

Shell Todd Oil Services Ltd
Kapuni Production Station
Monitoring Programme
Annual Report
2015-2016

Technical Report 2016-24

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Executive summary

Shell Todd Oil Services Ltd (STOS) operates the Kapuni Production Station located on Palmer Road in the Kapuni catchment. This report for the period July 2015 to June 2016 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess STOS's environmental performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of STOS's activities.

STOS holds four resource consents; one relating to discharges to water, one to discharge emissions to the air, and two relating to structures in the Kapuni Stream. The consents include a total of 36 conditions setting out the requirements that STOS must satisfy. STOS also holds a further 31 resource consents for production activities at wellsites associated with the Kapuni Production Station.

During the monitoring period, Shell Todd Oil Services Ltd demonstrated an overall high level of environmental performance.

The Council's monitoring programme for the year under review included six inspections, three water samples collected for physicochemical analysis, one biomonitoring survey of receiving waters, and two ambient air quality analyses.

Receiving water inspections, in conjunction with sampling conducted by both the Council and STOS during the 2015-2016 period, showed that the site discharges were not causing any adverse effects in the Kapuni Stream. This was supported by the findings of the macroinvertebrate survey.

There were no adverse effects on the environment resulting from the exercise of the air discharge consents. The ambient air quality monitoring at the Kapuni Production Station showed that levels of carbon monoxide, combustible gases, PM10 particulates and nitrogen oxides were all below levels of concern at the time of sampling. No offensive or objectionable odours were detected beyond the boundaries during inspections and there were no complaints in relation to air emissions from the sites.

During the period under review, STOS demonstrated an overall high level of both environmental performance and administrative compliance with the resource consents. There were no unauthorised incidents recorded by the Council in relation to STOS's activities. The Kapuni Production Station was well managed and maintained.

For reference, in the 2015-2016 year, 71% 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 24% demonstrated a good level of environmental performance and compliance with their consents.

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

This report includes recommendations for the 2016-2017 year, including a recommendation relating to an optional review of consents 0633-1, 5960-1 and 9555-1.

Table of contents

	Page
1. Introduction	1
1.1 Compliance monitoring programme reports and the Resource Management Act 1991	1
1.1.1 Introduction	1
1.1.2 Structure of this report	1
1.1.3 The Resource Management Act 1991 and monitoring	2
1.1.4 Evaluation of environmental and administrative performance	2
1.2 Process description	4
1.3 Resource consents	5
1.3.1 Water discharge permit	5
1.3.2 Air discharge permit	5
1.3.3 Land use permits	6
1.3.4 Associated wellsites	7
1.4 Monitoring programme	9
1.4.1 Introduction	9
1.4.2 Programme liaison and management	9
1.4.3 Site inspections	10
1.4.4 Chemical sampling	10
1.4.5 Biomonitoring surveys	10
2. Results	11
2.1 Water	11
2.1.1 Inspections	11
2.1.2 Results of discharge monitoring	12
2.1.3 Results of receiving environment monitoring	14
2.1.4 Consented water abstractions	15
2.1.5 Kapuni wellsites blowdown pit remediations	15
2.2 Air	15
2.2.1 Inspections	15
2.2.2 Results of receiving environment monitoring	16
2.2.3 Summary of flaring volumes reported by STOS	19
2.3 Investigations, interventions, and incidents	20
3. Discussion	21
3.1 Discussion of site performance	21
3.2 Environmental effects of exercise of consents	21
3.3 Evaluation of performance	21
3.4 Recommendations from the 2014-2015 Annual Report	24
3.5 Alterations to monitoring programmes for 2016-2017	24
3.6 Exercise of optional review of consent	25
4. Recommendations	26

Glossary of common terms and abbreviations	27
Bibliography and references	29
Appendix I Resource consents held by Shell Todd Oil Services Ltd	
Appendix II Biomonitoring report	
Appendix III Air monitoring reports	

List of tables

Table 1	Resource consents for production activities at the Kapuni wellsites	7
Table 2	Results of discharge monitoring from Kapuni Production Station	13
Table 3	STOS Kapuni Production Station stormwater discharge results summary for 2015-2016	13
Table 4	Receiving environment results for Kapuni Stream on 28 June 2016	14
Table 5	Results of carbon monoxide and LEL monitoring at Kapuni Production Station	17
Table 6	Daily averages of PM10 results from monitoring at Kapuni Production Station	18
Table 7	Summary of performance for Consent 0633-3	21
Table 8	Summary of performance for Consent 4054-5	22
Table 9	Summary of performance for Consent 5960-1	23
Table 10	Summary of performance for Consent 9555-1	23

List of figures

Figure 1	Kapuni Production Station and associated sampling sites	12
Figure 2	Air monitoring sites at Kapuni Production Station for 2015-2016	16
Figure 3	Ambient CO levels in the vicinity of Kapuni Production Station	17
Figure 4	PM10 concentrations ($\mu\text{g}/\text{m}^3$) at Kapuni Production Station	18
Figure 5	Monthly gas flaring for Kapuni Production Station under consent 4054-5	20

List of photos

Photo 1	Kapuni Production Station	4
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1. Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is for the period July 2015 to June 2016 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Shell Todd Oil Services Ltd (STOS). STOS operates the Kapuni Production Station situated on Palmer Road, Kapuni, together with its associated wellsites.

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consents held by STOS that relate to discharges of water within the Kapuni catchment, structures in the Kapuni Stream, and emissions to air from the production station site.

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 STOS's use of water, land and air, and is the 26th combined annual report by the Council for the Kapuni Production Station.

1.1.2 Structure of this report

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

- consent compliance monitoring under the RMA and the Council's obligations;
- the Council's approach to monitoring sites through annual programmes;
- the resource consents held by STOS in the Kapuni catchment;
- the nature of the monitoring programme in place for the period under review; and
- a description of the activities and operations conducted at the Kapuni Production Station.

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

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

Section 4 presents recommendations to be implemented in the 2016-2017 monitoring year.

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

1.1.3 The Resource Management Act 1991 and monitoring

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

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

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

1.1.4 Evaluation of environmental and administrative performance

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

Environmental performance is concerned with actual or likely effects on the receiving environment from the activities during the monitoring year. **Administrative performance** is concerned with STOS’s approach to demonstrating consent compliance in site operations and management including the timely provision of information to Council (such as contingency plans and water take data) in accordance with consent conditions.

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

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

Environmental Performance

- **High:** No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment. The Council did not record any verified unauthorised incidents involving significant environmental impacts and was not obliged to issue any abatement notices or infringement notices in relation to such impacts.
- **Good:** Likely or actual adverse effects of activities on the receiving environment were negligible or minor at most. There were some such issues noted during monitoring, from self reports, or in response to unauthorised incident reports, but these items were not critical, and follow-up inspections showed they have been dealt with. These minor issues were resolved positively, co-operatively, and quickly. The Council was not obliged to issue any abatement notices or infringement notices in relation to the minor non-compliant effects; however abatement notices may have been issued to mitigate an identified potential for an environmental effect to occur.

For example:

- High suspended solid values recorded in discharge samples, however the discharge was to land or to receiving waters that were in high flow at the time;
- Strong odour beyond boundary but no residential properties or other recipient nearby.
- **Improvement required:** Likely or actual adverse effects of activities on the receiving environment were more than minor, but not substantial. There were some issues noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent minor non-compliant activity could elevate a minor issue to this level. Abatement notices and infringement notices may have been issued in respect of effects.
- **Poor:** Likely or actual adverse effects of activities on the receiving environment were significant. There were some items noted during monitoring, from self reports, or in response to unauthorised incident reports. Cumulative adverse effects of a persistent moderate non-compliant activity could elevate an 'improvement required' issue to this level. Typically there were grounds for either a prosecution or an infringement notice in respect of effects.

Administrative performance

- **High:** The administrative requirements of the resource consents were met, or any failure to do this had trivial consequences and were addressed promptly and co-operatively.
- **Good:** Perhaps some administrative requirements of the resource consents were not met at a particular time, however this was addressed without repeated interventions from the Council staff. Alternatively adequate reason was provided

for matters such as the no or late provision of information, interpretation of 'best practical option' for avoiding potential effects, etc.

- **Improvement required:** Repeated interventions to meet the administrative requirements of the resource consents were made by Council staff. These matters took some time to resolve, or remained unresolved at the end of the period under review. The Council may have issued an abatement notice to attain compliance.
- **Poor:** Material failings to meet the administrative requirements of the resource consents. Significant intervention by the Council was required. Typically there were grounds for an infringement notice.

For reference, in the 2015-2016 year, 71% 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 24% demonstrated a good level of environmental performance and compliance with their consents.

1.2 Process description



Photo 1 Kapuni Production Station

The Kapuni Production Station is located approximately in the middle of the Kapuni gas field, and adjacent to the Vector Gas Ltd facility called the Kapuni Gas Treatment Plant (KGTP). Exploration of the Kapuni Field began in 1959, and production began at Kapuni in 1969.

The function of the Kapuni Production Station is to gather the gas and condensate from the wellsites. The gas is delivered to KGTP for processing. The condensate gathered at

the production station is treated and stabilised for storage and export to the Paritutu Tank Farm. LPG is delivered to the production station from KGTP for storage and export via road and rail tankers.

Three flares operate continuous pilots, which burn as yellow flames and are visible at night. The Kapuni Stream separates two of the flares from the remainder of the Kapuni Production Station site. The flares are linked to the main site by high and low pressure piping systems carried on a single span girder bridge with vehicular access via a ford through the Kapuni Stream. The flares are surrounded by farmland and the nearest dwelling is more than 300 m from the flare stacks. The other flare is located in the north eastern corner of the site.

1.3 Resource consents

1.3.1 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.

STOS holds water discharge permit **0633-3** to discharge treated stormwater from the Kapuni Production Station into the Kapuni Stream. The latest renewal was issued by the Council on 1 August 2011 under Section 87(e) of the RMA. It is due to expire on 1 June 2029.

There are 8 special conditions attached to this consent.

Condition 1 requires the consent holder to apply the best practicable option for preventing or minimising environmental effects when exercising the consent.

Conditions 2 and 3 prescribe the size of the stormwater catchment and the controls that must be applied to stormwater.

Conditions 4 and 5 impose limits on contaminants in the discharge, and stipulate that the discharge shall not cause any significant adverse effect on the freshwater biological communities or the water quality of the Kapuni Stream.

Condition 6 requires a contingency plan to be maintained which outlines measures and procedures to prevent spillage or accidental discharge and measures to remedy or mitigate the effects of an accidental spillage or discharge.

Condition 7 makes it clear that any significant plant changes must be evaluated for potential implications for the consent, and condition 8 is the review provision.

The permit is attached to this report in Appendix I.

1.3.2 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.

STOS holds air discharge permit **4054-5** to discharge emissions into the air from combustion involving flaring of petroleum products incidental to the treatment of gas at the Kapuni Production Station. The latest renewal was issued by the Council on 9 November 2001 under Section 87(e) of the RMA. It was subsequently amended on 7 April 2005 to remove reference to carbon dioxide emissions in condition 5 after an amendment to the RMA. A change to special condition 4 was requested by STOS and made on 9 August 2013 to move the due date for annual reporting from May to August. The consent is due to expire on 1 June 2017.

There are 13 special conditions attached to this consent.

Conditions 1, 2, 3, and 5 relate to use and maintenance of equipment to minimise emissions and impacts.

Condition 4 requires an annual report from STOS including information on flaring, emissions, plant efficiency, and mitigation measures.

Condition 6 stipulates that the discharge shall not give rise to offensive or obnoxious or objectionable odour at or beyond the site boundary.

Condition 7 requires consultation with the Council prior to significant changes on the site.

Conditions 8 and 10 relates to notifying the Council of flaring which lasts more than five minutes, and requires all practicable steps to be taken to minimise flaring.

Conditions 9 and 12 relate to record keeping.

Condition 11 stipulates that depressurisation of the plant must be carried out over a sufficient period of time to prevent dense black smoke from being discharged from the flares, except in emergencies.

Condition 13 provides for review of the consent.

The permit is attached to this report in Appendix I.

1.3.3 Land use permits

Section 13(1)(a) of the RMA stipulates that no person may in relation to the bed of any lake or river use, erect, reconstruct, place, alter, extend, remove, or demolish any structure or part of any structure in, on, under, or over the bed, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations.

STOS holds consent **5960-1** to erect, place, use and maintain a concrete ford on the bed of the Kapuni Stream for access purposes. The consent was issued on 13 February 2002 and is due to expire on 1 June 2023.

There are 8 special conditions attached to this consent.

Condition 1 requires initial construction and any maintenance to only be undertaken between 1 November and 30 April.

Conditions 2 and 3 relate to notification of the Council before undertaking works, and constructing and maintaining the structure in accordance with documentation submitted for the application.

Conditions 4 and 5 require the consent holder to observe every practicable measure to prevent discharges, and to minimise disturbance of the streambed.

Condition 6 stipulates that the structure shall not obstruct fish passage.

Condition 7 requires the structure to be removed and the area reinstated if the structure is no longer required.

Condition 8 provides for review of the consent.

STOS also holds consent **9555-1** to disturb the bed of the Kapuni Stream for the purpose of undertaking maintenance work on the fire water intake chamber. The consent was issued on 16 April 2013 and is due to expire on 1 June 2029.

There are 7 special conditions attached to this consent.

Condition 1 requires notification to the Council before undertaking works.

Conditions 2 and 3 require the adoption of the best practicable option to avoid or minimise effects on the stream bed and water quality.

Conditions 4 and 5 prohibit instream works between 1 May and 31 October and require that exercise of the consent shall not obstruct fish passage.

Conditions 6 and 7 are lapse and review provisions.

Copies of these consents are appended to this report.

1.3.4 Associated wellsites

STOS also holds consents for production activities at wellsites associated with the Kapuni Production Station and these are summarised in Table 1.

Table 1 Resource consents for production activities at the Kapuni wellsites

Wellsite	Consent	Purpose	Issue Date	Expiry
KA-1/7/19/20	6200-1	To discharge treated stormwater and treated site water from hydrocarbon exploration and production operations onto and into land at the KA-1/7 wellsite	16/09/2003	2017
	6646-1	To take and use groundwater from a bore as a contingency backup supply for fire fighting, well killing, workover and domestic purposes at the KA-1/7 wellsite	18/07/2005	2023

Wellsite	Consent	Purpose	Issue Date	Expiry
	6822-1	To discharge emissions into the air from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the KA-1/7 wellsite	21/03/2006	2023
KA-2	0611-3	To take and use groundwater from a bore as a contingency backup supply for fire fighting, well killing, workover and domestic purposes at the KA-2 wellsite	18/07/2005	2023
	3267-3	To discharge stormwater from the KA-2 wellsite into the Kapuni Stream	02/08/2011	2029
	6823-1	To discharge emissions into the air from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the KA-2 wellsite	21/03/2006	2023
KA-3	0610-3	To take and use groundwater from a bore as a contingency backup supply for fire fighting, well killing, workover and domestic purposes at the KA-3 wellsite	18/07/2005	2023
	3268-3	To discharge stormwater from the KA-3 wellsite into an unnamed tributary of the Inaha Stream	02/08/2011	2029
	6824-1	To discharge emissions into the air from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the KA-3 wellsite	21/03/2006	2023
KA-4/14	2365-3	To discharge stormwater from the KA-4/14 wellsite into an unnamed tributary of the Waiokura Stream	02/08/2011	2029
	6645-1	To take and use groundwater from a bore as a contingency backup supply for fire fighting, well killing, workover and domestic purposes at the KA-4/14 wellsite	18/07/2005	2023
	6825-1	To discharge emissions into the air from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the KA-4/14 wellsite	21/03/2006	2023
KA-5/10	6199-1	To discharge treated stormwater and treated site water from hydrocarbon exploration and production operations onto and into land at the KA-5/10 wellsite	16/09/2003	2017
	6826-1	To discharge emissions into the air from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the KA-5/10 wellsite	21/03/2006	2023
KA-6/11/17	3266-3	To discharge stormwater from the KA-6/11/17 wellsite into an unnamed tributary of the Inaha Stream	02/08/2011	2029
	6827-1	To discharge emissions into the air from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the KA-6/11 wellsite	21/03/2006	2023
	7114-1	To discharge liquids onto and into land from a purpose built, blow down pit at the KA-6/11 wellsite	19/06/2007	2023
KA-8/12/15/18	3265-3	To discharge stormwater from the KA-8/12/15/18 wellsite into an unnamed tributary of the Inaha Stream	02/08/2011	2029
	6828-1	To discharge emissions into the air from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the KA-8/12/15 wellsite	21/03/2006	2023
	7113-1	To discharge liquids onto and into land from a purpose built, blow down pit at the KA-8/12/15 wellsite	19/06/2007	2023
KA-9	5871-1	To discharge stormwater from hydrocarbon exploration and production operations at the KA-9 wellsite onto land and into an unnamed tributary of the Inaha Stream	23/08/2001	2017

Wellsite	Consent	Purpose	Issue Date	Expiry
	5873-1	To discharge emissions into the air from long-term hydrocarbon processing facilities and miscellaneous emissions at the KA-9 wellsite	23/08/2001	2017
	5874-1	To erect, place, use and maintain a pipebridge over the Kapuni Stream	23/08/2001	2017
KA-13	1105-3	To discharge stormwater from the KA-13 wellsite into the Kapuni Stream	02/08/2011	2029
	6829-1	To discharge emissions into the air from well workovers and in emergency situations and miscellaneous emissions associated with production activities at the KA-13 wellsite	21/03/2006	2023
	7005-1	To discharge liquids onto and into land from a purpose built, blow down pit at the KA-13 wellsite	24/11/2006	2023
Ngarewa	5881-1	To discharge stormwater from hydrocarbon exploration and production operations at the Ngarewa wellsite onto and into land in the vicinity of the Inaha Stream	04/09/2001	2017
	5883-1	To discharge emissions into the air from long-term hydrocarbon processing facilities and miscellaneous emissions at the Ngarewa wellsite	04/09/2001	2017
Patea-A	6079-1	To discharge emissions to air from flaring associated with production activities and miscellaneous emissions at the Patea-A wellsite	09/12/2002	2016
	6080-1	To discharge treated stormwater, treated site water and treated production water from hydrocarbon exploration and production operations at the Patea-A Wellsite onto and into land	05/11/2002	2016
Various	6647-1	To take and use water from the Kapuni Stream for fire fighting, well killing and well workover purposes for emergency backup supply at various wellsites	27/09/2005	2023

1.4 Monitoring programme

1.4.1 Introduction

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

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

The monitoring programme for the Kapuni Production Station site consisted of four primary components.

1.4.2 Programme liaison and management

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

- ongoing liaison with resource consent holders over consent conditions and their interpretation and application;
- in discussion over monitoring requirements;
- preparation for any reviews;
- renewals;
- new consents;

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

1.4.3 Site inspections

The Kapuni Production Station site was visited six times during the monitoring period. 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 STOS 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.

1.4.4 Chemical sampling

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

The Kapuni Production Station discharge was sampled once, and the sample analysed for chlorides, conductivity, hydrocarbons, pH, suspended solids and turbidity. The Kapuni Stream was sampled concurrently, and the samples analysed for the same constituents.

The Council also undertook sampling of the ambient air quality outside the boundary of the site. A multi-gas meter was deployed on one occasion 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). A PM10 particulate monitor was deployed concurrently with the multi-gas meter. Two nitrogen oxide measuring devices were also deployed in the vicinity of the plant on one occasion during the year under review. STOS supplied data on flaring causes and flare volumes throughout the period.

1.4.5 Biomonitoring surveys

A biological survey was performed on one occasion in the Kapuni Stream, to determine whether or not the discharges of stormwater from the Kapuni Production Station were having a detrimental effect upon the communities of the stream.

2. Results

2.1 Water

2.1.1 Inspections

Six inspections were carried out at the Kapuni Production Station in the 2015-2016 period, along with an annual site inspection of all associated wellsites. The following was found during the inspections:

30 July 2015

The site was neat and tidy. The separator was clear of contaminants and the discharge to the Kapuni Stream was clear with no effects noted in the receiving waters. Minimal flaring was being undertaken at the time of the inspection and no smoke or odours were noted as a result of this.

13 November 2015

The site stormwater system was operating as per design with minimal discharge of very clear water to the Kapuni Stream and no visual impact to receiving waters. The oily water separator was functioning well. The API stormwater system was clear of any contamination. A population of aquatic 'boatmen' within the pit indicated good water quality. The fire water intake area was satisfactory. The pilot flare was visible, with no smoke or odours noted. There was no dust evident in the windy conditions.

8 March 2016

The site inspection was undertaken during fine weather following very heavy rainfall in the Kapuni catchment the week before. The river had risen to a very high level during this rainfall event. No damage was noted around the fire water intake or the stormwater discharge point into the Kapuni Stream. Minimal flaring was being undertaken at the time of the inspection, with no odours or smoke observed.

28 April 2016

A site inspection was undertaken during routine production. The fire water intake gallery had been pumped out for maintenance. The separators and stormwater discharge facilities were all clear with ring drains and bunds empty. Normal flaring was being undertaken with no smoke or odours downwind.

30 May 2016

The inspection was undertaken during showery weather following a long period of inclement weather. Ring drains and bunds were all very clear as was the treated site water discharging to the Kapuni Stream. Minimal flaring was being undertaken.

23 June 2016

The site inspection was undertaken during very heavy showers. The stormwater system was operating as designed and there was good flow evident through the separator system. The discharge into the river did not give rise to any visual effects on the receiving water. Ring drains and bunds were secure. Flaring was minimal with no off-site effects.

28 June 2016

The annual site inspection of all wellsites associated with the Kapuni Production Station was undertaken during heavy squally showers, giving a visual indication of stormwater management on each site. The stormwater systems were all fit for purpose.

with silt controls being provided by retaining vegetation within the ring drains. The consent holder was asked to check the flow of stormwater from the KA-9 northern boundary adjacent to the railway line. Bunding was provided around key storage areas and processing plants where necessary. Discharge points were checked where possible, with no effects noted. No flaring was being undertaken at any of the sites and no odours associated with the sites were evident. Plant pest management was generally good, however gorse and pampas were noted at a couple of the sites and the consent holder was asked to remove these.

2.1.2 Results of discharge monitoring

Stormwater at the Kapuni Production Station is treated using two API separators. Stormwater captured beneath equipment and in bunded areas around storage facilities is directed to the first separator for initial treatment. It is then treated in a second separator prior to discharge to the Kapuni Stream. Stormwater from other areas, such as roads, is directed to the second separator.

Chemical water quality sampling of the treated stormwater discharge from the production station was undertaken once during the 2015-2016 period. Table 2 presents the results of this sampling. The location of the sampling site at the outlet of the second API separator (STW002014) is shown in Figure 1.

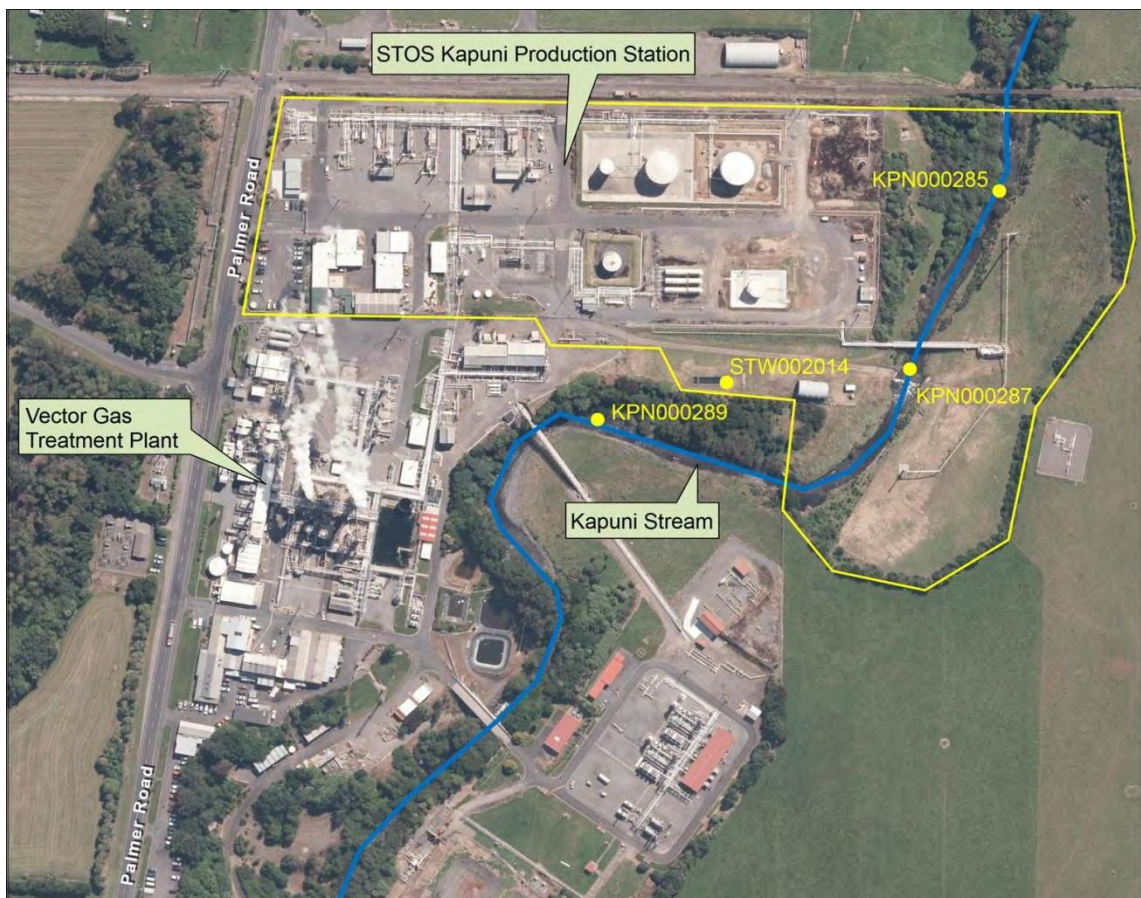


Figure 1 Kapuni Production Station and associated sampling sites

Table 2 Results of discharge monitoring from Kapuni Production Station

Parameter	Units	28 June 2016	Consent limits
Chloride	g/m ³	11.0	50
Conductivity	g/m ³	7.4	-
Hydrocarbons	g/m ³	<0.5	15
Suspended solids	g/m ³	4	100
pH		6.6	6.0 – 9.0
Turbidity	NTU	4.0	-

The results show compliance with the conditions of consent 0633-3 at the time of sampling and are indicative of a very clean discharge.

Every month, STOS provided the Council with the results for daily composite samples of the Kapuni Production Station stormwater discharge, sampled at the outfall from the final separator. The results are summarised in Table 3.

Table 3 STOS Kapuni Production Station stormwater discharge results summary for 2015-2016

Month	Hydrocarbons (g/m ³)		Suspended solids (g/m ³)		pH	
<i>Consent 0633-3 limits</i>	15		100		6.0 – 9.0	
	Max	Average	Max	Average	Range	Average
July 2015	2.0	<0.5	8	4	6.3 – 8.8	7.1
August 2015	<0.5	<0.5	6	3	6.4 – 7.3	6.9
September 2015	<0.5	<0.5	8	3	6.6 – 7.9	7.1
October 2015	<0.5	<0.5	7	4	6.8 – 8.1	7.4
November 2015	<0.5	<0.5	22	5	6.5 – 8.5	7.0
December 2015	<0.5	<0.5	13	5	6.6 – 7.6	7.2
January 2016	<0.5	<0.5	9	5	6.4 – 7.9	7.2
February 2016	<0.5	<0.5	52	8	6.7 – 7.9	7.2
March 2016	<0.5	<0.5	21	6	6.8 – 8.0	7.3
April 2016	<0.5	<0.5	12	7	6.4 – 7.7	7.1
May 2016	<0.5	<0.5	77	16	6.6 – 7.7	7.0
June 2016	<0.5	<0.5	9	3	6.7 – 8.8	7.2
Days limit exceeded	0		0		0	

The STOS monitoring results show a consistently clean discharge. Maximum values for hydrocarbons and suspended solids were well below the consent limits, and pH was within the acceptable range, throughout the period under review.

2.1.3 Results of receiving environment monitoring

2.1.3.1 Chemical

Chemical water quality sampling of the Kapuni Stream was undertaken in conjunction with discharge monitoring at points upstream (KPN000287) and downstream (KPN000289) of the discharge point. The results are shown in Table 4 and the sampling sites are shown in Figure 1.

There was negligible difference in receiving water quality upstream and downstream of the production station discharge. This indicates that the discharge was in compliance with consent conditions regarding receiving environment quality.

Table 4 Receiving environment results for Kapuni Stream on 28 June 2016

Parameter	Units	Upstream KPN000287	Downstream KPN000289	Consent 0633-3 conditions
Chloride	g/m ³	8.7	8.6	-
Conductivity	g/m ³	7.9	7.9	-
Hydrocarbons	g/m ³	<0.5	<0.5	No conspicuous oil films or foams
Suspended solids	g/m ³	50	34	No conspicuous change
pH		7.6	7.6	-
Turbidity	NTU	24	18	No conspicuous change

2.1.3.2 Biomonitoring

The Council's standard 'kick-sampling' technique was used at two established sites (KPN000285 and KPN000289) to collect streambed macroinvertebrates from the Kapuni Stream on 21 March 2016 to assess whether stormwater discharges from the STOS Kapuni Production Station have had any adverse effects on the macroinvertebrate communities of this stream. Samples were processed to provide number of taxa (richness), MCI and SQMCI_s scores for each site. These sites are shown in Figure 1.

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 the 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 survey of the Kapuni Stream was performed under very low summer flow conditions indicated that stormwater discharges from the Kapuni Production Station had not had any recent significant impacts on the macroinvertebrate communities of the stream. It was noted during this survey that the stream appeared to be affected by erosion in the headwaters, with large amount of silt tied up in the substrate. These communities had moderate community richnesses, although lower than that recorded in the previous survey, likely to be a reflection of this erosion event. Similar

characteristic taxa were recorded in the communities at both sites, resulting in similar SQMCI_s scores. The MCI scores were also similar, with the score recorded at site 2b only three units higher than that recorded at site 2, not a statistically significant result (Stark, 1998). The score recorded at site 2b was equal to the median for this site, and this is considered a reflection of the moderate period of low flow that preceded this survey, being 32 days after the last flood that exceeded a flow of seven times median. The similarity in MCI scores between sites reflects the similar habitat present at both sites, with the lack of periphyton being an important factor. When gravel and cobble substrate supports little periphyton, the habitat is more suited to 'sensitive' taxa such as stoneflies, and was less suited to snails or midge larvae and was indicative of the absence of any recent impacts of any stormwater discharges from the Kapuni Production Station.

The full biomonitoring report is attached to this report in Appendix II.

2.1.4 Consented water abstractions

No water was abstracted under the water take consents for the Kapuni sites during the period under review.

2.1.5 Kapuni wellsites blowdown pit remediations

Since 2012, STOS has pursued a programme of staged wellsite soil remediation and comprehensive groundwater monitoring at the Kapuni wellsites. A detailed description of this project and additional historical context is included in the Council's Shell Todd Oil Services Ltd Maui and Kapuni Production Stations Monitoring Programmes Annual Report 2011-2012 (Technical Report 2012-35) and the Biennial 2012-2014 Report (Technical Report 2014-41). STOS committed to undertaking the assessment, decommissioning, impacted soil remediation and remediation validation works at wellsites where unlined pits were previously used for temporary containment of blowdown fluids from well maintenance and workovers.

Detailed decommissioning and remediation reports have now been submitted to the Council for all of the remediated wellsites. STOS's consultants have concluded that there is low risk to the stream environment on the basis of ground and surface water sampling to date.

STOS no longer uses unlined pits within its operations i.e. existing consents for discharges to blowdown pits are not being exercised. Impervious containment systems such as steel tanks, lined pits, and/or separators are now employed instead. Remediation validation and groundwater monitoring are ongoing.

2.2 Air

2.2.1 Inspections

Air inspections were carried out in conjunction with site inspections as discussed in section 2.1.1 above. Air discharges were all found to be satisfactory, and no offensive, obnoxious or objectionable odours were noted during the inspections.

2.2.2 Results of receiving environment monitoring

2.2.2.1 Carbon monoxide and combustible gases

During the monitoring year, a multi-gas meter was deployed on one occasion in the vicinity of the plant. The deployment lasted approximately 24 hours, with the instrument placed in a downwind position at the start of the deployment. Monitoring consisted of continuous measurements of gas concentrations for the gases of interest (carbon monoxide and combustible gases). The monitoring sites used in the year under review are shown in Figure 2.



Figure 2 Air monitoring sites at Kapuni Production Station for 2015-2016

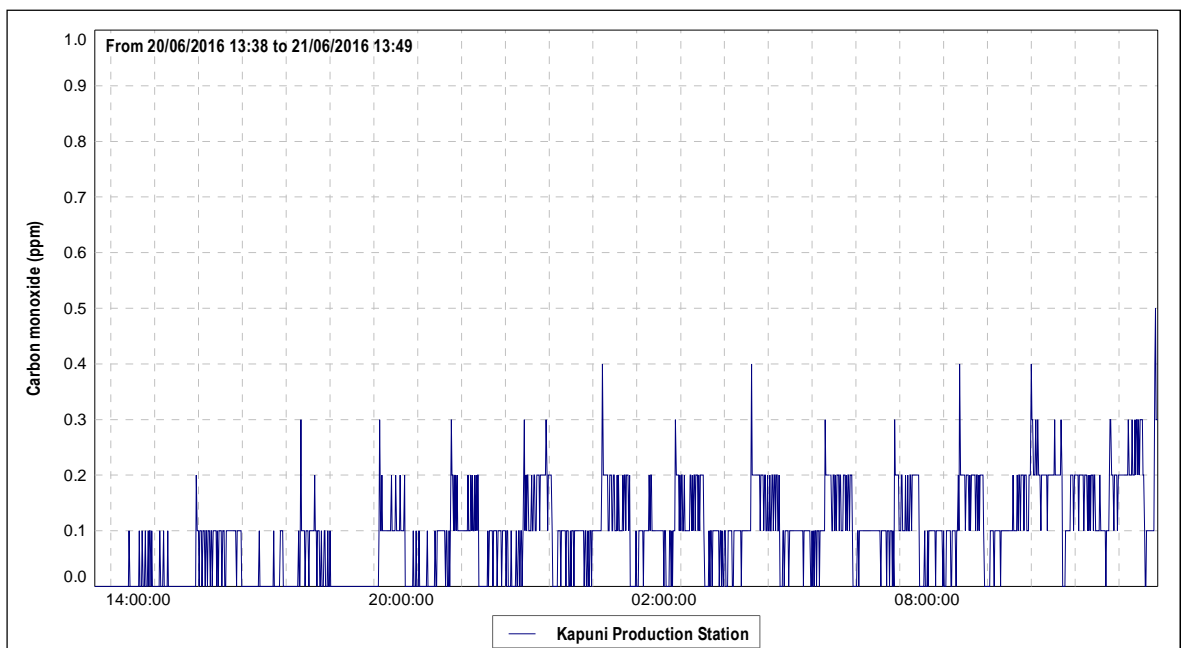
Because of the nature of the activities on the site, it was considered that the primary information of interest in respect of gases potentially emitted from the site was the average downwind concentration, rather than any instantaneous peak value. That is, the long-term exposure levels, rather than short-term 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 the sample run are summarised in Table 5 and the data from the sample run are presented graphically in Figure 3.

The consent covering air discharges from the Kapuni Production Station does not have specific limits related to particular gases. The Ministry for the Environment's air quality guidelines for carbon monoxide (which are based on health protection) are 30 mg/m³ averaged over a 1 hour exposure and 10 mg/m³ averaged over an 8 hour exposure period. The maximum concentration of carbon monoxide found during the monitoring run was 0.57 mg/m³ while the average concentration for the entire dataset was 0.20 mg/m³ which comply with the Ministry for the Environment's air quality guidelines. This is in line with the pattern found in previous years.

Table 5 Results of carbon monoxide and LEL monitoring at Kapuni Production Station

Period		20 to 21 June 2016 (24 hours)
Max	CO (ppm)	0.50
	LEL (%)	0.20
Mean	CO (ppm)	0.10
	LEL (%)	0.00
Min	CO (ppm)	0.00
	LEL (%)	0.00

Notes: (1) the instrument records in units of ppm. At 25°C and 1 atm, 1ppm CO = 1.145 mg/m³
(2) 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 percentage LEL by 20.

**Figure 3** Ambient carbon monoxide levels in the vicinity of Kapuni Production Station

Lower Explosive Limit (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 dangerous levels of airborne contaminants, including any risk of explosion. At no time did the level of explosive gases downwind of the Kapuni Production Station reach any more than a trivial level.

2.2.2.2 PM10 particulates

In September 2004 the Ministry for the Environment enacted National Environmental Standards (NESs) relating to certain air pollutants. The NES for PM10 particulates is 50 µg/m³ (24-hour average).

Particulates can be derived from many sources, including motor vehicles (particularly diesel), solid and oil-burning processes for industry and power generation, incineration and waste burning, photochemical processes, and natural sources such as pollen, abrasion, and sea spray.

PM10 particles are linked to adverse health effects that arise primarily from the ability of particles of this size to penetrate the defences of the human body and enter deep into the lungs, significantly reducing the exchange of gases across the lung walls. Health effects from inhaling PM10 include increased mortality and the aggravation of existing respiratory and cardiovascular conditions such as asthma and chronic pulmonary diseases.

During the reporting period, a DustTrak PM10 monitor was deployed on one occasion in the vicinity of Kapuni Production Station. The deployment lasted approximately 24 hours, with the instrument placed in a down-wind position at the start of the deployment. Monitoring consisted of continual measurements of PM10 concentrations. The location of the DustTrak monitor during the sampling run is shown in Figure 2. The results of the sample run are presented in Table 6 and Figure 4.

Table 6 Daily averages of PM10 results from monitoring at Kapuni Production Station

	20 to 21 June 2016 (24 hours)	
24 hr. set	Day 1	Day 2
Daily average	8.00 $\mu\text{g}/\text{m}^3$	N/A
NES limit (24 hour average)	50 $\mu\text{g}/\text{m}^3$	

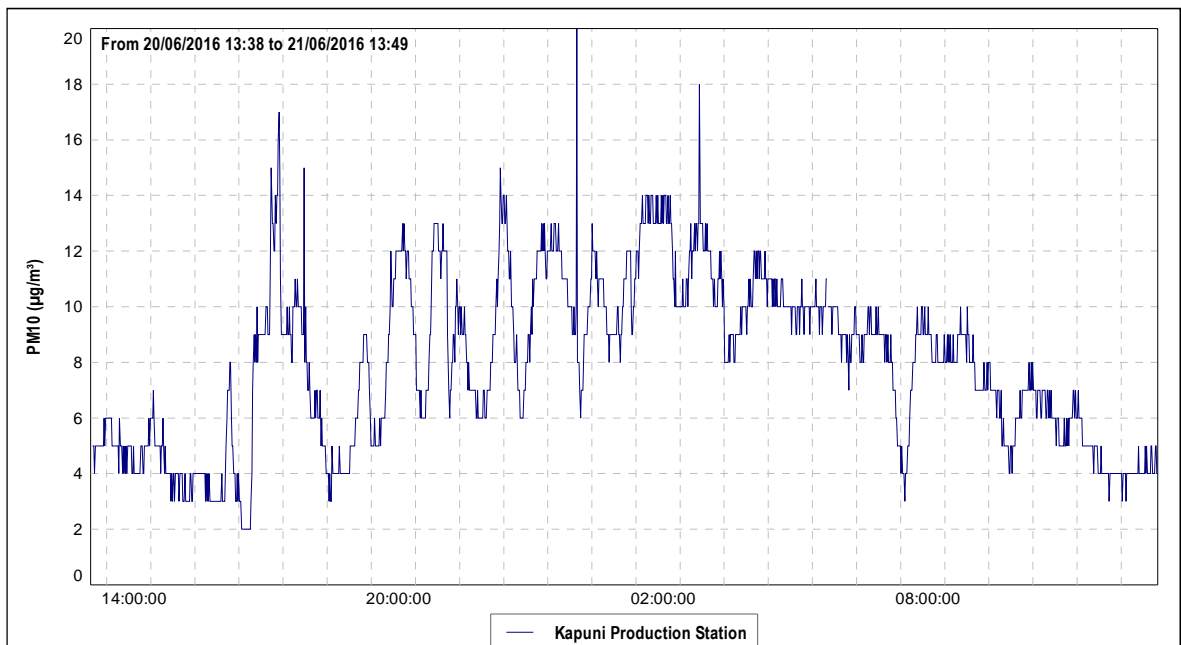


Figure 4 PM10 concentrations ($\mu\text{g}/\text{m}^3$) at Kapuni Production Station

During the 24 hour run, from 20 to 21 June 2016, the average recorded PM10 concentration was 8.0 $\mu\text{g}/\text{m}^3$. This daily average equate to 16.0% of the 50 $\mu\text{g}/\text{m}^3$ value

that is set by the NES. Background levels of PM10 in the region have been found to be typically around 11 µg/m³.

2.2.2.3 Nitrogen oxides

From 2014 onwards, the Council implemented a coordinated region-wide compliance monitoring programme to measure nitrogen oxides (NO_x). The programme involves deploying measuring devices at 28 NO_x monitoring sites (including two sites in the vicinity of Kapuni Production Station) on the same day, with retrieval three weeks later. This approach assists the Council in further evaluating the effects of local and regional emission sources and ambient air quality in the region.

Consent 4054-5 covering air discharges from the Kapuni Production Station does not have specific limits related to particular gases. The Ministry for the Environment's air quality guidelines for nitrogen dioxide are 200 µg/m³ for a 1-hour average or 100 µg/m³ for a 24-hour average exposure.

NO_x passive adsorption discs were placed at two locations in the vicinity of the Kapuni Production Station on one occasion during the year under review. The discs were left in place for a period of 21 days. The calculated 1-hour and 24-hour theoretical maximum NO_x concentrations found at Kapuni Production Station during the year under review equate to 22.2 µg/m³ and 11.7 µg/m³, respectively. The results show that the ambient ground level concentration of NO_x is well below the limits set out by the Ministry for the Environment's air quality guidelines.

The full air monitoring report is attached to this report in Appendix III.

2.2.3 Summary of flaring volumes reported by STOS

STOS provided the Council with an annual report on flaring and emissions during the 2015-2016 period, as required by consent 4054-5. A summary of flaring volumes at Kapuni Production Station is provided in Figure 5. The total volume flared in the 2015-2016 year was 182,400 m³ of gas, which was a 44% reduction compared with the 327,700 m³ of gas flared in the previous year.

The main reason for the decrease in flaring during the 2015-2016 year compared with the previous monitoring period was the reduction in the volume of purge gas being discharged.

Of the 174 flaring events reported in the period, 107 lasted for five minutes or more and only 16 generated light smoke which was localised and dissipated quickly. The majority of events related to re-starting low pressure wells, or planned maintenance. Planned Emergency Shutdowns occurred in February and March 2016. The median duration of these events was four minutes. No complaints were received from the public regarding flaring at the production station.

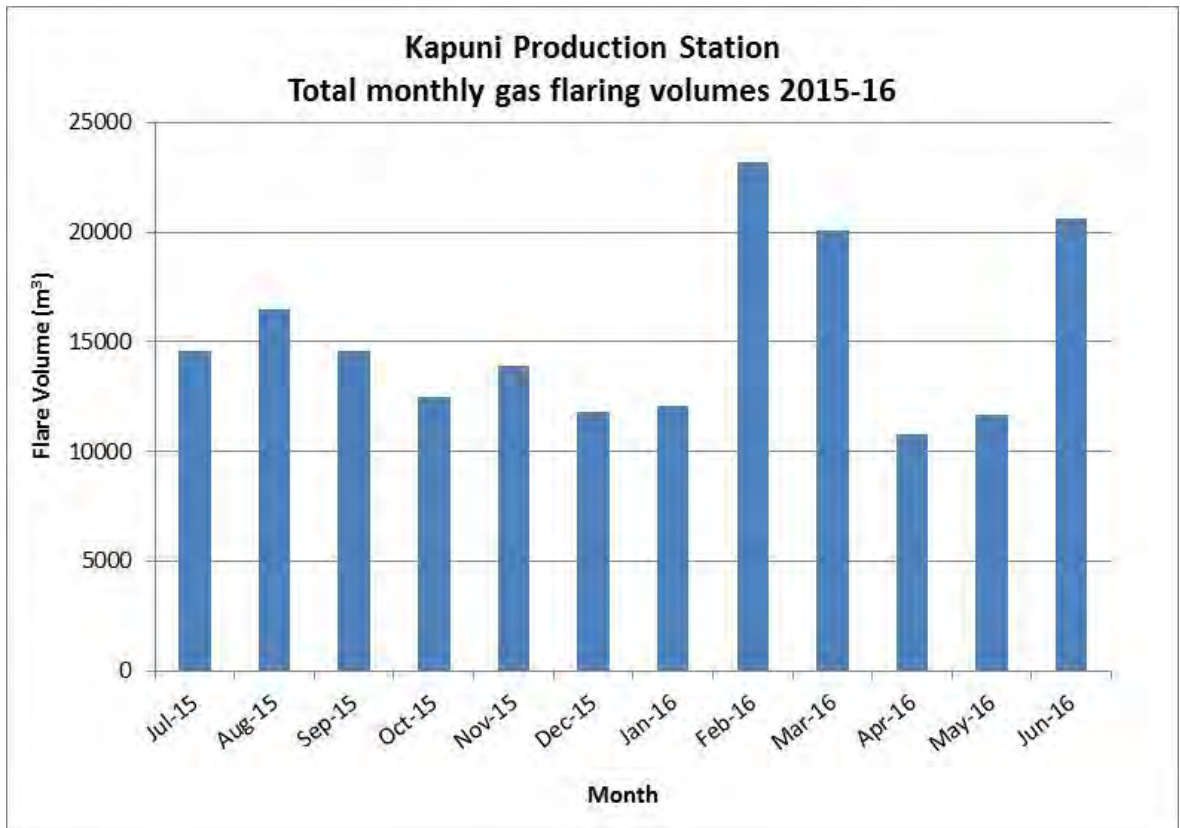


Figure 5 Monthly gas flaring for Kapuni Production Station under consent 4054-5

2.3 Investigations, interventions, and incidents

The monitoring programme for the year was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with 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 causes of non-compliance or failure to maintain good practices. A pro-active approach that in the first instance avoids issues occurring is favoured.

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

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

In the 2015-2016 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with STOS's conditions in resource consents or provisions in Regional Plans.

3. Discussion

3.1 Discussion of site performance

Inspections of the Kapuni Production Station during the 2015-2016 year found that the site was well managed. All consent conditions relating to site operations and management were complied with.

3.2 Environmental effects of exercise of consents

Stormwater discharge inspections showed that discharges from the site complied with consent conditions. Receiving water monitoring inspections and sampling showed that the discharge was not causing any adverse effects on the Kapuni Stream at the time of monitoring. This was supported by the findings of the macroinvertebrate survey carried out in the stream.

There were no adverse effects on the environment resulting from the exercise of the air discharge consent. The ambient air quality monitoring at the site showed that levels of carbon monoxide, combustible gases, PM10 particulates and nitrogen oxides were all below levels of concern at the time of sampling. No offensive or objectionable odours were detected beyond the boundary during inspections and there were no complaints in relation to air emissions from the site.

3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Tables 7-10.

Table 7 Summary of performance for Consent 0633-3

Purpose: To discharge treated stormwater from the Kapuni Production Station into the Kapuni Stream		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Adoption of best practicable option to minimise adverse effects	Site inspections and liaison with consent holder	Yes
2. Catchment area not to exceed 4 ha	Site inspections	Yes
3. Stormwater to be directed through a treatment system	Site inspections	Yes
4. Limit on the concentration of pH, suspended solids, hydrocarbons and chloride	Inspections and sampling	Yes
5. In-stream effects	Inspections, sampling, biomonitoring	Yes
6. Contingency plan	Plan reviewed and approved	Yes
7. Consent holder to notify Council of significant changes to processes or operations	Site inspections and liaison with consent holder	Yes

8. Review of consent	Next option for review in June 2017, recommendation attached in section 3.6	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 8 Summary of performance for Consent 4054-5

Purpose: To discharge emissions into the air from combustion involving flaring of petroleum products incidental to the treatment of gas at the Kapuni Production Station		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Adoption of best practicable option to minimise adverse effects	Site inspections and liaison with consent holder	Yes
2. Minimise emissions by appropriate selection, operation, supervision, control and maintenance of equipment	Site inspections and liaison with consent holder	Yes
3. Effective liquid separation and recovery to avoid smoke emissions during flaring	Site inspections	Yes
4. Provision of annual report on flaring to council	Report received	Yes
5. Appropriate maintenance and operation of equipment	Site inspections	Yes
6. No offensive, obnoxious or objectionable odours beyond site boundary	Site inspections	Yes
7. Consultation with Council prior to significant alterations to plant, processes, or operations	Site inspections and liaison with consent holder	Yes
8. Notification of flaring more than five minutes in duration	Flaring notifications received	Yes
9. Maintenance of log of continuous flaring incidents	Information received	Yes
10. Take all practicable steps to minimise flaring	Site inspections, review of information received, liaison with consent holder	Yes
11. Depressurisation of plant to prevent dense black smoke being discharged from the flare	Site inspections, records kept by consent holder, and liaison with consent holder	Yes
12. Record of smoke emitting events and complaints	Site inspections, records kept by consent holder, and liaison with consent holder	Yes

Purpose: To discharge emissions into the air from combustion involving flaring of petroleum products incidental to the treatment of gas at the Kapuni Production Station		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
13. Optional review provision re environmental effects, best practicable option or mass discharge quantities or ambient concentrations	No further option for review	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

Table 9 Summary of performance for Consent 5960-1

Purpose: To erect, place, use and maintain a concrete ford on the bed of the Kapuni Stream for access purposes		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Construction and maintenance only between 1 November and 30 April	Inspections. No maintenance undertaken during this monitoring period	N/A
2. Notify Council before undertaking construction and maintenance works	No maintenance undertaken during this monitoring period	N/A
3. Constructed and maintained in accordance with application	Inspections. No maintenance undertaken during this monitoring period	N/A
4. During maintenance works observe measures to prevent discharge and minimise disturbance	Inspections. No maintenance undertaken during this monitoring period	N/A
5. Minimise disturbance and reinstate any disturbed areas	Inspections. No maintenance undertaken during this monitoring period	N/A
6. The structure shall not obstruct fish passage	Site inspection	Yes
7. Structures to be removed and area reinstated when no longer required	N/A	N/A
8. Review of consent	Next option for review in June 2017, recommendation attached in section 3.6	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

Table 10 Summary of performance for Consent 9555-1

Purpose: To disturb the bed of the Kapuni Stream for the purpose of undertaking maintenance work on the fire water intake chamber		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Notify Council before undertaking maintenance works	Notification received	Yes

Purpose: To disturb the bed of the Kapuni Stream for the purpose of undertaking maintenance work on the fire water intake chamber		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
2. Adopt best practicable option to avoid or minimise effects	Inspections, liaison with consent holder	Yes
3. Restrict area and volume of disturbance to a practicable minimum	Inspections, liaison with consent holder	Yes
4. No instream works between 1 May and 31 October	Maintenance carried out in December 2015 and February 2016	Yes
5. Exercise of consent shall not obstruct fish passage	Inspections, liaison with consent holder	Yes
6. Lapse of consent	Consent has now been exercised	N/A
7. Review of consent	Next option for review in June 2017, recommendation attached in section 3.6	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

During the period under review, STOS demonstrated an overall high level of both environmental performance and administrative compliance with the resource consents as defined in Section 1.1.4. There were no unauthorised incidents recorded by the Council in relation to STOS's activities. The Kapuni Production Station was well managed and maintained.

3.4 Recommendations from the 2014-2015 Annual Report

In the 2014-2015 Annual Report, it was recommended:

1. THAT monitoring of consented activities at the Kapuni Production Station in the 2015-2016 year continues at the same level as in 2014-2015.

This recommendation was implemented.

3.5 Alterations to monitoring programmes for 2016-2017

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

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

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

It is proposed that for 2016-2017 the monitoring programme remains unchanged from that of 2015-2016.

3.6 Exercise of optional review of consent

Resource consents 0633-3, 5960-1 and 9555-1 provide for an optional review of the consent in June 2017. Conditions of the consents allow the Council to review the consents, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment.

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.

4. Recommendations

1. THAT monitoring of consented activities at the Kapuni Production Station in the 2016-2017 year continue at the same level as in 2015-2016.
2. THAT the option for a review of resource consents 0633-3, 5960-1 and 9555-1 in June 2017, as set out in conditions of the consents, not be exercised on the grounds that the current conditions are adequate.

Glossary of common terms and abbreviations

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

Biomonitoring	Assessing the health of the environment using aquatic organisms.
Bund	A wall around a tank to contain its contents in the case of a leak.
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m.
g/m ³	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
Incident Register	The incident register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
LEL	Lower Explosive Limit. The percentage of the lower explosive limit, expressed as methane, that is detected in the air sampled.
m ²	Square Metres.
mg/m ³	Milligrams per cubic metre.
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.
NES	National Environmental Standards.
NO _x	Nitrogen oxides.
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).
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 1991</i> 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.
µg/m ³	Micrograms per cubic metre of air

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

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Appendix I

Resource consents held by Shell Todd Oil Services Ltd

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

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

Name of
Consent Holder: Shell Todd Oil Services Ltd
Private Bag 2035
NEW PLYMOUTH 4342

Decision Date: 1 August 2011

Commencement
Date: 1 August 2011

Conditions of Consent

Consent Granted: To discharge treated stormwater from the Kapuni Production
Station into the Kapuni Stream at or about (NZTM)
1701051E-5629618N

Expiry Date: 1 June 2029

Review Date(s): June 2017, June 2023

Site Location: Kapuni Production Station, Palmer Road, Kapuni

Legal Description: Pt Lot 1 DP 5227 Blk XVI Kaupokonui SD [Discharge source]
Lot 1 DP 15254 [Discharge site]

Catchment: Kapuni

*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 to section 36 of the Resource Management Act.

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 stormwater discharged shall be from a catchment area not exceeding four hectares.
3. All stormwater shall be directed for treatment through the stormwater treatment system for discharge in accordance with the special conditions of this permit.
4. Constituents of 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
chloride	Concentration not greater than 50 gm ⁻³

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

5. After allowing for reasonable mixing, within a mixing zone extending 25 metres downstream of the discharge point, the discharge shall not, either by itself or in combination with other discharges, give rise to any or all of the following effects in the Kapuni 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;
 - e) any significant adverse effects on aquatic life.
6. The consent holder shall maintain a contingency plan. The contingency plan shall be adhered to in the event of a spill or emergency and shall, to the satisfaction of the Chief Executive, Taranaki Regional Council, detail 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.

7. The consent holder shall notify the Chief Executive, Taranaki Regional Council, prior to making any changes to the processes or operations undertaken at the site, or the chemicals used or stored on site, that could alter the nature of the discharge. Any such change shall then only occur following receipt of any necessary approval under the Resource Management Act.
8. 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:
 - a) during the month of June 2017 and/or June 2023; and/or
 - b) within 3 months of receiving a notification under special condition 7 above;

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 1 August 2011

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: Shell Todd Oil Services
Private Bag 2035
NEW PLYMOUTH 4342

Decision Date 9 August 2013
[change]:

Commencement Date 9 August 2013 [Granted: 9 November 2001]
[change]:

Conditions of Consent

Consent Granted: To discharge emissions into the air from combustion involving flaring of petroleum products incidental to the treatment of gas at the Kapuni Production Station

Expiry Date: 1 June 2017

Site Location: Kapuni Production Station, Palmer Road, Kapuni

Legal Description: Pt Lot 1 DP 5227 Lot 1 DP 12628 Bk XVI Kaupokonui SD

Grid Reference (NZTM) 1701044E-5629660N

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

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 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 into the environment from the flare emissions.
2. The consent holder shall minimise the emissions and impacts of air contaminants discharged from the flares by the selection of the most appropriate process equipment, process control equipment, emission control equipment, methods of control, supervision and operation, and the proper and effective operation, supervision, control and maintenance of all equipment and processes.
3. The consent holder shall undertake effective liquid separation and recovery, as far as is practicable, to avoid or mitigate smoke emissions during flaring.
4. The consent holder shall provide to the Taranaki Regional Council during August of each year, for the duration of this consent, a report:
 - i) detailing gas combustion in the flares under condition 9;
 - ii) detailing smoke emissions as required under condition 12;
 - iii) detailing any measures to reduce smoke emissions;
 - iv) detailing any measures to reduce flaring;
 - v) providing data on the emitted and/or ambient concentrations and/or mass discharge rates and/or an emission inventory, of such contaminants the Chief Executive, Taranaki Regional Council, may from time to time specify; and
 - vi) addressing any other issue relevant to the minimisation or mitigation of emissions from the flares.

Consent 4054-5

5. All equipment used to avoid, remedy or mitigate any effect on the environment from the discharge of emissions into the air shall be maintained in good condition and shall be operated within design parameters at all times that the flares are in operation.
6. The discharges authorised by this consent shall not give rise to any offensive or obnoxious or objectionable odour at or beyond the site boundary in the opinion of an enforcement officer of the Taranaki Regional Council.
7. Prior to undertaking any alterations to the plant, processes or operations, which may significantly change the nature or quantity of contaminants emitted to air from the flares, the consent holder shall first consult with the Chief Executive and shall obtain any necessary approvals under the Resource Management Act 1991.
8. The consent holder shall, whenever practicable, notify the Chief Executive whenever the continuous flaring of hydrocarbons [other than purge gas] is expected to occur for more than five minutes in duration.
9. The consent holder shall keep and maintain a log of all continuous flaring incidents longer than 2 minutes and any intermittent flaring lasting for an aggregate of 4 minutes or longer in any 60-minute period. Such a log shall contain the date, the start and finish times, the quantity and type of material flared, and the reason for flaring. This log shall be made available to the Chief Executive upon request, and summarised annually in the report required under condition 4.
10. All practicable steps shall be taken to minimise flaring.
11. Other than in emergencies, or during tests or exercises to simulate emergencies to a maximum frequency of twice per year, depressurisation of the plant, or sections of the plant, shall be carried out over a sufficient period of time to prevent dense black smoke from being discharged from the flares.
12. The consent holder shall keep and make available to the Chief Executive, upon request, a record of all smoke emitting incidents, noting time, duration and cause. The consent holder shall also keep, and make available to the Chief Executive, upon request, a record of all complaints received as a result of the exercise of this consent.

Consent 4054-5

13. Subject to the provisions of this condition, the Council may within six months of receiving a report prepared by the consent holder pursuant to condition 4 of this consent but not more often than once every three years, or in June 2005 and/or June 2011, serve notice that it intends to review the conditions of this resource consent in accordance with section 128(1)(a) of the Resource Management Act 1991 for the purposes of:
- (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; and/or
 - (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; and/or
 - (c) to alter, add or delete limits on mass discharge quantities or discharge or ambient concentrations of any contaminant or contaminants.

Signed at Stratford on 09 August 2013

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Land Use Consent
Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of
Consent Holder: Shell Todd Oil Services Limited
Private Bag 2035
NEW PLYMOUTH

Consent Granted
Date: 13 February 2002

Conditions of Consent

Consent Granted: To erect, place, use and maintain a concrete ford on the bed of the Kapuni Stream for access purposes at or about GR: Q20:113-915

Expiry Date: 1 June 2023

Review Date(s): June 2005, June 2011, June 2017

Site Location: 318 Palmer Road, Kapuni

Legal Description: Pt Lot 1 DP 5227 Lot 1 DP 12628 Blk XVI Kaupokonui SD

Catchment: Kapuni

Consent 5960-1

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. The initial construction and any further disturbance of parts of the riverbed covered by water and/or any works which may result in downstream discolouration of water shall be undertaken only between 1 November and 30 April, except where this requirement is waived in writing by the Chief Executive, Taranaki Regional Council.
2. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to the commencement and upon completion of any subsequent maintenance works which would involve disturbance of or deposition to the riverbed or discharges to water.
3. The structure[s] authorised by this consent shall be constructed generally in accordance with the documentation submitted in support of the application and shall be maintained to ensure the conditions of this consent are met.
4. The consent holder shall adopt the best practicable option to avoid or minimise the discharge of silt or other contaminants into water or onto the riverbed and to avoid or minimise the disturbance of the riverbed and any adverse effects on water quality.
5. The consent holder shall ensure that the area and volume of riverbed disturbance shall, so far as is practicable, be minimised and any areas which are disturbed shall, so far as is practicable, be reinstated.
6. The structure which is the subject of this consent shall not obstruct fish passage.
7. The structure[s] authorised by this consent shall be removed and the area reinstated, if and when the structure[s] are no longer required. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to structure[s] removal and reinstatement.

Consent 5960-1

8. 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 2005, June 2011, and June 2017, for the purpose of ensuring that the conditions adequately deal with the environmental effects arising from the exercise of this 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 13 February 2002

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Land Use Consent
Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of
Consent Holder: Shell Todd Oil Services Ltd
Private Bag 2035
NEW PLYMOUTH 4342

Decision Date: 16 April 2013

Commencement Date: 16 April 2013

Conditions of Consent

Consent Granted: To disturb the bed of the Kapuni Stream for the purpose of undertaking maintenance work on the fire water intake chamber

Expiry Date: 1 June 2029

Review Date(s): June 2017, June 2023

Site Location: Kapuni Production Station, 318 Palmer Road, Kapuni

Legal Description: Lot 1 DP 5227 (Site of structure)

Grid Reference (NZTM) 1701162E-5629698N

Catchment: Kapuni

*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.

Special conditions

1. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 48 hours prior to the commencement of work. Notification shall include the consent number and a brief description of the activity consented and be emailed to worknotification@trc.govt.nz.
2. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to avoid or minimise the discharge of sediments or other contaminants into water or onto the riverbed and to avoid or minimise the disturbance of the riverbed and any adverse effects on water quality.
3. The consent holder shall ensure that the area and volume of stream bed disturbance is restricted to a practicable minimum.
4. No instream works shall take place between 1 May and 31 October inclusive.
5. The exercise of this consent shall not restrict the passage of fish.
6. This consent shall lapse on 30 June 2018, 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.
7. 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 2017 and/or June 2023 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 16 April 2013

For and on behalf of
Taranaki Regional Council

Chief Executive

Appendix II
Biomonitoring report

To Job Manager, C MacKenzie
 From Freshwater Biologist, B Jansma
 File 03-02-005-13/01; 0633;
 Report No BJ285
 Document No 1704472
 Date 24 June 2016

Biomonitoring of the Kapuni Stream in relation to the Kapuni Production Station of Shell Todd Oil Services Ltd, March 2016

Introduction

This biological survey of two sites in the Kapuni Stream was conducted to monitor effects related to the discharge of stormwater from the Kapuni Production Station. The survey fulfilled the biological monitoring requirements for this industry in the 2015-2016 monitoring year. Results from surveys performed since the 2000-2001 monitoring year are discussed in reports referenced in this report.

Methods

The standard '400 ml kick-sampling' technique was used to collect streambed macroinvertebrates from two established sites in the Kapuni Stream related to the Kapuni Production Station stormwater discharge (Table 1, Figure 1) on 21 March 2016. 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 the Kapuni Stream, related to the Kapuni Production Station

Site No.	Site Code	Map Reference	Location
2	KPN000285	Q20: 112914	Upstream of Kapuni Production Station
2b	KPN000289	Q20: 111914	50 metres downstream of Production Station discharge

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



Figure 1 Biomonitoring sites in the Kapuni Stream related to the Kapuni Production Station

MCI is a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. 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, so that its corresponding range of values is 20x lower.

Results and discussion

At the time of this midday survey there was a clear, uncoloured and low flow in the Kapuni Stream and the water temperature ranged from 18.3°C at site 2 to 18.6°C at site 2b. The bed of the stream predominantly comprised cobble and gravel with some boulder also recorded. Of note during this survey was that the bed seemed quite loose at both sites, with silt released when disturbed, consistent with a significant erosion event in the headwaters. Likely as related to this erosion event, only thin films of periphyton were present at both sites. Site 2 was unshaded, while there was partial shading of site 2b. This survey was

performed during late summer, in the midst of a long dry period, and following a moderate low flow period, 32 days after freshes in excess of three times and seven times median flows.

Macroinvertebrate communities

Previous biological surveys in the Kapuni Stream have generally recorded macroinvertebrate communities that would be expected in clean, mid reaches of Taranaki ring plain streams. The communities have had moderate to relatively good numbers of taxa and relatively high MCI values. The results of previous surveys are summarised in Table 2 together with current results and are illustrated in Figure 2 and Figure 3. The results for site 2b also include results from the long term monitoring programme performed by Cawthron Institute/Stark Environmental for other consented discharges. The full macroinvertebrate results of this survey are presented in Table 3.

Table 2 Numbers of taxa and MCI values recorded in previous surveys in the Kapuni Stream in relation to the Kapuni Production Station since May 1987, together with current results.

Site no.	Site	Number of previous surveys	Numbers of taxa			MCI values		
			Median	Range	Current Survey	Median	Range	Current Survey
2	KPN000285	25	23	18-33	21	107	94-132	112
2b	KPN000289	110	18	9-35	20	115	90-145	115

Site 2 Upstream of Kapuni Production Station

A moderate richness of twenty-one taxa was recorded at site 2, upstream of the Kapuni Production Station; two taxa less than the median found by 25 previous surveys (Table 2), typical of most previous surveys (Figure 2). Five 'highly sensitive' taxa were present, with the community characterised by two of these 'highly sensitive' taxa (mayfly (*Deleatidium*) and caddisfly (*Beraeoptera*)); as well as two 'moderately sensitive' taxa (abundant mayfly (*Coloburiscus*) and elmids beetles). This represents a significant reduction in the number of abundant taxa when compared with the previous survey, which is likely to be a reflection of the shorter period of low flows that preceded this survey, but also the erosion event that has introduced a significant amount of silt and aggregate to the stream.

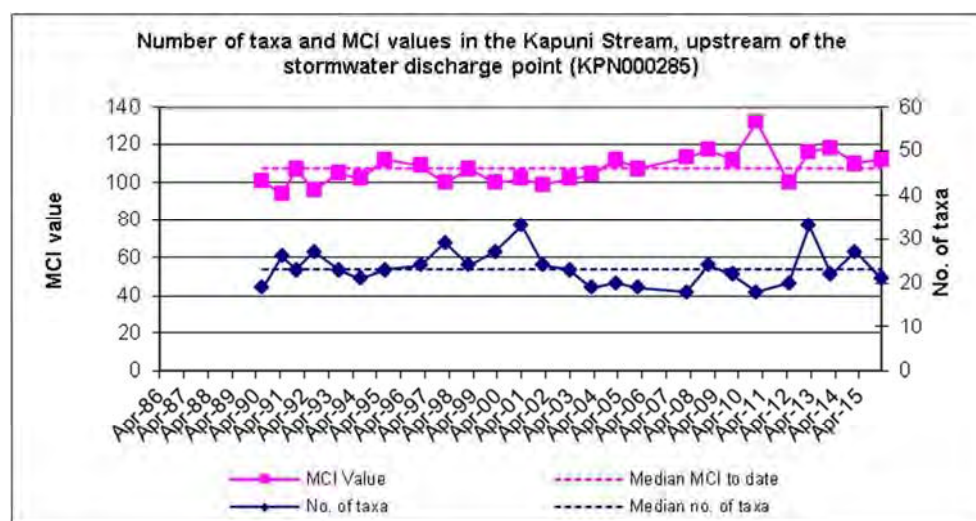


Figure 2 Number of taxa and MCI values in the Kapuni Stream upstream of STOS discharge

Table 3 Macroinvertebrate fauna of the Kapuni River re STOS Kapuni Production Station sampled on 21 March 2016

Taxa List	Site Number	MCI score	2	2b
	Site Code		KPN000285	KPN000289
	Sample Number		FWB16177	FWB16178
ANNELIDA (WORMS)	Oligochaeta	1	R	R
	Lumbricidae	5	R	R
MOLLUSCA	<i>Potamopyrgus</i>	4	R	R
EPHEMEROPTERA (MAYFLIES)	<i>Ameletopsis</i>	10	-	R
	<i>Austroclima</i>	7	-	C
	<i>Coloburiscus</i>	7	A	A
	<i>Deleatidium</i>	8	XA	XA
	<i>Nesameletus</i>	9	C	A
HEMIPTERA (BUGS)	<i>Saldula</i>	5	R	-
COLEOPTERA (BEETLES)	Elmidae	6	A	VA
	Hydraenidae	8	R	-
MEGALOPTERA (DOBSONFLIES)	<i>Archichauliodes</i>	7	C	C
TRICHOPTERA (CADDISFLIES)	<i>Hydropsyche (Aoteapsyche)</i>	4	C	A
	<i>Hydrobiosis</i>	5	R	C
	<i>Psilochorema</i>	6	R	R
	<i>Beraeoptera</i>	8	A	VA
	<i>Hudsonema</i>	6	R	-
	<i>Olinga</i>	9	R	C
	<i>Pycnocentroides</i>	5	C	A
DIPTERA (TRUE FLIES)	<i>Aphrophila</i>	5	R	C
	Eriopterini	5	C	-
	<i>Maoridiamesa</i>	3	-	R
	Orthoclaadiinae	2	R	-
	<i>Polypedilum</i>	3	-	R
	<i>Austrosimulium</i>	3	R	R
No of taxa			21	20
MCI			112	115
SQMCIs			7.8	7.5
EPT (taxa)			10	11
%EPT (taxa)			48	55
'Tolerant' taxa		'Moderately sensitive' taxa		'Highly sensitive' taxa

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

The moderately high proportion of 'sensitive' taxa (76% of taxa numbers) comprising the community was reflected in the MCI score of 112 units, which was slightly higher than that recorded in the previous survey, and five units higher than the median of all past survey scores (Figure 2 and Table 2). This is similar to the trend observed from 2005 to 2011, when this site recorded MCI scores well above the median score. In addition, the score was higher than the predicted score for this site (99 units), 18.1 km downstream of the National Park boundary (Stark and Fowles, 2009). Overall, this is a higher than expected MCI score, considering the period of low flow that preceded this survey. An excellent (Stark & Maxted, 2007) SQMCIs score (7.8 units) reflected the relative dominance of 'highly sensitive' taxa in the community at this site.

Site 2b 50 m downstream of Kapuni Production Station discharge

A similar richness (20 taxa) was recorded at site 2b, a further 300m downstream and 50 m below the production station stormwater discharge. This richness was only two taxa above the median found by the long term record of 110 previous surveys at this site but ten less than that recorded by the previous (Council) survey at this site (Table 2 and Figure 3). There were five 'highly sensitive' taxa present, indicative of good preceding physicochemical water quality. The community was characterised by three 'highly sensitive' taxa (extremely abundant *Deleatidium* mayfly, abundant *Nesameletus* mayfly and *Beraeoptera* caddisfly); three 'moderately sensitive' taxa (mayfly (*Coloburiscus*), elmid beetles, and caddisfly (*Pycnocentroides*)) and one 'tolerant' taxon (abundant net-spinning caddisfly (*Hydropsyche-Aoteapsyche*)). This included all of the taxa recorded in abundance at site 2b.

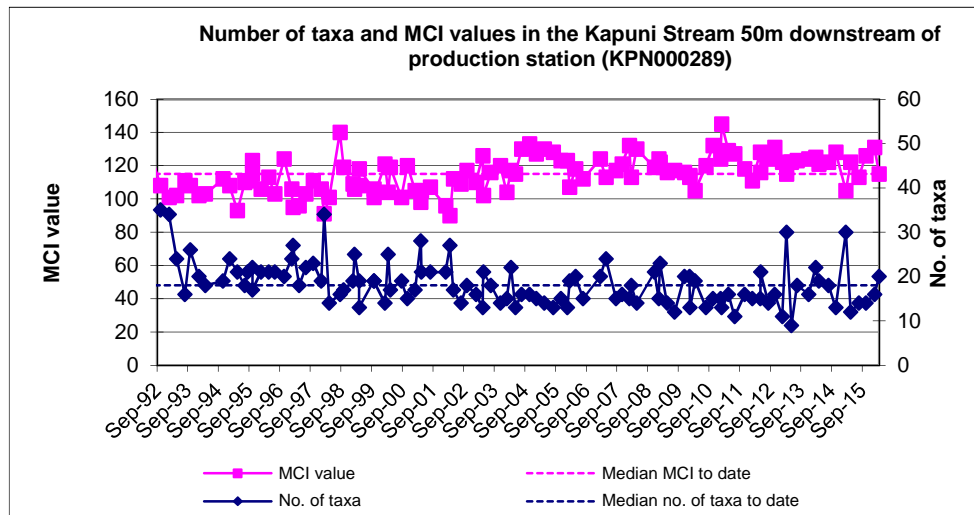


Figure 3 Number of taxa and MCI values in the Kapuni Stream 50m d/s of the Kapuni production station discharge.

There were only two significant changes in individual taxa abundance recorded between sites. Generally, the dominant taxa at the two sites were very similar, which were reflected in the SQMCI_s scores, which were not statistically significantly different to each other (Table 2 and Table 3) (Stark, 1998). Similarly, the MCI score (155) was only three units higher than recorded at site 2 (Stark, 1998), which was not a statistically significant difference, and it was equal to the median for this site (Figure 3). The similarity in index scores with that recorded upstream reflects the similar habitat present at both sites, with the lack of periphyton being an important factor. When gravel and cobble substrate supports little periphyton, the habitat is more suited to 'sensitive' taxa such as stoneflies, and was less suited to snails or midge larvae.

Summary and Conclusions

The Council's standard 'kick-net' sampling technique was used at two sites to collect streambed macroinvertebrates from the Kapuni Stream to assess whether stormwater discharges from the STOS Kapuni Production Station have had any adverse effects on the macroinvertebrate communities of this stream. 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 the 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.

This March 2016 biological survey of the Kapuni Stream performed under very low summer flow conditions indicated that stormwater discharges from the Kapuni Production Station had not had any recent significant impacts on the macroinvertebrate communities of the stream. It was noted during this survey that the stream appeared to be affected by erosion in the headwaters, with large amount of silt tied up in the substrate. These communities had moderate community richnesses, although lower than that recorded in the previous survey, likely to be a reflection of this erosion event. Similar characteristic taxa were recorded in the communities at both sites, resulting in similar SQMCI_s scores. The MCI scores were also similar, with the score recorded at site 2b only three units higher than that recorded at site 2, not a statistically significant result (Stark, 1998). The score recorded at site 2b was equal to the median for this site, and this is considered a reflection of the moderate period of low flow that preceded this survey, being 32 days after the last flood that exceeded a flow of seven times median. The similarity in MCI scores between sites reflects the similar habitat present at both sites, with the lack of periphyton being an important factor. When gravel and cobble substrate supports little periphyton, the habitat is more suited to 'sensitive' taxa such as stoneflies, and was less suited to snails or midge larvae and was indicative of the absence of any recent impacts of any stormwater discharges from the Kapuni Production Station.

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Appendix III

Air monitoring reports

Memorandum

To Fiza Hafiz, Scientific Officer – State of the Environment
Job Managers - Callum MacKenzie, Emily Roberts, James Kitto
From Brian Cheyne, Scientific Officer – Air Quality
File Frodo # 1718841
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Monitoring of nitrogen oxides (NO_x) levels in Taranaki near the NO_x emitting sites, year 2015-2016

From 2014 onwards, the Taranaki Regional Council (TRC) has implemented a coordinated region-wide monitoring programme to measure NO_x, not only at individual compliance monitoring sites near industries that emit NO_x, but simultaneously at the urban sites (the Council regional state of the environment programme) to determine exposure levels for the general population. The programme involves deploying all measuring devices on the same day, with retrieval three weeks later. This approach will assist the Council to further evaluate the effects of local and regional emission sources and ambient air quality in the region.

Nitrogen oxides

Nitrogen oxides (NO_x), a mixture of nitrous oxide (N₂O), nitric oxide (NO) and nitrogen dioxide (NO₂), are produced from natural sources, motor vehicles and other fuel combustion processes. Indoor domestic appliances (gas stoves, gas or wood heaters) can also be significant sources of nitrogen oxides, particularly in areas that are poorly ventilated. NO and NO₂ are of interest because of potential effects on human health.

Nitric oxide is colourless and odourless and is oxidised in the atmosphere to form nitrogen dioxide. Nitrogen dioxide is an odorous, brown, acidic, highly corrosive gas that can affect our health and environment. Nitrogen oxides are critical components of photochemical smog – nitrogen dioxide produces the brown colour of the smog.

Environmental and health effects of nitrogen oxides

Nitrogen dioxide is harmful to vegetation, can fade and discolour fabrics, reduce visibility, and react with surfaces and furnishings. Vegetation exposure to high levels of nitrogen dioxide can be identified by damage to foliage, decreased growth or reduced crop yield.

Nitric oxide does not significantly affect human health. On the other hand, elevated levels of nitrogen dioxide cause damage to the mechanisms that protect the human respiratory tract and can increase a person's susceptibility to, and the severity of, respiratory infections and asthma. Long-term exposure to high levels of nitrogen dioxide can cause chronic lung disease. It may also affect sensory perception, for example, by reducing a person's ability to smell an odour.

National environmental standards and guidelines

In 2004, national environmental standards (NES) for ambient (outdoor) air quality were introduced in New Zealand to provide a guaranteed level of protection for the health of New Zealanders. The national standard for nitrogen dioxide (NO₂) is set out below.

In any 1-hour period, the average concentration of nitrogen dioxide in the air should not be more than 200 µg/m³.

Before the introduction of the national environmental standards, air quality was measured against the national air quality guidelines. The national guidelines were developed in 1994 and revised in 2002 following a comprehensive review of international and national research and remain relevant. The national guideline for nitrogen dioxide (NO₂) is set out below.

In any 24-hour period, the average concentration of nitrogen dioxide in the air should not be more than 100 µg/m³.

Nitrogen dioxide limits are also set in the special conditions of the resource consents. The consents limits are the same as those imposed under the NES and MfE's guideline.

Measurement of nitrogen oxides

The Taranaki Regional Council has been monitoring nitrogen oxides (NO_x) in the Taranaki region since 1993 using passive absorption discs. Research to date indicates that this is an accurate method, with benefits of simplicity of use and relatively low cost. To date more than 660 samplers of nitrogen oxides have been collected in Taranaki region. Discs are sent to EUROFINs ELS Ltd. Lower Hutt for analysis. Passive absorption discs are placed at the nominated sites. The gases diffuse into the discs and any target gases (nitrogen dioxide or others) are captured.

In the 2015-16 year, passive absorption discs were placed on one occasion at twenty four sites, staked about two metres off the ground for a period of 21 days, for the purpose of Compliance Monitoring.

Conversion of exposure result to standardised exposure time period

From the average concentration measured, it is possible to calculate a theoretical maximum daily or one hour concentrations that may have occurred during the exposure period. Council data on NO_x is gathered over a time period other than exactly 24 hours or one hour. There are mathematical equations used by air quality scientists to predict the maximum concentrations over varying time periods. These are somewhat empirical, in that they take little account of local topography, micro-climates, diurnal variation, etc. Nevertheless, they are applied conservatively and have some recognition of validity.

One formula in general use is of the form:

$$C(t_2) = C(t_1) \times \left(\frac{t_1}{t_2}\right)^p$$

where C(t) = the average concentration during the time interval t, and p = a factor lying between 0.17 and 0.20. When converting from longer time periods to shorter time periods, using p = 0.20 gives the most conservative estimate (i.e. the highest calculated result for time period t₂ given a measured concentration for time period t₁). Using the 'worst case' factor of p = 0.20, the monitoring data reported above has been converted to equivalent 'maximum' 1-hour and 'maximum' 24-hour exposure levels.

Results

The location of the NO_x monitoring sites are shown in Figure 1 and the details of the NO_x results are presented in Table 1 and Figure 2.

Table 1 Actual (laboratory) and recalculated ambient NO_x results, NES and MfE guideline.

	Survey at	Site code	NO _x (µg/m ³) Lab. results	NO _x 1/hr (µg/m ³) Theoretical max.	NO _x 24/hr (µg/m ³) Theoretical max.
Petrochemical	McKee PS	AIR007901	1.9	6.5	3.5
		AIR007902	8.1	27.8	14.8
	Turangi PS	AIR007922	3.8	13.1	6.9
		AIR007824	3.3	11.3	6.0
	Kaimiro PS	AIR007817	1.2	4.1	2.2
		AIR007818	4.0	13.8	7.3
	Sidewinder PS	AIR007831	0.8	2.8	1.5
		AIR007832	0.8	2.8	1.5
	Maui PS	AIR008201	1.3	4.5	2.4
		AIR008214	2.4	8.3	4.4
	Kupe PS	AIR007827	2.1	7.2	3.8
		AIR007830	1.4	4.9	2.6
	Kapuni PS	AIR003410	5.9	20.3	10.7
		AIR003411	7.0	24.1	12.7
	Cheal PS	AIR007841	1.5	5.2	2.7
		AIR007842	2.0	6.9	3.6
Waihapa PS	AIR007815	1.5	5.2	2.7	
	AIR007816	2.6	8.9	4.7	
Ballance AUP	AIR003401	4.2	14.4	7.7	
	AIR003404	6.9	23.8	12.6	
Dairy factory	Fonterra	AIR002410	3.4	11.7	6.2
		AIR002711	4.8	16.5	8.7
		AIR002412	4.3	14.8	7.8
		AIR002413	4.1	14.1	7.5
National Environmental Standard (NES) and MfE guideline				200 (NES)	100 (guideline)

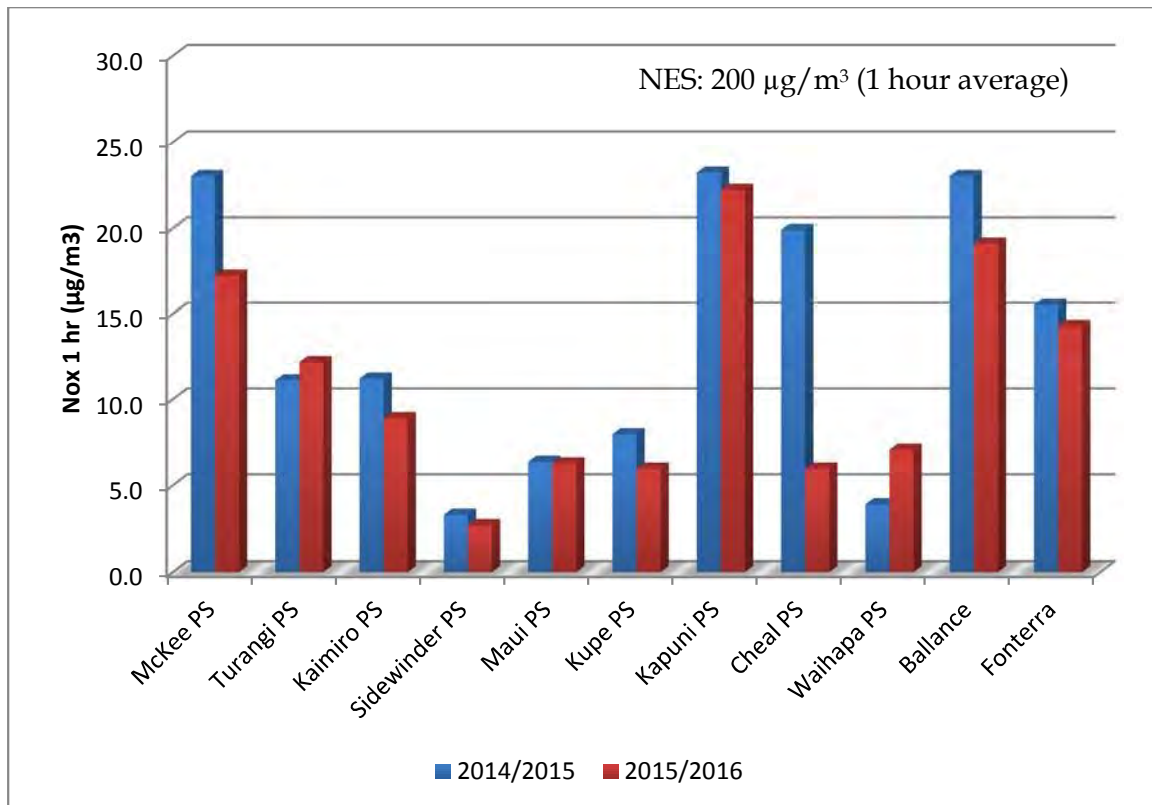


Figure 2 Average NO_x levels at 11 surveyed locations throughout the region (year 2014-2016).

Discussion

The calculated 1-hour and 24-hour theoretical maximum concentrations (using a power law exponent of 0.2) ranged from 2.8 µg/m³ to 27.8 µg/m³ and 1.5 µg/m³ to 14.8 µg/m³ respectively. The highest results in 2015-16 monitoring year were obtained from the NO_x emitting sites at four different locations:

1. Around the Fonterra's Whareroa co-generation plant.
2. In Kapuni heavy industrial area around the STOS production station and
3. Ballance ammonia/urea plant.
4. And from the sites at McKee production station and power generation plant.

All values were within the National Environmental Standards, Ministry for the Environment Ambient Air Quality Guidelines and the respective resource consents limits. This continues the pattern found in previous years.

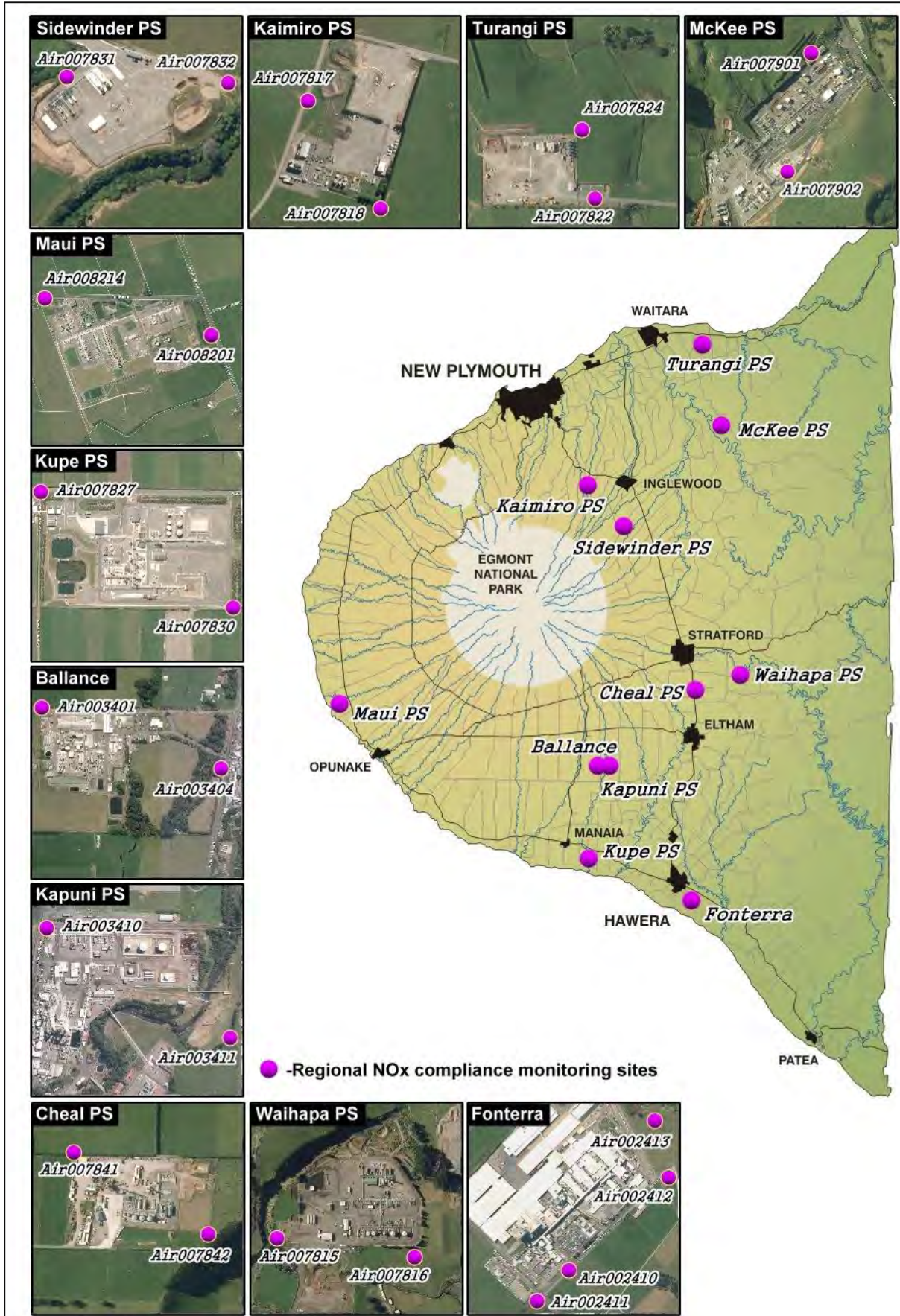


Figure 1 NOx monitoring sites in Taranaki Region, 2015-2016

Ministry for the Environment environmental performance indicator

Ministry for the Environment uses an environmental performance indicator to categorise air quality. These categories are set out in Table 2 and further details of the entire NO_x results are set out in Table 3.

Table 2 Environmental Performance Indicator air quality categories

Measured value	Less than 10% of NES	10-33% of NES	33-66% of NES	66-100% of NES	More than 100% of NES
Category	<i>excellent</i>	<i>good</i>	<i>acceptable</i>	<i>alert</i>	<i>action</i>

Table 3 Categorisation of results (2015-16 monitoring year)

National Environmental Standard for NO ₂ = 200 µg/m ³ - 1 hour average.		
Category	Measured values	
Excellent	<10% of the NES, (0-20µg/m ³)	20 (83%)
Good	10-33% of the NES, (20-66µg/m ³)	4 (17 %)
Acceptable	33-66% of the NES, (66-132 µg/m ³)	0 (0%)
Alert	66-100% of the NES, (132-200 µg/m ³)	0 (0%)
Total number of samples		24 (100%)

Conclusion

The monitoring showed that 83% of the 1-hour average results fell into Ministry's 'excellent' categories and 17% of the results lay within Ministry's 'good' category. No results ever entered the 'acceptable' or 'alert' categories, i.e., no results ever exceeded the National Environmental Standard of 200µg/m³.

These results, and all regional monitoring to date, have shown that Taranaki has very clean air, and on a regional basis there are no significant pressures upon the quality of the air resource.

Memorandum

To Job Manager, Callum MacKenzie
From Scientific Officer - Air Quality, Brian Cheyne
File 1782044
Date November 23, 2016

Ambient Gas (PM10, NOx, CO and LEL) Monitoring at Kapuni Production Stations during 2015-2016 monitoring year

Introduction

In January and June 2016 as part of the compliance monitoring programme for the Kapuni production station, a survey of ambient air quality sampling was carried out by the Taranaki Regional Council (the Council) in the vicinity of the plant. The main objectives were to measure:

- The concentrations of PM10 using a portable data logging TSI 'DustTrak';
- To measure the concentrations of the nitrogen oxides (NOx) using a passive sampling method, that gives a result for average exposure;
- And to measure carbon monoxide (CO) using a portable multi gas meter that provides instantaneous data throughout the monitoring period.

The findings of this study are presented in this memorandum, together with the locations of the monitoring sites which are provided in Figure 1.

Carbon monoxide (CO) and Lower explosive limit (LEL)

During the monitoring year, a multi-gas meter was deployed on one occasion in the vicinity of the plant. The deployment lasted approximately 24 hours, with the instrument placed in a down-wind position at the start of the deployment. Monitoring consisted of continuous measurements of gas concentrations for the gases of interest (carbon monoxide and combustible gases).

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 at Kapuni production station (2015-2016)

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

The consent 4054-5 covering air discharges from the Kapuni Production Station does not have specific limits related to particular gases. The Ministry for the Environment’s air quality guidelines for carbon monoxide (which are based on health protection) are 30mg/m³ averaged over a 1 hour exposure and 10mg/m³ averaged over an 8 hour exposure period. The maximum concentration of carbon monoxide found during the monitoring run was 0.57 mg/m³ with average concentration for the entire dataset was only 0.20 mg/m³ which comply with the Ministry for the Environment’s air quality guidelines. This is in line with the pattern found in previous years.

Table 1 Results of carbon monoxide and LEL monitoring at Kapuni production station

Period (from-to)		20/06/2016 13:38 to 21/06/2016 13:49
Max	CO(ppm)	0.50
	LEL(%)	0.20
Mean	CO(ppm)	0.10
	LEL(%)	0.00
Min	CO(ppm)	0.00
	LEL(%)	0.00

Note: (1) the instrument records in units of ppm. At 25°C, 1 atm.
 1ppm CO = 1.145 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 percentage 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 dangerous levels of airborne contaminants, including any risk of explosion. At no time did the level of explosive gases downwind of the Kapuni production station reach any more than a trivial level.

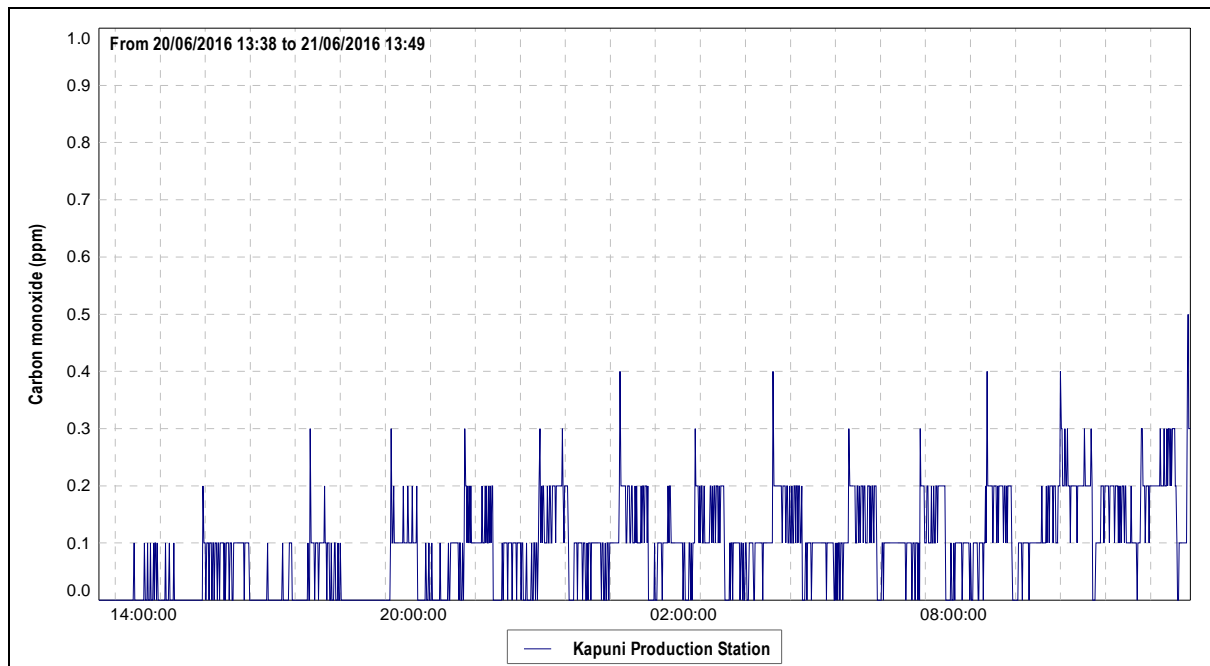


Figure 2 Graph of ambient CO levels in the vicinity of the Kapuni Production Station (2015-16)

PM10

In September 2004 the Ministry for the Environment made public National Environmental Standards (NESs) relating to certain air pollutants. The NES for PM10 is $50 \mu\text{g}/\text{m}^3$ (24-hour average).

Particulates can be derived from many sources, including motor vehicles (particularly diesel), solid and oil-burning processes for industry and power generation, incineration and waste burning, photochemical processes, and natural sources such as pollen, abrasion, and sea spray.

PM10 particles are linked to adverse health effects that arise primarily from the ability of particles of this size to penetrate the defences of the human body and enter deep into the lungs significantly reducing the exchange of gases across the lung walls. Health effects from inhaling PM10 include increased mortality and the aggravation of existing respiratory and cardiovascular conditions such as asthma and chronic pulmonary diseases.

During the reporting period, a "DustTrak" PM10 monitor was deployed on one occasion in the vicinity of the Kapuni production station. The deployment lasted approximately 24 hours, with the instrument placed in a down-wind position at the start of the deployment. Monitoring consisted of continual measurements of PM10 concentrations. The location of the "DustTrak" monitor during the sampling run is shown in Figure 1.

The details of the sample run are presented in Figure 3 and Table 2.

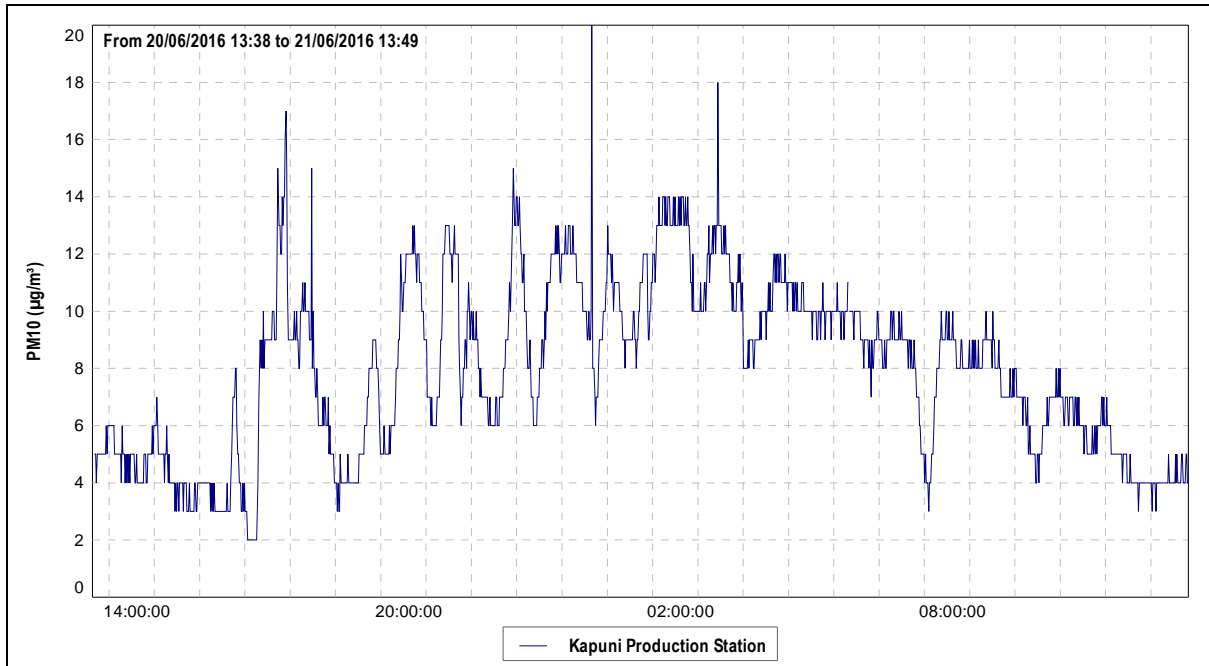


Figure 2 PM10 concentrations ($\mu\text{g}/\text{m}^3$) at the Kapuni production station (2015-16)

	(24 hours) (20-21/06/2016)	
24 hr. set	Day 1	Day 2
Daily average	8.00 $\mu\text{g}/\text{m}^3$	N/A
NES	50 $\mu\text{g}/\text{m}^3$	

Table 1 Daily mean of PM10 results during two days' monitoring at Kapuni production station (2015-16)

During the 24-hour run, from 20th of June to 21th of June 2016, the average recorded PM₁₀ concentration for the 24 hour period was 8.0 $\mu\text{g}/\text{m}^3$. These daily means equate to 16.0% of the 50 $\mu\text{g}/\text{m}^3$ value that is set by the National Environmental Standard.

Background levels of PM₁₀ in the region have been found to be typically around 11 $\mu\text{g}/\text{m}^3$.

Nitrogen oxides (NOx)

From 2014 onwards, the Council has implemented a coordinated region-wide compliance monitoring programme to measure NOx. The programme involves deploying all measuring devices at 28 NOx monitoring sites (including two sites in the vicinity of the Kapuni production station) on the same day, with retrieval three weeks later. This approach assists the Council in further evaluating the effects of local and regional emission sources and ambient air quality in the region.

The complete report covering region-wide NOx monitoring is attached to this memorandum.

The consent 4054-5 covering air discharges from the Kapuni Production Station does not have specific limits related to particular gases. The Ministry for the Environment's air quality guidelines for nitrogen dioxide are 100 $\mu\text{g}/\text{m}^3$ for a 24 hour average or 200 $\mu\text{g}/\text{m}^3$ for a one hour average exposure.

NO_x passive adsorption discs were placed at two locations in the vicinity of the Kapuni production station on one occasion during the year under review. The discs were left in place for a period of 21 days.

The calculated 1-hour and 24-hour theoretical maximum NO_x concentrations found at the Kapuni production station during the year under review equates to 23.3µg/m³ and 11.7 µg/m³ respectively. The results show that the ambient ground level concentration of NO_x is well below the limits set out by the Ministry for the Environment's air quality guidelines.