McKechnie Aluminium Solutions Limited
Monitoring Programme
Annual Report
2016-2017

Technical Report 2017-50

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Executive summary

Mckechnie Aluminium Solutions Ltd (MASL) operates an aluminium foundry and extrusion plant located at Bell Block, in the Mangaone and Mangati catchments. Processing of copper and brass (copper/zinc) at the plant ceased in June 2002 and January 2003, respectively. This report for the period July 2016 to June 2017 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess MASL's environmental and consent compliance performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of MASL's activities.

MASL holds two resource consents that are covered within this particular report: consent 1857 to discharge stormwater into an unnamed tributary of the Mangaone Stream, and consent 4034 to discharge emissions into the air, which together include a total of 22 conditions setting out the requirements that they must satisfy.

During the monitoring period, McKechnie Aluminium Solutions Ltd demonstrated an overall high level of environmental performance.

The Council's monitoring programme for the year under review included three inspections, 18 water samples collected for physicochemical analysis, two biomonitoring surveys of receiving waters, and one deposition gauge survey in the vicinity of the foundry site.

As in the previous monitoring period, sampling showed slight improvements in water quality in relation to dissolved copper and dissolved zinc concentrations. This supports the trend from previous sampling of an improvement in water quality within the receiving environment. Biomonitoring results have also continued to indicate a slight improvement in water quality and ecological conditions in the stream over the last few years. MCI and $SQMCI_S$ scores indicated that treated stormwater discharged from the site was not having a detrimental effect on the macroinvertebrate communities of the unnamed tributary of the Mangaone Stream.

The results from deposition gauging indicated that there was an environmentally acceptable level of particulate deposition in the vicinity of the foundry site. No visible emissions or odour issues were noted during inspections and no complaints were received during the period under review.

During the year, MASL demonstrated a high level of both environmental performance and administrative compliance with the resource consents.

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

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

This report includes recommendations for the 2017-2018 year.

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1 Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is for the period July 2016 to June 2017 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by McKechnie Aluminium Solutions Ltd (MASL). MASL operates an aluminium foundry and extrusion process situated at Paraite Road, in the Mangaone and Mangati catchments. The location of the site is shown in Figures 1 and 2.

Copper and brass foundries and extrusion processes had previously been operated at the site. Copper processing ceased in June 2002 and brass processing ceased in January 2003. MASL also previously operated a separate powdercoating facility on Connett Road in the Mangati catchment. This operation was shifted to the main Paraite Road site during the 2008-2009 year and is now monitored under the existing consents for this site.

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consents held by MASL that relate to discharges of water within the Mangaone[1] catchment, and the air discharge permit held by MASL 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 MASL's use of water, land and air, and is the 24th combined annual report by the Council for MASL.

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 MASL in the Mangaone and Mangati catchments;
- the nature of the monitoring programme in place for the period under review; and
- a description of the activities and operations conducted in MASL's site.

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

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

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

[1] Two stormwater discharge permits are held for the MASL site, consents 1857 and 3139. Consent 3139 (for the discharge of cooling water and stormwater from the MASL site to the Mangati Stream) monitoring is reported separately by the Council in a joint report covering discharges within the Mangati catchment.

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

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

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

Environmental Performance

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

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

For example:

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

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

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

Administrative performance

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

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

Improvement required: Repeated interventions to meet the administrative requirements of the resource consents were made by Council staff. These matters took some time to resolve, or remained unresolved at the end of the period under review. The Council may have issued an abatement notice to attain compliance.

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

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

1.2 Process description

1.2.1 Discharges to stormwater

The MASL manufacturing plant extends across the boundary between two stormwater catchments (Figure 1). Drainage from the western side (3.9 hectares) is to the eastern headwaters of the Mangaone

Stream, about four kilometres from where the stream enters the Waiwhakaiho River. Drainage from the eastern side (4.9 hectares) is to the Mangati Stream. There are separate consents for stormwater discharges to the two catchments. This report relates to the western stormwater discharge. The eastern stormwater discharge, consent 3139, is monitored under the Mangati Stream Catchment Monitoring Programme.

The area which drains to the Mangaone catchment is bounded by the Marton – New Plymouth railway, Henwood Road, and the main building. Significant changes have occurred at the site during the last twenty years with respect to both processing activities undertaken at the site and improvements to control the effects of historical activities. An outline of the historical activities and their potential impacts on current stormwater quality is given below. More detailed discussions are contained in previous monitoring reports, which are listed in the bibliography.

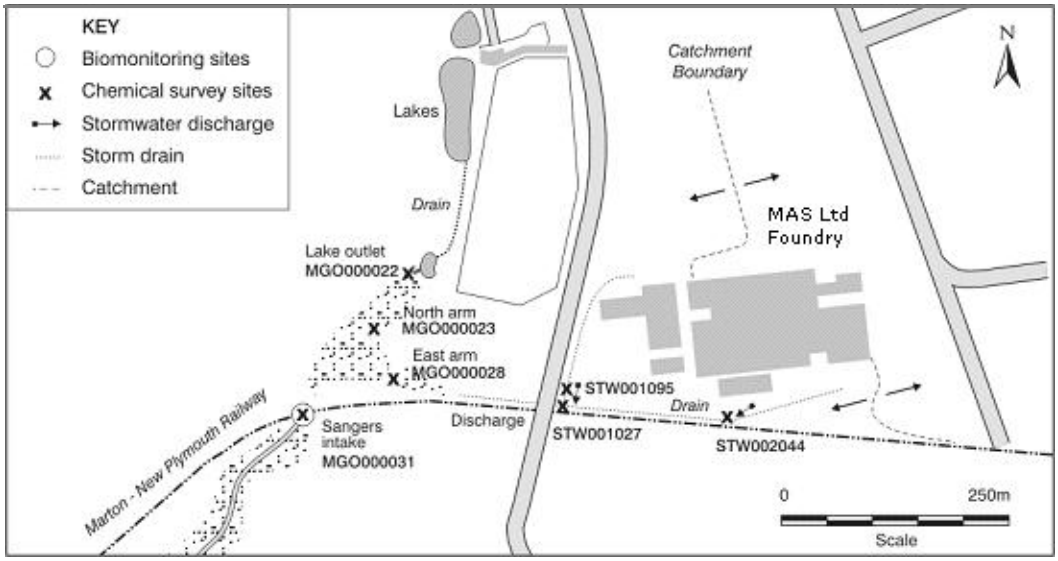

Figure 1 MASL foundry site, showing the boundary between Mangaone and Mangati stream catchments and water monitoring sites

Approximately 40% of the site draining to the Mangaone catchment is planted, 16% roofed, 41% tar seal or concrete, and 3% bare gravel.

The estimated storm flow to the Mangaone system, for a 10-minute duration event of 5 year return period, is 670 litres per second. Currently, for consent compliance purposes, the discharge point is at Henwood Road railway crossing. Monitoring is also undertaken at the points of exit from the site.

Aerial emissions from the now defunct brass and copper foundry and swarf drying plant prior to the installation of the baghouse in 1996, have contributed to the significant concentrations of metals, particularly copper, zinc and lead, now found in the surface soils at the site. Historical practices relating to the handling and storage of scrap, dross and baghouse dust have also resulted in particular areas having elevated metals concentrations.

Included in the Mangaone catchment are a tool room, fabrication shops, an aluminium anodising plant, an anodising effluent treatment plant, and a powdercoating facility. Also in this catchment are areas previously used in relation to the copper and brass re-melting and extrusion activities, which are now used for aluminium scrap sorting, finishing and warehousing.

A Stormwater Management Plan developed by MASL identifies actions that MASL has already carried out and is continuing to undertake to minimise the potential for contaminants to enter the stormwater from current operating practices and historical contamination.

There are two main stormwater drains westward from the site, which converge immediately above the railway crossing.

The southern drainage ditch runs approximately parallel with the railway, starting outside the former swarf drying plant and brass foundry. Its catchment includes a bunded holding area for drummed waste substances. The drainage from this area is discharged via a piped system which incorporates a baffled sediment and oil trap. A stop valve is fitted just downstream of the trap allowing isolation of the discharge in the event of a spillage in this catchment.

The western drain services the area around the aluminium anodising plant and fabrication building. The anodising effluent treatment plant is contained within a bunded area. The stormwater discharges to a small swamp in the eastern headwaters of the Mangaone Stream, about four kilometres from where the stream enters the Waiwhakaiho River further west. The swamp is fed from groundwater seeps and from a small lake previously on the property of the Pacific International Hotel Management School on Henwood Road. This area was redeveloped during the creation of the SH3 Bell Block bypass. Transit NZ holds consents for the reclamation of part of the northern end of the lake (5801) and to discharge stormwater from road surface drainage into the lakes (5803).

1.2.2 Discharges to air

In January 2008, a reconditioned gas fired furnace was installed which replaced the previous gas fired melting and holding furnaces. Only clean scrap is loaded into the new gas furnace, which discharges directly to atmosphere through a separate stack.

MASL receives clean in-house production and purchased scrap aluminum extrusions and ingots for re-melting and casting into extrusion log. A small amount of fumeless cleaning flux is used during the melting process. Small additions of silicon and magnesium are made to the aluminum in the gas fired furnace after it is melted for alloying purposes. The furnace burners are turned to low during dross removal, which combined with the fumeless flux, means that there are no emissions generated. No toxic metals are used during the melting process.

Before the aluminum is cast, further fumeless cleaning flux is used, along with casting table and launder coating applications. Continuous lubricant is injected into molds during the casting process.

Anodised and powdercoated scrap is chopped for loading into a separate induction furnace where emissions are routed to the aluminum baghouse. A fumeless cleaning flux is used after melting, followed by dross removal with the melt then being transferred to the gas fired furnace.

Discharges to air from the powdercoating facility are monitored under the foundry site consent. The potential effects from powdercoating are emissions of powder and odours into the air from the process. If solvents are used in the process there is also potential for air emissions to contain a toxic component. These effects can all be avoided by use of appropriate technology; in this case an exhaust fan followed by a baghouse. This technology is simple, robust and effective.

During past monitoring periods, there were frequent, but intermittent, plume discharges from the various sources to air. These varied in their impact offsite, depending on processing and weather conditions at the time of emission. Fugitive emissions have not been noted from vents on the aluminium building roof in recent monitoring periods. The baghouse controls have pre-set temperature limits, which will divert the exhaust gases directly to the stacks if the incoming gases exceed the limits set. This avoids the superheated gases damaging the baghouse or its components. This type of discharge is still subject to conditions 1 and 2 of consent 4034-3, which require the consent holder to adopt the 'best practicable option' to minimise adverse effects upon the receiving environment from the discharges.

Photo 1 MASL Baghouse

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.

MASL holds water permit **1857-6** to discharge treated stormwater from an industrial premises that includes a metal extrusion plant into an unnamed tributary of the Mangaone Stream. This permit was issued by the Council on 4 December 2012 under Section 87(e) of the RMA. It is due to expire on 1 June 2026.

There are nine special conditions imposed on consent 1857-6.

Condition 1 requires that the consent holder adopts the best practicable option to prevent or minimise any adverse effects on the environment.

Condition 2 limits the catchment area of the discharge to 4 hectares.

Condition 3 requires that hazardous substance storage areas are isolated from the stormwater catchment.

Condition 4 specifies limits for the components within the discharge immediately downstream of the railway crossing culvert.

Condition 5 establishes a mixing zone of 150 metres extending from below the railway crossing culvert, beyond which compliance with Section 107 of the RMA is required.

Condition 6 requires that MASL maintain a contingency plan for action to be taken in the event of accidental discharge or spillage of contaminants.

Condition 7 requires the maintenance of a stormwater management plan to the satisfaction of the Council.

Condition 8 requires the consent holder to notify the Council prior to making changes at the site which may alter the nature of the discharge.

Condition 9 provides for review of the consent.

The permit is attached to this report in Appendix I.

1.3.2 Air discharge permit

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

MASL holds air discharge permit **4034-3** to discharge emissions into the air from extrusion and remelting of aluminium and associated activities. This permit was first issued by the Council on 8 September 1993 as a resource consent under Section 87(e) of the RMA. It was most recently renewed on 15 August 2008 and is due to expire on 1 June 2026.

There are thirteen special conditions imposed on consent 4034-3.

Conditions 1 and 2 require that the consent holder adopts the best practicable option to prevent or minimise any adverse effects on the environment.

Condition 3 stipulates that any discharge to air shall not give rise to offensive or toxic levels of smoke, dust or odour at or beyond the site boundary.

Conditions 4, 5 and 6 limit the dust deposition rate beyond the site boundary; the total particulate matter concentration of ventilated gas streams; and the effect of discharges on the ambient suspended particulate concentration at the site boundary.

Condition 7 requires the consent to be exercised in accordance with the consent holder's Environmental Management Manual.

Condition 8 requires the consent holder to notify the Council prior to making any changes at the site which may alter the nature of the discharge.

Conditions 9, 10 and 11 stipulate limits on the opacity of any discharge; the increase in the ground level PM_{10} concentration beyond the boundary due to site discharges; and the concentration of any other contaminants in the discharge not specifically named in this consent.

Condition 12 requires the consent holder to immediately notify the Council of any incident or situation that does not comply with this consent, and to supply a written report on the incident to the Council within one week.

Condition 13 provides for review of the consent.

The permit is attached to this report in Appendix I.

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

1.4 Monitoring programme

1.4.1 Introduction

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

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

The monitoring programme for the MASL site consisted of four primary components.

1.4.2 Programme liaison and management

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

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

1.4.3 Site inspections

The MASL site was visited three 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. Air inspections focused on plant processes with associated actual and potential emission sources and characteristics, including potential odour, dust, noxious or offensive emissions. Sources of data being collected by MASL were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council. The neighbourhood was surveyed for environmental effects.

1.4.4 Chemical sampling

The Council undertook sampling of the discharges from the site for the purpose of compliance monitoring, and surveyed the water quality upstream and downstream of the discharge point and mixing zone to determine the impact on the receiving water.

There are eight permanent chemical monitoring sites (as shown in Figures 1 and 2). These are the western and eastern discharge points; the discharge drain at Henwood Road; the lake outlet upstream of the stormwater discharge; the northern arm of the swamp upstream of the discharge; the eastern arm of the swamp which receives the discharge (just inside the mixing zone); the receiving water in the unnamed tributary; and the receiving water in the Mangaone Stream at Egmont Road.

One monitoring run is carried out annually in wet weather, for compliance monitoring of the stormwater discharge, and one run is carried out annually in dry weather, to determine long term trends in the quality of the receiving water. Samples are analysed for pH, conductivity, suspended solids and concentrations of total and dissolved copper and zinc. The results of this monitoring are presented in Table 1.

In addition, two reduced wet weather sampling runs and two dry weather receiving water samples were collected to assess the relative levels of dissolved copper and zinc in the combined discharge and the receiving water below the mixing zone. The results are included in Tables 2 and 3.

To assess levels of particulate emissions to air, deposition gauges were placed in the vicinity of the site on one occasion during the period under review and the collected samples were analysed for deposited particulates and selected metals.

1.4.5 Biomonitoring surveys

Biological surveys were performed in February and April 2017 in an unnamed tributary of the Mangaone Stream to determine whether or not the discharge of stormwater from the site had had a detrimental effect upon the communities of the stream.

2 Results

2.1 Water

2.1.1 Inspections

Three inspections were undertaken at the MASL site during the period under review on 9 August, 6 December 2016 and 23 March 2017. The site was found to be generally tidy and well managed during inspections. There was good bunding of chemicals and contaminants, and spill kits were located in appropriate places.

During the August inspection a spill of spent caustic was discussed. The incident had occurred whilst transferring spent caustic from a tank to a truck and action was immediately taken to prevent a discharge to the stormwater sump. The area was washed down multiple times and a pH reading of the water was taken to ensure the caustic had been removed. An IBC containing acid-etch sludge was noted without bunding in the yard. This was discussed onsite and action was taken to ensure it was appropriately bunded.

2.1.2 Results of discharge monitoring

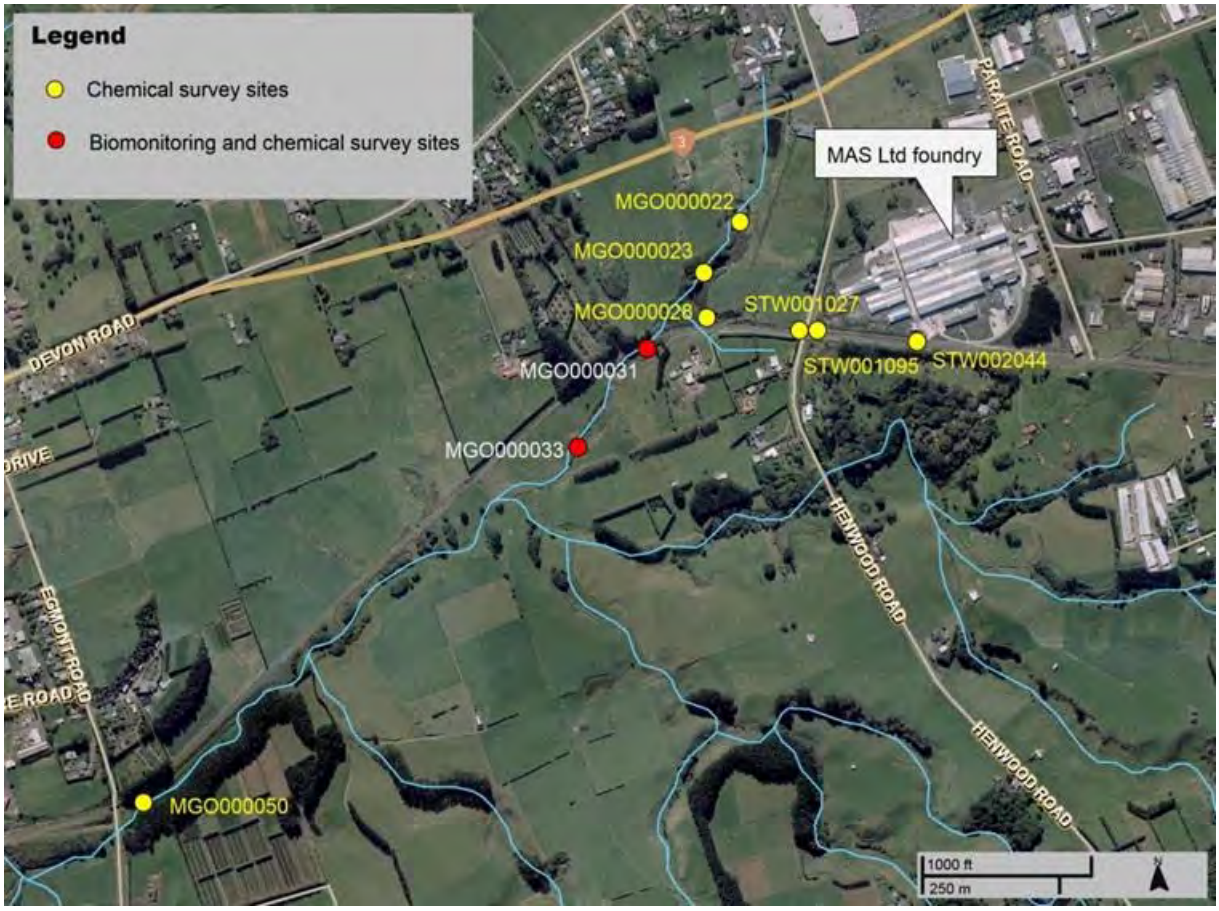

Figure 2 Location of the MASL plant at Bell Block and related water quality monitoring sites

Samples were taken by the Council from several permanent sampling points under dry conditions on 27 February 2017 and in wet weather conditions on 17 May 2017. The results are presented in Table 1. Two reduced wet weather runs were conducted on 22 June and 12 July 2017 (the latter delayed due to unsuitable weather conditions and availability of resources). A summary of these combined discharge and receiving water results is given in Table 2. Two dry weather samples of the tributary of the Mangaone

Stream below the mixing zone were also taken during the year. The results from these samples are presented in Table 3.

Dry weather runs are intended to determine long term trends in the quality of the receiving water. Historical metals concentration data available for dry weather runs was limited prior to the introduction of regular sampling at the start of the 1999-2000 monitoring period.

Wet weather runs enable the Council to determine whether compliance with the discharge conditions on consent 1857-6 is being achieved, and what effects the discharge is having on the receiving waters.

Up until a consent renewal in September 2003 there were six prescribed control limits imposed upon the MASL stormwater discharge. These limits applied to the pH, suspended solids, oil and grease, and copper, lead and zinc concentrations. From September 2003 to the end of the 2012 monitoring period the three prescribed control limits imposed on contaminants were for pH, oil and grease, and suspended solids. The current version of the consent also includes a limit of 0.05 g/m^3 on dissolved copper in the combined discharge and 1 g/m^3 for dissolved zinc.

The consent also limits the effects that the discharge may have on the receiving water beyond a mixing zone extending 150 m from the discharge point at the Henwood Road railway crossing. Site MGO000028 is within this mixing zone.

Traditionally, the establishment of water quality criteria has been based upon the use of measures such as "total recoverable metals" for determining acceptable limits for metal concentrations in discharges. However, in recent years a number of countries including the United States (under the aegis of the USEPA) have revised their toxicant criteria towards the protection of freshwater aquatic ecosystems in the receiving environment, and as such dissolved metal concentrations are considered more representative of the bioavailable fraction of metals in the water column.

The receiving water quality criteria for dissolved copper and zinc, in water with hardness of 50 g/m^3 $CaCO_3$, are 0.0062 g/m^3 Cu and 0.058 g/m^3 Zn for chronic (long-term) exposure. The corresponding criteria for acute (1-hour) exposure are 0.0088 g/m^3 Cu and 0.064 g/m^3 Zn. Chronic exposure criteria are best related to dry weather sampling results, whilst acute exposure criteria are best related to wet weather sampling conditions.

Aside from the dissolved metal concentrations within the mixing zone in the Eastern Arm (MGO000028), none of the samples collected from the tributary of the Mangaone Stream exceeded the relevant USEPA receiving water criteria for the protection of aquatic ecosystems.

The levels of dissolved copper found within the mixing zone of the Eastern Arm were significantly lower than the median of previous sampling (0.034 g/m^3), with 0.010 g/m^3 found during the current survey. Levels of dissolved zinc in the Eastern Arm were also well below the median of previous results (0.380 g/m^3). In general, there is continuing evidence of an improvement in the water quality of the tributary of the Mangaone Stream in relation to both dissolved copper and dissolved zinc.

The results for all other parameters indicated that the discharge was not having an adverse effect on the receiving waters. Levels of aluminium, lead, oil and grease, and suspended solids in the discharge were low and in compliance with applicable consent conditions.

Table 1 Results of comprehensive discharge and receiving environment monitoring

Parameter	Discharge			Downstream			Upstream	
	Western drain	Eastern drain	Combined Discharge	East Arm	Sanger's Intake*	Egmont Road	North Arm	Lake outlet
Site code	STW001095	STW002044	STW001027	MGO000028	MGO000031	MGO000050	MGO000023	MGO000022
Dry run – 27 February 2017								
Temperature (°C)	-	-	-	-	16.2	18.4	16.6	17.8
Conductivity (mS/m)	-	-	-	-	19.0	18.5	19.6	12.7
pH	-	-	-	-	7.1	7.3	6.8	6.6
Suspended Solids (g/m^3)	-	-	-	-	<2	2	10	5
Cu Acid Soluble (g/m^3)	-	-	-	-	<0.01	<0.01	<0.01	<0.01
Cu Dissolved (g/m^3)*	-	-	-	-	0.001	<0.001	<0.001	<0.001
Zn Acid Soluble (g/m^3)	-	-	-	-	0.008	<0.005	0.005	0.028
Zn Dissolved (g/m^3)*	-	-	-	-	0.006	<0.005	<0.005	0.024
Wet run – 17 May 2017								
Temperature (°C)	15.3	15.1	15.5	15.5	14.6	15.1	14.6	14.6
Conductivity (mS/m)	2.5	5.2	3.0	11.2	9.4	14.4	8.1	6.4
pH	6.6	7.5	7.1	6.4	6.9	6.9	6.7	6.4
Suspended Solids (g/m^3)	<2	4	<2	<2	5	18	5	<2
Cu Acid Soluble (g/m^3)	<0.01	0.02	0.02	0.01	<0.01	<0.01	<0.01	<0.01
Cu Dissolved (g/m^3)*	0.015	0.016	0.015	**0.010**	0.002	0.001	0.001	0.002
Zn Acid Soluble (g/m^3)	0.819	0.072	0.469	0.200	0.017	<0.005	0.010	0.037
Zn Dissolved (g/m^3)*	0.796	0.060	0.429	**0.199**	0.011	<0.005	0.007	0.032
Al Acid Soluble (g/m^3)	<0.1	0.26	0.20	-	-	-	-	-
Pb Acid Soluble (g/m^3)	<0.05	<0.05	<0.05	-	-	-	-	-
Oil and Grease (g/m^3)	<0.5	<0.5	<0.5	-	-	-	-	-
*USEPA acute criteria for dissolved metals: Cu 0.0088 g/m^3 and Zn 0.064 g/m^3 [at hardness of 50 g/m^3 $CaCO_3$]								

The results of combined discharge and receiving water monitoring for the 2016-2017 monitoring period are summarised in Table 2. The monitoring points are the stormwater culvert at the Henwood Road railway

crossing (STW001027), which is representative of the total stormwater discharge from the foundry site to the Mangaone catchment, and the unnamed tributary of the Mangaone Stream that is located downstream of the MASL stormwater discharge point. The second location is shown in Figure 1 and Figure 2 and is referred to as Sanger's Intake (MGO000031)[2]. Two sets of samples were taken during the period under review. All results for dissolved metals in the tributary below the mixing zone were below the USEPA acute receiving water criteria. The discharge was in compliance with consent 1857-6.

Table 2 Results of combined discharge (STW001027) and receiving water (MGO000031) monitoring

Date	Sampling point	Temp (°C)	pH	Conductivity (mS/m)	Suspended solids (g/m^3)	Oil & grease (g/m^3)	Dissolved Copper* (g/m^3)	Dissolved Zinc* (g/m^3)
22 June 2017	STW001027	11.7	6.9	3.2	18	<0.5	0.011	0.415
	MGO000031*	12.3	7.0	17.6	2	-	<0.001	0.009
12 July 2017	STW001027	6.1	7.0	1.9	4	-	0.010	0.283
	MGO000031*	9.3	6.8	7.9	12	-	0.002	0.018
*USEPA acute criteria for dissolved metals: Cu 0.0088 g/m^3 and Zn 0.064 g/m^3 [at hardness of 50 g/m^3 $CaCO_3$]								

The aim of this monitoring was to examine any potential correlation between the levels of dissolved metals in the MASL discharge and in the tributary of the Mangaone Stream below the mixing zone. This monitoring was instigated during the previous monitoring periods for the purpose of gathering data to assist in setting practical metals content limits in MASL's renewed stormwater discharge consent.

Table 3 Dry weather Sanger's Intake (MGO000031) monitoring results

Date	Temp (°C)	pH	Conductivity (mS/m)	Dissolved Copper* (g/m^3)	Dissolved Zinc* (g/m^3)
15 March 2017	15.8	7.0	17.0	0.001	0.005
30 June 2017	10.6	7.1	18.3	<0.001	<0.005
*USEPA chronic criteria for dissolved metals: Cu 0.0062 g/m^3 and Zn 0.058 g/m^3 [at hardness of 50 g/m^3 $CaCO_3$]					

Samples of the tributary of the Mangaone Stream at Sanger's Intake during dry weather were also collected during the year. The results are shown in Table 3.

In interpreting the impact of the discharge on the receiving water at Sanger's Intake, a number of other sources of metals not directly associated with the discharge itself that also affect the receiving water must be considered. For example, other sources may include: leaching related to historical aerial contamination from the MASL site; stormwater run-off from the Bell Block shopping complex and State Highway; earthworks associated with the bypass and industrial area development; and release of metals from the Eastern Arm associated with historical stormwater discharge activities.

[2] Sanger's Intake sampling location is downstream of the stormwater mixing zone. It also provides a useful indication of the overall quality of the receiving water within the unnamed tributary because this particular sampling location is representative of all contributing sources of heavy metals, including several other sources of contaminants that are not directly associated with the stormwater discharge itself.

The results of sampling from Sanger's Intake under dry weather conditions are similar to those found when stormwater was discharging from the MASL site. This indicates that the discharge is not significantly increasing copper and zinc concentrations within the tributary of the Mangaone Stream.

2.1.3 Results of receiving environment monitoring

The Council's standard 'kick-sampling' and 'sweep sampling' techniques were used at two established sites to collect streambed macroinvertebrates from an unnamed tributary of the Mangaone Stream on 15 February and 26 April 2017. Samples were sorted and identified to provide number of taxa (richness) and MCI and $SQMCI_S$ scores.

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

The results of these biological surveys indicated that the number of taxa recorded in the community a short distance downstream of the stormwater discharge from MASL was lower than normal for the two sites but did not indicate that there had been any toxic discharges from stormwater discharges. MCI scores indicated that the macroinvertebrate communities were in 'fair' health. In the February survey there was no significant difference between sites or from the previous survey completed in March 2016 but site 3 did have a significantly higher than normal score compared with its historical median indicating a healthier than usual macroinvertebrate community at the site. In the April survey there was no significant difference between sites or from the previous survey completed in February 2017.

With the exception of the February 2006, April 2007 and March 2016 surveys, the $SQMCI_S$ values have been relatively high in the last 25 surveys. This was due mainly to the very high abundances of medium-scoring taxa, particularly 'moderately sensitive' amphipods (*Paracalliope* and Paraleptamphopidae). This trend was continued in both surveys at both sites.

The macroinvertebrate surveys indicated that the discharge of treated stormwater from the MASL site had not had any detrimental effect on the macroinvertebrate communities present in this unnamed tributary of the Mangaone Stream.

The full biomonitoring reports are attached in Appendix II.

2.2 Air

2.2.1 Inspections

No issues regarding air quality were noted during the monitoring period.

2.2.1.1 Deposition dust gauging

Many industries emit dust from various sources during operational periods. In order to assess the effects of the emitted dust, industries have been monitored using deposition gauges. Deposition gauges are buckets elevated on a stand to about 1.6 metres. The buckets have a solution in them to ensure that any dust that settles out of the air is not re-suspended by wind.

The rate of dust-fall is calculated by dividing the weight of insoluble material (grams) collected by the cross-sectional area of the gauge (m^2) and the number of days over which the sample was taken. The units of measurement are grams/metre^2/day.

Guideline values used by the Council for dust deposition are 4 g/m^2/30 days or 130 mg/m^2/day deposited matter. Consideration is given to the location of the industry and the sensitivity of the surrounding community when assessing results against these values. Material from the gauges was analysed both for solid particulates and for constituents associated with pollution, including selected metals.

In the 2016-2017 period, gauges were deployed on one occasion at four locations in the vicinity of the foundry site for a period of 22 days from 10 April to 2 May 2017. The locations of the monitoring sites around the foundry are shown in Figure 3.

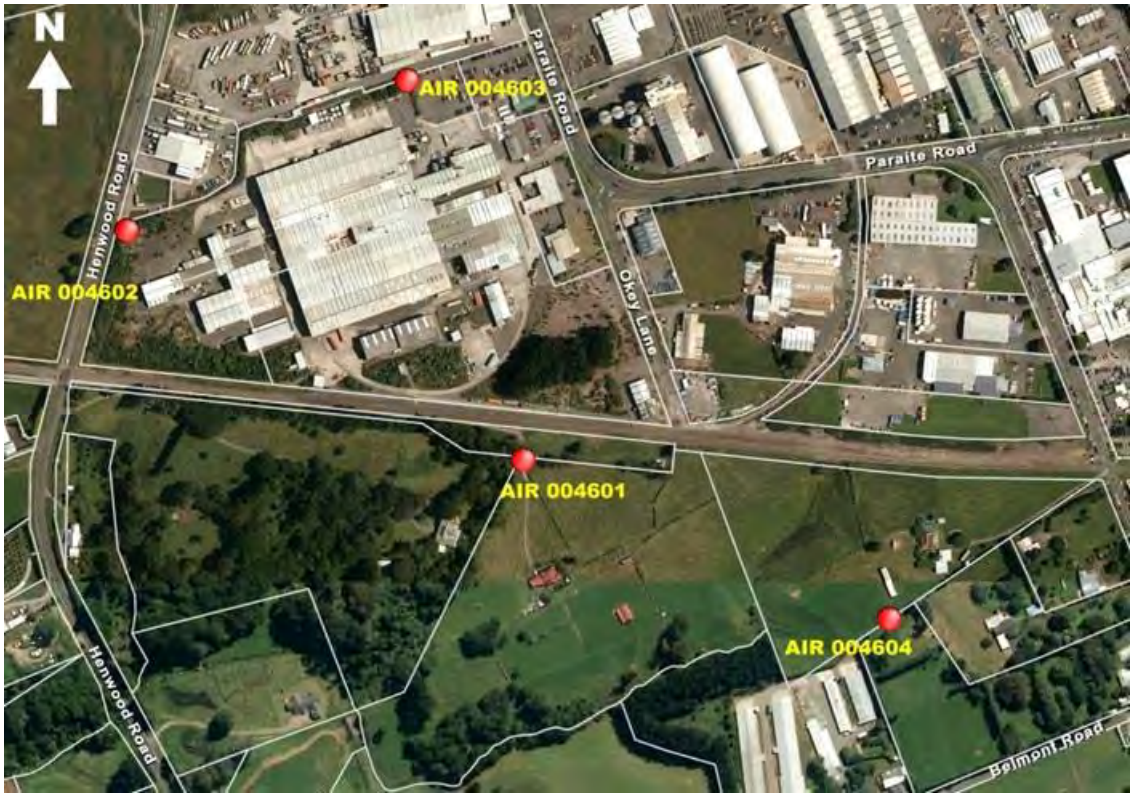

Figure 3 Locations of dust deposition monitoring sites in relation to the MASL site

Material from the gauges was analysed for particulates, aluminium, copper, lead, zinc and conductivity. For comparison, the median values of data obtained from an urban 'state of the environment' deposition gauge site located on the corner of Mangorei Road and Devon Road (site AIR000012) have been included in Table 4.

Particulates

The rates of particulate deposition were below the 130 mg/m^2/day guideline value at all sites. The particulate level at site AIR004603, closest to the MASL facilities, was well below the median of previous samples. This site may have been sheltered from high ambient dust levels by its proximity to surrounding buildings. Levels at the control site AIR004604 were within the guideline value but the result was higher than the historical median.

Table 4 Foundry deposition gauge results for the May 2017 survey

Site		AIR004601	AIR004602	AIR004603	AIR004604	AIR000012 (median 2000-2003) comparison site
Total particulate mg/m^2/day		60	50	50	110	50
Total particulate mg/m^2/day June 1996-June 2016 median		*40*	*40*	*95*	*50*	-
Aluminium mg/m^2/day	Dissolved	0.28	0.25	0.28	0.33	-
	Particulate	0.304	0.318	0.256	0.782	-
Copper mg/m^2/day	Dissolved	0.03	0.02	0.03	0.03	0.021
Lead mg/m^2/day	Dissolved	0.14	0.12	0.14	0.17	-
Zinc mg/m^2/day	Dissolved	0.11	0.15	0.11	0.08	0.284
Conductivity @ 20°C mS/m/day		0.38	0.20	0.23	1.44	0.28

Metals deposition

The ratio between the particulate and dissolved fractions varies according to the individual metal and the pH of the liquid in the deposition gauge. As much as 99% of the total zinc has been found to be in the dissolved (bio-available) form. This is likely to be higher than the proportion bio-available in the soil, as historically the pH of the liquid in the gauge has been quite acidic (favouring metal solubility) relative to the soil. Because of this, combined with the closure of the copper and brass activities at the site, particulate metal analysis of the filters for copper, lead and zinc has been ceased.

The Department of Health (1992) has set guidelines for maximum annual application to agricultural land of heavy metals (in sewage sludge). These guidelines may be used for assessing the impact of metals deposited on land in the vicinity of the MASL site. The guidelines for copper, lead and zinc are 12, 15 and 30 kilograms per hectare per year, respectively. This equates to 3.3, 4.1 and 8.2 mg/m^2/day for copper, lead and zinc respectively. There is no guideline for aluminium.

The highest values recorded for the dissolved metals deposited in the 2016-2017 monitoring year were 1%, 4%, and 2% of the respective guidelines for copper, lead, and zinc. The levels of dissolved aluminium were slightly above historical medians (which range from 0.197 to 0.255 mg/m^2/day) for all four sites, while particulate aluminium levels were below the median values (ranging from 0.580 to 1.52 mg/m^2/day) for all four sites.

In comparison to the median values found at the urban 'state of the environment' monitoring site AIR000012, the MASL deposition gauge sites showed copper deposition rates that were similar to those in an urban area close to a main road, while zinc deposition rates were mostly much lower than the urban median.

Other parameters

These results are consistent for those parameters which are predominantly affected by the proximity of a monitoring site to the sea, i.e. total dissolved salts (indicated by conductivity). Activities at the MASL site do

not lead to significant emissions of these compounds, and there is no evidence from the monitoring of site-specific effects related to total dissolved salts.

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 MASL. During the year matters may arise which require additional activity by the Council, for example provision of advice and information, or investigation of potential or actual causes of non-compliance or failure to maintain good practices. A pro-active approach that in the first instance avoids issues occurring is favoured.

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

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

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

3 Discussion

3.1 Discussion of site performance

MASL has markedly reduced the discharge of contaminants from its foundry site in recent years. MASL achieved compliance with the prescribed consent limits imposed on its discharge permits for the site in the period under review. Good control of emissions from the aluminium foundry was also achieved. There were no air related complaints received by Council.

MASL has implemented the improvements relating to consent 1857 and the stormwater management programme developed in conjunction with the Council.

3.2 Environmental effects of exercise of consents

3.2.1 Environmental effects of exercise of water discharge permit

Stormwater from the MASL site has discharged to a small swamp in the headwaters of the Mangaone Stream for a period of over 30 years. The Council has monitored the effects of the discharge and the receiving water since 1982 through both chemical and biological surveys.

Continued improvements in effluent management and housekeeping practices by MASL have assisted in reducing the concentrations of contaminants within the stormwater discharged from the site. Sample results during the period under review support the trend of reductions in the levels of contaminants in the receiving water at Sanger's Intake seen during recent years. No samples outside of the mixing zone exceeded the relevant USEPA receiving water criteria for the protection of aquatic ecosystems.

The two biological surveys undertaken during the period under review indicated that the discharge of treated stormwater from the MASL site had not had any recent detrimental effect on the macroinvertebrate communities of the unnamed tributary of the Mangaone Stream. This provides further evidence that there has been an improvement in physicochemical water quality in recent monitoring years, consistent with the water quality monitoring data.

3.2.2 Environmental effects of exercise of air discharge permit

Atmospheric particulate matter can arise from a number of sources, both natural and from human activity, for example: vegetation pollens, smoke and ash, sea spray, dust from soils and paved surfaces, and manufacturing processes. While extremely fine particles may remain floating in the atmosphere for weeks or months, coarser dusts may settle out within timeframes ranging from a few seconds to minutes.

The environmental effects of dusts include loss of visibility, loss of the amenity and aesthetic values of a 'clear sky', irritation to breathing, and soiling of surfaces. It has been found that background rates of dust deposition in rural areas of New Zealand are typically 3-50 mg/m^2/day, while in urban areas rates are generally higher, in the range of 20-100 mg/m^2/day. From experience, rates above 100-135 mg/m^2/day tend to lead to complaints by neighbours over the objectionable or offensive nature of dust emissions from particular sources.

Deposition gauging was conducted for the 22nd time during the 2016-2017 monitoring period around the foundry site. The results from the gauging indicated that there was an environmentally acceptable level of particulate deposition in the vicinity of the foundry site. The results of the gauging also showed that the levels of deposited metals were much lower than allowed by the Department of Health (1992) guidelines for maximum annual application to agricultural land of heavy metals (in sewage sludge).

The incidence of conspicuously visible emissions has reduced greatly at the foundry site since the installation of the aluminium baghouse. No visible emissions or odour issues were noted during inspections and no complaints were received during the period under review.

3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Tables 5 and 6.

Table 5 Summary of performance for consent 1857-6

Purpose: ***To discharge treated stormwater from an industrial premise that includes a metal extrusion plant into an unnamed tributary of the Mangaone Stream***		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Adoption of best practicable option to minimise effects on the environment	Inspections and liaison with consent holder	Yes
2. Maximum catchment size	Site inspections	Yes
3. Appropriate hazardous substance storage	Site inspections	Yes
4. Limits on chemical composition of discharge	Sampling	Yes
5. Discharge shall not cause specified adverse effects beyond mixing zone	Sampling and biomonitoring surveys of the receiving water	Yes
6. Implementation and review of a contingency plan	MASL Environmental Management Manual includes contingency plan	Yes
7. Maintenance of a stormwater management plan	Updated Stormwater Management Plan received September 2016	Yes
8. Notification prior to making changes at the site which may alter the nature of the discharge	Notifications and site inspections	Yes
9. Optional review provision re environmental effects	Not scheduled for consideration during year under review. Next consideration 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 6 Summary of performance for consent 4034-3

Purpose: *To discharge emissions into the air from extrusion and remelting of aluminium and associated activities*		
Condition requirement	**Means of monitoring during period under review**	**Compliance achieved?**
1. Adoption of best practicable option to minimise effects on the environment	Site inspections	Yes
2. Selection of best practicable equipment and processes	Site inspections	Yes
3. Discharge shall not give rise to offensive or toxic levels of contaminants at the site boundary	Site inspections and discharge monitoring	Yes
4. Limit on dust deposition rate beyond the site boundary	Deposition gauge monitoring	Yes
5. Maximum particulate concentration of discharges	Testing not undertaken during year under review	N/A
6. Limit on elevation of ambient suspended particulate matter concentration	Testing not undertaken during year under review	N/A
7. Compliance with the MASL Environmental Management Manual	Site inspections and liaison with consent holder	Yes
8. Notification prior to making changes at the site which may alter the nature of the discharge	Notifications and site inspections	Yes
9. Limit on opacity of any discharge	Testing not undertaken during year under review	N/A
10. Limit on effect of emissions on PM10 concentration at the boundary	Testing not undertaken during year under review	N/A
11. Limits on other contaminants beyond site boundary	Testing not undertaken during year under review	N/A
12. Notification in the event of unauthorised discharge	No unauthorised incidents logged during the year	N/A
13. Optional review of consent	Not scheduled for consideration during year under review. Next consideration 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**

Table 7 Evaluation of environmental performance over time

Year	Consent no	High	Good	Improvement req	Poor
2008-09	1857-5	1			
	4034-3	1			
	5566-2	1			
	6049-1	1			
2009-10	1857-5	1			
	4034-3	1			
2010-12	1857-5	1			
	4034-3	1			
2012-13	1857-6	1			
	4034-3	1			
2013-14	1857-6		1		
	4034-3	1			
2014-15	1857-6	1			
	4034-3	1			
2015-16	1857-6	1			
	4034-3	1			
Totals		15 (94%)	1 (6%)		

During the year, MASL demonstrated a high level of environmental performance and a high level of administrative compliance with the resource consents as defined in Section 1.1.4. There were no unauthorised incidents recorded by the Council in relation to MASL's activities. The site was well managed and maintained. Ratings are as defined in Section 1.1.4.

3.4 Recommendations from the 2015-2016 Annual Report

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

1. THAT monitoring of consented activities at the McKechnie Aluminium Solutions Ltd site in the 2016-2017 year continue at the same level as in 2015-2016.

This recommendation was implemented.

3.5 Alterations to monitoring programmes for 2017-2018

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

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

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

It is proposed that for 2017-2018 the monitoring programme remains the same as that scheduled in 2016-2017.

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the site(s) in question. The Council reserves the right to subsequently adjust the programme from that initially prepared, should the need arise if potential or actual non-compliance is determined at any time during 2017-2018.

4 Recommendations

1. THAT monitoring of consented activities at the McKechnie Aluminium Solutions Ltd site in the 2017-2018 year continue at the same level as in 2016-2017.
2. THAT should there be issues with environmental or administrative performance in 2017-2018, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.

Glossary of common terms and abbreviations

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

Al*	Aluminium.
Biomonitoring	Assessing the health of the environment using aquatic organisms.
Bund	A wall around a tank to contain its contents in the case of a leak.
Conductivity	Conductivity, an indication of the level of dissolved salts in a sample, usually measured at 20°C and expressed in mS/m.
Cu*	Copper.
g/m^3	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
Incident Register	The Incident Register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
m^2	Square Metres.
MCI	Macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats.
$mg/m^2/day$	Milligrams/$meter^2$/day
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.
O&G	Oil and grease, defined as anything that will dissolve into a particular organic solvent (e.g. hexane). May include both animal material (fats) and mineral matter (hydrocarbons).
Pb*	Lead.
pH	A numerical system for measuring acidity in solutions, with 7 as neutral. Numbers lower than 7 are increasingly acidic and higher than 7 are increasingly alkaline. The scale is logarithmic i.e. a change of 1 represents a ten-fold change in strength. For example, a pH of 4 is ten times more acidic than a pH of 5.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
PM_{10}	Relatively fine airborne particles (less than 10 micrometre diameter).

Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	*Resource Management Act 1991* and including all subsequent amendments.
SS	Suspended solids.
SQMCI	Semi quantitative macroinvertebrate community index.
Temp	Temperature, measured in °C (degrees Celsius).
Zn*	Zinc.

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

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

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Appendix I

Resource consents held by McKechnie Aluminium Solutions Ltd

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

Discharge Permit

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

Name of Consent Holder:	McKechnie Aluminium Solutions Limited Private Bag 2007 NEW PLYMOUTH 4342
Decision Date:	4 December 2012
Commencement Date:	4 December 2012

Conditions of Consent

Consent Granted:	To discharge treated stormwater from an industrial premise that includes a metal extrusion plant into an unnamed tributary of the Mangaone Stream at or about (NZTM) 1698859E-5677985N
Expiry Date:	1 June 2026
Review Date(s):	June 2014, June 2020 and in accordance with special condition 9
Site Location:	36 Paraite Road, Bell Block, New Plymouth
Legal Description:	Lot 1 DP 10008 Lot 1 DP 9212 Lot 2 DP 330342 [discharge source]
Catchment:	Waiwhakaiho
Tributary:	Mangaone

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 [the Council] all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act.

Special conditions

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.

2. The stormwater discharged shall be from a catchment area not exceeding 4 hectares.

3. Any significant volumes of hazardous substances on site shall be stored in a dedicated bunded area with drainage to sumps, or to other appropriate recovery systems, and not directly to the site stormwater system.

4. Constituents of the discharge shall meet the standards shown in the following table.

Constituent	Standard
pH	within the range 6.0 to 9.0
Suspended solids	concentration not greater than 100 gm^{-3}
Oil and grease	concentration not greater than 15 gm^{-3}
Dissolved copper	concentration not greater than 0.05 gm^{-3}
Dissolved zinc	concentration not greater than 1 gm^{-3}

This condition shall apply in the receiving waters at a designated sampling point immediately downstream of the railway crossing culvert at or about [1698859E-5677985N].

5. After allowing for reasonable mixing, within a mixing zone extending 150 metres downstream of the discharge point, the discharge shall not, either by itself or in combination with other discharges, give rise to any or all of the following effects in the receiving water:

   a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
   b) any conspicuous change in the colour or visual clarity;
   c) any emission of objectionable odour;
   d) the rendering of fresh water unsuitable for consumption by farm animals;
   e) any significant adverse effects on aquatic life.

6. The consent holder shall maintain a contingency plan that details measures and procedures to be undertaken to prevent spillage or any discharge of contaminants not authorised by this consent. The contingency plan shall be followed in the event of a spill or unauthorised discharge and shall be certified by the Chief Executive, Taranaki Regional Council as being adequate to avoid, remedy or mitigate the environmental effects of such a spillage or discharge.

7. The consent holder shall maintain a stormwater management plan that documents how the site is to be managed to minimise the contaminants that become entrained in the stormwater. This plan shall be followed at all times, shall be certified by the Chief Executive, Taranaki Regional Council, and shall include but not necessarily be limited to:

   a) the loading and unloading of materials;
   b) maintenance of conveyance systems;
   c) general housekeeping; and
   d) management of the interceptor system.

8. The consent holder shall notify the Chief Executive, Taranaki Regional Council, prior to making any changes to the processes or operations undertaken at the site, or the chemicals used or stored on site, or any disturbance of soil on site that could alter the nature of the discharge. Any such change shall then only occur following receipt of any necessary approval under the Resource Management Act. Notification shall include the consent number, a brief description of the activity consented and an assessment of the environmental effects of any changes, and be emailed to consents@trc.govt.nz.

9. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review:

   a) during the month of June 2014 and/or June 2020; and/or
   b) within 3 months of receiving a notification under special condition 8 above;

   for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 4 December 2012

For and on behalf of
Taranaki Regional Council

_____

Director-Resource Management

Discharge Permit

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

Name of Consent Holder:	McKechnie Aluminium Solutions Limited Private Bag 2007 NEW PLYMOUTH 4342
Consent Granted Date:	15 August 2008

Conditions of Consent

Consent Granted:	To discharge emissions into the air from extrusion and remelting of aluminium and associated activities at or about (NZTM) 1699193E-5678120N
Expiry Date:	1 June 2026
Review Date(s):	June 2014, June 2020
Site Location:	Paraite Road, Bell Block, New Plymouth
Legal Description:	Lot 1 DP 9212, Lot 1 DP 10008 & Lot 2 DP 330342

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. Notwithstanding any other conditions of this consent 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 consent holder shall minimise the emission and effects of contaminants discharged to air from the property, by the selection of the best practicable process equipment, process control equipment, contaminant abatement equipment, and methods of control, supervision and operation, and the proper and effective operation, supervision, control and maintenance of all equipment and processes at all times.

3. Any discharge to air from the exercise of this consent shall not give rise to any offensive, objectionable or toxic levels of smoke or dust or odour at or beyond the boundary of the property on which the extrusion and remelting of aluminium and associated activities are occurring.

4. The dust deposition rate beyond the property boundary of the MCK Metals Pacific Ltd Plant, arising from the discharge, shall be less than 4.0 $g/m^2/30$ days or 0.13 $g/m^2/day$.

5. All gas streams ventilated or otherwise discharged from the plant shall be treated to reduce the concentration of total particulate matter to less than 125 milligrams per cubic metre, normal temperature and pressure, at any time.

6. The discharge of suspended particulate matter from the site shall not increase the ambient concentration of suspended particulate matter by more than 3 milligrams per cubic metre (measured under ambient conditions), determined by measurements at the upwind and downwind boundaries of the property.

7. The consent will be exercised in accordance with the procedures set out in the consent holder's Environmental Management Manual (August 2007) and subsequent revisions, and the consent holder shall subsequently adhere to and comply with the procedures, requirements, obligations and all other matters specified in the Environmental Management Manual (August 2007), except by specific agreement of the Chief Executive, Taranaki Regional Council. In the case of any contradiction between the Environmental Management Manual (August 2007) and the conditions of this resource consent, the conditions of this resource consent shall prevail.

8. The consent holder shall notify the Chief Executive, Taranaki Regional Council, prior to making any changes to the processes or operations undertaken at the site, or the chemicals used or stored on site, which could alter the nature of the discharge. Any such change shall then only occur following receipt of any necessary approval under the Resource Management Act. Notification shall include the consent number, a brief description of the activity consented and an assessment of the environmental effects of any changes, and to be emailed to worknotification@trc.govt.nz.

9. The opacity of any discharge to air when measured by photoelectric means shall not equal or exceed a value of 20% opacity.

10. The emissions to the air from the Consent Holder's premises shall not significantly contribute to, nor cause the monitored ground level concentrations of particulate material less than 10 microns in aerodynamic diameter to exceed 50 micrograms per cubic metre of air expressed as a 24 hour average at or beyond the boundary of Consent Holder's premises.

11. That the discharge to atmosphere of any contaminants other then those specified above shall not cause the concentration within the air space beyond the boundary of the Consent Holder's property of that contaminant to exceed 1/30th [one-thirtieth] of the relevant Workplace Exposure Standard Time-weighted average [Workplace Exposure Standards Effective from 2002].

12. The Consent Holder shall, for the purposes of adequately monitoring the consent as required under Section 35 of the Act, on becoming aware of any incident or situation that does not comply with this consent, immediately advise the Council on the incident. The Consent Holder shall then supply a written report to the Council on the cause, effects and the actions taken to mitigate the effects on the environment and to prevent recurrence. The written report shall be submitted to the Council within one week of the incident occurring.

13. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 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.

Transferred at Stratford on 4 March 2010

For and on behalf of
Taranaki Regional Council

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Director-Resource Management

Appendix II

Biomonitoring reports

To	Job Manager, Callum MacKenzie
From	Scientific Officer, Darin Sutherland
File	03-02-005-07/01; 1857
Report No	DS064
Document No.	1858128
Date	4 May 2017

Biomonitoring of an unnamed tributary of the Mangaone Stream below the McKechnie Aluminium Solutions Ltd plant, February 2017

Introduction

The macroinvertebrate communities of an unnamed tributary of the Mangaone Stream below the McKechnie Aluminium Solutions Ltd [MASL] plant have been monitored annually or biannually since November 1983. This biological survey was the first of two surveys scheduled in the 2016-2017 monitoring year. Due to persistent, heavy rain during the spring 2016 period the sampling was postponed and a second survey will occur in autumn 2017. The results of surveys performed since the 1998-99 monitoring years are discussed in various Taranaki Regional Council reports (refer to the references).

Methods

On 15 February 2017 streambed macroinvertebrates in the Mangaone Stream tributary were collected from site 3 using the 'vegetation sweep ' technique , while a combination of the 'kick-net-sampling' and 'sweep-net-sampling' techniques were used to collect streambed macroinvertebrates from site 4 (Table 1, Figure 1). These sampling techniques are very similar to Protocol C1 (hard-bottomed, semi-quantitative) (kick-sample) and Protocol C2 (soft-bottomed, semi-quantitative) (vegetation-sweep) 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 tributary of the Mangaone Stream that receives stormwater discharges from MASL

Site No	Site code	Grid reference	Location
3	MGO000031	E1698576 N5677952	Below swamp (Sanger's intake)
4	MGO000033	E1698447 N5677770	400 metres downstream of site 3

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 were 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. Averaging the scores assigned to the taxa found at a site, and multiplying the average by a scaling factor of 20 produces a Macroinvertebrate Community Index (MCI) value. 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 Macroinvertebrate health based on MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2015) from Stark's classification (Stark, 1985, Boothroyd and Stark, 2000, and Stark and Maxted, 2007)

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

MCI results can also reflect the effects of warm temperatures, slow current speeds and low dissolved oxygen levels, because the taxa capable of tolerating these conditions generally have low sensitivity scores. Usually more 'sensitive' communities (with higher MCI values) inhabit less polluted waterways. The use of this index in non-stony streams is possible if results are related to physical habitat (muddy or weedy streams tend to produce lower MCI values than stony streams).

A semi-quantitative MCI value ($SQMCI_s$) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the $SQMCI_s$ is not multiplied by a scaling factor of 20, therefore $SQMCI_s$ values range from 1 to 10, while MCI values range from 20 to 200. A difference of 0.83 units or more in $SQMCI_s$ values is considered significantly different (Stark 1998).

Results

Site habitat characteristics and hydrology

This summer survey was performed under low flow conditions (approximately 7.4% of median flow of 243 L/s), 12 days after a fresh in excess of both 3 times and 7 times median flow (flow gauge at the Mangaone at Katere Road). The survey followed a relatively wet summer period with several freshes recorded over the preceding month. Water temperature was 17.5°C at site 3 and 16.7°C at site 4**.** Site 3 had slow flow with uncoloured, clear water and site 4 had very slow flow with uncoloured, clear water.

Substrate comprised predominantly silt at both sites. Site 3 had macrophytes on the streambed with overhanging vegetation partially shading the streambed. Site 4 in contrast had macrophytes on the edge of the streambed with overhanging vegetation partially shading the streambed. No obvious algal growth was noted at either site during this survey. Consistent with most previous surveys, both sites were impacted by iron oxide sedimentation.

The stormwater discharge from the MASL plant flows into a small drain which itself flows into the eastern arm of a swampy area. The swamp forms the headwaters of a small stream in which sites 3 and 4 are located. A long culvert was laid in the stream between sites 3 and 4 prior to the November 2000 survey, with this pipe extended downstream between the February and December 2015 surveys (Figure 1). The culvert begins a few metres downstream of site 3 and ends at the point where site 4 was previously located. Site 4 was subsequently moved several metres downstream. The habitat at this location was similar to the habitat at the original site. There have also been changes in the headwaters of this unnamed tributary in relation to the construction of the bell block bypass.

It should be noted that the stream was culverted between sites 3 and 4 to allow the landowner to discharge cleanfill, in doing so, slowly filling in the gully. This site holds a consent to discharge from this cleanfill, and is monitored under a separate monitoring programme. However, activities at this cleanfill site have the potential to impact on the communities of this stream. Due to recent earthworks related to the infilling of the gully, a pond immediately above site 4 has formed which has slowed the flow rate at the site.

Macroinvertebrate communities

The results of the previous macroinvertebrate surveys performed at sites 3 and 4 in the Mangaone tributary that receives stormwater discharges from MASL are summarised in Table 4, together with the results of the current survey.

Table 4 Numbers of taxa and MCI values recorded in the unnamed tributary of the Mangaone Stream downstream of MASL, from November 1983 to the current survey

Site No.	N	No of taxa			MCI value			$SQMCI_s$ value		
		Median	Range	Current survey	Median	Range	Current survey	Median	Range	Current survey
3	59	17	6-26	11	78	52-94	91	4.3	1.7-4.8	4.9
4	50	19	6-30	12	78	70-90	83	4.3	1.5-4.9	4.2

Table 5 Macroinvertebrate fauna of a tributary of Mangaone Stream in relation to MASL sampled on 15 February 2017

Taxa List	Site Number	MCI score	3	4
	Site Code		MGO000031	MGO000033
	Sample Number		FWB17074	FWB17075
PLATYHELMINTHES (FLATWORMS)	*Cura*	3	R	R
NEMERTEA	Nemertea	3	-	R
ANNELIDA (WORMS)	Oligochaeta	1	R	-
HIRUDINEA (LEECHES)	Hirudinea	3	-	R
MOLLUSCA	Lymnaeidae	3	-	R
	Potamopyrgus	4	VA	XA
CRUSTACEA	Isopoda	5	-	R
	Paracalliope	5	XA	A
	Paraleptamphopidae	5	XA	VA
	Talitridae	5	-	R
TRICHOPTERA (CADDISFLIES)	*Plectrocnemia*	8	R	-
	Triplectides	5	C	A
DIPTERA (TRUE FLIES)	Eriopterini	5	R	-
	Zelandotipula	6	R	R
	Polypedilum	3	C	C
	Tanypodinae	5	R	-
		No of taxa	11	12
		MCI	91	83
		SQMCIs	4.9	4.2
		EPT (taxa)	2	1
		%EPT (taxa)	18	8
'Tolerant' taxa	'Moderately sensitive' taxa		'Highly sensitive' taxa	

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

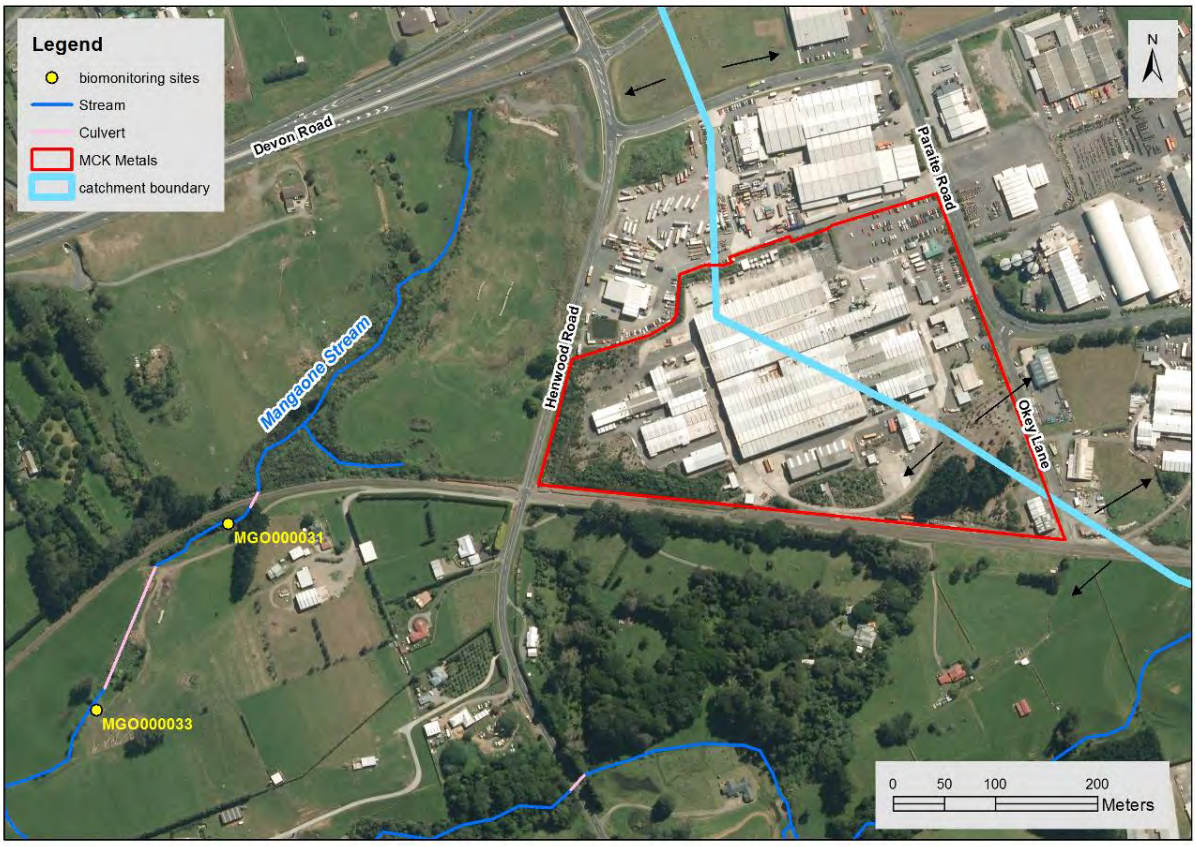

Figure 1 Biomonitoring sites in a tributary of the Mangaone Stream related to the stormwater discharge from MASL

Site 3 (MGO000031)

A moderately low macroinvertebrate community richness of 11 taxa was found at site 3 at the time of this summer survey. This was six taxa lower than the historical median for this site and five taxa lower than the preceding survey on March 2016 (Table 4 and Figure 2).

The MCI score of 91 units indicated a community of 'fair' biological health which was significantly higher (Stark, 1998) than the historical median MCI score (78 units) but not to the preceding survey score (84 units). The score was also significantly higher than the median score recorded from other lowland coastal streams (MCI score of 79 units) (TRC, 2016) (Table 4 and Figure 2).

The $SQMCI_S$ score of 4.9 units was not significantly different (Stark, 1998) to the historical median $SQMCI_S$ score of 4.3 units and to the previous survey score (4.7 units) (Stark, 1998) (Table 4).

The community was characterised by one 'tolerant' taxon [snail (*Potamopyrgus*)], and two 'moderately sensitive' taxa [amphipods (*Paracalliope* and Paraleptamphopidae)], (Table 5).

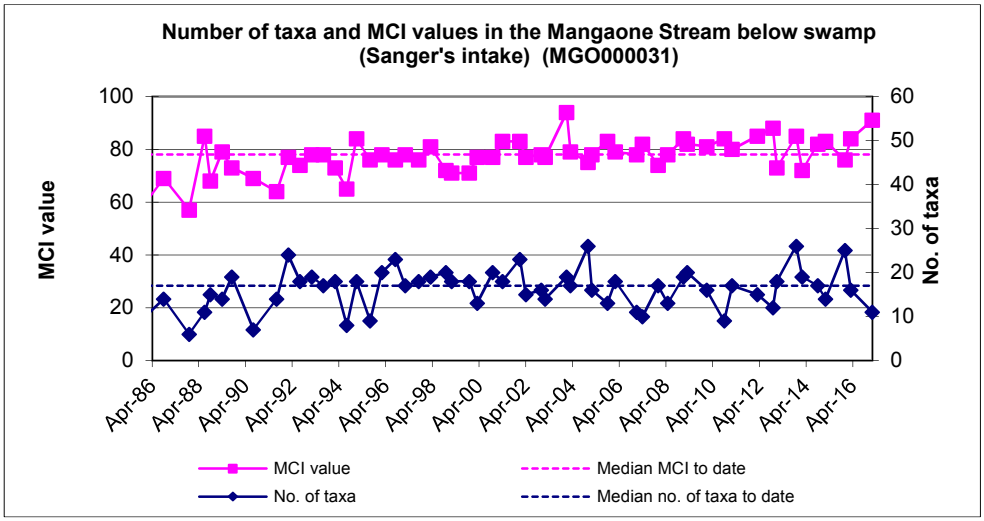

Figure 2 Taxa numbers and MCI scores recorded to date at site 3

Site 4 (MGO000033)

A moderately low macroinvertebrate community richness of 12 taxa was found at site 4 at the time of this summer survey. This was seven taxa lower than the historical median for this site and five taxa lower than the preceding survey on March 2016 (Table 4 and Figure 3).

The MCI score of 83 units indicated a community of 'fair' biological health which was not significantly different (Stark, 1998) to the historical median MCI score (78 units) and the preceding survey score (88 units). The score was not significantly different from the median score recorded from other lowland coastal streams (MCI score of 79 units) (TRC, 2016) (Table 4 and Figure 3).

The $SQMCI_S$ score of 4.2 units was not significantly different (Stark, 1998) to the historical median $SQMCI_S$ score of 4.4 units but was significantly higher than the previous survey score (2.9 units) (Stark, 1998) (Table 4).

The community was characterised by one 'tolerant' taxon [snail (*Potamopyrgus*)], and two 'moderately sensitive' taxa [amphipods (*Paracalliope* and Paraleptamphopidae)], (Table 5).

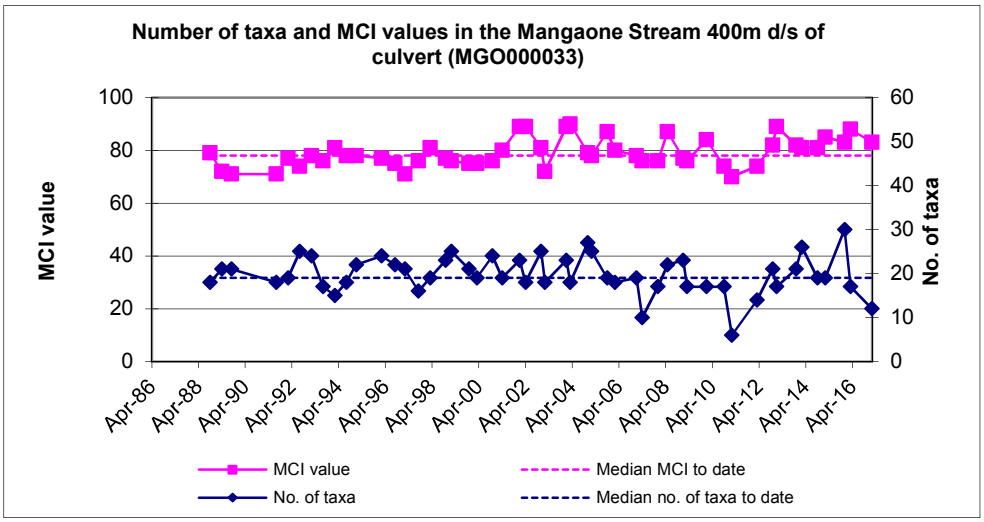

Figure 3 Taxa numbers and MCI scores recorded to date at site 4

Long term trend in taxa numbers

Macroinvertebrate communities at site 3 (closer to the swampy headwaters and MASL stormwater discharge) have generally contained slightly lower numbers of taxa than the communities at site 4 (site 3 median = 17, site 4 median = 19) and this result was repeated in the current survey (by one taxon).

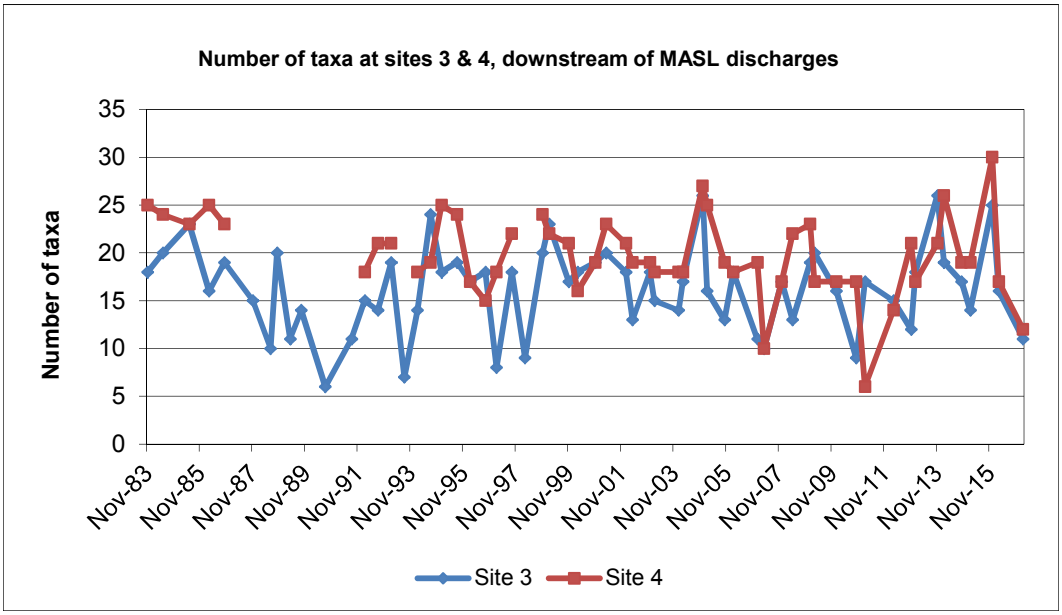

Figure 4 Number of taxa at sites 3 and 4 in an unnamed tributary of the Mangaone Stream in relation to discharges from MASL

Long term trend in SQMCI$_S$ values

SQMCI$_S$ values from both sites have generally varied between 4 and 5 units in more recent surveys (site 4 recorded a 'poor' score of only 2.9 units in the previous survey) and this trend has continued for both sites. Furthermore, both scores were not significantly different from each other.

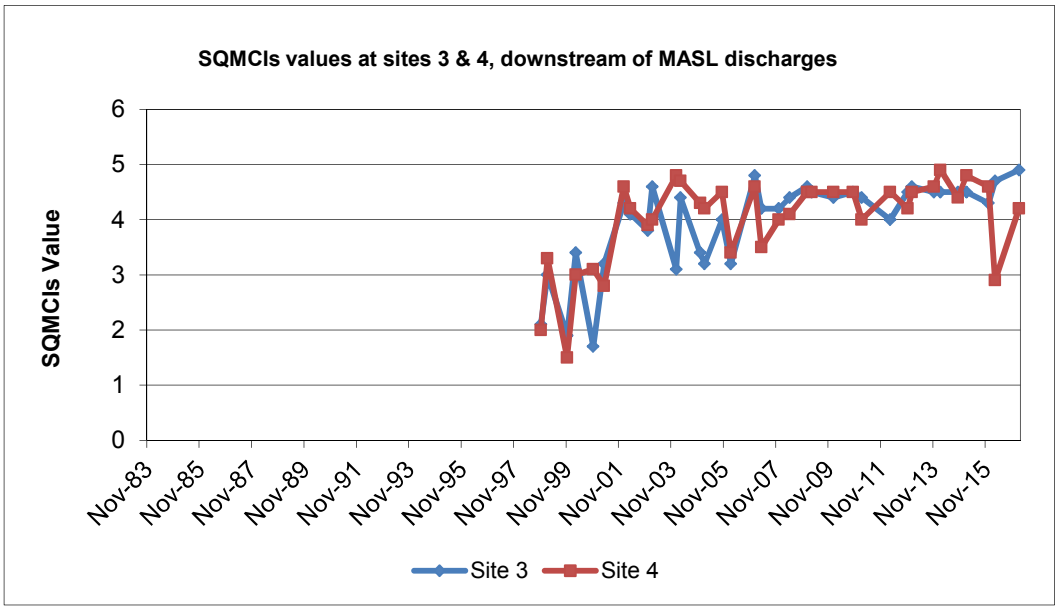

Figure 5 $SQMCI_S$ values at sites 3 and 4 in an unnamed tributary of the Mangaone Stream in relation to discharges from MASL

Discussion and conclusions

Both Mangaone Stream sites had moderately low macroinvertebrate community richnesses with very little variation between sites (one taxon). Taxa richnesses were lower than historical medians at both sites (6-7 taxa), and lower than the previous survey (5 taxa) at both sites. Though there was a moderate decrease in taxa richness this was not at a sufficiently large enough level to attribute to any recent toxic discharges affecting the macroinvertebrate community. Furthermore, both sites had moderately low taxa richness but it would be expected that recent toxic discharges would decrease taxa richness by significantly more, potentially to zero taxa, but more likely some very hardy taxa would persist at low abundance levels. This was not the case in the current survey. 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 or deliberately drift downstream thus potentially lowering taxa richness at a site.

MCI scores indicated that the macroinvertebrate communities were in 'fair' health with no significant difference between sites, or compared with the preceding survey in March 2016 and the historical median for site 4. Site 3 had a significantly higher than normal MCI score which was the second highest recorded MCI score for the site since monitoring began in 1983.

The $SQMCI_S$ scores for both sites were congruent with their MCI scores and were typical for each site indicating 'fair' health (Stark and Maxted, 2007).

Overall, these results indicate that the stormwater discharge from the MASL site had not had any impact on the macroinvertebrate communities present in this unnamed tributary of the Mangaone Stream.

Summary

The Council's standard 'kick-sampling' and 'sweep sampling' techniques were used at two established sites to collect streambed macroinvertebrates from an unnamed tributary of the Mangaone Stream on 15 February 2017. Samples were sorted and identified to provide number of taxa (richness) and MCI and $SQMCI_S$ scores.

Taxa richness is the most robust index when ascertaining whether a macroinvertebrate community has been exposed to toxic discharges. The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The $SQMCI_S$ takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities,

particularly if non-organic impacts are occurring, and may be more useful in soft-bottomed streams. Significant differences in either the MCI or the $SQMCI_S$ between sites may indicate the degree of adverse effects (if any) of the discharges being monitored.

The results of this biological survey indicated that the number of taxa recorded in the community a short distance downstream of the stormwater discharge from MASL was lower than normal for the two sites but did not indicate that there had been any toxic discharges from stormwater discharges. MCI scores indicated that the macroinvertebrate communities were in 'fair' health with no significant difference between sites or from the previous survey completed in March 2016 but site 3 did have a significantly higher than normal score compared with its historical median indicating a healthier than usual macroinvertebrate community at the site.

With the exception of the February 2006, April 2007 and March 2016 surveys, the $SQMCI_S$ values have been relatively high in the last 25 surveys. This was due mainly to the very high abundances of medium-scoring taxa, particularly 'moderately sensitive' amphipods (*Paracalliope* and Paraleptamphopidae). This trend was continued in the present survey at both sites.

This macroinvertebrate survey indicated that the discharge of treated stormwater from the MASL site had not had any detrimental effect on the macroinvertebrate communities present in this unnamed tributary of the Mangaone Stream.

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To	Job Manager, Callum MacKenzie
From	Scientific Officer, Darin Sutherland
File	03-02-005-07/01; 1857
Report No	DS074
Document No.	1902340
Date	20 July 2017

Biomonitoring of an unnamed tributary of the Mangaone Stream below the McKechnie Aluminium Solutions Ltd plant, April 2017

Introduction

The macroinvertebrate communities of an unnamed tributary of the Mangaone Stream below the McKechnie Aluminium Solutions Ltd [MASL] plant have been monitored annually or biannually since November 1983. This biological survey was the second of two surveys scheduled in the 2016-2017 monitoring year. Due to persistent, heavy rain during the spring 2016 period the sampling was postponed and this autumn survey has been completed in its place. The results of surveys performed since the 1998-99 monitoring years are discussed in various Taranaki Regional Council reports (refer to the references).

Methods

On 26 April 2017 streambed macroinvertebrates in the Mangaone Stream tributary were collected from site 3 using the kick-net-sampling' technique , while a combination of the 'kick-net-sampling' and 'sweep-net-sampling' techniques were used to collect streambed macroinvertebrates from site 4 (Table 1, Figure 1). These sampling techniques are very similar to Protocol C1 (hard-bottomed, semi-quantitative) (kick-sample) and Protocol C2 (soft-bottomed, semi-quantitative) (vegetation-sweep) 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 tributary of the Mangaone Stream that receives stormwater discharges from MASL

Site No	Site code	Grid reference	Location
3	MGO000031	E1698576 N5677952	Below swamp (Sanger's intake)
4	MGO000033	E1698447 N5677770	400 metres downstream of site 3

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. Averaging the scores assigned to the taxa found at a site, and multiplying the average by a scaling factor of 20 produces a Macroinvertebrate Community Index (MCI) value. 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 Macroinvertebrate health based on MCI ranges which has been adapted for Taranaki streams and rivers (TRC, 2015) from Stark's classification (Stark, 1985, Boothroyd and Stark, 2000, and Stark and Maxted, 2007)

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

MCI results can also reflect the effects of warm temperatures, slow current speeds and low dissolved oxygen levels, because the taxa capable of tolerating these conditions generally have low sensitivity scores. Usually more 'sensitive' communities (with higher MCI values) inhabit less polluted waterways. The use of this index in non-stony streams is possible if results are related to physical habitat (muddy or weedy streams tend to produce lower MCI values than stony streams).

A semi-quantitative MCI value ($SQMCI_s$) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998 and 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the $SQMCI_s$ is not multiplied by a scaling factor of 20, therefore $SQMCI_s$ values range from 1 to 10, while MCI values range from 20 to 200. A difference of 0.83 units or more in $SQMCI_s$ values is considered significantly different (Stark 1998).

Results

Site habitat characteristics and hydrology

This autumn survey was performed under moderate flow conditions (approximately median flow), 10 days after a fresh in excess of 3 times median flow and 12 days after a fresh in excess of 7 times median flow (flow gauge at the Mangaoraka River at Corbett Rd). The survey followed a relatively wet summer period with several freshes recorded over the preceding month. Water temperature was 13.8°C at site 3 and 13.9°C at site 4**.** Site 3 had swift flow with uncoloured, clear water and site 4 had very slow flow with grey, cloudy water.

Substrate comprised predominantly coarse gravel and cobble at site 3 and silt with hard clay at site 4. Both sties had patchy leaves and wood with overhanging vegetation partially shading the streambed. No obvious algal growth was noted at either site during this survey. Unlike most previous surveys, both sites were not impacted by iron oxide sedimentation and silt substrate levels were considerably lower, presumably due to the frequent freshes.

The stormwater discharge from the MASL plant flows into a small drain which itself flows into the eastern arm of a swampy area. The swamp forms the headwaters of a small stream in which sites 3 and 4 are located. A long culvert was laid in the stream between sites 3 and 4 prior to the November 2000 survey, with this pipe extended downstream between the February and December 2015 surveys (Figure 1). The culvert begins a few metres downstream of site 3 and ends at the point where site 4 was previously located. Site 4 was subsequently moved several metres downstream. The habitat at this location was similar to the habitat at the original site. There have also been changes in the headwaters of this unnamed tributary in relation to the construction of the bell block bypass.

It should be noted that the stream was culverted between sites 3 and 4 to allow the landowner to discharge cleanfill, in doing so, slowly filling in the gully. This site holds a consent to discharge from this cleanfill, and is monitored under a separate monitoring programme. However, activities at this cleanfill site have the potential to impact on the communities of this stream. Due to recent earthworks related to the infilling of the gully, a pond immediately above site 4 has formed which has slowed the flow rate at the site.

Macroinvertebrate communities

The results of the previous macroinvertebrate surveys performed at sites 3 and 4 in the Mangaone tributary that receives stormwater discharges from MASL are summarised in Table 4, together with the results of the current survey.

Table 4 Numbers of taxa and MCI values recorded in the unnamed tributary of the Mangaone Stream downstream of MASL, from November 1983 to February 2017 and the current survey

Site No.	N	No of taxa			MCI value			$SQMCI_s$ value		
		Median	Range	Current survey	Median	Range	Current survey	Median	Range	Current survey
3	60	17	6-26	13	78	52-94	85	4.3	1.7-4.9	4.8
4	50	19	6-30	13	78	70-90	85	4.2	1.5-4.9	4.1

Table 5 Macroinvertebrate fauna of a tributary of Mangaone Stream in relation to MASL sampled on 26 April 2017

Taxa List	Site Number	MCI score	3	4
	Site Code		MGO000031	MGO000033
	Sample Number		FWB17232	FWB17233
PLATYHELMINTHES (FLATWORMS)	*Cura*	3	R	-
NEMERTEA	Nemertea	3	-	R
ANNELIDA (WORMS)	Oligochaeta	1	C	A
	Lumbricidae	5	R	-
HIRUDINEA (LEECHES)	Hirudinea	3	R	R
MOLLUSCA	*Potamopyrgus*	4	VA	XA
CRUSTACEA	Isopoda	5	C	-
	Paracalliope	5	A	VA
	Paraleptamphopidae	5	XA	A
ODONATA (DRAGONFLIES)	*Austrolestes*	4	-	R
COLEOPTERA (BEETLES)	Dytiscidae	5	-	R
TRICHOPTERA (CADDISFLIES)	Ecnomidae/Psychomyiidae	6	-	R
	Hydropsyche (Orthopsyche)	9	R	-
	Triplectides	5	R	A
DIPTERA (TRUE FLIES)	*Zelandotipula*	6	-	R
	Polypedilum	3	R	R
	Austrosimulium	3	R	-
	Tanyderidae	4	R	-
ACARINA (MITES)	Acarina	5	-	R
		No of taxa	13	13
		MCI	85	85
		SQMCIs	4.8	4.1
		EPT (taxa)	2	2
		%EPT (taxa)	15	15

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

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

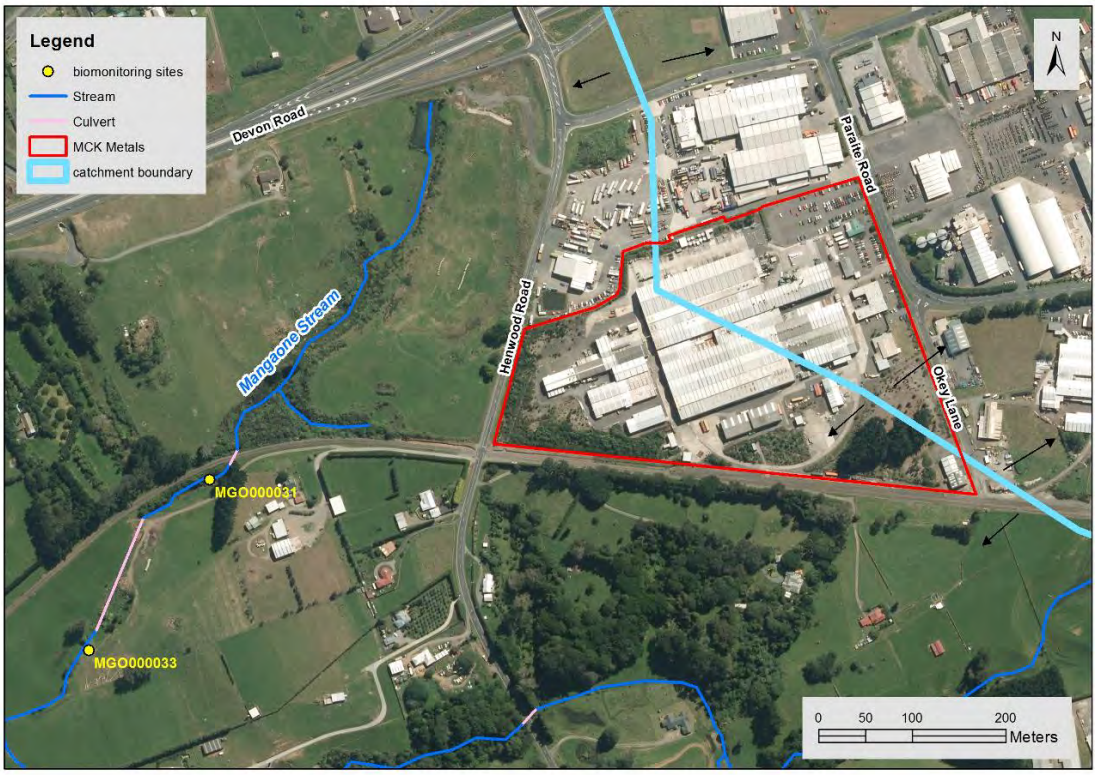

Figure 1 Biomonitoring sites in a tributary of the Mangaone Stream related to the stormwater discharge from MASL

Site 3 (MGO000031)

A moderately low macroinvertebrate community richness of 13 taxa was found at site 3 at the time of this autumn survey. This was four taxa lower than the historical median (17 taxa) for this site and two taxa lower than the previous survey on February 2017 (13 taxa) (Table 4 and Figure 2).

The MCI score of 85 units indicated a community of 'fair' biological health which was not significantly different (Stark, 1998) to the historical median MCI score (78 units) and to the preceding survey score (91 units) (Table 4 and Figure 2).

The $SQMCI_S$ score of 4.8 units was not significantly different (Stark, 1998) to the historical median $SQMCI_S$ score of 4.3 units and to the previous survey (4.9 units) (Stark, 1998) (Table 4).

The community was characterised by one 'tolerant' taxon [snail (*Potamopyrgus*)], and two 'moderately sensitive' taxa [amphipods (*Paracalliope* and Paraleptamphopidae)], (Table 5).

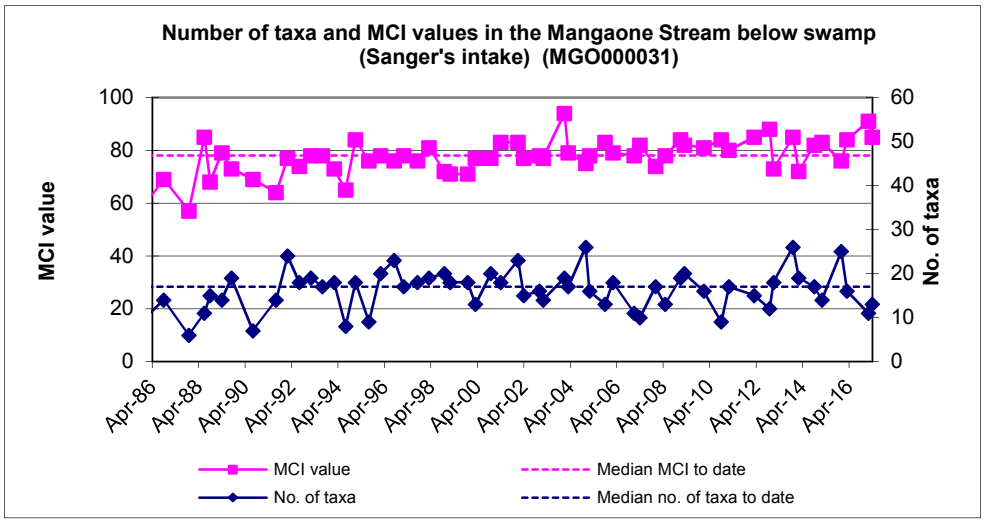

Figure 2 Taxa numbers and MCI scores recorded to date at site 3

Site 4 (MGO000033)

A moderately low macroinvertebrate community richness of 13 taxa was found at site 4 at the time of this autumn survey. This was six taxa lower than the historical median for this site (19 taxa) and one taxon higher than the previous survey (12 taxa) (Table 4 and Figure 3).

The MCI score of 85 units indicated a community of 'fair' biological health which was not significantly different (Stark, 1998) to the historical median MCI score (78 units) and the preceding survey score (83 units)(Table 4 and Figure 3).

The $SQMCI_S$ score of 4.1 units was not significantly different (Stark, 1998) to the historical median $SQMCI_S$ score of 4.2 units or to the previous survey (4.2 units) (Stark, 1998) (Table 4).

The community was characterised by one 'tolerant' taxon [snail (*Potamopyrgus*)], and three 'moderately sensitive' taxa [amphipods (*Paracalliope* and Paraleptamphopidae) and caddisfly (*Triplectides*)], (Table 5).

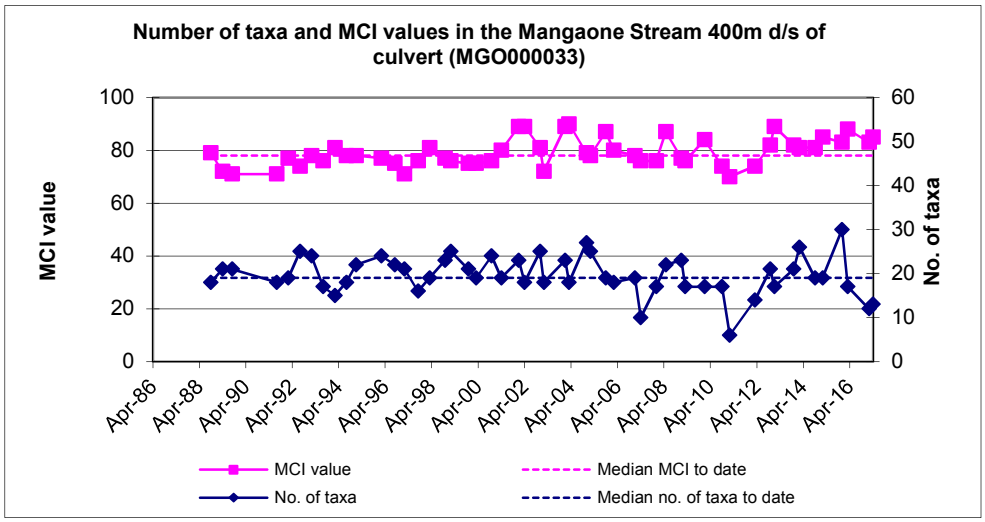

Figure 3 Taxa numbers and MCI scores recorded to date at site 4

Long term trend in taxa numbers

Macroinvertebrate communities at site 3 (closer to the swampy headwaters and MASL stormwater discharge) have generally contained slightly lower numbers of taxa than the communities at site 4 (site 3 median = 17, site 4 median = 19) but for the current survey taxa numbers were identical between sites and lower than historic medians (by 4 and 6 taxa).

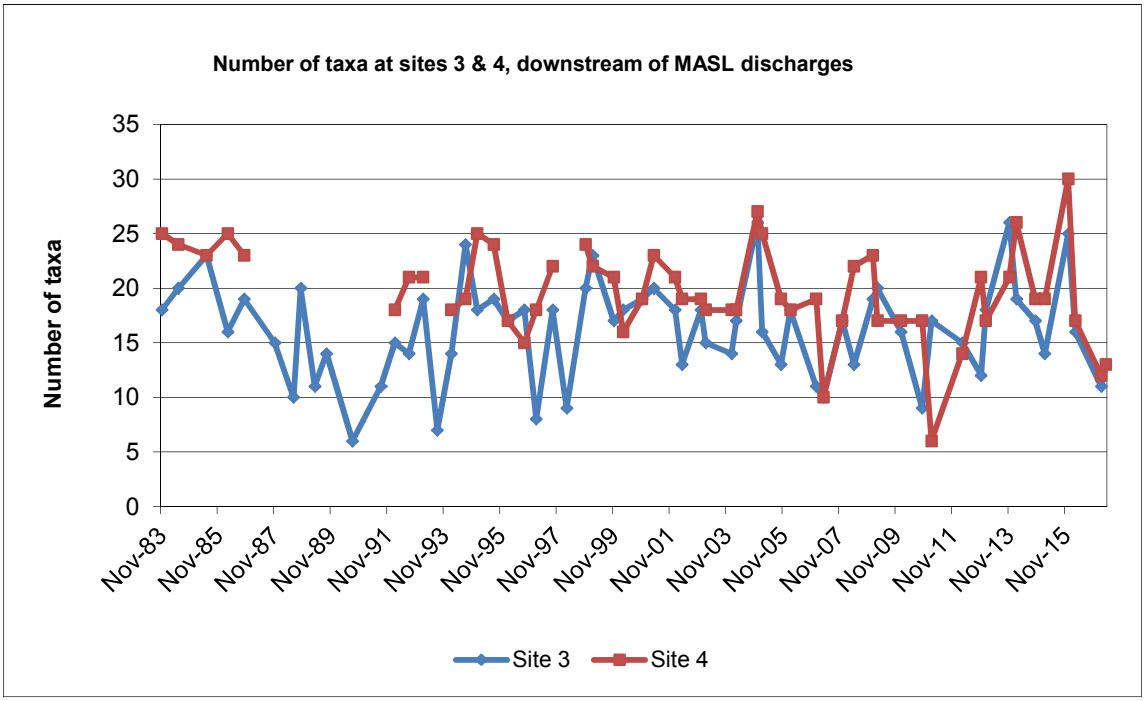

Figure 4 Number of taxa at sites 3 and 4 in an unnamed tributary of the Mangaone Stream in relation to discharges from MASL

Long term trend in $SQMCI_S$ values

$SQMCI_S$ values from both sites have generally varied between 4 and 5 units in more recent surveys and this trend has continued for both sites with scores not significantly different from each other.

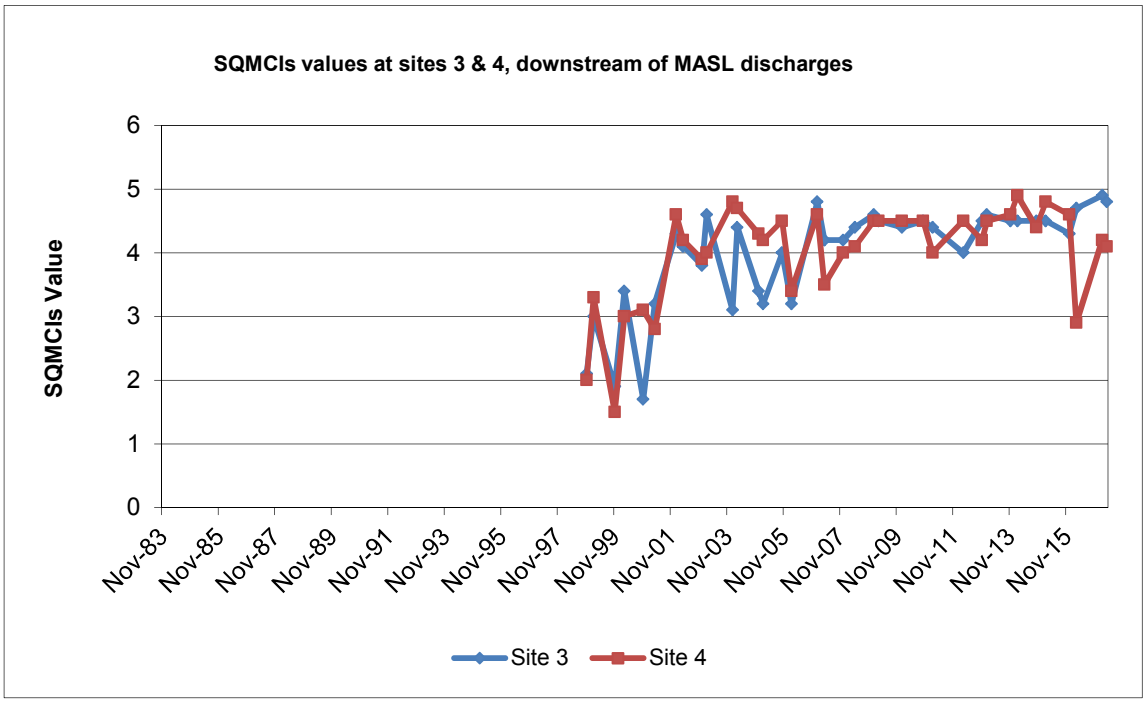

Figure 5 SQMCI$_S$ values at sites 3 and 4 in an unnamed tributary of the Mangaone Stream in relation to discharges from MASL

Discussion and conclusions

Both Mangaone Stream sites had moderately low macroinvertebrate community richnesses with no variation between sites. Taxa richnesses were lower than historical medians at both sites (4-6 taxa) but higher than the previous survey (1-2 taxa) at both sites. Though taxa richness remains relatively low this was not at a low enough level to attribute to any recent toxic discharges affecting the macroinvertebrate community. It would be expected that recent toxic discharges would decrease taxa richness by significantly more, potentially to zero taxa, though more likely some very hardy taxa would persist at low abundance levels. This was not the case in the current survey. 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 or deliberately drift downstream thus potentially lowering taxa richness and abundances at a site.

MCI scores indicated that the macroinvertebrate communities were in 'fair' health with no difference between sites, and no significant differences compared with the preceding survey in February 2017 and to historical medians for both sites.

The SQMCI$_S$ scores for both sites were congruent with their MCI scores and typical for each site indicating 'fair' health (Stark and Maxted, 2007). There was a decrease in SQMCI$_S$ score from site 3 to site 4 but this was non-significant and probably reflected poorer habitat quality at site 3. Furthermore, number of EPT taxa and %EPT taxa were identical between sites.

Overall, these results indicate that the stormwater discharge from the MASL site had not had any impact on the macroinvertebrate communities present in this unnamed tributary of the Mangaone Stream.

Summary

The Council's standard 'kick-sampling' and 'sweep sampling' techniques were used at two established sites to collect streambed macroinvertebrates from an unnamed tributary of the Mangaone Stream on 15 February 2017. Samples were sorted and identified to provide number of taxa (richness) and MCI and SQMCI$_S$ scores.

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

The results of this biological survey indicated that the number of taxa recorded in the community a short distance downstream of the stormwater discharge from MASL was lower than normal for the two sites but did not indicate that there had been any toxic discharges from stormwater discharges. MCI scores indicated that the macroinvertebrate communities were in 'fair' health with no significant difference between sites or from the previous survey completed in February 2017.

With the exception of the February 2006, April 2007 and March 2016 surveys, the $SQMCI_S$ values have been relatively high in the last 25 surveys. This was due mainly to the very high abundances of medium-scoring taxa, particularly 'moderately sensitive' amphipods (*Paracalliope* and Paraleptamphopidae). This trend was continued in the present survey at both sites.

This macroinvertebrate survey indicated that the discharge of treated stormwater from the MASL site had not had any detrimental effect on the macroinvertebrate communities present in this unnamed tributary of the Mangaone Stream.

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