Dow AgroSciences (NZ) Ltd Monitoring Programme Annual Report 2015-2016

Technical Report 2016-16

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Executive summary

Dow AgroSciences (NZ) Ltd (DAS) operates an industrial agrichemical formulating and packaging facility located at Paritutu Road, New Plymouth, in the Herekawe catchment. DAS holds resource consents to allow it to discharge stormwater into the Herekawe Stream, and to discharge emissions into the air. This report for the period July 2015 to June 2016 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess DAS's environmental performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of DAS's activities.

DAS holds two resource consents, which include a total of 24 conditions setting out the requirements that they must satisfy. DAS holds one consent to allow it to discharge stormwater into the Herekawe Stream, and one consent to discharge emissions into the air at the plant site.

During the monitoring period, Dow AgroSciences (NZ) Ltd demonstrated an overall high level of environmental performance.

The Council's monitoring programme for the year under review included four inspections, four sets of water samples collected for pesticide analysis, two biological surveys of receiving waters, and a marine ecology inspection. DAS carried out air emission sampling and groundwater monitoring through independent consultants and further storm water sampling, and forwarded the results to the Council for audit and review.

The monitoring showed that DAS has had no significant impact on air quality in the vicinity of the plant or on water quality in the Herekawe Stream. No complaint in relation to DAS's activities was registered by the Council.

During the year, DAS demonstrated a high level of environmental and administrative performance.

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 remains at a high level.

This report includes a recommendation for the 2016-2017 year.

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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 Dow AgroSciences (NZ) Ltd (DAS). DAS operates an industrial agrichemical formulation plant situated at Paritutu Road, New Plymouth, in the Herekawe catchment.

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consent held by DAS that relates to discharges of water within the Herekawe catchment, and the air discharge permit held to cover emissions to air from the 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 DAS's use of water and air, and is the twenty-fourth combined annual report by the Council for the Paritutu Road plant.

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 though annual programmes;
- the resource consents held by DAS in the Herekawe 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 DAS site.

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

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

Section 4 presents recommendations to be implemented in the 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 DAS, 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 DAS'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

Figure 1 Aerial photograph of the DAS Paritutu Road site

DAS prepares a range of agricultural chemicals at its facility in New Plymouth. It both manufactures (reacting substances to form new ones) and formulates (blending active ingredients and other agents). The production is based on 'batch' processes (i.e. not continuous) involving chemical reactions, blending or packaging. Various formulation types are produced/packed or repacked, including liquid concentrates, flowable

suspensions, wettable powders, water dispersible granules and coated granules. There are approximately 36 different active ingredients handled on the site. Of these, 13 are contained in products that are only repacked or stored for further distribution. The remainder are used in the formulation of products in varying quantities. There are five production plants on the site, and in addition there are support activities such as laboratories and a high temperature waste incinerator.

1.2.1 History

DAS has been located at the present site since 1960. The manufacturing processes for phenoxy herbicide active ingredients (2,4-D, MCPA and MCPB) and triclopyr were discontinued in early 1998 and the Phenoxy Plant shut down. These active ingredients were then imported for formulation into herbicide products. As a result of the closure of the Phenoxy Plant a number of raw materials are no longer used on the site, including chlorophenols (2, 4- dichlorophenol and p-chloro-o-cresol) and monochloroacetic acid (MCAA). The cessation of these chemical syntheses reduced the number of chemicals stored on site and consequently has reduced the potential for odour to be emitted from the site.

Changes to the site over the past three decades have included:

- production of the herbicide 2,4,5-T ceased in 1987;
- terminating the manufacture of dairy sanitisers and detergent bases;
- the high temperature solids incinerator has been upgraded to include a new control system, an extended secondary combustion chamber, and the installation of a liquids nozzle to allow liquids to be burnt;
- cessation of use of the 'liquids' incinerator in 1994, and demolition of the liquids incinerator in June 2000;
- diversion of stormwater from the roads in the vicinity of the incinerator to a new HDPE-lined stormwater pond (SV9200) in the 1995-1996 year;
- termination of the production of phenoxy herbicides (2,4-D, MCPA and MCPB) and triclopyr in 1998;
- introduction of the insecticide active ingredient spinosad, and start up of the Spinosad Plant in 1998;
- closure of the powders side of the Powders/Protectants Plant at the end of 1999;
- in accordance with the revised site Groundwater Management Plan, 18 groundwater bores were closed in 2001-2002; dedicated pumps were installed into remaining sampling wells in May 2002;
- formulation of solid herbicides ceased in June 2002 and the Solids Plant closed;
- the formulation of water-based glyphosate product was introduced during 2002-2003;
- from 2003-2004, there was reduced use of the High Temperature Incinerator, with the operation changed from continuous use to operation 5 days per week (24 hours) intermittently for a total of 6 months of the year;
- the esterification process of 2,4-D esters recommenced in October 2005, in the Commodity Herbicides Plant;
- the neutralisation process with amines of MCPA (2006) and 2,4-D (2007) recommenced, and of glyphosate (2007) and clopyralid (2012) commenced, in the Commodity Herbicides Plant;

- a new building air extraction and vent treatment system for improved odour control was completed in 2011 for the warehouse where 2,4-D acid is stored;
- the pilot plant and TCP plant were demolished in 2014;
- the amine neutralisation of glyphosate was ceased in 2013; and
- the esterification of 2,4-D was ceased in 2015.

1.2.2 Herbicides Plant

Formulations involving a wide range of active ingredients are prepared for sale. Both liquid (water and solvent based) and granular herbicides are produced. Triclopyr is the highest volume active ingredient.

Air from liquid formulation preparation areas is passed through a coarse filter to capture dust, before treatment through a series of carbon beds before being discharged to atmosphere.

1.2.3 Commodity Herbicides Plant

The amine neutralisation of MCPA recommenced in September 2006, using the same equipment that was used in 2,4-D esterification. Imported MCPA is mixed with dimethylamine (DMA) to convert the acid to the amine.

The amine neutralisation of 2,4-D recommenced in August 2007. Imported 2,4-D flake is mixed with either IPA or a dimethylamine/dimethylethanolamine (DMEA) mixture to convert the acid to amine form.

The amine neutralisation of clopyralid commenced in September 2012. Imported clopyralid is mixed with DMA to convert the acid to amine form.

The process ventilation system is connected to a caustic scrubber followed by a carbon filter, to remove organic vapours before discharge to atmosphere.

1.2.4 Insecticides Plant

Liquid organophosphate insecticides, mostly based on chlorpyrifos, and adjuvants are blended and packaged for sale. The process ventilation system is connected to a sodium hypochlorite scrubber, in which chemical reactions between hypochlorite and compounds released from the process lead to the solubilisation of those compounds and their capture in the scrubber.

1.2.5 Granular Herbicides Plant

Granules, based on picloram, are formulated and packaged. Discharges are passed through a bag filter and absolute (high performance) filter before discharge.

1.2.6 Suspension Concentrates (Spinosad) Plant

Liquid spinosyn and sulfoxaflor based insecticides are formulated and packaged. The process ventilation system passes through a bag filter and absolute filter before discharge.

1.2.7 High Temperature Incinerator

A high temperature incinerator provides for the thermal destruction of DAS wastes. Materials to be combusted include all chemically contaminated clothing and production plant wastes. The liquids nozzle allows the burning of liquids such as wash water.

Emissions are controlled primarily by optimising the conditions of combustion, together with the proper design of the combustion chamber and stack.

1.2.8 Laboratories

Fumes from the laboratories are extracted either as general building ventilation air or through fume cupboard hoods. The quantities of chemicals involved are minute by comparison either with the formulating processes or with the amounts that would be handled by an end user of DAS's products.

1.2.9 Maintenance workshops

Activities carried out in the workshops, and periodically on site, include welding, painting, abrasive blasting, and other typical operations. Ventilation systems extract air from around particular process areas.

1.2.10 Product Development Laboratory

The building is used only infrequently, to trial process control or to produce small scale batches.

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.

DAS holds water discharge permit **4108-2** to cover the discharge of stormwater from its production site via retention dams, together with uncontaminated stormwater from landscape and non-manufacturing areas, into the Herekawe Stream. This permit was issued by the Council on 4 September 2008 under Section 87(e) of the RMA. It is due to expire on 1 June 2026.

Condition 1 requires the adoption of the best practicable option for controlling effects of discharges on the environment.

Condition 2 sets a maximum stormwater catchment area.

Condition 3 requires a management plan to prevent and to deal with spillage and accidental discharges.

Condition 4 addresses record keeping.

Condition 5 prohibits significant adverse effect on the environment.

Condition 6 imposes limits upon the discharge's significant potential contaminants.

Condition 7 is a general review provision.

The permit is attached to this report in Appendix I.

1.3.2 Air discharge pemit

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.

DAS holds discharge permit **4020-4** to discharge contaminants to air from all activities associated with the current and future operation of an agrichemical formulation and packaging plant. This permit was issued by Council on 5 November 2014 under Section 87(e) of the RMA.

Condition 1 relates to the maintenance and operation of emission control equipment.

Condition 2 prohibits offensive or objectionable odour or dust beyond the site boundary.

Condition 3 sets limits on concentrations of contaminants, other than from the High Temperature Incinerator Stack, at ground level off-site.

Conditions 4 to 10 deal with the High Temperature Incinerator, imposing limits on significant potential contaminants, prohibiting incineration of certain materials, placing controls on operating conditions, and requiring records to be kept.

Condition 11 requires an air discharge management and monitoring plan.

Conditions 12 and 13 relate to the maintenance of a chemical materials register.

Condition 14 deals with air monitoring and response triggers (thresholds for actions in response to any elevated emission levels).

Condition 15 requires the annual provision of information on air quality monitoring, any changes in process or in emission controls, and any consultation undertaken.

Condition 16 requires a six-yearly report on investigations into and, where applicable, the adoption of new technology to reduce or mitigate emissions to air.

Condition 17 is a review provision.

The permit is attached to this report in Appendix I.

1.4 Monitoring programme: water

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 DAS site consisted of six 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 DAS site was visited four times during the monitoring period. With regard to consents for the 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. Sources of data being collected by DAS 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 Stormwater sampling

Stormwater is sampled and analysed for chemical and physical parameters before it is released. If the collected stormwater does not meet the release criteria, an application for approval is sought from New Plymouth District Council before it is pumped to the trade waste system.

Results of monitoring are reported by DAS to the Council, and samples of stormwater are taken by the Council for comparative laboratory analysis. The stormwater discharge was sampled by Council on four occasions, and the samples sent to an independent laboratory (AsureQuality) for acid herbicides analysis and a multi-residue pesticide scan on each occasion and for glyphosate analysis once.

1.4.5 Groundwater monitoring

DAS conducts an on-going groundwater monitoring and modelling program, prepared in consultation with the Council, to assess the quality of groundwater beneath the site. Results are forwarded to the Council annually, while relevant matters are discussed as they arise. Shallow groundwater under the site flows under natural gradients north and west towards the coastal marine area, including the Sugar Loaf Islands (Nga Motu) Marine Protected Area.

To address the low-level contamination found through a past investigation, DAS developed a Site Groundwater Management Plan, which was received and agreed to by the Council during the 1996-1997 period and (updated) in 2001. Contaminants (phenoxies and chlorophenols) were initially detected at low levels and groundwater flow suggested that the contamination evident would pose no environmental risk and would reduce to levels below detection.

DAS fully evaluated the site and recommended a monitoring approach to ensure that, as predicted by modelling, no adverse environmental effects occur. The current monitoring approach adopted through the Site Groundwater Management Plan requires the Council to remain fully informed of the results. The approach enables the risk of effects on the environment to be assessed fully on an on-going basis, and appropriate action to be taken. The information available at this time suggests that no adverse environmental effects are likely and that the contaminants will fully degrade before migration from the site occurs.

In July 2008, the Council agreed to a change in the date of annual sample collection, from October to June-August, to coincide with maximum groundwater levels. This was in response to most of the monitoring wells being found dry in October 2007.

1.4.6 Freshwater biological surveys

The Council has a bio-monitoring programme to assess biological diversity and richness of the Herekawe Stream. Two surveys were conducted during the monitoring year to assess whether discharges from DAS's Paritutu Road site were having any environmental impact on the stream.

1.4.7 Foreshore marine ecology inspection

The Council carries out an annual marine ecology inspection on the Back Beach foreshore by DAS's Paritutu Road plant to look for any evidence of a discharge from the site (including any groundwater seeps) and to assess any environmental impact.

1.5 Monitoring programme: air emissions

1.5.1 Introduction

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

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

The air quality monitoring programme for the DAS site consisted of three primary components.

1.5.2 Site inspections

The DAS site was visited four times during the monitoring period.
The main points of interest were plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by the consent holder were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was surveyed for environmental effects.

As far as was practicable, inspection in relation to air emissions were integrated with inspections undertaken for other purposes such as stormwater discharges.

1.5.3 Chemical emission sampling

Air emissions from the Commodity Herbicides Plant process vent and the High Temperature Incinerator stack were monitored to check for compliance with consent conditions. Since 2006-2007, DAS has implemented a policy that all air emission monitoring be undertaken by independent specialist environmental consultants. In 2015-2016, Source Testing New Zealand Ltd carried out and reported on the sampling and analysis of vent and stack emissions.

The process vent in the Commodity Herbicides Plant was monitored under typical operating conditions.

The High Temperature Incinerator stack was monitored under typical operating conditions. The stack emissions were tested for dioxins and furans, hydrogen chloride, total halides, sulphur dioxide, metals and (voluntarily) particulate matter.

2. Results

2.1 Water

2.1.1 Inspections

Stormwater from the production plants, dangerous goods storage compound, despatch store, incinerator and roads in these areas is collected in two retention pond systems. It is sampled and analysed for comparison with release criteria. If the stormwater meets the release criteria, it is discharged to the Herekawe Stream. Stormwater which fails to meet the release criteria may be pumped to the trade waste system with approval from the New Plymouth District Council.

Stormwater from the southern part of the site drains directly to a New Plymouth District Council stormwater drain and then to the Herekawe Stream. This part of the site is predominantly an open grassed area surrounding a parking area, two storage buildings, the closed pilot plant and the access road to the site.

There are four stormwater retention ponds at the Paritutu Road site: SV9000, SV9100, SV9200 and SV8000. Stormwater from building roofs and roading is collected in SV9100 after treatment in separators to remove silt. SV9000 is used as an overflow retention pond. Stormwater from around the incinerator building and roadway is collected in SV9200, while stormwater from around the despatch and dangerous goods storage areas is collected in SV8000.

If stormwater does not meet the release criteria, DAS seeks to identify the source of the contaminant so corrective actions can be implemented to prevent a recurrence.

Officers of the Council carried out regular inspections of the site during the 2015-2016 monitoring period. The inspections included the storage of raw materials and product, the maintenance and housekeeping of process areas and roadways, the stormwater collection and retention systems, stormwater sampling and release records and inspections of the discharge point and receiving waters in the Herekawe Stream. Scheduled inspections were carried out on 1 September and 18 November 2015, and 18 March and 26 May 2016.

Notes from these visits are summarised below. Records of production and incinerator operation were inspected and found to be satisfactory.

1 September 2015

The inspection was conducted during light showers, with 47.5 mm of rain recorded over the previous few days at the New Plymouth Wastewater Treatment Plant (NPWWTP). Some pollen was present on the surface of SV8000, otherwise the ponds were relatively clear.

The incinerator was in the process of starting up after a blocked liquids nozzle had been cleaned. Recent temperature and gas concentration records and burn manifests were sighted and these were all satisfactory. The temperature was typically 80+°C over minimum limits.

The WorkSafe NZ HSNO major hazards facility team had visited recently and the site was considered satisfactory.

The discharge to the Herekawe Stream was sampled. The discharge was clear with a slight musty odour and no foaming. The stream was in fresh from recent rain, with slight foaming upstream.

An odour survey was performed beyond the boundary of the site with no effects noted from DAS.

18 November 2015

The weather was fine with a westerly breeze. A total of 14 mm of rain was recorded during the previous week at NPWWTP. The plant had been relatively quiet during the recent restructure period. Production was to increase in the following weeks. It was expected that esterification processes would be ceased in the near future, to be replaced by importation of completed product. Acid/base reactions will then be the only remaining chemical processes undertaken at the Paritutu plant.

Stormwater ponds SV8000 and SV9100 were sampled for acid herbicide and multi-residue pesticide analysis. The ponds were very low with water levels at 350 and 75 m^3 on their staff gauges, respectively. The stormwater was slightly turbid and brownish with minimal algal growth. Exposed sides were clean. Frogs were observed in the southern ponds. One of the outlet valves in SV8000 was in need of replacement, though emptying of the pond via the other functioning valve was not an issue.

The incinerator was unmanned at the time of inspection. Exhaust temperatures were well above the minimum limit. The packaging areas were viewed. A fan in the filter system of the granular products plant air outlet was being replaced. General site housekeeping was excellent. All roadways and stormwater catchments were clean and clear. The site was very well managed.

The discharge to the Herekawe Stream was sampled, it was clear and slightly turbid with slight foaming visible in the stream. No sheen or odour was apparent.

18 March 2016

A total of 65.5 mm rainfall had been recorded in the previous week at NPWWTP, 58 mm of which fell during the day prior to the inspection. This had rapidly filled the site's stormwater ponds. While the water was being tested by DAS on the afternoon of the 17th March, permission was sought and given by the Council to allow the ponds to overflow to the surrounding grassed areas. Once the test results had confirmed the suitability of the water for discharge, enough water was released to the Herekawe Stream to prevent the ponds from overflowing further.

The site was back to full production after a reduction during a recent restructure. Acid/base reactions are the only remaining chemical processes undertaken at the Paritutu plant. Stormwater ponds SV8000 and SV9100 were sampled for acid herbicide and multi-residue pesticide analysis. The ponds were full with water levels at 1700 and 220 m^3 on their respective staff gauges. The stormwater was clean and clear with minimal algal growth. Exposed sides were clean. Handrails on the southern ponds were being replaced.

The incinerator had been shutdown for the previous three weeks for maintenance. It was expected to be restarted in the following days. The fan in the filter system of the granular products plant air outlet had been replaced. General site housekeeping was

excellent. All roadways and stormwater catchments were clean and clear. The site was observed to be very well managed.

The discharge to the Herekawe Stream was sampled, it was clean and clear with no sheen or odour. There was moderate flow in the stream which was clear above and below the discharge with no foaming evident.

26 May 2016

Isolated heavy showers and a strong westerly wind were experienced during the inspection. Total rainfall during the preceding week was 62.5 mm at the Brooklands Zoo station. The stormwater ponds SV8000 and SV9100 were sampled for acid herbicide, multi-residue pesticide and glyphosate analysis, the stormwater was clean and clear with some wind blown debris. The ponds were half-full with water levels at 650 and 90 m^3 on their respective staff gauges. Exposed sides in the ponds were clean.

The incinerator was running at the time of inspection. All parameters met relevant consent conditions. Stack testing was being undertaken. General site housekeeping was excellent. All roadways and stormwater catchments were clean and clear. The site was very well managed.

The discharge from SV8000 to the Herekawe Stream was sampled. It was clean and clear with no sheen or odour. There was very high flow in the stream with some foaming and a slight sheen unrelated to the DAS discharge, possibly from the western industrial drain outlet.

An odour survey was conducted on the roads around the site prior to the inspection with no issues noted.

2.1.2 Results of discharge monitoring

All stormwater collected in the four stormwater retention ponds is sampled and analysed by DAS prior to release. The samples are checked for the parameters controlled by consent 4108; floatable and suspended materials, odour, colour and visual clarity, pH and the potential chemical contaminants phenoxy herbicides, organophosphates, triclopyr, picloram, glyphosate, and oxyfluorfen. During the 2015-2016 year, a total of 131 stormwater samples were collected and analysed by DAS. On all occasions, the release criteria were met.

Two of the stormwater ponds are also sampled by the Council for consent compliance checking and inter-laboratory comparison on four occasions each year. The Council's laboratory determines general water quality parameters, and an independent specialist laboratory (AsureQuality) is used to analyse for the organic constituents limited on the consent. In 2015-2016, sampling was undertaken by an officer from the Council with staff from DAS on 1 September and 18 November 2015, and 18 March and 26 May 2016.

The focus of monitoring continued to be on acid herbicides, in connection with the recommencement of esterification of 2,4-D and neutralisation of MCPA and 2,4-D with amines, rather than on organophosphorus pesticides, which had not been detected from monitoring over the previous decade.

The results of Council monitoring for 2015-2016 are presented in Tables 1 and 2.

Table 1 Stormwater results for acid herbicides, glyphosate and pH in 2015-2016

Parameter	Maximum concentration detected (g/m³ or mg/L)	
	SV8000 (n = 4)	SV9100 (n = 4)
2,4,5-T	0.00025	0.00084
2,4-D	0.00075	0.00099
2,4-DB	<0.0001	<0.0001
MCPA	0.00055	0.00033
MCPB	0.00011	<0.0001
Picloram	0.0011	0.0022
Triclopyr	0.0014	0.00044
Glyphosate	<0.001	<0.001
pH (range)	6.5 – 7.2	6.7 – 8.1

Table 2 Stormwater results for pesticides in 2015-2016

Parameter	Maximum concentration detected (g/m³ or mg/L)		
	SV8000 (n = 3)	SV9100 (n = 3)	Maximum
Chlorpyrifos	<1	<1	<1
Chlorpyrifos-methyl	<1	<1	<1
Oxyfluorfen	<1	<1	<1

A total of 255 pesticide residues were tested for (excluding acid herbicide compounds that were tested separately), at detection limits of 0.001 to 0.005 g/m³. The list of residues determined is given in Appendix II.

A summary of DAS's results from inter-laboratory comparison exercises is presented in Table 3. The results indicate good agreement between laboratories, and compliance with the conditions of stormwater discharge consent 4108.

Table 3 DAS stormwater results from 2015-2016 inter-laboratory comparisons

Consent Item	Consent limit	SV8000 (n = 4)	SV9000 (n = 4)	SV9100 (n = 4)
Oil, floatables, suspended solids	None present	Pass	Pass	Pass
Objectionable odour	None present	Pass	Pass	Pass
Colour and visual clarity	No change	Pass	Pass	Pass
pH	6.0 – 9.0	6.7 – 7.4	6.7 – 7.1	6.7 – 7.3
Total phenoxy herbicides	0.10 mg/L	0.075*	0.075*	0.075*
Total organophosphates	0.0005 mg/L	0.0004**	0.0004**	0.0004**

Consent Item	Consent limit	SV8000 (n = 4)	SV9000 (n = 4)	SV9100 (n = 4)
Triclopyr	0.10mg/L	0.025*	0.025*	0.025*
Picloram	0.10mg/L	0.025*	0.025*	0.025*
Glyphosate	0.10mg/L	0.00011*	0.00011*	0.00011*
Oxyfluorfen	0.005mg/L	0.00035*	0.00035*	0.00035*

* none detected, assumes 2,4-D, MCPA and MCPB all present at half detection limit of 0.05 mg/L
** none detected, assumes chlorpyrifos and chlorpyrifos-methyl both present at half detection limit of 0.0004 mg/L

In September 2015, the Council received a stormwater report from DAS covering the period between July 2015 and June 2016. The stormwater report summarises the monitoring and discharge data for the DAS site during the 2015-2016 monitoring period. It also details process management of stormwater and its release from site. As noted in the report, there were no changes to the stormwater system during 2015-2016. The report is attached as Appendix III.

1.1.1 Groundwater monitoring

Field investigations into possible groundwater contamination at the site were commenced by DAS in 1993 and concluded in 1996. The site investigation identified two locations where soil and/or groundwater have been impacted by phenoxy herbicides and chlorophenols.

For a history of groundwater monitoring see 'Dow AgroSciences (NZ) Ltd, Monitoring Program Annual Report 2002-2003' Technical Report 2003-72.

In September 2016, the Council received a groundwater management report from DAS covering the period between July 2015 and June 2016. The report is based on the results of the groundwater sampling round undertaken in September 2015 by consultant ERM New Zealand Limited.

Groundwater sampling of the nine Groundwater Monitoring Plan wells was carried out between 21 and 24 September 2015 using in-well bladder pumps in accordance with "Low Flow Sampling Methodology".

The results of the chlorophenol and phenoxy acid analyses are listed in Table 4.

No phenoxy acid or chlorophenol was detected in either of the shallow perimeter wells (1 and 21).

Phenoxy herbicides were detected at three of the deep perimeter wells, at wells 32R, 42 and 47R on the northern boundary, at ≤ 0.18, ≤ 0.25 and ≤ 0.17 µg/L, respectively, significantly below the action level of 50,000 µg/L. Chlorophenols were detected at one deep perimeter well, at well 42 on the northern boundary, at ≤ 0.27 µg/L, significantly below the action level of 10,000 µg/L.

Non-perimeter well 46A, drilled into the andesite south of the stormwater pond, showed low levels of phenoxy herbicides, at < 1.29 µg/L, and of chlorophenols, at ≤ 0.59 µg/L. Well 39R had slightly higher levels of both phenoxy herbicides

(112.1 µg/L) and chlorophenols (≤ 785), however these values were well below the trigger levels (which do not apply to non-perimeter wells anyway as these are sampled for interest and not subject to the established action levels).

Table 4 Groundwater monitoring results September 2015

Well identification No	Phenoxy Herbicides concentration (µg/L)	Chlorophenol concentration (µg/L)
Shallow perimeter wells		
1	ND	ND
21	ND	ND
Deep Perimeter wells		
20	ND	ND
32R	≤0.18	ND
41	ND	ND
42	≤0.25	≤0.27
47R	≤0.17	ND
Additional non-perimeter wells		
39R	112.1	≤785
46A	≤1.29	≤0.59
Trigger levels	50,000	10,000

Phenoxy herbicides [2,4-D; 2,4,5-T; MCPA; MCPB]

Chlorophenols [2,4-DCP; 2,4,5-TCP; 2,4,6-TCP; PCOC]

ND = below laboratory reporting limits (< 0.16 µg/L for phenoxy acids and < 0.2µg/L for chlorophenols)

Total phenoxy acid herbicide and total chlorophenol concentrations have not exceeded the Groundwater Management Plan trigger levels since sampling rounds began in 1993, and if detected, concentrations typically continue to show a decreasing trend.

Wells 20, 32, 39J, 41 and 47 were redeveloped in August 2013 to provide more reliable groundwater levels for low flow sampling techniques, and to free up the dedicated sampling pump in well 20. Wells 32, 39J and 47 frequently had insufficient water to sample and as a result were decommissioned in August 2015 and replaced with adjacent new wells 32R, 39R, and 47R.

All 28 existing monitoring wells (five shallow and 23 deep) were gauged on 24 September 2015 to assess groundwater levels, water column and silt build-up thickness. This five-yearly survey of all the wells is next due in 2020-2021.

2.1.3 Freshwater biological monitoring

Freshwater biological surveys were undertaken in the Herekawe Stream on 12 October 2015 and 8 March 2016. Copies of the full reports are attached as Appendix IV.

The surveys were undertaken using standard Council procedures and indicated that the streambed communities had not been significantly affected by stormwater discharges from the DAS site or other industrial sites in the vicinity.

2.1.4 Foreshore marine ecology inspections

A marine ecological inspection was undertaken of the intertidal area at Back Beach on 16 November 2015. A copy of the report is attached as Appendix V.

An intertidal reef area is present at the north eastern end of Back Beach at the base of Paritutu Rock. Further down the shore, rocks and boulders were exposed, but there were no cobbles present higher on the shore.

Two groundwater seeps were observed flowing down the cliffs to the south of Paritutu Rock. The groundwater had no noticeable odour. The seeps flowed across the beach and over the reef before reaching the sea. These flows did not appear to be deleteriously affecting the reefs, as abundant limpets and little back mussels were present close to the flows.

A diverse range of algae and animal species were present on the reef. *Scytothamnus* sp. was abundant and several other algae were common, including encrusting *Corallina* spp., *Corallina officinalis*, *Endarachne binghamiae*, *Laurencia thryisifera, Ralfsia sp.* and *Ulva* sp. A variety of filter feeders (little black mussels, barnacles, anemones), grazers (limpets, chitons, top-shells) and crabs were present. From observations made during this inspection, the diversity of reef biota is typical to that seen at other local intertidal reefs in the Taranaki region.

2.2 Air

2.2.1 Inspections

Officers of the Council carried out regular inspections of the DAS Paritutu Road site during the 2015-2016 monitoring period. Scheduled inspections were undertaken on 1 September and 18 November 2015, and 18 March and 26 May 2016.

During each inspection a record was made of weather conditions prevailing at the time. An odour survey was carried out on the site boundary and around the surrounding neighbourhood. Slight odours were detected during two of the inspections. However these were not considered significant.

The vents on site were all visually checked for emissions during each inspection. At no time were any emissions noticed. A high standard of housekeeping in all areas of the site was noted at each inspection.

2.2.2 DAS air emissions report

In September 2016, Council received an air emissions report from DAS covering the period from July 2015 to June 2016. The main body of this report is attached as Appendix VI – the appendices to the report are available from Council.
The report addresses changes in plant processes, emission control technology, resource consent requirements, and emission monitoring. Process management of air emissions

is described, and the results from monitoring of point source emissions produced. General aspects of air quality management are covered, including the Air Discharge Management and Monitoring Plan (ADMMP). The results of monitoring are summarised in sections 2.2.3 and 2.2.4 below.

2.2.3 Process vents

Monitoring of process vent emissions from the Insecticides Plant, Suspension Concentrates Plant, Granule Herbicides Plant, and Herbicides Plant was undertaken in the 2014-2015 monitoring period and will next be undertaken in 2016-2017.

Monitoring of the Commodity Herbicides Plant was carried out by independent specialist Source Testing New Zealand Ltd (STNZ). Emissions were sampled by STNZ using international standard methods where applicable, and analysed by an IANZ accredited laboratory.

The monitoring was undertaken in accordance with the Stack Emission Monitoring Plan attached to the ADMMP.

Sampling was timed and conducted to provide data representative of the various production and formulation processes. The emission component monitored was MCPA (acid and salt).

A summary of the emission test results and associated information is presented in Table 5.

Table 5 Summary of process vent emission monitoring results 2015-2016

Plant	Vent	Emission component	No	Sampling period	Concentration* µg/m³	Emission limit**	
						µg/m³	%
Insecticides	03-5		0	Next due in 16-17	-	-	-
Suspension Concentrates	BB600		0	Next due in 16-17	-	-	-
Granulated Herbicides	03-14		0	Next due in 16-17	-	-	-
Herbicides	03-8		0	Next due in 16-17	-	-	-
Commodity Herbicides	48-1	MCPA (acid and salt)	3	1 - 2 June 2016	<0.5 - 0.86	290,000	0.0003

* all data corrected to 0˚C, one atmosphere, dry gas basis
** limits for emission component concentrations derived from Schedules 1 and 3 attached to consent 4020-4

Condition 3 on new consent 4020-4 requires that the discharge of contaminants to air, other than from the High Temperature Incinerator Stack, shall be controlled to ensure that the maximum ground-level concentrations off site do not exceed air quality limits listed in Schedule 1 to the consent, using the following formula:

Maximum stack concentration (µg/m³) = air quality limit (µg/m³) x Dilution Factor

The Dilution Factor is taken from the table in Schedule 3 to the consent, based on worst-case predictions from air dispersion modelling of the dilution of contaminants with ambient air between each process plant stack and ground level at the site boundary.

Table 5 presents the emission component concentrations as a percentage of the relevant maximum stack concentrations that are allowed. The highest emission concentration measured was 0.0003% of the respective limit, for MCPA (acid and salts) from the Commodity Herbicides Plant stack.

It is noted that additional monitoring was carried out on the Commodity Herbicides Plant vent in April 2006, to verify that dioxins were not being generated from the 2,4-D esterification process. The maximum reported value for dioxins and furans was 0.00399 ng(TEQ)/m^3, which is well within the range of field blank data from previous testing of the High Temperature Incinerator, that is, not measurably different from ambient air levels. As dioxins/furans are not created as part of the 2,4-D esterification or neutralisation processes, future monitoring is not required. In comparison, the consent limit on average concentration for the High Temperature Incinerator stack is 0.1 ng(TEQ)/m^3 (see section 2.2.4.1).

2.2.3.1 Multiple sources

Where multiple sources of an individual contaminant are involved, individual stack concentrations for that contaminant will be determined to ensure the air quality limit is complied with on a cumulative basis (Schedule 3 of consent 4020-4).

During 2015-2016, there were three substances with potential to have multiple sources: 2,4-D, MCPA and clopyralid. These materials are used in the Herbicides Plant and the Commodity Herbicides Plant. However, the discontinuation of esterification in the Commodity Herbicides Plant has meant that each of these compounds is now predominantly used in only one plant at a time. Therefore there was no requirement to undertake a determination of multiple sources in 2015-2016.

2.2.4 High Temperature Incinerator

Conditions on DAS's air discharge permit 4020-3 placed limits on the discharge of dioxins/furans and of hydrogen chloride from the High Temperature Incinerator. New discharge permit 4020-4 retained the concentration limit on dioxins/furans, and changed the mass discharge limit for hydrogen chloride (HCl) to include total halides (HF, HCl and HBr).

Under the Stack Emission Monitoring Plan, discharges from the High Temperature Incinerator stack shall also be monitored annually for particulates, sulphur dioxide and metals.

Monitoring for each type of emission component was carried out during the 2015-2016 period.

2.2.4.1 Dioxins and furans

Special condition 4 on DAS's air discharge consent 4020-4 states that the total concentration of polychlorinated dibenzodioxins (PCDD) and polychlorinated

dibenzofurans (PCDF) from the High Temperature Incinerator Stack shall not exceed 0.1 ng/m^3 (adjusted to 0°C, dry gas basis, 101.3 kPa pressure and 11% oxygen) when calculated as total toxic equivalents using World Health Organisation 2005 toxic equivalence factors. Compliance is determined based on the average of not less than three samples, each of which is taken while the incinerator is fed on different waste types.

Monitoring of the incinerator for dioxin and furan emissions was carried out by independent specialist STNZ using the revised sampling method that was developed in 2007. A modification was made to the USEPA Method 23 sampling train, in order to lower the detection limit for dioxins and furans. The sampling programme was carried out with separate monitoring of crushed drums, liquid waste and general waste incineration. The sampling periods were all four hours.

Testing during incineration of all three waste types occurred on 10 to 12 February 2016. The concentration of PCDD/PCDF for the liquids waste stream was significantly higher than in previous years and an investigation identified the most likely cause to be within the sampling process. Consequently a repeat sample was taken on 28 July 2016. A summary of the results is presented in Table 6.

Table 6 High Temperature Incinerator PCDD/PCDF monitoring results 2015-2016

Date	Waste type	PCDD/PCDF Concentration (ng/m^3 Total WHO-TEQ Upper Bound, not corrected for laboratory blank)	PCDD/PCDF Emission rate (ng/hr Total WHO-TEQ Upper Bound, not corrected for laboratory blank)
		Total WHO-TEQ	Total WHO-TEQ
Feb 2016	Laboratory blank	0.00381	10.2
July 2016		0.00373	10.0
10 Feb 16	Crushed drums	0.01290	33.0
11 Feb 16	General waste	0.00262	7.1
28 July 16	Liquid waste	0.03700	98.9
Average		**0.01751**	**46**
Consent limit		**0.1**	

Key: PCDD polychlorinated dibenzodioxins
PCDF polychlorinated dibenzofurans
ng/m^3 nanograms per cubic metre, adjusted to 0°C, 101.3 kPa, 11% oxygen, dry gas basis
ng/hr nanograms per hour
WHO-TEQ World Health Organisation – Total Toxic Equivalence

Results are presented in terms of WHO 2005 toxic equivalence factors. Maximum upper bound values are reported, for PCDD/PCDF concentration and emission rate, together with the analytical laboratory blank value.

The average concentration value for the three sampling runs, 0.01751 ng/m^3 WHO-TEQ, is less than the limit of 0.1 ng/m^3 on consent 4020 by a factor of about six.

The maximum mass emission rate value for the three sampling runs was 98.9 ng/hr WHO-TEQ.

These are highly conservative values, given that no correction is made for the laboratory blank, and that upper bound analytical values are used. The revised sampling method has lowered the detection limits for individual PCDD/PCDF cogeners to the extent that total toxic equivalence (TEQ) for the laboratory blank has become similar to that for the test samples.

2.2.4.2 Total halides (HF, HCl, HBr)

Special condition 5 on consent 4020-4 limits the discharge of total halides from the High Temperature Incinerator Stack to 1.5 kg/hr.

Testing for hydrogen fluoride (HF), hydrogen chloride (HCl) and hydrogen bromide (HBr) was undertaken on 8 and 9 June 2016. Two-hour samples were collected during a normal burn of crushed drums, liquid waste and general waste. The results are presented in Table 7.

Table 7 High Temperature Incinerator HF, HCl, HBr and Total Halide monitoring results 2015-2016

Date	Waste type	Concentration mg/m³				Emission rate kg/hr			
		HF	HCl	HBr	Total	HF	HCl	HBr	Total
9 June 2016	Crushed drums	19.1	151	<0.02	170	0.0411	0.324	<0.00005	0.365
8 June 2016	General waste	6.07	74.4	0.03	80.5	0.0145	0.178	0.00007	0.193
9 June 2016	Liquid waste	0.70	22.7	<0.01	23.4	0.0018	0.057	<0.00004	0.059
Consent Limit									**1.5**

Key: mg/m³ milligrams per cubic metre, adjusted to 0°C, 101.3 kilopascals pressure, 11% oxygen, and calculated as a dry gas
kg/hr kilograms per hour

The results of the total halide monitoring performed showed that the mass emission rate ranged from 0.059 to 0.365 kg/hr, complying with the maximum limit of 1.5 kg/hr. Bromide concentrations were 0.03 mg/m³ for general waste and non-detectable at <0.02 mg/m³ for other samples.

2.2.4.3 Particulate matter

Testing for particulate matter was undertaken on 8 and 9 June 2016. Two-hour samples were collected during a normal intermittent burn of crushed drums, general waste and liquid waste. The results are presented in Table 8.

The results for particulate matter monitoring performed showed that the mass emission rate ranged from 0075 to 0.194 kg/hr. There is no limit within the consent on mass emission rate of particulate, or on particulate concentration.

Table 8 High Temperature Incinerator particulate matter monitoring results 2015-2016

Date	Waste type	Particulate matter Concentration mg/m³	Particulate matter Emission rate kg/hr
9 June 2016	Crushed drums	71.6	0.154
8 June 2016	General waste	76.7	0.194
9 June 2016	Liquid waste	31.4	0.075

Key: mg/m³ milligrams per cubic metre, adjusted to 0°C, 101.3 kilopascals pressure, 11% oxygen, and calculated as a dry gas
kg/hr kilograms per hour

2.2.4.4 Sulphur dioxide

Testing for Sulphur dioxide was undertaken on 26 and 27 May 2016. One-to-two-hour samples were collected during a normal intermittent burn of crushed drums, general waste and liquid waste. The results are presented in Table 9.

Table 9 High Temperature Incinerator sulphur dioxide monitoring results 2015-2016

Date	Waste type	Total Sulphur Dioxide Concentration mg/m³	Total Sulphur Dioxide Emission rate kg/hr
27 May 2016	Crushed drums	8.9	0.0237
26 May 2016	General waste	2.0	0.0055
27 May 2016	Liquid waste	0.8	0.0022

Key: mg/m³ milligrams per cubic metre, adjusted to 0°C, 101.3 kilopascals pressure, 11% oxygen, and calculated as a dry gas
kg/h kilograms per hour

The results for sulphur dioxide monitoring performed showed that the mass emission rate ranged from 0.0022 to 0.0237 kg/hr. There is no limit with the consent on mass emission rate of sulphur dioxide.

2.2.4.5 Metals

Testing for metals was carried out on 24 to 26 May 2016. Two-hour samples were collected during a normal intermittent burn of crushed drums, general waste and liquid waste. The results are presented in Table 10.

Table 10 High Temperature Incinerator metals monitoring results 2015-2016

Metal	Discharge Concentration mg/m³		Emission rate g/hr	
	Range	Average	Range	Average
Aluminium	0.0126 – 0.0287	0.0181	0.0366 – 0.0734	0.0492
Antimony	0.0004 – 0.0112	0.0040	0.0011 – 0.0324	0.0117
Arsenic	0.0013 – 0.0021	0.0016	0.0038 – 0.0053	0.0045
Boron	0.0232 – 0.109	0.0654	0.0677 – 0.316	0.183

Metal	Discharge Concentration mg/m³		Emission rate g/hr	
	Range	Average	Range	Average
Cadmium	0.0001 – 0.0064	0.0022	0.0004 – 0.0186	0.0065
Chromium	0.0045 – 0.0084	0.0061	0.0132 – 0.0245	0.0170
Cobalt	<0.0002 – 0.0002	<0.0002	<0.0006 – 0.0006	<0.0006
Copper	0.0093 – 0.0211	0.0157	0.0238 – 0.0614	0.0446
Iron	0.0278 – 0.103	0.0693	0.0807 – 0.264	0.190
Lead	0.0021 – 0.0037	0.0028	0.0054 – 0.0106	0.0078
Lithium	0.0017 – 0.0022	0.0020	0.0043 – 0.0064	0.0056
Manganese	0.0009 – 0.0030	0.0022	0.0027 – 0.0086	0.0061
Mercury	<0.0004 – 0.0004	<0.0004	<0.0011 – 0.0013	<0.0012
Molybdenum	0.0018 – 0.0058	0.0033	0.0051 – 0.0169	0.0092
Nickel	0.0023 – 0.0027	0.0024	0.0066 – 0.0069	0.0067
Tin	0.0011 – 0.0021	0.0015	0.0028 – 0.0062	0.0043
Vanadium	<0.0016 – 0.0071	<0.0035	<0.0047 – 0.0182	<0.0093
Zinc	0.123 – 0.415	0.227	0.315 – 1.20	0.646

Key: mg/m³ milligrams per cubic metre, adjusted to 0°C, 101.3 kilopascals pressure, 11% oxygen, and calculated as a dry gas
g/hr grams per hour

These results are similar (where comparison is possible) to those found from the metals testing of incinerator emissions that was carried out in March 2013 as part of the assessment of environmental effects for the replacement of consent 4020-3. There is no limit on consent 4020-4 on mass emission rate of metals.

2.2.5 Community consultation

DAS was required by the conditions of the old air consent 4020-3 to hold a public meeting at least annually. There is no specific requirement under the new consent 4020-4 for community consultation, other than that the annual report required under condition 15 shall provide a description of any consultation undertaken and any views put forward by those consulted.

No community consultation was reported in the Air Discharge Annual Report that was produced for the 2015-2016 review period.

2.2.6 Technical review report

Special condition 18 on consent 4020-4 requires that:

No later than 30 April 2020 and every six years thereafter, the consent holder shall provide to the Chief Executive, Taranaki Regional Council, a written report which includes:

(a) A review of any relevant technological advances in the reduction or mitigation of discharge to air from the site activities, and the costs and benefits of these advances;

(b) A summary concluding which air discharge and treatment methods will be operated onsite and why; and

(c) A description of any significant changes in air quality assessment methodology since the previous reporting period (including computer modelling techniques and the associated dilution factors set out in Schedule 3) that are likely to materially affect the assessment of environmental effects of the activities authorised by this consent.

It is noted that the assessment of environmental effects that was undertaken in support of the application lodged in November 2013 for replacement of air discharge permit 4020-3 included a comprehensive review of technological advances relevant to the reduction or mitigation of discharges to air from the Paritutu site, and an assessment of issues relevant to the minimisation or mitigation of discharges to air from the site.

The first report under condition 18 is due by 30 April 2020.

2.3 Investigations, interventions, and incidents

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

The Council operates and maintains a register of all complaints or reported and discovered excursions from acceptable limits and practices, including non-compliance with consents, which may damage the environment. The 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 DAS's conditions in resource consents or provisions in Regional Plans.

3. Discussion

3.1 Discussion of site performance

In general, from the inspections of the site and from discussions held with staff, Council officers have concluded that DAS has a comprehensive, carefully documented and well considered approach to all areas of environmental performance. This included written methods for process management and technical control, documentation of processes and emissions, a self monitoring programme implemented by DAS and regular provision of information to the Council. Staff are assigned particular areas of responsibility, so that familiarity and experience are gained. All major air emissions sources have appropriate treatment systems and in most cases general building ventilation is also extracted through similar treatment systems.

One process change was made in 2015-2016 with esterification of 2,4-dichlorophenoxyacetic acid (2,4-D) discontinued. 2,4-D ester will be imported directly in 2016-2017. Two new products were introduced to the site; Conserve PluS Grain Protector and Penoxsulam 240 g/L SC Herbicide.

The Air Discharge Management and Monitoring Plan (ADMMP) required under the air consent was changed slightly after consultation with Council.

Upon application of the "process for relating stack concentrations to air quality limits" as prescibed in Schedule 3 to the new air consent 4020-4, the discharge of contaminants to air was found to be controlled so that ground-level concentrations off-site did not exceed the relevant air quality limits.

The annual report on air emission monitoring was produced as required under consent 4020-4. Compliance with the consent conditions was demonstrated.

The annual report on stormwater discharge monitoring was produced as required under consent 4108-2. Compliance with the consent conditions was demonstrated.

The annual groundwater management report was produced as agreed in the Site Groundwater Management Plan. All groundwater samples from the perimeter wells were found to be significantly below the contaminant action levels.

3.2 Environmental effects of exercise of consents

Environmental investigations, including biomonitoring of the Herekawe Stream, found no cause for concern over the effects of the discharge of stormwater from the site, or from groundwater from beneath the site.

3.3 Environmental effects of exercise of air discharge permit

The results of emission testing on various plant processes indicate that there is no potential health effect from the primary contaminants discharged from the site, according to recognised guidelines.

3.4 Environmental effects of groundwater movement

Monitoring of groundwater quality beneath the site has confirmed modelling that predicts that historical groundwater contamination at two points beneath the site would not result in any off-site effects, nor detection at the limits of detection used by DAS for its routine monitoring.

3.5 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Tables 11 and 12.

Table 11 Summary of performance for Consent 4108-2

Purpose: ***To discharge stormwater from an industrial agrichemical manufacturing site via retention dams together with uncontaminated stormwater from landscape and non-manufacturing areas into the Herekawe Stream***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Adopt best practicable option	Checking that standard operating procedures to achieve compliance with consent conditions are followed	Yes
2. Stormwater catchment area not to be exceeded	Inspections of plant site	Yes
3. Provision of stormwater management plan	Revised plan received 14 November 2014 and approved by Council	Yes
4. Keeping of discharge records	Inspection by Council and annual report by DAS, received in September 2016	Yes
5. Controls on effect of discharge in receiving water	Inspections, chemical sampling and biomonitoring	Yes
6. Concentration limits upon potential contaminants in discharge	Chemical sampling by DAS with validation by Council	Yes
7. Optional review of consent	Next review date June 2020	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent Overall assessment of administrative performance in respect of this consent		**High** **High**

N/A = not applicable

Table 12 Summary of performance for Consent 4020-4

Purpose: ***To discharge contaminants to air from all activities associated with the current and future operation of an agrichemical formulation and packaging plant***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Maintenance and operation of emission control equipment	Monitoring of activity as necessary by Council Officers and review of the ADMMP required by condition 11	Yes
2. Prohibition of offensive odour or dust beyond boundary	Monitoring of activity as necessary by qualified Council officers	Yes
3. Limits on contaminants, other than from incinerator, beyond site	Testing as detailed in ADMMP	Yes

Purpose: ***To discharge contaminants to air from all activities associated with the current and future operation of an agrichemical formulation and packaging plant***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
4. Limit on specific incinerator emission components concentration	Testing as detailed in ADMMP	Yes
5. Limit on specific incinerator emission components mass discharge rate	Testing as detailed in ADMMP	Yes
6. No incineration of certain materials	Inspection by Council, monitoring and recording of processes by DAS	Yes
7. Incinerator monitoring record keeping	Inspection by Council and Annual Report by DAS	Yes
8. Incinerator oxygen concentration	Continuous monitoring by DAS	Yes
9. Incinerator secondary chamber temperature	Continuous monitoring by DAS	Yes
10. Incinerator exhaust gas temperature	Continuous monitoring by DAS	Yes
11. Air Discharge Management and Monitoring Plan	Plan updated March 2016	Yes
12. Maintenance of Chemical Materials Register for current use	Review of records received by Council	Yes
13. Introduction of new items to Chemical Materials Register	Data sheets received	Yes
14. Air monitoring and triggers	No action required	Yes
15. Annual report on monitoring results, process change, and consultation	Report received September 2016	Yes
16. Six-yearly report on technological advances in emission reduction	Due April 2020	N/A
17. Optional review of consent	Next review date June 2020	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent Overall assessment of administration performance in respect of this consent		**High** **High**

During the year, DAS demonstrated an overall high level of both environmental performance and administrative compliance with the resource consents as defined in Section 1.1.4.

3.6 Recommendations from the 2014-2015 Annual Report

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

1. THAT monitoring of air emissions from Dow AgroSciences in the 2015-2016 year continue at the same level as the amended programme in 2014-2015.
2. THAT monitoring of water discharges from Dow AgroSciences in the 2015-2016 year continue at the same level as in 2014-2015.

These recommendations were implemented during 2015-2016.

3.7 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 is changed slightly, by updating the air monitoring requirements to reflect the recent changes to the stack emissions monitoring plan, and removing the annual glyphosate testing of stormwater as glyphosate products are no longer handled at the Paritutu Road plant.

3.8 Exercise of optional review of consent

Neither of the consents held for operation of the DAS plant provides for an optional review of the consent in June 2017.

4. Recommendation

1. THAT monitoring of consented activities at the DAS Paritutu Road plant in the 2016-2017 year is altered slightly from 2015-2016, by updating the air monitoring requirements to reflect the recent changes to the stack emissions monitoring plan, and removing the annual glyphosate testing of stormwater.

Glossary of common terms and abbreviations

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

2,4-D	2,4 di-chloro-phenoxy-acetic acid, a herbicide.
2,4-DB	2,4 di-chloro-phenoxy-butanoic acid, a herbicide.
2,4,5-T	2,4,5 tri-chloro-phenoxy-acetic acid, a herbicide.
AEE	Assessment of environmental effects.
ADMMP	Air Discharge Management and Monitoring Plan.
Biomonitoring	Assessing the health of the environment using aquatic organisms.
Bund	A wall around a tank to contain its contents in case of a leak.
Condy	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20˚C and expressed in mS/m.
DMA	Dimethylamine.
DMEA	Dimethylethanolamine.
Dioxins	See PCDD.
g/m^3	Grams per cubic metre, and equivalent to milligrammes per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
IPA	Isopropylamine.
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 lest 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.
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.
MCPA	Methyl-chloro-phenoxy-acetic acid, a herbicide.
MCPB	Methyl-chloro-phenoxy-butanoic acid, a herbicide.
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.
ng/m^3	Nanograms per cubic metre.
NPWWTP	New Plymouth Wastewater Treatment Plant.
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water.
PCDD	Polychlorinated dibenzo-para-dioxins, a contaminant of phenoxy herbicides.
PCDF	Polychlorinated dibenzofurans, a contaminant of phenoxy herbicides.

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 pH of 5.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections (9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	*Resource Management Act 1991* and including all subsequent amendments.
SQMCI	Semi-quantitative macroinvertebrate community index.
TCP	Trichlorophenol.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.
$\mu g/m^3$	Micrograms per cubic metre.

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

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Appendix I

Resource consents held by Dow AgroSciences (NZ) Limited

(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:	Dow AgroSciences (NZ) Limited Private Bag 2017 New Plymouth 4342
Decision Date:	14 October 2014
Commencement Date:	05 November 2014

Conditions of Consent

Consent Granted:	To discharge contaminants to air from all activities associated with the current and future operation of an agrichemical formulation and packaging plant
Expiry Date:	01 June 2044
Review Date(s):	June 2020, June 2026, June 2032, June 2038 and in accordance with special condition 17
Site Location:	89 Paritutu Road, New Plymouth
Legal Description:	Lot 3 DP 8465 Lot 1 DP 9022 Lots 1 & 2 DP9829 Lot 1 DP10018 (Discharge source & site)
Grid Reference (NZTM)	1688529E-5675602N

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

General condition

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

Special conditions

1. The consent holder shall ensure that all emissions control equipment, including but not limited to that referred to in condition 16(b) is maintained and operated effectively and efficiently at all times.

2. The discharges authorised by this consent shall not give rise to any odour, or dust emissions, at or beyond the boundary of the site that is offensive or objectionable.

3. The discharge of contaminants to air, other than from the High Temperature Incinerator Stack (see conditions 4 and 5) shall be controlled to ensure that the maximum ground-level concentrations off-site do not exceed:

   (a) Subject to condition 3(b),the relevant air quality limits listed in Schedule 1 of this consent and assessed using the process set out in Schedule 3; and

   (b) In the case of emissions due to raw materials or formulations introduced to the site after this consent commences, limits developed in accordance with the approach set out in Schedule 2 and assessed using the process set out in Schedule 3.

   See Advice Notes 1 and 2.

4. The total concentration of polychlorinated dibenzodioxins and polychlorinated dibenzofurans in any discharge from the High Temperature Incinerator Stack shall not exceed 0.1 nanograms per cubic metre (adjusted to 0 degrees Celsius, dry gas basis, 101.3 kPa pressure and 11% oxygen) when calculated as total toxic equivalents using the World Health Organization 2005 toxic equivalence factors.

   See Advice Notes 1 and 3.

5. The rate of discharge of total halides from the High Temperature Incinerator stack shall not exceed 1.5 kg/hour.

   See Advice Note 1.

6. There shall be no incineration of plastics and packaging that contain brominated flame retardants.

7. The consent holder shall record, and make available to the Chief Executive, Taranaki Regional Council upon request:

   a) the carbon monoxide concentration within or at the exit from the secondary combustion chamber;
   b) the feedstock type and loading rate;
   c) operating times; and
   d) the prevailing weather conditions

   for each incinerator burn. Records shall be retained for a period of six months.

8. The oxygen concentration within the secondary combustion chamber of the incinerator shall be maintained between 6% and 9% (by volume) as far as is practicable, and shall not be less than 4.5% (by volume), for more than 60 seconds at any time during the incineration of material during any 24-hour period.

9. The temperature in the secondary chamber of the High Temperature Incinerator shall not be less than 1100 degrees Celsius at any time during the incineration of waste.

10. The temperature of the exhaust gas from the High Temperature Incinerator shall not be less than 1000 degrees Celsius at any time during the incineration of waste.

11. Within three months of the date of commencement of consent, and at intervals not exceeding three years thereafter, the consent holder shall prepare and provide to the Chief Executive, Taranaki Regional Council and the Medical Officer of Health for Taranaki, for comment, a draft Air Discharge Management and Monitoring Plan ("ADMMP") for the site. The ADMMP shall be finalised and submitted to the Chief Executive, Taranaki Regional Council within a further three months. The ADMMP shall be to the satisfaction of the Chief Executive of the Taranaki Regional Council, acting in a technical certification capacity, and shall detail the management and monitoring of air discharges on the site and procedures and methodologies to ensure consent compliance. As a minimum, the ADMMP shall include:

    (a) A summary of the on-site air discharge activities and the nature of the discharges to air from each source on-site;

    (b) A description of how compliance with the conditions of this consent will be achieved;

    (c) A description of the air quality control measures and equipment, and maintenance programme in place for each of the air treatment systems used on-site, including specifically the systems used in the:
        - Commodity Herbicides Plant;
        - Herbicides Plant;
        - Granular Herbicides Plant;
        - Insecticides Plant;
        - High Temperature Incinerator Stack and Building;
        - Raw Material Storage Warehouse;
        - Product Development Laboratory;
        - Bulk Storage Tanks;
        - Natural gas-fired boiler; and
        - Any other air discharge sources on-site.

    (d) Descriptions of the site operating requirements related to the air discharge activities on-site, including:
        - Operating procedures;
        - Monitoring and supervision procedures including any performance indicators ; and
        - Waste processing and discharge logs.

(e) A description of the High Temperature Incinerator operational record-keeping and reporting procedures and requirements including:

- Feedstock type and loading rate, operating times and the prevailing weather conditions for each incinerator burn;
- Continuous monitoring of oxygen, carbon monoxide and temperature;
- Limits on the oxygen concentration at the outlet of the secondary combustion chamber; and
- limits on the halogen content of the feedstock;

(f) A description of the management procedures for the Product Development Laboratory, including management of the air treatment system, to minimise discharges to air to the extent practicable;

(g) A description of any additional air quality limits determined in accordance with condition 3(b);

(h) The consent holder's Air Monitoring Programme including, as a minimum:

- Identification of the contaminants and compounds being monitored;
- A description of the methodology for the air monitoring programme;
- Monitoring locations and frequency; and
- A description of how compliance with consent conditions will be demonstrated.

(i) A description of the Odour Register for the site, which is used to record any observations of odour (both on-site and off-site), the findings of any investigations, and any recommendations that arise; and

(j) A 'Contingency Plan' detailing measures and procedures to be undertaken to avoid or mitigate the adverse environmental effects of any spillage or discharge of contaminants not authorised by this consent. The Contingency Plan shall include the requirement that the Medical Officer of Health for Taranaki be notified as soon as practicable following any contingency event occurring that is likely to adversely affect human health beyond the boundary of the site.

12. At all times the consent holder shall maintain:

(a) A Chemical Materials Register containing details of all of the chemicals or product formulations currently received, prepared, stored, mixed or otherwise processed on-site; and

(b) The Safety Data Sheet, toxicology information and environmental fate information for each chemical and product listed in the Chemical Materials Register; and

(c) Details of the assessments and resulting air quality limits determined in accordance with condition 3(b).

The information required by this condition shall be retained and be made available to the Chief Executive, Taranaki Regional Council upon request.

13. Before any new chemicals or product formulations are introduced to the site for purposes other than research or development, they shall be added to the Chemical Materials Register.

14. For any air monitoring undertaken, the following actions apply:

    (a) If a measured air quality parameter would result, or has resulted in air quality that is 25% or less of the relevant limit referred to in condition 3, then no action is required;

    (b) If the measured air quality parameter would result, or has resulted in air quality that is more than 25% and less than or equal to 50% of the relevant limit referred to in condition 3, the consent holder shall notify the Chief Executive, Taranaki Regional Council within three working days of receipt of the monitoring results;

    (c) If the measured air quality parameter would result, or has resulted in air quality that is more than 50% and less than or equal to 100% of the relevant limit referred to in condition 3, the consent holder shall notify the Chief Executive, Taranaki Regional Council immediately upon receipt of the monitoring results, and investigate, and where appropriate remedy, the cause of the decrease in discharge quality. The consent holder shall notify the Chief Executive, Taranaki Regional Council of the outcomes of any investigations and subsequent actions, within 10 working days of receipt of the monitoring results; and

    (d) If the measured air quality parameter would result, or has resulted in air quality that is greater than 100% of the relevant limit referred to in condition 3, the consent holder shall immediately cease the discharge activity and notify the Chief Executive, Taranaki Regional Council upon receipt of the monitoring results. The consent holder shall then investigate the cause of the decrease in discharge quality, and remedy the cause of the exceedance prior to any recommencement of the discharge activity. A summary report shall be provided to the Chief Executive, Taranaki Regional Council within 10 working days of the original notification.

15. Before 30 September each year the consent holder shall provide to the Chief Executive, Taranaki Regional Council the following information for the 12 month period ending on the previous 30 June:

    (a) The results of all air quality monitoring that the consent holder has undertaken under the Air Monitoring Programme in accordance with condition 11(h);

    (a) A description of any process changes or changes to emission control technology that have been implemented at the site; and

    (c) A description of any consultation undertaken and any views put forward by those consulted.

16. No later than 30 April 2020 and every six years thereafter, the consent holder shall provide to the Chief Executive, Taranaki Regional Council, a written report which includes:

    (a) A review of any relevant technological advances in the reduction or mitigation of discharges to air from the site activities, and the costs and benefits of these advances;

    (b) A summary concluding which air discharge and treatment methods will be operated on-site and why; and

    (c) A description of any significant changes in air quality assessment methodology since the previous reporting period (including computer modelling techniques and the associated dilution factors set out in Schedule 3) that are likely to materially affect the assessment of environmental effects of the activities authorised by this consent.

17. In accordance with section 128 and 129 of the Resource Management Act 1991, the Chief Executive, 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 2020 and/or June 2026, and/or June 2032, and/or June 2038 for the purpose of ensuring that the conditions are adequate to avoid, remedy or mitigate 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 that time; and

    (b) Within three months of receiving any report provided pursuant to condition 16 to direct the consent holder to adopt the best practicable option to remove or reduce any adverse effect on the environment.

Signed at Stratford on 14 October 2014

For and on behalf of
Taranaki Regional Council

_____

A D McLay
Director - Resource Management

Advice Notes

1. Compliance with the limits in conditions 3, 4, and 5 shall be demonstrated by monitoring, or, as described in the ADMMP, by the use of air emission technology that has been designed to ensure any discharge meets those limits.

2. The methodology used for relating stack concentrations to air quality limits shall be determined in accordance with the process provided for in Schedule 3 of this consent.

3. If any monitoring is undertaken to assess compliance with condition 4, compliance shall be determined based on the average of not less than 3 samples, each of which shall be taken while the incinerator is fed on different waste types.

SCHEDULE 1: Air quality limits applying beyond the boundary of the site

The air quality limits for the one hour and the 24-hour average will apply at any location beyond the site boundary. The air quality limits for the annual average will apply at any land on which any residential activity (excluding any temporary or transient residential activity) is established.

Agrichemical actives

Substance	Air quality limit (annual average)
2,4-D acid, esters and salts	2 µg/m^3
2,4-DB acid and salts	4 µg/m^3
aminopyralid acid and amine salts	10 µg/m^3
Buprofezin	2 µg/m^3
Chlorpyrifos	0.57 µg/m^3
chlorpyrifos-methyl	1.9 µg/m^3
clopyralid acid and amine salts	30 µg/m^3
cyhalofop-butyl	0.6 µg/m^3
dicamba acid and amine salts	57 µg/m^3
Fenpyroximate	2 µg/m^3
Florasulam	10 µg/m^3
fluroxypyr, methylheptyl ester	153 µg/m^3
glyphosate acid and amine salts	191 µg/m^3
haloxyfop-R methyl ester	0.06 µg/m^3
lambda cyhalothrin	3.7 µg/m^3

MCPA acid, esters and salts	10 µg/m^3
MCPB acid and salts	2 µg/m^3
(s)-methoprene	10 µg/m^3
methoxyfenozide	19 µg/m^3
myclobutanil	6 µg/m^3
Oxyfluorfen	0.6 µg/m^3
picloram acid, esters and salts	57 µg/m^3
Quinoxyfen	38 µg/m^3
Spinetoram	6 µg/m^3
Spinosad	4 µg/m^3
Sulfoxaflor	6 µg/m^3
triclopyr, ester and amine salt	6 µg/m^3

Note: most of the toxicity data makes no distinction between the individual substances and their esters, amines, or salt forms. The air quality limit specified is a total, inclusive of all forms of the active.

Other compounds

Substance	Air quality limit	Averaging period
Benzene	3.6 µg/m^3	Annual
2,4-dichlorophenol	0.6 µg/m^3	Annual
2-ethyl hexanol	160 µg/m^3	Annual
Diethanolamine	3 µg/m^3	Annual
diethylene glycol monoethyl ether	27 µg/m^3	Annual
Dimethylamine	9 µg/m^3	Annual
dimethylethanolamine	50 µg/m^3	Annual
dipropylene glycol monomethyl ether	310 µg/m^3	Annual
EDTA	5 µg/m^3 120 µg/m^3	Annual 24-hour
Ethylbenzene	570 µg/m^3 1,000 µg/m^3	Annual 24-hour
Isopropylamine	12 µg/m^3	Annual
Monoethanolamine	7.5 µg/m^3	Annual
Naphthalene	3 µg/m^3	Annual
N-methyl-2-pyrrolidone	100 µg/m^3	Annual
propylene glycol	120 µg/m^3	24-hour
sodium bicarbonate	5 µg/m^3	Annual

Substance	Air quality limit	Averaging period
sodium hydroxide	2 µg/m^3	Annual
triethanolamine	5 µg/m^3	Annual
1,2,4-trimethylbenzene	20 µg/m^3	Annual
toluene (as a component in some distillate solvents)	5000 µg/m^3	Annual
triisopropanolamine	40 µg/m^3	Annual
xylene (as a component in some distillate solvents)	870 µg/m^3	Annual

SCHEDULE 2: Process for developing air quality limits for emissions associated with new raw materials or formulations.

The air quality limit for any particular contaminant shall be determined in accordance with the hierarchy set out in the Good Practice Guide (GPG) for Assessing Discharges to Air from Industry (Ministry for the Environment, June 2008), or another hierarchy as may be specified in the ADMMP.

In the event that no recognised air quality criteria (as described in the GPG) are available, a limit will be developed by calculating the air concentration that would give rise to an exposure equivalent to one tenth of the Acceptable Daily Intake (or equivalent) set by the New Zealand Environmental Protection Agency, Joint FAO/WHO Meeting on Pesticide Residues (JMPR) or European Commission. This procedure is described in Appendices E5 and E8, Dow AgroSciences (NZ) Ltd: Technical Air Quality Assessment - Discharges to Air – Paritutu Road Site, New Plymouth, Volume 2, prepared by Graham Environmental Consulting Ltd and Tonkin & Taylor Ltd, 31 October 2013.

The air quality limits for the one hour and the 24-hour average will apply at any location beyond the site boundary. The air quality limits for the annual average will apply at land on which any residential activity (excluding any temporary or transient residential activity) is established.

SCHEDULE 3: Process for relating stack concentrations to air quality limits.

Assessment of compliance with the air quality limits in Schedule 1 and those determined in accordance with Schedule 2 can be achieved based on actual or potential stack emissions, by using the following formula:

Maximum stack concentration ($\mu g/m^3$) = air quality limit ($\mu g/m^3$) x Dilution Factor

Where:

a) The stack concentration of any particular contaminant may be measured by stack emission testing or estimated based on the measured stack concentration of another representative contaminant and corrected for differences in molecular weight and vapour pressure; and

b) The Dilution Factor is taken from:

i. the following table for the averaging period specified for the relevant air quality criterion; or

ii. where the relevant averaging period is annual average and a residential activity (excluding any temporary or transient residential activity) has established within the hatched area shown on Figure 1 attached, the results of an atmospheric dispersion modelling study carried out to a similar standard as that provided with the application.

Where multiple sources of an individual contaminant are involved, individual stack concentrations for that contaminant will be determined to ensure that the air quality limit is complied with on a cumulative basis.

Plant stack	Dilution Factor		
	1-hour average	24-hour average	Annual average
Commodity Herbicides	750	1,300	29,000
Herbicides	550	1,150	107,000
Granular Herbicides	1,300	2,400	432,000
Insecticides – Emulsifiable Concentrates	700	1,250	232,000
Insecticides – Suspension Concentrates	1,500	2,750	513,000

SCALE 1: 5000
0 50 100 150 200 250 (m)

Aerial photo sourced from Google Earth(Copyright: 2009). Images Copyright; Image @ 2013 DigitalGlobe. Flown 23/02/2013.

Property boundaries sourced from Land Information New Zealand data as at 8-Jul-2013 (Crown Copyright Reserved).

Tonkin & Taylor
Environmental and Engineering Consultants
105 Carlton Gore Road, Newmarket, Auckland

DRAWN	RBS	Aug 14
DRAFTING CHECKED		
APPROVED		
CADFILE: 85 199.200-ADP-F1.dwg		
SCALES (AT A4 SIZE): 1: 5000		
PROJECT No. 85 199.200		

DOW AGROSCIENCES (NZ) LTD
AIR DISCHARGE PERMIT
PARITUTU, NEW PLYMOUTH
Site Plan

FIG. No. Figure 1
REV. 0

Discharge Permit

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

Name of Consent Holder:	Dow AgroSciences (NZ) Limited Private Bag 2017 NEW PLYMOUTH
Consent Granted Date:	4 September 2008

Conditions of Consent

Consent Granted:	To discharge stormwater from an industrial agrichemical manufacturing site via retention dams together with uncontaminated stormwater from landscape and non-manufacturing areas into the Herekawe Stream at or about (NZTM) 1688226E-5675009N
Expiry Date:	1 June 2026
Review Date(s):	June 2014, June 2020
Site Location:	89 Paritutu Road, New Plymouth
Site Legal Description:	Lot 3 DP 8465 Lot 1 DP 9022 Lots 1 & 2 DP 9829 Lot 1 DP 10018
Catchment:	Herekawe

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 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 collected from a catchment area of no more than 16 hectares.

3. The consent holder shall maintain, and comply with at all times, a stormwater management plan, approved by the Chief Executive, Taranaki Regional Council, detailing measures and procedures to be undertaken to prevent spillage or accidental discharge of contaminants not licensed by this consent, and measures to avoid, remedy or mitigate the environmental effects of such a discharge.

4. The consent holder shall keep records of the date and time that the stormwater discharges begin and end, the volume of water discharged, and the results of all physicochemical testing carried out on water discharged to the Herekawe Stream. These records shall be made available to the Chief Executive, Taranaki Regional Council, upon request.

5. After allowing for a mixing zone of 25 metres from the point of discharge, the discharge shall not give rise to any of the following effects in the Herekawe 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) any significant adverse effects on aquatic life.

6. Concentrations of the following components shall not be exceeded in the discharge:

Component	**Concentration**
Total phenoxy herbicides [2,4-D, MCPA and MCPB]	0.10 mg/L
Total organophosphates [chlorpyrifos and chlorpyrifos-methyl]	0.0005 mg/L
Triclopyr 0.10	mg/L
Picloram 0.10	mg/L
Glyphosate	0.10 mg/L
Oxyfluorfen	0.005 mg/L
pH [range]	6.0 – 9.0

This condition shall apply prior to the entry of the stormwater into the Herekawe Stream, at designated sampling points approved by the Chief Executive, Taranaki Regional Council.

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 2014 and/or June 2020, 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 4 September 2008

For and on behalf of
Taranaki Regional Council

_____

Director-Resource Management

Appendix II

List of 255 pesticide residues analysed for in DAS stormwater

GC/MS MULTI RESIDUE METHOD (FWA-02)

The sample is extracted and further purified using gel permeation chromatography. Measurement is performed using gas chromatography - mass spectrometry.

Specific Residues reportable and MOLs can be matrix dependent.
MDL Method Detection Limit

No	COMPOUND	MDL (mg/kg)
1	acetochlor	0.001
2	alachlor	0.001
3	aldrin	0.001
4	allidochlor	0.001
5	ametryn	0.001
6	anilotos	0.001
7	atrazine	0.001
8	azaconazole	0.001
9	azinphos-methyl	0.005
10	azoxystrobin	0.001
11	benalaxyl	0.001
12	bendiocarb	0.001
13	benfluralin	0.001
14	benodanil	0.001
15	benoxacor	0.001
16	BHC-alpha	0.001
17	BHC-beta	0.001
18	BHC-delta	0.001
19	BHC-gamma (lindane)	0.001
20	bifenox	0 005
21	biferahrin	0.001
22	bioresmethrin	0001
23	bitedanol	0.001
24	bromacil	0.005
25	bromobutide	0.001
26	bromophos-ethyl	0.001
27	bromophos-methyl	0.001
28	bromopropylate	0.001
29	bupinmate	0.001
30	buprofezin	0.001
31	butachlor	0.001
32	butafenacil	0.001
33	butamifos	0.001
34	cadusafos	0.001
35	carbaryl	0.005
36	carbofuran	0.001
37	carboxin	0.001
38	carfentrazone-ethyl	0.001
39	chlordane-cis	0.001
40	chlordane-trans	0.001
41	chlorienapyr	0.001
42	chlorlenvinphos	0.001
43	chlorobenzilate	0.001
44	chlorothalonil	0.001
45	chtorpropham	0.001
46	chlorpyrifos	0.001
47	chlorpyrifos-methyl	0.001
48	chlorthal-dimethyl	0.001
49	chtozolinate	0.001
50	clodinafop-propargyl	0.001
51	clomazone	0.001
52	cloquintocet-1 anethylhexyl	0.001
53	cournaphos	0.001
54	cyanazine	0.001
55	cyanophos	0.001
56	cyflufenamid	0.001
57	cyfluthrin	0.005
58	cyhalofop-butyl	0.001
59	cyhalothrin	0.001
60	cypermethrin	0.005
61	cyproconazole	0.001
62	cyprodinil	0.001
63	DDD (o,p')	0.001
64	DDD (p,p')	0.001
65	DDE (o,p')	0.001
66	DDE (p,p')	0.001
67	DDT (o,p')	0.001
68	DDT (p,p')	0.005
69	deltamethrin	0.005
70	demeton-S-methyl	0.001
71	diazinon	0.001
72	dichlobenil	0.001
73	dichlofenthion	0.001
74	dichlofluanid	0.001
75	dichloran	0.001
76	dicofol	0.001
77	dichlorvos	0.001
78	diclobutrazol	0.001
79	diclofop-methyl	0.001
80	dieldrin	0.001
81	diethofencarb	0.001
82	difenoconazole	0.001
83	diflufenican	0.001
84	dimepiperate	0.001
85	dimethenamid	0.001
86	dimethoate	0.005
87	dimethomorph	0.001
88	dimethylvinphos	0.001
89	dioxabenzofos	0.001
90	diphenamid	0.001
91	diphenylamine	0.001
92	disulfoton	0.001
93	daltiopyr	0.001
94	edifenphos	0.001
95	endosulfan sulphate	0.001
96	endosulfan (alpha)	0.001
97	endosulfan (beta)	0.005
98	endrin	0.001
99	EPN	0.005
100	epoxiconazole	0.001
101	EPTC	0.001
102	esprocarb	0.001
103	ethalfluralin	0.001
104	ethiofencarb	0.001
105	ethion	0.001
106	ethoprophos	0.001
107	etoxazole	0.001
108	etridiazole	0.001
109	etrimfos	0.001
110	famphur	0.001
111	fenamiphos	0.001
112	fenarimol	0.001
113	fenchlorphos	0.001
114	fenitrothion	0 005
115	fenobucarb	0.001
116	fenoxanil	0.001
117	fenoxaprop-ethyl	0.001
118	fenoxycarb	0.001
119	fenpropathrin	0.001
122	fenpropimorph	0.001
121	fensulfothion	0.001
122	fenthion	0.001
123	fenvalerate	0.001
124	fipronil	0.001
125	flamprop-methyl	0.001
126	fluacrypyrim	0.001
127	fluazifop-P-butyl	0.005
128	fluazinam	
129	flumiclorac-pentyl	0.001
130	flumioxazin	0.001
131	fluquinconazole	0.001
132	flusilazole	0.001
133	flutolanil	0.001
134	flutriafol	0.001
135	fluvalinate	0.001
136	fonotos	0.001
137	fosthiazate	0.001
138	furalaxyl	0.001
139	furathiocarb	0.001
140	haloxyfop-e1otyl	0.001
141	haloxyfop-methyl	0.001
142	heptachlor	0.001
143	heptachlor-endo-epoxide	0.005
144	heptachlor-exo-epoxide	0.001
145	heptenophos	0.005
146	hexachlorobenzene	0.001
147	hexaconazote	0.001
148	hexazinone	0.001
149	indoxacarb	0.001
150	iodofenphos	0.001
151	iprobenfos	0.001
152	iprodione	0.001
153	iprovalicarb	0.001
154	isazofos	0.001
155	isofenphos	0.001
156	isoprocarb	0.001
157	isoprothiolane	0.001
158	kresoxim-methyl	0.001
159	lactofen	0.001
160	leptophos	0.001
161	malathion	0.001
162	mepronil	0.001
163	metalaxyl	0.001
164	methacrifos	0.001
165	methidathion	0.001
166	methiocarb	0.001
167	metolachlor	0.001
168	mevinphos	0.001
169	molinate	0.001
170	myclobulanil	0.005
171	napropamide	0.001
172	nitrofen	0.001
173	nitrothal-isopropyl	0.001
174	norflurazon	0.005
175	oxadiazon	0.001
176	oxadixyl	0.001
177	oxyfluorfen	0.001
178	paclobutrazol	0.001
179	parathion	0.001
180	parathion-methyl	0.001
181	penconazole	0.001
182	pendimethalin	0.001
183	permethrin	0.005
184	phenthoate	0.001
185	phorate	0.001
186	phorate-sulphone	0.001
187	phorate-sulphoxide	0.001
188	phosalone	0.001
189	phosmet	0.001
190	phosphamidon	0.001
191	picolinafen	0.001
192	piperonyl butoxide	0,001
193	piperophos	0.001
194	pirimicarb	0.001
195	pirimiphos-methyl	0.001
196	pretilachlor	0.001
197	prochloraz	0.001
198	procymidone	0.001
199	profenofos	0.001
200	promecarb	0.001
201	prometryn	0.001
202	propachlor	0.001
203	propergite	0.001
204	propazine	0.001
205	propetamphos	0.001
206	propham	0.001
207	propiconazole	0.001
208	propoxur	0.001
209	propyzamide	0.005
210	prothiofos	0.001
211	pyraclostrobn	0.001
212	pyraflufen-ethyl	0.001
213	pyrazophos	0.001
214	pyributicarb	0.001
215	pyridaben	0.001
216	pyridaphenthion	0.001
217	pyrimethanil	0.001
218	pyrimidifen	0.001
219	pyriminobac-methyl(E)	0.001
220	pyriminobac-methyl(Z)	0.001
221	pyriproxyfen	0.001
222	quinalphos	0.005
223	quinoxyfen	0.001
224	quintozene	0.001
225	quizalofop-ethyl	0.001
226	simazine	0.001
227	simeconazole	0.001
228	simettyn	0.001
229	tebuconazole	0.001
230	tebufenpyrad	0.001
231	tecnazene	0,001
232	tefluthrin	0.001
233	terbacil	0.001
234	terbufos	0.001
235	terbuthylazine	0.001
236	terbutryne	0.001
237	tetrachlorvinphos	0.001
238	tetraconazole	0.001
239	tetradifon	0.001
240	thenylchlor	0.001
241	thiobencarb	0.001
242	thiometon	0.001
243	tolclofos-methyl	0.001
244	tolyfluanid	0.001
245	tralkozychm	0.005
246	triadimefon	0.001
247	triadimenol	0.001
248	triallate	0.001
249	triazophos	0.001
250	tribufos	0.001
251	trifloxystrobin	0.001
252	trifluralin	0.001
253	uniconizole-P	0.001
254	vinclozolin	0.001
255	XMC	0.001

Appendix III

DAS Annual Stormwater Report
2015-2016

Dow AgroSciences

Stormwater Discharge Report

1 July 2015 - 30 June 2016

Consent No. 41 08-2

29 August 2016

Table of Contents

Introduction

Discharge of stormwater from the Paritutu Site is subject to the conditions detailed in discharge permit 4108-2 issued by the Taranaki Regional Council.

In order to comply with these conditions, stormwater from the production plant, dangerous goods storage compound, despatch store, incinerator, and roads in these areas is directed to stormwater retention ponds. The water collected in these ponds is sampled and analysed before being released. The sampling, analysis and release procedures are outlined in standard operating procedures.

Drainage from process areas is segregated from non-process areas to reduce the potential for contamination of stormwater. Areas around storage tanks and process equipment, located outside buildings in the production area, are contained by bunding. This water is discharged to the site trade waste system.

Stormwater from the southern part of the site drains directly to the New Plymouth District Council stormwater drain and then to the Herekawe Stream. This part of the site is a predominantly open grassed area surrounding a parking area, two storage buildings, the closed Pilot Plant and the access road to the site. Specific controls for stormwater from the storage buildings and storage tank bunds are in place to direct stormwater to the trade waste system.

There are four stormwater retention ponds on the site:

i. Concrete stormwater retention pond: SV9100

Stormwater enters this system through a series of under/over separators and then discharges into SV9100. This pond collects water from the production plant and roads in this area.

ii. Concrete stormwater retention pond: SV9000

When SV9100 is full, the water overflows into SV9000. This pond collects water from the production plant and roads in this area.

iii. HDPE stormwater retention pond: SV9200

This pond collects stormwater from the incinerator and roads in this area. Stormwater in this pond is discharged through SV91 00 when it is empty.

iv. HDPE stormwater retention pond: SV8000

This pond collects stormwater from the despatch and dangerous goods areas and roads in this area.

Changes Made During The Year

Stormwater System Changes

Other than carrying out routine maintenance, no physical changes were made to the stormwater system during the period.

Consent Changes

No consent changes occurred during the reported period.

Monitoring & Discharge

Conditions

Performance Criteria

1) *Adopting best practicable option to prevent or minimise any adverse effects on the environment.*

2) *Stormwater discharge from catchment area of no more than 16 hectares.*

3) *Compliance with the storm water management plan (standard operating procedure) at all times.*

4) *Records of stormwater sampling, analysis and discharge shall be kept and made available for review by the Taranaki Regional Council.*

5) *After allowing for a mixing zone of 25 metres from the point of discharge, the discharge shall not give rise to any of the following effects on the Herekawe 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 any objectionable odour;
   d) any significant adverse effects on aquatic life.

6) *Discharge shall not exceed the following limits prior to the entry of storm water into the Herekawe Stream:*

Total phenoxy herbicides	*0.10 mg/L*
Total organophosphates	*0.0005 mg/L*
Triclopyr	*0.10 mg/L*
Picloram	*0.10 mg/L*
Glyphosate	*0.10 mg/L*
Oxyfluorfen	*0.005 mg/L*
pH	*6.0 - 9.0*

7 *The consent may be reviewed in 2014 and 2020.*

Monitoring

Stormwater collected in the four stormwater retention ponds is sampled and analysed before release to the Herekawe Stream.

In the rare event that stormwater does not meet the release criteria, the Company will identify the source of the contamination so corrective actions can be implemented to prevent a reoccurance. Prompt attention is given to the containment and clean-up of any spills/leaks on site.

If an incident occurs and impacts the standard management of the stormwater system the Company will discuss the specific details and obtain the any necessary approvals from the Taranaki Regional Council, before any action is taken. Water may be treated, or an alternative method of disposal identified such as, seeking approval from the New Plymouth District Council to pump to the site trade waste system.

Results

There were a total of 131 discharges from the stormwater retention ponds to the Herekawe Stream, during the monitoring period of 1 July 2015 to 30 June 2016.

On all occasions (100%) the conditions of the discharge consent were met, that is, there were no breaches of the consent conditions. For details refer to Appendix 1 attached to this report.

Biological Monitoring

Conditions

Performance Criteria

Discharge shall not cause an adverse biological impact on the receiving water.

Monitoring

The Taranaki Regional Council has undertaken regular biomonitoring of the Herekawe Stream to assess the impact stormwater discharges from industrial sites in the area have on the stream bed fauna and microflora. The surveys have been carried out at six monthly intervals since April 1986.

Three sites are sampled during each survey period:

1. *Upstream of Centennial Drive culvert and stormwater discharges;*
2. *Downstream of stormwater discharges and approximately 75m above the coast; and*
3. *Downstream of stormwater discharges and approximately 50m above the coast.*

Results

Results from the biological monitoring studies are held by the Taranaki Regional Council.

General

Stormwater Quality Inspections

Regular stormwater quality inspections, including collection of stormwater samples for interlaboratory testing, were undertaken by officers of the Taranaki Regional Council during 1 July 2015 to 30 June 2016.

Incident Review

During the monitoring year (1 July 2015 to 30 June 2016) there were zero incidents resulting in breaches of the discharge resource consent conditions.

Appendices

Appendix 1: Stormwater discharged to the Herekawe Stream (2015-1 6)

Appendix IV

Biomonitoring reports

To	Job Managers, Scott Cowperthwaite & Callum MacKenzie
From	Freshwater Biologist, CR Fowles
Doc No	1592680
Report No	CF646
Date	3 November 2015

Biomonitoring of the Herekawe Stream in relation to the Omata Tank Farm and other stormwater discharges, surveyed in October 2015

Introduction

This biological survey was the first of two scheduled for the Herekawe Stream in the 2015-2016 monitoring year to assess whether there had been any detrimental effects on the Herekawe Stream from stormwater discharges originating from STOS, DowAgro Sciences, Chevron, Origen Energy and NPDC. The previous survey (CF643) was performed in summer, 2015 as scheduled. The results from surveys performed since the 2001-02 monitoring year are discussed in reports referenced at the end of this report.

Methods

The standard '400 ml kick-net' technique was used to collect streambed macroinvertebrates at a 'control' site and another downstream site in the Herekawe Stream (Table 1, Figure 1) on 12 October 2015. The '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 Herekawe Stream in relation to stormwater discharges

Site No.	Site Code	GPS Reference	Location
1	HRK 000085	E1688283 N5674972	Upstream of Centennial Drive culvert and stormwater discharges
2	HRK 000094	E1688201 N5675010	Downstream of stormwater discharges, approx. 75 m above coast

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

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

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly `sensitive' taxa were assigned the highest scores of 9 or 10, while the most `tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. By averaging the scores obtained from a list of taxa taken from one site and multiplying by a scaling factor of 20, a Macroinvertebrate Community Index (MCI) value was obtained. The MCI is a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. More 'sensitive' taxa 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 & 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, ranging from 0 to 10 $SQMCI_s$ units.

Figure 1 Biomonitoring sites in the Herekawe Stream

Results

At the time of this mid morning survey, the water temperature in the Herekawe Stream was 15.2 ˚C at both of the sites. No stormwater discharges were occurring from the right bank or the left bank outfalls at the time of the survey. The channel at site 1 was narrow and constrained by gabion baskets on the banks and bed of the stream where the substrate was comprised mainly of sand, gravels, wood, and gabion-cobble material with some silt and boulders. The stream at this site had a low, clear, uncoloured, swift flow and there were thin periphyton mats, patchy filamentous algae, and leaves on the bed. No macrophytes were recorded at this partially shaded site on this occasion.

The substrate at site 2 was comprised mainly of sand, cobbles and boulders. The site can periodically be affected by salt water intrusion under extremely high tide and very low flow conditions. The clear, uncoloured, low flow at this site was shallower and much quicker moving than usual in the absence of log jams further downstream and due to some increase in the harder substrate components since the previous survey. There were no filamentous algae but thin periphyton mats noted on the harder substrate components of the bed during the survey. No aquatic macrophytes were recorded along the stream margins. The survey was performed nine days after a fresh in excess of 3 times median flow and 32 days after a fresh in excess of 7 times median flow in the catchment in accordance with Taranaki Regional Council biomonitoring fieldwork protocols.

Macroinvertebrates

A number of surveys have been performed previously at these two sites. Results of the current and past surveys are summarised in Table 2 and the results of the current survey presented in Table 3.

Table 2 Results of the current and previous surveys (since April 1986) performed at sites 1 and 2 in the Herekawe Stream in relation to the Omata Tank Farm and other stormwater discharges

Site	Number of previous surveys	Numbers of taxa			MCI values		
		Median	Range	12 Oct 2015	Median	Range	12 Oct 2015
1	59	18	11-29	23	87	68-99	100
2	59	15	9-22	19	72	54-96	97

Table 3 Macroinvertebrate fauna of the Herekawe Stream in relation to Omata Tank Farm and other stormwater discharges sampled on 12 October 2015

Taxa List	Site Number	MCI score	1	2
	Site Code		HRK000085	HRK000094
	Sample Number		FWB15265	FWB15266
ANNELIDA (WORMS)	Oligochaeta	1	C	C
MOLLUSCA	*Potamopyrgus*	4	VA	XA
CRUSTACEA	*Paracalliope*	5	C	C
	Paratya	3	R	-
EPHEMEROPTERA (MAYFLIES)	*Austroclima*	7	A	C
	Coloburiscus	7	C	R
	Deleatidium	8	R	-
	Zephlebia group	7	R	C
PLECOPTERA (STONEFLIES)	*Acroperla*	5	R	-
	Zelandobius	5	-	R
	Zelandoperla	8	-	R
COLEOPTERA (BEETLES)	Elmidae	6	R	R
	Ptilodactylidae	8	R	-
TRICHOPTERA (CADDISFLIES)	*Hydropsyche (Aoteapsyche)*	4	R	R
	Hydrobiosis	5	R	R
	Hydropsyche (Orthopsyche)	9	R	-
	Oxyethira	2	R	-
	Pycnocentria	7	R	C
	Pycnocentrodes	5	R	-
	Triplectides	5	-	R
DIPTERA (TRUE FLIES)	*Aphrophila*	5	C	R
	Eriopterini	5	R	-
	Maoridiamesa	3	-	R
	Orthocladiinae	2	A	VA
	Polypedilum	3	C	C
	Austrosimulium	3	C	C
	Tanyderidae	4	R	-
ACARINA (MITES)	Acarina	5	-	R
		No of taxa	23	19
		MCI	100	97
		SQMCIs	4.2	3.7
		EPT (taxa)	10	9
		%EPT (taxa)	43	47

'Tolerant' taxa | 'Moderately sensitive' taxa | 'Highly sensitive' taxa

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

Site 1 (upstream of stormwater discharges)

A moderate richness of 23 taxa was recorded at this site, which was five taxa more than the median number of taxa from previous surveys at this site (Table 2) but above richnesses typically found in the lower reaches of small coastal streams elsewhere in Taranaki (TRC, 2015a). However, 14 of these taxa were present only as rarities (less than five individuals per taxon).

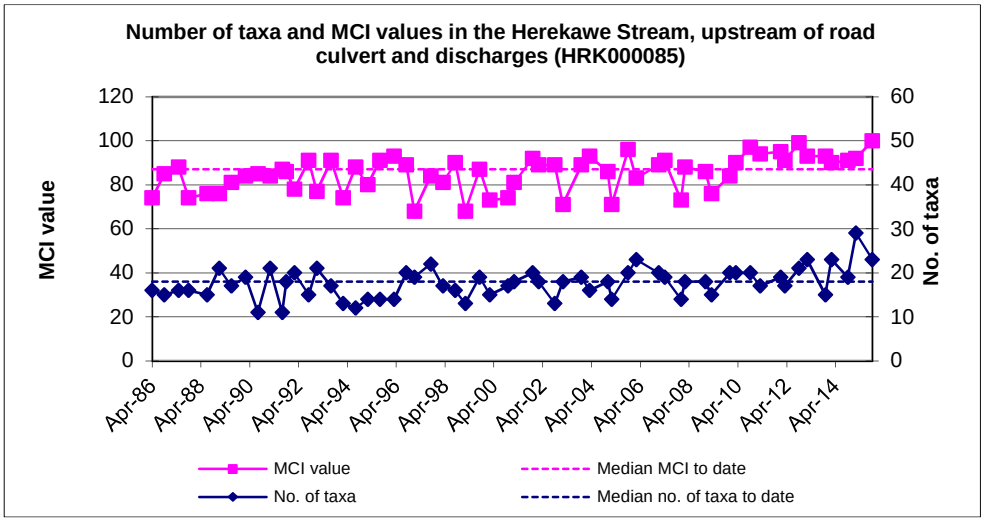

Figure 2 Number of taxa and MCI values in the Herekawe Stream upstream of the Centennial Road culvert since monitoring began in 1986

There were only three taxa dominant in the community (Table 3) which included no 'highly sensitive' taxa, one 'moderately sensitive' taxon [mayfly (*Austroclima*)], and two 'tolerant' taxa [very abundant snail (*Potamopyrgus*); and orthoclad midges]. These taxa are commonly found in habitats typical of the lower gradient reaches of small coastal streams, some of which are particularly abundant in association with periphyton and/or aquatic macrophytes. However, some of the more 'sensitive' taxa also present at this site (e.g. mayflies, stonefly, beetles, and some caddisflies) are associated with swifter flowing, harder substrates.

Characteristic macroinvertebrate taxa in the communities at this site prior to this spring 2015 survey are listed in Table 4. Prior to the current survey, 16 taxa had characterised the community at this site on occasions. These have comprised of one 'highly sensitive', seven 'moderately sensitive', and eight 'tolerant' taxa i.e. a relatively high proportion of 'tolerant' taxa as would be expected in the lower reaches of a small coastal stream. Predominant taxa have included only the one 'moderately sensitive' taxon [amphipod (*Paracalliope*)] and two 'tolerant' taxa [oligochaete worms and snail (*Potamopyrgus*)]. This snail taxon has characterised this site's community on every occasion.

Table 4 Characteristic taxa (abundant, very abundant, extremely abundant) recorded in the Herekawe Stream at Centennial Drive between April 1986 and February 2015 [59 surveys], and by the spring 2015 survey

Taxa List		MCI Score	Total abundances	% of Surveys	Survey
					Spring 2015
ANNELIDA	Oligochaeta	1	36	61	
MOLLUSCA	*Potamopyrgus*	4	59	100	VA
CRUSTACEA	Ostracoda	1	2	3	
	Paracalliope	5	38	64	
EPHEMEROPTERA	*Austroclima*	7	4	7	A
	Coloburiscus	7	11	19	
PLECOPTERA	*Acroperla*	5	1	2	
	Megaleptoperla	9	1	2	
COLEOPTERA	Elmidae	6	1	2	
TRICHOPTERA	*Hydropsyche (Aoteapsyche)*	4	1	2	
	Oxyethira	2	12	20	
	Triplectides	5	13	22	
DIPTERA	*Aphrophila*	5	4	7	
	Orthocladiinae	2	27	46	A
	Polypedilum	3	2	3	
	Austrosimulium	3	18	31	

Only three of the historically characteristic taxa were dominant in the spring 2015 community and comprised only one of the predominant taxa (above) together with another one 'moderately sensitive' and one 'tolerant' taxa which previously had been characteristic of this site's communities on 7% and 46% of occasions respectively (Table 4). The one taxon which was recorded as very abundant in this spring survey had characterised this site's communities on 100% of past surveys.

The MCI score (100 units) reflected the presence of a significant proportion of 'sensitive' taxa (61% of richness). The score was a significant (Stark, 1998) 13 units above the median of scores, and one unit higher than the maximum, found by previous surveys (Table 2, Figure 2). It was also a significant 22 units higher than the median score found by 194 previous surveys of sites below 25 masl in similar lowland coastal streams (TRC, 2015a). The moderate $SQMCI_s$ value of 4.2 units (Table 3) reflected the numerical dominance of the 'tolerant' snail in particular at this site. The presence of a relatively high proportion of 'sensitive' taxa indicated reasonably good physicochemical water quality conditions preceding this survey.

Site 2 (downstream of stormwater discharges)

An above median richness of 19 taxa was found at this more open site which was noticeably more of a cobble-boulder substrate habitat than on recent occasions. This richness was only slightly less (by four taxa) than that recorded upstream (Table 2, Figure 3) although it should be noted that 10 of these taxa (53% of richness) were also recorded as rarities (less than five individuals per taxon). Fourteen of these taxa were also present at the upstream site 1 and the two sites shared two of the dominant taxa (with one fewer 'moderately sensitive' taxon characteristic at this site (2)). The two sites had only 50% of taxa in common of the total taxa (28) found over this short reach unlike the much lower percentage found by the previous (summer) survey where there was a marked difference in the site 2 habitat. Only one 'highly sensitive' taxon was found at this site compared with three such taxa at site 1.

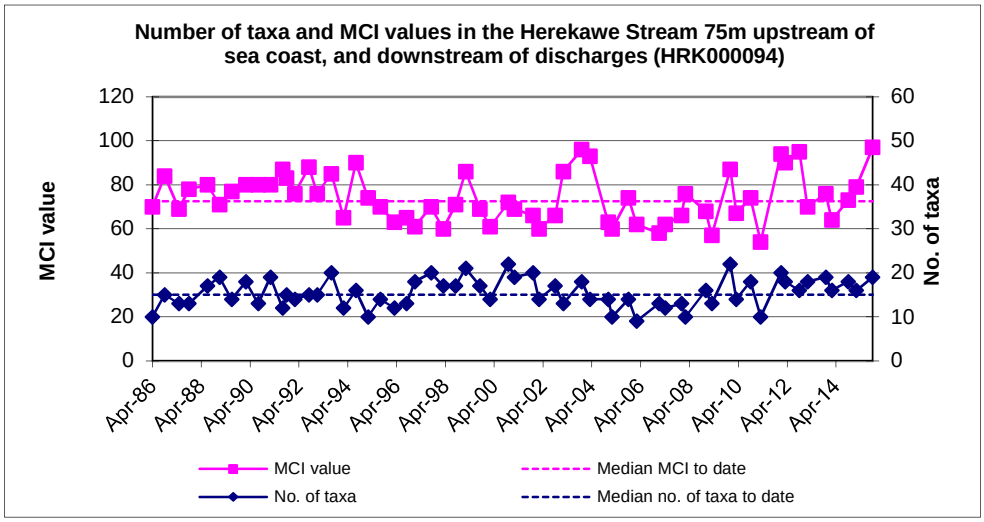

Figure 3 Number of taxa and MCI values in the Herekawe Stream downstream of industrial stormwater discharges since monitoring began in 1986

There was a very similar proportion of 'tolerant' taxa in this community compared to that at the upstream site. Taxa characteristic of this community included both of the 'tolerant' taxa dominant at the upstream site together with the loss of one 'moderately sensitive' taxon.

Characteristic macroinvertebrate taxa in the communities at this site prior to this spring 2015 survey are listed in Table 5.

Table 5 Characteristic taxa (abundant, very abundant, extremely abundant) recorded in the Herekawe Stream downstream of Centennial Drive between April 1986 and February 2015 [59 surveys], and by the spring 2015 survey

Taxa List		MCI Score	Total abundances	% of Surveys	Survey
					Spring 2015
NEMERTEA	Nemertea	3	1	2	
ANNELIDA	Oligochaeta	1	34	58	
MOLLUSCA	*Physa*	3	1	2	
	Potamopyrgus	4	55	93	XA
	Sphaeriidae	3	2	3	
CRUSTACEA	Ostracoda	1	10	17	
	Paracalliope	5	30	51	
	Paratya	3	2	3	
EPHEMEROPTERA	*Coloburiscus*	7	5	8	
ODONATA	*Xanthocnemis*	4	1	2	
HEMIPTERA	*Sigara*	3	3	5	
TRICHOPTERA	*Hydrobiosis*	5	2	3	
	Oxyethira	2	15	25	
	Triplectides	5	10	17	
DIPTERA	*Aphrophila*	5	4	7	
	Chironomus	1	13	22	
	Maoridiamesa	3	1	2	
	Orthocladiinae	2	35	59	VA
	Polypedilum	3	4	7	
	Empididae	3	1	2	
	Austrosimulium	3	8	14	
ACARINA	Acarina	5	2	3	

Prior to the current survey, 22 taxa had characterised the community at this site on occasions. These have comprised six 'moderately sensitive' and sixteen 'tolerant' taxa i.e. an absence of 'highly sensitive' taxa and a very high proportion of 'tolerant' taxa as would be expected in the lower reaches of a small coastal stream, particularly more often with a softer, more sedimented substrate and aquatic vegetation. Predominant taxa have included only three 'tolerant' taxa [oligochaete worms, snail (*Potamopyrgus*), and orthoclad midges] and one 'moderately sensitive' taxon [amphipod (*Paracalliope*)].

Only two of the historically characteristic taxa were dominant in the current survey community and were comprised of two of the predominant 'tolerant' taxa (above) (Table 5). The two taxa which were recorded as very or extremely abundant at the time of this spring survey had characterised this site's communities on 59% to 93 % of past surveys.

The MCI value of 97 units was a significant (Stark, 1998) 25 units higher than the median and one unit above the maximum of previous values (Table 2) but an insignificant three units less than the score recorded at site 1. This was due to the similar proportion of 'sensitive' taxa in the community as a result of the shallower and swifter flow of water and the higher proportion of hard (cobble-boulder) substrate at this site. This reflected the more similar habitat to that at the upstream 'control' site 1, than usual. Ponding as a result of log jams, together with sand inundation and saltwater penetration have occurred at this site in the past as a result of very high tides coincident with low stream flow conditions. Atypically no significant differences between the communities at sites 1 and 2 were recorded by this survey. Relatively minor downstream increases in the numerical abundances of tow 'tolerant' taxa recorded between sites, resulted in a decrease of only 0.5 unit in $SQMCI_s$ value at the downstream site 2, indicative of the relative similarity in numerically most dominant (characteristic) taxa between sites.

Discussion

The MCI values recorded since monitoring of these sites began in 1986 are illustrated in Figure 4.

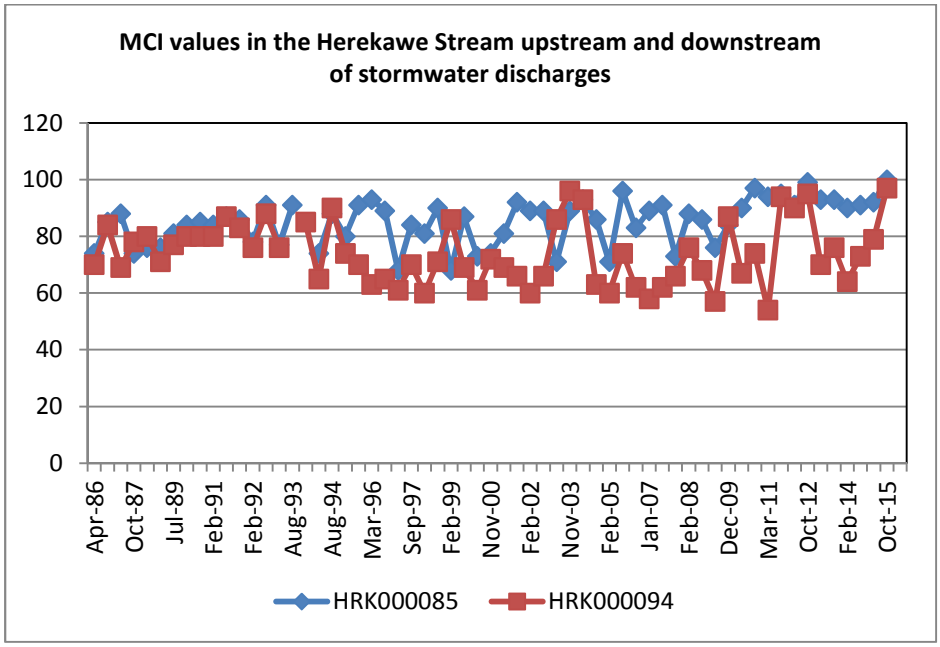

Figure 4 MCI values at sites upstream (site 1) and downstream (Site 2) of the stormwater discharges from the Omata tank farm area since monitoring began in 1986

There was a distinct change in the MCI values in 1995 when values at site 2 decreased markedly in comparison with those recorded at site 1, upstream of the culvert. Between March and September 1995 the habitat in the Herekawe Stream at site 2 changed significantly. Prior to the September 1995 survey, the stream at this site had a more riffle-like habitat. Although the water was slower flowing (compared to site 1), the stream had been shallower and contained a greater proportion of cobbles. A natural dam of debris and rocks appeared downstream between these two surveys, causing the stream to pond around site 2, becoming deeper and very slow flowing. The substrate became more dominated by silt and macrophyte beds developed. This habitat generally supports fewer 'sensitive' taxa and therefore MCI values generally reflected a poorer community. The very low flow conditions surveyed at the time of post 2002 summer surveys however, indicated more similar conditions at site 2 to pre-1995 habitat, particularly the absence of aquatic macrophytes, reversing recent trends in MCI scores. Ponding at site 2 became more apparent again during many of the last seven (spring and summer) surveys, but not at the time of the current survey, with the MCI value reflecting a habitat dominated by harder substrate components.

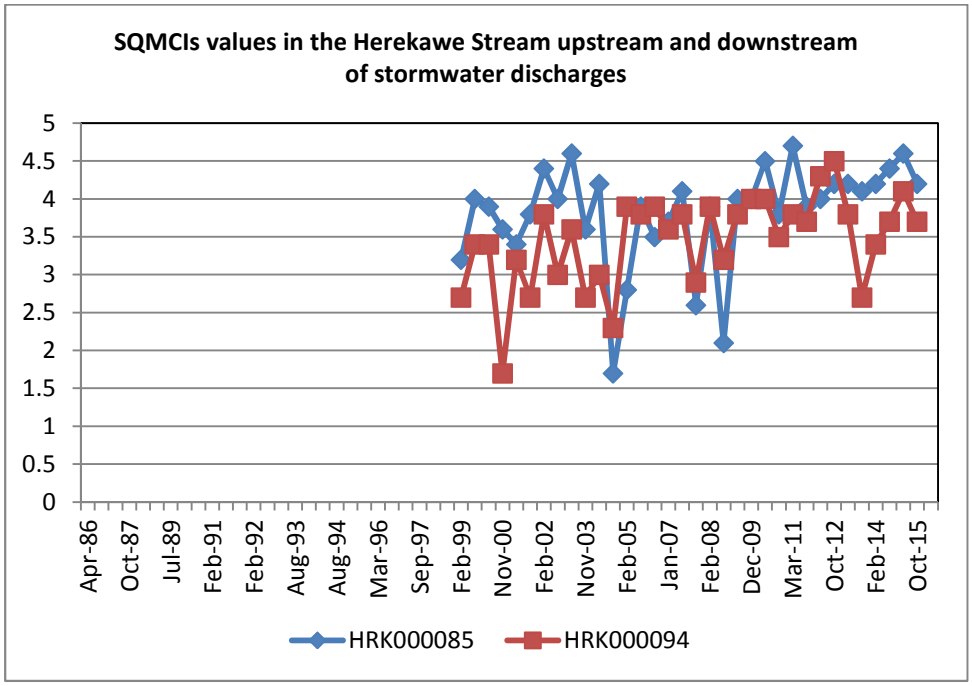

Figure 5 $SQMCI_s$ values for surveys conducted in the Herekawe Stream since 1999 (when $SQMCI_s$ was first implemented)

The $SQMCI_s$ values over the surveys conducted since 1999 suggest that while there have been differences in community composition, it is likely that the dominant taxa on many occasions were similar between sites, and $SQMCI_s$ values at both sites have followed a similar pattern (Figure 5). The exception has been certain post-2004 surveys when the $SQMCI_s$ highlighted some significant differences in community composition at site 2 in terms of increased abundances within several individual 'sensitive' taxa in a downstream direction. Since this date, with a few exceptions (spring 2008, spring 2010, and spring 2013), the two sites have had relatively similar $SQMCI_s$ values.

It is unlikely that any differences in macroinvertebrate communities between site 1 and site 2 in recent years have been due to stormwater discharges from the Omata Tank Farm, NPDC or DowAgro Sciences. There have been no records of major changes to community compositions, i.e. significant loss of characteristic taxa, at the site (2) below these discharges, indicative of minimal impacts of stormwater discharges.

Conclusions

This spring 2015 survey of the Herekawe Stream performed under low flow conditions indicated that the streambed communities had not been detrimentally affected by discharges of stormwater to the stream from the Omata Tank Farm, New Plymouth District Council, or other industrial sites. The macroinvertebrate communities at the sites upstream and downstream of the discharges contained similar proportions of 'sensitive' macroinvertebrate taxa which were most probably related to minimal variation in stream habitat, and the two sites had similar numerically most dominant (characteristic) taxa.

The numbers of taxa at both sites were higher than medians previously found and MCI scores were significantly higher than the respective medians of results found by previous surveys at these sites. The MCI value downstream was only three units lower than that recorded upstream at the time of this spring survey due to improved physical habitat (harder substrate and faster flow) at the site downstream of the discharge outlets. This was a minimal deterioration in MCI score dissimilar to those found by several previous surveys principally since the mid 1990's when habitat changed markedly at the downstream site, and atypical of the historical median MCI difference (15 units). There was a similar proportion of 'sensitive' taxa in the community at this site andminimal change in the composition of the characteristic taxa, particularly the predominant components.

Larger differences in the MCI value between sites 1 and 2 have been illustrated by historical data since 1995. Before 1995 both of these sites contained similar numbers of taxa and MCI values. A change in the habitat occurred at site 2 in 1995 when the faster flowing stream with substrate more characteristic of a riffle altered to a slow flowing, deeper, and ponded area with silt and from time to time macrophyte beds dominating the substrate. Saltwater penetration as far upstream as the road culvert (Figure 1), under extremely high tide and very low stream flow conditions, may have influenced community composition at site 2 on occasions. These changes in habitat are more likely to be the cause of lower MCI values at this downstream site since 1995, but not at the time of the current survey rather than stormwater discharges from the Omata Tank Farm area. [However, under the low flow conditions of some of the more recent summer surveys, this trend in MCI scores was reversed (e.g. in 2009, 2010, 2011, and in spring 2012; and in this spring 2015 survey)].

Summary

The Council's standard 'kick-sampling' technique was used at two established sites, to collect streambed macroinvertebrates from the Herekawe Stream. Samples were sorted and identified to provide the number of taxa (richness) and 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 abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities. It may be the more appropriate index if non-organic impacts are occurring.

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

This spring macroinvertebrate survey indicated that the discharge of treated stormwater and discharges from the Omata Tank Farm or Dow Agro Sciences sites had not had any recent detrimental effect on the macroinvertebrate communities of the stream. An insignificant

decrease in the MCI scores between the upstream 'control' site and site downstream of the discharges was more attributable to minimal habitat differences between these sites. There were few significant changes in the number and composition of dominant taxa in communities in a downstream direction (as reflected in a small decrease in $SQMCI_s$ scores) and there were no significant changes in terms of historical community compositions at the downstream site.

The macroinvertebrate communities of the stream were generally dominated by limited numbers of taxa, mainly 'tolerant' taxa. Taxonomic richnesses (numbers of taxa) were lower at the time of this spring survey at the upstream site but slightly higher at the downstream site, compared to the previous summer survey, while MCI scores were both higher (by 8 to 18 units).

MCI and $SQMCI_s$ scores indicated that the stream communities deteriorated from 'good' (upstream) to 'fair' health at the downstream site, but the health was typical of conditions recorded in similar small Taranaki coastal streams. The relatively recent community initiatives to create the Herekawe walkway and extensive adjacent riparian planting in the 1.5 km reach immediately upstream of Centennial Drive (Report: CF485) should maintain or contribute towards a gradual improvement in stream health over future years, and it is noted that this spring MCI score at the upstream site was a significant (Stark, 1998) 13 units above the median for the 29-year period of monitoring. This site has recently shown a more positive improvement in MCI scores which has become a statistically significant temporal trend for the 19-year period between 1995 and 2014 (TRC, 2015).

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To	Job Managers, Scott Cowperthwaite & Callum MacKenzie
From	Freshwater Biologist, Darin Sutherland
Doc No	1682125
Report No	DS049
Date	10 May 2016

Biomonitoring of the Herekawe Stream in relation to the Omata Tank Farm and other stormwater discharges, surveyed in March 2016

Introduction

This biological survey was the second of two scheduled for the Herekawe Stream in the 2015-2016 monitoring year to assess whether there had been any detrimental effects on the Herekawe Stream from stormwater discharges originating from STOS, DowAgro Sciences, Chevron, Origen Energy and NPDC. The previous survey (CF646) was performed in spring, 2015 as scheduled. The results from surveys performed since the 2001-02 monitoring year are discussed in reports referenced at the end of this report.

Methods

The standard '400 ml kick-net' technique was used to collect streambed macroinvertebrates at a 'control' site and another downstream site in the Herekawe Stream (Table 1, Figure 1) on 8 March 2016. The '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 Herekawe Stream in relation to stormwater discharges

Site No.	Site Code	GPS Reference	Location
1	HRK 000085	E1688283 N5674972	Upstream of Centennial Drive culvert and stormwater discharges
2	HRK 000094	E1688201 N5675010	Downstream of stormwater discharges, approx. 75 m above coast

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 abundances scored based on the categories presented in Table 2.

Table 2 Macroinvertebrate abundance categories

Abundance category	Number of individuals
R (rare)	1-4
C (common)	5-19
A (abundant)	20-99
VA (very abundant)	100-499
XA (extremely abundant)	500+

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 collected from one site and multiplying by a scaling factor of 20, a Macroinvertebrate Community Index (MCI) value was obtained. The MCI is a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. A gradation of biological water quality conditions based upon MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2013) from Stark's classification (Stark, 1985 and Boothroyd and Stark, 2000) (Table 3). More 'sensitive' communities inhabit less polluted waterways. A difference of 10.83 units or more in MCI values is considered significantly different (Stark 1998).

Table 3 Macroinverbrate health based on MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2015) from Stark's classification (Stark, 1985 and Boothroyd and Stark, 2000)

Grading	MCI
Excellent	>140
Very Good	120-140
Good	100-119
Fair	80-99
Poor	60-79

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 & 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, ranging from 0 to 10 $SQMCI_s$ units. A difference of 0.83 units or more in $SQMCI_s$ values is considered significantly different (Stark 1998).

Figure 1 Biomonitoring sites in the Herekawe Stream

Results

Site habitat characteristics and hydrology
This summer survey was performed under very low flow conditions (near MALF), 19 days after a fresh in excess of both 3 times and 7 times median flow (flow gauge at the Mangaoraka Stream at Corbett Rd). The survey followed a relatively dry spring period with only one significant river fresh recorded over the preceding month, which was well in excess of 7 times median flow. The water temperature was 18.5°C at site 1 and 19.0°C at site 2. At site 1 the water speed was steady, water uncoloured and cloudy while at site 2 the water speed was slow, water grey and cloudy.

No stormwater discharges were occurring from the right bank or the left bank outfalls at the time of the survey. The channel at site 1 was narrow and constrained by gabion baskets on the banks and bed of the stream where the substrate was comprised mainly of sand. The stream at this site had a low, clear, uncoloured, swift flow and there were no periphyton mats, patchy filamentous algae, and moss and wood on the bed. No macrophytes were recorded at this partially shaded site on this occasion.

The substrate at site 2 was comprised mainly of sand. The site can periodically be affected by salt water intrusion under extremely high tide and very low flow conditions. There were no filamentous algae but patchy periphyton mats noted on the harder substrate components of the bed during the survey. Macrophytes were recorded along the stream margins.

Macroinvertebrates

A number of surveys have been performed previously at these two sites. Results of the current and past surveys are summarised in Table 4 and the results of the current survey presented in Table 5.

Table 4 Results of the current and previous surveys (since April 1986) performed at sites 1 and 2 in the Herekawe Stream in relation to the Omata Tank Farm and other stormwater discharges

Site	Number of previous surveys	Numbers of taxa			MCI values			$SQMCI_s$ values		
		Median	Range	8 Mar 2016	Median	Range	8 Mar 2016	Median	Range	8 Mar 2016
1	60	18	11-29	14	87	68-100	81	4.0	1.7-4.7	3.5
2	60	15	9-22	17	73	54-97	72	3.7	1.7-4.5	3.8

Table 5 Macroinvertebrate fauna of the Herekawe Stream in relation to Omata Tank Farm and other stormwater discharges sampled on 8 March 2016

Taxa List	Site Number	MCI score	1	2
	Site Code		HRK000085	HRK000094
	Sample Number		FWB16147	FWB16148
ANNELIDA (WORMS)	Oligochaeta	1	A	C
MOLLUSCA	*Potamopyrgus*	4	VA	XA
	Sphaeriidae	3	-	R
CRUSTACEA	*Paracalliope*	5	A	C
	Paratya	3	-	R
	Paranephrops	5	R	-
EPHEMEROPTERA (MAYFLIES)	*Coloburiscus*	7	R	-
	Deleatidium	8	-	R
ODONATA (DRAGONFLIES)	*Xanthocnemis*	4	-	R
HEMIPTERA (BUGS)	*Sigara*	3	-	A
COLEOPTERA (BEETLES)	Elmidae	6	R	-
TRICHOPTERA (CADDISFLIES)	*Hydrobiosis*	5	R	R
	Oxyethira	2	A	C
	Triplectides	5	R	A
DIPTERA (TRUE FLIES)	*Aphrophila*	5	C	-
	Chironomus	1	-	A
	Orthocladiinae	2	C	A
	Polypedilum	3	-	C
	Tanypodinae	5	-	R
	Tanytarsini	3	R	R
	Paradixa	4	-	R
	Austrosimulium	3	C	-
	Tanyderidae	4	R	-
		No of taxa	14	17
		MCI	81	72
		SQMCIs	3.5	3.8
		EPT (taxa)	3	3
		%EPT (taxa)	21	18

'Tolerant' taxa | 'Moderately sensitive' taxa | 'Highly sensitive' taxa

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

Site 1 (upstream of stormwater discharges)

A moderately low macroinvertebrate community richness of 14 taxa was found at site 1 ('control' site) at the time of the summer survey. This was four less than the historical median for this site and nine taxa lower than the previous survey on October 2015 (Table 4, Figure 2).

The MCI score of 81 units indicated a community of 'fair' biological health which was not significantly different (Stark, 1998) to the historical median MCI score of 87 units. The MCI score was significantly lower (Stark, 1998) than the preceding survey (100 units) which was the highest MCI score recorded at the site in 60 surveys but not significantly different to similar streams (79 units, TRC, 2015a).

The SQMCIs score of 3.5 units was not significantly different (Stark, 1998) to the median MCI score of 4.0 units (Stark, 1998) and to similar streams (4.0 units, TRC, 2015) (Table 4).

The community was characterised by one 'very abundant' taxon ['tolerant' snails (*Potamopyrgus*)]

and three 'abundant' taxa ['tolerant' oligochaete worms and caddisfly (*Oxyethira*), and a 'moderately sensitive' amphipod (*Paracalliope*)] (Table 5).

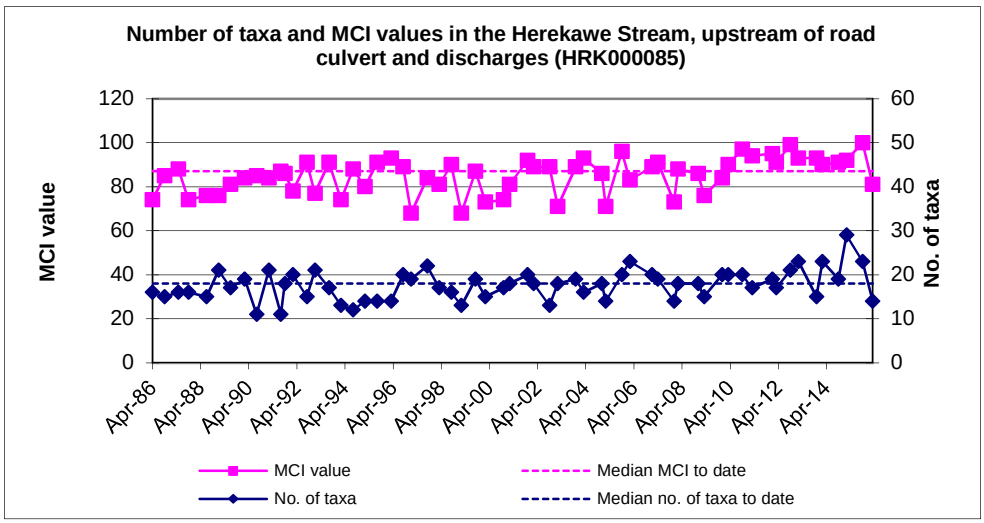

Figure 2 Number of taxa and MCI values in the Herekawe Stream upstream of the Centennial Road culvert since monitoring began in 1986

Site 2 (downstream of stormwater discharges)

A moderate macroinvertebrate community richness of 17 taxa was found at site 2 ('primary impact' site). This was two more than the historical median for this site and two taxa lower than the previous survey on October 2015 (Table 4, Figure 3).

The MCI score of 72 units indicated a community of 'poor' biological health which was the same as the historical median. The MCI score was significantly lower (Stark, 1998) than the preceding survey (97 units) which was the highest MCI score recorded at the site in 60 surveys but not significantly different to similar streams (79 units, TRC, 2015a).

The $SQMCI_S$ score of 3.8 units was not significantly different (Stark, 1998) to the median MCI score of 3.7 units (Stark, 1998) and to similar streams (4.0 units, TRC, 2015) (Table 4).

The community was characterised by one 'extremely abundant' taxon ['tolerant' snails (*Potamopyrgus*)] and four 'abundant' taxa ['tolerant' true bug (*Sigara*), blood worms (*Chironomus*) and orthoclad midges, and a 'moderately sensitive' caddisfly (*Trilectides*)] (Table 5).

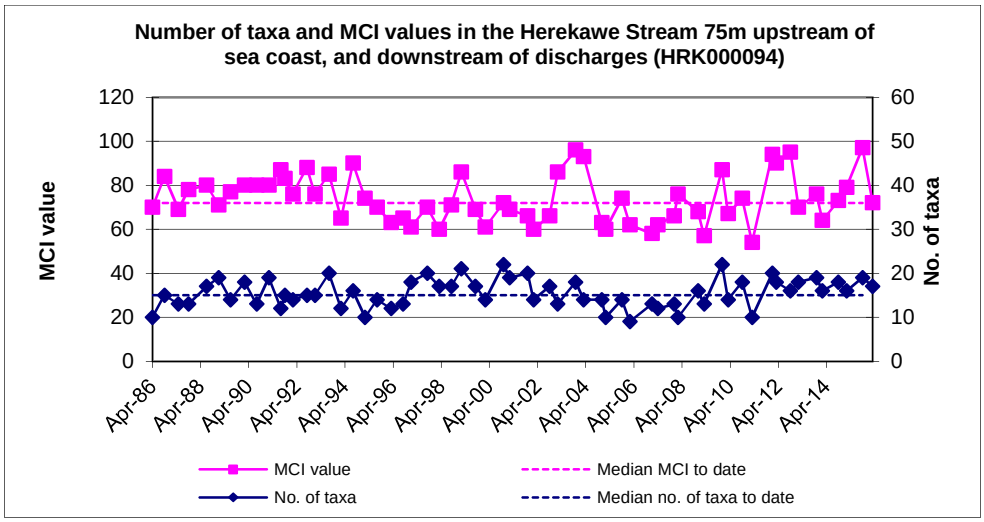

Figure 3 Number of taxa and MCI values in the Herekawe Stream downstream of industrial stormwater discharges since monitoring began in 1986

Discussion and conclusions

Macroinvertebrate richness at the 'primary impact' site (site 2) was five taxa higher than the 'control' site (site 1). Furthermore, taxa richness at site 2 was two taxa higher than the historical median, compared with site 1 that had lower than usual taxa richness. Taxa richness is the most robust index when ascertaining whether a macroinvertebrate community has been exposed to toxic discharges such as petrochemicals that could be discharged by the Omata Tank Farm. Macroinvertebrates when exposed to toxic chemicals may die and be swept downstream or deliberately drift downstream as an avoidance mechanism (catastrophic drift). The lack of any discernible impact on taxa richness at site 2 strongly indicates that no toxic discharges have been occurring.

Site 2 had a MCI score of 72 units which was a non-significant (Stark, 1998) 9 units lower than site 1 and only one unit lower than the historical median. Site 1 had a historical median MCI score 14 units higher than site 2 indicating that the 'control' site usually had a healthier macroinvertebrate community compared with the 'primary impact' site. Both sites had large decreases in MCI scores (19 and 25 units for sites 1 and 2 respectively) compared with the previous survey which would be unrelated to stormwater discharges as site 1 is above the influence of any stormwater discharge. Both scores were also similar to the median calculated from other lowland coastal streams in Taranaki (79 units).

The $SQMCI_s$ can be more sensitive to organic pollution compared with the MCI. Site 2 had a $SQMCI_s$ score of 3.8 units which was a not significantly different (Stark, 1998) to site 1 (by 0.3 units) and was close to normal for lowland coastal streams (4.0 units, TRC, 2015). It was a typical score for the site as it was very close to the historic median (0.1 units). In contrast, site 1 had a slightly lower than normal score (by 0.5 units). The lack of significant differences between the 'control' and 'primary impact' sites indicates no significant discharges of organic pollution or nutrient enrichment occurring in the stormwater discharges.

The community composition between the two sites is relatively similar which would be expected given there proximity to each other, there similarity of habitat and relative closeness of $SQMCI_s$ scores. Most changes in community composition between the two sites were due to 'rare' taxa (less than five individuals) or one change in abundance category. However, there were three changes of note. The cased caddisfly *Triplectides* went from 'rare' to 'abundant' at site 2. The taxon is likely to be *T. obsoletus* which is tolerant of brackish water which might give it a competitive advantage at the site which occasionally becomes inundated with seawater.

Waterboatmen (*Sigara*) prefer slow moving water which explains why they were absent from site 1 (steady water) but 'abundant' at site 2 (slow moving water). The very 'tolerant' bloodworms (*Chironomus*) are a strong indicator of organic pollution. They were absent from site 1 yet 'abundant' at site 2 which suggests that there was some nutrient enrichment occurring between sites but in this case may be due to habitat variation between sites as site 2 has slower flowing water and macrophytes on the edges of the streambed which bloodworms prefer which site 1 does not.

It is unlikely that any differences in macroinvertebrate communities between site 1 and site 2 in recent years have been due to stormwater discharges from the Omata Tank Farm, NPDC or DowAgro Sciences. There have been no records of major changes to community compositions, i.e. significant loss of characteristic taxa, at the site (2) below these discharges, indicative of minimal impacts of stormwater discharges

Summary

The Council's standard 'kick-sampling' technique was used at two established sites, to collect streambed macroinvertebrates from the Herekawe Stream. Samples were sorted and identified to provide the number of taxa (richness) and MCI and $SQMCI_s$ scores for each site.

Taxa richness is the most robust index when ascertaining whether a macroinvertebrate community has been exposed to toxic discharges. Macroinvertebrates when exposed to toxic chemicals may die and be swept downstream or deliberately drift downstream as an avoidance mechanism (catastrophic drift). The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The $SQMCI_S$ takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities. It may be the more appropriate index if non-organic impacts are occurring. Significant differences in either taxa richness, community composition, the MCI or $SQMCI_s$ between sites may indicate the degree of adverse effects (if any) of the discharges being monitored.

The macroinvertebrate communities of the stream were generally dominated by limited numbers of taxa, mainly 'tolerant' taxa. Taxonomic richnesses (numbers of taxa) were similar to historic medians.

MCI scores indicated that the stream communities deteriorated from 'fair' (upstream) to 'poor' health at the downstream site, but the health was typical of conditions recorded in similar small Taranaki coastal streams. The relatively recent community initiatives to create the Herekawe walkway and extensive adjacent riparian planting in the 1.5 km reach immediately upstream of Centennial Drive (Report: CF485) should maintain or contribute towards a gradual improvement in stream health over future years.

This summer macroinvertebrate survey indicated that the discharge of treated stormwater and discharges from the Omata Tank Farm or Dow Agro Sciences sites had not had any recent detrimental effect on the macroinvertebrate communities of the stream. An insignificant decrease in the MCI scores between the upstream 'control' site and site downstream of the discharges was more attributable to minimal habitat differences between these sites. There were few significant changes in the number and composition of dominant taxa in communities in a downstream direction (as reflected in a small increase in $SQMCI_s$ score).

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Appendix V

Marine ecological report

Memorandum

To Job Manager, Callum Mackenzie
From Scientific Officer - Marine Ecology, Emily Roberts
File #1779673
Date 16 November 2015

Marine Ecological Inspection at Back Beach for Dow Agro Sciences

A marine ecological inspection was undertaken on 16 November 2015 at 18:00 NZDT (low tide at 19:43 NZDT, 0.7 m) of the intertidal area from the base of Paritutu Rock to approximately 200 m south of Paritutu. At the time of the inspection the weather was fine with very light winds. There had been no significant rain for the week preceding the inspection.

The purpose of this inspection was to ascertain whether activities of the adjacent Dow Agro Sciences plant were having any observable environmental effects on the intertidal communities at Back Beach. The inspection was undertaken as part of the 2015-2016 monitoring programme for this company.

An intertidal reef area is present at the north eastern end of Back Beach at the base of Paritutu Rock. Further down the shore, rocks and boulders were exposed, but there were no cobbles present higher on the shore.

Two groundwater seeps were observed flowing down the cliffs to the south of Paritutu Rock. The groundwater had no noticeable odour. The seeps flowed across the beach and over the reef before reaching the sea. These flows did not appear to be deleteriously affecting the reefs, as abundant limpets and little back mussels were present close to the flows.

A diverse range of algae and animal species were present on the reef. *Scytothamnus* sp. was abundant and several other algae were common, including encrusting *Corallina* spp., *Corallina officinalis*, *Endarachne binghamiae*, *Laurencia thryisifera, Ralfsia sp*. and *Ulva* sp. A variety of filter feeders (little black mussels, barnacles, anemones), grazers (limpets, chitons, top-shells) and crabs were present. From observations made during this inspection, the diversity of reef biota is typical to that seen at other local intertidal reefs in the Taranaki region.

Photograph 1 Reef at the base of Paritutu Rock (May 2015)

Photograph 2 Groundwater seeps to the south of Paritutu Rock (May 2015)

Photograph 2 Reef with encrusting animals (little back mussels) and algae (*Scytothamnus* sp., *Corallina officinalis* and *Endarachne binghamiae*) May 2015

Emily Roberts

Scientific Officer - Marine Ecology

Appendix VI

DAS Annual Air Discharge Report
2015-2016

Dow AgroSciences

Air Discharge Report

1 July 2015 - 30 June 2016

Consent No. 4020-4.0

29 August 2016

Table of Contents

Introduction

Dow AgroSciences (NZ) Ltd formulates agricultural chemicals at the New Plymouth site. All sources of air emissions from the Dow AgroSciences site are permitted by Air Discharge Permit (Consent 4020-4.0) granted and monitored by the Taranaki Regional Council ("TRC").

This report details the following for the 2015-16 year:

(a) The results obtained from all air quality monitoring undertaken during the year
(b) A description of changes to processes, emission control technology, consent conditions and products made during the year
(c) A description of any consultation undertaken during the year and any views put forward by those consulted

Changes Made During the Year

Process Changes

During the 2015-16 year, the following process changes were made.

- Esterification of 2,4-dichlorophenoxyacetic acid (2,4-D) was discontinued in late 2015. 2,4-D ester will be imported directly in 2016-1 7.
- Two new products were introduced to the site:
  - o Conserve PluS Grain Protector
  - o Penoxsulam 240 gai/L SC Herbicide

Emission Control Technology Changes

No changes were made to emission control equipment during the year.

Permit Changes

No changes were made to the air discharge permit during the year.

Monitoring Changes

The following changes were made to the monitoring program after agreement with the Taranaki Regional Council:

Air Discharges Management and Monitoring Plan (ADMMP):

- Removed the esterification process from the Commodity Herbicides Plant process summary.

Stack Emission Monitoring Plan (Appendix 2 of ADMMP):

- Replacment of 2,4-D with MCPA as the indicator compound in the Commodity Herbicides Plant.
- Added haloxyfop-R methyl ester as an alternative indicator compound for Herbicides Plant monitoring.
- Extended chlorpyrifos monitoring in Insecticides Plant to two-yearly.

Deferment of Herbicides Stack Monitoring:

- Herbicides Plant stack monitoring was deferred to 2016-2017 due to delays in importation of 2,4-D ester following the discontinuation of the esterification process.

Process Vents

Permit Conditions

Special Condition 2

The discharges authorised by this consent shall not give rise to any odour, or dust emissions, at or beyond the boundary of the site that is offensive or objectionable.

Special Condition 3

The discharge of contaminants to air, other than from the High Temperature Incinerator Stack (see conditions 4 and 5) shall be controlled to ensure that the maximum ground level concentrations off-site do not exceed:

(a) Subject to condition 3(b), the relevant air quality limits listed in schedule 1 of this consent and assessed using the process set out in Schedule 3; and

(b) In the case of emissions due to raw materials or formulations introduced to the site after this consent commences, limits developed in accordance with the approach set out in schedule 2 and assessed using the process set out in Schedule 3

Special Condition 14

For any air monitoring undertaken, the following conditions apply:

(a) If a measured air quality parameter would result, or has resulted in, air quality that is 25% or less of the relevant limit referred to in condition 3, then no action is required.

Subsequent sub-clauses (b) to (d) outline actions for results of 25% and higher.

Insecticides Plant (Vent No. 03-5)

Permit Conditions

Emission Component: Chlorpyrifos

Air Quality Limit from Schedule 1: 0.57 µg/m^3 (annual average)

Dilution Factor from Schedule 3: 232,000 (annual average)

Maximum Stack Concentration: 132,240 µg/m^3

Sampling Plan

This vent was last monitored in 2014-1 5, and is next scheduled to be monitored in 201 6-1 7.

The formulating and packing activities carried out during the reporting period were typical for the Insecticides Plant.

Plant Operating Conditions

Chlorpyrifos is an organophosphate active ingredient used in liquid insecticide formulations. Chlorpyrifos is obtained in a solid form and melted in a hot water bath before use. Chlorpyrifos is pumped into a vessel containing solvent(s) and emulsifiers. The product is mixed, transferred to a bulk tank and packed.

Emissions may occur during the melting and pump-out of the active ingredient and during the packing of finished product.

Local exhaust ventilation removes vapour from the drum pump-out station, the top of the blending vessel, the bulk tank and the pack-off point. The extracted air is passed through a wet scrubber (BS1400) containing alkaline sodium hypochlorite solution before being vented to atmosphere.

The process technician monitors the condition of the scrubber solution. Results are logged and are available for inspection during visits by officers of the Taranaki Regional Council**.**

Conclusion

Operation of the Insecticides Plant processes and air treatment system is consistent with the 2014-15 year. Monitoring carried out in the 2014-15 year gave results less than 0.002% of the discharge consent maximum stack for chlorpyrifos.

This indicates the performance of the Insecticides Plant meets the conditions of the air discharge permit.

Suspension Concentrates Plant (Vent No. BB600)

Permit Conditions

Emission Components: Spinosad
Spinetoram

Air Quality Limit from Schedule 1: 4 µg/m^3 Spinosad (annual average)
6 µg/m^3 Spinetoram (annual average)

Dilution Factor from Schedule 3: 513,000 (annual average)

Maximum Stack Concentration: 2,052,000 µg/m^3 Spinosad
3,078,000 µg/m^3 Spinetoram

Sampling Plan

This vent was last monitored in 2014-1 5, and is next scheduled to be monitored in 201 6-1 7.

The formulating and packing activities carried out during the reporting period were typical for the Suspension Concentrates Plant.

Plant Operating Conditions

Spinosad and spinetoram are naturally produced metabolites from living organisms and are the active ingredients used in several liquid insecticide formulations. Spinosad and spinetoram are obtained in a solid form and loaded into a vessel containing solvent(s) and emulsifiers. The product is mixed and packed.

The process ventilation system extracts air from the loading hood and blender area. The process air passes through a bag filter, pre-filter and absolute filter before discharge.

The process technician monitors the condition of, and the pressure across, the filters. Results are logged and are available for inspection during visits by officers of the Taranaki Regional Council**.**

Conclusion

Operation of the Suspension Concentrates Plant processes and air treatment system is consistent with the 2014-15 year. Monitoring carried out in the 2014-15 year gave results less than 0.0002% of the discharge consent maximum stack concentration for spinetoram.

This indicates the performance of the Suspension Concentrates Plant meets the conditions of the air discharge permit.

Granulated Herbicides Plant (Vent No. 03-14)

Permit Conditions

Emission Components: Picloram

Air Quality Limit from Schedule 1: 57 µg/m^3 Picloram acid, esters and salts (annual average)

Dilution Factor from Schedule 3: 432,000 (annual average)

Maximum Stack Concentration: 24,624,000 µg/m^3 Picloram

Sampling Plan

This vent was last monitored in 2014-1 5, and is next scheduled to be monitored in 201 6-1 7.

The formulating and packing activities carried out during the reporting period were typical for the Granulated Herbicides Plant.

Plant Operating Conditions

Picloram is a herbicide active ingredient used in a granule formulation. Picloram is obtained in a solid form and neutralised in solution with either amine or potassium hydroxide before being mixed with and dried onto inert granules.

The process ventilation system extracts air from the loading hood, blender and packing area. The process air passes through a bag filter and absolute filter before discharge. Product caught on the filters is returned to the following batches.

The process technician monitors the condition of, and the pressure across, the filters. Results are logged and are available for inspection during visits by officers of the Taranaki Regional Council.

Conclusion

Operation of the Granulated Herbicides Plant processes and air treatment system is consistent with the 2014-15 year. Monitoring carried out in the 2014-15 year gave results of 0.000002% of the discharge consent maximum stack concentration for picloram.

This indicates the performance of the Granulated Herbicides Plant meets the conditions of the air discharge permit.

Herbicides Plant (Vent No. 03-8)

Permit Conditions

Emission Components: 2,4-D (acid and ester)

Air Quality Limit from Schedule 1: 2 µg/m^3 2,4-D acid, esters and salts (annual average)

Dilution Factor from Schedule 3: 107,000 (annual average)

Maximum Stack Concentration: 214,000 µg/m^3 2,4-D (acid and ester)

Sampling Plan

This vent was last monitored in 2014-1 5, and was scheduled to be monitored in 2015-1 6. However the move from on-site esterification of 2,4-D to imported 2,4-D ester resulted in the production of products containing 2,4-D ester being halted in December 2015. Production is scheduled to resume in 2016-1 7.

This change removed the opportunity to complete this monitoring during the year.

Discussions with the Taranaki Regional Council agreed on the following approach:

- An alternative indicator compound will be developed (haloxyfop-R methyl ester) and monitored in 2016-1 7.
- 2,4-D monitoring will also be carried out in 2016-17, once production resumes.

The general formulating and packing activities carried out during the reporting period were typical for the Herbicides Plant.

Plant Operating Conditions

The process ventilation system extracts air from the packing area. The process air passes through pre-filters followed by activated carbon filters before discharge.

The process technician monitors the condition of the pre-filters and activated carbon filters. Results are logged and are available for inspection during visits by officers of the Taranaki Regional Council.

Conclusion

Operation of the Herbicides Plant processes and air treatment system is consistent with the 2014-15 year. Monitoring carried out in the 2014-15 year gave results of less than 0.0002% of discharge consent maximum stack concentration for 2,4-D.

These results indicate the performance of the Herbicides Plant meets the conditions of the air discharge permit.

Commodity Herbicides Plant (Vent No. 48-1)

Permit Conditions

Emission Components: MCPA (acid and salt)

Air Quality Limit from Schedule 1: 10 µg/m^3 MCPA acid, esters and salts (annual average)

Dilution Factor from Schedule 3: 29,000 (annual average)

Maximum Stack Concentration: 290,000 µg/m^3 MCPA (acid)

Sampling Plan & Methods

An Air Quality Scientist with STNZ (Source Testing New Zealand Limited, Wellington) was commissioned by Dow AgroSciences (NZ) Ltd to undertake air discharge monitoring of the Commodity Herbicides Plant, coordinate the analyses of the samples with an accredited laboratory and prepare a report.

For details of the sampling methodology and quality control refer to Appendix 1: *Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Commodity Herbicides Plant, June 2016, Source Testing New Zealand Limited, issued June 2016.*

During the reporting period, esterification activities were discontinued in the Commodity Herbicides Plant, significantly reducing the amount of 2,4-D used within the plant. As a result the indicator compound used for monitoring was changed to MCPA.

Plant Operating Conditions

MCPA acid is reacted with amine (dimethylamine) to produce an aqueous solution of the amine salt. It is tested and transferred to a bulk tank to be packed in the Herbicides Plant at a later date.

The process ventilation system extracts air from the loading hood and process areas. The process air passes through a caustic scrubber and activated carbon filter before discharge.

The process technician monitors the condition of the caustic scrubber and the activated carbon filters. Results are logged and are available for inspection during visits by officers of the Taranaki Regional Council.

Air Discharge Monitoring Results

For details of the Commodity Herbicides Plant air discharge monitoring results refer to Appendix 1: *Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Commodity Herbicides Plant, June 2016, Source Testing New Zealand Limited, issued June 2016.*

i. Three (3) samples were collected for MCPA acid and salts from the Commodity Herbicides Plant vent over the period 1st to 2nd June 2016.

ii. The maximum concentration in the air discharged from the vent for Total MCPA (acid and salt) was 0.86 µg/m3 (corrected to 0°C, 101.3 kPa dry gas basis).

Conclusion

Under normal operating conditions, the maximum emission of MCPA (acid and salts) from the Commodity Herbicides Plant vent (#48-1) was 0.86 µg/m^3; which is 0.0003% of the discharge consent maximum stack concentration of 290,000 µg/m^3 for MCPA.

These results indicate the performance of the Commodity Herbicides Plant meets the conditions of the air discharge permit.

Multiple Sources of an Individual Contaminant

Schedule 3

Where multiple sources of an individual contaminant are involved, individual stack concentrations for that contaminant will be determined to ensure the air quality is complied with on a cumulative basis

Applicable Situations

There were three substances in 2015-16 that had the potential to have multiple sources: 2,4-D, MCPA and clopyralid. These materials are used in the Herbicides Plant and the Commodity Herbicides Plant.

However, the discontinuation of esterification in the Commodity Herbicides Plant has meant that each of these compounds is now predominantly used in only one plant at a time.

During 2015-16 no indicator compound monitored was common between the two plants.

Conclusion

This requirement had no application during the 2015-16 year.

Incinerator

High Temperature Incinerator (Vent No. 64-1)

Permit Conditions

Special Condition 4

The total concentration of polychlorinated dibenzodioxins and polychlorinated dibenzofurans in any discharge from the High Temperature Incinerator Stack shall not exceed 0.1 nano grams per cubic metre (adjusted to 0 degrees Celsius, dry gas basis, 101.3 kPa pressure and 11% oxygen) when calculated as total toxic equivalents using the World Health Organisation 2005 toxic equivalence factors.

Special Condition 5

The rate of discharge of total halides from the High Temperature Incinerator Stack shall not exceed 1.5 kg/hr.

Special Condition 6

There shall be no incineration of plastics and packaging that contain brominated flame retardants.

Special Condition 8

The oxygen concentration within the secondary combustion chamber of the incinerator shall be maintained between 6% and 9% (by volume) as far as is practicable, and shall not be less than 4.5% (by volume) for more than 60 seconds at any time during the incineration of material during any 24-hour period.

Special Condition 9

The temperature in the secondary chamber of the High Temperature Incinerator shall not be less than 1100 degrees Celsius at any time during the incineration of waste.

Special Condition 10

The temperature of the exhaust gas from the High Temperature Incinerator shall not be less than 1000 degrees Celsius at any time during the incineration of waste.

Sampling Plan & Methods

An Air Quality Scientist with STNZ (Source Testing New Zealand Limited, Wellington) was commissioned by Dow AgroSciences (NZ) Ltd to undertake air discharge monitoring of the Incinerator, coordinate the analyses of the samples with an accredited laboratory and prepare a report.

For details of the sampling methodology and quality control refer to:

Appendix 2: *Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the High Temperature Incinerator, Compliance Monitoring February - June 2016, Source Testing New Zealand Limited, issued August 2016 a*nd,

Appendix 3: *Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the High Temperature Incinerator, Liquid Waste Dioxin and Furan Monitoring - July 2016, Source Testing New Zealand Limited, issued August 2016*.

The waste incinerated during the sampling programmes was typical of waste disposed of through the incinerator.

Incinerator Operating Conditions

The high temperature incinerator typically operates up to seven days/week and up to 24 hours/day, for the majority of the year. It is used to burn solid and liquid waste from the formulating and packaging plants. This waste includes all chemically contaminated materials including: packaging, contaminated drums, used protective clothing and production plant wastes. The liquids nozzle allows the burning of liquid wastes such as wash water.

Every day the high temperature incinerator is operated a log sheet is completed during the day detailing various operating parameters and including the times at which waste was placed in the high temperature incinerator, the quantity and a description of the waste. The primary and secondary chamber temperatures, and stack gas oxygen and carbon monoxide concentrations are continuously monitored and recorded on a chart which is attached to each log sheet at the completion of the "burn". Process messages and alarms are printed and this is attached to each log sheet. This information is retained for future reference and available for inspection during visits by officers of the Taranaki Regional Council. All information relating to the operating conditions during the sampling runs is also retained.

Air Discharge Monitoring Results

STNZ carried out annual compliance monitoring of the high temperature incinerator using the modified USEPA Method 23 sampling train incorporating a water-cooled probe.

For details of the incinerator air discharge monitoring results refer to:

Appendix 2: *Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the High Temperature Incinerator, Compliance Monitoring February - June 2016, Source Testing New Zealand Limited, issued August 2016 a*nd,

Appendix 3: *Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the High Temperature Incinerator, Liquid Waste Dioxin and Furan Monitoring - July 2016, Source Testing New Zealand Limited, issued August 2016..*

a Dioxins & Furans (PCDD/PCDF)

i. Over the period 10th to 12th February 2016, the incinerator was monitored for discharges of dioxins and furans (PCDD/PCDF).

ii. Four-hour samples were collected from each of the following three streams: crushed drums, liquid waste, and general waste.

iii. The concentrations of PCDD/PCDF for crushed drums and general wastel streams were low, the overall maximum concentration being 0.0129 ng/m^3 WHO-TEQ (corrected for 0°C, 101.3 kPa, 11 % O_2, dry gas basis) being the upper bound level for crushed drums.

iv. The concentration of PCDD/PCDF for the liquids waste stream was significantly higher than previous years and an investigation identified the most likely cause to be within the sampling process. Consequently a repeat sample was taken on the 28th July 2016. The upper bound concentration from this sample was 0.0370 ng/m^3 WHO-TEQ (corrected for 0°C, 101.3 kPa, 11 % O_2, dry gas basis).

TABLE 1: PCDD/PCDF Maximum Concentration & Emission Rate

Sampling Date	Waste Type	PCDD/PCDF Concentration (ng/m^3 Total WHO-TEQ Upper Bound)[1] (Not corrected for laboratory blank)	PCDD/PCDF Emission Rate (ng/hr Total WHO-TEQ Upper Bound) (Not corrected for laboratory blank)
10 Feb 16	Crushed Drums	0.01 29	33.0
11 Feb 16	General Waste	0.00262	7.1
28 July 16	Liquid Waste	0.0370	98.9
Feb 2016	**Laboratory Blank[2]**	**0.00381**	**10.2**
July 2016	**Laboratory Blank[2]**	**0.00373**	**10.0**

[1] Corrected to 0ºC, 101.3 kPa, 11% oxygen, dry gas basis

[2] Equivalent concentrations and mass emissions rates using the laboratory blank concentrations and the average emission testing data

b. Total Halides (HF, HCl, HBr)

i. On the 8th and 9th June 2016 the incinerator was monitored for discharges of hydrogen fluoride, hydrogen chloride and hydrogen bromide.

ii. Two-hour samples were collected from each of the following waste sources: crushed drums, liquid waste, and general waste.

iii. The results of the total halide air discharges showed that the mass emissions of total halides from the Incinerator ranged from 0.0592 to 0.365 kg/hr.

iv. Bromide concentrations were 0.03 mg/m^3, for general waste. Other samples were non-detectable at <0.02 mg/m^3. The general waste manifest indicates no brominated fire retardant containing materials were incinerated.

TABLE 2: Total Halide Maximum Concentration & Emission Rate

Date	Waste Type	Total Halide Concentration (mg/m^3)[1]	Total Halide Emission Rate (kg/hr)
9 June 2016	Crushed Drums	170	0.365
8 June 2016	General Waste	23.4	0.0592
9 June 2016	Liquid Waste	80.5	0.193

[1] Corrected to 0ºC, 101.3 kPa, 11% oxygen, dry gas basis

c. Particulate Matter

i. On the 8th and 9th June 2016 the incinerator was monitored for discharges of particulate matter.

ii. One 2-hour sample was collected from each of the following waste sources: crushed drums, liquid waste, and general waste.

iii. The results of the particulate matter air discharge monitoring showed that the concentration of particulate matter ranged from 31.4 to 76.7 mg/m^3 (corrected for 0°C, 101.3 kPa, 11 % O_2, dry gas basis) with the particulate matter mass emissions ranging from 0.075 to 0.194 kg/hr.

TABLE 3: Total Particulate Concentration & Emission Rate

Date	Waste Type	Total Particulate Concentration (mg/m^3)[1]	Total Particulate Emission Rate (kg/hr)
9 June 2016	Crushed Drums	71.6	0.154
8 June 2016	General Waste	76.7	0.194
9 June 2016	Liquid Waste	31.4	0.075

[1] Corrected to 0ºC, 101.3 kPa, 11% oxygen, dry gas basis

d Sulphur Dioxide (SO_2)

i. On the 26th to 27th May 2016 the incinerator was monitored for discharges of sulphur dioxide.

ii. One 1 to 2-hour sample was collected from each of the following waste sources: crushed drums, liquid waste, and general waste.

iii. The results of the sulphur dioxide air discharge monitoring showed that the concentration of sulphur dioxide ranged from 0.8 to 8.9 mg/m^3 (corrected for 0°C, 101.3 kPa, 11 % O_2, dry gas basis) with the sulphur dioxide mass emissions ranging from 0.0022 to 0.0237 kg/hr.

TABLE 5: Total Sulphur Dioxide Concentration & Emission Rate

Date	Waste Type	Total Sulphur Dioxide Concentration (mg/m^3)[1]	Total Sulphur Dioxide Emission Rate (kg/hr)
27 May 2016	Crushed Drums	8.9	0.0237
26 May 2016	General Waste	2.0	0.0055
27 May 2016	Liquid Waste	0.8	0.0022

[1] Corrected to 0ºC, 101.3 kPa, 11% oxygen, dry gas basis

e Metals

i. On the 24th to 26th May 2016 the incinerator was monitored for discharges of metals.

ii. One 2-hour sample was collected from each of the following waste sources: crushed drums, liquid waste, and general waste.

iii. The results of the metals monitoring are given in the following table.

TABLE 6: Total Metal Concentration & Emission Rate

Metal	Discharge Concentration (mg/m^3)[1]		Emission Rate (g/hr)	
	Range	Average	Range	Average
Aluminium	0.0126 - 0.0287	0.0181	0.0366 - 0.0734	0.0492
Antimony	0.0004 - 0.0112	0.0040	0.0011 - 0.0324	0.0117
Arsenic	0.0013 - 0.0021	0.0016	0.0038 - 0.0053	0.0045
Boron	0.0232 - 0.109	0.0654	0.0677 - 0.316	0.183
Cadmium	0.0001 - 0.0064	0.0022	0.0004 - 0.0186	0.0065
Chromium	0.0045 - 0.0084	0.0061	0.0132 - 0.0245	0.0170
Cobalt	<0.0002 - 0.0002	<0.0002	<0.0006 - 0.0006	<0.0006
Copper	0.0093 - 0.0211	0.0157	0.0238 - 0.0614	0.0446
Iron	0.0278 - 0.103	0.0693	0.0807 - 0.264	0.190
Lead	0.0021 - 0.0037	0.0028	0.0054 - 0.0106	0.0078
Lithium	0.0017 - 0.0022	0.0020	0.0043 - 0.0064	0.0056
Manganese	0.0009 - 0.0030	0.0022	0.0027 - 0.0086	0.0061
Mercury	<0.0004 - 0.0004	<0.0004	<0.0011 - 0.0013	<0.0012
Molybdenum	0.0018 - 0.0058	0.0033	0.0051 - 0.0169	0.0092
Nickel	0.0023 - 0.0027	0.0024	0.0066 - 0.0069	0.0067
Tin	0.0011 - 0.0021	0.0015	0.0028 - 0.0062	0.0043
Vanadium	<0.0016 - 0.0071	<0.0035	<0.0047 - 0.0182	<0.0093
Zinc	0.123 - 0.415	0.227	0.315 - 1.20	0.646

[1] Corrected to 0ºC, 101.3 kPa, 11% oxygen, dry gas basis

Conclusion

Under normal operating conditions, the maximum emission of PCDD/PCDF from the incinerator stack was 0.0370 ng/m^3 WHO-TEQ, which is less than the discharge consent limit of 0.1 ng/m^3 WHO-TEQ (corrected for 0°C, 101.3 kPa, 11 % O_2, dry gas basis).

Under normal operating conditions, the maximum emission of Total Halides from the incinerator stack was 0.365 kg/hr, which is below the discharge consent limit of 1.5 kg/hr.

These results indicate the performance of the Incinerator meets the conditions of the air discharge permit.

General

Consultation

Air Discharge Management and Monitoring Plan

On 1 March 2016 Dow AgroSciences met with representatives of the Taranaki Regional Council to discuss proposed changes to the ADMMP resulting from process changes in late 2015. The updates agreed during the meeting were incorporated into the ADMMP and the finalised plan submitted to the Chief Executive, Taranaki Regional Council on 25 May 2016.

Air Quality Inspections

Officers of the Taranaki Regional Council undertook regular air quality inspections during the period.

Incident Review

No incidents occurred during the 2015-16 period.

Appendices

Appendix 1: Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the Commodity Herbicides Plant, June 2016, Source Testing New Zealand Limited, issued June 2016.

Appendix 2: Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the High Temperature Incinerator, Compliance Monitoring February - June 2016, Source Testing New Zealand Limited, issued August 2016.

Appendix 3: Dow AgroSciences (NZ) Ltd, New Plymouth, Air Discharge Monitoring of the High Temperature Incinerator, Liquid Waste Dioxin and Furan Monitoring - July 2016, Source Testing New Zealand Limited, issued August 2016.