

BTW Company Ltd
Wellington Landfarm
Annual Report
2016-2017

Technical Report 2017-09

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Executive summary

BTW Company Ltd (the Company) operates a landfarm (Wellington Landfarm) located on Brown Road, Waitara, in the Waitara catchment. The consent held by the Company allowed for the discharge of wastes from hydrocarbon exploration, well work-over, production and storage activities, onto and into land via landfarming.

This report for the period July 2016 to June 2017 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the Company's environmental and consent compliance performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of the Company's activities.

The Company holds one resource consent, which includes a total of 31 conditions setting out the requirements that the Company must satisfy.

During the monitoring period, the Company demonstrated an overall Good level of environmental performance.

The Council's monitoring programme for the year under review included six inspections, 17 water samples and four composite soil samples collected for physicochemical analysis.

The monitoring indicated, in similarity to the previous monitoring period, that the groundwater in the immediate vicinity of the former storage cell area is still impacted by elevated salinity concentrations and trace benzene. The saline plume has been observed through monitoring to be migrating slowly northwards. The down gradient bore had detailed an elevation in saline parameters as well as trace benzene. At the same time, the up gradient bore had indicated a slight decrease in salinity concentration, monitoring indicated that the saline peak occurred in the previous monitoring period (2015-2016).

As in previous monitoring years, the Council will continue to monitor these parameters in the groundwater. Of note, there are likely to be no significant adverse effects due to the elevated salinity in the groundwater or the trace benzene, as the analytes detail concentrations below MfE guidelines for stock watering.

In terms of the soils, area F18 as defined in the previous monitoring period is now within surrender criteria while area F12 is not. F12 will continue to be monitored for mid range (C₁₀-C₁₄) and heavy range (C₁₅-C₃₆) hydrocarbons, which remain above their conditional value for surrender.

During the year, the Company demonstrated a good level of environmental and a high level of administrative performance with the resource consents.

For reference, in the 2016-2017 year, consent holders were found to achieve a high level of environmental performance and compliance for 74% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 21% of the consents, a good level of environmental performance and compliance was achieved.

In terms of overall environmental and compliance performance by the consent holder over the last several years, this report shows that the consent holder's performance remains at a good level in the year under review.

This report includes recommendations for the 2017-2018 year.

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1. Introduction

1.1. Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1. Introduction

This report is for the period July 2016 to June 2017 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by BTW Company Ltd (The Company). The Company operates a landfarm (Wellington Landfarm) situated on Brown Road, Waitara, in the Waitara catchment.

The Wellington Landfarm was the second site in this area. The first at Brown Road began stockpiling in 2006 and was surrendered in the 2013-2014 monitoring period. The Wellington Landfarm started in the 2010-2011 monitoring year; it was an expansion of the then operational Brown Road landfarm. During the 2010-2011 monitoring year the Wellington site became the primary disposal site for the Company.

During 2011-2012, the Council required the Company to apply for additional resource consent to explicitly provide for the disposal of well work-over and production fluids, including hydraulic fracturing return fluids. This consent (7884-1) was granted on 8 July 2011. The landfarm extension was utilised for the remainder of the monitoring period to dispose of several different types of hydrocarbon exploration and production waste, in accordance with the latest consent. The initial consent (7670-1) for the Wellington area was subsequently surrendered during the 2011-2012 monitoring year as surrender criteria were deemed to have been satisfied, and all further activities were covered under the new consent.

Activity at the site in terms of deliveries of landfarmable material ceased during the 2013-2014 period. The site had since moved into a monitoring stage, whereby material, post application and incorporation will slowly bioremediate. The Company and the Council have both monitored the degree of the bio remediation at this facility.

During the 2014-2015 period, further areas of the site met the surrender criteria and the Company applied for a change of conditions to the consent. Post partial surrender of the site, two areas remained above the required surrender criteria, these areas (F12 and F18), formed the basis for monitoring in the previous monitoring period, 2015-2016.

In the 2015-2016 monitoring period, soil analysis of area F18 indicated compliance with its specific surrender criteria and further analysis of this area was not required in this monitoring year. Subsequently, area F12 is the final area to meet surrender criteria and formed the basis for soil monitoring this period.

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consent held by the Company that relate to discharges of waste from hydrocarbon exploration, well work over, production and storage activities onto and into land via landfarming within the Waitara catchment.

One of the intents of the *Resource Management Act 1991* (RMA) is that environmental management should be integrated across all media, so that a consent holder's use of water, air, and land should be considered from a single comprehensive environmental perspective. Accordingly, the Council generally implements integrated environmental monitoring programmes and reports the results of the programmes jointly. This report discusses the environmental effects of the Company's use of land and is the fifth annual report by the Council for the Company.

1.1.2. Structure of this report

Section 1 of this report is a background section. It sets out general information about:

- consent compliance monitoring under the RMA and the Council's obligations;
- the Council's approach to monitoring sites through annual programmes;
- the resource consents held by the Company/companies in the Waitara catchment;
- the nature of the monitoring programme in place for the period under review; and
- a description of the activities and operations conducted in the Company's site.

Section 2 presents the results of monitoring during the period under review, including scientific and technical data.

Section 3 discusses the results, their interpretations, and their significance for the environment.

Section 4 presents recommendations to be implemented in the 2017-2018 monitoring year.

A glossary of common abbreviations and scientific terms, and a bibliography, are presented at the end of the report.

1.1.3. The Resource Management Act 1991 and monitoring

The RMA primarily addresses environmental 'effects' which are defined as positive or adverse, temporary or permanent, past, present or future, or cumulative. Effects may arise in relation to:

- a. the neighbourhood or the wider community around an activity, and may include cultural and social-economic effects;
- b. physical effects on the locality, including landscape, amenity and visual effects;
- c. ecosystems, including effects on plants, animals, or habitats, whether aquatic or terrestrial;
- d. natural and physical resources having special significance (for example recreational, cultural, or aesthetic); and
- e. risks to the neighbourhood or environment.

In drafting and reviewing conditions on discharge permits, and in implementing monitoring programmes, the Council is recognising the comprehensive meaning of 'effects' inasmuch as is appropriate for each activity. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the RMA to assess the effects of the exercise of consents. In accordance with Section 35 of the RMA, the Council undertakes compliance monitoring for consents and rules in regional plans, and maintains an overview of the performance of resource users and consent holders. Compliance monitoring, including both activity and impact monitoring, enables the Council to continually re-evaluate its approach and that of consent holders to resource management and, ultimately, through the refinement of methods and considered responsible resource utilisation, to move closer to achieving sustainable development of the region's resources.

1.1.4. Evaluation of environmental and administrative performance

Besides discussing the various details of the performance and extent of compliance by the Company, this report also assigns them a rating for their environmental and administrative performance during the period under review.

Environmental performance is concerned with actual or likely effects on the receiving environment from the activities during the monitoring year. Administrative performance is concerned with the Company's

approach to demonstrating consent compliance in site operations and management including the timely provision of information to Council (such as contingency plans and water take data) in accordance with consent conditions.

Events that were beyond the control of the consent holder and unforeseeable (that is a defence under the provisions of the RMA can be established) may be excluded with regard to the performance rating applied. For example loss of data due to a flood destroying deployed field equipment.

The categories used by the Council for this monitoring period, and their interpretation, are as follows:

Environmental Performance

High: No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment. The Council did not record any verified unauthorised incidents involving significant environmental impacts and was not obliged to issue any abatement notices or infringement notices in relation to such impacts.

Good: Likely or actual adverse effects of activities on the receiving environment were negligible or minor at most. There were some such issues noted during monitoring, from self reports, or in response to unauthorised incident reports, but these items were not critical, and follow-up inspections showed they have been dealt with. These minor issues were resolved positively, co-operatively, and quickly. The Council was not obliged to issue any abatement notices or infringement notices in relation to the minor non-compliant effects; however abatement notices may have been issued to mitigate an identified potential for an environmental effect to occur.

For example:

- High suspended solid values recorded in discharge samples, however the discharge was to land or to receiving waters that were in high flow at the time;
- Strong odour beyond boundary but no residential properties or other recipient nearby.

Improvement required: Likely or actual adverse effects of activities on the receiving environment were more than minor, but not substantial. There were some issues noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent minor non-compliant activity could elevate a minor issue to this level. Abatement notices and infringement notices may have been issued in respect of effects.

Poor: Likely or actual adverse effects of activities on the receiving environment were significant. There were some items noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent moderate non-compliant activity could elevate an 'improvement required' issue to this level. Typically there were grounds for either a prosecution or an infringement notice in respect of effects.

Administrative performance

High: The administrative requirements of the resource consents were met, or any failure to do this had trivial consequences and were addressed promptly and co-operatively.

Good: Perhaps some administrative requirements of the resource consents were not met at a particular time, however this was addressed without repeated interventions from the Council staff. Alternatively adequate reason was provided for matters such as the no or late provision of information, interpretation of 'best practical option' for avoiding potential effects, etc.

Improvement required: Repeated interventions to meet the administrative requirements of the resource consents were made by Council staff. These matters took some time to resolve, or remained

unresolved at the end of the period under review. The Council may have issued an abatement notice to attain compliance.

Poor: Material failings to meet the administrative requirements of the resource consents. Significant intervention by the Council was required. Typically there were grounds for an infringement notice.

For reference, in the 2016-2017 year, consent holders were found to achieve a high level of environmental performance and compliance for 74% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 21% of the consents, a good level of environmental performance and compliance was achieved.

1.2. Process description

1.2.1. Hydrocarbon exploration and production wastes management

For the purposes of disposal to land, waste from the petroleum industry can be divided into two broad categories; exploration (drilling) wastes, and production wastes.

1.2.1.1. Exploration wastes

Drilling wastes

Waste drilling material is produced during well drilling for hydrocarbon exploration. The primary components of this waste are drilling fluids (muds) and rock cuttings. Drilling fluids are engineered to perform several crucial tasks in the drilling of a hydrocarbon well. These include: transporting cuttings from the drill bit to the well surface for disposal; controlling hydrostatic pressure in the well; supporting the sides of the hole and preventing the ingress of formation fluids; and lubricating and cooling the drill bit and drill pipe in the hole.

Drilling fluids

Oil and gas wells may be drilled with either synthetic based mud (SBM) or water based mud (WBM). As the names suggest, these are fluids with either water (fresh or saline) or synthetic oil as a base material, to which further compounds are added to modify the physical characteristics of the mud (for example mud weight or viscosity). More than one type of fluid may be used to drill an individual well. In the past, oil based muds (diesel/crude oil based) have also been used. Their use has declined since the 1980s due to their ecotoxicity; they have been replaced by SBM. SBM use olefins, paraffins or esters as a base material. While this is technically still a form of oil based fluid, these fluids have been engineered to remove polycyclic aromatic hydrocarbons, reduce the potential for bioaccumulation and accelerate biodegradation compared with OBM.

Common constituents of WBM and SBM include weighting agents, viscosifiers, thinners, lost circulation materials (LCM), pH control additives, dispersants, corrosion inhibitors, bactericides, filtrate reducers, flocculants and lubricants. Of these, the naturally occurring clay mineral barite (barium sulphate) is generally the most common additive. It is added to most drilling muds as a wetting and weighting agent.

Drilling fluids are normally recovered from return flows during the drilling of a well, for re-use after separation from rock cuttings. They may be intentionally discharged in bulk for changes to the drilling fluid programme or at the completion of drilling. Depending on operational requirements and fluid type and properties, fluids may be re-used in multiple wells.

Cuttings

Cuttings are produced as the drill bit penetrates the underlying geological formations. They are brought to the surface in the drilling fluid where they pass over a shaker screen that separates the cuttings and drilling fluids. The drilling fluids are recycled for reuse within the drilling process, but small quantities of drilling

fluids remain adhered to the cuttings. The cuttings and smaller particle material from the drill fluid treatment units drain into sumps. If sumps cannot be constructed corrals or special bins are used. During drilling this material is the only continuous discharge.

1.2.1.2. Production wastes

Produced water

Produced water is subsurface water brought to the surface with oil and gas during the production of a well. It is primarily highly saline water, but its chemistry is altered through direct contact with geological formations and hydrocarbon reservoirs. The physical and chemical properties of produced water vary considerably depending on the geographic location of the field, geological formations, and the type of hydrocarbon product being produced.

Produced water is typically disposed of using deep well injection or similar disposal methods, but fixed quantities have on occasion been disposed of to land following evaluation of chemical concentrations.

Fracturing return fluids

Water and sand (proppant) make up 98% to 99.5% of the fluid used in hydraulic fracturing. In addition, chemical additives are used. The exact formulation varies depending on the well. Chemicals serve many functions in hydraulic fracturing. From limiting the growth of bacteria to preventing corrosion of the well casing, chemicals are needed to ensure that the fracturing job is effective and efficient.

The number of chemical additives used in a typical fracture treatment depends on the conditions of the specific well being fractured. A typical fracture treatment will use very low concentrations of between 3 and 12 additive chemicals, depending on the characteristics of the water and the tight sand/shale formations being fractured. Each component serves a specific, engineered purpose. For example, the predominant fluids currently being used for fracture treatments in the gas shale plays are water-based fracturing fluids mixed with friction-reducing additives (called slickwater). The addition of friction reducers allows fracturing fluids and sand, or other solid materials called proppants, to be pumped to the target zone at a higher rate and reduced pressure than if water alone were used.

In addition to friction reducers, other additives include: biocides to prevent microorganism growth which can interfere with the gel management system, and to reduce biofouling of the fractures and the production of sour gas; oxygen scavengers and other stabilisers to prevent corrosion of metal pipes; and sometimes used acids that are used to remove drilling mud damage within the near-wellbore area. These fluids are used to create the fractures in the formation and to carry a propping agent (typically silica sand), which is deposited in the induced fractures to keep them from closing up.

The fracturing fluids disposed of to land through landfarming in Taranaki have been return fluids following the completion of hydraulic fracturing jobs. The make-up of these fluids is altered during the fracturing process as these fluids interact with hydrocarbon reservoirs and varying geological formations. This material is tested for an extensive range of contaminants prior to storage and subsequent disposal.

Fracturing fluids are disposed of in Taranaki via deep well re-injection. The discharge to land through landfarming of return fluids following the completion of hydraulic fracturing jobs in Taranaki had been explicitly consented only at the Wellington landfarm.

1.2.2. Landfarming process description

The landfarming process has typically been used in the Taranaki region to assist the conversion of sandy coastal sites prone to erosion into productive pasture. Landfarming is a technology that uses natural and assisted bioremediation to reduce the concentration of petroleum compounds through degradation, while simultaneously utilising the drilling muds to stabilise poor quality sandy soils for subsequent land use.

Results of an independent research project conducted by AgKnowledge Ltd (2013) have indicated that the re-contoured sand dunes, after the inclusion of the drilling wastes (as per the consents), and with the addition of appropriate fertilisers and water (irrigation) are capable of producing high quality clover-based pastures and thus increasing the value of the land from about \$3-4,000/ha to \$30-40,000/ha (2013).



Photo 1 An example of a landfarmed area Wellington landfarm 2013

The landfarming process utilised at this facility is on a single application basis. This means dedicated spreading areas receive only single applications of waste. Basic steps in the landfarming process include:

1. Waste is transported from wellsites. It may be discharged directly to land or placed in a dedicated storage pit.
2. The required area is prepared by scraping back and stockpiling existing pasture/topsoil and levelling out uneven ground.
3. Waste is transferred to the prepared area by excavator and truck and spread out with a bulldozer. Liquids may be discharged by tanker or a spray system.
4. Waste is allowed to dry sufficiently before being tilled into the soil to the required depth with a tractor and discs.
5. The disposal area is levelled with chains or harrows.
6. Stockpiled or brought in topsoil/clay is applied to aid stability and assist in grass establishment.
7. Fertiliser may be applied and the area is sown in crop or pasture at a suitable time of year, to re-instate and stabilise the site for future alternative use.

Consent 7884-1.1 allowed for the disposal of drilling wastes, oily wastes, contaminated soil, and production fluids including hydraulic fracturing return fluids.

When disposal is complete, the area is re-instated and the consents surrendered once proven to be suitable for uses such as grazing, following stabilisation and re-grassing. It is proven by providing analytical evidence which will satisfy the specific consented conditions that dictate the acceptable level of certain contaminants in the soil.

1.2.3. Site description

The Wellington Landfarm is located on Brown Road, Waitara, on marginal coastal farm land situated on reworked dune fields. The predominant soil type has been identified as black loamy sand. Vegetation growth is primarily a mixture of pasture and dune grasses. Prior to the Wellington property consents (7670-1, 7884-1) being exercised there were areas of pine which have been subsequently removed and processed.

Average annual rainfall for the site is 1,383 mm (taken from nearby Motunui monitoring station). There are no significant surface water bodies located in the immediate vicinity of the areas that are landfarmed, other than small farm drains. Previous land use at the Wellington section of the landfarm has been a mixture of agriculture and small scale forestry. Further inland there are a number of commercial chicken sheds; one is located on the site (Figure 1).



Figure 1 Wellington Landfarm with associated monitoring locations

Site data

Location	
Word descriptor:	Brown Road, Waitara, Taranaki
Map reference:	E 1704599
(NZTM)	N 5683484
Mean annual rainfall:	1383 mm
Mean annual soil temperature:	~14.05°C
Mean annual soil moisture:	~33.06%
Elevation:	~10 m asl
Geomorphic position:	Dune backslope
Erosion / deposition:	Erosion
Vegetation:	Pasture, dune grasses
Parent material:	Aeolian deposit

Drainage class:	Free / well draining
Land use:	Active disposal (previously forestry)

1.3. Resource consents

1.3.1. Discharges of wastes to land

Sections 15(1)(b) and (d) of the RMA stipulate that no person may discharge any contaminant onto land if it may then enter water, or from any industrial or trade premises onto land under any circumstances, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations.

The Company holds discharge permit **7884-1.1** to cover the discharge of wastes from hydrocarbon exploration drilling operations with water based muds and synthetic based muds, and oily wastes from hydrocarbon exploration and production activities, condensate storage tank wastewater, and well work-over fluids (which includes fracturing fluids) onto and into land via land farming. This permit was issued by the Council on 8 July 2011 under Section 87(e) of the RMA. It is due to expire on 1 June 2027.

There are 30 special conditions attached to the consent.

- Conditions 1 to 3 deal with definitions, best practicable option and wastes to be discharged.
- Conditions 4 to 9 deal with notifications, monitoring and reporting.
- Conditions 10 to 12 relate to storage of wastes.
- Conditions 13 to 21 deal with discharge limits.
- Conditions 22 and 23 set limits on contaminants in receiving waters.
- Conditions 24 to 28 deal with contaminants in soil.
- Condition 29 relates to any archaeological remains found.
- Conditions 30 and 31 deal with lapse and review of the consent.

The permit is attached to this report in Appendix I.

This summary of consent conditions may not reflect the full requirements of each condition. The consent conditions in full can be found in the resource consent which is appended to this report.

1.4. Monitoring programme

1.4.1. Introduction

Section 35 of the RMA sets obligations upon the Council to gather information, monitor and conduct research on the exercise of resource consents within the Taranaki region. The Council is also required to assess the effects arising from the exercising of these consents and report upon them.

The Council may therefore make and record measurements of physical and chemical parameters, take samples for analysis, carry out surveys and inspections, conduct investigations and seek information from consent holders.

The monitoring programme for the Wellington Landfarm site consisted of three primary components.

1.4.2. Programme liaison and management

There is generally a significant investment of time and resources by the Council in:

- ongoing liaison with resource consent holders over consent conditions and their interpretation and application;
- in discussion over monitoring requirements;
- preparation for any consent reviews, renewals or new consent applications;
- advice on the Council's environmental management strategies and content of regional plans; and
- consultation on associated matters.

1.4.3. Site inspections

The Wellington site was visited five times during the monitoring period. As discussed the site was not operational during this monitoring period and was decommissioned during the previous monitoring period. As such the main focus of the monitoring in this period was the remediation of the remaining parameters within the soil profile, monitoring the site groundwater impacts, the degree of revegetation post application, and reinstatement. The neighbourhood was also surveyed for environmental effects.

1.4.4. Chemical sampling

The Wellington landfarm contains defined monitoring locations. The Council monitored soil, groundwater and surface water, where applicable, during this monitoring period. Monitoring locations are defined in Figure 1.

The site contains four groundwater monitoring wells, these wells were sampled by the Council four times per monitoring year to assess for seasonal variation. Groundwater analytes are defined in Table 1.

Four composite soil samples from the Wellington site were collected for analysis during the monitoring period. The methodology utilised was modified from the Guidelines for the Safe Application of Biosolids to land in NZ (2003) and it involves the compositing of 10 soil cores. These cores are taken from 400 mm +/- depth below ground level (bgl) to encompass the zone of application. The cores are collected at 10 m intervals along a transect through a spreading area. The sample transects are GPS marked for reference. The soil analysis is provided in Table 1.

On one occasion in the monitoring year, water samples from the drainage pipes are obtained, this is only possible when the pipes are flowing. The drainage pipes are situated on the northern seaward boundary of the site. The analytes of the drainage pipes are defined in Table 1.

Table 1 Chemical analytes Wellington Landfarm 2016-2017

Groundwater monitoring parameters		Soil monitoring parameters	
Barium (acid soluble)	Benzene	Calcium	Total petroleum hydrocarbons C ₇ -C ₉ , C ₁₀ -C ₁₄ , C ₁₅ -C ₃₆ , C ₇ -C ₃₆ .
Barium (dissolved)	Toluene	Chloride	
Chloride	Ethylbenzene	Conductivity	Benzene
Conductivity	Xylenes	Potassium	Ethylbenzene
Sodium	Total petroleum hydrocarbons C ₇ -C ₉ , C ₁₀ -C ₁₄ , C ₁₅ -C ₃₆ , C ₇ -C ₃₆ .	Moisture factor	Toluene
Total dissolved salts	Polycyclic aromatic hydrocarbons	Magnesium	Xylenes
		Sodium	Ammoniacal nitrogen
		Sodium absorption ratio (SAR)	Nitrite/nitrate nitrogen
		Total soluble salts	pH
		Naphthalene	Benzo (a) pyrene (BaP)
			Pyrene
Surfacewater monitoring parameters			
Barium (acid soluble)	Benzene		
Barium (dissolved)	Ethylbenzene		
Chloride	Toluene		
Sodium	Xylenes		
Total dissolved salts	Total petroleum hydrocarbons C ₇ -C ₉ , C ₁₀ -C ₁₄ , C ₁₅ -C ₃₆ , C ₇ -C ₃₆		
pH			

2. Results

2.1. Inspections

29 June 2016

At the time of inspection the wind was from the west at a speed of approximately 3 m/s. No recent storage or land-farming had occurred at the site and no infrastructure was present.

The areas where muds were historically applied were observed to have complete pasture cover across all areas. The pasture was described as healthy. Due to recent heavy rain the paddock contained lots of ponded water. The ponded water appeared free of hydrocarbons. The overland flow observed on the foreshore had lots of iron oxide present and iron oxide was also prevalent at the face of the cliff.

8 August 2016

Site inspected in conjunction with groundwater sampling. Bores GND2282-2285 inclusive were sampled. Site pasture cover described as generally good condition aside from the former spreading area F12. In F12 cover is patchy, muds are visible on the surface and a hydrocarbon odour was observed when the muds were disturbed. No other obvious effects were present at the site. Groundwater samples from GND2285 and GND2284 had high field conductivity and in the GND2285 sample, slight foam and a hydrocarbon sweet odour were noticed.

7 December 2016

The inspection was conducted in conjunction with soil sampling in overcast conditions with a light west wind.

Two soil transects were collected in spreading area F12. The soils were described as damp, dark brown/black sands with good rootlet development and pasture coverage. Very slight hydrocarbon odour was noted in the second transect only.

The site was unoccupied at the time of inspection.

17 February 2017

At the time of inspection the wind was from the north east at a speed of approximately 3-4 m/s. No objectionable odours or visible emissions were found during the inspection. No recent storage activities had occurred and no storage pits are present.

All spreading areas were observed and found to have complete pasture cover which appeared healthy. No muds were identified at the surface. No adverse effects were observed on the foreshore. Iron oxide was prevalent in the discharges onto the beach.

3 March 2017

The inspection was conducted in conjunction with groundwater and surface water sampling from the subsurface drainage pipe drainage system. The weather was described as overcast with a light north west wind.

The site was unoccupied at the time, although two contractors were on site spraying gorse. Three of the four groundwater bores were sampled. The fourth was not accessible due to gorse spraying. The samples collected were relatively clear and uncoloured, with nil to minor odour and no foaming or sheen detected.

A surface water sample was collected from GND2364 only. Location GND2363 was not discharging at the time. The sample was described as slightly turbid, orange in colour, with a noticeable oxide sheen present.

31 May 2017

At the time of inspection the wind was from the east at a speed of approximately 2 m/s. No objectionable odours or visible emissions were found during the inspection. No recent storage of muds had occurred. The spread areas were observed and pasture was prevalent across the areas. No muds were identifiable at the surface or in any test pits.

The coastal side of site was saturated and ponded water was prevalent at the surface. Some iron oxide sheen was present. Multiple groundwater discharges were observed onto the foreshore. The discharge had left a typical iron oxide staining on the cliff face. No detrimental effects were observed on the reef or foreshore. The remaining pine trees situated along the cliff top all appeared healthy. Groundwater monitoring bores were intact.

2.2. Results of discharge monitoring

Details of the landfarming applications dates provided by the consent holder are detailed in the following Table 2. The actual locations are depicted in Figure 2. Twenty three areas were landfarmed between March 2011 and December 2013.

Table 2 Wellington Landfarm application farming dates full site

ID	Mud Type	Date	Well Name
F1	WBM	March-April 2011	Cheal B(WBM, OBM), Sidewinder (WBM), Mckee Production Station (OBM), Copper Moki (WBM)
F2	WBM	May, 2011	Sidewinder 3&4, Cheal C
F3	WBM	July, 2011	Ruru, KA 4/14
F4	WWF	July, 2011	Waitui-1
F5	WBM	Nov, 2011	MPO (OBM), Copper Moki (WBM), Cheal C (WBM), Sidewinder Sidetrack 1 (WBM), Mangahewa-D (WBM), Mangahewa-C (CF), Mangahewa-A (WBM), Waitui (CO), Talon-1 (WBM)
F6	WW	Nov, 2011	Tank Farm(WW), KA 1/7 (CO), KA 4/14 (CF)
F7	WWF	Nov, 2011	Mangahewa-D(WWF)
F8	WWF	April, 2012	Mangahewa-D(WWF)
F9	CF	April, 2012	Tank Farm(WW), Pacific Chieften - Maui-B (OBM), KA8/12/15/18
F10	OBM	April, 2012	Mangahewa-C (WBM,OBM,WW), Mangahewa A (WBM), Pacific Chieften - Maui-B (OBM), Nobel Discoverer (OBM), Mamutu Rd Spill (CO), Cheal C (CF,CO), MPO(CO)
F11	WWF	May, 2012	Mangahewa-C
F12	OBM	Aug, 2012	MangaHewa-A(WBM, OBM, WW, CO), Mangahewa-C(OBM, WW),Mangahewa-D (WBW, OBM, CO), Copper Moki (WW, CO, OBM), Kea Puka/Douglas (OBM,WBM,OBM)
F13	OBM	Aug, 2012	Mangahewa-D(OBM,CO,WW)

ID	Mud Type	Date	Well Name
F14	OBM	Aug, 2012	KA 2 (CO) Maui B(OBM)
F15	WBM	Oct, 2012	Mangahewa-C
F16	CS	Mar,2013	KA 13
F17	CS	May, 2013	KA 3
F18	WWF	May, 2013	Todd MHW D
F19	WWF	May, 2013	Todd MHW D
F20	WWF	Aug, 2013	Todd MHW C9
F21	OBM	Aug, 2013	Todd MHW C9
F22	CS	Aug, 2013	KA 3, KA 6
F23	CS	Dec, 2013	KA 6
WWF: Well work over fluid OBM: Oil based materials WBM: Water based muds			
WW: Waste water CS: Contaminated soil CF : Contaminated Fluid SBM: Synthetic based muds			

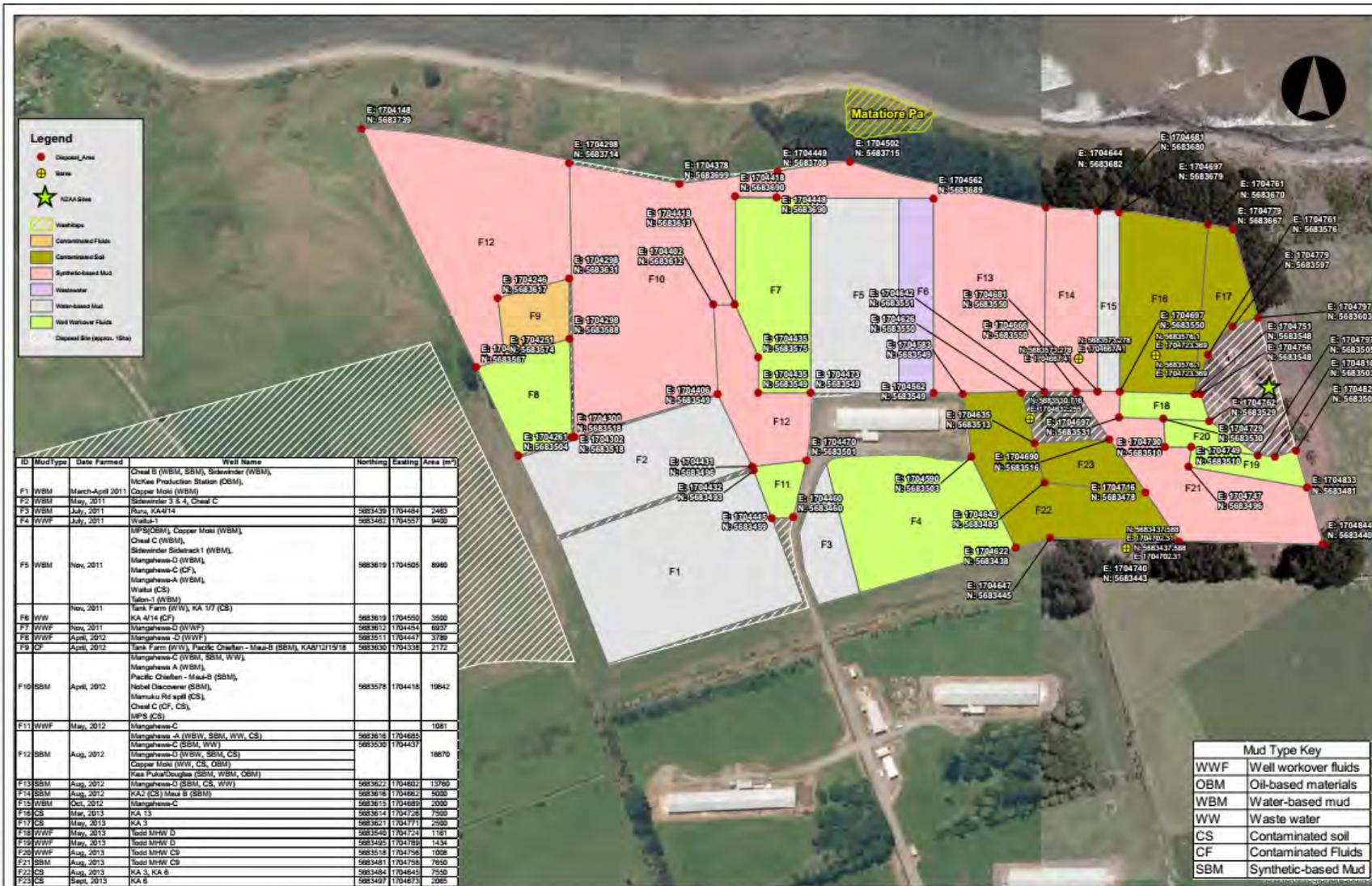


Figure 2 Company provided landfarm application area map Wellington Landfarm

2.2.1. Council soil results

Two previously landfarmed locations (F12 and F18 respectively, Figure 2) remain active to consent 7884-1.1.

Area F18 was held back from surrender during the 2014-2015 period due to the analysis of benzo (a) pyrene (BaP). This analysis was above the conditional surrender limit which is set at 0.027 g/m³ BaP.

The analysis undertaken in the 2015-2016 monitoring period indicated that the analyte (BaP) had met its conditional limit for surrender. Two results from the 2015-2016 monitoring period indicated that BaP was found to be equal to or less than 0.03 g/m³ BaP.

Of note the concentration (0.03 g/m³ BaP) is the lowest analytical limit which the laboratory, R J Hill laboratories in Hamilton can reach with certainty. Thus the Council is willing to accept the successive analyte results (as defined in the previous year's report) at or below the limit of detection for the laboratory as being acceptable for surrender of area F18.

The other landfarmed area which is active to the consent is area F12. This location was farmed in 2012 and the Council has monitored this parcel of land since this date.

In this monitoring period four composite soil samples were collected from area F12. The analysis of the four composite soil samples is provided in the following Table 3. The consent limit with respect to surrender is provide where applicable for the parameter of concern, as defined by consent 7884-1.1

Table 3 Soil analysis of Area F12 Wellington LF 2016-2017

Soil Results Wellington LF	Location	Consent limit	F12	F12	F12	F12
Parameter	Unit	7884-1.1	07/12/2016	07/12/2016	30/06/2017	30/06/2017
Conductivity	mS/m@20°C	400	13.6	6.4	21.7	27.5
Calcium	mg/kg	-	70.8	32.2	180.2	176.8
Chloride	mg/kg	700	39	36.3	29.5	58.2
TPH TRC	mg/kg	-	1,296	200	583	9,518
Potassium	mg/kg	-	35.4	13.3	37.2	119.5
Magnesium	mg/kg	-	7.8	5.1	10.7	13.7
Sodium	mg/kg	460	45.3	24.5	31.6	114
Ammonia	mgN/kg	-	0.96	0.68	3.17	6.13
Nitrite/nitrate nitrogen	mgN/kg	-	0.16	0.72	2.29	0.86
Sodium Absorption Ratio	None	18	1.36	1.05	0.61	2.22
Total Soluble Salts	mg/kg	2,500	554.1	255.9	864.8	1,090.2
Benzene	mg/kg dry wt	1.1	< 0.08	< 0.05	< 0.06	< 0.05
Toluene	mg/kg dry wt	68	< 0.08	< 0.05	< 0.06	< 0.05
Ethylbenzene	mg/kg dry wt	53	< 0.08	< 0.05	< 0.06	< 0.05
m&p-Xylene	mg/kg dry wt	48	< 0.16	< 0.10	< 0.11	< 0.10
o-Xylene	mg/kg dry wt	48	< 0.08	< 0.05	< 0.06	0.24
TPH C ₇ -C ₉	mg/kg dry wt	120	< 8	< 8	< 8	12
TPH C ₁₀ -C ₁₄	mg/kg dry wt	58	67	< 20	49	1,940
TPH C ₁₅ -C ₃₆	mg/kg dry wt	4,000	590	99	310	6,600
TPH C ₇ -C ₃₆	mg/kg dry wt	-	660	99	360	8,600
Chrysene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03	< 0.3
Dibenzo[a,h]anthracene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03	< 0.3
Dry Matter (Env)	g/100g as rcvd	-	87	85	81	84
Fluoranthene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03	< 0.3
Fluorene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03	< 0.3
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03	< 0.3
Naphthalene	mg/kg dry wt	7.2	< 0.13	< 0.13	< 0.14	< 1.3

Soil Results Wellington LF	Location	Consent limit	F12	F12	F12	F12
Parameter	Unit	7884-1.1	07/12/2016	07/12/2016	30/06/2017	30/06/2017
Phenanthrene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03	0.4
Pyrene	mg/kg dry wt	160	< 0.03	< 0.03	< 0.03	< 0.3
pH	pH	-	7.5	6.9	7.4	7.6
Acenaphthene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03	< 0.3
Anthracene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03	< 0.3
Acenaphthylene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03	< 0.3
Benzo[a]anthracene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03	< 0.3
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.027	< 0.03	< 0.03	< 0.03	< 0.3
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03	< 0.3
Benzo[g,h,i]perylene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03	< 0.3
Benzo[k]fluoranthene	mg/kg dry wt	-	< 0.03	< 0.03	< 0.03	< 0.3
TPH: Total petroleum hydrocarbons						

The composite soil samples of area F12 indicated that the total petroleum hydrocarbon chains C₁₀-C₁₄ and C₁₅-C₃₆ are still elevated above the conditional limit with respect to surrender, as defined in the final sample collected in June 2017.

The limit for these analytes is set at 58 mg/kg for C₁₀-C₁₄ and 4,000 mg/kg for C₁₅-C₃₆. It is noteworthy to mention that the location of F12 contains a good deal of variation as can be discerned from Table 3.

The Council will continue to monitor area F12 until surrender criteria has been reached.

2.2.2. Council groundwater

The site has four groundwater monitoring wells as shown in Figure 1. As previously discussed, the wells are monitored four times per year to account for seasonal fluctuations. The analysis of the four monitoring wells, throughout the 2016-2017 monitoring year is presented in the following Tables 4-7 inclusive.

Table 4 GND2282 2016-2017 results

GW	Site	GND2282	GND2282	GND2282	GND2282
Parameter	Collected	08 Aug 2016	21 Dec 2016	03 Mar 2017	30 May 2017
Barium (acid soluble)	g/m ³	0.16	0.1	0.12	0.12
Barium (dissolved)	g/m ³	0.13	0.1	0.11	0.12
Chloride	g/m ³	271	245	241	244
Conductivity	mS/m@20°C	151	129	121	124
Sodium	g/m ³	174	142	125	134
pH	pH	6.6	6.6	6.7	6.6
Water level	m	1.985	2.348	2.37	2.137
Temperature	°C	15.1	16	16.6	15.8
Benzene	g/m ³	0.0015	< 0.001	< 0.001	< 0.001
Toluene	g/m ³	<0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	g/m ³	<0.001	< 0.001	< 0.001	< 0.001
XYLENE-M	g/m ³	<0.002	< 0.002	< 0.002	< 0.002
XYLENE-O	g/m ³	<0.001	< 0.001	< 0.001	< 0.001
TPH C ₇ -C ₉	g/m ³	<0.10	< 0.10	< 0.10	< 0.06
TPH C ₁₀ -C ₁₄	g/m ³	<0.2	< 0.2	< 0.2	< 0.2
TPH C ₁₅ -C ₃₆	g/m ³	<0.04	< 0.4	< 0.4	< 0.4

GW	Site	GND2282	GND2282	GND2282	GND2282
Parameter	Collected	08 Aug 2016	21 Dec 2016	03 Mar 2017	30 May 2017
TPH C ₇ -C ₃₆	g/m ³	<0.7	< 0.7	< 0.7	< 0.7
Total Dissolved Salts	g/m ³	1,168.3	998.1	936.2	959.4

Table 5 GND2283 2016-2017 results

GW	Site	GND2283	GND2283	GND2283	GND2283
Parameter	Collected	08 Aug 2016	21 Dec 2016	03 Mar 2017	30 May 2017
Barium (acid soluble)	g/m ³	0.07	0.06	0.07	0.07
Barium (dissolved)	g/m ³	0.07	0.06	0.07	0.06
Chloride	g/m ³	84.6	86	94.8	97.4
Conductivity	mS/m@20°C	48.9	53.9	50.7	53.9
Sodium	g/m ³	45	40.3	41.4	43.5
pH	pH	6.4	6.3	6.4	6.5
Water level	m	2.012	3.562	4.5	3.346
Temperature	°C	15.7	16.5	17.2	15.9
Benzene	g/m ³	<0.001	< 0.001	< 0.001	< 0.001
Toluene	g/m ³	<0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	g/m ³	<0.001	< 0.001	< 0.001	< 0.001
XYLENE-M	g/m ³	<0.002	< 0.002	< 0.002	< 0.002
XYLENE-O	g/m ³	<0.001	< 0.001	< 0.001	< 0.001
TPH C ₇ -C ₉	g/m ³	<0.10	< 0.10	< 0.10	< 0.06
TPH C ₁₀ -C ₁₄	g/m ³	<0.2	< 0.2	< 0.2	< 0.2
TPH C ₁₅ -C ₃₆	g/m ³	<0.4	< 0.4	< 0.4	< 0.4
TPH C ₇ -C ₃₆	g/m ³	<0.7	< 0.7	< 0.7	< 0.7
Total Dissolved Salts	g/m ³	378.3	417	392.3	417

Table 6 GND2284 2016-2017 monitoring results

GW	Site	GND2284	GND2284	GND2284	GND2284
Parameter	Collected	08 Aug 2016	21 Dec 2016	03 Mar 2017	30 May 2017
Barium (acid soluble)	g/m ³	1.13	1.1	1.24	1.12
Barium (dissolved)	g/m ³	1.07	1.1	1.2	1.11
Chloride	g/m ³	2,240	2,280	2,520	2,520
Conductivity	mS/m@20°C	628	655	680	636
Sodium	g/m ³	536	568	600	572
pH	pH	6	6.1	6	6.2
Water level	m	1.091	2.048	2.115	1.687
Temperature	°C	16.1	16.6	17.3	16.4
Benzene	g/m ³	0.07	0.23	0.112	0.11
Toluene	g/m ³	<0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	g/m ³	<0.001	< 0.001	< 0.001	< 0.001
XYLENE-M	g/m ³	<0.002	< 0.002	< 0.002	< 0.002
XYLENE-O	g/m ³	<0.001	0.0016	< 0.001	< 0.001
TPH C ₇ -C ₉	g/m ³	<0.10	< 0.10	< 0.10	< 0.06
TPH C ₁₀ -C ₁₄	g/m ³	<0.2	< 0.2	< 0.2	< 0.2
TPH C ₁₅ -C ₃₆	g/m ³	<0.4	< 0.4	< 0.4	< 0.4

GW	Site	GND2284	GND2284	GND2284	GND2284
Parameter	Collected	08 Aug 2016	21 Dec 2016	03 Mar 2017	30 May 2017
TPH C ₇ -C ₃₆	g/m ³	<0.7	< 0.7	< 0.7	< 0.7
Total Dissolved Salts	g/m ³	4,858.9	5,067.8	5,261.2	4,920.8

Table 7 GND2285 2016-2017 monitoring results

GW	Site	GND2285	GND2285	GND2285	GND2285
Parameter	Collected	08 Aug 2016	21 Dec 2016	10 Mar 2017	30 May 2017
Barium (acid soluble)	g/m ³	3.45	2.74	2.64	2.27
Barium (dissolved)	g/m ³	3.25	2.46	2.64	2.22
Chloride	g/m ³	2,520	2,100	1,960	2,130
Conductivity	mS/m@20°C	733	644	586	564
Sodium	g/m ³	924	818	790	708
pH	pH	6.1	6.1	6.2	6.3
Water level	m	0.874	1.544	1.734	1.274
Temperature	°C	16.5	16.6	17.3	16.5
Benzene	g/m ³	0.24	0.094	0.194	0.3
Toluene	g/m ³	<0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	g/m ³	<0.001	< 0.001	< 0.001	< 0.001
XYLENE-M	g/m ³	<0.003	< 0.002	0.002	0.005
XYLENE-O	g/m ³	<0.0033	< 0.001	0.0012	< 0.001
TPH C ₇ -C ₉	g/m ³	<0.10	< 0.10	< 0.10	< 0.06
TPH C ₁₀ -C ₁₄	g/m ³	<0.2	< 0.2	< 0.2	< 0.2
TPH C ₁₅ -C ₃₆	g/m ³	<0.4	< 0.4	< 0.4	< 0.4
TPH C ₇ -C ₃₆	g/m ³	<0.7	< 0.7	< 0.7	< 0.7
Total Dissolved Salts	g/m ³	5,671.3	4,982.7	4,533.9	4,363.7

The monitoring of the site specific groundwater wells indicated the following:

- GND2282 detailed a concentration of 0.0015g/m³ benzene in the August 2016 sample. There were no more results above the limit of detection with respect to this analyte in this well in the remaining three rounds undertaken by Council. In comparison to the previous monitoring year, benzene was found in each round, which ranged in the 2015-2016 period 0.0014-0.0031 g/m³ benzene.
- GND2283 detailed no petroleum hydrocarbons (TPH all chains), benzene, toluene, ethylbenzene or xylenes (BTEX) above the limit of detection for these analytes.
- GND2284 indicated benzene concentrations in all four monitoring rounds, this ranged from 0.07-0.23 g/m³ benzene. This was slightly elevated when compared to the previous monitoring period where the range was observed to be lower (0.042-0.074 g/m³ benzene). Xylene O was also recorded in the December 2016 sample at a concentration of 0.0016 g/m³. Chloride and total dissolved salt (TDS) concentrations were found to be above the conditional limit set by the consent of 2,500 g/m³ salts, in two rounds for chloride and all four rounds for TDS.
- GND2285 is the more impacted well in comparison to the other three monitoring wells. Benzene was detected in this well in the four monitoring rounds undertaken. The range in this monitoring period, (2016-2017, 0.094-0.3 g/m³ benzene), was greater than the previous year, (2015-2016 0.24-0.27 g/m³ benzene) and the concentration was marginally higher in this period. Low concentrations of xylene O, just above the limit of detection, were also detected in two of the four rounds undertaken. TDS concentration were found to be elevated above the conditional limit of 2,500 g/m³ in all four

monitoring rounds undertaken in the 2016-2017 monitoring period. The long term record of TDS is presented in Figure 3.

By way of background, the impacts associated with the exercise of this consent are centred on a legacy issue. The site originally undertook the storage of drilling muds in unlined storage pits. As such the impacts are directly related to the lack of storage liners¹. The Council will continue to monitor these locations until background concentrations are achieved, as these impacts are directly related to the exercise of consent.

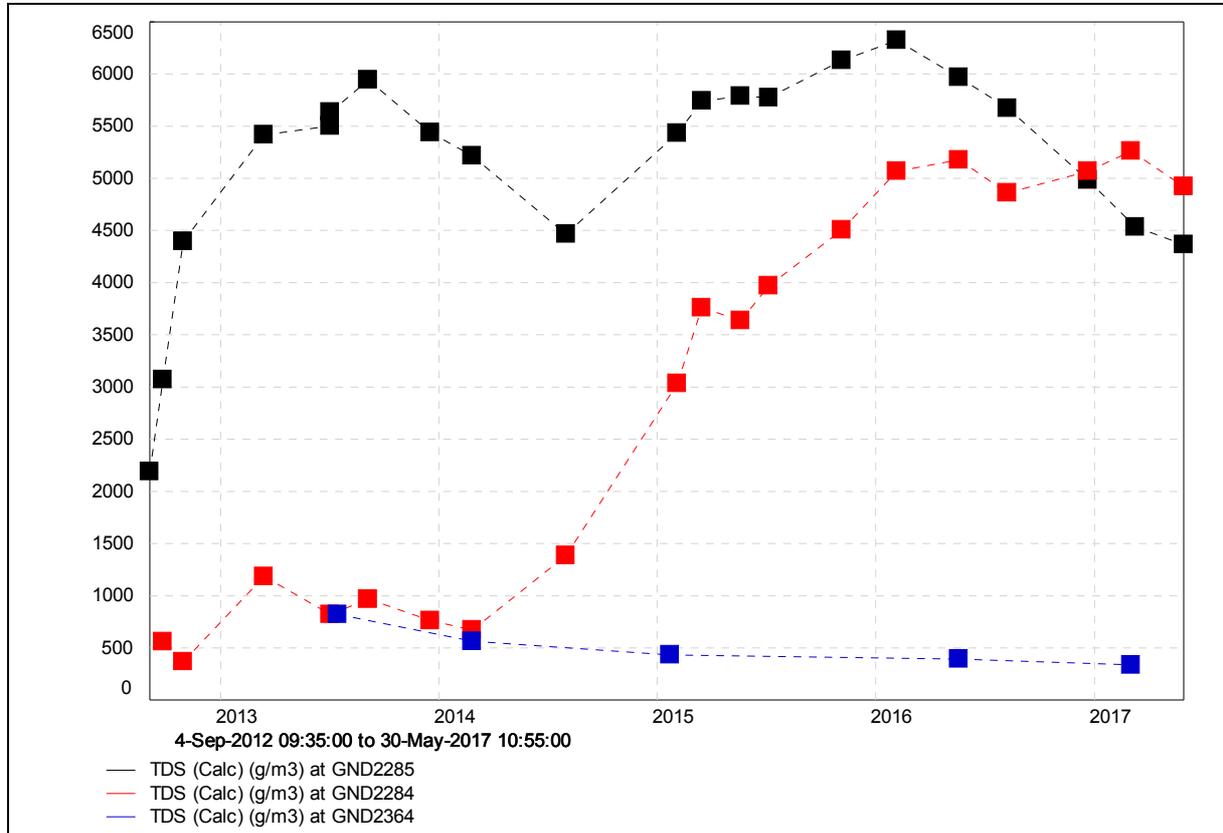


Figure 3 Long terms TDS concentrations GND2284, 2285 and drainage pipe GND2364

2.2.3. Council surface water

One sample of the drainage pipe (Figure 1) was collected this monitoring period. The results are provided in the following Table 8. The other of the two drainage pipes GND2363, was not flowing at the time of sample collection thus a sample was un-obtainable. The long term record of TDS analysis is provided in the above Figure 3.

¹ All storage cells in Taranaki landfarms are now fitted with fit for purpose synthetic liners to prevent interaction with geological mediums as a process of storage.

Table 8 GND2364 (drainage pipe) 2016-2017

	Site	GND2364
Parameter	Date	03 Mar 2017
Chloride	g/m ³	76.5
Conductivity	mS/m@20°C	43.5
Sodium	g/m ³	33.4
pH	pH	6.4
Temperature	°C	18
Benzene	g/m ³	< 0.0010
Ethylbenzene	g/m ³	< 0.0010
Toluene	g/m ³	< 0.0010
XYLENE-M	g/m ³	< 0.002
XYLENE-O	g/m ³	< 0.0010
TPH C ₁₀ -C ₁₄	g/m ³	< 0.2
TPH C ₁₅ -C ₃₆	g/m ³	< 0.4
TPH C ₇ -C ₃₆	g/m ³	< 0.7
TPH C ₇ -C ₉	g/m ³	< 0.10
Total dissolved salts	g/m ³	336.6

The analysis indicated that no petroleum hydrocarbons or BTEX were found above the limit of detection in the singular spot sample collected this monitoring period. TDS concentration (336 g/m³ TDS 2016-2017) were found to be consistent with the spot sample collected in the previous monitoring period (393 g/m³ TDS 2015-2016) though slightly decreased in comparison (Figure 3).

2.3. Investigations, interventions, and incidents

The monitoring programme for the year was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with the Company. During the year matters may arise which require additional activity by the Council, for example provision of advice and information, or investigation of potential or actual causes of non-compliance or failure to maintain good practices. A pro-active approach that in the first instance avoids issues occurring is favoured.

The Council operates and maintains a register of all complaints or reported and discovered excursions from acceptable limits and practices, including non-compliance with consents, which may damage the environment. The incident register includes events where the Company concerned has itself notified the Council. The register contains details of any investigation and corrective action taken.

Complaints may be alleged to be associated with a particular site. If there is potentially an issue of legal liability, the Council must be able to prove by investigation that the identified company is indeed the source of the incident (or that the allegation cannot be proven).

In the 2016-2017 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with the Company's conditions in resource consents or provisions in Regional Plans.

3. Discussion

3.1. Discussion of site performance

The Wellington landfarm is in its final stages of remediation in terms of areas of land which had been utilised for the practice of landfarming. Twenty three locations were landfarmed at the Wellington landfarm between March 2011 and September 2013. One location, area F12, remains above the analytical criteria with respect to surrender. Specifically in this area, total petroleum hydrocarbons chains C₁₀-C₁₄ and C₁₅-C₃₆ remain above the consented limit for surrender.

In the previous monitoring period the consent holder undertook additional agitation of the ground exercises, with a view of aiding remediation of hydrocarbons specifically in area F12. As a result the analysis indicated a decrease in hydrocarbon (total) observed over the last few monitoring periods.

In October 2013 the total hydrocarbons (C₇-C₃₆) within area F12 held a concentration of 23,000 mg/kg, by May 2016 this value had reduced to 9,200 mg/kg. The final sample collected at the end of the current monitoring period indicated a total value of 8,600 mg/kg. Thus it can be inferred that remediation is apparent, though slightly reduced when compared to the other areas.

In other landfarms the application of dairy shed effluent or straw applications had proved effective in stimulating microbial activity in the soil, as had been undertaken in F12 last period. It is noteworthy to mention that area F12 contained material from multiple sources and multiple materials. Included in this location was oil based muds, which contain a higher concentration of base hydrocarbons than the more recent synthetic or water based muds.

The Council will continue to monitor the final landfarmed area F12.

3.2. Environmental effects of exercise of consents

The environmental effects associated with the exercise of this consent are centred on a legacy issue which was first identified during the 2012-2013 monitoring period. The issue was described as minor but significant at the time, whereby the groundwater in the vicinity of the storage cells had been impacted by poor storage of fluid waste. This had resulted in high salinity in two of the four groundwater monitoring wells as well as trace benzene in three of the four wells. The legacy remained apparent in the groundwater monitoring undertaken by the Council during this reporting period (Figure 3, Table 4, 6 and 7).

A review of the groundwater monitoring data in terms of TDS, indicated that the TDS concentration in monitoring well GND2285 appeared to have peaked in the previous monitoring period. However GND2284, which is situated down gradient from GND2285, was observed to elevate to above the concentrations observed in GND2285. This may infer the saline plume is slowly tracking northwards towards the coast, which is the inferred groundwater direction. The spot analysis of the drainage pipe indicated negligible effects when compared the analysis of the groundwater.

The impacts associated with this facility are described as localised to the former storage cell area and to date there have been no offsite effects noted. The Council will continue to monitor this facility in the upcoming monitoring period. Of note, there are likely to be no significant adverse effects due to the elevated salinity in the groundwater or the trace benzene, as the reported analytes detail concentrations below MfE guidelines for stock watering.

3.3. Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Table 9.

Table 9 Summary of Company performance in respect of Consent 7884-1.1 2016-2017

Purpose: To discharge wastes from hydrocarbon exploration, well work-over, production and storage activities, onto and into land via landfarming		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Consent application definition	Not applicable	N/A
2. Definitions which apply to the consent	Not applicable	N/A
3. Best practicable option to be adopted	Inspections and liaison with consent holder, initial landfarming storage in unlined cells.	For the most part
4. Only specified wastes to be discharged	Information provided by consent holder	Yes
5. Notification 48 hours prior to stockpiling	Not applicable as no deliveries in this monitoring period	N/A
6. Notification 48 hours prior to landfarming	Not applicable as no landfarming operations in this monitoring period	N/A
7. Sample of wastes from each individual source to be collected and analysed	Not applicable as no landfarming operations have been undertaken since September 2013	N/A
8. Keep records relating to wastes, areas, compositions, volumes, dates, treatments and monitoring	Information provided by consent holder	Yes
9. Report on records in to Council by 31 August	Report received 30 August 2017	Yes
10. Well work-over fluids to be stored in tank or pit	Inspections and information provided by consent holder indicated WWF was stored in a lined cell. Though no longer stockpiling and landfarming completed in September 2013	N/A
11. Liquid oily wastes to be stored in tank or mixed into pit	None received during monitoring period	N/A
12. All wastes landfarmed ASAP or within 12 months	Inspections and information provided by consent holder	Yes
13. Well work-over fluids to be kept separate from other waste types	Inspections and information provided by consent holder	Yes
14. No waste to be discharged into F1 and F2 areas	Inspections and information provided by consent holder	Yes
15. Solid waste to be applied either 100mm or 50mm thick depending on hydrocarbon concentration	Inspections and information provided by consent holder	Yes
16. Parameters for rate of liquid waste application	Inspections and information provided by consent holder	Yes

Purpose: To discharge wastes from hydrocarbon exploration, well work-over, production and storage activities, onto and into land via landfarming		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
17. Incorporation of solid wastes to a depth of at least 250mm ASAP	Inspections and information provided by consent holder	Yes
18. Hydrocarbon concentration shall not exceed 50,000 mg/kg dry weight	Sampling and information provided by consent holder	Yes
19. Single application of wastes to each area of land	Inspections and information provided by consent holder	Yes
20. No discharge within 25m of a water body, property boundary or within 50m of the Tasman Sea	Inspections and information provided by consent holder	Yes
21. Re-vegetate landfarmed areas as soon as practicable	Inspections and information provided by consent holder	Yes
22. Total dissolved salts in surface water or groundwater shall not exceed 2,500 g/m ³	Exceeded in two of four monitoring wells.	No
23. Contaminants in surface or groundwater not to exceed background concentrations	Trace benzene in three of four monitoring wells	No, but reducing
24. Conductivity must be less than 400 mS/m. If background conductivity exceeds 400 mS/m, then increase shall not exceed 100 mS/m	Sampling	Yes
25. Sodium absorption ratio [SAR] must be less than 18.0, if background SAR exceeds 18.0 then increase shall not exceed 1.0	Sampling	Yes
26. Concentration of metals in soil to comply with guidelines	Sample analysis provided by consent holder	Yes
27. Levels of contaminants prior to expiry, cancellation, or surrender of consent	One area remains above surrender criteria, Area F12	N/A
28. Consent may not be surrendered until condition 26 is satisfied	See above	N/A
29. Notification of discovery of archaeological remains	None found	N/A
30. Consent to lapse in 2016 unless given effect to	Consent exercised	N/A
31. Optional review provision re environmental effects	Next optional review in June 2015	N/A
Overall assessment of environmental performance in respect of this consent		Good
Overall assessment of administrative performance in respect of this consent		High

Table 10 Evaluation of environmental performance over time

Year	Consent no	High	Good	Improvement req	Poor
2011-2012	7884-1		1		
2012-2013	7884-1				1
2013-2014	7884-1		1		
2014-2015	7884-1.1		1		
2015-2016	7884-1.1		1		
Totals		0	4	0	1

During the year, the Company demonstrated a Good level of environmental and High level of administrative performance with the resource consents as defined in Section 1.1.4.

3.4. Recommendations from the 2015-2016 Annual Report

In the 2015-2016 Annual Report, it was recommended:

1. THAT monitoring of consented activities at the Wellington Landfarm in the 2016-2017 year be modified to include field parameter collection for surface water samples, with the caveat for sample collection if required and that soil samples are limited to the area F12. Groundwater monitoring will continue.

Undertaken, also with a slight variation, a singular surface water sample was collected from drainage pipe GND2364.

Alterations to monitoring programmes for 2017-2018

In designing and implementing the monitoring programmes for air/water discharges in the region, the Council has taken into account:

- the extent of information made available by previous authorities;
- its relevance under the RMA;
- its obligations to monitor emissions/discharges and effects under the RMA; and
- to report to the regional community.

The Council also takes into account the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki emitting to the atmosphere/discharging to the environment.

It is proposed that for 2017-2018 the monitoring programme remains unchanged.

4. Recommendations

1. THAT monitoring of consented activities at the Wellington Landfarm in the 2017-2018 year continues at the same level as in 2016-2017.

Glossary of common terms and abbreviations

The following abbreviations and terms may be used within this report:

Al*	Aluminium.
As*	Arsenic.
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m.
Cu*	Copper.
Cumec	A volumetric measure of flow- 1 cubic metre per second (1 m ³ s ⁻¹).
DO	Dissolved oxygen.
DRP	Dissolved reactive phosphorus.
Fresh	Elevated flow in a stream, such as after heavy rainfall.
g/m ² /day	grams/metre ² /day.
g/m ³	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
Incident Register	The Incident Register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
m ²	Square Metres.
MCI	Macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats.
mS/m	Millisiemens per metre.
Mixing zone	The zone below a discharge point where the discharge is not fully mixed with the receiving environment. For a stream, conventionally taken as a length equivalent to 7 times the width of the stream at the discharge point.
NH ₄	Ammonium, normally expressed in terms of the mass of nitrogen (N).
NH ₃	Unionised ammonia, normally expressed in terms of the mass of nitrogen (N).
NO ₃	Nitrate, normally expressed in terms of the mass of nitrogen (N).
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water.
O&G	Oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons).

Pb*	Lead.
pH	A numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	<i>Resource Management Act 1991</i> and including all subsequent amendments.
SS	Suspended solids.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.
Zn*	Zinc.

*an abbreviation for a metal or other analyte may be followed by the letters 'As', to denote the amount of metal recoverable in acidic conditions. This is taken as indicating the total amount of metal that might be solubilised under extreme environmental conditions. The abbreviation may alternatively be followed by the letter 'D', denoting the amount of the metal present in dissolved form rather than in particulate or solid form.

For further information on analytical methods, contact the Council's laboratory.

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Appendix I

Resource consents held by BTW Company Ltd Wellington Landfarm

(For a copy of the signed resource consent
please contact the TRC Consents department)

Discharge Permit
Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of
Consent Holder: BTW Company Limited
 PO Box 551
 New Plymouth 4340

Decision Date 19 March 2015
(Change):

Commencement Date 19 March 2015 (Granted Date: 8 July 2011)
(Change):

Conditions of Consent

Consent Granted: To discharge wastes from hydrocarbon exploration, well
 work-over, production and storage activities, onto and into
 land via landfarming

Expiry Date: 1 June 2027

Review Date(s): June 2015. June 2016, June 2021

Site Location: 70 Brown Road, Waitara
 (Property owner: HV & MC Wellington)

Legal Description: Lot 1 DP 5462 Blk III Paritutu SD (Discharge site)

Grid Reference (NZTM) 1704600E-5683480N

Catchment: Waitara

*For General, Standard and Special conditions
pertaining to this consent please see reverse side of this document*

General condition

- a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

Special conditions

1. This consent applies only to areas F12 and F18, as detailed in attached drawing no 10181-01-GIS Revision 40.
2. For the purposes of this consent the following definitions shall apply:
 - a) Landfarming means the discharge of wastes onto land, subsequent spreading and incorporation into the soil, for the purpose of attenuation of hydrocarbon and/or other contaminants, and includes any stripping and relaying of topsoil.
 - b) Storage means a discharge of wastes from vehicles, tanks, or other containers onto land for the purpose of temporary storage prior to landfarming, but without subsequently spreading onto, or incorporating the discharged material into the soil within 48 hours.
3. The consent holder shall adopt the best practicable option (as defined section 2 of the Resource Management Act 1991) to prevent or minimise any actual or potential effects on the environment arising from the discharge.
4. Only those wastes specified in application 6815 shall be discharged.

Notifications, monitoring and reporting

5. The consent holder shall notify the Chief Executive, Taranaki Regional Council, (by emailing worknotification@trc.govt.nz) at least 48 hours prior to permitting wastes onto the site. Notification shall include the following information:
 - a) the consent number;
 - b) the name of the well and wellsite, or other source, from which the waste was generated;
 - c) the type of waste to be stored; and
 - d) the volume of waste to be stored.
6. The consent holder shall notify the Chief Executive, Taranaki Regional Council, (by emailing worknotification@trc.govt.nz) at least 48 hours prior to landfarming wastes. Notification shall include the following information:
 - a) the consent number;
 - b) the name of the well and wellsite, or other source, from which the waste was generated;
 - c) the type of waste to be landfarmed;
 - d) the volume of the waste to be landfarmed;
 - e) the concentration of hydrocarbons in the waste; and
 - f) the specific location and area over which the waste will be landfarmed.

Consent 7884-1.1

7. The consent holder shall take a representative sample of the wastes from each individual source and have it analysed for the following:
- a) total petroleum hydrocarbons (C₆-C₉, C₁₀-C₁₄, C₁₅-C₃₆);
 - b) benzene, toluene, ethylbenzene, and xylenes;
 - c) polycyclic aromatic hydrocarbons screening;
 - d) chloride, nitrogen, pH, potassium, and sodium; and
 - e) for well work-over fluids only, ethylene glycol, gluteraldehyde, hexavalent chromium and methanol;

and shall provide the results to the Chief Executive, Taranaki Regional Council, prior to landfarming the wastes.

8. The consent holder shall keep records of the following:
- a) composition of wastes;
 - b) storage area(s);
 - c) volumes of material stored;
 - d) landfarming area(s), including a map showing individual disposal areas with GPS co-ordinates;
 - e) volumes and weights of wastes landfarmed;
 - f) dates of commencement and completion of storage and landfarming events;
 - g) dates of sowing landfarmed areas;
 - h) photographic evidence of pasture establishment;
 - i) treatments applied;
 - j) details of monitoring, including sampling locations, sampling methods and the results of analysis;

and shall make the records available to the Chief Executive, Taranaki Regional Council.

9. The consent holder shall provide to the Chief Executive, Taranaki Regional Council, by 31 August of each year, a report on all records required to be kept in accordance with condition 8, for the period of the previous 12 months, 1 July to 30 June.

Storage

10. Well work-over fluids requiring storage prior to landfarming, shall be stored in a tank, or in a pit with an impermeable synthetic liner.
11. Liquid oily wastes shall be either:
- a) stored in a tank, or in a pit with an impermeable synthetic liner; or
 - b) mixed directly into a pit containing a suitable volume of water based mud waste, in a manner that prevents the liquid oily wastes entering the ground.
12. All wastes must be landfarmed as soon as practicable, but no later than twelve months after being brought onto the site.

Discharge limits

13. Well work-over fluids shall be kept separate and distinct from other waste types.
14. No wastes shall be discharged in the F1 and F2 areas landfarmed under consent 7670-1.
15. For the purposes of landfarming, solid wastes shall be applied to land in a layer not exceeding:
 - a) 100 mm thick for wastes with a hydrocarbon concentration less than 50,000 mg/kg dry weight; or
 - b) 50 mm thick for wastes with a hydrocarbon concentration equal to or greater than 50,000 mg/kg dry weight.
16. For the purposes of landfarming, liquid wastes shall be applied to land:
 - a) at a rate not exceeding 1 cubic metre of waste per 4 square metres of land; and
 - b) at a rate such that there is no overland flow of liquids; and
 - c) at a rate such that no ponded liquids remain after one hour, after application.
17. As soon as practicable following the application of solid wastes to land, the consent holder shall incorporate the wastes into the soil to a depth of at least 250 mm.
18. The hydrocarbon concentration in the soil over the landfarming area shall not exceed 50,000 mg/kg dry weight at any point where:
 - a) liquid waste has been discharged; or
 - b) solid waste has been discharged and incorporated into the soil.
19. Any areas of land used for the landfarming of wastes in accordance with conditions 15-17 of this consent, shall not be used for any subsequent discharges of waste.
20. No discharge shall take place within 25 metres of surface water courses or of property boundaries, or within 50 metres of Mean High Water Springs.
21. As soon as practicable following landfarming, areas shall be sown into pasture (or into crop). The consent holder shall monitor revegetation and if adequate establishment is not achieved within two months of sowing, shall undertake appropriate land stabilisation measures to minimise wind and stormwater erosion.

Receiving environment limits - water

22. The exercise of this consent shall not result in the concentration of total dissolved salts in any fresh water body exceeding 2500 g/m³.
23. Other than as provided for in condition 22, the exercise of this consent shall not result in any contaminant concentration, within surface water or groundwater, which after reasonable mixing, exceeds the background concentration for that particular contaminant.

Receiving environment limits - soil

- 24. The conductivity of the soil/waste layer after landfarming shall be less than 400 mS/m, or alternatively, if the background soil conductivity exceeds 400 mS/m, the landfarming of waste shall not increase the soil conductivity by more than 100 mS/m.
- 25. The sodium absorption ratio (SAR) of the soil/waste layer after landfarming shall be less than 18.0, or alternatively if the background soil SAR exceeds 18.0, the landfarming of waste shall not increase the SAR by more than 1.0.
- 26. The concentration of metals in the soil shall at all times comply with the guidelines for heavy metals in soil set out in Table 7.1, Section 7 of the Ministry for the Environment and New Zealand Water & Wastes Association’s Guidelines for the safe application of biosolids to land in New Zealand (2003).
- 27. From 1 March 2027 (three months prior to the consent expiry date), constituents in the soil shall not exceed the standards shown in the following table:

<u>Constituent</u>	<u>Standard</u>
conductivity	290 mS/m
chloride	700 mg/kg
sodium	460 mg/kg
total soluble salts	2500 mg/kg
MAHs PAHs TPH	Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Ministry for the Environment, 1999). Tables 4.12 and 4.15, for soil type sand.

MAHs - benzene, toluene, ethylbenzene, xylenes
 PAHs - naphthalene, non-carc. (pyrene), benzo(a)pyrene eq.
 TPH - total petroleum hydrocarbons (C₇-C₉, C₁₀-C₁₄, C₁₅-C₃₆)

The requirement to meet these standards shall not apply if, before 1 March 2027, the consent holder applies for a new consent to replace this consent when it expires, and that application is not subsequently withdrawn.

- 28. This consent may not be surrendered at any time until the standards in condition 27 have been met.

Archaeological remains

- 29. In the event that any archaeological remains are discovered as a result of works authorised by this consent, the works shall cease immediately at the affected site and tangata whenua and the Chief Executive, Taranaki Regional Council, shall be notified within one working day. Works may recommence at the affected area when advised to do so by the Chief Executive, Taranaki Regional Council. Such advice shall be given after the Chief Executive has considered: tangata whenua interest and values, the consent holder’s interests, the interests of the public generally, and any archaeological or scientific evidence. The New Zealand Police, Coroner, and Historic Places Trust shall also be contacted as appropriate, and the work shall not recommence in the affected area until any necessary statutory authorisations or consents have been obtained.

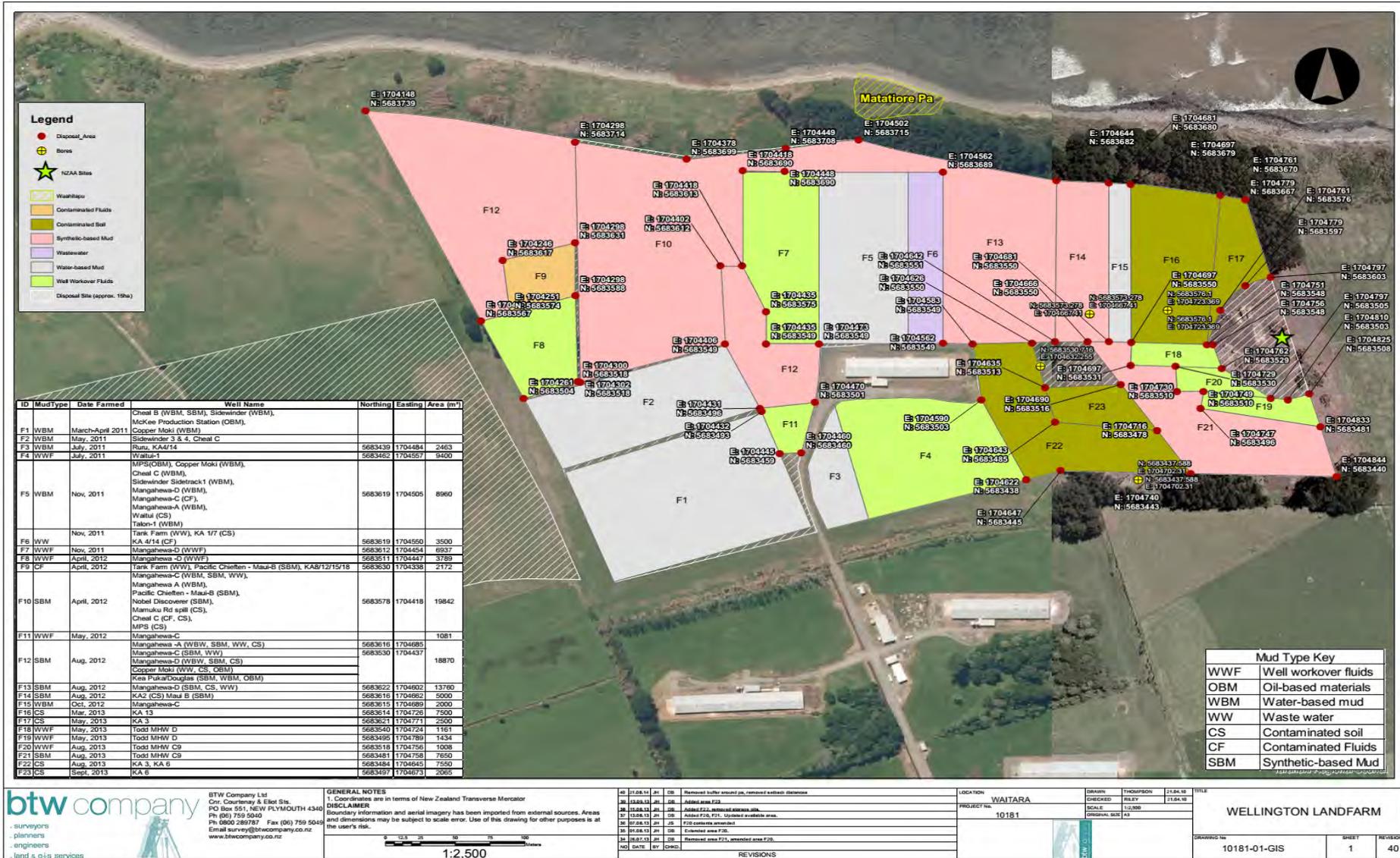
Lapse and review

30. This consent shall lapse on 30 September 2016, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.
31. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2015 and/or June 2016 and/or June 2021, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 19 March 2015

For and on behalf of
Taranaki Regional Council

A D McLay
Director - Resource Management



Appendix II

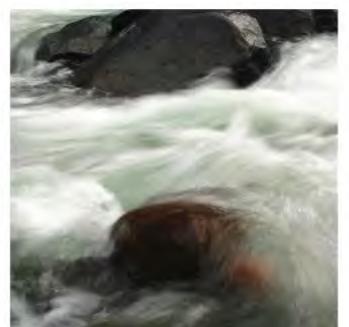
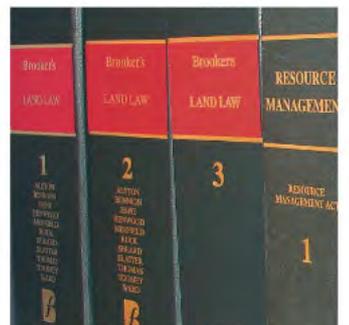
Annual report

Annual Report

Special Condition 8 - Monitoring and Reporting

Wellington Land Farm Annual Report - Consent 7884

by *BTW Company*



Wellington Land Farm Annual Report - Consent

7884
10181

Reviewed

Report Author	 _____ Dave Bolger Senior Environmental Scientist - CEnvP	28-8-17 _____ Date
Reviewed by	 _____ Cameron Twigley Director, Planning and Environment	28-8-17 _____ Date

10181
30/08/2017

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1 INTRODUCTION

1.1 Special Condition 8

In accordance with Special Condition 8 (SC8) of resource consent 7884 -1 it is a requirement that:

The consent holder provide to the Chief Executive, Taranaki Regional Council, by 31 August of each year, a report on all records required to be kept in accordance with Special Condition 7 (SC7), for the period of the previous 1 July to 30 June.

This report therefore includes all information related to activities provided for under consent 7884-1 from 1 July 2016 to 30 June 2017 as well as monitoring required under SC 21-27.

1.2 July 2016 to June 2017 - Summary

The site was completely decommissioned during the monitoring period (2013-14). Therefore no new material has been taken to the site during the monitoring period and no new areas were landfarmed during the monitoring period.

Pasture establishment has been excellent across the site, especially considering there has been minimal farm management of the site, which accounts for the abundant array of weed species within the vegetation cover.

The F12 area which is of considerable size (18870m²) has provided considerable variance in soil sampling results. The last sample taken by the consent holder demonstrated compliance with consent surrender condition requirements. However, we acknowledge a recent sample taken by the Taranaki Regional Council (TRC) has shown results above surrender criteria. Parts of this area had been re-worked in the previous monitoring years to assist in the bioremediation of hot spot areas; however, we believe there are still locations within the F12 area at a depth of 300mm to 500mm that are above surrender criteria. At a depth of greater than 300mm below the surface level, which is below the root structure, we consider the risk to livestock grazing on isolated hot spots of hydrocarbons to be low.

As the drilling muds appear to be deeper in the F12 area, this does slow the rate of any bioremediation of the drilling muds, and we also acknowledge the drilling muds in this area did have a high hydrocarbon content when they were landfarmed. We expect the drilling muds in F12 to slowly bio remediate over time to meet surrender criteria. It is anticipated surrender criteria will be met by the end of the new monitoring period.

Overall it is considered the bioremediation of the drilling material overtime has been a positive outcome, especially considering the mixture of waste sources that were previously disposed of and landfarmed at the site.

1.3 Records required under Special Condition 7

The consent holder shall keep records of the following:

- a) *Composition of waste;*
- b) *Storage areas;*
- c) *Volume of material stored;*

- d) *Landfarming areas, including a map showing individual disposal area with GPS co-ordinates;*
- e) *Volumes and weight of wastes landfarmed;*
- f) *dates of commencement and completion of storage and landfarming events;*
- g) *dates of sowing landfarming areas;*
- h) *photographic evidence of pasture establishment treatment;*
- i) *treatment applied;*
- j) *details of monitoring, including sampling locations, sampling methods and the results of analysis;*

and shall make the records available to the Chief Executive, Taranaki Regional Council.

1.4 Report Overview

The following information has been collated for the purpose of demonstrating compliance with SC8. Information will be supplied generally in order as requested within SC7 a-j.

- Records required under SC7 condition a) The site was completely decommissioned during the 2013 -14 monitoring year. So, no new records on the composition of waste are supplied, as this information has been provided in previous annual monitoring reports.

Condition a) is also addressed in Section 4 of this report.

- A map of the site showing individual disposal areas, GPS co-ordinates and stockpiling areas is located in Appendix A displaying compliance with SC7 b), d) & f). This includes:
 - *Storage Area's*
 - *Landfarming areas, including a map showing individual disposal area with GPS co-ordinates;*
 - *Dates and commencement and completion of storage and landfarming events.*
- Section 2 provides the information related to the recording of details required within conditions c), e), g), h) & i) of SC7 which are listed below;
 - *volumes of material stored;*
 - *volumes and weights of wastes landfarmed;*
 - *dates of sowing landfarmed areas;*
 - *photographic evidence of pasture establishment;*
 - *treatments applied.*

Material volumes have been calculated based on the area of disposal and the thickness which disposal is undertaken. This information is available on the site map provided in Appendix A.

- Section 3 provides details of monitoring, including sampling locations and sampling methods as required by SC7, condition j.
- Section 4 provides the results of analysis as required also by SC7, condition j. Special Conditions 23-27 of Consent 7884-1 are also addressed in this section.

2 MATERIAL STORAGE AND TREATMENT

The following section provides the information related to recording of details required within c), e), g), h) & i) of SC7 which are listed below;

- *volumes of material stored;*
- *volumes and weights of wastes landfarmed;*
- *dates of sowing landfarmed areas;*
- *photographic evidence of pasture establishment;*
- *treatments applied.*

2.1 Material Volumes

No new material was disposed of or stockpiled during the monitoring year. The site was totally decommissioned during the monitoring period 2013 to 2014.

Historical volumes of material landfarmed can be ascertained in previous annual monitoring reports and also on the site map provided in Appendix A.

2.2 Sowing and treatments

No sowing or land treatments have taken place during the monitoring year.

2.3 Pasture Establishment

The site is completely vegetated. Photographic evidence of pasture establishment is contained in Appendix B.

3 MONITORING INFORMATION

The following section provides the details of monitoring, including sampling locations, sampling methods and the results of analysis.

3.1 Monitoring

Monitoring of the landfarmed area begins within the first month of topsoil being re-applied to the landfarmed area. At this point, an entire suite of tests (both environmental and agricultural) is undertaken to assess the receiving environment against consent conditions.

For WBM material, monitoring is undertaken every six months for the first year following application, and then 6-monthly sampling continues until compliance with consent conditions is achieved. For SBM material, monitoring is undertaken every three months for the first year following application, and then 6-monthly until compliance is achieved. Within the first year, if results are compliant with surrender conditions, monitoring ceases. To ensure compliance best practice, all individual landfarmed areas must meet surrender criteria on two consecutive occasions, before sampling of an individual area ceases.

Monitoring results have been provided in a spread sheet form to assist with compliance and consent requirements for surrender (See Section 4). The results provided include the complete set of soil sampling results on each individual area to meet consent conditions

The consent holder's results demonstrate that all areas meet surrender criteria for this consent. However, we acknowledge there are still likely some hot spot areas in the F12 area. Surrender criteria data and analysis is discussed in section 4.

All receiving environment samples are tested by Hill Laboratories and sampling methodology is in accordance with the TRC procedure for soil sampling at landfarm sites. In addition, BTW Company has its own sampling procedure which is strictly adhered to and adopts current best practice for specific sampling requirements.

3.2 Sampling Locations

Specific landfarmed areas are located and identified through the use of a GPS navigational system. These co-ordinates are contained within the 'Wellington Disposal Site' – Site plan (Appendix A) which shows individual areas of disposal and this is updated whenever new landfarm areas are completed. A central point is located within each area and a composite sample (5 sub samples) retrieved in a transect line from the central point. The line direction is dependent on the underlying orientation of the landfarmed material. The transect line is approximately 60 meters in length, essentially 30meters either side of the central coordinate point.

3.3 Methods

Sampling involves collecting a composite of 5 sub-samples which are located with GPS along a transect line running from the central point of a landfarmed area. Typically, samples are retrieved from approximately 250mm but this can vary depending on the location of the drilling mud layer. This procedure has been adopted by the TRC for land farming sites where the composition of the waste is known (pre-disposal samples) and the location of each specific waste source is known.

3.4 **Inspection Notices**

The site has been inactive since about November 2013, therefore no landfarming has taken place during the monitoring year.

All inspections from the TRC during the monitoring year have found the site to be compliant with the resource consent conditions.

3.5 **Infringement Notices**

No infringement notices have been issued by the TRC for this site.

3.6 **Abatement Notices**

No abatement notices have been issued by the TRC for this site.

4 ANALYSIS OF RESULTS

The following Table 4.1 provides a summary of the monitoring results undertaken over the reporting period. Analysis of the results of monitoring are required by SC7, condition j. Special Conditions 23-27 of Consent 7884-1 are also addressed in this section.

Where compliant with consent surrender conditions, the fields are coloured green, where the sampling indicates the sampled constituent has not yet reached surrender limits for the receiving environment soil, the field is coloured red. The consent holder's results show compliance in all landfarm areas now. A complete table of soil sampling results for each individual area provides significant data and demonstrates the rate of breakdown of certain constituent's overtime at the landfarming site.

Analysis of the monitoring results is undertaken over the following Sections 4.1 and 4.2, with a summary proved in Section 4.3

Table 4.1: Monitoring results from Wellington Landfarm

Date	Consent Surrender Met				Consent Surrender not met																		Material			
	Soil conductivity <290mS m-1 (see Consent if PD is greater than 400)	Sodium 460 mg/kg	SAR <18	Dissoved salts <2500gm-3	Benozene <1.1(v)	Toulene <68(4m)	Ethylbenzene (53)(4.v)	Xylenes (48) (4.m)	Naphthalene (7.2) (p)	Non-carc. (Pyrene) (160) (4p)	Benzo(a)pyrene eq.(5) (0.027)(p)	Arsenic (20mg/kg)	Cadmium (1mg/kg)	Chromium (600mg/kg)	Copper (100mg/kg)	Lead (300mg/kg)	Mercury (1mg/kg)	Nickel (60mg/kg)	Zinc (300mg/kg)	C7-C9 120 (m)	C10-C14 58 (x)	C15-C36 (4000) (7.x)		nitrogen g/100g dry wt	Chloride 700 mg/kg	
4/11/2012																									23	WBM
19/04/2013	90	41	1.1	594	0.05	<0.05	<0.05	<0.05	<0.12	<0.03	<0.03	<2	<0.10	11	23	3.9	<0.10	6	57	8	20	40	26	23	WBM	
21/01/2012					0.05	<0.05	<0.05	<0.10	<0.03	<0.03	<0.03	<2	<0.10	10	18	3.3	<0.10	6	57	8	20	40	0.05	310	WBM	
19/04/2013	250	76	2.2	1643	0.05	<0.05	<0.05	<0.10	<0.12	<0.03	<0.03	<2	<0.10	9	16	2.3	<0.10	4	53	8	20	40	2	116	WBM	
14/02/2012																					9	20	40	19	WBM	
12/06/2012																									WBM	
11/04/2013	1	49	1.4	260	0.05	<0.05	<0.05	<0.10	<0.05	<0.05	<0.05	<2	<0.10	12	15	2.6	<0.10	5	63	8	20	40	0.13	36	WBM	
21/01/2012		490			<0.05	<0.05	<0.05	<0.10	<0.13	<0.03	<0.03	6	<0.10	13	24	2.9	<0.10	5	73	8	20	40	0.11	<30	WWF	
12/06/2012																					9	20	40		WWF	
19/04/2013	60	47	2.3	389	0.05	<0.05	<0.05	<0.10	<0.12	<0.03	<0.03	<2	<0.10	9	27	5.2	<0.10	5	56	8	20	40	22	27	WWF	
21/01/2012		560			<0.05	<0.05	<0.05	<0.10	<0.13	<0.03	<0.03	<2	<0.10	12	24	4.4	<0.10	6	68	8	390	1350	0.09	610	WBM	
18/02/2012	180	57	1.6	1155																			6	610	WBM	
12/06/2012																					9	20	129		WBM	
12/12/2012		510			0.05	<0.05	<0.05	<0.10	<0.12	<0.03	<0.03	<2	<0.10	8	15	1.8	<0.10	4	55	9	20	340	0.09	6	WBM	
19/04/2013	630	178	2	4140	0.05	<0.05	<0.05	<0.10	<0.13	<0.03	<0.03	<2	<0.10	10	16	2.7	<0.10	4	56	8	20	380	1	210	WBM	
28/09/2013	40	0.5	1.6	251	<0.05	<0.05	<0.05	<0.10	<0.13	<0.03	<0.03	<2	<0.10	9	15	2.5	<0.10	5	50	<8	<20	<40	2	7	WBM	
21/01/2012		450			0.05	<0.05	<0.05	<0.10	<0.13	<0.03	<0.03	7	<0.1	10	17	41	0.26	5	71	<8	<20	191	<0.05	<30	CS / WW	
18/02/2012	70	43	1.3	436																					CS / WW	
12/06/2012																					9	20	117		CS / WW	
12/12/2012		460			0.05	<0.05	<0.05	<0.10	<0.14	<0.03	<0.03	<2	<0.10	7	15	5.9	<0.1	4	52	10	124	620	0.15	12	CS / WW	
11/04/2013	50	43	1.7	356	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.10	<2	<0.10	10	16	3.4	<0.10	4	68	8	20	40	2	17	CS / WW	
29/05/2012	170	218	8.7	1135	0.05	<0.05	<0.05	<0.10	<0.015	<0.03	<0.03	<2	<0.10	11	17	1.4	0.1	6	75	9	20	40	0.07	91	WWF	
12/12/2012		580			0.05	<0.05	<0.05	<0.10	<0.13	<0.03	<0.03	<2	<0.10	7	14	1.4	<0.10	4	42	9	20	40	0.06	41	WWF	
19/04/2013	100	161	9.3	667	0.05	<0.05	<0.05	<0.10	<0.13	<0.13	<0.13	<2	<0.10	9	13	1.3	<0.10	4	56	8	20	40	9	33	WWF	
10/07/2012		580	0.7	554	0.06	0.09	<0.05	<0.05	<0.13	<0.03	<0.03	<2	<0.10	11	21	1.7	<0.10	6	79	8	20	220	0.1	7	WWF	
12/12/2012		580			0.05	<0.05	<0.05	<0.10	<0.12	<0.03	<0.03	<2	<0.10	8	15	1.7	<0.10	4	55	8	20	40	0.06	<3	WWF	
24/04/2013	30	35	1.9	218	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<2	<0.10	8	13	1.4	<0.10	4	51	8	20	51	5	7	WWF	
10/07/2012		640	0.5	323	0.05	<0.05	<0.05	<0.1	<0.13	<0.03	<0.03	<2	<0.10	9	15	2.1	<0.10	4	63	8	780	11,100	0.09	15	SBM	
30/10/2012					0.05	<0.05	<0.05	<0.1	<0.14	0.21	<0.04	<2	<0.10	9	17	3.3	<0.10	4	72	8	760	9,200	0.12	50	SBM	
12/12/2012		760			0.05	<0.05	<0.05	<0.1	<0.14	0.05	<0.03	<2	<0.10	7	16	6.7	<0.10	4	48	13	390	7400	0.1	27	SBM	
24/04/2013	140	113	2.4	950	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<2	<0.10	8	14	2.4	<0.10	4	59	8	290	3100	3	44	SBM	
28/09/2013	70	26	0.7	488	<0.05	<0.05	<0.05	<0.10	<0.14	<0.03	<0.03	<2	<0.13	18	16	17.9	<0.10	10	75	8	20	260		15	SBM	
10/07/2012		470			0.06	0.09	<0.05	<0.05	<0.12	0.04	<0.03	2	0.3	10	17	69	0.2	7	135	8	400	2,800	0.08	36	SBM	
30/10/2012					0.05	<0.05	<0.05	<0.1	<0.13	0.12	0.04	<2	0.24	10	17	44	0.15	5	108	8	3,000	8,300	0.06	103	SBM	
12/12/2012		440			0.06	<0.06	<0.06	<0.11	<0.15	0.06	<0.03	<2	0.14	14	19	18.6	<0.10	8	90	12	1,650	4,500	0.18	108	SBM	
24/04/2013	170	92	1.8	1148	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<2	<0.10	9	15	11.9	<0.10	4	56	9	260	1700	1	6	SBM	
28/09/2013	30	11	0.5	191.4	<0.05	<0.05	<0.05	<0.10	<0.14	<0.03	0.07	<2	0.19	10	31	20	<0.10	6	63	8	20	72		15	SBM	
7/05/2014					<0.05	<0.05	<0.05	<0.10	<0.13	<0.03	<0.03									8	20	40			SBM	

F11	15/11/2012	20	17	1.6	118.8	0.05	<0.05	<0.05	0.12	<0.13	0.04	<0.03	<2	<0.10	8	13	1.1	<0.10	4	55	8	20	101	0.05	3	WWF	
	12/12/2012		270			0.05	<0.05	<0.05	<0.10	<0.12	<0.03	<0.03	<2	<0.10	6	10	1	<0.10	3	41	8	20	40	0.05	7	WWF	
	24/04/2013	20	19	1.1	165	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<2	<0.10	8	12	1	<0.10	5	48	8	20	40	5	6	WWF	
																										WWF	
F12	15/11/2012	32	451	12.9	2140	0.05	<0.05	<0.05	<0.12	<0.13	0.06	<0.03	<2	<0.10	6	22	6	<0.10	3	52	8	2600	6400	0.12	290	SBM	
	12/12/2012		780			0.05	<0.05	<0.05	<0.10	0.28	0.39	0.05	<2	<0.10	8	19	12.6	<0.1	5	64	95	7100	23000	0.09	220	SBM	
	24/04/2013	380	245	2.6	2490	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<2	<0.10	9	14	2.4	<0.10	5	48	8	1120	3600	1	63	SBM	
	28/09/2013	140	151	4.3	950	<0.05	<0.05	<0.05	2.1	0.58	0.35	0.05	2	0.19	11	18	7.3	0.11	6	63	38	2700	12900		88	SBM	
	7/05/2014					<0.06	0.1	0.09	1.76	0.91	0.14	0.03										20	1010	6300		SBM	
	4/03/2015																					8	20	250		SBM	
4/03/2015																					8	24	830		SBM		
F13	15/11/2012	50	41	1.6	330	0.05	<0.05	<0.05	<0.10	<0.13	<0.03	<0.03	<2	<0.10	7	13	2.5	<0.10	3	52	8	20	40	0.09	35	SBM	
	12/12/2012		530			0.05	<0.05	<0.05	<0.10	<0.14	0.06	<0.03	2	0.16	8	16	22	<0.10	5	73	9	3100	6800	0.11	330	SBM	
	24/04/2013	920	535	6.1	6100	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<2	<0.10	10	16	12.4	<0.10	6	53	8	2500	6400	1	620	SBM	
	28/09/2013	290	153	3	1907	<0.05	<0.05	<0.05	<0.10	<0.13	<0.03	<0.03	<2	<0.10	11	16	7	<0.10	5	55	8	310	1460		300	SBM	
	7/05/2014					<0.05	<0.05	<0.05	<0.10	<0.13	<0.03	<0.03										8	20	40		SBM	
F14	15/11/2012	480	292	5.8	3180	0.05	<0.05	<0.05	<0.1	<0.13	0.04	<0.03	<2	<0.10	9	14	12.5	<0.1	4	73	8	2200	4700	0.09	370	SBM	
	24/04/2013	530	350	4.4	3500	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<2	<0.10	11	22	7	<0.10	6	55	9	1560	4100	1	390	SBM	
	28/12/2013	780	989	11.7	5140	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<2	<0.10	9	17	2.4	<0.10	5	55	8	20	97		580	SBM	
	5/06/2014	150	173	5.3	970	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.03	<2	<0.10	12	17	2.6	<0.10	6	59	8	20	145	0.06	88	SBM	
F15	11/04/2013	180	200	4.2	1195	0.05	<0.05	<0.05	<0.05	<0.12	<0.03	<0.03	<2	<0.10	12	16	2.2	<0.10	5	65	8	62	680	1	69	WBM	
	28/09/2013	60	94	6.9	383	<0.06	<0.06	<0.06	<0.14	<0.14	0.1	<0.03	<2	<0.10	12	34	4.2	<0.10	6	47	<9	69	570		41	WBM	
	5/06/2014					0.05	<0.05	<0.05	<0.05	<0.14	<0.03	<0.03										8	20	240		WBM	
F16	13/06/2013	50	74	5.7	350	0.06	<0.06	<0.06	<0.06	0.14	<0.03	<0.03	2	<0.10	17	30	4.3	<0.10	9	54	9	45	280	0.12	29	CS	
	28/09/2013	40	52	3.7	277	<0.05	<0.05	<0.05	<0.10	<0.14	0.23	<0.03	<2	<0.10	13	29	3.5	<0.10	7	52	9	250	1360		40	CS	
	5/06/2014					<0.05	<0.05	<0.05	<0.10	<0.14	0.03	<0.03										9	20	270		CS	
F17	21/06/2013	0.2	19	1.6	105.6	0.05	<0.05	<0.05	<0.05	<0.14	<0.03	<0.03	<2	<0.10	10	12	1.6	<0.10	6	42	9	20	75	1	6	CS	
	28/09/2013	20	24	1.6	145.2	<0.05	<0.05	<0.05	<0.10	<0.14	<0.03	<0.03	<2	<0.10	10	12	1.5	<0.10	4	52	9	20	40		9	CS	
																										CS	
F18	18/07/2013	0.4	51	3	271	0.05	<0.05	<0.05	<0.05	<0.12	0.06	0.05	<2	<0.10	9	16	2.5	<0.10	4	39	8	20	40		36	WWF	
	28/09/2013	40	52	2.6	290	<0.05	<0.05	<0.05	<0.10	<0.13	0.15	0.1	<2	<0.10	11	19	3.3	<0.10	4	46	8	20	40	54		37	WWF
	5/06/2014					<0.05	<0.05	<0.05	<0.10	<0.12	0.12	0.08														WWF	
	27/01/2015									<0.11	0.04	0.04															
	23/09/2015									<0.14	0.03	0.03															
F19	18/07/2013	0.2	12	0.9	99	0.05	<0.05	<0.05	<0.05	<0.12	<0.03	<0.03	<2	<0.10	9	11	1.2	<0.10	4	41	8	20	40	1	3	WWF	
	28/09/2013	10	12	1.1	79.2	<0.05	<0.05	<0.05	<0.05	<0.12	0.12	0.06	<2	<0.10	9	12	1.4	<0.10	4	46	8	20	40		4	WWF	
	5/06/2014					<0.05	<0.05	<0.05	<0.05	<0.12	<0.03	<0.03										8	20	40		WWF	
F20	27/09/2013	1	11	0.8	79.2	<0.05	<0.05	<0.05	<0.05	<0.12	<0.03	<0.03	<2	<0.10	11	12	1.1	<0.10	4	49	8	20	40		3	WWF	
	4/03/2014					<0.05	<0.05	<0.05	<0.05	<0.11	<0.03	0.02										8	20	40			

	Date	Soil conductivity <290mSm-1 (see Consent if PD is greater than 400)	SAR <18	Total Soluble salts 2500 mg/kg	TPH																			Material			
					Consent Surrender limit met	Consent Surrender limit not met	Benzene <1.1(v)	Toulene <68(4m)	Ethylbenzene (53)(4.v)	Xylenes (48) (4,m)	Naphthalene (7.2) (p)	Non-carc. (Pyrene) (160) (4p)	Benzo(a)pyrene eq.(5) (0.027)(p)	Arsenic (20mg/kg)	Cadmium (1mg/kg)	Chromium (600mg/kg)	Copper (100mg/kg)	Lead (300mg/kg)	Mercury (1mg/kg)	Nickel (60mg/kg)	Zinc (300mg/kg)	C7-C9 (120) (m)	C10-C14 (58) (x)		C15-C36 (4000) (7,x)	nitrogen mg/kg	Chloride 700 mg/kg
F21	9/10/2013	160	1.8	1082	<0.05	<0.05	<0.05	<0.05	<0.13	0.17	0.13	<2	<0.10	8	12	1.6	<0.10	5	45	8	490	1960	2	107	77	SBM	
	4/03/2014				<0.05	<0.05	<0.05	<0.05	<0.12	0.04	0.11									8	39	340					
	5/06/2014				<0.05	<0.05	<0.05	<0.05	<0.12	0.02	<0.03									8	20	164					
F22	9/10/2013	40	1.7	231	<0.05	<0.05	<0.05	<0.05	<0.13	0.07	<0.03	<2	<0.10	11	21	3.3	<0.10	5	52	8	90	400	1	14	33	CS	
	4/03/2014				<0.05	<0.05	<0.05	<0.05	<0.12	<0.03	<0.03									8	20	83					
F23	9/10/2013	40	1.3	244	<0.05	<0.05	<0.05	<0.05	<0.12	<0.03	<0.03	<2	<0.10	10	13	1.8	<0.10	5	54	8	20	88	<0.05	12	27	CS	
	4/03/2014				<0.05	<0.05	<0.05	<0.05	<0.11	<0.03	<0.03									8	20	40					

4.1 Compliance with SC's 21 and 22

21. The exercise of this consent shall not result in the concentration of total dissolved salts in any fresh water body exceeding 2500 g/m³

22. Other than as provided for in condition 21, the exercise of this consent shall not result in any containment concentration, within surface water or groundwater, which after reasonable mixing, exceeds the background concentration for that particular contaminant.

Surface water sampling ceased in monitoring period 2014-15, as no contaminant concentration had ever been detected above expected background levels for the subject site. The TRC continues to monitor the four groundwater monitoring bores on site.

4.2 Compliance with SC's 23 - 27

4.2.1 Condition 23 – Soil Conductivity

Condition 23 requires:

23. The conductivity of the soil/ waste layer after landfarming shall be less than 400 mS / m or alternatively, if the background soil conductivity exceeds 400 mS / m, the landfarming of water shall not increase the soil conductivity by more than 100 mS / m.

Over the year in review, the consent limit for Soil Conductivity of 400 mS / m continues to be met, having been met for all landfarmed areas since 2014 as shown in table 4.1 above.

4.2.2 Condition 24 – SAR

Condition 24 requires:

24. The sodium absorption ratio (SAR) of the soil / waste layer after landfarming shall be less than 18.0, or alternatively if the background SAR exceeds 18.0, the landfarming of waste shall not increase the SAR by more than 1.0.

As shown in table 4.1 above, SAR limits have generally been low and all areas have met surrender criteria throughout the sampling regime to date.

4.2.3 Condition 25 – Heavy Metals

Condition 25 requires:

25. The concentration of metals in the soil shall at all times comply with the guidelines for heavy metals in soil set out in Table 7.1, Section 7 of the Ministry of the Environment and New Zealand Water and Wastes Association's Guidelines for the safe application of biosolids to land in New Zealand (2003)

As shown in Table 4.1, all metal concentrations are compliant with Table 7.1, Section 7 of the Ministry of the Environment and New Zealand Water and Wastes Association's Guidelines for the safe application of biosolids to land in New Zealand (2003).

4.2.4 Condition 26 and 27 – Constituent Closure Criteria

Condition 26 requires:

26. From 1 March 2027 (Three months prior to the consent expiry date), constituents in the soil shall not exceed the standards shown in the following table:

Table 4.2: Consent Closure Criteria – Condition 26

Constituent	Standard
Conductivity	290 mS/m
Chloride	700 mg / kg
Sodium	460 mg /kg
Total soluble salts	2500 mg / kg
MAHs PAHs TPH	Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Ministry for the Environment, 1999). Tables 4.12 and 4.15, for soil type sand.

MAHs – benzene, toluene, ethylbenzene, xylenes

PAHs – naphthalene, non carc. (Pyrene) benzo(a)pyrene eq.

TPH – Total petroleum hydrocarbons (C₇-C₉, C₁₀-C₁₄, and C₁₅-C₃₆).

The requirement to meet these standards shall not apply if, before 1 March 2027, the consent holder applies for a new consent to replace this consent when it expires, and that application is not subsequently withdrawn.

27. This consent may not be surrendered at any time until the standards in condition 26 have been met.

The following sub sections provide details on constituent status in regards to consent surrender requirements.

4.2.5 Conductivity

As shown in table 4.1 above, all landfarmed areas meet the consent surrender limit of 290mS/m for conductivity.

Area/s not within surrender limits: None

4.2.6 Chloride

As shown in table 4.1 above, all landfarmed areas meet the consent surrender limit of 700 mg/Kg for Chloride.

Area/s not within surrender limits: None

4.2.7 Sodium

As shown in table 4.1 above, all landfarmed areas meet the consent surrender limit of 460 mg/kg for Sodium.

Area/s not within surrender limits: None

4.2.8 Dissolved Salts

As shown in table 4.1 above, all landfarmed areas meet the consent surrender limit of 2500mg/Kg for total soluble salts.

Area/s not within surrender limits: None.

4.2.9 TPH C7 – C9

The lighter fraction hydrocarbon chains (C7-C9) have shown to have met consent surrender criteria during soil sampling monitoring, this carbon band has essentially been under detection limits for these fractions of hydrocarbons through-out the monitoring. This is demonstrated in table 4.1 above.

Area/s not within surrender limits: None.

4.2.10 TPH C10 – C14

The carbon band of C10-C14 has often been elevated in the synthetic based muds. However, the last remaining area (F12) has now shown a significant reduction in this band and now meets surrender criteria for the consent for the carbon band of C10 – C14 in the location BTW sampled. We note though the F12 area would appear to have isolated hotspot areas that are above the consent surrender criteria. These hotspot areas are likely to be at a depth of greater than 300mm.

Area/s not within surrender limits: Hotspot areas in the F12 area were identified by the recent sampling by TRC.

4.2.11 TPH C15 – C36

The carbon band of C15-C36 has in the past shown elevated levels in the synthetic based muds which is not surprising. All areas landfarmed have seen a significant reduction in this carbon band, and now all areas meet consent surrender criteria by the consent holder's results.

We note the F12 area has shown large variance in the soil sample results by the consent holder and the TRC. A sample taken by the TRC on the 5th of November 2015 demonstrated compliance with consent surrender conditions, however a subsequent sample taken on the 19th of November 2016 demonstrated that consent surrender levels had not been met for this area. Again, TRC sampling on the 31st of May 2017 demonstrated one transect showed surrender criteria had been met, however the second transect demonstrated consent surrender compliance had not been met.

Area/s not within surrender limits: Still potentially some hotspot areas in the F12 area as identified by the TRC on the 31st of May 2017.

4.2.12 PAHs

A trace detection of Benzo (a) pyrene had been in the past identified in the F18 area. Sampling results by the consent holder and the TRC over the previous monitoring year have shown Benzo (a) pyrene to be below detection limits and consent surrender criteria met. No further sampling of the F18 has been undertaken.

Area/s not within surrender limits: None

4.2.13 Summary

The site has been inactive during the monitoring year as the site was decommissioned and completed during the 2013-2014 monitoring year.

The site was partially surrendered on the 19th of March 2015 with only the F12 and F18 areas not meeting surrendering criteria at the time, all other areas had met the soil surrender criteria. The F18 area has now met surrender criteria and this has been confirmed by the TRC, so no further sampling has been undertaken in this area during the 2016-17 monitoring year.

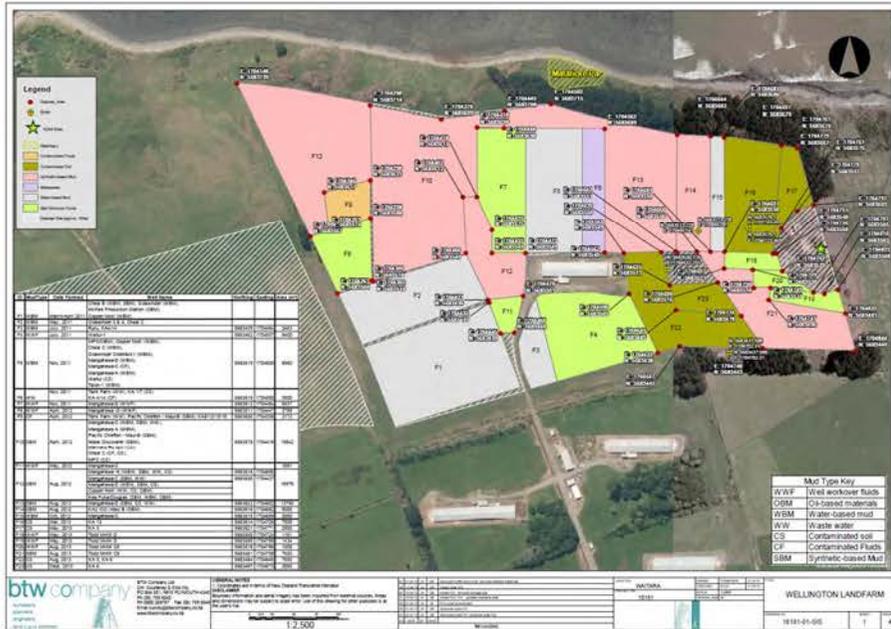
The F12 area has shown a significant variance in the sampling results around hydrocarbons. This may be due to a change in sampling methodology by the TRC (sampling deeper than previously) or the area having isolated hot spots. The F12 area is a large area of 18,870m² so it is highly likely the land farmed material is not completely homogeneous. The latest sampling from the TRC demonstrated surrender compliance from one transect and the other transect showed the surrender criteria had not yet been met.

All historical soil sampling results demonstrated no elevated levels of heavy metals in the soil. All levels fall well below the biosolids guideline values set by the Ministry for the Environment to protect human health and the environment, plus to safeguard the life-supporting capacity of soils. All the landfarmed areas are also measured against the Ministry for the Environment guidelines for assessing and managing petroleum hydrocarbons on contaminated sites in New Zealand. This is a conservative guideline document to protect human health and based on the agricultural landuse values which are the most stringent in this guideline.

Only the F12 area is in question regarding meeting surrender criteria. The variance in the results does provide some evidence there is still likely to be hot spot areas within the F12 area. We also consider these hot spot areas to be slightly deeper which will slow the bio-remediation process and increase the time before surrender criteria can be met. Overall the site has shown a significant reduction in hydrocarbon levels in the soil, and this process will continue into the future until background soil levels have been met.

We are of the opinion the amount of monitoring on the site can be significantly reduced by the TRC. No impacts off site have ever been established and the site has been decommissioned for some time now.

APPENDIX A SITE MAPS



APPENDIX B PHOTOGRAPHIC RECORD OF LANDFARMING



August 2017

