

Greymouth Petroleum Ltd
Kaimiro Production Station
Monitoring Programme
Annual Report
2013-2014

Technical Report 2014–69

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Executive summary

Greymouth Petroleum Acquisitions Company Limited operates the Kaimiro Production Station located at Inglewood, in the Waiongana catchment, and the associated Ngatoro-A and Ngatoro-B producing wellsites at Inglewood, in the Waitara catchment. The Company holds resource consents to allow it to discharge into the Mangaoraka and Ngatoro Streams, and to discharge emissions into the air. This report for the period July 2013-June 2014 describes the monitoring programme implemented by the Taranaki Regional Council to assess the Company's environmental performance during the period under review, and the results and environmental effects of the Company's activities.

During the monitoring period, the Company demonstrated an overall good level of environmental performance at the sites.

The Company holds eight resource consents for production activities at the three sites, which include a total of 125 conditions setting out the requirements that the Company must satisfy. The Company holds one consent to allow it to take and use water, three consents to discharge stormwater and treated wastewater into the Mangaoraka and Ngatoro Streams, one consent to discharge sand waste to land for storage, and three consents to discharge emissions into the air.

The Council's monitoring programme included six inspections of the Kaimiro Production Station; five inspections of the Ngatoro sites; an annual inspection of the associated wellsites; 25 water samples collected for physicochemical analysis; three biological surveys of receiving waters; and three ambient air quality analyses.

It was necessary for the Council to record one incident in relation to the operation of the Ngatoro-A stormwater system. On 18 February 2014, during the investigation of an unrelated complaint regarding the Inglewood water treatment plant, a waxy substance with a strong hydrocarbon odour was noted floating on the surface of the water in both of the skimmer pits at Ngatoro-A. An abatement notice was issued requiring the Company to undertake works to ensure that no contaminants were discharged to the environment. The Company upgraded the skimmer pits, installed an impermeable liner and removed potentially contaminated soil from the perimeter drain. No offsite effects were recorded.

On 27 June 2014, inadequate sediment controls during upgrade works on the stormwater system at Kaimiro Production Station resulted in elevated suspended solids in the unnamed tributary of the Mangaoraka Stream. However, water quality sampling earlier in the month had shown that this stream is naturally prone to high sediment loading during heavy rainfall. Hence, the discharge from the Kaimiro site on 27 June was not expected to have had any significant or long term effect on the receiving environment. Biomonitoring carried out in the tributaries of the Mangaoraka Stream indicated that the discharge was not having a significant adverse effect on the downstream water quality.

There were no adverse effects on the environment as a result of the exercise of the air discharge permits at the Kaimiro and Ngatoro sites.

During the year, the Kaimiro and Ngatoro facilities were largely well managed and maintained. However, the inconsistent application of 'best practicable option' by the Company

means that an improvement is required in administrative compliance with the resource consents.

For reference, in the 2013-2014 year, 60% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 29% demonstrated a good level of environmental performance and compliance with their consents.

This report includes recommendations for the 2014-2015 year, including a recommendation relating to the optional review of consents 3951-3, 7220-1 and 7295-1.

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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 the Annual Report for the period July 2013-June 2014 by the Taranaki Regional Council on the monitoring programme associated with resource consents held by Greymouth Petroleum Acquisition Company Limited [GPL]. The Company operates the Kaimiro Production Station situated on Upland Road at Inglewood, in the Waiongana catchment. GPL also operates the Ngatoro-A and Ngatoro-B producing wellsites. The Ngatoro-A wellsite is located on Upper Dudley Road and the Ngatoro-B wellsite is located on Bedford Road. Both of these sites are at Inglewood, in the Waitara catchment. A further 20 wellsites are monitored annually in conjunction with the Kaimiro Production Station.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consents held by GPL that relate to abstractions and discharges of water within the Waiongana and Waitara catchments, and the air discharge permits held to cover emissions to air from the sites.

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 water, land and air, and is the tenth combined annual report by the Council for the Kaimiro and Ngatoro sites.

1.1.2 Structure of this report

Section 1 of this report is a background section. It sets out general information about compliance monitoring under the RMA and the Council's obligations and general approach to monitoring sites through annual programmes, and a description of the activities and operations conducted at the Kaimiro and Ngatoro sites.

Sections 2 and 3 present the resource consents held by GPL in the Waiongana and Waitara catchments, the nature of the monitoring programme in place for the period under review, and the results of monitoring during the period under review, including scientific and technical data.

Section 4 discusses the results, their interpretations, and their significance for the environment.

Section 5 presents recommendations to be implemented in the 2014-2015 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 a discharger, 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 (eg, recreational, cultural, or aesthetic);
- (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 consent holder/s during the period under review, this report also assigns a rating as to each Company’s environmental and administrative performance.

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 (i.e. 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 compliance

- **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 2013-2014 year, 60% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 29% demonstrated a good level of environmental performance and compliance with their consents.

1.2 Process descriptions

1.1.1 Kaimiro Production Station

The Kaimiro Production Station was commissioned in 1985. The production station separates and treats oil and gas from wells in the Kaimiro and Ngatoro fields. Oil is piped to the Omata tank farm and gas is piped into the national grid. Wellsites associated with the Kaimiro Production Station are as follows: Kaimiro: B, C, D, F, G, H, J, K, L, M, O; Ngatoro: A, B, C, D, E, F; Goldie; Windsor and Surrey.

The site's BTEX vapour incinerator was replaced in October 2007 with a more efficient unit. A new gas compressor was commissioned in June 2008 and upgrades made to all existing compressor PLC control systems. These measures have resulted in a significant sustained improvement in plant energy efficiency at the Kaimiro site.



Photo 1 Kaimiro Production Station

Stormwater from the Kaimiro Production Station passes through a separator system and a skimmer pit before discharging to an unnamed tributary of the Mangaoraka Stream. All chemical storage is contained within bunds and isolated from the stormwater system.

1.1.2 Ngatoro producing wellsites



Photo 2 Ngatoro-A wellsite

Ngatoro-A was established in July 1992. The site consists of five wells (Ngatoro-1, -6, -7, -8, and -14), storage facilities for recovered oil and a bunded earth flare pit. In July 1999 the north-east skimmer pit at the site was decommissioned. The south-west skimmer pit now receives all treated stormwater, treated production water and treated wastewater from oil well drilling and production operations. Recovered oil and gas is piped off site to the Kaimiro Production Station, consequently flaring has been reduced.

The Ngatoro-B site was established in 1991 and consists of four wells (Ngatoro-2, -5, -9 and -11), storage facilities for recovered oil and a bunded earth flare pit. Produced water is piped to Kaimiro and re-injected. There are two sumps with a combined capacity of 1,290 m³ to which stormwater and wastewater are directed, and a skimmer pit with a 243 m³ capacity is used for treatment prior to discharge to an unnamed tributary of the Ngatoro Stream. Produced gas and liquids are piped to the Kaimiro Production Station for processing.



Photo 3 Ngatoro-B wellsite

2. Kaimiro Production Station

2.1 Resource consents

2.1.1 Water abstraction permit

Section 14 of the RMA stipulates that no person may take, use, dam or divert any water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or it falls within some particular categories set out in Section 14.

During the period under review, GPL held water abstraction permit **5384-1** to cover the abstraction of 550 m³/day (6.4 l/s) of groundwater from a bore for oilfield waterflooding purposes in the Waiwhakaiho Catchment. This permit was issued by the Council on 18 September 1998 under Section 87(e) of the RMA. It was transferred to GPL on 10 April 2002 and was renewed on 24 July 2014.

Condition 1 required that the consent holder undertake the abstraction in accordance with the application.

Condition 2 required that the consent holder keep records of all abstractions, including dates and volumes.

Condition 3 required that the yield of a bore situated 1.7 km north-west of the bore licensed by the consent be monitored and should there be adverse effects on the bore to the north-west an alternative water supply shall be provided by the consent holder.

Condition 4 provided for review of the consent.

The permit is attached to this report in Appendix I.

2.1.2 Water discharge permit

Section 15(1)(a) of the RMA stipulates that no person may discharge any contaminant into water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or by national regulations.

GPL holds water discharge permit **1334-3** to cover discharge of treated stormwater from the Kaimiro Production Station into an unnamed tributary of the Mangaoraka Stream in the Waiongana Catchment. This permit was issued by the Council on 10 January 2002 under Section 87(e) of the RMA. It was transferred to GPL on 10 April 2002. An application for change of consent conditions was approved on 5 September 2012 to remove three redundant conditions relating to operational and management planning. A further change of consent was approved on 8 April 2014 to increase the catchment area, move the discharge point and increase the discharge chloride limit to 230 g/m³. It is due to expire on 1 June 2020.

Condition 1 requires the consent holder to adopt the best practicable option to prevent or minimise adverse effects of the discharge on any waterbody.

Condition 2 imposes a limit on the stormwater catchment size.

Condition 3 requires site specific details relating to contingency planning for the site.

Condition 4 requires all stormwater be directed through a stormwater treatment system.

Condition 5 requires that design, management and maintenance of the stormwater system be undertaken in accordance with information submitted in the application.

Condition 6 requires that hazardous substance storage areas be bunded with drainage to appropriate recovery systems, and not to the stormwater catchment.

Conditions 7, 8 and 9 impose limits on contaminants in the discharge, and stipulate effects the discharge shall not give rise to in the unnamed tributary of the Mangaoraka Stream.

Condition 10 requires that the consent holder prepare and annually maintain a contingency plan in relation to spillages at the site.

Condition 11 requires that the Council be advised of reinstatement of the site.

Condition 12 provides for review of the consent.

The permit is attached to this report in Appendix I.

2.1.3 Air discharge permit

Section 15(1)(c) of the RMA stipulates that no person may discharge any contaminant from any industrial or trade premises into air, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations.

GPL holds air discharge permit **4048-3** to cover discharge of emissions into the air from the flaring of hydrocarbons arising from hydrocarbon production and hydrocarbon processing operations together with miscellaneous emissions at the Kaimiro Production Station. This permit was first issued by the Council on 20 June 1995 under Section 87(e) of the RMA. It was transferred to GPL on 10 April 2002 and renewed on 10 January 2008. The current permit covers emissions from Kaimiro Production Station only and is due to expire on 1 June 2026. Separate air discharge permits were issued for the associated wellsites.

Condition 1 limits the duration of flaring during well testing.

Conditions 2, 3 and 4 specify the requirements for notification prior to flaring and before undertaking alterations to equipment or processes which may substantially alter the nature or quantity of the discharge.

Conditions 5 to 10 stipulate the required equipment and processes for undertaking flaring, and limit the substances which may be flared to gases from the well stream.

Conditions 11 to 16 stipulate limits on contaminants and effects from flaring and any other emissions from the production station.

Conditions 17 to 21 specify the requirements for the recording and reporting of information relating to flaring and the details of any measures undertaken to reduce or mitigate emissions from the production station.

Condition 22 provides for review of the consent.

The permit is attached to this report in Appendix I.

2.1.4 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.

During the period under review, GPL held permit **6218-1** to cover the discharge of sand waste from hydrocarbon production within the Kaimiro Field onto land for storage, and including the discharge of stormwater from the site onto and into land and into an unnamed tributary of the Mangaoraka Stream in the Waiongana catchment. This permit was issued by the Council on 5 September 2005 under Section 87(e) of the RMA. It expired on 1 June 2014 and was not renewed.

Conditions 1 and 2 required the consent holder to adopt the best practicable option to prevent or minimise effects on the environment, and that the exercise of the consent should be made in accordance with the documentation submitted in support of the application.

Conditions 3, 4 and 5 related to recording and reporting, and include contingency planning for the site, notification of transfer of wastes to the disposal site and records of the wastes discharged.

Conditions 6, 7 and 8 set limits on the nature and quantity of waste material stored at the site.

Conditions 9 and 10 stipulated that the sand storage area should be separately bunded and all stormwater from the site should be treated prior to discharge.

Conditions 11 to 15 imposed limits on contaminants in the stormwater discharge, and stipulated effects the exercise of this consent should not give rise to in any surface or groundwater.

Condition 16 required that levels of metals in the soil at any time should comply with the Department of Health's guidelines.

Condition 17 required that prior to expiry, cancellation, or surrender of the consent, the levels of hydrocarbons in the soil comply with guideline values.

Conditions 18 and 19 required the consent holder to provide a reinstatement/ remediation plan for removal and final disposal of wastes from the storage site and to advise the Council prior to reinstatement of the site.

Conditions 20 and 21 provided for lapse of consent and review of conditions.

The permit is attached to this report in Appendix I.

2.2 Monitoring programme

2.2.1 Introduction

Section 35 of the RMA sets out obligation/s upon the Council to gather information, monitor, and conduct research on the exercise of resource consents, and the effects arising, within the Taranaki region and report upon these.

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 Kaimiro Production Station consisted of four primary components, as set out sections 2.2.2 to 2.2.5.

2.2.2 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 reviews;
- renewals;
- new consents;
- advice on the Council's environmental management strategies and content of regional plans; and
- consultation on associated matters.

2.2.3 Site inspections

Kaimiro Production Station was visited six times during the monitoring period. Producing wellsites associated with the production station are inspected annually. With regard to consents for the abstraction of/or discharge to water, the main points of interest were plant processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters. Air inspections focused on plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the consent holder were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was surveyed for environmental effects.

2.2.4 Chemical sampling

The Council undertook sampling of the discharges from the site as well as the water quality upstream and downstream of the discharge point and mixing zone.

The treated stormwater discharge was sampled on two occasions, and the samples analysed for hydrocarbons, suspended solids, conductivity, pH, alkalinity and chloride. The unnamed tributary of the Mangaoraka Stream was sampled concurrently, upstream and downstream of the discharge, and the samples analysed for hydrocarbons, suspended solids, conductivity, pH, alkalinity and chloride.

The Council also undertook sampling of the ambient air quality outside the boundary of the site. A multi-gas meter was deployed on two occasions in the vicinity of the plant, with monitoring consisting of continuous measurements of gas concentrations for the gases of interest (carbon monoxide and combustible gases).

The full air monitoring report is attached in Appendix III.

2.2.5 Biomonitoring surveys

Two biological surveys were performed in the unnamed tributary of the Mangaoraka Stream to determine whether or not the discharge of treated stormwater from the site has had a detrimental effect upon the communities of the stream.

The full survey reports are attached in Appendix II.

2.3 Results: water

2.3.1 Inspections

Six inspections were carried out at the Kaimiro Production Station in the 2013-2014 year. The annual inspection of associated wellsites was undertaken on 23 January 2014. The following was found during the inspections:

6 August 2013

The site was inspected following recent heavy rainfall. No flaring was being carried out and no odours from the production facilities were evident during a downwind, off-site odour survey. Stormwater was being discharged with no visual effects downstream in the receiving waters. The site was neat and tidy.

12 August 2013

The site was inspected after a weekend of rainfall. No flaring was being undertaken and no odours or smoke were evident. The ring drains, separator and bunds were clear of all contaminants. The skimmer pits were full and discharging with no evidence of effects to receiving waters noted. The site was neat and tidy. Everything was satisfactory.

25 September 2013

Kaimiro Production Station was inspected following a weekend of torrential rain and high winds. The site was neat and tidy. The ring drains and bunds were secure. The discharge to the nearby stream was not causing any visual effects on water quality. There was no flaring at the time of inspection.

7 November 2013

The site was neat and tidy. No flaring was occurring at the time of inspection. The ring drains and bunds were clear of obstructions and contaminants. The skimmer pits were

clear with no visible effects from any discharges to the adjacent stream. Everything was satisfactory.

9 January 2014

Inspection was undertaken during heavy rainfall resulting in stormwater runoff to the skimmer pits and stormwater discharge. All stormwater was directed via the ring drains for treatment before discharging to the adjacent stream. No visual effects from the discharge were noted. No flaring was being undertaken. The site was neat and tidy. Everything was satisfactory.

23 January 2014 – annual wellsite inspection

Inspection of the associated wellsites was undertaken with Allan Crawford (environmental advisor to GPL) following heavy rainfall on the previous day. Sites were inspected to ensure compliance with resource consents held for discharges to water, land and air.

Most of the sites were neat, tidy and well maintained, with ring drains, bunds and stormwater systems that were fit for purpose. The skimmer pits were clear of contaminants and most were not discharging. Some minor repair work and lining was required at a few sites. The flare pits were well sited to minimise potential off site effects, including odour, noise and light issues. Most had not been used for long periods. Some sites had minor pest plant infestations which GPL was to address with a spraying programme. The sites were well managed and no environmental concerns or effects were noted.

5 June 2014

The site was inspected following a period of fine weather. There was some windblown foliage from the shelter belt to be removed from the eastern skimmer pit beside the control room. The Company was advised to clean out the main skimmer pits to remove silt deposition resulting from runoff from the adjacent pad. No flaring was being undertaken. The site was neat and tidy.

2.3.2 Results of discharge monitoring

Sampling of the discharge from the Kaimiro Production Station was undertaken on two occasions during the 2013-2014 monitoring period. The samples were collected on 17 June 2014 and 27 June 2014. Table 1 below presents the results along with a summary of previous results and limits stipulated by consent 1334-3. The sampling sites are shown in Figure 1.

On 17 June the sample was taken after exceptionally heavy rainfall. There was significant surface ponding in the area, including in the paddock where the production station discharge enters the drain to the piped stream. This water was brown and turbid with a slight hydrocarbon sheen, but no odour. The suspended solids content of the discharge was well above the consent limit at 580 g/m³. However, the suspended solids in the receiving waters (see Table 2) was higher upstream of the discharge point (330 g/m³) than below it (280 g/m³), indicating that the discharge was not exacerbating the already poor water quality of the stream. This exceedance of the consent limit resulted more from the extreme weather conditions at the time rather than from any act or oversight by the Company.

Table 1 Physicochemical results for discharge from the Kaimiro Production Station with a summary of previous monitoring data (TRC site code STW002016)

Parameter	Units	17 Jun 14	27 Jun 14	Consent limits*	N	Min	Max	Median
Total alkalinity	g/m ³	8	25	-	34	3	88	11
Chloride	g/m ³	16.5	23.3	230	36	2.2	330	11.2
Conductivity	mS/m	7.4	12.6	-	38	2.3	190	6.8
Hydrocarbons	g/m ³	0.6	< 0.5	15	40	< 0.5	38	< 0.5
pH		6.9	6.7	6.5-8.5	38	6.0	9.1	6.6
Suspended solids	g/m ³	580	1,600	100	37	< 2	610	31
Temperature	Deg. C	13.2	11.7	-	35	6.6	41.2	12.6

*The chloride concentration limit was raised to 230 g/m³ on 8 April 2014



Figure 1 Water quality monitoring sites in relation to the Kaimiro Production Station

During sampling on 27 June, it was noted that works were being undertaken at the northern end of the Kaimiro Production Station. Two excavators were working on alterations to the ring drains and pits in the area which were necessary to meet Council requirements. Due to showers occurring at the time, a significant amount of sediment was being entrained in the stormwater. Water from the first skimmer pit was also being pumped directly to the discharge point. These issues were raised with the Company immediately. Upon returning to Kaimiro Production Station after the completion of sampling at the Ngatoro sites, it was noted that the first skimmer pit was no longer

being pumped to the discharge point and additional sediment controls had been put in place.

The results of sampling showed that the very high suspended solids content was having a negative impact on the water quality of the receiving waters (see Table 2), elevating the suspended solids content from $< 2 \text{ g/m}^3$ upstream of the discharge, to 140 g/m^3 below it. All other measured parameters were acceptable. In this instance, the consent limit exceedance was a result of the actions of the consent holder and their contractors.

Unfortunately, these results were not communicated to GPL until six months after the event. The Council is implementing an externally accessible database for sampling results to reduce such delays in notification.

2.3.3 Results of receiving environment monitoring

Chemical

Chemical water quality sampling of the unnamed tributary of the Mangaoraka Stream was undertaken in conjunction with discharge monitoring on 17 June 2014 and 27 June 2014, as discussed above. These results are presented in Table 2, and the sampling sites are shown in Figure 1.

Table 2 Results of receiving environment monitoring of an unnamed tributary of the Mangaoraka Stream in relation to the Kaimiro Production Station

Parameter	Units	17 June 2014		27 June 2014	
		Upstream [site MRK000200]	Downstream [site MRK000202]	Upstream [site MRK000200]	Downstream [site MRK000202]
Total Alkalinity	g/m^3	9	11	23	22
Chloride	g/m^3	5.5	9.2	13.1	12.9
Conductivity	mS/m	5.1	5.9	10.7	10.6
Hydrocarbons	g/m^3	< 0.5	< 0.5	< 0.5	< 0.5
pH	pH	6.7	6.7	6.4	6.5
Suspended solids	g/m^3	330	280	< 2	140
Temperature	$^{\circ}\text{C}$	13.2	13.2	13.4	13.2

Biomonitoring

Three-site biomonitoring surveys were undertaken in November 2013 and February 2014 in two tributaries of the Mangaoraka Stream, to monitor the health of the macroinvertebrate communities of these tributaries in relation to the discharge of treated stormwater from the Kaimiro Production Station. Site 1 is the 'control' site which is located in a major tributary of the Mangaoraka Stream, upstream of the confluence with a more minor tributary. Site 2 is situated in the minor tributary which receives the stormwater discharge from the production station and site 3 is approximately 50 metres downstream of the confluence of this tributary. The Council's standard 'kick' sampling technique was used to collect the stream bed macroinvertebrate samples from each site. Samples were processed to provide number of taxa (richness), MCI and SQMCI_s scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI_s takes into account taxa abundances as well as sensitivity to pollution. It may indicate subtle changes in communities, and therefore be more relevant index if non-organic impacts are occurring. Significant differences in either the MCI or the SQMCI_s between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

25 November 2013

The MCI and SQMCI_s scores recorded at site 2 in the small unnamed tributary downstream of the production station discharge typically were dissimilar to the scores recorded at the two sites in the larger tributary. At the time of this survey, the availability of instream habitat at this site was limited due to bank slumping sediment rather than the presence of iron oxide deposits and limited periphyton on the bed of the stream which is restrictive to the establishment of a macroinvertebrate community comprising certain 'sensitive' taxa. In contrast, sites 1 and 3 in the major tributary supported much more diverse communities which included abundances of several 'sensitive' taxa. It was considered most likely that the difference in taxa richness, MCI, and SQMCI_s scores at site 2 compared to the two sites in the larger tributary, resulted from differences in physical habitat rather than as a result of the production station discharges.

MCI and SQMCI_s scores recorded at each of the two sites in the main tributary in this survey were equivalent with, or similar to, the median scores for each respective site on this spring occasion; an indication of relatively good preceding water quality under moderate flow conditions following a recent wet early spring period.

In summary, the results of this November 2013 survey indicated that discharges from the Kaimiro Production Station had not had any recent detrimental effects on the macroinvertebrate communities of the main tributary of the Mangaoraka Stream and that the poor community found in the (minor) receiving tributary was coincident with sedimentation of the substrate due to bank slumping.

3 February 2014

The richness and SQMCI_s score recorded at site 2 in the small unnamed tributary downstream of the production station discharge typically were dissimilar to those recorded at the two sites in the larger tributary. At the time of this survey, the availability of instream habitat at this site was limited due to sedimentation and iron-oxide deposition on the streambed which is restrictive to the establishment of a macroinvertebrate community comprising certain 'sensitive' taxa. In contrast, sites 1 and 3 in the major tributary supported much more diverse communities which included abundances of several 'sensitive' taxa. It was considered most likely that the difference in taxa richness and SQMCI_s score at site 2 compared to the two sites in the larger tributary, resulted from differences in physical habitat rather than as a result of the production station discharges.

MCI and SQMCI_s scores recorded at each of the two sites in the main tributary in this survey were within five units of the median scores for each respective site on this summer occasion; an indication of relatively good preceding water quality under low flow conditions following a recent dry summer period.

In summary, the results of this February 2014 survey indicated that discharges from the Kaimiro Production Station had not had any recent detrimental effects on the macroinvertebrate communities of the main tributary of the Mangaoraka Stream and that the poorer community found in the (minor) receiving tributary was coincident with sedimentation of the substrate including iron-oxide deposition.

2.4 Results: air

2.4.1 Inspections

Air inspections were carried out in conjunction with site inspections as discussed in section 2.3.1 above. On all occasions air discharges complied with consent conditions.

2.4.2 Results of discharge monitoring

During the monitoring year, a multi-gas meter was deployed on two occasions in the vicinity of the plant. Each deployment lasted approximately twenty-four hours, with the instrument placed in a downwind position at the start of each deployment. Monitoring consisted of continuous measurements of gas concentrations for the gases of interest (carbon monoxide and combustible gases). The location of the multi-gas meter for each sampling run is shown in Figure 2.



Figure 2 Air monitoring sites at Kaimiro Production Station (2013-2014 year)

Because of the nature of the activities on the site, it was considered that the primary information of interest in respect of gases potentially emitted from the site was the average downwind concentration, rather than any instantaneous peak value. That is, the long-term exposure levels, rather than short-term maxima, are of most interest. The gas meter was therefore set up to create a data set based on recording the average concentration measured during each minute as raw data. The details of each sample run are summarised in Table 3.

Table 3 Results of ambient gas monitoring at Kaimiro Production Station

Run		1	2	Average
Period (from-to)		19 – 21 November 2013	9 – 10 May 2014	
Max	CO(ppm)	8.0	4.8	6.4
	LEL(%)	0.1	0.1	0.1
Mean	CO(ppm)	0.0	0.1	< 0.1
	LEL(%)	0.0	0.0	0.0
Min	CO(ppm)	0.0	0.0	0.0
	LEL(%)	0.0	0.0	0.0

Note: (1) The instrument records in units of ppm. At 15°C 1ppm CO = 0.85 mg/m³

(2) See text for explanation of LEL. Because the LEL of methane is equivalent to a mixture of approximately 5% methane in air, then the actual concentration of methane in air can be obtained by dividing the % LEL by 20.

The consent covering air discharges from the Kaimiro Production Station has specific limits related to particular gases. Special condition 13 of consent 4048-3 sets a limit on the carbon monoxide concentration at or beyond the production station's boundary. The limit is expressed as 10 mg/m³ for an eight hour average or 30 mg/m³ for a one hour average exposure. The maximum concentration of carbon monoxide found during the monitoring runs was 6.8 mg/m³ (8 ppm), with an average concentration for both runs of less than 0.1 mg/m³, which complies with the consent condition. This continues the pattern found in previous years.

LEL% is the percentage of the lower explosive limit, expressed as methane, which is detected in the air sampled. The sensor on the instrument reacts to gases and vapours such as acetone, benzene, butane, methane, propane, carbon monoxide, ethanol, and higher alkanes and alkenes, with varying degrees of sensitivity. The Council's Regional Air Quality Plan has a typical requirement that no discharge shall result in a dangerous level of airborne contaminants, including any risk of explosion. At no time did the level of explosive gases downwind of the Kaimiro Production Station reach any more than a trivial level.

2.5 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 consent holder. 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

courses 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 Unauthorised Incident Register [UIR] 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 2013-2014 year, it was not necessary for the Council to undertake significant additional investigations and interventions, or record incidents, in association with GPL's conditions in resource consents or provisions in Regional Plans in relation to the Company's activities at the Kaimiro Production Station.

3. Ngatoro producing wellsites

3.1 Resource consents

3.1.1 Water discharge permits

Section 15(1)(a) of the RMA stipulates that no person may discharge any contaminant into water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or by national regulations.

GPL holds water discharge permit **4073-2** to cover the discharge of up to 100 m³/day of treated stormwater, treated production water and treated wastewater from oil well drilling and production operations and a truck turning area at the Ngatoro-A wellsite into the Ngatoro Stream in the Waitara Catchment. This permit was issued by the Council on 4 February 1998 under Section 87(e) of the RMA. It was transferred to GPL on 23 February 2004 and is due to expire on 1 June 2015.

Conditions 1 to 5 require the establishment of a permanent mixing zone below the point of discharge and stipulate the limits of contaminants in the discharge, and effects the discharge shall not give rise to in both the receiving waters and the Ngatoro Stream.

Condition 6 requires that the consent holder provide a contingency plan in relation to spills at the site.

Condition 7 requires advance notification of the drilling of additional wells at the site.

Condition 8 requires advance notification of the disposal of production water via the stormwater system.

Condition 9 provides for review of the consent.

GPL also holds water discharge permit **3951-3** to discharge treated wastewater and treated stormwater from hydrocarbon exploration and production operations at the Ngatoro-B wellsite into an unnamed tributary of the Ngatoro Stream in the Waitara catchment. This permit was issued by the Council on 23 April 2009 under Section 87(e) of the RMA and is due to expire on 1 June 2027.

Condition 1 requires the consent holder to adopt the best practicable option to prevent or minimise adverse effects of the discharge on the environment.

Condition 2 imposes a limit on the stormwater catchment size.

Condition 3 requires written notification to the Council prior to commencement of site works and drilling operations.

Condition 4 requires that the consent holder prepare and maintain a contingency plan in relation to spillages at the site.

Condition 5 requires that management and maintenance of the stormwater system be undertaken in accordance with information submitted in the application.

Condition 6 requires all stormwater be directed through the stormwater treatment system.

Condition 7 requires that hazardous substance storage areas be bunded with drainage to appropriate recovery systems, and not to the stormwater catchment.

Conditions 8, 9 and 10 impose limits on contaminants in the discharge, and stipulate effects the discharge shall not give rise to in the receiving water.

Condition 11 requires that the Council be advised of reinstatement of the site.

Conditions 12 and 13 are lapse and review provisions.

These permits are attached to this report in Appendix I.

3.1.2 Air discharge permits

Section 15(1)(c) of the RMA stipulates that no person may discharge any contaminant from any industrial or trade premises into air, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations.

GPL holds air discharge permit **7295-1** to cover discharge of emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Ngatoro-A site. This permit was issued by the Council on 12 May 2008 under Section 87(e) of the RMA and is due to expire on 1 June 2027.

Twenty two special conditions are attached to the consent regarding: information and notification (Council and neighbourhood notification, alteration to plant equipment or processes); emissions from the site (regard to wind speed, solid and liquid separation and recovery, best practicable option, offensive odour or smoke, vapour recovery systems, smoke opacity, noxious gases, other contaminants); recording and reporting information (gas stream analysis, visible smoke log, flaring log, annual air discharge report); and lapse of consent and review of conditions.

GPL also holds air discharge permit **7220-1** to cover discharge of emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Ngatoro-B site. This permit was issued by the Taranaki Regional Council on 9 May 2008 under Section 87(e) of the Resource Management Act and is due to expire on 1 June 2027.

The twenty two special conditions attached to the consent are identical to those for consent 7295-1 above.

These permits are attached to this report in Appendix I.

3.2 Monitoring programme

3.2.1 Introduction

Section 35 of the RMA sets out an obligation for the Council to gather information, monitor and conduct research on the exercise of resource consents, and the effects arising, within the Taranaki region.

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 Ngatoro wellsites consisted of four primary components, as set out sections 2.2.2 to 2.2.5.

3.2.2 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 reviews;
- renewals;
- new consents;
- advice on the Council's environmental management strategies and content of regional plans; and
- consultation on associated matters.

3.2.3 Site inspections

The Ngatoro-A and B wellsites were visited five times during the monitoring period. Other producing wellsites associated with the Kaimiro Production Station are inspected annually. With regard to consents for the abstraction of or discharge to water, the main points of interest were plant processes with potential or actual discharges to receiving watercourses, including contaminated stormwater and process wastewaters. Air inspections focused on plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the consent holder were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was surveyed for environmental effects.

3.2.4 Chemical sampling

The Council undertook sampling of the discharges from the Ngatoro-A and B wellsites as well as the water quality upstream and downstream of the discharge points and mixing zones.

The discharges from Ngatoro-A and B were each sampled on two occasions during the year. The samples were analysed for hydrocarbons, suspended solids, conductivity, pH, chloride, turbidity and temperature.

The Ngatoro Stream and tributaries were sampled on two occasions at five sites in relation to Ngatoro-A, and on two occasions at three sites in relation to Ngatoro-B. Both sets of samples were analysed for hydrocarbons, suspended solids, conductivity, pH, chloride, turbidity and temperature.

The Council also undertook sampling of the ambient air quality outside the boundary of Ngatoro-A. A multi-gas meter was deployed on one occasion in the vicinity of the site, with monitoring consisting of continuous measurements of gas concentrations for the gases of interest (carbon monoxide and combustible gases).

The full air monitoring report is attached in Appendix III.

3.2.5 Biomonitoring

A three-site biological survey was performed in the Ngatoro Stream and an unnamed tributary to determine whether or not the discharge of treated stormwater from the Ngatoro-B wellsite has had a detrimental effect upon the communities of the stream.

The full survey report is attached in Appendix II.

3.3 Results: water

3.3.1 Inspections

Five inspections were carried out at each of the Ngatoro sites in the 2013-2014 year. The following was found during the inspections:

6 August 2013

The sites were inspected following recent heavy rainfall. No flaring was being carried out at either site and no odours from the facilities were evident during downwind, off-site odour surveys. Stormwater was being discharged at both sites with no visual effects downstream in the receiving waters. The sites were neat and tidy.

25 September 2013

The sites were inspected following weekend of torrential rain and high winds. No flaring was being undertaken at Ngatoro-A. The ring drains and bunds were clear and there were no apparent effects from the stormwater discharge. Ngatoro-B was unmanned. Inspection from the perimeter showed that the site was neat and tidy. There were no apparent effects on the adjacent stream from the stormwater discharge. Everything was satisfactory.

7 November 2013

The sites were neat and tidy. No flaring was occurring at either site at the time of inspection. The ring drains and bunds were clear of obstructions and contaminants. The skimmer pits were clear with no visible effects from any discharges to the adjacent streams. Everything was satisfactory.

9 January 2014

Inspections were undertaken during heavy rainfall resulting in stormwater runoff to the skimmer pits and stormwater discharges. All stormwater was directed via the ring drains for treatment before discharging to the adjacent streams. No visual effects from

the discharges were noted. No flaring was being undertaken. The sites were neat and tidy. Everything was satisfactory.

5 June 2014

The sites were inspected following a period of fine weather. Ngatoro-A was neat and tidy. Improvements to the skimmer pits had been completed. Ngatoro-B was also neat and tidy with no activity at the time of inspection. No effects from the stormwater discharges were noted. No flaring was being undertaken.

3.3.2 Results of discharge monitoring

The location of water quality sampling sites in relation to both Ngatoro-A and Ngatoro-B sites are described in Table 4 and shown in Figure 3.

Table 4 Location of chemical water quality and biological monitoring sites for Ngatoro-A and Ngatoro-B

Site No.	Site code	Description
Ngatoro-A	IND002024	Ngatoro-A discharge
	NGT000177	Tributary 5 m upstream of discharge
	NGT000179	Tributary 140 m downstream of discharge
	NGT000182	Ngatoro Stream 50 m upstream of confluence with tributary
	NGT000183	Tributary 50 m upstream of confluence with Ngatoro Stream
	NGT000184	Ngatoro Stream 40 m downstream of confluence with tributary
Ngatoro-B	IND002017	Ngatoro-B discharge
	NGT000197	Ngatoro stream 60 m upstream of tributary
	NGT000199	Drain tributary 10 m upstream of confluence with Ngatoro Stream
	NGT000200	Ngatoro Stream 40 m downstream of tributary

Ngatoro-A

Chemical water sampling of the discharge from Ngatoro-A was undertaken on two occasions during the 2013-2014 monitoring period. Table 5 presents the results along with a summary of previous results.

Table 5 Results of discharge monitoring from Ngatoro-A (site IND002024) during the period under review with a summary of previous monitoring data

Parameter	Units	Date		Previous results			
		17 Jun 2014	27 Jun 2014	Min	Max	Median	Number
Chloride	g/m ³	27.0	118	216	25,400	4,690	41
Conductivity	mS/m	12.4	46.2	2.1	5,320	668	41
Hydrocarbons	g/m ³	< 0.5	< 0.5	< 0.5	18.0	0.7	41
pH		7.1	7.0	6.2	7.3	6.8	41
Suspended solids	g/m ³	44	22	< 2	260	31	41
Turbidity	NTU	33	16	3.2	510	31.5	33
Temperature	°C	11.7	11.3	6.5	24.0	13.9	41

The chloride concentration in the discharges was significantly lower than previous years because the Company is no longer discharging treated production water via the stormwater system. No hydrocarbons were detected in the samples.

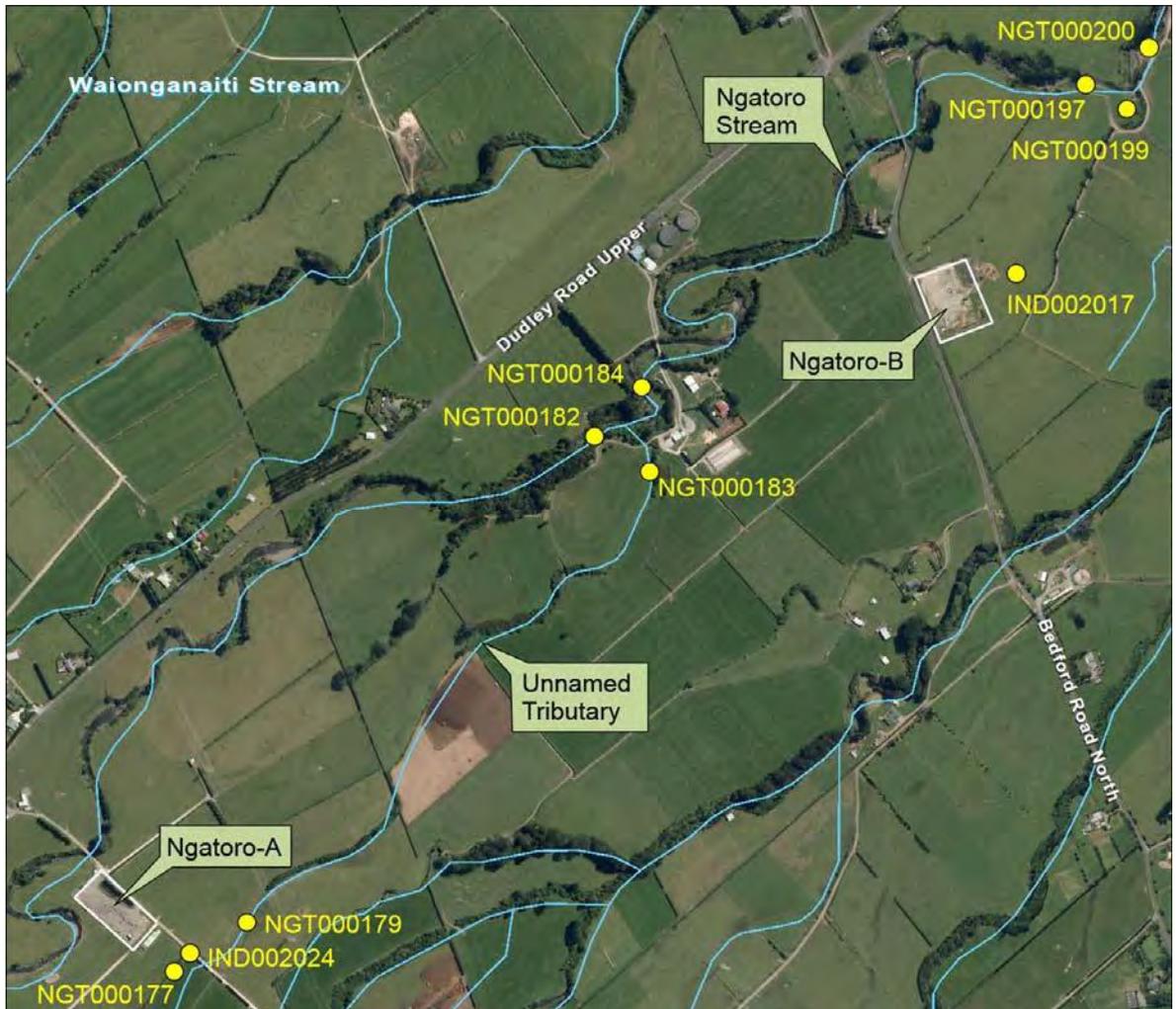


Figure 3 Monitoring sites in relation to the Ngatoro wellsites

Ngatoro-B

Chemical water sampling of the discharge from Ngatoro-B was undertaken on two occasions during the 2013-2014 monitoring period. Table 6 presents the results along with a summary of previous results.

Table 6 Results of discharge monitoring from Ngatoro-B (site IND002017) during the period under review with a summary of previous monitoring data

Parameter	Units	Date		Previous Results			
		17 Jun 2014	27 Jun 2014	Min	Max	Median	Number
Chloride	g/m ³	7.6	9.1	6.7	29,000	54.5	50
Conductivity	mS/m	5.2	7.6	5.2	6,190	22.2	48
Hydrocarbons	g/m ³	< 0.5	< 0.5	< 0.5	5.9	< 0.5	49
pH		6.7	6.6	6.4	8.4	7.0	49
Suspended solids	g/m ³	19	4	< 2	220	13	47
Turbidity	NTU	14	3.8	3.4	100	12.0	35
Temperature	°C	11.9	12.0	7.3	23.9	14.0	49

No hydrocarbons were detected in the discharge in the year under review. Chloride and conductivity results for the samples continued to reflect the improvements found from monitoring in recent years. The results show a clean stormwater discharge.

3.3.3 Results of receiving environment monitoring

Ngatoro-A

Chemical water quality sampling of the receiving environment was undertaken in conjunction with discharge monitoring on two occasions (see Table 4 for an explanation of sites). The results are presented in Table 8 below. Table 7 sets out the water quality standards relating to consent 4073-2. The receiving water (below mixing zone) limits apply within the Ngatoro Stream itself at site NGT000184, not in the tributary (sites NGT000179 and NGT000183).

Table 7 Water quality standards below the mixing zone at Ngatoro-A according to consent 4073-2

Parameter	Unit	Must not exceed
Chloride	g/m ³	50
pH range	g/m ³	6.5-8.5
Suspended solids	g/m ³	An increase of 10 (when turbidity upstream is ≤ 5 NTU)
Turbidity	NTU	An increase of 50 % (if turbidity upstream is ≥ 5 NTU)

The results indicate that the discharge was having minimal effect on the water quality of the Ngatoro Stream at the times of sampling (refer to the difference between the upstream NGT000182 and downstream NGT000184 site results). Chloride levels, suspended solids, pH and turbidity below the mixing zone were all within consent limits on both occasions.

Table 8 Results of receiving environment monitoring in relation to Ngatoro-A

Date	Site	Chloride g/m ³	Conductivity mS/m	Hydrocarbons g/m ³	pH	Suspended solids g/m ³	Temp °C	Turbidity NTU
17-06-14	NGT000177 u/s	18.5	11.2	< 0.5	6.5	25	12.6	19
	NGT000179 d/s	16.6	11.5	< 0.5	6.7	32	12.6	26
	NGT000182 u/s	4.8	3.4	< 0.5	7.2	16	10.9	12
	NGT000183 trib	13.9	11.0	< 0.5	7.0	44	12.8	52
	NGT000184 d/s	4.9	3.5	< 0.5	7.2	14	10.9	9.9
27-06-14	NGT000177 u/s	23.9	14.5	< 0.5	6.7	2	12.3	2.2
	NGT000179 d/s	24.4	15.4	< 0.5	6.9	11	12.3	5.4
	NGT000182 u/s	7.2	5.8	< 0.5	7.1	< 2	10.7	0.9
	NGT000183 trib	-	-	-	-	-	-	-
	NGT000184 d/s	7.3	6.0	< 0.5	7.3	< 2	10.8	1.3

Two sites in the tributary of the Ngatoro Stream, upstream and downstream of the discharge point (NGT000177 and NGT000179), were also sampled in the 2013-14 monitoring period. With the renewal of consent 4073-2 in 2015, it is expected that the tributary itself will be designated as the receiving waters and these sites will be used to monitor the effect of the stormwater discharge from Ngatoro-A.

Ngatoro-B

Chemical water quality sampling of the receiving environment was undertaken in conjunction with discharge monitoring on two occasions (see Table 4 for an explanation of sites). The results are presented in Table 9 below.

Table 9 Results of receiving environment monitoring in relation to Ngatoro-B

Date	Site	Chloride g/m ³	Conductivity mS/m	Hydrocarbons g/m ³	pH	Suspended solids g/m ³	Temp °C	Turbidity NTU
17-06-14	NGT000197 u/s	5.1	3.7	< 0.5	7.1	14	11.1	10
	NGT000199 trib	17.8	10.3	< 0.5	6.7	30	13.0	26
	NGT000200 d/s	5.4	3.8	< 0.5	7.1	13	11.1	9.2
27-06-14	NGT000197 u/s	7.1	6.3	< 0.5	7.1	< 2	11.0	1.0
	NGT000199 trib	24.4	13.7	< 0.5	6.8	< 2	12.5	1.5
	NGT000200 d/s	7.7	6.4	< 0.5	7.4	5	11.0	1.1

The results indicate that the discharge was having minimal effect on the water quality of the Ngatoro Stream at the times of sampling. Measured parameters were in compliance with consent conditions for the receiving waters.

Biomonitoring at Ngatoro-B

On 25 November 2013, The Council's standard 'kick-sampling' technique was used at three established sites to collect streambed macroinvertebrates from an unnamed tributary and the main Ngatoro Stream (NGT000197, 199 and 200 in Figure 3). Samples were sorted and identified and the number of taxa (richness) and MCI and SQMCI_s scores were obtained for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI_s takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities, particularly if non-organic impacts are occurring. Significant differences in either the MCI or the SQMCI_s between site indicate the degree of adverse effects (if any) of the discharges being monitored.

This November 2013 macroinvertebrate survey indicated that discharges from the Ngatoro-B site had not had any recent detrimental effects on the macroinvertebrate communities of the Ngatoro Stream. Minimal significant differences in the macroinvertebrate communities were recorded between the upstream 'control' site and the site downstream of the receiving tributary confluence.

The macroinvertebrate communities of the Ngatoro Stream contained significant proportions of 'sensitive' taxa at both sites and the communities were generally dominated by 'sensitive' taxa. Taxonomic richnesses (numbers of taxa) were slightly above medians at both sites at the time of this spring survey. MCI scores indicated that the stream communities were of 'good' health, and generally typical of conditions recorded in similar reaches of ringplain Taranaki streams.

A much improved richness and a higher than maximum MCI score were recorded in the receiving water tributary despite iron-oxide deposits which partially smothered the substrate and contributed to reduced abundances within many individual taxa. Despite these conditions, more diluted and lower salinity discharges from Ngatoro-B were found to have had no recent detrimental impacts on the macroinvertebrate communities of the Ngatoro Stream beyond the designated mixing zone downstream of the tributary confluence.

3.4 Results: air

3.4.1 Inspections

Air inspections were carried out in conjunction with site inspections as discussed in section 3.3.1 above. On all occasions air discharges complied with consent conditions.

3.4.2 Results of discharge monitoring

During the monitoring year, a multi-gas meter was deployed on one occasion in the vicinity of the Ngatoro-A site on 17 March 2014. The deployment lasted approximately 72 hours, with the instrument placed in a downwind position at the start of the deployment. Monitoring consisted of continuous measurement of gas concentrations for the gases of interest (carbon monoxide and combustible gases). The location of the multi-gas meter for the sampling run is shown in Figure 4.

Because of the nature of the activities on the site, it was considered that the primary information of interest in respect of gases potentially emitted from the site was the average downwind concentration, rather than any instantaneous peak value. That is, the long-term exposure levels, rather than short-term maxima, are of most interest. The gas meter was therefore set up to create a data set based on recording the average concentration measured during each minute as raw data.

The consent covering air discharges from the Ngatoro-A wellsite has specific limits related to particular gases. Special condition 13 of consent 7295-1 sets a limit on the carbon monoxide concentration at or beyond the site boundary. The limit is expressed as 10 mg/m³ for an eight hour average or 30 mg/m³ for a 1 hour average exposure. The maximum concentration of carbon monoxide found during the monitoring run was 2.8 mg/m³ (3.3 ppm), with an average concentration of less than 0.1 mg/m³, which complies with the consent condition. This continues the pattern found in previous years.

LEL% is the percentage of the lower explosive limit, expressed as methane, which is detected in the air sampled. The sensor on the instrument reacts to gases and vapours such as acetone, benzene, butane, methane, propane, carbon monoxide, ethanol, and higher alkanes and alkenes, with varying degrees of sensitivity. The Council's Regional Air Quality Plan has a typical requirement that no discharge shall result in a dangerous level of airborne contaminants, including any risk of explosion. At no time did the level of explosive gases downwind of Ngatoro-A reach any more than a trivial level.



Figure 4 Air monitoring site at Ngatoro-A (2013-2014 year)

3.5 Investigations, interventions, and incidents

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 courses 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 Unauthorised Incident Register (UIR) 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 2013-2014 period, the Council recorded one incident in relation to the operation of the Ngatoro-A stormwater system. On 18 February 2014, during the investigation of an unrelated complaint regarding the Inglewood water treatment plant, a waxy substance with a strong hydrocarbon odour was noted floating on the surface of the water in both of the skimmer pits at Ngatoro-A. Abatement notice EAC20160 was issued requiring the Company to undertake works to ensure that no contaminants were discharged to the environment. An inspection on 4 March 2014 found that some works had been carried out towards compliance with the abatement notice. The notice was extended to 21 March 2014 to allow for additional works to be completed.

A follow-up inspection on 27 March 2014 found that the skimmer pits had been upgraded and fitted with an impervious liner. The outlet pipe had a manual shut-off valve installed. Potentially contaminated soil had been removed from the site perimeter drain. The Investigating Officer was satisfied that sufficient works had been undertaken to mitigate the potential for contamination of surface or ground water and the abatement notice was therefore withdrawn.

4. Discussion

4.1 Discussion of site performance

Inspections of the Kaimiro and Ngatoro sites during the 2013-2014 monitoring year found that they were largely well managed and the stormwater systems were maintained to a satisfactory standard. Emissions to air were well controlled. However, the undertaking of upgrade works on the drains and skimmer pits at Kaimiro Production Station during wet weather with inadequate sediment controls, and the loss of primary containment indicated by the presence of significant amounts of hydrocarbons in the skimmer pits at Ngatoro-A, showed that the best practicable option was not always being exercised by the Company and its contractors.

4.2 Environmental effects of exercise of consents

4.2.1 Kaimiro Production Station

Inadequate sediment controls during upgrade works on the stormwater system at Kaimiro Production Station on 27 June 2014 resulted in elevated suspended solids in the unnamed tributary of the Mangaoraka Stream. However, water quality sampling earlier in the month had shown that this stream is naturally prone to high sediment loading during heavy rainfall. Hence, the discharge from the Kaimiro site on 27 June was not expected to have had any significant or long term effect on the receiving environment. It should be noted that these upgrades works were related to the lining of the skimmer pits to improve environmental performance, as requested by the Council during winter months. Biomonitoring carried out in the tributaries of the Mangaoraka Stream indicated that the discharge was not having a significant adverse effect on the downstream water quality.

There were no adverse effects on the environment as a result of the exercise of the air discharge permit at the Kaimiro Production Station. Measurements of ambient air quality at the site showed that the concentrations of carbon monoxide, volatile organic compounds and combustible gases were below levels of concern.

4.2.2 Ngatoro producing wellsites

Results of samples collected of the discharges and receiving waters were within the limits prescribed by the consents and, along with the results of biomonitoring carried out in the Ngatoro Stream, indicated that the discharges were not having a significant adverse effect on the downstream water quality.

There were no adverse effects on the environment as a result of the exercise of the air discharge permits at Ngatoro-A and B.

4.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Tables 10-17.

4.3.1 Kaimiro Production Station

Table 10 Summary of performance for Consent 1334-3 to discharge treated stormwater

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Best practicable option to prevent effects on environment	Site inspections	No. Excavation of stormwater drains during rainfall on one occasion.
2. Maximum stormwater catchment	Site inspections	Yes
3. Contingency plan provided prior to commencement	Received	Yes
4. Site water directed for treatment through stormwater treatment system	Site inspections	No. First pit was being pumped directly to the discharge point on one occasion.
5. Design, management and maintenance of stormwater system in accordance with application	Site inspections	Yes
6. Hazardous storage areas bunded with drainage to sumps	Site inspections	Yes
7. Limits on contaminants in the discharge	Sample collection	No. Two suspended solids limit exceedances.
8. Limits on BOD and temperature increase below mixing zone	Sample collection	Yes
9. Effects on receiving water below mixing zone	Inspection and sample collection	No. Significantly elevated suspended solids in stream on one occasion.
10. Annual preparation and maintenance of contingency plan relating to spills at the site	Update of plan approved 20 Aug 2014	Yes
11. Council advised prior to reinstatement of the site	Site not reinstated during period under review	N/A
12. Provisions for review of consent conditions	Review not scheduled during monitoring period	N/A
Overall assessment of environmental performance and compliance in respect of this consent		Improvement req.
Overall assessment of administrative performance in respect of this consent		Improvement req.

N/A = not applicable

Table 11 Summary of performance for Consent 4048-3 to discharge emissions to air

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Limit on flaring duration	Site inspections and company logs	Yes
2. Neighbours notified prior to flaring	No complaints received from neighbours	Yes
3. Council notified of continuous flaring	Notifications received	Yes
4. Consultation prior to alteration to plant equipment or processes	Site inspections and liaison with consent holder	Yes
5. Regard given to wind conditions during flaring	No complaints received from neighbours	Yes
6. Gas treated by liquid and solid separation and recovery	Site inspections	Yes
7. No liquid or solid hydrocarbons combusted through gas flare	Site inspections	Yes
8. Flare only used to dispose of substances from the well stream	Site inspections	Yes
9. Hydrocarbon storage vessels fitted with vapour recovery systems	Site inspections	Yes
10. Best practicable option to prevent effects on environment	Site inspections	Yes
11. No offensive odour or smoke at boundary of site	Site inspections	Yes
12. Limit on smoke opacity	Site inspections	Yes
13. Limit on carbon monoxide emissions	Ambient gas monitoring	Yes
14. Limit on nitrogen dioxide emissions	Not monitored during period under review	N/A
15. No discharge of contaminant that is hazardous, toxic or noxious beyond boundary	Site inspections and ambient gas monitoring	Yes
16. No discharge of contaminant that exceeds specific WES limits	Ambient gas monitoring	Yes
17. Record of smoke emitting incidents	Annual air report received	Yes
18. Provision of flaring logs to Council	Flaring logs received	Yes
19. Maintenance of flaring logs	Flaring logs received	Yes
20. Provision of annual air emissions report	Report received	Yes
21. Analysis of gas and crude oil stream	Not requested during period under review	N/A
22. Provisions for review of consent conditions	Review not scheduled during the monitoring period	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

Table 12 Summary of performance for Consent 5384-1 to abstract groundwater

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Abstraction undertaken in accordance with application	Site inspections and review of records	Yes
2. Records of abstractions, available to Council upon request	Records not requested for this monitoring period	N/A
3. Consent holder shall monitor neighbouring bore	No problems reported by the Company or neighbours	Yes
4. Provisions for review of consent conditions	Not scheduled during the monitoring period	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

Table 13 Summary of performance for Consent 6218-1 to discharge sand waste onto land for storage

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Best practicable option to prevent or minimise adverse effects on the environment	Site inspections	Yes
2. Exercise of consent in accordance with application	Site inspections	Yes
3. Contingency planning	Update of plan received 17 Aug 2012	Yes
4. Notification prior to transfer	No waste transferred during period under review	N/A
5. Records of waste	No waste transferred during period under review	N/A
6. Waste limited to sand	Site inspections	Yes
7. Sand waste to be treated for removal of free liquid phase hydrocarbons	No waste transferred during period under review	N/A
8. Total volume less than 45 cubic metres	Site inspections	Yes
9. Storage area to be bunded	Area has been bunded	Yes
10. Stormwater directed through treatment system	Site inspections	Yes
11. Limits on contaminants in discharge	Discharge not sampled during period under review	N/A
12. Effects on receiving waters	Site inspections	Yes
13. No contaminants to enter surface water	Site inspections	Yes
14. No adverse effects on groundwater	No samples collected during period under review	N/A

Condition requirement	Means of monitoring during period under review	Compliance achieved?
15. Limits on total dissolved salts in surface and groundwater	No samples collected during period under review	N/A
16. Limits on levels of metals in the soil	No samples collected during period under review	N/A
17. Levels of hydrocarbons in soil upon expiry of consent	Review of usage and reinstatement is pending	N/A
18. Remediation plan	Review of usage and reinstatement is pending	N/A
19. Notification prior to reinstatement	Site not reinstated during period under review	N/A
20. Lapse of consent	Consent exercised within lapse period	N/A
21. Review provisions	Not scheduled to be reviewed during the monitoring period	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

4.3.2 Ngatoro-A wellsite

Table 14 Summary of performance for Consent 4073-2 to discharge treated stormwater and production water

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Establishment of permanent mixing zone 25 m below discharge	Mixing zone established prior to monitoring period	N/A
2. Effects on stream below mixing zone	Inspections and sampling	Yes
3. Limit on hydrocarbons in discharge	Sampling	Yes, but abatement notice issued to undertake preventative works.
4. Limits on chloride and pH in receiving waters	Sampling	Yes
5. Suspended solid and turbidity levels below mixing zone	Sampling	Yes
6. Provision of contingency plan	Update of plan approved 20 Nov 2013	Yes
7. Advise Council prior to drilling of additional wells	No drilling undertaken during monitoring period	N/A
8. Notification prior to discharge of production water	Prior notification received	Yes
9. Provisions for review of consent conditions	Not scheduled to be reviewed during the monitoring period	N/A
Overall assessment of environmental performance and compliance in respect of this consent		Good
Overall assessment of administrative performance in respect of this consent		Good

Table 15 Summary of performance for Consent 7295-1 to discharge emissions to air

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Council notified of continuous flaring	Notifications received	Yes
2. Neighbours notified prior to flaring	No complaints received from neighbours	Yes
3. Consultation prior to alteration to plant equipment or processes	Site inspections	Yes
4. Regard given to wind conditions during flaring	No complaints received from neighbours	Yes
5. Gas treated by liquid and solid separation and recovery	Site inspections	Yes
6. Notify Council of any failure to maintain liquid and solid separation	No events recorded	Yes
7. No liquid or solid hydrocarbons combusted through gas flare	Site inspections	Yes
8. Best practicable option to prevent effects on environment	Site inspections	Yes
9. Flare only used to dispose of substances from the well stream	Site inspections	Yes
10. No offensive odour or smoke at boundary of site	Site inspections	Yes
11. Hydrocarbon storage vessels fitted with vapour recovery systems	Site inspections	Yes
12. Limit on smoke opacity	Site inspections	Yes
13. Limit on carbon monoxide emissions	Ambient gas monitoring	Yes
14. Limit on nitrogen dioxide emissions	Not monitored during period under review	N/A
15. No discharge of contaminant that is hazardous, toxic or noxious beyond boundary	Ambient gas monitoring and inspections	Yes
16. No discharge of contaminant that exceeds specific WES limits	Ambient gas monitoring	Yes
17. Analysis of gas and crude oil stream	Not requested during period under review	N/A
18. Record of smoke emitting incidents	Flaring logs received	Yes
19. Maintenance of flaring logs	Flaring logs received	Yes
20. Provision of annual air emissions report	Report received	Yes
21. Lapse of consent	Consent exercised within lapse period	N/A

Condition requirement	Means of monitoring during period under review	Compliance achieved?
22. Provisions for review of consent conditions	Review not scheduled during the monitoring period	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

4.3.3 Ngatoro-B wellsite

Table 16 Summary of performance for Consent 3951-3 to discharge treated stormwater and wastewater

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Best practicable option to prevent effects on environment	Site inspections	Yes
2. Maximum stormwater catchment	Site inspections	Yes
3. Notification prior to site works or drilling activities	Notifications received	Yes
4. Contingency plan provided to Council	Update of plan received 17 Aug 2012	Yes
5. Activity undertaken in accordance with application	Site inspections	Yes
6. All stormwater and waste water to be directed through treatment system	Site inspections and sampling	Yes
7. Hazardous substance areas to be isolated from the stormwater system	Site inspections	Yes
8. Limits on contaminants in the discharge	Sampling	Yes
9. Limit on temperature increase below the mixing zone	Sampling	Yes
10. Effects on receiving water below mixing zone	Inspections and sampling	Yes
11. Reinstatement to the satisfaction of the Council	Site not reinstated during the period under review	N/A
12. Lapse of consent	Consent exercised within lapse period	N/A
13. Review provisions	Review not scheduled during the monitoring period	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

Table 17 Summary of performance for Consent 7220-1 to discharge emissions to air

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Council notified of continuous flaring	No flaring during period under review	N/A
2. Neighbours notified prior to flaring	No complaints received from neighbours	Yes
3. Consultation prior to alteration to plant equipment or processes	Site inspections and liaison with consent holder	Yes
4. Regard given to wind conditions during flaring	No complaints received from neighbours	Yes
5. Gas treated by liquid and solid separation and recovery	Site inspections	Yes
6. Notify Council of any failure to maintain liquid and solid separation	No events recorded	Yes
7. No liquid or solid hydrocarbons combusted through gas flare	Site inspections	Yes
8. Best practicable option to prevent effects on environment	Site inspections	Yes
9. Flare only used to dispose of substances from the well stream	Site inspections	Yes
10. No offensive odour or smoke at boundary of site	Site inspections	Yes
11. Hydrocarbon storage vessels fitted with vapour recovery systems	Site inspections	Yes
12. Limit on smoke opacity	Site inspections	Yes
13. Limit on carbon monoxide emissions	Not monitored during year under review	N/A
14. Limit on nitrogen dioxide emissions	Not monitored during year under review	N/A
15. No discharge of contaminant that is hazardous, toxic or noxious beyond boundary	Site inspections	Yes
16. No discharge of contaminant that exceeds specific WES limits	Not monitored during year under review	N/A
17. Analysis of gas and crude oil stream	Not requested during period under review	N/A
18. Record of smoke emitting incidents	Flaring logs received	Yes
19. Maintenance of flaring logs	Flaring logs received	Yes
20. Provision of annual air emissions report	Report received	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
21. Lapse of consent	Consent exercised within lapse period	N/A
22. Provisions for review of consent conditions	Review not scheduled during the monitoring period	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

4.3.4 Summary

During the period under review, the Company demonstrated an overall good level of environmental performance as defined in Section 1.1.4. The Kaimiro and Ngatoro facilities were largely well managed and maintained. However, the inconsistent application of 'best practicable option' by the Company means that an improvement is required in administrative compliance with the resource consents.

4.4 Recommendation from the 2012-2013 Annual Report

In the 2012-2013 Annual Report, it was recommended:

1. THAT monitoring of consented activities at the Kaimiro and Ngatoro Production Stations in the 2013-2014 year continues at the same level as in 2012-2013.
2. THAT the option for review of resource consents 1334-3 and 4048-3 in June 2014, as set out in conditions 12 and 22, respectively, not be exercised on the grounds that the current conditions are considered adequate to deal with any adverse effects on the environment arising from the exercise of these resource consents.

These recommendations were implemented.

4.5 Alterations to monitoring programmes for 2014-2015

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, the obligations of the Act in terms of monitoring emissions/discharges and effects, and subsequently reporting 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 2014-2015 the monitoring programme for consented activities at the Kaimiro and Ngatoro sites is amended from that in 2013-2014 by reducing the level of monitoring at Ngatoro-A and Ngatoro-B to reflect the consolidation of the majority of production activities for the Kaimiro/Ngatoro assets at Kaimiro Production Station in recent years. It is now more appropriate to consider Ngatoro-A and B as associated

sites of Kaimiro Production Station. A recommendation to this effect is attached to this report.

4.6 Exercise of optional review of consents

Resource consent 3951-3 provides for an optional review of the consent in June 2015. Condition 13 allows the Council to review the consent 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.

Resource consents 7220-1 and 7295-1 also provide for optional review of the consents in June 2015. In both cases, condition 22 allows the Council to review the consents for any of the following purposes:

- a) dealing with any significant adverse effect on the environment arising from the exercise of the consent which was not foreseen at the time the application was considered or which it was not appropriate to deal with at the time;
- b) requiring the consent holder to adopt the best practicable option to remove or reduce any adverse effect on the environment caused by the discharge;
- c) to alter, add or delete limits on mass discharge quantities or discharge or ambient concentrations of any contaminant;
- d) taking into account any Act of Parliament, regulation, national policy statement or national environmental standard which relates to limiting, recording, or mitigating emissions of gases which are products of combustion, and which is relevant to the air discharge from the Kaimiro Production Station.

Based on the results of monitoring in the year under review, and in previous years as set out in earlier annual compliance monitoring reports, it is considered that there are no grounds that require a review to be pursued or grounds to exercise the review option for consents 3951-3, 7220-1 or 7295-1.

A recommendation to this effect is presented in Section 5 of this report.

5. Recommendations

1. THAT for 2014-2015 the monitoring programme for consented activities at the Kaimiro and Ngatoro sites is amended from that in 2013-2014 by reducing the level of monitoring at Ngatoro-A and Ngatoro-B to reflect the consolidation of the majority of production activities for the Kaimiro/Ngatoro assets at Kaimiro Production Station in recent years.
2. THAT the option for review of resource consents 3951-3, 7220-1 and 7295-1 in June 2015, as set out in conditions 13 (3951) and 22 (7220 and 7295), not be exercised on the grounds that the current conditions are considered adequate to deal with any adverse effects on the environment arising from the exercise of these resource consents.

Glossary of common terms and abbreviations

The following abbreviations and terms are used within this report:

Al*	Aluminium.
As*	Arsenic.
Biomonitoring	Assessing the health of the environment using aquatic organisms.
BOD	Biochemical oxygen demand. A measure of the presence of degradable organic matter, taking into account the biological conversion of ammonia to nitrate.
BODF	Biochemical oxygen demand of a filtered sample.
Bund	A wall around a tank to contain its contents in the case of a leak.
CBOD	Carbonaceous biochemical oxygen demand. A measure of the presence of degradable organic matter, excluding the biological conversion of ammonia to nitrate.
cfu	Colony forming units. A measure of the concentration of bacteria usually expressed as per 100 millilitre sample.
COD	Chemical oxygen demand. A measure of the oxygen required to oxidise all matter in a sample by chemical reaction.
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.
E.coli	Escherichia coli, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample.
Ent	Enterococci, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre of sample.
F	Fluoride.
FC	Faecal coliforms, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample.
Fresh	Elevated flow in a stream, such as after heavy rainfall.
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.
l/s	Litres per second.
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.
PM ₁₀	Relatively fine airborne particles (less than 10 micrometre diameter).
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</i> 1991 and including all subsequent amendments.
SS	Suspended solids.
SQMCI	Semi quantitative macroinvertebrate community index.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.
UI	Unauthorised Incident.
UIR	Unauthorised 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.

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 Greymouth Petroleum



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

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

Please quote our file number
on all correspondence

Name of
Consent Holder: Greymouth Petroleum Acquisition Company Limited
P O Box 3394
Fitzroy
NEW PLYMOUTH

Consent Granted
Date: 4 February 1998

Conditions of Consent

Consent Granted: To discharge up to 100 cubic metres/day of treated stormwater, treated production water and treated wastewater from oil well drilling and production operations and a truck turning area into the Ngatoro Stream a tributary of the Manganui River in the Waitara Catchment at or about GR: Q19:110-217

Expiry Date: 1 June 2015

Review Date(s): June 2003, June 2009

Site Location: Ngatoro-1 Wellsite, Dudley Road, Inglewood
[Property owner: I & EE Jones]

Legal Description: Sec 11 Pt Sec 17 Blk VIII Egmont SD

Catchment: Waitara

Tributary: Manganui
Ngatoro

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

Consent 4073-2

General conditions

- a) That on receipt of a requirement from the Chief Executive, Taranaki Regional Council (hereinafter the Chief Executive), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
 - i) the administration, monitoring and supervision of this consent; and
 - ii) charges authorised by regulations.

Special conditions

1. That the consent holder, in conjunction with the Taranaki Regional Council, shall establish a permanent mixing zone for the discharge, which is 25 metres below the point of discharge into the receiving waters of the Ngatoro Stream.
2. That, after allowing for a mixing zone established for special condition 1, the discharge shall not give rise to any of the following effects in the receiving water:
 - a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
 - b) any conspicuous change in the colour or visual clarity;
 - c) any emission of objectionable odour;
 - d) the rendering of fresh water unsuitable for consumption by farm animals;
 - e) any significant adverse effects on aquatic life.
3. That the discharge shall not contain total recoverable hydrocarbons [infrared spectroscopic technique] in excess of 15 gm^{-3} at any time.
4. That the discharge shall not cause the receiving waters of the Ngatoro Stream to exceed the following limits, outside of the mixing zone established in special condition 1, at any time:

chloride	50 gm^{-3}
pH range	6.5 - 8.5
5. That after allowing for the mixing zone established for special condition 1, the discharge shall not give rise to either of the following effects in the receiving waters of the Ngatoro Stream:
 - i) an increase in suspended solids concentration in excess of 10 gm^{-3} when the stream turbidity as measured immediately upstream of the discharge point is equal to or less than 5 nephelometric turbidity units [NTU]; or
 - ii) an increase in turbidity of more than 50% when the stream turbidity as measured immediately upstream if the discharge point is greater than 5 NTU.
6. That the consent holder shall provide, for the written approval of the Chief Executive, a contingency plan outlining measures and procedures undertaken to prevent a spillage, or accidental discharge of materials and/or waters not licensed by this consent and procedures to be carried out should such a spillage or discharge occur.
7. That the consent holder shall advise the Chief Executive two weeks prior to the drilling of additional wells on the site.

Consent 4073-2

8. That the consent holder shall advise the Chief Executive two weeks prior to discharging production water to the Ngatoro Stream as licensed by this consent.
9. That the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during the month of June 2003 and/or June 2009, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects of the discharge on the environment arising from the exercise of this consent, which were not foreseen at the time the application was considered and which it was not appropriate to deal with at that time.

Transferred at Stratford on 23 February 2004

For and on behalf of
Taranaki Regional Council



Director - Resource Management

Consent 5384-1



PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 0-6-765 7127
FAX 0-6-765 5097

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

Name of
Consent Holder: Greymouth Petroleum Acquisitions Company Limited
P O Box 1394
Shortland Street
AUCKLAND

New Address:
PO Box 3394
New Plymouth

Consent Granted
Date: 18 September 1998

Conditions of Consent

Consent Granted: To take up to 550 cubic metres/day [6.4 litres/second] of groundwater from a bore for oilfield waterflooding purposes in the Waiwhakaiho Catchment at or about GR: P19:087-249

Expiry Date: 1 June 2014

Review Date(s): June 2002, June 2008

Site Location: Kaimiro-O Wellsite, 123 Alfred Road, Inglewood

Legal Description: Pt 115 & 116 Hua & Waiwhakaiho Hundred Blk III Egmont SD

Catchment: Waiwhakaiho

Consent 5384-1

General conditions

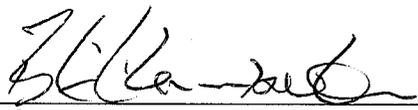
- a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council (hereinafter the Chief Executive), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
 - i) the administration, monitoring and supervision of this consent; and
 - ii) charges authorised by regulations.

Special conditions

1. That the consent holder shall undertake the abstraction in general accordance with the information supplied in support of application 434.
2. That the consent holder shall keep records of all abstractions, including dates and volumes, and shall make these records available upon request, to the Chief Executive, Taranaki Regional Council.
3. That the consent holder shall monitor the productive yield of the bore situated approximately 1.7 km north-northwest of the bore licensed by this consent to the satisfaction of the Chief Executive, Taranaki Regional Council. If as a result of the exercise of this consent there is an adverse effects, as determined by the Chief Executive, Taranaki Regional Council, on the bore situated approximately 1.7 km north-northwest of the bore licensed by this consent then the consent holder shall immediately provide an alternative water supply at the request of the Chief Executive, Taranaki Regional Council.
4. That the Taranaki Regional Council may review any or all of the conditions of the consent by giving notice of review during the month of June 2002 and/or June 2008, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this consent, which were not foreseen at the time the application was considered and which it was not appropriate to deal with at that time.

Transferred at Stratford on 10 April 2002

For and on behalf of
Taranaki Regional Council



Chief Executive



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

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE: 06-765 7127
FAX: 06-765 5097
www.trc.govt.nz

Please quote our file number
on all correspondence

Name of
Consent Holder: Greymouth Petroleum Acquisition Company Limited
P O Box 3394
Fitzroy
NEW PLYMOUTH

Consent Granted
Date: 5 September 2005

Conditions of Consent

Consent Granted: To discharge sand waste from hydrocarbon production within the Kaimiro Field onto land for storage, and including the discharge of stormwater from the site onto and into land and into an unnamed tributary of the Mangaoraka Stream in the Waiongana catchment at or about GR: P19:094-264

Expiry Date: 1 June 2014

Review Date(s): June 2006, June 2008, June 2010

Site Location: Kaimiro-J wellsite, Upland Road, Inglewood
[Property owner: B & S Duynhoven]

Legal Description: Lot 1 DP 19651 Blk III Egmont SD

Catchment: Waiongana

Tributary: Mangaoraka

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

www.trc.govt.nz

Consent 6218-1

General conditions

- a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
 - i) the administration, monitoring and supervision of this consent; and
 - ii) charges authorised by regulations.

Special conditions

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.
2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 2671. In the case of any contradiction between the documentation submitted in support of application 2671 and the conditions of this consent, the conditions of this consent shall prevail.

Recording and reporting

3. Prior to the exercise of this consent, the consent holder shall provide for the written approval of the Chief Executive, Taranaki Regional Council, site specific details relating to contingency planning for the site. The contingency plan shall be reviewed annually.
4. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 48 hours prior to commencement of each operation involving transfer of wastes to the disposal site for discharge.
5. The consent holder shall keep records of the wastes discharged, including:
 - a) composition of material, including concentrations of total petroleum hydrocarbons [in ranges $C_7 - C_9$, $C_{10} - C_{14}$, $C_{15} - C_{36}$ and BTEX], and chloride;
 - b) volumes of material discharged; and
 - c) dates and times of discharge events.

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

Discharge and receiving environment limits

6. The exercise of this consent is limited to sand wastes recovered within the processes at the Kaimiro Production station, and shall not include the discharge of drilling muds or cuttings.
7. As far as practicable, sand waste for discharge under this consent shall be treated to remove any free liquid phase hydrocarbons.
8. The total volume of sand wastes stored on the site shall be not more than 45 cubic metres at any one time.
9. The sand waste storage area shall be bunded so that drainage is not directly to the stormwater catchment.
10. All stormwater to be discharged under this consent shall be directed for treatment through the stormwater treatment system for discharge in accordance with the special conditions of this permit.
11. The following concentrations shall not be exceeded in the stormwater discharge:

Component	Concentration
pH (range)	6.0-9.0
suspended solids	100 gm ⁻³
total recoverable hydrocarbons [infrared spectroscopic technique]	15 gm ⁻³
chloride	50 gm ⁻³

This condition shall apply prior to the entry of the treated stormwater into the unnamed tributary of the Mangaoraka Stream at a designated sampling point approved by the Chief Executive, Taranaki Regional Council.

12. The exercise of this consent shall not give rise to any of the following effects in any surface water body:
 - a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
 - b) any conspicuous change in the colour or visual clarity;
 - c) any emission of objectionable odour;
 - d) the rendering of fresh water unsuitable for consumption by farm animals;
 - e) any significant adverse effects on aquatic life.
13. The exercise of this consent, including the design, management and implementation of the discharge, shall not lead or be liable to lead to contaminants entering a surface waterbody.
14. The exercise of this consent shall not result in any adverse impacts on groundwater as a result of leaching, or on surface water including aquatic ecosystems, and/or result in a change to the suitability of use of the receiving water as determined by the Chief Executive, Taranaki Regional Council.

Consent 6218-1

15. The exercise of this consent shall not result in a level of total dissolved salts within any surface or groundwater of more than 2500 gm³.
16. At any time the levels of metals in the soil shall comply with the guidelines for heavy metals in soil set out in the Department of Health's Guidelines for the Disposal of Sewerage Sludge to Land [1992].

Site reinstatement

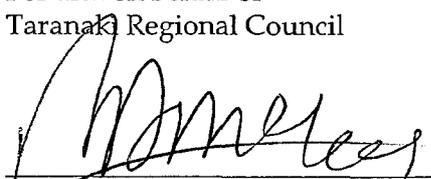
17. Prior to the expiry, cancellation, or surrender of this consent the levels of hydrocarbons in the soil shall comply with the guideline values in the Ministry for the Environment Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand [1999].
18. Within three years of the granting of this consent, the consent holder shall provide to the satisfaction of the Chief Executive, Taranaki Regional Council, a reinstatement/remediation plan for removal and final disposal of wastes from the storage site. The plan shall include proposed management and remediation of the site to achieve condition 17.
19. The Chief Executive, Taranaki Regional Council, shall be advised prior to the reinstatement of the site and the reinstatement shall be carried out to the satisfaction of the Chief Executive, Taranaki Regional Council.

Lapse and review

20. This consent shall lapse on the expiry of five years after the date of issue of this consent, 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.
21. 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 2006 and/or June 2008 and/or June 2010, 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 5 September 2005

For and on behalf of
Taranaki Regional Council



Director-Resource Management

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

Name of
Consent Holder: Greymouth Petroleum Acquisition Company Limited
P O Box 3394
NEW PLYMOUTH 4341

Consent Granted
Date: 10 January 2008

Conditions of Consent

Consent Granted: To discharge emissions into the air from the flaring of hydrocarbons arising from hydrocarbon production and processing operations, together with miscellaneous emissions, at the Kaimiro Production Station at or about 2609726E-6225978N

Expiry Date: 1 June 2026

Review Date(s): June 2014, June 2020

Site Location: Upland Road, Inglewood

Legal Description: Pt Sec 115 Tarurutangi Dist Blk III Egmont SD

Consent 4048-3

General conditions

- a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
 - i) the administration, monitoring and supervision of this consent; and
 - ii) charges authorised by regulations.

Special conditions

Duration

1. Flaring of gas from each well during well testing shall not occur on more than 30 days.

Information and notification

2. At least 24 hours before any flaring, other than in emergencies, the consent holder shall provide notification to all residents within 1000 metres of the site of the commencement of flaring. The consent holder shall include in the notification a 24-hour contact telephone number for a representative of the consent holder, and shall keep and make available to the Chief Executive, Taranaki Regional Council, a record of all queries and complaints received.
3. The consent holder shall notify the Chief Executive, Taranaki Regional Council, whenever the continuous flaring of hydrocarbons [other than purge gas] is expected to occur for more than five minutes in duration. Notification shall be no less than 24 hours before the flaring commences. Notification shall include the consent number and be emailed to worknotification@trc.govt.nz. Notification by fax or post is acceptable if the consent holder does not have access to email.
4. No alteration shall be made to plant equipment or processes which may substantially alter the nature or quantity of flare emissions or other site emissions, including but not limited to the recovery of produced gas, other than as authorised by this consent, without prior consultation with the Chief Executive, Taranaki Regional Council.

Emissions from the site

5. Other than for the maintenance of a pilot flare flame, the consent holder shall have regard to the prevailing and predicted wind speed and direction at the time of initiation of, and throughout, any episode of flaring so as to minimise offsite effects.

Consent 4048-3

6. All gas that is flared must first be treated by effective liquid and solid separation and recovery to ensure that smoke emission during flaring is minimised.
7. No liquid or solid hydrocarbons shall be combusted through the gas flare system.
8. Only substances originating from the well stream and treated as outlined by conditions 6 and 7 shall be combusted within the flare pit.
9. All hydrocarbon storage vessels shall be fitted with vapour recovery systems.
10. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or potential effect on the environment arising from any emission to air from the flare or any other emissions to air from the Kaimiro Production Station.
11. There shall not be any offensive odour or smoke at or beyond the boundary of the property where the production station is located.
12. The opacity of any smoke emissions shall not exceed a level of 1 as measured on the Ringelmann Scale.
13. The consent holder shall control all emissions of carbon monoxide to the atmosphere from the flare so that, whether alone or in conjunction with any other emissions from the production station, the maximum ground level concentration of carbon monoxide arising from the exercise of this consent measured under ambient conditions does not exceed 10 milligrams per cubic metre [mg/m^3] [eight-hour average exposure], or 30 mg/m^3 one-hour average exposure] at or beyond the boundary of the property.
14. The consent holder shall control all emissions of nitrogen oxides to the atmosphere from the flare so that, whether alone or in conjunction with any other emissions from the production station, the maximum ground level concentration of nitrogen dioxide arising from the exercise of this consent measured under ambient conditions does not exceed 100 micrograms per cubic metre [$\mu\text{g}/\text{m}^3$] [24-hour average exposure], or 200 $\mu\text{g}/\text{m}^3$ [1-hour average exposure] at or beyond the boundary of the of the property.
15. The consent holder shall control emissions to the atmosphere, from the production station and flare, of contaminants other than carbon dioxide, carbon monoxide, and nitrogen oxides so that, whether alone or in conjunction with any other emissions from the production station, is not hazardous or toxic or noxious at or beyond the boundary of the property.
16. The consent holder shall control emissions to the atmosphere from the production station and flare of contaminants other than carbon dioxide, carbon monoxide, and nitrogen oxides so that, whether alone or in conjunction with any emissions from the flare, the maximum ground level concentration for any particular contaminant arising from the exercise of this consent measured at or beyond the boundary of the property, is not increased above background levels:

Consent 4048-3

- a) by more than 1/30th of the relevant Occupational Threshold Value-Time Weighted Average, or by more than the Short Term Exposure Limit at any time [all terms as defined in Workplace Exposure Standards, 2002, Department of Labour]; or
- b) if no Short Term Exposure Limit is set, by more than three times the Time Weighted Average at any time [all terms as defined in Workplace Exposure Standards, 2002, Department of Labour].

Recording and reporting information

17. Each time there is visible smoke as a result of the exercise of this consent, the consent holder shall record the time, duration and cause. The consent holder shall make the record available to the Chief Executive, Taranaki Regional Council, upon request.
18. Each month, the consent holder shall supply to the Chief Executive, Taranaki Regional Council a record of flaring information in relation to the production station, and each wellsite. The flaring information supplied shall comprise: the type and amount of material flared [including any gas used to maintain a pilot flame], the date this was flared, the reason why flaring was undertaken, and an indication of whether smoke was produced from the flaring events.
19. The consent holder shall record and maintain a log of all continuous flaring events longer than five minutes duration, and any intermittent flaring lasting for an aggregate of ten minutes or longer in any 120-minute period. The log shall contain the date, the start and finish times of the flaring event, the quantity and type of material flared, and the reason for flaring. The log shall be made available to the Chief Executive, Taranaki Regional Council, upon request, and summarised annually in the report required under condition 20.
20. The consent holder shall provide to the Taranaki Regional Council during May of each year, for the duration of this consent, a report:
 - i) detailing any energy efficiency measures implemented on the site;
 - ii) detailing smoke emissions as required under condition 17;
 - iii) detailing any measures undertaken or proposed to reduce smoke emissions;
 - iv) detailing any measures undertaken or proposed to reduce flaring;
 - v) addressing any other issue relevant to the minimisation or mitigation of emissions from the flare;
 - vi) detailing any complaints received and any measures undertaken to address complaints; and
 - vii) reviewing all options and technological advances relevant to the reduction or mitigation of any discharge to air from the site, how these might be applicable and/or implemented at the site, and the benefits and costs of these advances.
21. The consent holder shall make available to the Chief Executive, Taranaki Regional Council, upon request, an analysis of a typical gas and condensate stream from the field, covering sulphur compound content and the content of carbon compounds of structure C₆ or higher number of compounds.

Review

22. 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 within six months of receiving a report prepared by the consent holder pursuant to condition 20 of this consent, and/or by giving notice of review during the month of June 2014 and/or June 2020, for any of the following purposes:
- a) dealing with any significant adverse effect on the environment arising from the exercise of the consent which was not foreseen at the time the application was considered or which it was not appropriate to deal with at the time;
 - b) requiring the consent holder to adopt the best practicable option to remove or reduce any adverse effect on the environment caused by the discharge;
 - c) to alter, add or delete limits on mass discharge quantities or discharge or ambient concentrations of any contaminant;
 - d) taking into account any Act of Parliament, regulation, national policy statement or national environmental standard which relates to limiting, recording, or mitigating emissions of gases which are products of combustion, and which is relevant to the air discharge from the Kaimiro Production Station.

Signed at Stratford on 10 January 2008

For and on behalf of
Taranaki Regional Council

Director-Resource Management

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

Name of
Consent Holder: Greymouth Petroleum Limited
P O Box 3394
NEW PLYMOUTH 4341

Consent Granted
Date: 12 May 2008

Conditions of Consent

Consent Granted: To discharge emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Ngatoro-A wellsite at or about 2611074E-6221732N

Expiry Date: 1 June 2027

Review Date(s): June 2015, June 2021

Site Location: Ngatoro-A wellsite, Dudley Road, Inglewood
[Property owners: GD & VK Robinson]

Legal Description: Sec 11 Blk VIII Egmont SD

General conditions

- a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
 - i) the administration, monitoring and supervision of this consent; and
 - ii) charges authorised by regulations.

Special conditions

Information and notification

1. The consent holder shall notify the Chief Executive, Taranaki Regional Council, whenever the continuous flaring of hydrocarbons [other than purge gas] is expected to occur for more than five minutes in duration. Notification shall be no less than 24 hours before the flaring commences. Notification shall include the consent number and be emailed to worknotification@trc.govt.nz. Notification by fax or post is acceptable if the consent holder does not have access to email.
2. At least 24 hours before any flaring, other than in emergencies, the consent holder shall provide notification to all residents within 1000 metres of the site of the commencement of flaring. The consent holder shall include in the notification a 24-hour contact telephone number for a representative of the consent holder, and shall keep and make available to the Chief Executive, Taranaki Regional Council, a record of all queries and complaints received in respect of any flaring activity.
3. No alteration shall be made to plant equipment or processes which may substantially alter the nature or quantity of flare emissions or other site emissions, including but not limited to the recovery of produced gas, other than as authorised by this consent , without prior consultation with the Chief Executive, Taranaki Regional Council.

Emissions from the site

4. Other than for the maintenance of a pilot flare flame, the consent holder shall have regard to the prevailing and predicted wind speed and direction at the time of initiation of, and throughout, any episode of flaring so as to minimise offsite effects.
5. All gas that is flared must first be treated by effective liquid and solid separation and recovery to ensure that smoke emission during flaring is minimised.

Consent 7295-1

6. If separation required by special condition 5 cannot be implemented or maintained at any time while there is a flow from the well, whether natural or induced, then the consent holder shall immediately advise the Compliance Manager, Taranaki Regional Council, and shall in any case re-establish liquid and solid separation and recovery within three hours.
7. Subject to special condition 6, no liquid or solid hydrocarbons shall be combusted through the gas flare system, other than in an emergency.
8. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or potential effect on the environment arising from any emission to air from the flare or any other emissions to air from the Ngatoro-A wellsite [including use of a separator during well clean-up].
9. Only substances originating from the well stream and treated as outlined by conditions 5, 6, 7, and 8 shall be combusted within the flare pit.
10. There shall not be any offensive odour or smoke, as determined by an enforcement officer of the Taranaki Regional Council, at or beyond the boundary of the property where the wellsite is located.
11. All hydrocarbon storage vessels shall be fitted with vapour recovery systems.
12. The opacity of any smoke emissions shall not exceed a level of 1 as measured on the Ringelmann Scale.
13. The consent holder shall control all emissions of carbon monoxide to the atmosphere from the flare so that, whether alone or in conjunction with any other emissions from the wellsite, the maximum ground level concentration of carbon monoxide arising from the exercise of this consent measured under ambient conditions does not exceed 10 milligrams per cubic metre [mg/m^3] [eight-hour average exposure], or $30 \text{ mg}/\text{m}^3$ one-hour average exposure] at or beyond the boundary of the property where the wellsite is located.
14. The consent holder shall control all emissions of nitrogen oxides to the atmosphere from the flare so that, whether alone or in conjunction with any other emissions from the wellsite, the maximum ground level concentration of nitrogen dioxide arising from the exercise of this consent measured under ambient conditions does not exceed 100 micrograms per cubic metre [$\mu\text{g}/\text{m}^3$] [24-hour average exposure], or $200 \mu\text{g}/\text{m}^3$ [1-hour average exposure] at or beyond the boundary of the of the property where the wellsite is located.
15. The consent holder shall control emissions to the atmosphere, from the production station and flare, of contaminants other than carbon dioxide, carbon monoxide, and nitrogen oxides so that, whether alone or in conjunction with any other emissions from the production station, is not hazardous or toxic or noxious at or beyond the boundary of the property.

Consent 7295-1

16. The consent holder shall control emissions to the atmosphere from the wellsite and flare of contaminants other than carbon dioxide, carbon monoxide, and nitrogen oxides so that, whether alone or in conjunction with any emissions from the flare, the maximum ground level concentration for any particular contaminant arising from the exercise of this consent measured at or beyond the boundary of the property where the wellsite is located, is not increased above background levels:
- a) by more than 1/30th of the relevant Occupational Threshold Value-Time Weighted Average, or by more than the Short Term Exposure Limit at any time [all terms as defined in Workplace Exposure Standards, 2002, Department of Labour]; or
 - b) if no Short Term Exposure Limit is set, by more than three times the Time Weighted Average at any time [all terms as defined in Workplace Exposure Standards, 2002, Department of Labour].

Recording and reporting information

17. The consent holder shall make available to the Chief Executive, Taranaki Regional Council, upon request, an analysis of a typical gas and condensate stream from the field, covering sulphur compound content and the content of carbon compounds of structure C₆ or higher number of compounds.
18. Each time there is visible smoke as a result of the exercise of this consent, the consent holder shall record the time, duration and cause. The consent holder shall make the record available to the Chief Executive, Taranaki Regional Council, upon request.
19. The consent holder shall record and maintain a log of all continuous flaring events longer than five minutes duration, and any intermittent flaring lasting for an aggregate of ten minutes or longer in any 120-minute period. The log shall contain the date, the start and finish times of the flaring event, the quantity and type of material flared, and the reason for flaring. The log shall be made available to the Chief Executive, Taranaki Regional Council, upon request, and summarised annually in the report required under condition 20.
20. The consent holder shall provide to the Taranaki Regional Council during May of each year, for the duration of this consent, a report:
- i) detailing any energy efficiency measures implemented on the site;
 - ii) detailing smoke emissions as required under condition 18;
 - iii) detailing any measures undertaken or proposed to reduce smoke emissions;
 - iv) detailing any measures undertaken or proposed to reduce flaring;
 - v) addressing any other issue relevant to the minimisation or mitigation of emissions from the flare;
 - vi) detailing any complaints received and any measures undertaken to address complaints; and
 - vii) reviewing all options and technological advances relevant to the reduction or mitigation of any discharge to air from the site, how these might be applicable and/or implemented at the site, and the benefits and costs of these advances.

Lapse and Review

21. This consent shall lapse five years after the date of issue of this consent, 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.
22. 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 within six months of receiving a report prepared by the consent holder pursuant to condition 20 of this consent, and/or by giving notice of review during the month of June 2015 and/or June 2021, for any of the following purposes:
 - a) dealing with any significant adverse effect on the environment arising from the exercise of the consent which was not foreseen at the time the application was considered or which it was not appropriate to deal with at the time;
 - b) requiring the consent holder to adopt the best practicable option to remove or reduce any adverse effect on the environment caused by the discharge;
 - c) to alter, add or delete limits on mass discharge quantities or discharge or ambient concentrations of any contaminant;
 - d) taking into account any Act of Parliament, regulation, national policy statement or national environmental standard which relates to limiting, recording, or mitigating emissions of gases which are products of combustion, and which is relevant to the air discharge from the Ngatoro-A wellsite.

Signed at Stratford on 12 May 2008

For and on behalf of
Taranaki Regional Council

Director-Resource Management

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

Name of
Consent Holder: Greymouth Petroleum Limited
P O Box 3394
NEW PLYMOUTH 4341

Consent Granted
Date: 9 May 2008

Conditions of Consent

Consent Granted: To discharge emissions to air during flaring from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the Ngatoro-B wellsite at or about 2612457E-6222691N

Expiry Date: 1 June 2027

Review Date(s): June 2015, June 2021

Site Location: Ngatoro-B wellsite, Bedford Road North, Inglewood
[Property owner: CJ & GD Alexander]

Legal Description: Sec 128 Pt Secs 126 & 127 Moa Dist Blk VIII Egmont SD

General conditions

- a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
 - i) the administration, monitoring and supervision of this consent; and
 - ii) charges authorised by regulations.

Special conditions

Information and notification

1. The consent holder shall notify the Chief Executive, Taranaki Regional Council, whenever the continuous flaring of hydrocarbons [other than purge gas] is expected to occur for more than five minutes in duration. Notification shall be no less than 24 hours before the flaring commences. Notification shall include the consent number and be emailed to worknotification@trc.govt.nz. Notification by fax or post is acceptable if the consent holder does not have access to email.
2. At least 24 hours before any flaring, other than in emergencies, the consent holder shall provide notification to all residents within 1000 metres of the site of the commencement of flaring. The consent holder shall include in the notification a 24-hour contact telephone number for a representative of the consent holder, and shall keep and make available to the Chief Executive, Taranaki Regional Council, a record of all queries and complaints received in respect of any flaring activity.
3. No alteration shall be made to plant equipment or processes which may substantially alter the nature or quantity of flare emissions or other site emissions, including but not limited to the recovery of produced gas, other than as authorised by this consent, without prior consultation with the Chief Executive, Taranaki Regional Council.

Emissions from the site

4. Other than for the maintenance of a pilot flare flame, the consent holder shall have regard to the prevailing and predicted wind speed and direction at the time of initiation of, and throughout, any episode of flaring so as to minimise offsite effects.
5. All gas that is flared must first be treated by effective liquid and solid separation and recovery to ensure that smoke emission during flaring is minimised.

Consent 7220-1

6. If separation required by special condition 5 cannot be implemented or maintained at any time while there is a flow from the well, whether natural or induced, then the consent holder shall immediately advise the Compliance Manager, Taranaki Regional Council, and shall in any case re-establish liquid and solid separation and recovery within three hours.
7. Subject to special condition 6, no liquid or solid hydrocarbons shall be combusted through the gas flare system, other than in an emergency.
8. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or potential effect on the environment arising from any emission to air from the flare or any other emissions to air from the Ngatoro-B wellsite [including use of a separator during well clean-up].
9. Only substances originating from the well stream and treated as outlined by conditions 5, 6, 7, and 8 shall be combusted within the flare pit.
10. There shall not be any offensive odour or smoke, as determined by an enforcement officer of the Taranaki Regional Council, at or beyond the boundary of the property where the wellsite is located.
11. All hydrocarbon storage vessels shall be fitted with vapour recovery systems.
12. The opacity of any smoke emissions shall not exceed a level of 1 as measured on the Ringelmann Scale.
13. The consent holder shall control all emissions of carbon monoxide to the atmosphere from the flare so that, whether alone or in conjunction with any other emissions from the wellsite, the maximum ground level concentration of carbon monoxide arising from the exercise of this consent measured under ambient conditions does not exceed 10 milligrams per cubic metre [mg/m^3] [eight-hour average exposure], or 30 mg/m^3 one-hour average exposure] at or beyond the boundary of the property where the wellsite is located.
14. The consent holder shall control all emissions of nitrogen oxides to the atmosphere from the flare so that, whether alone or in conjunction with any other emissions from the wellsite, the maximum ground level concentration of nitrogen dioxide arising from the exercise of this consent measured under ambient conditions does not exceed 100 micrograms per cubic metre [$\mu\text{g}/\text{m}^3$] [24-hour average exposure], or 200 $\mu\text{g}/\text{m}^3$ [1-hour average exposure] at or beyond the boundary of the of the property where the wellsite is located.
15. The consent holder shall control emissions to the atmosphere, from the production station and flare, of contaminants other than carbon dioxide, carbon monoxide, and nitrogen oxides so that, whether alone or in conjunction with any other emissions from the production station, is not hazardous or toxic or noxious at or beyond the boundary of the property.

Consent 7220-1

16. The consent holder shall control emissions to the atmosphere from the wellsite and flare of contaminants other than carbon dioxide, carbon monoxide, and nitrogen oxides so that, whether alone or in conjunction with any emissions from the flare, the maximum ground level concentration for any particular contaminant arising from the exercise of this consent measured at or beyond the boundary of the property where the wellsite is located, is not increased above background levels:
- a) by more than 1/30th of the relevant Occupational Threshold Value-Time Weighted Average, or by more than the Short Term Exposure Limit at any time [all terms as defined in Workplace Exposure Standards, 2002, Department of Labour]; or
 - b) if no Short Term Exposure Limit is set, by more than three times the Time Weighted Average at any time [all terms as defined in Workplace Exposure Standards, 2002, Department of Labour].

Recording and reporting information

17. The consent holder shall make available to the Chief Executive, Taranaki Regional Council, upon request, an analysis of a typical gas and condensate stream from the field, covering sulphur compound content and the content of carbon compounds of structure C₆ or higher number of compounds.
18. Each time there is visible smoke as a result of the exercise of this consent, the consent holder shall record the time, duration and cause. The consent holder shall make the record available to the Chief Executive, Taranaki Regional Council, upon request.
19. The consent holder shall record and maintain a log of all continuous flaring events longer than five minutes duration, and any intermittent flaring lasting for an aggregate of ten minutes or longer in any 120-minute period. The log shall contain the date, the start and finish times of the flaring event, the quantity and type of material flared, and the reason for flaring. The log shall be made available to the Chief Executive, Taranaki Regional Council, upon request, and summarised annually in the report required under condition 20.
20. The consent holder shall provide to the Taranaki Regional Council during May of each year, for the duration of this consent, a report:
- i) detailing any energy efficiency measures implemented on the site;
 - ii) detailing smoke emissions as required under condition 18;
 - iii) detailing any measures undertaken or proposed to reduce smoke emissions;
 - iv) detailing any measures undertaken or proposed to reduce flaring;
 - v) addressing any other issue relevant to the minimisation or mitigation of emissions from the flare;
 - vi) detailing any complaints received and any measures undertaken to address complaints; and
 - vii) reviewing all options and technological advances relevant to the reduction or mitigation of any discharge to air from the site, how these might be applicable and/or implemented at the site, and the benefits and costs of these advances.

Lapse and Review

21. This consent shall lapse five years after the date of issue of this consent, 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.
22. 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 within six months of receiving a report prepared by the consent holder pursuant to condition 20 of this consent, and/or by giving notice of review during the month of June 2015 and/or June 2021, for any of the following purposes:
 - a) dealing with any significant adverse effect on the environment arising from the exercise of the consent which was not foreseen at the time the application was considered or which it was not appropriate to deal with at the time;
 - b) requiring the consent holder to adopt the best practicable option to remove or reduce any adverse effect on the environment caused by the discharge;
 - c) to alter, add or delete limits on mass discharge quantities or discharge or ambient concentrations of any contaminant;
 - d) taking into account any Act of Parliament, regulation, national policy statement or national environmental standard which relates to limiting, recording, or mitigating emissions of gases which are products of combustion, and which is relevant to the air discharge from the Ngatoro-B wellsite.

Signed at Stratford on 9 May 2008

For and on behalf of
Taranaki Regional Council

Director-Resource Management



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

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE: 06-765 7127
FAX: 06-765 5097
www.trc.govt.nz

Please quote our file number
on all correspondence

Name of
Consent Holder: Greymouth Petroleum Limited
P O Box 3394
NEW PLYMOUTH 4341

Consent Granted
Date: 23 April 2009

Conditions of Consent

Consent Granted: To discharge treated wastewater and treated stormwater from hydrocarbon exploration and production operations into an unnamed tributary of the Ngatoro Stream a tributary of the Manganui River in the Waitara catchment at or about (NZTM) 1702355E-5660948N

Expiry Date: 1 June 2027

Review Date(s): June 2015, June 2021

Site Location: Ngatoro-B wellsite, Bedford Road, Inglewood
[Property owner: GD & CJ Alexander]

Legal Description: Pt Sec 127 Moa Dist Blk VIII Egmont SD

Catchment: Waitara

Tributary: Manganui
Ngatoro

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

www.trc.govt.nz

Doc# 597795-v1

Consent 3951-3

General conditions

- a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
 - i) the administration, monitoring and supervision of this consent; and
 - ii) charges authorised by regulations.

Special conditions

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely adverse effect on the environment associated with the discharge of contaminants from the site.
2. Stormwater discharged shall be collected from a catchment area of no more than 12,000 m².
3. The Chief Executive, Taranaki Regional Council, shall be advised in writing at least 7 days prior to any site works commencing, and again in writing at least 7 days prior to any well drilling operation commencing. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.
4. The consent holder shall maintain a contingency plan that, to the satisfaction of the Chief Executive, Taranaki Regional Council, details measures and procedures to be undertaken to prevent spillage or accidental discharge of contaminants not authorised by this consent and measures to avoid, remedy or mitigate the environmental effects of such a spillage or discharge.
5. The management and maintenance of the stormwater system shall be undertaken in accordance with the information submitted in support of the consent application [application 5221].

Consent 3951-3

6. All stormwater and wastewater shall be directed for treatment through the stormwater treatment system before being discharged.
7. Any above ground hazardous substances storage areas shall be bunded with drainage to sumps, or other appropriate recovery systems, and not to the stormwater catchment.
8. Constituents in the discharge shall meet the standards shown in the following table.

<u>Constituent</u>	<u>Standard</u>
pH	Within the range 6.0 to 9.0
suspended solids	Concentration not greater than 100 gm ⁻³
total recoverable hydrocarbons	Concentration not greater than 15 gm ⁻³ [as determined by infrared spectroscopic technique]
chloride	Concentration not greater than 50 gm ⁻³

This condition shall apply prior to the entry of the treated stormwater into the receiving waters at a designated sampling point approved by the Chief Executive, Taranaki Regional Council.

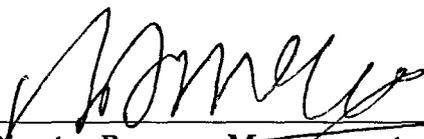
9. After allowing for a mixing zone of 25 metres, the discharge shall not give rise to an increase in temperature of more than 2 degrees Celsius.
10. After allowing for a mixing zone of 25 metres, the discharge shall not give rise to any of the following effects in the receiving water:
 - a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
 - b) any conspicuous change in the colour or visual clarity;
 - c) any emission of objectionable odour;
 - d) the rendering of fresh water unsuitable for consumption by farm animals;
 - e) any significant adverse effects on aquatic life.
11. The consent holder shall advise the Chief Executive, Taranaki Regional Council, in writing at least 48 hours prior to the reinstatement of the site and the reinstatement shall be carried out so as to minimise effects on stormwater quality. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.
12. This consent shall lapse on 30 June 2014, 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.

Consent 3951-3

13. 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 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 23 April 2009

For and on behalf of
Taranaki Regional Council


Director-Resource Management

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

Name of
Consent Holder: Greymouth Petroleum Acquisition Company Limited
P O Box 3394
Fitzroy
NEW PLYMOUTH 4341

Decision Date
(Change): 8 April 2014

Commencement Date
(Change): 8 April 2014 (Granted: 10 January 2002)

Conditions of Consent

Consent Granted: To discharge treated stormwater from the Kaimiro
Production Station site into an unnamed tributary of the
Mangaoraka Stream in the Waiongana catchment

Expiry Date: 1 June 2020

Review Date(s): June 2014

Site Location: Kaimiro Production Station, Upland Road, Inglewood

Legal Description: Lot 4 DP 436344 (Discharge source)
Lot 2 DP 19651 (Discharge site)

Grid Reference (NZTM) 1699783E–5664369N

Catchment: Waiongana

Tributary: Mangaoraka

*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. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects of the discharge on any water body.
- 2. The maximum stormwater catchment area shall be no more than 25,000 m².
- 3. Prior to the exercise of this consent, the consent holder shall provide for the written approval of the Chief Executive, Taranaki Regional Council, site specific details relating to contingency planning for the production site.
- 4. All site water to be discharged under this permit shall be directed for treatment through the stormwater treatment system for discharge in accordance with the specific conditions of this permit.
- 5. The design, management and maintenance of the stormwater system shall be generally undertaken:
 - in accordance with the stormwater management plan submitted to Taranaki Regional Council on 16 August 2012, in response to the request for further information for application 7156; and
 - as amended by the stormwater design report submitted with the application for consent 1334-3.2, prepared by BTW Company Limited and dated 28 February 2014.

These plans shall be followed at all times. If changes are proposed, the consent holder shall advise the Taranaki Regional Council one month prior to the changes to the plan.

- 6. Any above ground hazardous substances storage areas shall be bunded with drainage to sumps, or other appropriate recovery systems, and not to the stormwater catchment.
- 7. Constituents of the discharge shall meet the standards shown in the following table.

Constituent	Concentration
pH (range)	6.5 – 8.5
suspended solids	100 gm ⁻³
total recoverable hydrocarbons (infrared spectroscopic technique)	15 gm ⁻³
chloride	230 gm ⁻³

This condition shall apply before entry of the treated stormwater, at a designated sampling point approved by the Chief Executive, Taranaki Regional Council.

Consent 1334-3.2

8. After allowing for reasonable mixing, within a mixing zone extending 15 metres downstream of the discharge point, the discharge shall not give rise to any of the following effects in the receiving waters of the unnamed tributary of the Mangaoraka Stream:
 - a. an increase in temperature of more than 2 degrees Celsius; and
 - b. filtered carbonaceous biochemical oxygen demand shall not exceed 2.00 gm^{-3} ; or
 - c. shall not cause the chloride concentration to exceed 50 gm^{-3}
9. After allowing for reasonable mixing, within a mixing zone extending 15 metres downstream of the discharge point, the discharge shall not give rise to any of the following effects in the receiving waters of the unnamed tributary of the Mangaoraka Stream:
 - a. the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
 - b. any conspicuous change in the colour or visual clarity;
 - c. any emission of objectionable odour;
 - d. the rendering of fresh water unsuitable for consumption by farm animals; and
 - e. any significant adverse effects on aquatic life.
10. The consent holder shall prepare annually and maintain a contingency plan to the satisfaction of the Chief Executive, Taranaki Regional Council, outlining measures and procedures undertaken to prevent spillage or accidental discharge of contaminants, and procedures to be carried out should such a spillage or discharge occur.
11. The Chief Executive, Taranaki regional Council, shall be advised in writing at least 48 hours prior to the reinstatement of the site and the reinstatement shall be carried out so as to minimise effects on stormwater quality.
12. 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 2008 and/or June 2014, 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 8 April 2014

For and on behalf of
Taranaki Regional Council

A D McLay
Director-Resource Management

Appendix II

Biomonitoring reports

Memorandum

To Callum MacKenzie, Scientific Officer
From Freshwater Biologists, Chris Fowles and B R Thomas
Document 1376360
Report No CF609
Date 17 July 2014

Biomonitoring of the Ngatoro Stream and an unnamed tributary, in relation to the saline discharge from the Ngatoro-B production site, November 2013

Introduction

This survey is related to monitoring the effects of a discharge of saline water from the Ngatoro-B oil production site (operated by Greymouth Petroleum Ltd) on the streambed communities of the Ngatoro Stream and an unnamed tributary. The results of previous routine surveys are discussed in the references at the end of this report. The results of two surveys performed in relation to drilling at the Ngatoro-9 well site are detailed in McWilliam (1998b and 1998c). The current survey was performed as a component of the 2013-2014 monitoring programme.

Methods

The standard '400 ml kick-sampling' technique was used to collect streambed macroinvertebrates from two sites in the Ngatoro Stream and one site in a tributary of the stream (Table 1, Figure 1), on 25 November 2013.

The 'kick-sampling' technique used in this survey is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark et al, 2001).

Samples were preserved with Kahle's Fluid for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark et al. 2001). Macroinvertebrate taxa found in each sample were recorded as:

R (rare)	= less than 5 individuals;
C (common)	= 5-19 individuals;
A (abundant)	= estimated 20-99 individuals;
VA (very abundant)	= estimated 100-499 individuals;
XA (extremely abundant)	= estimated 500 individuals or more.

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. By averaging the scores obtained from a list of taxa taken from one site and multiplying by a scaling factor of 20, a Macroinvertebrate Community Index (MCI) value was obtained. The MCI is a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. More 'sensitive' communities inhabit less polluted waterways.

Table 1 Biomonitoring sites in the Ngatoro Stream and a tributary of the stream

Site No.	Site Code	GPS location	Location
2	NGT000197	E1702558 N5661243	Ngatoro Stream 60 m upstream of drain
3	NGT000200	E1702596 N5661277	Ngatoro Stream 40 m downstream of drain
T	NGT000199	E1702593 N5661220	Drain tributary near confluence with Ngatoro Stream

**Figure 1** Sampling sites in relation to the production water/stormwater discharges from the Ngatoro B production station

A semi-quantitative MCI value (SQMCI_s) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the SQMCI_s is not multiplied by a scaling factor of 20, so that its corresponding range of values is 20x lower.

Results and discussion

At the time of this early afternoon, spring survey there was a low flow of slightly turbid, brownish water in the Ngatoro Stream which had thin periphyton mats but no filamentous algal growths on the substrate. There was a brown, turbid, low, and steady flow in the tributary which had no periphyton mats on the substrate. Water temperatures recorded in the Ngatoro Stream were 16.6°C upstream and 16.3°C downstream of the confluence with the unnamed tributary which had a water temperature of 13.8°C. The bed of the tributary was thickly coated with iron oxide deposits which extended throughout the mainly silt, gravel, and cobble-bedded reach of this drain-like habitat immediately upstream of the confluence with the Ngatoro Stream. The bed of the Ngatoro Stream comprised mainly gravel, cobbles, and some boulders with a small proportion of sand.

Table 2 Numbers of taxa and MCI values recorded in the current survey, together with results from previous surveys

Site	Number of previous samples	Numbers of taxa			MCI values		
		Median	Range	25 Nov 2013	Median	Range	25 Nov 2013
2	21	26	20-34	28	114	99-130	115
3	21	27	17-34	28	114	95-128	106
T	19	11	3-20	28	80	65-91	101

The current survey results are presented in Table 3.

Table 3 Macroinvertebrate fauna of the Ngatoro Stream in relation to Ngatoro-B production station (sites 2 and 3) and tributary (site T) sampled on 25 November 2013

Taxa List	Site Number	MCI score	2	3	T
	Site Code		NGT000197	NGT000200	NGT000199
	Sample Number		FWB13361	FWB13363	FWB13362
PLATYHELMINTHES (FLATWORMS)	<i>Cura</i>	3	-	-	R
ANNELIDA (WORMS)	Oligochaeta	1	R	R	XA
	Lumbricidae	5	-	R	-
MOLLUSCA	<i>Potamopyrgus</i>	4	-	-	R
CRUSTACEA	Copepoda	5	-	-	R
	Ostracoda	1	-	-	R
	Paraleptamphopidae	5	-	-	R
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	R	C	R
	<i>Coloburiscus</i>	7	A	VA	C
	<i>Deleatidium</i>	8	XA	XA	XA
	<i>Ichthybotus</i>	8	R	-	-
PLECOPTERA (STONEFLIES)	<i>Nesameletus</i>	9	A	A	R
	<i>Megaleptoperla</i>	9	-	R	R
	<i>Zelandobius</i>	5	-	R	-
COLEOPTERA (BEETLES)	<i>Zelandoperla</i>	8	C	-	-
	Elmidae	6	XA	XA	A
	Dytiscidae	5	-	-	R
	Hydraenidae	8	C	C	-
MEGALOPTERA (DOBSONFLIES)	Hydrophilidae	5	-	-	R
	<i>Archichauliodes</i>	7	A	VA	C
TRICHOPTERA (CADDISFLIES)	<i>Aoleapsyche</i>	4	C	A	R
	<i>Costachorema</i>	7	C	C	R
	<i>Hydrobiosis</i>	5	R	C	R
	<i>Neurochorema</i>	6	R	R	-
	<i>Psilochorema</i>	6	R	-	-
	<i>Beraeoptera</i>	8	VA	VA	C
	<i>Helicopsyche</i>	10	R	R	-
	<i>Olinga</i>	9	R	-	-
	<i>Oxyethira</i>	2	-	R	R
	<i>Pycnocentroides</i>	5	XA	XA	C
	DIPTERA (TRUE FLIES)	<i>Aphrophila</i>	5	C	A
Eriopterini		5	R	R	-
<i>Zelandotipula</i>		6	-	-	R
<i>Maoridiamesa</i>		3	C	C	R
Orthoclaadiinae		2	R	C	C
<i>Polypedilum</i>		3	R	R	R
Tanytarsini		3	R	R	-
<i>Paradixa</i>		4	-	-	R
Empididae		3	R	R	-
Muscidae		3	R	R	-
<i>Austrosimulium</i>		3	-	R	-
ACARINA (MITES)	Acarina	5	R	-	C
No of taxa			28	28	28
MCI			115	106	101
SQMCIs			6.5	6.5	4.6
EPT (taxa)			15	13	10
%EPT (taxa)			54	46	36
'Tolerant' taxa		'Moderately sensitive' taxa		'Highly sensitive' taxa	
R = Rare	C = Common	A = Abundant	VA = Very Abundant	XA = Extremely Abundant	

Site 2 (NGT000197)

A moderately good community richness of 28 macroinvertebrate taxa was recorded in the Ngatoro Stream at this site. This was slightly higher than the median number of taxa recorded at this site to date (Table 2) but six taxa lower than the maximum richness previously found at this site. Good preceding physicochemical water quality conditions were indicated by the presence of eight 'highly sensitive' taxa, three of which were abundant. The community was characterised by these three 'highly sensitive' taxa [mayflies (*Deleatidium* (extremely abundant) and *Nesameletus*) and flare-cased caddisfly (*Beraeoptera*)] and four 'moderately sensitive' taxa [mayfly (*Coloburiscus*), elmids beetles, dobsonfly (*Archichauliodes*), and stony-cased caddisfly (*Pycnocentroides*)]. This assemblage was typical of the mid-reaches of a ringplain stream during spring, low flow conditions as also emphasised by the low densities within most 'tolerant' taxa.

The MCI score of 115 units was an insignificant one unit higher than the median of scores previously recorded at this site (Table 2) and reflected the relatively high proportion of 'sensitive' taxa in the community (71%). The extreme abundances of the 'highly sensitive' mayfly, *Deleatidium* and two 'moderately sensitive' taxa were responsible for the moderately high SQMCI_s value of 6.5 units.

Site 3 (NGT000200)

A moderately good community richness (28 taxa) was found at this site in the Ngatoro Stream below the designated 25 metre mixing zone downstream of the confluence with the unnamed tributary which receives the saline discharge from the Ngatoro-B production station. This richness was one taxon higher than the median of taxa numbers previously recorded at this site (Table 2) and equal with the richness found at the 'control' site 2 upstream of the tributary confluence (Table 3). Good preceding physicochemical water quality conditions were indicated again by the presence of several (six) 'highly sensitive' taxa. The macroinvertebrate community was characterised by three 'highly sensitive' taxa [the ubiquitous and extremely abundant mayfly (*Deleatidium*), another mayfly (*Nesameletus*), and flare-cased caddisfly (*Beraeoptera*)]; five 'moderately sensitive' taxa [mayfly (*Coloburiscus*), elmids beetles, dobsonfly larvae (*Archichauliodes*), caddisfly (*Pycnocentroides*), and crane fly (*Aphrophila*)], and one 'tolerant' taxon [net-spinning caddisfly (*Aoteapsyche*)]. This community composition was very similar to that found at the upstream 'control' site.

Only one significant difference was recorded in individual taxon abundances between sites 2 and 3, which was illustrated by the identical SQMCI_s scores. An increase in the number of 'tolerant' taxa and decrease in one 'highly sensitive' taxon at site 3 resulted in a statistically insignificant (Stark, 1998) reduction in MCI score of 9 units between these sites which was indicative of minor recent impacts of discharges from the Ngatoro-B Production Station upon the macroinvertebrate community of the Ngatoro Stream downstream of the receiving tributary. This site's score (106 units) was an insignificant eight units below the median of scores but 11 units above the minimum score previously recorded at site 3 (Table 2). Only very subtle changes in the individual abundances of taxa resulted in no change in SQMCI_s scores between sites 2 and 3.

Site T (NGT000199)

A good richness (28 taxa) was also recorded in the unnamed tributary drain (receiving the saline discharge from the Production Station) near its confluence with the Ngatoro Stream. This taxa number was for higher than the median richness recorded to date from this site and eight taxa above the maximum richness previously recorded. However, a high proportion of the taxa richness (68%) was present only as rarities (less than 5 individuals per taxon) and only three taxa were present in abundance [ubiquitous 'highly sensitive' mayfly (*Deleatidium*); 'moderately sensitive' elmids beetles; and 'tolerant' oligochaete worms]. The macroinvertebrate

community at this site generally has been comprised of fewer taxa (and in much lower abundances) than the communities found nearby in the Ngatoro Stream. This trend (in terms of abundances) has been continued in the current survey and is likely related to the slower flows and thick iron oxide deposits on the bed of the drain-like tributary, the latter being apparent at the time of the latest survey. Previously, impacts have been apparent coincident with elevated chloride (saline) concentrations in the unnamed tributary, but these have reduced very significantly since 2005 (Figure 2).

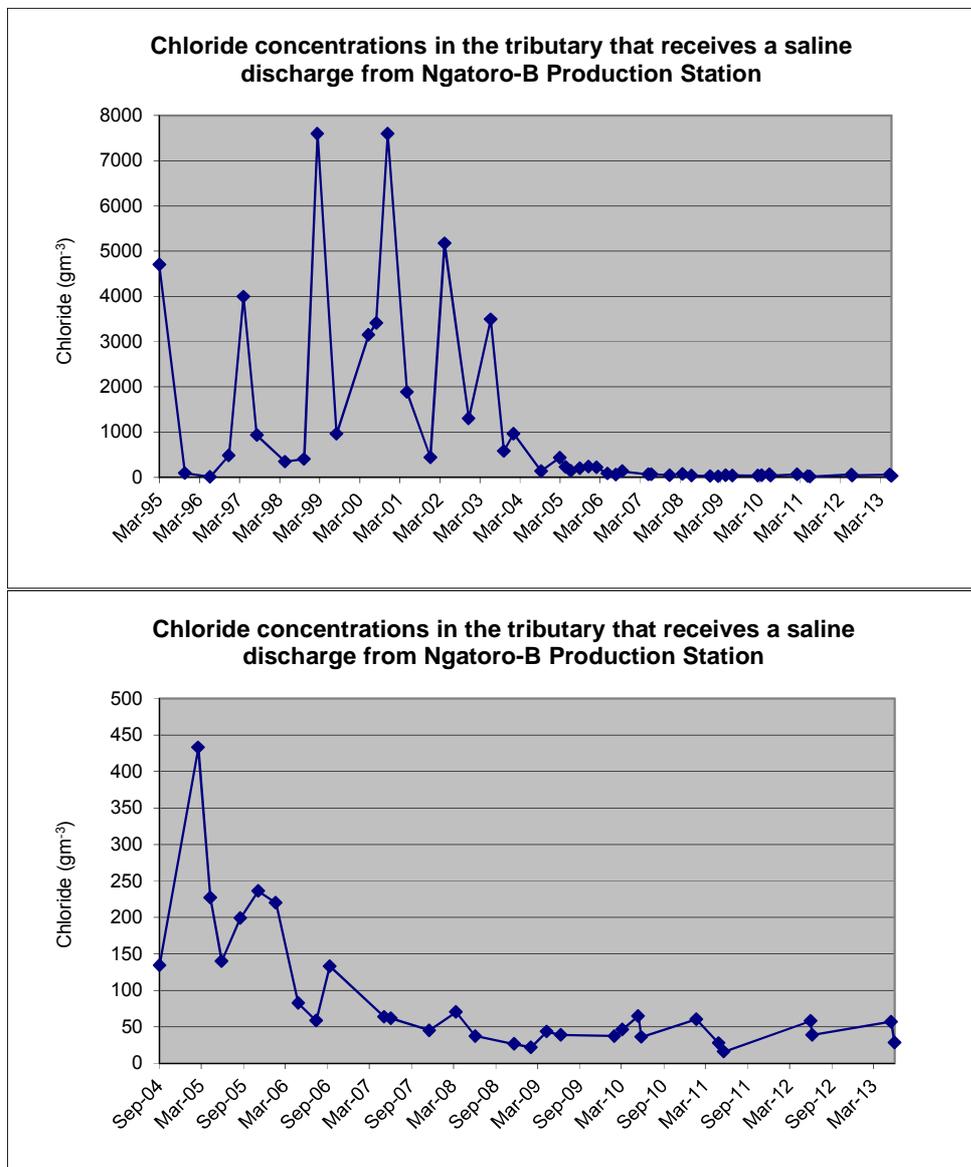


Figure 2 Chloride concentrations (g/m³) recorded in the tributary of the Ngatoro Stream that receives a saline discharge from the Ngatoro-B Production Station, 1995-current (upper graph), 2004 – current (lower graph)

The moderate proportion of ‘tolerant’ taxa (36% of total richness) contributed to the MCI score of 101 units, which was a significant 21 units above the median score found by 19 previous surveys at this site (Table 2) and higher than typical of scores in small drains, particularly near iron-laden seepage sources. The numerical dominance of the community by one very low scoring ‘tolerant’ taxon in particular resulted in the moderate SQMCI_s value of 4.6 units which was significantly higher (by 3.2 units) than the previous survey’s SQMCI_s due to the abundance of the ‘highly sensitive’ mayfly taxon. The more recent improvements in the community at this site may have been related to the lower salinity (chloride) levels monitored in the tributary consistently since 2005 (Figure 2).

Conclusions

The results of the survey indicated that the macroinvertebrate communities of the Ngatoro Stream were in good condition and had not been detrimentally affected by discharges of saline water to a small unnamed tributary from the Ngatoro-2 Production Station during relatively low flows in the main stream during a late spring period. The macroinvertebrate community in the tributary that receives the discharge from the production station was in better condition than previously recorded possibly due to the increased dilution of less saline discharges provided by the seepage flows in the drain-like tributary. It was affected to a lesser degree than usual despite the partial smothering of the habitat by iron oxide deposits.

Special condition 5 of the consent 3951 requires that the wastewater discharge shall not cause a significant adverse effect on freshwater biological communities of the receiving water. As the consent specifies that the point of discharge is located at the confluence of the receiving tributary and the Ngatoro Stream, the Ngatoro Stream is therefore defined as the receiving water. The saline discharge had had minimal recent effects upon the high quality macroinvertebrate community of the Ngatoro Stream below the discharge point. Therefore the discharge was in compliance with Special Condition 5 of the consent.

Summary

The Council's standard 'kick-sampling' technique was used at three established sites to collect streambed macroinvertebrates from an unnamed tributary and the main Ngatoro Stream. Samples were sorted and identified and the number of taxa (richness) and MCI and SQMCI_s scores were obtained for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI_s takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities, particularly if non-organic impacts are occurring.

Significant differences in either the MCI or the SQMCI_s between site indicate the degree of adverse effects (if any) of the discharges being monitored.

This November 2013 macroinvertebrate survey indicated that discharges from the Ngatoro-B Production Station site had not had any recent detrimental effects on the macroinvertebrate communities of the Ngatoro Stream. Minimal significant differences in the macroinvertebrate communities were recorded between the upstream 'control' site and the site downstream of the receiving tributary confluence.

The macroinvertebrate communities of the Ngatoro Stream contained significant proportions of 'sensitive' taxa at both sites and the communities were generally dominated by 'sensitive' taxa. Taxonomic richnesses (numbers of taxa) were slightly above medians at both sites at the time of this spring survey.

MCI scores indicated that the stream communities were of 'good' health, and generally typical of conditions recorded in similar reaches of ringplain Taranaki streams.

A much improved richness and a higher than maximum MCI score were recorded in the receiving water tributary despite iron-oxide deposits which partially smothered the substrate and contributed to reduced abundances within many individual taxa. Despite these conditions, more diluted and lower salinity discharges from the Production Station were found to have had no recent detrimental impacts on the macroinvertebrate communities of the Ngatoro Stream beyond the designated mixing zone downstream of the

tributary confluence.

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To Job Manager, Callum MacKenzie
From Freshwater Biologists, CR Fowles and BR Thomas
Report No CF611
Doc No 1377116
Date July 2014

Biomonitoring of two unnamed tributaries of the Mangaoraka Stream in relation to the Kaimiro Production Station, November 2013

Introduction

This was the first of two biomonitoring surveys scheduled to be undertaken in the 2013-2014 monitoring year for the Kaimiro Production Station of Greymouth Petroleum (previously owned by Fletcher Challenge Energy Taranaki Limited). The Taranaki Regional Council has undertaken surveys since January 1985 in the tributaries of the Mangaoraka Stream that receive stormwater and wastewater from the production station area. During 1987 and 1988 oil seepage to these streams disrupted the aquatic communities. Biomonitoring was not undertaken for nearly four years following the oil seepage period, until 1992. The results of surveys performed since the 1998-99 monitoring year are discussed in the references at the end of this report.

Methods

This survey was undertaken on 25 November 2013 at three sites in two unnamed tributaries of the Mangaoraka Stream. Figure 1 shows the location of these sampling sites. Site 1 is the 'control' site which is located in a major tributary of the Mangaoraka Stream, upstream of the confluence with a more minor tributary. Site 2 is situated in the minor tributary which receives the stormwater discharge from the production station and site 3 is approximately 50 metres downstream of the confluence of this tributary (Table 1).

The standard '400 ml kick-sampling' technique was used to collect streambed macroinvertebrates from these sites in this survey. This 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark *et al*, 2001).

Table 1 Biomonitoring sites in two tributaries of the Mangaoraka Stream in relation to discharges from the Kaimiro Production Station

Site	Site code	GPS reference (NZTM)	Location
1	MRK 000198	E1700117 N5664652	Major tributary approx. 50m u/s of confluence with minor tributary
2	MRK 000204	E1700054 N5664636	Minor tributary (receives discharge) 150m d/s of Upland Road
3	MRK 000207	E1700171 N5665679	Major tributary approx. 50m d/s of confluence with minor tributary

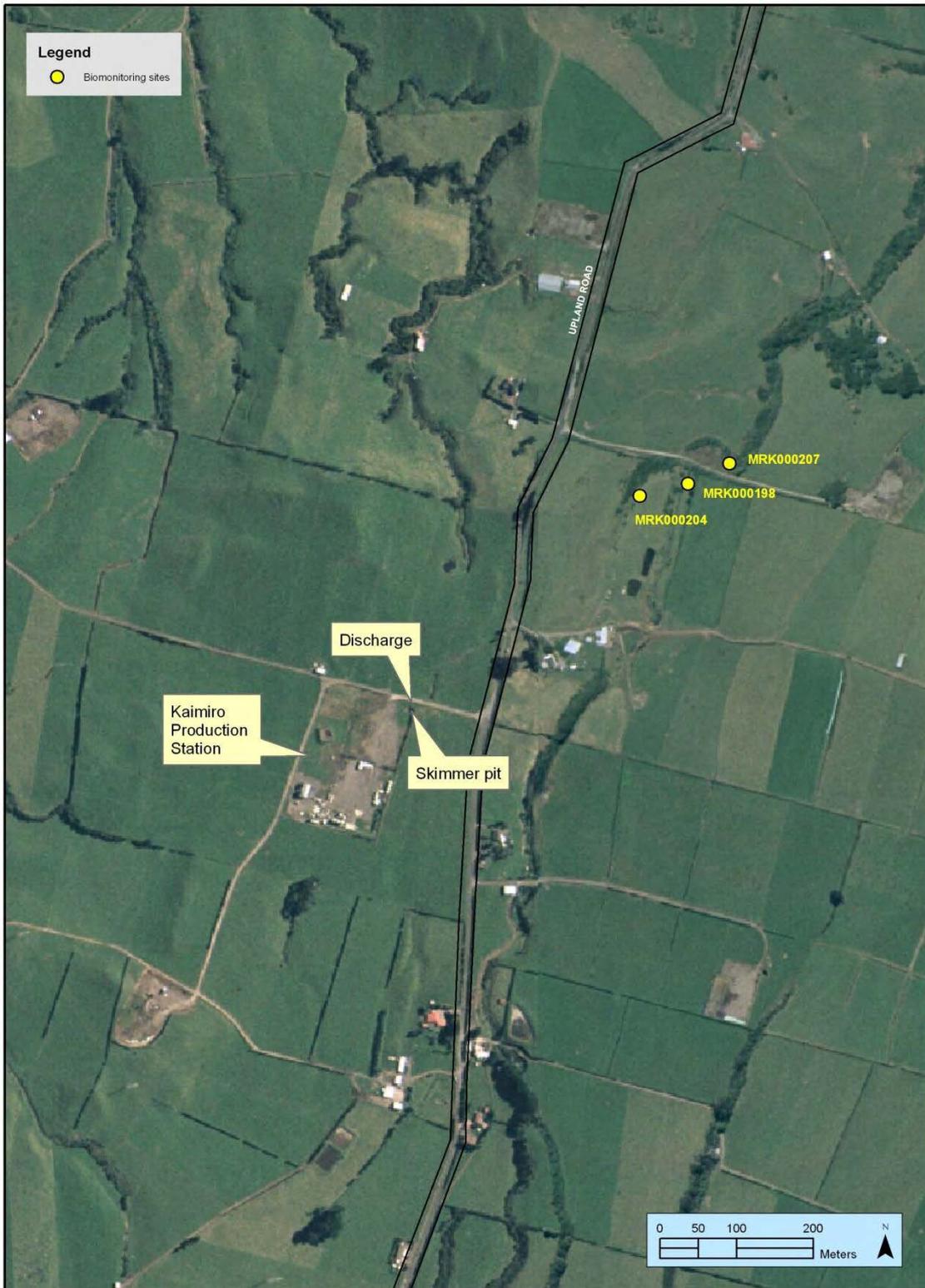


Figure 1 Biomonitoring sites in two unnamed tributaries of the Mangaoraka Stream related to the Kaimiro Production Station

Samples were preserved with Kahle’s Fluid for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark et al. 2001). Macroinvertebrate taxa found in each sample were recorded as:

R (rare)	= less than 5 individuals;
C (common)	= 5-19 individuals;
A (abundant)	= estimated 20-99 individuals;
VA (very abundant)	= estimated 100-499 individuals;
XA (extremely abundant)	= estimated 500 individuals or more.

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. Averaging the scores from a list of taxa taken from one site and multiplying by a scaling factor of 20 produces a Macroinvertebrate Community Index (MCI) value.

The MCI was designed for use in stony streams, and all sites sampled in this survey provided stony substrate. The MCI was designed as a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution, though sedimentation, temperatures, current speed, dissolved oxygen levels and some toxins can also affect the index values, because the taxa capable of tolerating extremes in these variables generally have low sensitivity scores. Usually more 'sensitive' communities inhabit less polluted waterways.

A semi-quantitative MCI value (SQMCI_s) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the SQMCI_s is not multiplied by a scaling factor of 20, therefore SQMCI_s values range from 1 to 10, while MCI values range from 20 to 200.

Results and discussion

This November 2013 survey was performed 17 days after a fresh in excess of three times median flow and 24 days after a fresh in excess of seven times median flow. However, in the month prior to this survey, there had been four fresh events which exceeded three times median flow. During this mid-afternoon survey, water temperatures in the main tributary ranged from 15.8°C to 16.2°C and in the minor tributary water temperature was 17.4°C.

The substrate at all sites consisted predominantly of silt, gravels and cobbles, with varying (lesser) proportions of boulder and sand substrate present also. A low, steady to swift flow of slightly turbid, brownish water was recorded at sites 1 and 3, while at site 2 there was a low, slower flow of dirty, brownish water; more discoloured flows than often surveyed in the past, particularly in the smaller tributary.

In the major tributary, there was no evidence of extensive slumping of the banks upstream and downstream of site 1 compared with that noted by the May 2012 survey, which most likely had been caused by stock accessing the stream. The stream bed at this partially shaded site was covered in a patchy periphyton mats, patchy algal filaments, and patchy moss.

At the completely shaded site 3, thin periphyton mats were observed on the bed of the stream along with widespread moss but no filamentous algae were present.

Thin algal mats and patchy moss were recorded at the completely shaded site 2 in the minor tributary of the Mangaoraka Stream. Unlike previous surveys, no iron oxide deposits were

found on the stream bed at this site despite its previous occurrence in this and many small seepage streams in Taranaki. Typically such deposits result from the oxidation of dissolved ferrous iron in groundwater seepage, upon contact with atmospheric oxygen. Small streams may often have insufficient flow to flush these deposits away. Neither were iron oxide deposits recorded at site 1 or site 3 at the time of this survey. However, there was evidence of unstable bank sediments deposited on parts of the tributary stream bed at the time of this survey.

Macroinvertebrate communities

Most past surveys have shown that the larger tributary supports richer macroinvertebrate communities, including abundances of 'sensitive' mayflies. These results reflect the good habitat conditions provided by faster-flowing, stony-bedded streams on the upper ring plain. The smaller tributary has tended to support communities with lower numbers of taxa and smaller proportions of 'sensitive' taxa. This in part has been due to the slower flow and/or iron oxide deposition on the stream bed of this tributary.

Table 2 provides a summary of the results from the sites sampled in this survey together with historical results. The full results of the current survey are presented in Table 3.

Table 2 Results of previous surveys performed between January 1985 and April 2013 in two unnamed tributaries of the Mangaoraka Stream, together with current survey results

Site No	Numbers of taxa				MCI values				SQMCI _s values			
	No. samples	Range	Median	November 2013	No. Samples	Range	Median	November 2013	No. samples	Range	Median	November 2013
1	52	18-37	27	29	52	83-110	97	97	27	1.9-5.1	3.4	2.5
2	48	3-26	15	7	48	55-103	81	71	26	1.2-4.1	2.2	1.2
3	52	14-33	24	28	52	71-111	99	99	27	1.7-6.2	4.0	4.2

Major tributary Upstream of discharge tributary (site 1)

Survey results to date are illustrated in Figure 2.

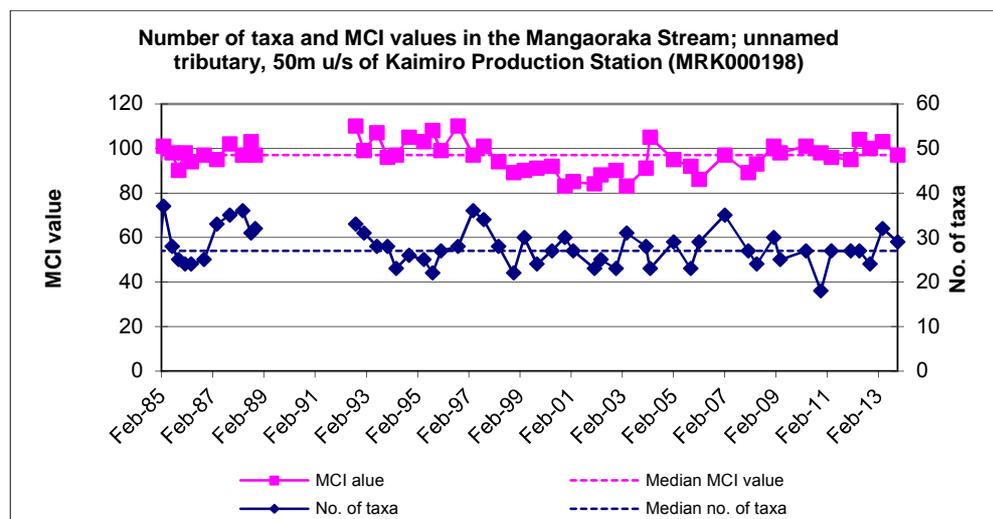


Figure 2 Number of taxa and MCI values in an unnamed tributary of the Mangaoraka Stream, 50 m upstream of Kaimiro Production Station (MRK000198)

A richness of twenty-nine taxa was recorded at this site by the current survey, slightly more than the historical median taxa number (Table 2).

Table 3 Macroinvertebrate fauna of two unnamed tributaries of the Mangaoraka Stream in relation to Kaimiro Production Station sampled on 25 November 2013

Taxa List	Site Number	MCI score	1	3	2
	Site Code		MRK000198	MRK000207	MRK000204
	Sample Number		FWB13358	FWB13360	FWB13359
NEMATODA	Nematoda	3	R	R	-
ANNELIDA (WORMS)	Oligochaeta	1	XA	VA	VA
	Lumbricidae	5	-	R	-
MOLLUSCA	<i>Potamopyrgus</i>	4	A	C	-
CRUSTACEA	Copepoda	5	-	C	-
	Ostracoda	1	-	R	-
	Paraleptamphopidae	5	R	R	-
	<i>Paranephrops</i>	5	R	R	R
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	R	C	-
	<i>Deleatidium</i>	8	A	R	-
	<i>Neozephlebia</i>	7	R	R	-
	<i>Nesameletus</i>	9	R	-	-
	<i>Zephlebia group</i>	7	VA	VA	R
PLECOPTERA (STONEFLIES)	<i>Acroperla</i>	5	-	R	-
HEMIPTERA (BUGS)	<i>Anisops</i>	5	R	-	-
COLEOPTERA (BEETLES)	Elmidae	6	A	C	-
	Dytiscidae	5	R	-	-
	Hydrophilidae	5	R	-	-
	Ptilodactylidae	8	-	R	-
MEGALOPTERA (DOBSONFLIES)	<i>Archichauliodes</i>	7	R	R	-
TRICHOPTERA (CADDISFLIES)	<i>Aoteapsyche</i>	4	C	C	R
	<i>Hydrobiosis</i>	5	R	-	-
	<i>Neurochorema</i>	6	R	-	-
	<i>Plectrocnemia</i>	8	-	R	-
	<i>Psilochorema</i>	6	R	C	-
	Oeconesidae	5	C	-	-
	<i>Oxyethira</i>	2	C	-	-
	<i>Triplectides</i>	5	-	R	-
DIPTERA (TRUE FLIES)	<i>Aphrophila</i>	5	C	R	-
	Eriopterini	5	R	R	-
	Hexatomi	5	-	R	-
	Orthoclaadiinae	2	VA	C	C
	<i>Polypedilum</i>	3	-	R	-
	Culicidae	3	-	-	R
	<i>Paradixa</i>	4	R	-	-
	Empididae	3	-	C	-
	Ephydriidae	4	R	-	-
	Psychodidae	1	R	-	-
	<i>Austrosimulium</i>	3	A	C	R
ACARINA (MITES)	Acarina	5	C	R	-
No of taxa			29	28	7
MCI			97	99	71
SOMCIs			2.5	4.2	1.2
EPT (taxa)			10	9	2
%EPT (taxa)			34	32	29
'Tolerant' taxa		'Moderately sensitive' taxa		'Highly sensitive' taxa	

R = Rare C = Common A = Abundant VA = Very Abundant XA = Extremely Abundant

The macroinvertebrate community at this site was characterised by one 'highly sensitive' taxon [mayfly (*Deleatidium*)]; two 'moderately sensitive' taxa [mayfly (*Zephlebia* group) and elmid beetles]; and four 'tolerant' taxa [oligochaete worms, snail (*Potamopyrgus*), orthoclad midges, and sandfly (*Austrosimulium*)] (Table 3). The presence of two 'highly sensitive' taxa (one of which was abundant) was indicative of relatively good preceding physicochemical water quality.

The moderately high proportion of 'sensitive taxa' (66%) recorded at this site was reflected in the MCI score of 97 units, equivalent with the median score recorded at the site previously (Figure 2 and Table 2) and relatively similar to the MCI score recorded by the previous spring survey (100 units).

A low SQMCI_s score of 2.5 units was recorded at this site by the current survey which reflected the numerical dominance by the extremely abundant 'tolerant' oligochaete worms and to a lesser degree, one other 'tolerant' taxon.

Downstream of discharge tributary (site 3)

Results to date for this site, downstream of the confluence with the Production Station discharges receiving waters tributary, are illustrated in Figure 3.

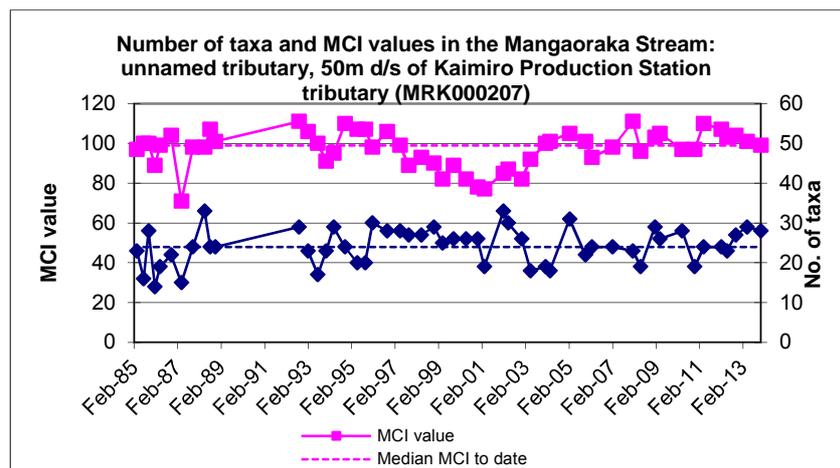


Figure 3 Number of taxa and MCI values in an unnamed tributary of the Mangaoraka Stream, 50 m d/s of Kaimiro Production Station tributary (MRK000207)

A moderate richness of twenty-eight seven taxa was found at this site, four more than the median recorded by all previous surveys (Figure 3 and Table 2). The community was characterised by no 'highly sensitive' taxa; one 'moderately sensitive' taxon [mayfly (*Zephlebia* group)]; and one 'tolerant' taxon [oligochaete worms]; fewer dominant taxa than usually found at this site.

There were several significant differences within individual taxon abundances found between sites 1 and 3, two of which were decreases in abundances of 'sensitive' taxa in a downstream direction (Table 3). These differences were tempered by subtle changes within a few 'tolerant' taxa (but particularly oligochaete worms), which resulted in a significant increase in SQMCI_s value of 1.5 units (Table 2). This SQMCI_s was higher than the historical median for this site and indicative of a macroinvertebrate community in relatively good health.

Due to a small increase in the proportion of 'sensitive' taxa in the community (71%) compared with site 1, the MCI score (99 units) increased slightly (by 2 units) which was equivalent with the median MCI score recorded to date at this site. The SQMCI_s and MCI scores were both indicative of minimal recent impacts on the macroinvertebrate community below the inflowing tributary which receives Kaimiro Production Station discharges.

Minor tributary which receives Kaimiro Production Station discharges (site 2)

The results of surveys performed to date at this site, in the tributary which receives the Production Station's discharges, are illustrated in Figure 4.

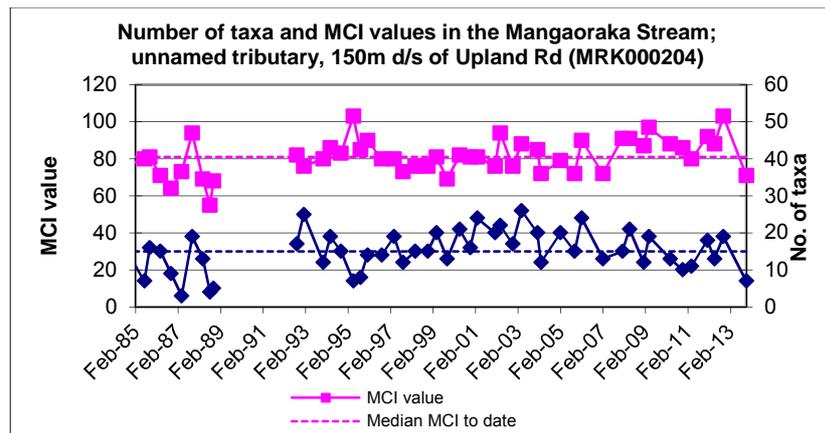


Figure 4 Number of taxa and MCI values in an unnamed tributary of the Mangaoraka Stream, 150 m d/s of Upland Road (MRK000204)

A poor richness of 7 taxa was found at this site where there was evidence of bank slumping sediment on the substrate. This was eight taxa fewer than the median richness of previous surveys (Figure 4, Table 2). This richness was considered to be related to the limited invertebrate habitat available due to sedimentation following several more recent stream freshes. The community was characterised by only one 'tolerant' taxon [oligochaete worms] (Table 3). The higher proportion of 'tolerant' taxa (71%) than usual in this community resulted in the MCI score of 71 units, 10 units lower than the historical median for this site but 16 units above the historical minimum, (Figure 4). No 'highly sensitive' taxa were recorded in the community, and together with the relatively low MCI, were indicative of poor habitat quality. The SQMCI_s score was well below the median, mainly due to the abundance of one 'tolerant taxon.

This site's taxa richness was much lower than those found at the two sites in the main tributary, the SQMCI_s score was below the range found at these two sites, and the MCI score was significantly lower than both sites' MCI scores. These dissimilarities were typical of the differences in communities usually found by past surveys under low, spring and/or autumn warmer flow conditions when the habitat differences between tributaries often have been pronounced.

The current survey results were more indicative of recent impacts of bank slumping upon the macroinvertebrate community of this receiving tributary rather than attributable to the Kaimiro Production Station discharges. This was also reinforced by an absence of 'sewage fungus' on the stream bed.

Discussion

Most of the previous surveys undertaken in relation to the Kaimiro Production Station stormwater discharge have shown that the larger tributary of the Mangaoraka Stream supports richer macroinvertebrate communities, including greater abundances of 'sensitive' mayflies. The results of this spring survey are consistent with these trends. Taxa richnesses recorded at sites 1 and 3 were much higher than that recorded at site 2 in the unnamed tributary which receives the production station stormwater discharge and had been affected by some sediment input attributable to nearby bank slumping. MCI and SQMCI_s scores recorded at site 2 were much lower than those recorded at sites 1 and 3 in the larger tributary. At the time of this survey, the availability of habitat in the smaller tributary was much more limited than in the major tributary with moderate flows recorded at all three sites after a wet early spring period. The condition of the habitat at site 2 was not compromised to the same extent by the presence of naturally occurring iron oxide sediment but more so by loose sediment on the substrate at this site. Such habitat conditions are unlikely to support more 'sensitive' taxa, several of which were recorded in abundance at the two sites in the major tributary. In this survey, no iron oxide was recorded at site 1 or at site 3. It is considered that the differences in richness, MCI, and SQMCI_s recorded between site 2 and the two sites in the larger tributary related to differences in habitat (mainly sedimentation) rather than due to the effects of the stormwater discharges from the production station.

The MCI and SQMCI results recorded at the site in the minor (receiving) tributary were lower than the median scores recorded at this site previously and were indicative of poor habitat quality in this tributary at the time of this survey.

Overall, the results of this survey under spring, moderate flow conditions indicated that the discharge of stormwater from the Kaimiro Production station had not resulted in any recent adverse effects on the macroinvertebrate communities in the main tributary of the Mangaoraka Stream.

Summary

A three site biomonitoring survey was undertaken in November 2013 in two tributaries of the Mangaoraka Stream, to monitor the health of the macroinvertebrate communities of these tributaries, in relation to the discharge of treated stormwater from the Kaimiro Production Station. The Council's standard 'kick' sampling technique was used to collect the stream bed macroinvertebrate samples from each site. Samples were processed to provide number of taxa (richness), MCI and SQMCI_s scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI_s takes into account taxa abundances as well as sensitivity to pollution. It may indicate subtle changes in communities, and therefore be more relevant index if non-organic impacts are occurring. Significant differences in either the MCI or the SQMCI_s between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

The MCI and SQMCI_s scores recorded at site 2 in the small unnamed tributary downstream of the production station discharge typically were dissimilar to the scores recorded at the two sites in the larger tributary. At the time of this survey, the availability of instream

habitat at this site was limited due to bank slumping sediment rather than the presence of iron oxide deposits and limited periphyton on the bed of the stream which is restrictive to the establishment of a macroinvertebrate community comprising certain 'sensitive' taxa. In contrast, sites 1 and 3 in the major tributary supported much more diverse communities which included abundances of several 'sensitive' taxa. It was considered most likely that the difference in taxa richness, MCI, and SQMCI_s scores at site 2 compared to the two sites in the larger tributary, resulted from differences in physical habitat rather than as a result of the Production Station discharges.

MCI and SQMCI_s scores recorded at each of the two sites in the main tributary in this survey were equivalent with, or similar to, the median scores for each respective site on this spring occasion; an indication of relatively good preceding water quality under moderate flow conditions following a recent wet early spring period.

In summary the results of this November 2013 survey indicated that discharges from the Kaimiro Production Station had not had any recent detrimental effects on the macroinvertebrate communities of the main tributary of the Mangaoraka Stream and that the poor community found in the (minor) receiving tributary was coincident with sedimentation of the substrate due to bank slumping.

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To Job Manager, Callum MacKenzie
From Freshwater Biologists, CR Fowles and BR Thomas
Report No CF615
Doc No 1387962
Date August 2014

Biomonitoring of two unnamed tributaries of the Mangaoraka Stream in relation to the Kaimiro Production Station, February 2014

Introduction

This was the second of two biomonitoring surveys scheduled to be undertaken in the 2013-2014 monitoring year for the Kaimiro Production Station of Greymouth Petroleum (previously owned by Fletcher Challenge Energy Taranaki Limited). The Taranaki Regional Council has undertaken surveys since January 1985 in the tributaries of the Mangaoraka Stream that receive stormwater and wastewater from the production station area. During 1987 and 1988 oil seepage to these streams disrupted the aquatic communities. Biomonitoring was not undertaken for nearly four years following the oil seepage period, until 1992. The results of surveys performed since the 1998-99 monitoring year are discussed in the references at the end of this report.

Methods

This survey was undertaken on 3 February 2014 at three sites in two unnamed tributaries of the Mangaoraka Stream. Figure 1 shows the location of these sampling sites. Site 1 is the 'control' site which is located in a major tributary of the Mangaoraka Stream, upstream of the confluence with a more minor tributary. Site 2 is situated in the minor tributary which receives the stormwater discharge from the production station and site 3 is approximately 50 metres downstream of the confluence of this tributary (Table 1).

The standard '400 ml kick-sampling' technique was used to collect streambed macroinvertebrates from these sites in this survey. This 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark *et al*, 2001).

Table 1 Biomonitoring sites in two tributaries of the Mangaoraka Stream in relation to discharges from the Kaimiro Production Station

Site	Site code	GPS reference (NZTM)	Location
1	MRK 000198	E1700117 N5664652	Major tributary approx. 50m u/s of confluence with minor tributary
2	MRK 000204	E1700054 N5664636	Minor tributary (receives discharge) 150m d/s of Upland Road
3	MRK 000207	E1700171 N5665679	Major tributary approx. 50m d/s of confluence with minor tributary

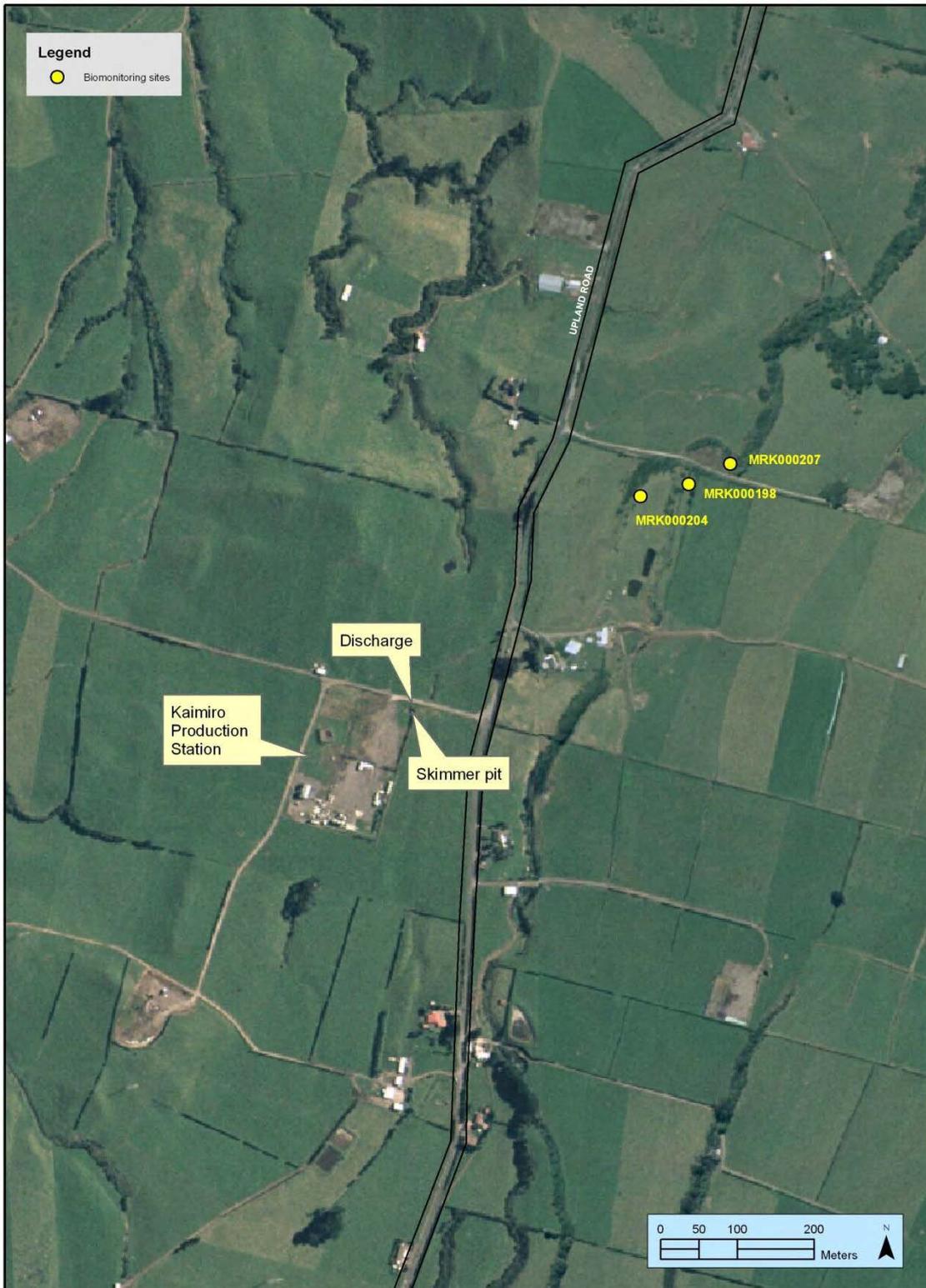


Figure 1 Biomonitoring sites in two unnamed tributaries of the Mangaoraka Stream related to the Kaimiro Production Station

Samples were preserved with Kahle's Fluid for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark et al. 2001). Macroinvertebrate taxa found in each sample were recorded as:

R (rare)	= less than 5 individuals;
C (common)	= 5-19 individuals;
A (abundant)	= estimated 20-99 individuals;
VA (very abundant)	= estimated 100-499 individuals;
XA (extremely abundant)	= estimated 500 individuals or more.

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. Averaging the scores from a list of taxa taken from one site and multiplying by a scaling factor of 20 produces a Macroinvertebrate Community Index (MCI) value.

The MCI was designed for use in stony streams, and all sites sampled in this survey provided stony substrate. The MCI was designed as a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution, though sedimentation, temperatures, current speed, dissolved oxygen levels and some toxins can also affect the index values, because the taxa capable of tolerating extremes in these variables generally have low sensitivity scores. Usually more 'sensitive' communities inhabit less polluted waterways.

A semi-quantitative MCI value (SQMCI_s) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the SQMCI_s is not multiplied by a scaling factor of 20, therefore SQMCI_s values range from 1 to 10, while MCI values range from 20 to 200.

Results and discussion

This February 2014 survey was performed 26 days after a fresh in excess of three times median flow and 29 days after a fresh in excess of seven times median flow. However, in the month prior to this survey, there had only been one fresh event which exceeded three times median flow. During this early afternoon survey, water temperatures in the main tributary ranged from 16.4°C to 18.1°C and in the minor tributary water temperature was 16.8°C.

The substrate at all sites consisted predominantly of silt, gravels and cobbles, with smaller proportions of boulder and sand substrate present also, with the exception of boulders which were predominant at site 3. A low, slow to steady flow of slightly turbid, uncoloured water was recorded at all three sites.

In the major tributary, there was no evidence of extensive slumping of the banks upstream and downstream of site 1 compared with that noted by the May 2012 survey, which most likely had been caused by stock accessing the stream. The stream bed at this open site was covered by thin periphyton mats and patchy moss but there was no filamentous algal cover. At the completely shaded site 3, thin periphyton mats were observed on the bed of the stream along with patchy moss but no filamentous algae were present. Thin algal mats and patchy moss were recorded at the partially shaded site 2 in the minor tributary of the Mangaoraka Stream. Some iron oxide deposits were found on the stream bed at this site similar to previous occurrences in this and many small seepage streams in Taranaki. Typically such deposits result from the oxidation of dissolved ferrous iron in groundwater seepage, upon contact with atmospheric oxygen. Small streams may often have insufficient

flow to flush these deposits away. No iron oxide deposits were recorded at site 3 but some were present at site 1 at the time of this survey. There was evidence of sediments deposited on parts of the tributary stream bed at the time of this survey where silt was the dominant component of the substrate at this site.

Macroinvertebrate communities

Most past surveys have shown that the larger tributary supports richer macroinvertebrate communities, including abundances of 'sensitive' mayflies. These results reflect the good habitat conditions normally provided by faster-flowing, stony-bedded streams on the upper to mid reaches of the ring plain. The smaller tributary has tended to support communities with lower numbers of taxa and smaller proportions of 'sensitive' taxa. This in part has been due to the slower flow and/or iron oxide deposition on the more sedimented stream bed of this tributary.

Table 2 provides a summary of the results from the sites sampled in this survey together with historical results. The full results of the current survey are presented in Table 3.

Table 2 Results of previous surveys performed between January 1985 and November 2013 in two unnamed tributaries of the Mangaoraka Stream, together with current survey results

Site No	Numbers of taxa				MCI values				SQMCI _s values			
	No. samples	Range	Median	February 2014	No. Samples	Range	Median	February 2014	No. samples	Range	Median	February 2014
1	53	18-37	27	26	53	83-110	97	92	28	1.9-5.1	3.4	4.4
2	49	3-26	15	12	49	55-103	81	95	27	1.2-4.1	2.1	2.7
3	53	14-33	24	18	53	71-111	99	101	28	1.7-6.2	4.0	4.4

Major tributary Upstream of discharge tributary (site 1)

Survey results to date are illustrated in Figure 2.

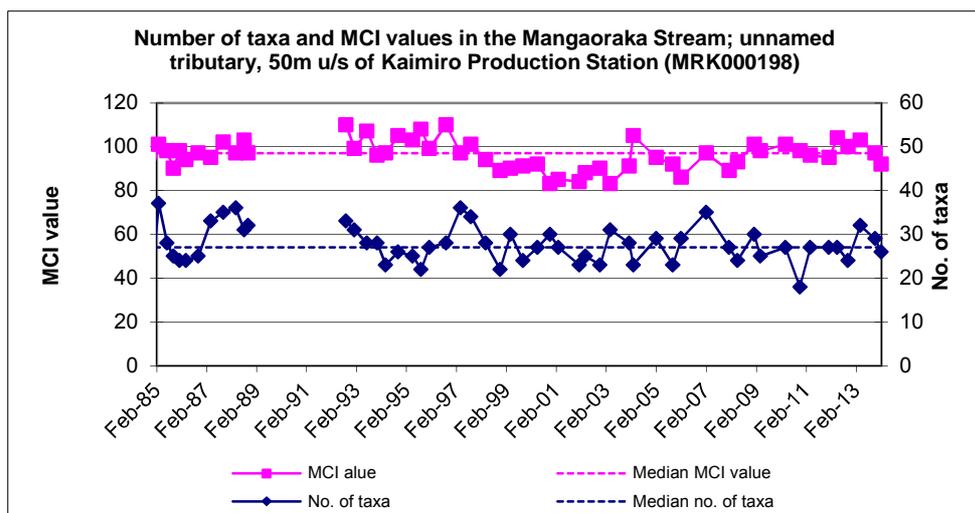


Figure 2 Number of taxa and MCI values in an unnamed tributary of the Mangaoraka Stream, 50 m upstream of Kaimiro Production Station (MRK000198)

Table 3 Macroinvertebrate fauna of two unnamed tributaries of the Mangaoraka Stream in relation to Kaimiro Production Station sampled on 3 February 2014

Taxa List	Site Number	MCI score	1	3	2
	Site Code		MRK000198	MRK000207	MRK000204
	Sample Number		FWB14042	FWB14044	FWB14043
ANNELIDA (WORMS)	Oligochaeta	1	A	A	A
	Lumbricidae	5	R	-	-
MOLLUSCA	<i>Potamopyrgus</i>	4	A	R	-
CRUSTACEA	Copepoda	5	-	R	R
	Ostracoda	1	R	-	-
	Isopoda	5	-	R	-
	Paraleptamphopidae	5	-	R	-
	<i>Paranephrops</i>	5	R	R	C
EPHEMEROPTERA (MAYFLIES)	<i>Austroclima</i>	7	-	C	-
	<i>Deleatidium</i>	8	C	C	-
	<i>Zephlebia</i> group	7	VA	A	R
COLEOPTERA (BEETLES)	Elmidae	6	A	C	-
	Dytiscidae	5	R	-	-
	Ptilodactylidae	8	-	R	-
MEGALOPTERA (DOBSONFLIES)	<i>Archichauliodes</i>	7	C	R	R
TRICHOPTERA (CADDISFLIES)	<i>Aoleapsyche</i>	4	A	C	-
	<i>Hydrobiosis</i>	5	A	-	R
	<i>Polypectropus</i>	6	R	-	-
	<i>Psilochorema</i>	6	C	-	-
	Oeconesidae	5	C	-	-
	<i>Oxyethira</i>	2	A	-	-
	<i>Pycnocentria</i>	7	R	-	-
	<i>Tripletides</i>	5	C	C	-
DIPTERA (TRUE FLIES)	<i>Aphrophila</i>	5	A	-	R
	Hexatomini	5	-	-	R
	<i>Paralimnophila</i>	6	-	-	R
	Orthoclaadiinae	2	VA	R	C
	Tanypodinae	5	C	R	R
	<i>Paradixa</i>	4	-	-	R
	Empididae	3	R	-	-
	Ephydriidae	4	R	R	-
	<i>Austrosimulium</i>	3	C	A	-
	Tanyderidae	4	R	-	-
ACARINA (MITES)	Acarina	5	C	-	-
No of taxa			26	18	12
MCI			92	101	95
SQMCIs			4.4	4.4	2.7
EPT (taxa)			9	5	2
%EPT (taxa)			35	28	17
'Tolerant' taxa		'Moderately sensitive' taxa	'Highly sensitive' taxa		
R = Rare	C = Common	A = Abundant	VA = Very Abundant	XA = Extremely Abundant	

A richness of twenty-six taxa was recorded at this site by the current survey, which was within one taxon of the historical median taxa number (Table 2). The macroinvertebrate community at this site was characterised by no 'highly sensitive' taxa; four 'moderately sensitive' taxa [mayfly (*Zephlebia* group), elmid beetles, free-living caddisfly (*Hydrobiosis*), and crane fly (*Aphrophila*)]; and five 'tolerant' taxa [oligochaete worms, snail (*Potamopyrgus*), net-building caddisfly (*Aoteapsyche*), algal-piercing caddisfly (*Oxyethira*), and orthoclad midges] (Table 3). The presence of one 'highly sensitive' taxon (although not abundant) was indicative of relatively good preceding physicochemical water quality.

The moderately high proportion of 'sensitive taxa' (62%) recorded at this site was reflected in the MCI score of 92 units, five units lower than the median score recorded at the site previously (Figure 2 and Table 2) and 11 units lower than the MCI score recorded by the previous summer-autumn survey (103 units).

A moderate SQMCI_s score of 4.4 units was recorded at this site by the current survey which reflected the numerical dominance by the very abundant 'tolerant' orthoclad midges and 'moderately sensitive' mayfly, and was 1.0 SQMCI_s unit higher than the historical median score.

Downstream of discharge tributary (site 3)

Results to date for this site, downstream of the confluence with the Production Station discharges receiving waters tributary, are illustrated in Figure 3.

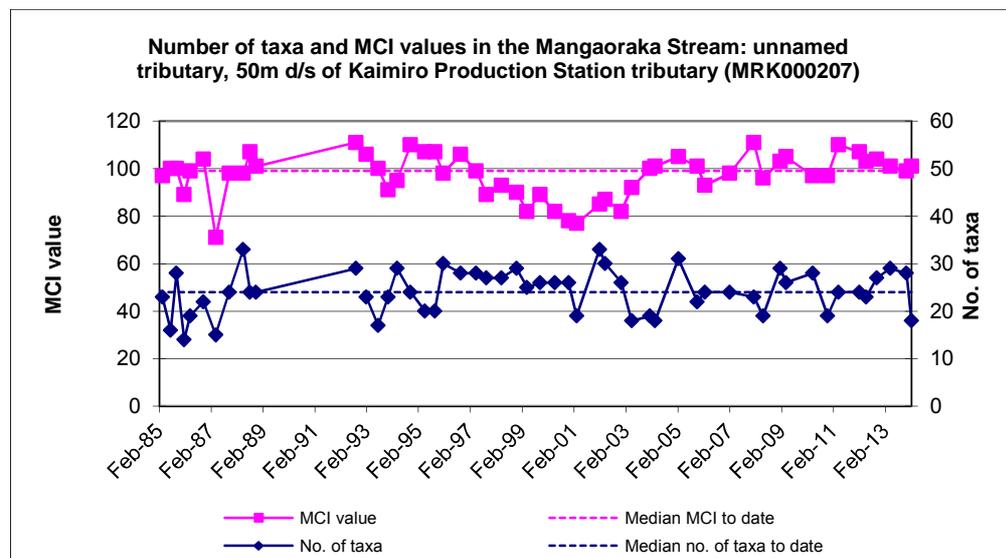


Figure 3 Number of taxa and MCI values in an unnamed tributary of the Mangaoraka Stream, 50 m d/s of Kaimiro Production Station tributary (MRK000207)

A poorer richness of eighteen taxa was found at this site, eight taxa fewer than at the upstream 'control' site, and six taxa fewer than the median recorded by all previous surveys (Figure 3 and Table 2). The community was characterised by no 'highly sensitive' taxa; one 'moderately sensitive' taxon [mayfly (*Zephlebia* group)]; and two 'tolerant' taxa [oligochaete worms and sandfly (*Austrosimulium*)]; fewer dominant taxa than usually found at this site and found at the upstream 'control' site.

There were several significant differences within individual taxon abundances found between sites 1 and 3, four of which were decreases in abundances of 'sensitive' taxa in a downstream direction (Table 3). These differences were tempered by subtle changes within one other 'sensitive' taxon and decreases in a few 'tolerant' taxa (particularly orthoclad midges), which resulted in no change in SQMCI_s values (Table 2). This SQMCI_s was higher than the historical median for this site and indicative of a macroinvertebrate community in relatively good health, despite a decrease in taxa richness of eight taxa and decreased abundances within several taxa, coincident with increased boulder and decreased cobble components of the stream substrate.

As a result of a small increase in the proportion of 'sensitive' taxa in the community (67%) compared with site 1, the MCI score (101 units) increased insignificantly (by 9 units) which was two units above the median MCI score recorded to date at this site. The SQMCI_s and MCI scores were both indicative of minimal recent impacts on the macroinvertebrate community below the inflowing tributary which receives the Kaimiro Production Station discharges.

Minor tributary which receives Kaimiro Production Station discharges (site 2)

The results of surveys performed to date at this site, in the tributary which receives the Production Station's discharges, are illustrated in Figure 4.

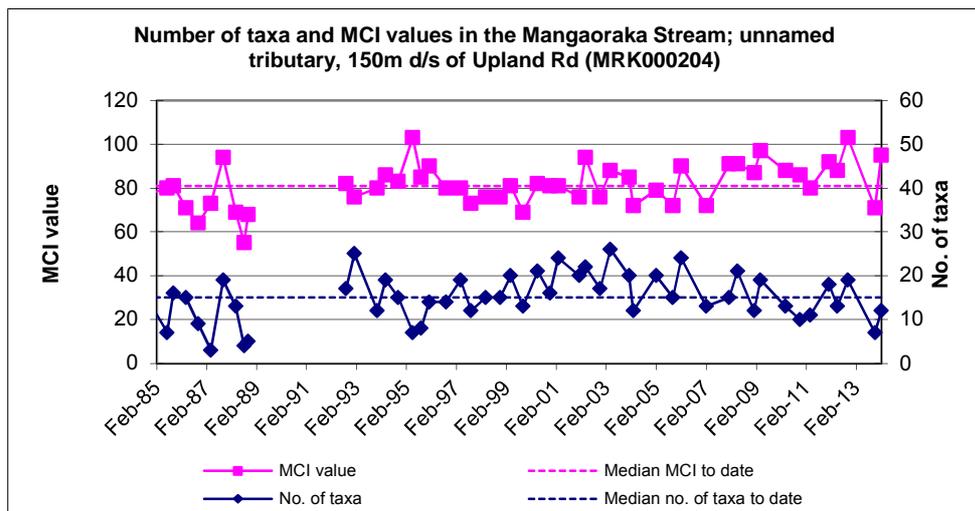


Figure 4 Number of taxa and MCI values in an unnamed tributary of the Mangaoraka Stream, 150 m d/s of Upland Road (MRK000204)

A relatively poor richness of 12 taxa was found at this site where there was evidence of some increased sedimentation and iron oxide deposition on the substrate. This was three taxa fewer than the median richness of previous surveys (Figure 4, Table 2) and was considered to be related in part to the reduced invertebrate habitat available due to sedimentation of the streambed. The community was characterised by only one 'tolerant' taxon [oligochaete worms] (Table 3). However, the relatively high proportion of 'moderately sensitive' taxa (75%) in this community resulted in the MCI score of 95 units, a significant 14 units higher than the historical median for this site but 8 units below the historical maximum, (Figure 4). However, the absence of 'highly sensitive' taxa and sparseness of abundant taxa recorded in the community were indicative of poorer habitat quality. This was reflected in the low SQMCI_s score (2.7 units) which was due mainly to the abundance of one 'tolerant' taxon.

This site's taxa richness was much lower than those found at the two sites in the main tributary. The SQMCI_s score was below the scores found at these two sites, although the MCI score was within the range found at both sites. These dissimilarities were typical of the differences in communities found by past surveys under low, spring and/or summer-autumn warmer flow conditions when the habitat differences between tributaries often have been pronounced.

The current survey results were more indicative of recent impacts of streambed sedimentation upon the macroinvertebrate community of this receiving tributary rather than attributable to the Kaimiro Production Station discharges. This was also reinforced by an absence of 'sewage fungus' on the stream bed.

Discussion

Most of the previous surveys undertaken in relation to the Kaimiro Production Station stormwater discharge have shown that the larger tributary of the Mangaoraka Stream supports richer macroinvertebrate communities, including greater abundances of 'sensitive' mayflies. The results of this summer survey are consistent with these trends. Taxa richnesses recorded at sites 1 and 3 were much higher than that recorded at site 2 in the unnamed tributary which receives the production station stormwater discharge and had been affected to some extent by sedimentation of the streambed and iron-oxide deposits under low, warmer flow conditions. The SQMCI_s score recorded at site 2 was much lower than those recorded at sites 1 and 3 in the larger tributary. At the time of this survey, the availability of habitat in the smaller tributary was much more limited than in the major tributary with low flows recorded at all three sites after a dry summer period. The condition of the habitat at site 2 was compromised to some extent by the presence of naturally occurring iron oxide sediment and also by looser sediment on the substrate at this site. Such habitat conditions are unlikely to support more 'sensitive' taxa, several of which were recorded in abundance at one or both of the two sites in the major tributary. In this survey, some iron oxide was recorded at site 1 but not at site 3. It is considered that the differences in richness, and SQMCI_s in particular, recorded between site 2 and the two sites in the larger tributary related to differences in habitat (mainly sedimentation) rather than due to the effects of the stormwater discharges from the production station.

The richness and SQMCI results recorded at the site in the minor (receiving) tributary were indicative of poorer habitat quality in this tributary at the time of this survey.

Overall, the results of this survey under summer, low flow conditions indicated that the discharge of stormwater from the Kaimiro Production station had not resulted in any recent significant adverse effects on the macroinvertebrate communities in the main tributary of the Mangaoraka Stream.

Summary

A three site biomonitoring survey was undertaken in February 2014 in two tributaries of the Mangaoraka Stream, to monitor the health of the macroinvertebrate communities of these tributaries, in relation to the discharge of treated stormwater from the Kaimiro Production Station. The Council's standard 'kick' sampling technique was used to collect the stream bed macroinvertebrate samples from each site. Samples were processed to provide number of taxa (richness), MCI and SQMCI_s scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI_s takes into account taxa abundances as well as sensitivity to pollution. It may indicate subtle changes in communities, and therefore be more relevant index if non-organic impacts are occurring. Significant differences in either the MCI or the SQMCI_s between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

The richness and SQMCI_s score recorded at site 2 in the small unnamed tributary downstream of the production station discharge typically were dissimilar to those recorded at the two sites in the larger tributary. At the time of this survey, the availability of instream habitat at this site was limited due to sedimentation and iron-oxide deposition on the streambed which is restrictive to the establishment of a macroinvertebrate community comprising certain 'sensitive' taxa. In contrast, sites 1 and 3 in the major tributary supported much more diverse communities which included abundances of several 'sensitive' taxa. It was considered most likely that the difference in taxa richness and SQMCI_s score at site 2 compared to the two sites in the larger tributary, resulted from differences in physical habitat rather than as a result of the Production Station discharges.

MCI and SQMCI_s scores recorded at each of the two sites in the main tributary in this survey were within five units of the median scores for each respective site on this summer occasion; an indication of relatively good preceding water quality under low flow conditions following a recent dry summer period.

In summary the results of this February 2014 survey indicated that discharges from the Kaimiro Production Station had not had any recent detrimental effects on the macroinvertebrate communities of the main tributary of the Mangaoraka Stream and that the poorer community found in the (minor) receiving tributary was coincident with sedimentation of the substrate including iron-oxide deposition.

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Appendix III

Air monitoring report

Memorandum

To Job Manager, Callum MacKenzie
From Scientific Officer - Air Quality, Brian Cheyne
File FRODO – #1402023,
Date September 11, 2014

Ambient Gas Monitoring at Kaimiro and Ngatoro Production Stations during 2013-2014 monitoring year

During the monitoring year, a multi-gas meter was deployed on three occasions in the vicinity of the plants. Each deployment lasted approximately twenty-four hours, with the instrument placed in a down-wind position at the start of each deployment. Monitoring consisted of continuous measurements of gas concentrations for the gases of interest (carbon monoxide and combustible gases). The location of the multi-gas meter for each sampling run is shown in Figure 1.

Because of the nature of the activities on the site, it was considered that the primary information of interest in respect of gases potentially emitted from the site was the average downwind concentration, rather than any instantaneous peak value. That is, the long-term exposure levels, rather than short-term maxima, are of most interest. The gas meter was therefore set up to create a data set based on recording the average concentration measured during each minute as raw data.

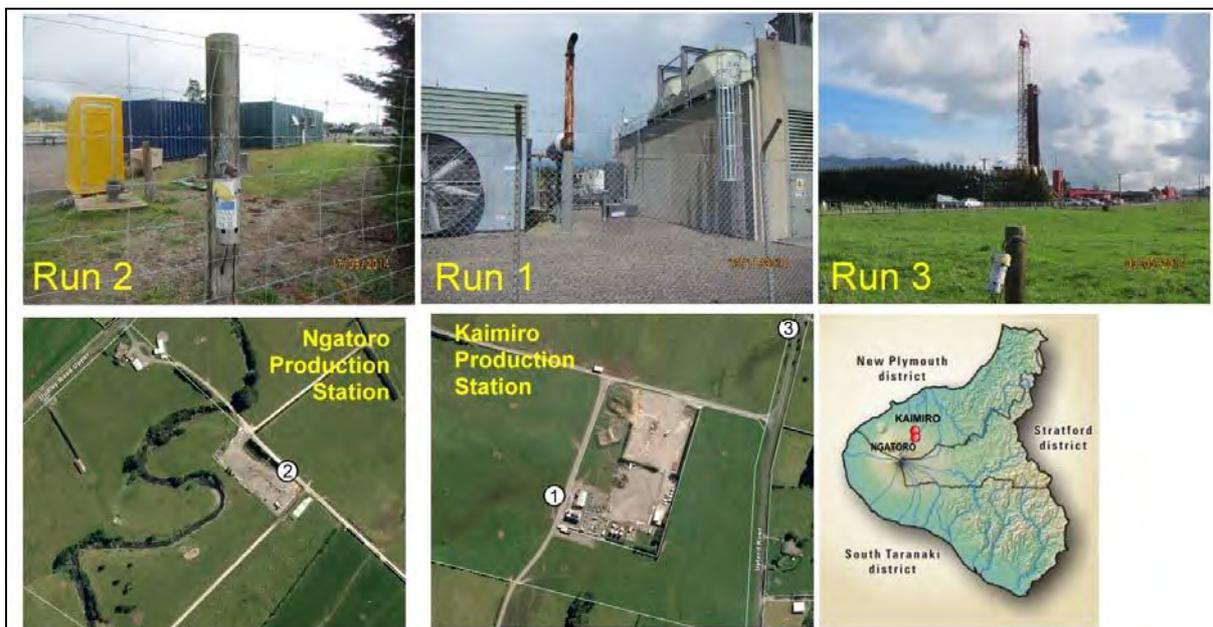


Figure 1 Air monitoring sites –Kaimiro & Ngatoro Production Stations (year 2013-2014)

The details of each sample run are summarised in Table 1 and the data from each run are presented graphically in Figure 2.

The consents covering air discharges from the Kaimiro and Ngatoro Production Stations have specific limits related to particular gases. Special condition 13 of consent 4048 and special condition 13 of consent 7295 set a limit on the carbon monoxide concentration at or beyond the production station's boundary. The limit is expressed as 10 mg/m³ for an eight hour average or 30 mg/m³ for a 1 hour average exposure. The maximum concentration of carbon monoxide found during the monitoring run was 4.6 mg/m³ with average concentration for all three runs was only 0.10mg/m³ which complies with both consents conditions. This continues the pattern found in previous years.

Table 1 Results of ambient gas monitoring at Kaimiro & Ngatoro production stations

Run		1 (Kmr)	2(Ngt)	3(Kmr)	Average
Period (from-to)		19.01.2012 14:25 22.01.2012 21:03	09.03.2012 07:14 12.03.2012 13:52	15.05.2012 12:29 16.05.2012 14:55	
Max	CO(ppm)	8.00	3.30	4.80	5.40
	LEL(%)	0.10	0.10	0.10	0.10
Mean	CO(ppm)	0.00	0.00	0.10	0.00
	LEL(%)	0.00	0.00	0.00	0.00
Min	CO(ppm)	0.00	0.00	0.00	0.00
	LEL(%)	0.00	0.00	0.00	0.00

* Faulty sensor

Note: (1) the instrument records in units of ppm. At 15°C
1ppm CO = 0.85 mg/m³

- (2) See text for explanation of LEL. Because the LEL of methane is equivalent to a mixture of approximately 5% methane in air, then the actual concentration of methane in air can be obtained by dividing the % LEL by 20.

LEL% gives the percentage of the lower explosive limit, expressed as methane, that is detected in the air sampled. The sensor on the instrument reacts to gases and vapours such as acetone, benzene, butane, methane, propane, carbon monoxide, ethanol, and higher alkanes and alkenes, with varying degrees of sensitivity. The Council's Regional Air Quality Plan has a typical requirement that no discharge shall result in a dangerous level of airborne contaminants, including any risk of explosion. At no time did the level of explosive gases downwind of the Kaimiro and Ngatoro Production Stations reach any more than a trivial level.

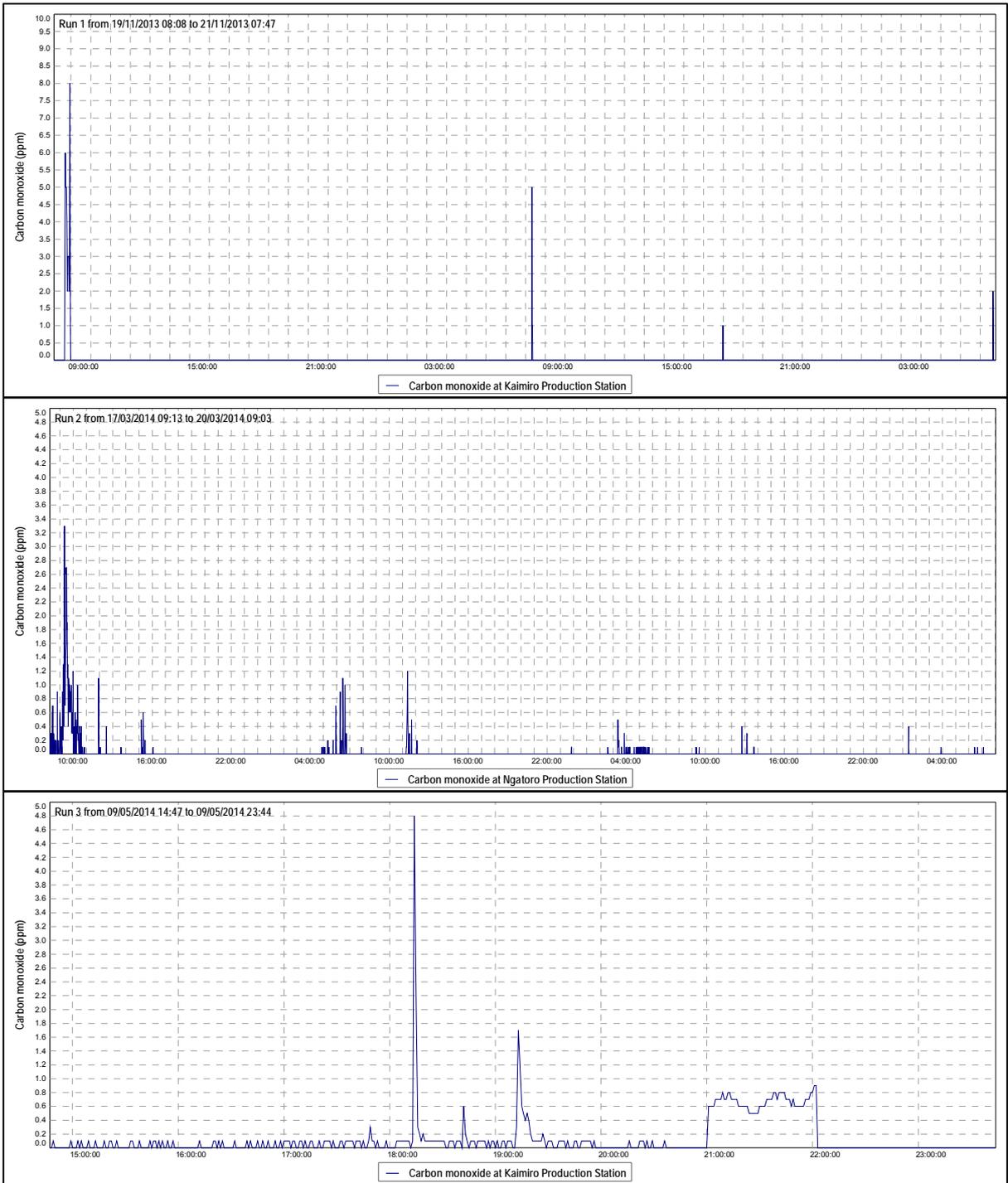


Figure 2 Graphs of ambient gas levels in the vicinity of the Kaimiro & Ngatoro Production Stations