634664.1	634664.3	634664.8	634664.10	634664.11	634741.1	634741.2	634741.3	634741.4	634741.5	634741.6	634741.7	
Location	Pit 1 SW	Pit 5 SW	Pit 1 SE	Pit 2 SE	Pit 2 SE	Trench 1	Trench 2	Trench 3	Trench 4	Trench 5	Trench 6	Trench 7	
Sample depth (m bgl)	1.5	1.5	1.5	1.2	>1	1	1	1	1	1	1	1.2	
Dry Matter	77	94	77	77	62	92	72	87	80	85	89	92	
Acenaphthene	<0.031	<0.024	<0.029	<0.029	<0.039	<0.025	<0.035	<0.027	<0.029	<0.026	<0.025	<0.025	
Acenaphthylene	<0.031	<0.024	0.062	<0.029	<0.039	0.026	<0.035	<0.027	<0.029	0.11	<0.025	<0.025	
Anthracene	<0.031	0.048	0.071	<0.029	<0.039	0.073	0.067	0.095	<0.029	<0.026	<0.025	<0.025	
Benzo[a]anthracene	<0.031	0.049	0.45	<0.029	<0.039	0.11	0.15	0.094	<0.029	0.11	0.080	<0.025	
Benzo[a]pyrene (BAP)	<0.031	<0.024	0.49	<0.029	<0.039	0.14	0.21	0.12	<0.029	0.22	0.093	<0.025	(25)
Benzo[b+j]fluoranthene	<0.031	0.044	0.48	<0.029	<0.039	0.23	0.40	0.24	<0.029	0.42	0.096	<0.025	
Benzo[g,h,i]perylene	<0.031	<0.024	0.41	<0.029	<0.039	0.15	0.21	0.10	<0.029	0.30	0.14	0.067	
Benzo[k]fluoranthene	<0.031	0.032	0.27	<0.029	<0.039	0.19	0.19	0.17	<0.029	0.25	0.072	<0.025	
Chrysene	<0.031	0.076	0.45	<0.029	<0.039	0.26	0.27	0.21	<0.029	0.20	0.11	<0.025	
Dibenzo[a,h]anthracene	<0.031	<0.024	<0.029	<0.029	<0.039	<0.025	<0.035	<0.027	<0.029	<0.026	<0.025	<0.025	
Fluoranthene	0.045	0.16	1.4	<0.029	<0.039	0.29	0.31	0.28	<0.029	0.35	0.25	0.090	
Fluorene	<0.031	<0.024	<0.029	<0.029	<0.039	<0.025	<0.035	<0.027	<0.029	<0.026	0<0.025	<0.025	
Indeno[1,2,3,-c,d]pyrene	<0.031	<0.024	0.29	<0.029	<0.039	0.093	0.15	0.050	<0.029	0.17	0.048	0.026	
Napthalene	<0.16	<0.12	<0.15	<0.15	<0.20	<0.13	<0.18	<0.14	<0.15	<0.13	<0.13	<0.13	(230)
Phenanthrene	<0.031	0.061	0.20	<0.029	<0.039	0.12	0.076	0.11	<0.029	<0.026	<0.025	<0.025	
Pyrene	0.037	0.12	1.0	<0.029	<0.039	0.23	0.28	0.19	<0.029	0.37	0.20	0.072	NA

Notes for Table 14 & Table 15:
1. Results in mg/kg
2. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons.
3. NA indicates contaminant not limiting as estimated health based criterion is significantly higher that that likely to be encountered on site.

Table 16 Results for groundwater and surface water samples

Sample Name	080648	080649	080650	080651	080652	080653	080679	080680	080681	080682	081283	081284	081285	081286	081287	Australian & NZ Guidelines for Fresh & Marine Water Quality Trigger values for toxicants in freshwater (95% species protection)
Date	25/02/2008	25/02/2008	25/02/2008	25/02/2008	25/02/2008	25/02/2008	26/02/2008	26/02/2008	26/02/2008	26/02/2008	21/04/2008	21/04/2008	21/04/2008	21/04/2008	21/04/2008	
Time	1048	1120	1140	1230	1245	1250	0900	0925	0935	1040	1515	1525	1545	1600	1615	
Lab Number	632057.1	632057.2	632057.3	632057.4	632057.5	632057.6	632062.1	632062.2	632062.3	632062.4	639603.1	639603.2	639603.3	639603.4	639603.5	
Location	Patea River background	Surface flow from freezers	Seep from freezers	SE drain	Fellmongery drain	Bar screen drain	Patea River background	SW drain	Stockyard drain	Seep from trench	MW1	MW2	MW3	MW4	MW5 background	
pH	8	7.3	6.7	7.9	8.1	7.2	7.9	8.1	7.3	7.1						
Total Aluminium	**1.1**	<0.063	**0.18**	**1.4**	**0.30**	<0.063										0.055
Total Antimony	<0.0053	0.0067	<0.0053	<0.0053	<0.0053	0.012										-
Total Arsenic	<0.021	<0.021	0.026	<0.021	<0.021	0.085										0.024
Total Boron	**3.9**	**2.5**	**3.8**	<0.11	<0.11	**2.7**										0.37
Total Cadmium	<0.0011	**0.0036**	<0.0011	<0.0011	<0.0011	**0.0074**										0.0002
Total Chromium	<0.011	<0.011	<0.011	<0.011	<0.011	**0.11**										0.001
Total Cobalt	<0.0042	0.013	0.0074	<0.0042	<0.0042	0.010										-
Total Copper	<0.011	**0.025**	**0.013**	<0.011	<0.011	**0.030**										0.0014
Total Iron	1.6	<0.42	1.2	6.3	3.1	0.55										-
Total Lead	<0.0021	0.0023	0.0030	0.0034	0.0022	**0.0078**										0.0034
Total Lithium	0.17	0.12	0.12	0.0072	0.0089	0.11										-
Total Manganese	0.036	1.5	1.9	0.21	0.14	0.84										1.9
Total Molybdenum	0.011	0.012	0.0059	<0.0042	<0.0042	0.0065										-
Total Nickel	0.011	0.017	0.015	<0.011	<0.011	0.021										0.11
Total Tin	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011										-
Total Vanadium	<0.021	<0.021	<0.021	0.023	<0.021	<0.021										-
Total Zinc	<0.021	**0.51**	**0.19**	**0.037**	<0.021	**2.5**										0.008
Dissolved Arsenic							<0.020	<0.0010	<0.060	<0.020	<0.020	<0.0050	<0.0010	0.0012	0.0019	0.024
Dissolved Cadmium							<0.00050	<0.000050	**0.0039**	**0.0038**	<0.0010	<0.00025	<0.000050	<0.000050	<0.000050	0.0002
Dissolved Chromium							<0.0020	<0.00050	**0.042**	**0.013**	<0.010	<0.0025	<0.00050	<0.00050	<0.00050	0.001
Dissolved Copper							<0.0020	<0.00050	**0.013**	**0.014**	<0.010	<0.0025	0.0021	<0.00050	0.0013	0.0014
Dissolved Lead							<0.0010	<0.00010	**0.0075**	0.0033	<0.0020	**0.0038**	<0.00010	<0.00010	0.00016	0.0034
Dissolved Nickel							<0.010	<0.00050	<0.010	<0.010	<0.010	<0.0025	<0.00050	<0.00050	0.0019	0.11
Dissolved Zinc							<0.0040	**0.033**	**0.81**	**1.9**	<0.020	**0.014**	**0.013**	<0.0010	0.0031	0.008
Acenaphthene	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	0.000017	<0.00010	<0.00010	<0.00010	0.00011	<0.00010		<0.00010	<0.00010	<0.00010	
Acenaphthylene	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	0.000067	<0.00010	<0.00010	<0.00010	0.00045	<0.00010		<0.00010	<0.00010	<0.00010	
Anthracene	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	0.000017	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010	
Benzo[a]anthracene	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010	
Benzo[a]pyrene (BAP)	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010	
Benzo[b+j]fluoranthene	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010	
Benzo[g,h,i]perylene	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010	
Benzo[k]fluoranthene	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010	
Chrysene	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010	
Dibenzo[a,h]anthracene	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010	
Fluoranthene	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	0.000055	<0.00010	<0.00010	<0.00010	0.00011	<0.00010		<0.00010	<0.00010	<0.00010	
Fluorene	<0.000008	0.00002	<0.000008	<0.000008	<0.000008	0.000038	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020		<0.00020	<0.00020	<0.00020	
Indeno[1,2,3,-c,d]pyrene	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010	
Napthalene	<0.000040	<0.000040	<0.000040	<0.000040	<0.000040	<0.000040	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050		<0.00050	<0.00050	<0.00050	0.016
Phenanthrene	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	<0.00040	<0.00040	<0.00040	<0.00040	0.00059		<0.00040	<0.00040	<0.00040	
Pyrene	<0.000008	<0.000008	<0.000008	<0.000008	<0.000008	0.000024	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020		<0.00020	<0.00020	<0.00020	
C7-C9	<0.10	<0.10	<0.10	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	
C10-C14	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	
C15-C36	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	
Total petroleum hydrocarbons	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	

Notes:
1. Results in g/m^3
2. Exceedances in bold type

Figure 8 Aerial photograph of sampling locations

(included as a separate file in electronic versions of this report)

10. Site characterisation

10.1 Soil and groundwater

Soil sampling was concentrated on the area of fill adjacent to the estuary, which had been used for the disposal of waste materials from the site. Of particular interest was the dumping of ash and clinker from the early period when the boilers were coal fired, prior to fuel oil and then gas. Many of these samples had elevated (above background) concentrations of metals and a few also had elevated concentrations of PAH. However, none of the results exceeded the selected guideline values for commercial/industrial land use.

The two groundwater samples from existing site bores met the drinking water standards for heavy metals. Results from the monitoring wells were compared to the guideline values for the protection of aquatic ecosystems on the assumption that groundwater discharges to the adjacent estuary. This is a conservative approach, as some attenuation will occur between the sampling and discharge points to the estuary. Furthermore, there is a large dilution factor/regular flushing of the receiving environment from tidal movement. In general, most results complied with the 95% species protection values and indicate minimal risk to the aquatic environment of the estuary.

10.2 Surface water

Surface water discharges from the site directly to the estuary, there is not a significant risk to human health and so the results were compared to the guideline values for the protection of aquatic ecosystems. Once again, this is considered a conservative approach given the effects of dilution and mixing of the receiving environment from tidal movement. All discharge samples exceeded receiving environment guideline values (95% protection) for at least one metal. However, it is expected that the concentrations of these metals in site discharges should reduce once the site has been cleaned up. TPH and PAH concentrations in the discharge were generally below the limits of detection. A survey of the estuary mudflats bordering the site by a Council marine ecologist has shown healthy numbers of plants, birds, crabs and snails typically found in this type of environment. Discharges from the site are not considered to be having an adverse effect on the estuary or the Patea River.

10.3 Asbestos

The results for asbestos indicate that the distribution of asbestos is widespread across the site buildings and within ash from the fire. However, the level of risk associated with asbestos on the site is considered to be minimal, as it is contained within buildings, intact building materials and by the polymer sealant. Asbestos cleaned up from McColl's property will be sealed in the reservoir. Furthermore, air quality sampling in the vicinity of the plant and within the Patea township has shown no asbestos to be present at limits of detection as expressed.

10.4 Other contamination issues

Elevated levels of metals in the samples of dust/debris from the floor of rooms within the factory buildings are not considered to pose a significant risk, povided that these materials are appropriately disposed of as part of any cleanup and that workers use correct procedures.

Some electrical equipment containing PCBs remain on the site, as they could not be safely removed for disposal. This includes numerous small wall-mounted units present in some of the buildings, fire damaged equipment, and areas that were too dangerous to enter.

11. Conclusions and recommendations

Summary of findings

The Preliminary Site Inspection Report (submitted to the Ministry for the Environment by the Taranaki Regional Council in July 2007 as supporting documentation for CSRF) identified that potential contaminants of concern at the Patea Freezing Works site could include:

- Asbestos from insulation, lagging and building materials
- Total petroleum hydrocarbons [TPH] from the presence of underground fuel storage tanks
- Heavy metals and polycyclic aromatic hydrocarbons [PAH], due to the onsite disposal of ash and clinker from the coal-fired boilers.

The Detailed Site Investigation now reported, involved a number of on-site and off-site inspections and surveys, consultation with specialists and experts, throughout the study to ensure it was completed in a robust and defensible manner, and the collection of 101 samples, including ash, dust/debris, road seal, groundwater, surface water and soil. Samples were analysed at accredited laboratories for the contaminants most likely to be present in each type of media. Several remedial actions were conducted during the site investigation and assessment, when deemed necessary because of the degree of imminent risk posed if situations were left unaddressed. During the investigation, a fire seriously damaged buildings on the site. This both delayed the programme and necessitated a review of the scope, with sampling of ash and airborne asbestos added.

Site maps and aerial photographs are attached to this report for the information of readers.

Ash

Twelve samples were collected in a grid pattern covering the area of fire damage from the location of the Freezing and Cold Storage Buildings (completely destroyed in the fire), and analysed for asbestos. In six of the samples no asbestos was detected, the remaining six had varying levels of chrysotile asbestos (up to 20%). This area has been treated with a polymer binder to prevent asbestos becoming airborne and consequently does not represent a hazard while the integrity of the binder is maintained. The Taranaki Regional Council has conducted air quality sampling consisting to date of five sampling runs each at twelve sites in the vicinity of the plant and within the Patea township, that have confirmed the efficacy of this interim control measure for protecting residents' health. However, suitable controls will need to be established prior to any cleanup. The ash binder is considered to have a life expectancy of less than twelve months. It disintegrates upon exposure to sunlight.

Dust/debris

Seven samples of dust/debris were collected from the floor of rooms within selected buildings left standing after the fire, and analysed for asbestos and heavy metals. No asbestos was detected outside the Fellmongery switch room or in a room adjacent to the Slaughterhouse. The Tallow House, Dry Rendering and Casings Floor showed only chrysotile asbestos (typical of asbestos sheeting) and the Boiler House and Paint Mixing room showed both chrysotile and amosite asbestos (typical of lagging asbestos usage). (Note: most if not all, of the lagging on the site consists of rockwool,

a glass-based insulation material containing no asbestos but still requiring some degree of care in its handling.)

These samples all had elevated levels of metals, particularly arsenic, copper, lead (probably ex paint) and zinc (probably ex galvanizing). Arsenic and lead represent the greatest risk to human health. However, it is expected that these materials (both the dusts, and their sources such as linings/claddings) would be disposed of as part of any cleanup of the on-site materials, and therefore are unlikely to pose a problem for future site use. If correct procedures are followed then workers' exposure during cleanup should be low and the detected concentrations should be no cause for concern. However, this material will need to be disposed of appropriately.

Road seal

Nine samples were collected from sealed areas and tested for PAH. The results were much lower than if the seal contained coal tar, therefore it can be assumed that the seal is bitumen-based (as is commonplace for all roading throughout New Zealand).

Groundwater

Two existing wells on the site which are in excess of 50 metres deep were sampled. The results for heavy metals were below the relevant guideline values for human or ecological health (even without allowing for subsequent dilution upon entry into surface watercourses in the case of the latter). The town is serviced by municipal water supply and there are no known water abstractions on site nor is it considered likely there would be.

Four monitoring wells were installed along the factory frontage adjacent to the estuary, from the south west corner, to in front of the Boiler House. These wells were located across the site along a line roughly perpendicular to the groundwater flow direction and as close to the estuary as practicable (ie on the downslope side of the site and intercepting flow paths). A background/baseline well was also installed at the rear of the factory on the north side of the main entrance road (upflow side). One sample was collected from each well after purging. Samples were analysed for heavy metals, TPH and PAH to assess contamination from the fill and the Fire Station fuel tank pit (refer below).

Results were compared to the guideline values for the protection of aquatic ecosystems on the assumption that groundwater discharges to the adjacent estuary. This is a conservative approach, as some attenuation will occur between the sampling and discharge points to the estuary. Furthermore, there is a large dilution factor/regular flushing of the receiving environment from tidal movement. In general, most results complied with the 95% species protection values and indicate minimal risk to the aquatic environment of the estuary.

Surface water

Surface water from the site drains to the estuary, and then into the Patea River. Irrigation of fire damaged areas of the site was undertaken to extinguish the fire and residual 'hotspots' and then to minimise the risk of asbestos becoming airborne. This activity may have some influence on the surface water quality investigation results, particularly those from the western half of the site. Springs originating at the base of cliffs on the eastern boundary are the main source of surface water on the eastern side of the site.

Surface water samples were collected from drains and surface flow. A total of 10 samples were collected, including background samples from the Patea River for comparative purposes. These samples were analysed for metals, TPH and PAH. As this water discharges from the site directly to the estuary, there is not a significant risk to human health and so the results were compared to the guideline values for the protection of aquatic ecosystems. Once again, this is considered a conservative approach given the effects of dilution and mixing of the receiving environment from tidal movement. All discharge samples exceeded receiving environment guideline values (95% protection) for at least one metal. It is expected that the concentrations of these metals in site discharges should reduce once the site has been cleaned up. TPH and PAH concentrations in the discharge were below guideline values for the receiving environment. A survey of the estuary mudflats bordering the site by a Council marine ecologist has shown healthy numbers of plants, birds, crabs and snails typically found in this type of environment and the Patea River. Discharges from the site are not considered to be having an adverse effect on the estuary.

Soil

Soil sampling was concentrated on the area of fill adjacent to the estuary, which had been used for the disposal of waste materials from the site. Of particular interest was the dumping of ash and clinker from the early period when the boilers were coal fired, prior to fuel oil and then gas. In the trench, a band of dark material approximately 100 mm thick, was present at a depth of around 1 m, along almost the entire length. Samples of this material were collected and in most of them clinker from the boilers was present.

Test pits excavated on terraces in the south east and south west corners of the site revealed the presence of fill from just below the surface to over 3 metres depth. As the investigation was focusing on deposits of ash and clinker, samples were collected from any areas of darker material. A total of 18 samples were collected and analysed for heavy metals and PAH.

Many of these samples had elevated (above background) concentrations of metals and a few also had elevated concentrations of PAH. These areas of the site are unsuitable for residential development because they exceed the residential guidelines, but options such as industrial, passive recreational or residential (following remediation) land use, could well be suitable. These options are however not explored further in this report, and the Council is not endorsing or advocating any particular land usage.

Assumptions

Knowledge of the site has been gathered from historical aerial photographs, records, site inspections by Council staff and the Council's advisors, and most importantly from interviews with former works staff. This information has guided the design of the site assessment including choice of analyses. Neither the information gathered, nor the analyses undertaken, indicate that there were other unidentified activities involving hazardous materials carried out on the site, nor that activities of key significance to this investigation were missed or mis-located. However, given the size of the site, this cannot be guaranteed.

Further, while site sampling was conducted with the application of professional judgment as being representative of the overall condition of the site, the possibility

cannot be excluded that there are undetected 'hotspots' or unidentified chemicals that the assessment has not revealed.

Remedial actions

Area affected by the fire

There is significant asbestos contamination on this part of the site, currently controlled through the application of the polymer membrane. This area will need to be remediated prior to the degradation of the polymer (ie within twelve months, more or less). It is anticipated that the contamination on this part of the site will need to be removed, or encapsulated on site. Remedial plans are yet to be developed. Prior to these works being undertaken a health and safety plan will need to be developed, and approved by the Ministry of Health and Department of Labour [DoL].

McColl's property

The fire completely destroyed all except one of the buildings on Noel McColl's property immediately west of the main factory. One half of the storage shed remained standing. Fire damage resulted in widespread asbestos contamination of the area. Following the appropriate approvals from DoL, a cleanup was conducted by Noel McColl under the supervision of a certified asbestos expert. This involved the demolition of severely fire damaged buildings, the removal of steel for recycling, and scraping up of all debris (capturing all asbestos). This material was placed in the Main Reservoir, which was pumped out of water during the fire and identified by the Council as a suitable structure for long term containment. Based on its observed water retention, the Council believes the reservoir to be impervious and structurally sound, and therefore a suitable secure long-term containment facility. It does not have the capacity to become a depository for all wastes and debris from the fire, and is in private ownership so access cannot be assumed in any case.

Underground storage tanks

The Council engaged contractors to remove three underground fuel storage tanks known to have been on the site. Two tanks were removed and are to be recycled for scrap metal, and a small amount of contaminated bedding material was removed from the tank pits, which were backfilled with clean soil. The third tank was not located having previously been removed, however the area was heavily contaminated with what appeared to be petrol residues, and approximately 100 cubic metres of soil was excavated. This soil was stockpiled along with bedding material from the other tank pits and some used to absorb fuel oil which had leaked from a pipe to the Boiler House. The stockpile was turned, to aid in degradation of the hydrocarbons, and after three weeks a composite sample was analysed. The results showed that hydrocarbon levels had reduced to within guideline values, allowing it to be appropriately placed in the Main Reservoir. Results from the sampling of all three tanks pits following the removal of contaminated soil, were below the relevant guideline values.

Chemicals

Council Officers located and removed one drum's volume (294 kg gross) of polychlorinated biphenyl [PCB] containing equipment, which was subsequently disposed of by Transpacific Technical Services. Some PCB equipment could not be safely removed for disposal, including numerous small wall-mounted units present

in some of the buildings, fire damaged equipment, and areas that were too dangerous to enter. The quantity remaining would be similar to or less than that removed.

The New Zealand Fire Service removed three drums containing a small amount of oil from buildings on the site. Two drums containing sodium nitrate were moved outside of buildings and filled with water to dissolve the chemical. One severely corroded drum of nitric acid was punctured, allowing the acid to neutralise while reacting with the concrete floor. It was then diluted with approximately 2,000 litres of water. These activities were conducted in a manner which did not result in any adverse environmental effects. No further action is required in respect of these drums.

Suitability for land use

The current land uses on the site are agricultural (cattle grazing on grassed areas-McColls) and vacant commercial/industrial. The results of chemical analysis for all samples except surface water discharging from the site, are below (ie they satisfy) the relevant guideline values for the current land uses. Access to the site is restricted for health and safety reasons due to the presence of asbestos (presently contained by the polymer binder) and the extreme danger posed by fire damaged and collapsing buildings.

Attached to this report is a site remediation proposal provided for indicative information purposes. The Council has not reviewed this proposal nor does it have any view on the environmental adequacy of the proposal.

Recommendations

In summary, surface water discharging from the site has concentrations of metals which exceed the guideline values for 95% protection of aquatic ecosystems. These concentrations should reduce once the site has been cleaned up, and in any case do not currently appear to be causing any adverse effects on the receiving environments i.e. estuary or the Patea River. With the exception of asbestos, the concentrations of all on site contaminants are below the relevant guideline values. The risk from asbestos is currently minimised by the restriction of access to the site and the polymer binder applied to fire damaged areas. Some electrical equipment containing PCBs remain on the site.

The Taranaki Regional Council recommends that any further work on the site focus on the safe removal and disposal of asbestos and electrical equipment containing PCBs. A proposal for the removal of asbestos, demolition and reinstatement of the site has been included in this report. Consideration by the current landowners, of this proposal and the contents of this report are required prior to making recommendations regarding the future use of the site.

This report has been prepared by staff of the Taranaki Regional Council. The conclusions and recommendations section of this report has been peer-reviewed by Graeme Proffitt (Director), of Pattle Delamore Partners Limited. The Taranaki Regional Council is happy to discuss any matters presented in this report. Contacts: Gary Bedford (Director-Environment Quality) or Shane Reynolds (Scientific Officer).

Bibliography and references

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