

Opunake Hydro Limited
Monitoring Programme
Report
2010-2014

Technical Report 2014–32

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Executive summary

Opunake Hydro Limited operates the Opunake hydroelectric power scheme located at Opunake, in the Waiaua River catchment. The scheme uses a 4.5 metre high weir to divert water from the Waiaua River along a canal to Lake Opunake, and then down penstocks to the Opunake power station. The power station discharges water to the Tasman Sea at Opunake Beach. This report for the period July 2010 – June 2014 describes the monitoring programme implemented by the Taranaki Regional Council to assess the Company's environmental performance during the period under review, and the results and environmental effects of the Company's activities.

The Company holds eight resource consents, which include a total of 60 conditions setting out the requirements that the Company must satisfy. The Company holds two consents to allow it to take and use water, one consent to discharge water into the Tasman Sea, one consent to discharge sand to the Waiaua River, two consents for structures associated with the scheme, and two consents to disturb the bed of the Waiaua River and Lake Opunake.

The Council's monitoring undertaken for the period under review included 29 compliance monitoring inspections, 17 hydrological inspections and one fish survey undertaken in relation to the scheme. In addition, analysis of generation data and lake level data provided by the Company was conducted.

The monitoring showed that despite issues related to environmental in the headwaters, and frequent equipment failure, the scheme operated with few major issues. Overall, in comparison with previous monitoring years, compliance with residual flow requirements has improved, and management of the level of Opunake Lake has improved, resulting in reduced potential for excessively low lake levels when the scheme shuts down in response to a flood. There is still concern about the sand inundation of the head of Opunake Lake, and the reduced recreational value that has resulted from this. The consent holder is investigating an array of options, including reducing the potential for sand ingress, modifying the head of the lake to allow better flushing of sand, and a means of removing the sand currently in the lake.

A fish survey undertaken in 2014 has confirmed that the weir and intake remains a barrier to fish passage to the upper Waiaua River. This is despite numerous modifications made to the scheme in an effort to improve fish passage. It is apparent that the passage of smelt, torrentfish and inanga is still severely restricted. The consent holder will need to investigate a means to improve passage past the weir.

With regard to submitted data, compliance with the operating range of the lake specified by resource consent 1796-3 was good, with the majority of low lake level readings being due to either recorder error or circumstances out of the consent holder's control. However, the consent holder was slow in providing this data, which is required by consent to be provided quarterly. In addition, three months of data was lost at the end of the reported period, due to equipment failure. The consent holder has been made aware of the importance of providing data as required.

During the monitoring period, the Company demonstrated a good level of environmental performance and compliance with the resource consents. During the period under review there were three unauthorised incidents lodged in relation to this scheme but further

investigation in each case established that the Company was not liable under the Resource Management Act.

The consent holder did not achieve a high level of performance, as data was not provided in the timeframes required, and the scheme continues to present a barrier to the passage of fish into the upper Waiaua River despite attempts to address this by the consent holder.

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

This report includes recommendations for the 2014-2015 year

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1. Introduction

1.1 Compliance monitoring programme reports and the Resource Management Act 1991

1.1.1 Introduction

This report is the Monitoring Report for the period July 2010- June 2014 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Opunake Hydro Limited (the Company). The Company operates a hydro electric power station situated on Beach Road at Opunake, in the Waiaua River catchment.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consents held by Opunake Hydro Ltd that relate to abstractions and discharges of water within the Waiaua River catchment, land use consents related to disturbance and damming of the Waiaua River, a discharge consent related to the discharge of sand and silt deposits and coastal permits for the discharge of water and the associated discharge structure.

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 Taranaki Regional Council generally implements integrated environmental monitoring programmes and reports the results of the programmes jointly. This report discusses the environmental effects of the Company's use of water, land and air, and is the 16th combined annual report by the Taranaki Regional Council for the Company.

1.1.2 Structure of this report

Section 1 of this report is a background section. It sets out general information about compliance monitoring under the RMA and the Council's obligations and general approach to monitoring sites through annual programmes, the resource consents held by Opunake Hydro in the Waiaua River catchment, the nature of the monitoring programme in place for the period under review, and a description of the activities and operations conducted in the Company's site/catchment.

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 2014-2015 monitoring year.

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

1.1.3 The Resource Management Act 1991 and monitoring

The *Resource Management Act 1991* (RMA) primarily addresses environmental 'effects' which are defined as positive or adverse, temporary or permanent, past, present or future, or cumulative. Effects may arise in relation to:

- (a) the neighbourhood or the wider community around a discharge, 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);
- (e) risks to the neighbourhood or environment.

In drafting and reviewing conditions on resource consents, and in implementing monitoring programmes, the Taranaki Regional Council is recognising the comprehensive meaning of 'effects' inasmuch as is appropriate for each activity that requires a consent. 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 consent performance

Besides discussing the various details of the performance and extent of compliance by the consent holder/s during the period under review, this report also assigns an overall rating. The categories used by the Council, and their interpretation, are as follows:

- A **high** level of environmental performance and compliance indicates that essentially there were no adverse environmental effects to be concerned about, and no, or inconsequential, non-compliance with conditions.
- A **good** level of environmental performance and compliance indicates that adverse environmental effects of activities during the monitoring period were negligible or minor at most, or, 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, or, there were perhaps some items noted on inspection notices for attention but these items were not urgent nor critical, and follow-up inspections showed they have been dealt with, and any inconsequential non-compliances with conditions were resolved positively, co-operatively, and quickly.
- **Improvement required (environmental) or improvement required (administrative compliance)** (as appropriate) indicates that the Council may have been obliged to record a verified unauthorised incident involving measurable

environmental impacts, and/or, there were measurable environmental effects arising from activities and intervention by Council staff was required and there were matters that required urgent intervention, took some time to resolve, or remained unresolved at the end of the period under review, and/or, there were on-going issues around meeting resource consent conditions even in the absence of environmental effects. Abatement notices may have been issued.

- **Poor performance (environmental) or poor performance (administrative compliance)** indicates generally that the Council was obliged to record a verified unauthorised incident involving significant environmental impacts, or there were material failings to comply with resource consent conditions that required significant intervention by the Council even in the absence of environmental effects. Typically there were grounds for either a prosecution or an infringement notice.

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

1.2 Process description

The Waiaua River has been used as a source of hydroelectric power generation for a period in excess of 60 years. The diversion of water from the river below South Road (SH45) (Photo 1) occurs via a 4.5 metre high weir, to a head race and storage lake. There is a river channel distance of approximately two kilometres in the Waiaua River between the diversion weir and the sea, known as the residual flow reach. The level of the storage lake (Lake Opunake) varies according to generation requirements. Water passes from Lake Opunake through the penstocks of the powerhouse and finally is released via a tunnel and tailrace onto the southeast end of Opunake Beach and into the Tasman Sea. Lake Opunake is used for a variety of recreational purposes (for example fishing, boating), but is subject to weed and algae proliferation.

The weir is designed to divert the total flow of the river for 80% of the time and to overtop only at higher flows. However, some minor seepage often occurs through the sluice gate in the weir. The weir itself constitutes a significant barrier to fish passage, and a fish pass has been installed to aid fish passage into the canal. Monitoring indicates that all species of fish present in the Waiaua River can negotiate this fish pass, however, these fish are then expected to swim up the intake tunnels, to re-enter the Waiaua River upstream of the weir. One of these tunnels has been retrofitted with a second fish pass type structure, although monitoring indicates that some species cannot negotiate these intake structures.

Photo 1 shows the scheme's layout, in relation to the township of Opunake. More extensive historical information is provided in previous monitoring reports, listed in the bibliography.



Photo 1 Opunake Hydro Limited scheme on the Waiaua River

1.3 Resource consents

1.3.1 Water abstraction permit

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

Opunake Hydro holds water permit **1795-4** to cover the taking of water from the Waiaua River in association with the Opunake hydroelectric power scheme. This permit was issued by the Taranaki Regional Council on 13 October 2006 under Section 87(d) of the RMA. It is due to expire on 1 June 2018.

Special condition 1 defines the maximum rate of abstraction (3900 l/s).

Special condition 2 requires the consent holder to exercise the consent generally in accordance with the application. Special conditions 3 and 4 require the consent holder to maintain fish passage and a residual flow of 80 l/s in the Waiaua River downstream of the fishpass and 180 l/s downstream of the canal sluice gate.

Special condition 5 is a provision to review the appropriateness of a gradual increase in residual flow.

Special condition 6 requires notification prior to the consent being exercised.

Special condition 7 defines when the sluice gate/bywash can be closed. Special condition 8 defines data that must be collected and forwarded to the Council.

Special condition 9 requires the consent holder to review the operational procedure.

Special condition 10 requires the consent holder and Council to meet with interested submitters to the consent once per year to discuss matters relating to this consent.

Special condition 11 relates to expiry of the consent should it not be exercised, and the last condition was a review provision.

This consent is currently under review, as per special condition 5.

Opunake Hydro Ltd also holds water permit **1796-3** to take and use water from Lake Opunake for hydroelectric power generation. This permit was issued by the Taranaki Regional Council on 21 March 2001 under Section 87(d) of the Resource Management Act, and a variation to this consent was granted in the 2005-2006 monitoring year. It is due to expire on 1 June 2018.

Special condition 1 requires the consent holder to maintain water levels in the lake above a specified limit and that approval must be gained prior to lowering it further maintain a constant flow through the fish pass.

Special condition 2 requires there to be a constant flow through the fish pass.

Special conditions 3 and 4 require the consent holder to maintain a record of water levels within the lake at a minimum of 15-minute intervals and to install a staff gauge at Lake Opunake.

The last condition is a review provision.

The permits are attached to this report in Appendix I.

1.3.2 Water discharge permit

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

Opunake Hydro Ltd holds water discharge permit **1797-3** to cover the discharge of sand and silt deposits from a diversion canal sand trap via a spillway to the Waiaua River. This permit was issued by the Taranaki Regional Council on 21 March 2001 under Section 87(e) of the RMA. It is due to expire on 1 June 2018.

Special condition 1 states that the consent holder shall supply a sediment management protocol within three months of the granting of the consent.

Special condition 2 states that the consent holder must maintain a record of any sand trap discharges for supply to the Council.

Special condition 3 requires the consent holder to adopt the best practicable option.

The last two conditions are review provisions.

Opunake Hydro Ltd holds coastal discharge permit **4744-4** to cover the discharge of up to 3900 l/s of water from hydroelectric power generation through two marine outfall pipes into the Tasman Sea. This permit expired on 1 June 2012, and on 15 November 2012 a new consent was issued by the Taranaki Regional Council under Section 87(e) of the RMA. There were effectively no changes to the consent, which is due to expire on 1

June 2018. The short term of this consent provides for a common expiry date, which allows the consent holder's applications to be considered at the same time.

There are 3 special conditions which limit the discharge rate, require that the discharge of contaminated water shall not occur as a result of the exercise of the consent, and that appropriate warning signage is installed and maintained at the discharge point.

The permits are attached to this report in Appendix I.

1.3.3 Land use consent

Section 13(2)(b) of the RMA stipulates that no person may disturb, remove, damage, or destroy any plant or part of any plant or the habitats of such plants or of animals in, on, or under the bed of any lake or river in a manner that contravenes a rule in a regional plan or a proposed regional plan unless the activity is allowed for by a resource consent or by Section 20 of the Act.

Opunake Hydro Ltd holds landuse consent **4658** to cover the disturbance of the bed of Lake Opunake in the Waiaua catchment by removing reeds and flaxes from the edge of the lake. This permit was issued by the Taranaki Regional Council on 22 March 2006 under Section 87(e) of the RMA, expiring on 1 June 2024.

Special conditions 1 and 2 require the consent holder to adopt the best practical option to prevent or minimise adverse effects, and to undertake the exercise of the consent generally in accordance with the application.

Special conditions 3 and 4 require the consent holder to notify the Taranaki Regional Council at least seven days before commencing work and that the works shall only be undertaken during the period 1 May to 31 October.

Special conditions 5 and 6 require that the consent holder minimise the discharge or placement of silt and/or organics and/or debris into the lake, and that the consent holder collect and remove all plant trimmings and other floatable material.

Special condition 7 requires that where removed material is placed on or near the banks of the lake, the consent holder ensures that decaying vegetation does not fall or leach into the lake.

The last two special conditions specify a lapse date, should this consent not be exercised within five years of it being granted, and provide for a review, if required.

Opunake Hydro Ltd holds landuse consent **5581-1** to cover the damming of the Waiaua River in association with the Opunake hydroelectric power scheme. This permit was issued by the Taranaki Regional Council on 21 March 2001 under Section 87(e) of the RMA. It is due to expire on 1 June 2018.

There are 10 special conditions associated with this consent.

Special condition 1 requires the consent holder to undertake the exercise of the consent generally in accordance with the application.

Special condition 2 states that it is the responsibility of the consent holder to maintain and operate a safe dam and the Taranaki Regional Council accepts no responsibility in this regard.

Special condition 3 requires that the consent holder shall maintain a fish pass that allows the passage of native fish, juvenile trout and adult trout. The special conditions also cover issues regarding maintenance work, notification of works, and that should the structure no longer be required then it is to be removed and the area re-instated.

Special conditions 4 to 6 place limitations and requirements around any maintenance works undertaken on or around the weir, while special condition 7 limits the timing of any riverbed disturbance to between 1 November and 30 April.

Special condition 8 requires the structure to be removed and the area reinstated should it no longer be required, and special conditions 9 and 10 are review provisions.

Opunake Hydro Ltd holds landuse consent **5692-1** to cover the disturbance of the bed of the Waiaua River by removing sediment build-up upstream of a weir for the purpose of maintaining the Opunake hydroelectric power scheme. This permit was issued by the Taranaki Regional Council on 21 March 2001 under Section 87(e) of the RMA. It is due to expire on 1 June 2018.

There are 9 special conditions associated with this consent. Special condition 1 and 2 require notification prior to undertaking maintenance works, and to undertake the exercise of the consent generally in accordance with the application, while special condition 3 states that the works shall only be undertaken during the period 1 December to 30 April.

Special conditions 4 and 5 require the adoption of the best practicable option to avoid or minimise the discharge of contaminants, and to minimise the area and volume of riverbed disturbance.

Special condition 6 requires the consent holder to keep records of works undertaken.

Special condition 7 requires that written permission be obtained prior to the deposition of sediment downstream of the weir.

The last two conditions are review provisions.

The permits are attached to this report in Appendix I.

1.3.4 Coastal permit

Section 12(1)(b) of the Resource Management Act stipulates that in the coastal marine area, no person may erect, reconstruct, place, alter, extend, remove, or demolish any structure or any part of a structure that is fixed in, on, under, or over any foreshore or seabed unless expressly allowed by a rule in a regional coastal plan, proposed regional coastal plan or a resource consent.

Opunake Hydro Ltd holds coastal permit **4563-2** to cover the erection, placement, and maintenance of an outfall structure in the coastal marine area on the Opunake Beach

foreshore. This permit was issued by the Taranaki Regional Council on 21 March 2001 under Section 87(e) of the RMA. It is due to expire on 1 June 2018.

There are 7 special conditions associated with the new consent with special condition 1 requiring the consent holder to undertake the exercise of the consent generally in accordance with the application, and special condition 2 requires the consent holder to notify Council prior to maintenance works.

Special condition 3 requires the consent holder to adopt the best practical option to prevent or minimise adverse effects, and the area and volume of disturbance is to be minimised as far as practicable, as per special condition 4.

Special condition 5 requires the structure to be removed and the area reinstated should it no longer be required, and the last two special conditions are review provisions.

The permit is attached to this report in Appendix I.

1.4 Monitoring programme

1.4.1 Introduction

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

The Taranaki Regional 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 Opunake Hydro Limited 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 Taranaki Regional Council in:

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

1.4.3 Site inspections

The river intake, lake and station were visited 46 times during the monitoring period. Twenty nine of these visits were to inspect the site, with regard to consents for the

abstraction of or discharge to water and the associated structures. The main points of interest were the maintenance of the fish pass, the maintenance of the residual flow in the river downstream of the weir, and compliance with lake level requirements. The remaining seventeen visits were hydrological inspections, which included gaugings of the lower river. Sources of data being collected by the consent holder were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council.

1.4.4 Fish surveys

A fish survey was conducted on 26 February 2014 to determine whether or not the fish pass around the Waiaua weir was effective in allowing the migration of fish up the river, and also to assess the community living within the residual flow reach. This survey also included a comparative survey of the Mangahume Stream, in order to provide some perspective to the result.

1.4.5 Data audit

Special condition 8 of consent **1795-4** requires that the consent holder records fish pass water levels and generation figures as a measure of abstraction rates, and is to forward the records to the Council at three monthly intervals.

Special condition 3 of consent **1796-3** requires the consent holder to maintain a record of water levels in Lake Opunake and provide records to the Taranaki Regional Council, at three monthly intervals. Opunake Hydro Limited has provided records at 15 minute intervals of generation records and water levels in Lake Opunake. The records were checked to determine whether or not water levels in the lake complied with consent conditions.

2. Results

2.1 Water

2.1.1 Inspections

Each inspection undertaken of the station and its associated features essentially followed the same format, including checking water levels, fish passage and making notes of general observations. As a result the vast majority of inspection comments are very similar and as such, there is little value in repeating them in detail here. However, the full inspection record is available on request. During all compliance monitoring inspections, the lake level was above the minimum level of 0.5m, although a non-compliant lake level was recorded during a hydrological inspection, which is discussed further in section 2.3 below. Fish passage into the canal was acceptable at most times, although this depended on the lake level at the time of inspection. Generally, during high water levels, the flow rate in the fish pass is above optimal, and may restrict the passage of native fish. However, as the lake level reduces through generation, the flow rate in the pass reduces, and consequently passage for native fish improves, for those fish migrating up into the canal. With regards to passage from the canal into the river, through the intake tunnels, this is best during high lake levels, as this is when there is less head pressure through the tunnels. In addition, there is less fall at the river intake itself (Photo 2).

With regards to maintenance of the fish pass, there have been frequent problems with sand inundation, impacting on the regulation of flow in the fish pass. The consent holder has been proactive in resolving these issues, and was also proactive when a break was noted in the fish pass itself. This break, noted during an inspection on 17 April 2013, resulted in water escaping under the fish pass (Photo 3), and was resolved by the next inspection (22 May 2013). As a result, schools of smelt, considered one of New Zealand's worst swimmers and climbers, were frequently observed in the race in the reported period.

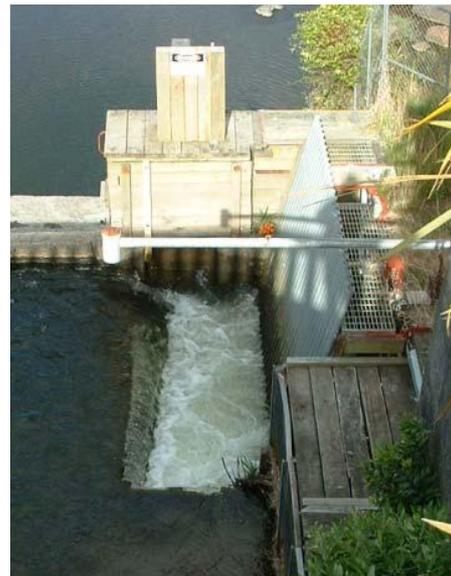


Photo 2 The river intake during high lake levels (top left) and low lake levels (right). The intake tunnels that carry water to the canal are located immediately behind the intake screen.

Photo 3 (right) The fish pass on 17 April 2013, showing where flow was escaping under the fish pass.

Photo 4 (below) Opunake Lake on 4 December 2010, showing an algal bloom covering a significant proportion of the lake surface.



The lake can at times suffer from algal proliferation, which can significantly impact on recreational use of the lake, and can even impact on generation by partially blocking the intake. An inspection undertaken on 4 December 2010 recorded a significant bloom (Photo 4), and this bloom was still present during an inspection on 26 January 2011.

Due to a high lake level during the latter inspection, water was leaving the lake over the spillway. This flow was drawing in significant amounts of floating algae, and as a result, a green plume was noted in the Waiaua River downstream of the spillway. The consent holder was advised at the time that the discharge of algae to the lower river was not appropriate, and had the potential to impact negatively on the habitat in this reach. Subsequent inspections noted did not record a recurrence of this discharge.

The sand inundation that affects the fish pass flow regulator has also affected the lake, with the sand delta continuing to extend into the lake. Discussions have been held with the community and the consent holder, as to how to resolve this issue, as if it continues, it has the potential to impact negatively on the recreational value of the lake, which is an important form of mitigation for the scheme. This delta does however provide habitat to a range of waterfowl and wading birds, with inspections recording mallard, black swan, paradise shelduck, New Zealand shoveler, pied stilt, royal spoonbill and godwit all on the delta at some time. The consent holder is continuing to investigate options to remove the sand, and also to prevent more sand entering the lake. Photo 5 shows how far the delta has progressed from 2007 to 2012.



Photo 5 Lake Opunake in 2007 (top) and 2012 (bottom), showing the progression of the delta at the top right of the lake.

The penultimate inspection of the reported period, undertaken on 27 May 2014, found that the station was not operating, and that fish passage was being maintained to a reasonable degree. At the coast, the outlet of the scheme was buried by sand (), and this was still the case during the final inspection of the reported period, completed on 25

June 2014. An enquiry was made to the consent holder, and it was revealed that the turbine was being serviced at this time.



Photo 6 The location of the station outlet on Opunake Beach completely buried in sand. Note the warning sign in the background, erected in compliance with consent 4744-4

2.1.2 Hydrological inspections

Special condition 4 of water permit 1795-4 sets residual flows that the operator needs to comply with. The consent holder needed to comply with the following:

“The consent holder shall ensure that a residual flow of not less than 80 l/s as measured in the Waiaua River immediately downstream of the fish pass, and not less than 180 l/s as measured in the Waiaua River immediately downstream of the canal sluice gate discharge, is maintained at all times”.

Some details of these inspections are described in section 2.1.1. The site was visited 17 times by hydrology staff. A summary of results are presented in Table 1.

During most inspections where gaugings were undertaken, two gaugings were conducted. The first gauging was undertaken in the river downstream of the fish pass, and the second gauging was conducted downstream of both the fish pass and canal sluice gate to assess the total residual flow. On 11 January 2011, the gauging conducted downstream of the fish pass found flows to be compliant with both residual flow requirements, and the remaining time was spent assisting the consent holder, who was on site, in assessing velocities and/or flows in the canal sluice, fish pass and diversion tunnel outlets. Another inspection, completed on 9 August 2013, did not undertake any gaugings, as the full flow of the river was spilling over the weir, while one inspection carried out just one gauging.

The very first hydrological inspection undertaken in the reported period recorded insufficient flow below both the fish pass and the canal sluice gate. This was registered as a non-compliant incident, and is discussed further in section 2.2. Twenty-nine other gaugings were undertaken, 15 downstream of the fish pass, and 14 downstream of the

canal sluice gate. Each of these gaugings measured flows that were compliant with the relevant consent condition.

Table 1 Hydrological inspection and gauging results for the Waiaua River, Opunake HEP

Date	Fish pass level (mm)	Lake Level (mm)	Flow downstream of fish pass (l/s)	Flow downstream of sluice gate (l/s)	Compliant?
Minimum required:	-	500	80	180	
15 July 2010	445	897	51	118	N
29 October 2010	490	-	398	909	Y
11 January 2011	432	769	278	-	Y
31 March 2011	433	729	336	511	Y
22 August 2011	433	813	1267	1267	Y
14 November 2011	470	669	580	832	Y
10 February 2012	430	793	287	579	Y
28 February 2012	428	612	259	516	Y
23 April 2012	555	1129	458	680	Y
2 November 2012	425	585	224	532	Y
13 February 2013	575	710	485	981	Y
16 May 2013	435	611	243	542	Y
9 August 2013	0	447	-	-	N
6 September 2013	495	1010	384	615	Y
17 December 2013	440	680	800	899	Y
13 March 2014	520	660	531	890	Y
12 May 2014	550	738	1907	1851	Y

In addition to undertaking gaugings, the water level in the lake was recorded, and compared with the minimum lake level. Of the seventeen visits, only one recorded a lake level that was too low (9 August 2013). This was also registered as a non-compliance incident, and is discussed in further detail in section 2.2. All other inspections recorded lake levels that were in compliance, and the inspection undertaken on 23 April 2012 recorded a very high lake level. This resulted in water backing up the canal (Photo 7).

On two occasions (13 March 2014 and 12 May 2014) flow was also gauged upstream of the scheme. On these days it was possible to estimate the abstraction rate at this time, by subtracting the flow downstream of the canal sluice gate from that recorded upstream of the scheme. The flow recorded upstream in March was 1.184 m³/s, resulting in an estimated take rate of 0.294 m³/s, while in May, it was recorded as 2.252 m³/s, resulting in an estimated take at this time of 0.401 m³/s. Both results are in compliance with the maximum rate of take condition of consent 1795-4, which is set at 3.9 m³/s.



Photo 7 The intake canal on 23 April 2012 looking towards Opunake Lake.

2.1.3 Provision of Company data

2.1.3.1 Generation levels

Water permit 1795-4 allows Opunake Hydro Ltd to abstract 3900 l/s of water from the Waiaua River.

Special condition 8 requires the consent holder to record generation figures (as a measure of abstraction rates) at a minimum of 15 minute intervals and to make records available to the Council. These records were provided to the Council for the 2010-2014 monitoring period (Figure 1). It is clear that the site experienced a number of breakdowns (evident as gaps in the data) in the latter half of the reported period. In the majority of these instances, these breakdowns were not related to a break in generation, but were a loss of data, caused by technical difficulties. The most significant of which was in the last quarter of the 13-14 monitoring period, where equipment failure resulted in the loss of three month's worth of data. The importance of maintaining as complete a data record as possible has been made clear to the consent holder, although it is recognised that such breakdowns may have been outside of their control.

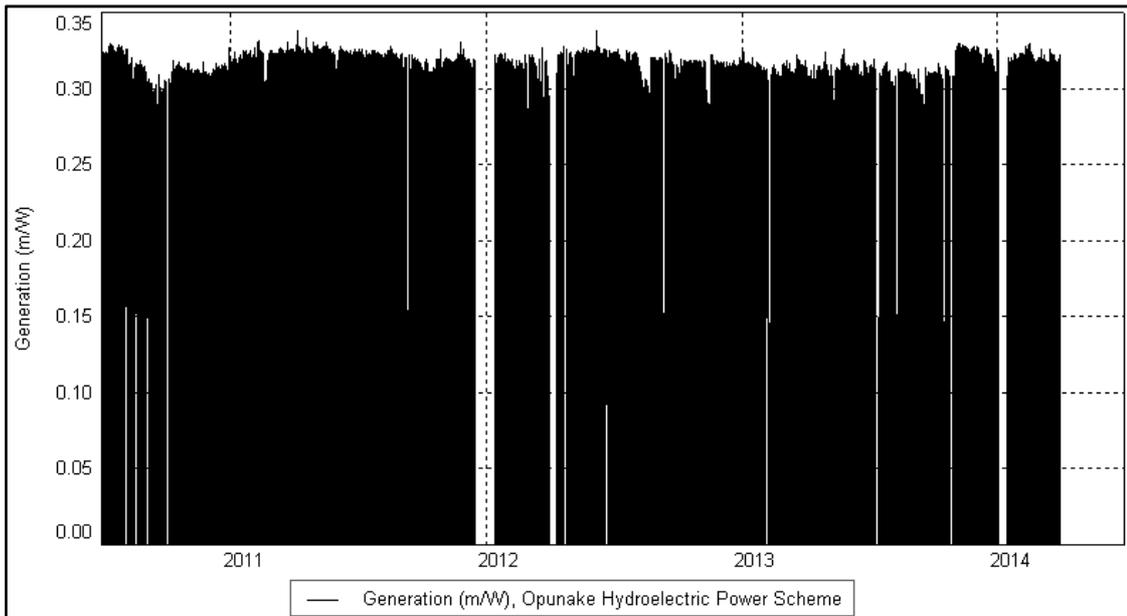


Figure 1 Generation figures from the Opunake HEP scheme from 1 July 2010 1 July to 2014

Figure 2 shows the typical generation cycle over three distinct periods. This indicates that there is some variation in how often generation occurs in a day, with generation ceasing to allow the lake to refill. This variation will in most cases be directly related to the amount of flow in the river, influencing the rate at which the lake refills. This is well illustrated by Figure 2, which shows generation during a wet winter (July 2010), a wet summer (February 2012) and a dry summer (February 2014).

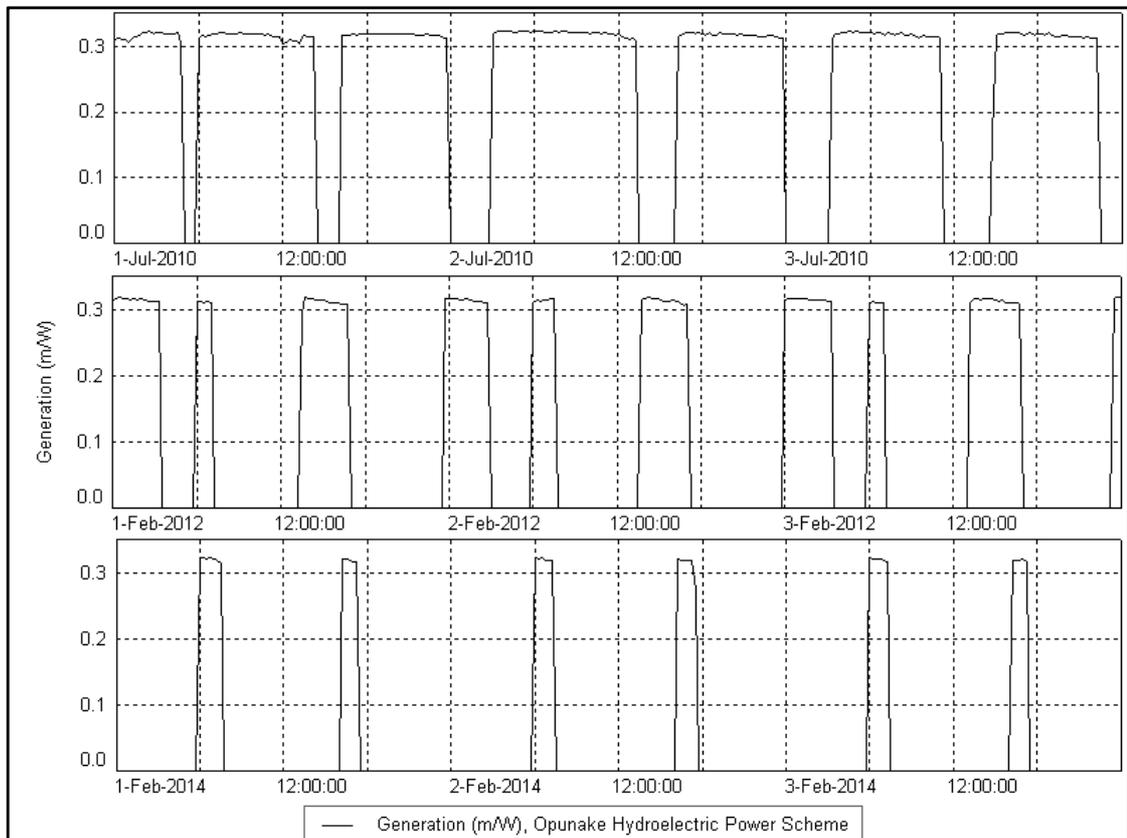


Figure 2 Typical generation pattern over three separate periods during the 2010-2014 period

2.1.3.2 Lake levels

Special condition 1 of consent 1796-3 outlines the requirements for water level management in the lake. According to the consent, the water level within the lake is not to be lowered more than 480 millimetres below the lake spillway crest (lake water level 500mm), although with the approval of the Taranaki Regional Council, it may be lowered further for maintenance purposes.

The spillway crest was altered by a previous consent holder, by adding boards to raise the lake level. The altered crest is equivalent in height to 0.98 m on the lake staff gauge. This work was carried out many years ago however, and the Taranaki Regional Council is of the understanding that the consent conditions relate to the top of the boards as being the “spillway crest”. This has been determined from the consent files, and monitoring data from previous consent holders.

A recording device for monitoring lake levels has been installed since November 2001. Records of lake levels have been provided for July 2010-June 2014 as required by special condition 3 of consent 1796-3. An improvement in the data recorded was noted in the 2003-2004 monitoring period, with a steady improvement occurring over time (2004-2010), and the records reported herein continue to indicate an improvement in the management of the lake level data, being more complete than those provided in previous periods. As with the generation data, there were occasions of missing or erroneous data, the majority of which being the result of system malfunctions. The equipment failure which affected generation figures at the end of the 2013-14 monitoring year also affected lake level data. Figure 3 shows the lake level data for the reporting period.

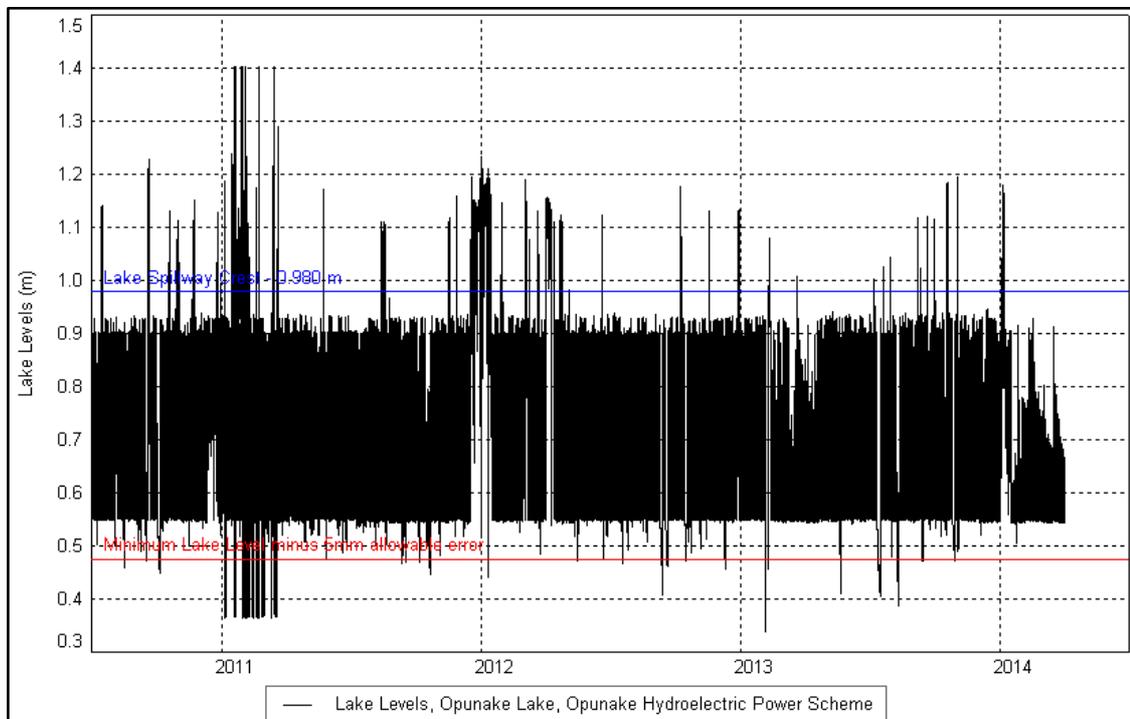


Figure 3 Water levels in Opunake Lake, 2010-2014 period.

On most occasions in the 2010-2014 period when the lake level dropped below 0.475m, which is the limit when allowing for a 5mm recorder error, it did so for a relatively short period of time. For many of the occasions the breach was as a result of computer or recorder error. However, there were a number of occasions where lake levels were confirmed as being too low, but in these cases it was not due to excessive generation. When there is a flood in the Waiaua River, the intake is closed to minimise sand inundation of the scheme. As a result, the canal is emptied, and even though there is a gate that stops most of the lake water flowing back into the canal, there is inevitably some leakage at this gate, and also at the lake spillway. This leakage draws the lake down if the river remains in flood for some time. This is illustrated in Figure 4. It is noted that the consent holder does not draw the lake down to 0.5m during each generation, and this ensures there is some reserve capacity, should the Waiaua River flood just as generation ceases, reducing the potential for a low lake level to eventuate. To date, no complaints have been received regarding the low lake levels, and there have been no observed environmental effects. Should either eventuate during subsequent low lake levels, the consent holder will need to undertake repairs.

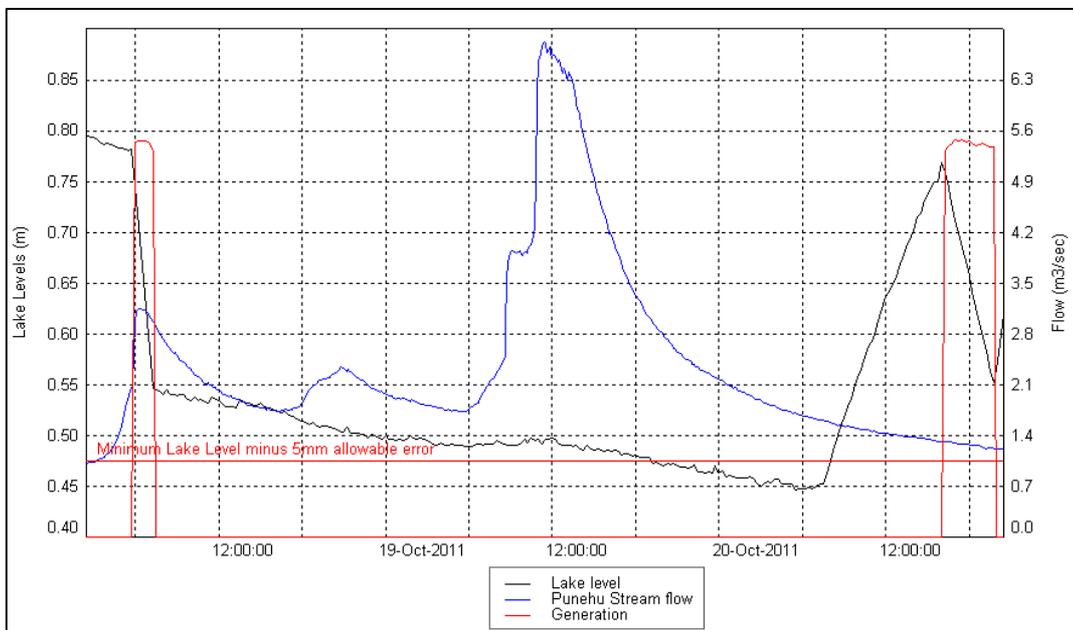


Figure 4 Lake levels, Punehu Stream flow and generation rate between 18 October 2011 and 20 October 2011

2.1.3.3 Fish pass water levels

The system is entirely controlled remotely, with the set up allowing the water level in the fish pass to be managed effectively and water levels adjusted remotely. The Company has also provided fish pass water level data to the Council since December 2004) (Figure 5). There are times where there is no data available, primarily due to equipment failure. The equipment failure which affected generation figures at the end of the 2013-14 monitoring year also affected fish pass data. Overall, fish pass water levels have been managed reasonably well, often being near to the optimum water level (440 mm), which has been gauged to reflect the 80 l/s residual flow which is required to pass down the fish pass. The larger variations in fish pass water levels observed in Figure 5 relate to the routine flushing of the canal and fish pass. The data indicates that for 65% of the time, water levels in the fish pass ranged from 390mm to 490mm.

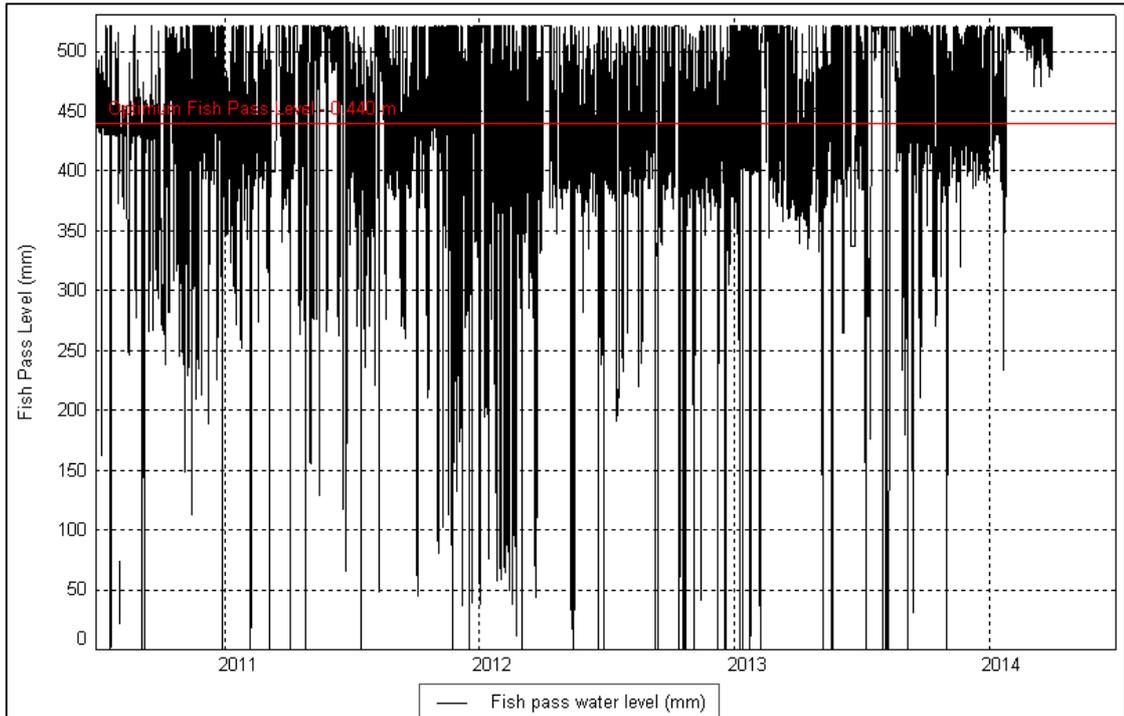


Figure 5 Fish pass water level data, July 2010 – June 2014

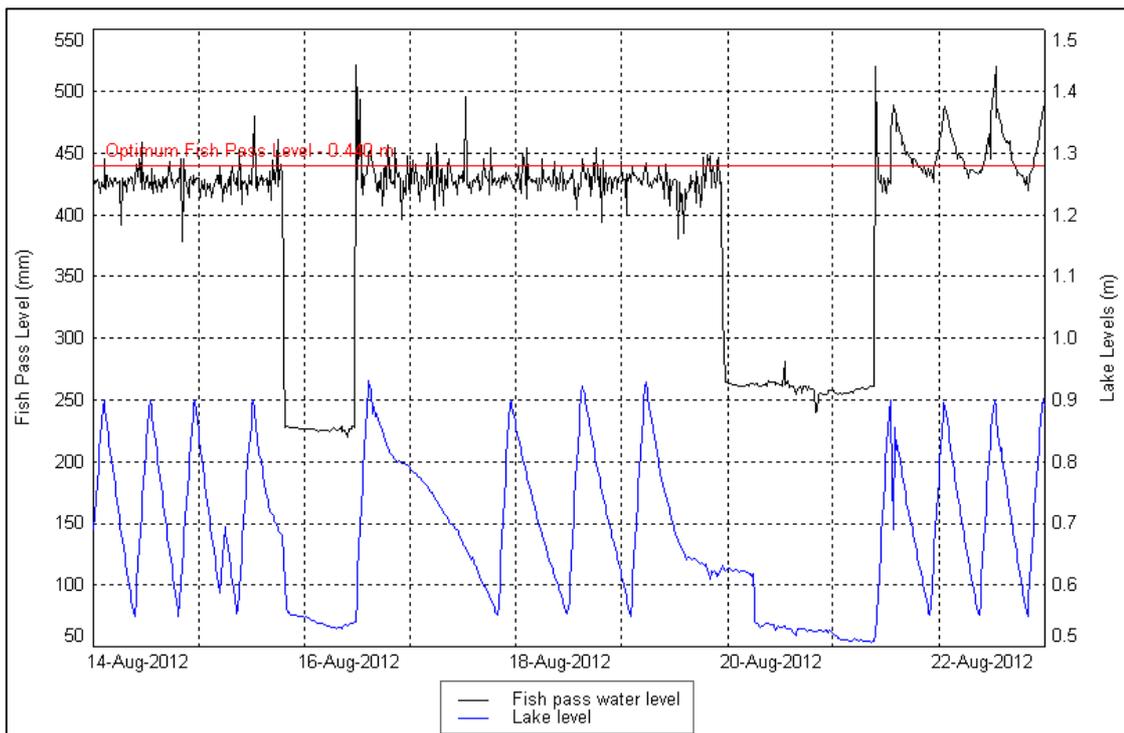


Figure 6 Relationship between fish pass water level and lake level between 14 August 2012 and 22 August 2012

Figure 6 shows the relationship between the lake water level and fish pass water level over an eight day period in 2012. The data indicates that the fish pass water level remains fairly steady, despite fluctuations in lake level. When the intake gates are closed in response to a flood, the canal empties and as a result there is no flow down the fish pass. This is illustrated in Figure 6, which presents lake level and fish pass water level for a period in which there were two floods in the Waiaua River. At such

times there is no fish passage, and although this is technically not compliant with the wording of the consent, this is not treated as non-compliance. This is because sand inundation, which frequently accompanies a flood in the Waiaua River, can severely impact on the operation of the scheme, by jamming equipment such as gates and hydraulic ramps. It is therefore considered unreasonable to require the gates to remain open during floods.

2.1.4 Stakeholders meeting

As a requirement of special condition 10 of consent 1795-4, an annual meeting is held between the consent holder, officers of the Regional Council, and interested submitters, to discuss any matters relating to the exercise of this consent, particularly the monitoring programme design, implementation and interpretation, in order to facilitate on going consultation.

Over time, since this consent has been granted, the need for this meeting has reduced, as each issue was resolved. One meeting was held during the reported period, on 24 November 2011. This meeting was held in Opunake, with a large number of attendees, including South Taranaki District Council, Opunake Community Board, Fish and Game, the Department of Conservation, members of the Opunake Lions Club, Taranaki Regional Council, Simon Young of Opunake Hydro Ltd and interested members of the public, including Margaret Tosland, the daughter of the original founders of the scheme. Representatives from the Institute of Volcanic Studies were invited to attend, to present information relating to sediment inflow to Lake Opunake.

A number of topics were discussed at this meeting, including:

- The environmental and operational performance of the scheme;
- The issue with sediment in the lake;
- The economically marginal nature of the scheme;
- The benefits of the scheme for recreational purposes as well as electricity generation and river habitat;
- The effect of the load distribution in the river with a preference for the intake being located at the surface to minimise sediment entrainment.

The general outcome from the meeting is that the consent holder will consider the feasibility and effectiveness of changing the intake structure to reduce sediment entrainment, and to consider options for removing sediment from the lake.

2.1.5 Fish surveys

On 26 February 2014, three sites were surveyed for freshwater fish. Two sites were located in the Waiaua River, upstream and downstream of the Opunake Hydro intake weir, while a third was located in the Mangahume Stream, at a similar altitude and distance inland as the Waiaua River sites. The survey methods employed included electric fishing and seine netting, with the latter method being particularly effective for pelagic species such as common smelt and inanga, which are less frequently recorded by electric fishing.

The Mangahume Stream recorded a relatively low species richness and fish abundance for a site so close to coast and at a low altitude. This may reflect the amount of habitat available, as this is a smaller stream, which at times can experience sand inundation.

However, it is also likely to be a reflection of the area surveyed, which was relatively small.

The two Waiaua River sites were clearly different to each other, with six migrant species recorded downstream (including one migrant invertebrate), and only two recorded upstream. Redfin bully, which was recorded at both sites, was much more abundant downstream (0.23 fish/m²) than upstream (0.03 fish/m²). Although this species is capable of climbing over the weir, it is apparent that the weir is still a significant barrier to this species.

The seine netting had similar results, with this method recording 72 common smelt downstream of the weir, at a density of 0.8 fish/m², but recording no fish upstream, despite the area surveyed upstream being approximately 150% of that surveyed downstream.

These results support the conclusions made previously, that the weir and intake tunnels constitute a significant barrier to the passage of some native fish, including common smelt, and inanga. It is apparent that passage into the canal is adequate, however, the intake tunnels present quite an impediment, most likely due to flow velocities. The maximum water velocity in which inanga will swim freely is between 0.30 and 0.34 metres per second (Department of Conservation, 1999). Water velocities suitable for smelt are similar. These velocities have been assessed twice prior to the current monitoring period, with velocities ranging from 1.1 to 2.0 meters per second. They were reassessed on 11 January 2011, and found to range from 0.5 to 1.3 m/sec. Therefore it is concluded that water velocities in the tunnels are frequently (if not always) too high for inanga and smelt to move through. Individuals of other fish species such as torrentfish may also be restricted in their ability to move through the tunnels, although previous surveys confirm that some torrentfish have successfully migrated upstream.

During the 2004-2005 monitoring period, the Company retrofitted one of the intake tunnels with a fish ladder which was hoped to provide rest areas and create a slower flowing boundary layer on the inside edge of the culvert which may improve the passage of fish through this area. Unfortunately it appears that this fish ladder has done little to improve the passage of native fish.

The results of this survey support the conclusion that the weir and intake tunnels constitute a barrier to fish passage, and as such, Opunake Hydro Limited are non-compliant with resource consents 1795-4 and 5581-1. The consent holder will need to investigate options for remediating fish passage at this location, and it is recommended their investigations include consultation with the Department of Conservation and Fish and Game NZ.

These investigations should as a minimum, consider the following:

- Trap and transfer at the head of the fish pass, possibly in conjunction with a local school(s)
- Installation of an additional fish pass that bypasses the intake tunnels
- Installation of a new fish pass, at the weir, bypassing the canal entirely

It is expected that the consent holder should have a plan ready for implementation by the end of the 2014-15 monitoring period (30 June 2015).

A copy of the complete fish survey report is included in Appendix II.

2.2 Investigations, interventions, and incidents

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

The Taranaki Regional 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 (UIR) includes events where the company concerned has itself notified the Council. The register contains details of any investigation and corrective action taken.

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

In the reported period, the Council was required to undertake additional investigations and interventions, and record incidents associated with Opunake Hydro Limited's compliance with their resource consents. The additional investigation pertained primarily to the assessment of fish passage, and has been discussed above.

Two incidents related to the results of two hydrological inspections, undertaken on 15 July 2010, when inadequate flow was recorded in the lower Waiaua River, and on 9 August 2013, when the lake level was below the minimum required.

Both incidents were fully investigated. The July 2010 incident was a result of substrate movement in the catchment, compromising the consent holder's ability to manage flows in the scheme as substrate can cause intake gates to jam. In addition to this, at this time, there was a significant amount of loose substrate in the river, potentially resulting in water flowing through the gravel. As a result, the gauging could have underestimated the amount of flow being released to the lower river, and when taking into account this increased margin of error on the gauging, there was potential that the flows were in fact compliant. As the consent holder responded immediately to the results of this inspection, and there was potentially a significant margin of error to the gauging result, no further action was considered appropriate.

The incident that occurred in August 2013 was the result of equipment failure, the cause of which was not reasonably foreseeable and outside of the consent holders control. The equipment caused the station to stop operating, and due to various leaks, the lake level slowly dropped below the minimum. As this low lake level was not due to the consent holder deliberately abstracting too much water, it was considered appropriate that no further action be taken.

Due to the loss of recorded data at the end of the 2013-14 period, an additional incident was recorded, which will be included in the report for the 2014-15 monitoring period. The results of the investigation determined that this data was being collected on a laptop, and the hard drive became corrupted. Attempts to recover this data failed. As with the earlier lake level incident, the cause of which was not reasonably foreseeable and outside of the consent holder's control lost due to equipment failure, and as such, no enforcement action was considered appropriate. However, the consent holder is now aware of the potential for data to be lost in this way, and is therefore expected to undertake steps to avoid a similar loss of data occurring again.

3. Discussion

3.1 National perspective

The Parliamentary Commissioner for the Environment (PCE) released a report in July 2006 entitled *Electricity, energy, and the environment: environmental performance assessment 1 July 2004-30 June 2005* (PCE, May 2006). The report examines the present and future environmental performance and effects of the electricity generation and transmission sector in New Zealand. It includes a focus upon the environmental performance and resource consent compliance of generators.

One of the recommendations in the PCE report is as follows:

‘13. Improve the transparency in reporting of resource consent compliance and monitoring.

At present there is a lack of transparency in the monitoring and reporting of resource consent compliance by electricity generators...

Based on the information provided by the large electricity generators in their environmental and sustainability reports, most companies breach their resource consent conditions several times a year. These breaches are often reported as minor, or as having no detrimental environmental effects. It is impossible to verify the actual effects of these breaches from the available reporting methods.

The PCE recommends that MFE work with electricity generators to develop a robust, transparent, and verifiable system of reporting on resource consent compliance and the environmental effects of electricity generation.’

The report comments on possible roles for the Ministry for the Environment. It states:

‘MFE has limited involvement in the electricity sector, but the PCE believes it should have a broader role in the development of energy policy. Key areas where MFE could play an important role are:

- establishing a nationally consistent method for electricity generators to report on compliance with resource consent conditions and the environmental impacts of electricity generation;
- working with electricity generators to reduce the number of breaches of resource consent conditions;

In many cases these national-level environmental issues are not effectively dealt with by regional councils or territorial authorities.’

The report also examines the consent compliance reporting record of each company. It concludes:

‘General comments on sustainability reporting

With the exception of TrustPower, none of the electricity generators detail the number of times they breach their agreed resource consent conditions. Some generators argue that compliance may not be a reasonable measure of their environmental performance. In general, it seems that it is not uncommon for electricity generators to breach their agreed resource consent conditions several times a year.

The PCE is seeking to quantify the number of non-compliance events in order to compare numbers for different generation plant and generators. The purpose is to identify any trends, which may be relevant.

Resource consent conditions for some plants are significantly more onerous than others, and sometimes this difference is based on the timing of the last resource consent rather than the local environmental effects.

National consistency in categorizing the breaches would be useful for this assessment report and for other purposes. We intend to look at this area in more detail in the next assessment period. This will include the extent to which these companies are reporting what they are doing to promote a robust demand-side sector in the electricity market, at both the wholesale and retail levels.

The Taranaki Regional Council notes that it is the long-standing practice of the Council to report publicly on environmental performance and consent compliance (including non-compliance events) in each annual compliance report. It has done so since compliance reports were first prepared. In the case of Opunake Hydro Limited's power generation facility at Opunake, the record of reporting covers more than five years. The reader is referred particularly to section 2 and Table 2 and Table 9 in this report for more information.

3.2 Discussion of plant performance

During the monitoring period under review, the Company has continued maintenance of the system in the face of significant problems caused by the atypical levels of erosion on the mountain within the Waiaua Catchment. Furthermore, localised storms have also impacted on the scheme.

Special condition 2 of consent 1795-4 requires that the consent holder maintain effective capability for the upstream and downstream passage of native and introduced fish at the diversion weir for the Opunake HEP scheme. During most inspections of the fish pass conducted during the 2010-2014 period, it was noted that the fish pass had adequate passage, and when it didn't it was primarily due to a high lake level, which would be resolved once generation commenced. It is accepted that the fish pass will not provide optimum fish passage all of the time, as when the system is flushed, shut down in response to a flood or experiencing a high lake level, the fish pass will have an inappropriate amount of flow. The goal is to provide appropriate flow for the majority of the time, and it is apparent that this has been achieved. Furthermore, when lake levels are high, it may aid fish passage through the intake tunnels into the river upstream of the weir. Unfortunately, it appears that these tunnels are where the primary barrier to fish passage exists.

The intake tunnels are considered to constitute a barrier to fish passage because although fish have been seen within the canal on occasions and in the fish pass during maintenance periods, fish surveys in the Waiaua River have not yet demonstrated that inanga are able to pass the weir (fish pass and intake tunnels). Other weak swimming species such as smelt and torrentfish have also been detected upstream of the weir only sporadically and in a much lower abundance compared to downstream, suggesting the weir and associated structures remain a barrier. Inanga and smelt have been observed on previous occasions in the canal however, suggesting that the fish pass up to the canal provides adequate passage when operating well. This has been confirmed in the current monitoring period, with two sites surveyed in the Waiaua River and one in the nearby Mangahume Stream finding that the Waiaua River upstream of the weir is relatively depauperate.

Special condition 4 of consent 1795-4 requires that 80 L/s of residual flow is provided downstream of the fish pass, and 180 L/s be provided downstream of the canal sluice gate. These flows were found to be compliant during sixteen of seventeen hydrological inspections undertaken between 1 July 2010 and 30 June 2014. However, one hydrological inspection recorded insufficient residual flow. While investigating this it became apparent that the gauging may have had a significant margin of error, and as such, it was not certain that there was indeed insufficient flow. As a result no further action was considered appropriate. When contacted regarding this insufficient flow, the Company responded quickly, and assisted in the investigation. The Company understands the importance of providing sufficient residual flow, and has committed to maintaining compliance. The results of the reported period shows improvement in compliance from that reported previously.

The consent holder is required to record generation figures, lake level, sand trap discharges, and fish pass water levels, and provide these records to the Council. All of these records, bar the sand trap discharges, have been taken, and provided to the Council for the monitoring period in question, with the exception of the last three months of data, which was lost due to equipment failure.

Resource consent 1797-3 relates to the discharge of sand and silt deposits from a sand trap within the diversion canal, back to the Waiaua River. Special condition 2 of this consent requires that a record of sand trap discharges be kept, and be provided at three monthly intervals for review. Automation work in the 2003-2004 year has meant that sluicing is now done automatically, four times per week for 10 minutes (at night). However, manual sluicing has also been required on occasions when there have been frequent floods and sediment deposition in the canal has been high. These manual sluices have been logged by the Company but were not forwarded to the Council at the time of writing this report.

Special condition 1 of resource consent 1796-3 specifies minimum water levels within Lake Opunake that the consent holder must maintain at different times of the day (i.e. the operating ranges for the lake). History shows that the consent holder struggled to comply with this consent condition. A change to consent conditions was granted on 16 October 2006, which specified a minimum lake level, which was to be maintained at all times. Compliance with this condition has been better, with only a small number of breaches mostly due to recorder error.

Overall, the scheme has operated well, and at all times the consent holder has been proactive and quick to respond to any queries from the Council.

3.3 Environmental effects of exercise of consents

The main environmental effects from the HEP scheme are associated with fish passage upstream of the weir in the Waiaua River and the maintenance of residual flows below the weir. Instream works such as gravel extraction, and maintenance of the lake may also produce adverse effects.

It is believed that the weir on the Waiaua River restricts the migration of poor swimming native fish such as smelt and inanga in the river. The only migrant fish recorded upstream of the weir in any numbers are longfin eels and redfin bullies. Despite good management of the fish pass, and previous improvement works on providing passage through the tunnels, no inanga and few smelt have been recorded upstream of the weir. The fish ladder that was installed in the 2004-2005 period does not seem to have improved passage for any species. Fish passage works undertaken to date have had very limited success with achieving fish passage past the weir and intake tunnels, and as such, the consent holder needs to investigate options for remediating fish passage at this location, and it is recommended their investigations include consultation with the Department of Conservation and Fish and Game NZ.

These investigations should as a minimum, consider the following:

- Trap and transfer at the head of the fish pass, possibly in conjunction with a local school(s)
- Installation of an additional fish pass that bypasses the intake tunnels;
- Installation of a new fish pass, at the weir, bypassing the canal entirely either modification to the current set up, or a change in approach

Following the first hydrological inspection, which recorded insufficient flow in the lower Waiaua River, all subsequent hydrological inspections recorded compliance. Frequently, the consent holder has provided flows well above what is required, and this will have gone some way in reducing the adverse effects of the low flows in the lower river. The fish survey undertaken in 2014 found large numbers of bullies, which is likely to be a result of the low flows, as this family of fish prefer lower velocities. However three torrentfish were also recorded, and this species, as their name suggests, prefer swift velocities. This indicates that although the lower flow inevitably reduces the amount of habitat available, it has not resulted in a loss of species. That said, it does appear that the low flows may result in a reduced abundance of swift water species such as torrentfish.

Gravel extraction in the river has been undertaken in the past to maintain a clear intake, improving the flow of water into the canal. Inspections, undertaken in previously reported periods, undertaken in relation to gravel extraction works have noted only slight discolouration of the river downstream of the works, with the Company operating in a manner that minimises effects during these maintenance works. The Company often diverts the water away from work areas where this is possible and no adverse effects have been noted downstream of instream works when they've been undertaken. No such works were undertaken during the 2010-2014 monitoring period. Neither were there any maintenance works undertaken that involved disturbance of the lake bed.

Although lake levels have been outside consent limits on a number of occasions in the reporting period, these instances were not deemed significant as they were beyond the control of the consent holder, and no complaints were received by Council about these low lake levels. With the hydraulic ram in the fish pass operating with reasonable success, water levels in the fish pass are relatively consistent, and operated well. The presence of the canal stop gate also helps to maintain higher lake levels during sluicing operations.

The issue of sedimentation within the lake has been the main topic of discussion with members of the local community who are concerned at the loss of recreational value in the lake. It is clear that the sand delta is continuing to grow, and the consent holder is investigating options to either reduce this sand ingress, or to flush this sand out of the lake. This is important, as the recreational value of the lake is an important form of mitigation for the scheme's effects on the local community including the low flows in the lower river.

3.4 Evaluation of performance

A tabular summary of the consent holder's compliance record for the 2010-2014 period under review is set out in Tables 2-9.

Table 2 Summary of performance for Consent **1795-4-** to take water from the Waiaua River in association with the Opunake hydroelectric power scheme

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Limits of abstraction rates	Inspections, review of data	Yes
2. Exercise of consent in accordance with application	Inspections	Yes
3. Fish passage	Inspections, fish survey	No
4. Residual flows	Inspections/Hydrological gaugings	Yes
5. Review condition – residual flow	Actioned by TRC in 2009	N/A
6. Notification condition	Consent holder to notify council	Yes
7. Sluice gate to be closed at certain flows	Inspections	Yes
8. Recording of generation and fishpass levels	Records provided to Council 3 monthly	No
9. Consent holder to review Operational Procedure by 30 June	Not provided	No
10. Meeting with stakeholders annually	Meeting held	Yes
11. Consent to lapse if not exercised in five years	Consent was exercised	N/A
12. Review Condition	No review sought by either Council or Company under this condition	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Good

N/A = not applicable

Table 3 Summary of performance for Consent **1796-3** to take and use water from Lake Opunake for hydroelectric power generation

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Defines lake levels within which the consent holder must operate	Inspections, records provided to Council 3 monthly	Yes
2. Must maintain a constant flow down fish pass	Inspections, records provided to Council – Note, the consent holder is not required to provide flow when the scheme is shut down in response to flooding or for maintenance.	Yes
3. Monitor lake levels and forward records to Council 3 monthly	Records provided to Council	No
4. Maintain a staff gauge at Lake Opunake	Inspection	Yes
5. Review of consent	No review sought by Council	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Good

N/A = not applicable

Table 4 Summary of performance for Consent **1797-3** to discharge sand and silt deposits from a diversion canal sand trap via a spillway to the Waiaua River

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Supply sediment management protocol within 3 months of granting consent	Received by Council in September 2001	Yes
2. Record sand trap discharges and supply to Council	Automated discharges 4 times/week; Manual discharges logged but not supplied to Council	No
3. Adopt best practicable option	Inspections	Yes
4. Option for change or cancellation of conditions	No review sought by either Council or Company	N/A
5. Review of consent	No review sought by Council	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Good

N/A = not applicable

Table 5 Summary of performance for Consent **4563-2** to erect, place and maintain an outfall structure in the coastal marine area on the Opunake Beach foreshore

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Structure shall be maintained in accordance with application	Inspections	Yes
2. Notify Council prior to and following maintenance works	No maintenance work undertaken	N/A
3. Adopt best practicable option	No maintenance work undertaken	N/A
4. Disturbance minimised during works	No maintenance work undertaken	N/A

Condition requirement	Means of monitoring during period under review	Compliance achieved?
5. Structure shall be removed if no longer required	Structure still in use	N/A
6. Option for change or cancellation of conditions	No review sought by either Council or Company	N/A
7. Review of consent	No review sought by Council	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		High

N/A = not applicable

Table 6 Summary of performance for Consent **4658-1** to disturb the bed of Lake Opunake by removing reeds and flaxes from the edge of the lake

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Consent holder to adopt best practical option	Inspections	N/A
2. Works to be undertaken in accordance with application	Inspections	N/A
3. Notify Council prior to works	No works undertaken	N/A
4. Defines time of year works can be undertaken in	No works undertaken	N/A
5. Minimise discharge or placement of silt/organics/debris into lake	Inspections	N/A
6. Remove all plant trimmings during work	Inspections	N/A
7. Place removed material so it does not enter lake	Inspections	N/A
8. Lapse condition	Not yet applicable	N/A
9. Review Condition	No review sought by Council	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		N/A

N/A = not applicable

Table 7 Summary of performance for Consent **4744-4** to discharge water from hydroelectric power generation through two marine outfall pipes into the Tasman Sea

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Discharge rate limit	Review of data	Yes
2. Discharge of contaminated water shall not occur	Inspections	Yes
3. Review of consent	No review sought by Council	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		High

N/A = not applicable

Table 8 Summary of performance for Consent **5581-1** to dam the Waiaua River in association with the Opunake hydroelectric power scheme

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Structure shall be maintained in accordance with application	Inspections	Yes
2. Maintain and operate a safe dam	Inspections	Yes
3. Maintain a fish pass	Inspections, fish surveys	No
4. Notify Council prior to and following maintenance works which involve disturbance of the bed	No works undertaken	N/A
5. Adopt best practicable option	No works undertaken	N/A
6. During works, bed disturbance shall be kept to a minimum and reinstated	No works undertaken	N/A
7. Defines times when disturbance of river bed may be undertaken	Notification and inspections	N/A
8. Removal of structure when no longer required	Structure still in use	N/A
9. Option for change or cancellation of conditions	No review sought by either Council or Company	N/A
10. Review of consent	No review sought by Council	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		Good

N/A = not applicable

Table 9 Summary of performance for Consent **5692-1** to disturb the bed of the Waiaua River by removing sediment build-up upstream of a weir

Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Notification prior to and following disturbance	No works undertaken	N/A
2. Disturbance shall be undertaken generally in accordance with application documentation	No works undertaken	N/A
3. Defines times when disturbance of river bed may be undertaken	No works undertaken	N/A
4. Adopt best practicable option	No works undertaken	N/A
5. During works, bed disturbance shall be kept to a minimum and reinstated	No works undertaken	N/A
6. Maintain a record of disturbance activity and forward to Council annually	No works undertaken	N/A

Condition requirement	Means of monitoring during period under review	Compliance achieved?
7. Placement of sediment downstream of weir only with Council permission	No works undertaken	N/A
8. Option for change or cancellation of conditions	No review sought by either Council or Company	N/A
9. Review of consent	No review sought by Council	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		N/A

N/A = not applicable

During the period under review, the Company demonstrated a good level of environmental performance and compliance with the resource consents overall as defined in Section 1.1.4. During the period under review there was an improvement in the compliance with residual flow compliance, and lake level management has improved, in an effort to minimise the occasions when the lake level drops below the minimum level. Where the lake did drop below this level, it was due to water leaking at the lake stop gate and spillway, and this was outside of the immediate control of the consent holder.

There were no unauthorised incidents that required enforcement action, however, the consent holder was not proactive in providing data required by consent. In addition, it has been concluded that the scheme constitutes a barrier to fish passage, and all of these matters were considered when giving the scheme a 'good' grade.

All other facets of the scheme were operated well during the 2010-2014 period, and the new consent holder has demonstrated a willingness to continue efforts to improve compliance where possible.

3.5 Recommendations from the 2008-2010 Monitoring Report

In the 2008-2010 Biennial Report, it was recommended:

1. THAT monitoring of Opunake Hydro's hydroelectric power scheme on the Waiaua River in the 2010-2011 year continues at the same level as in 2008-2009.

This recommendation was implemented.

3.6 Alterations to monitoring programmes for 2014-2015

In designing and implementing the monitoring programmes for air/water discharges in the region, the Taranaki Regional Council has taken into account the extent of information made available by previous authorities, its relevance under the RMA the obligations of the Act in terms of monitoring emissions/ discharges and effects, and subsequently reporting to the regional community. The Council also takes into account the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki emitting to the atmosphere/ discharging to the environment.

Following an improvement in compliance by the consent holder in the 2010-2011 monitoring period, it was determined that the number of inspections could be reduced from that programmed. In 2010-2011 twelve inspections were programmed. This was reduced to six for the 2011-2012 monitoring period, and this has continued through to the end of the 2013-2014 monitoring period.

It is proposed that for 2014-2015 year, that monitoring of Opunake Hydro's hydroelectric power scheme on the Waiaua River continues at the same level as in 2013-2014. A recommendation to this effect is attached to this report.

3.7 Exercise of optional review of consent

There are no consents held by the Company that allow for an optional review of consent in June 2015.

3.8 Review of consent 1795-4

Resource consent **1795-4** has a condition which states that the appropriateness of a gradual increase in the residual flow shall be reviewed in 2009 and/or 2012. In this regard it is noted that at the time of this consent renewal application, three objectives had been determined for the reach of the Waiaua River that is most affected by the applicant's abstraction, the 2 km between the abstraction point and the sea. These objectives are to provide sufficient flow:

- to provide fish passage (both trout and native fish),
- to retain an acceptable minimum of invertebrate habitat (referred to as food producing habitat) and fish habitat and
- to maintain adequate water quality.

It was therefore recommended in the 2007-2008 annual report that the conditions of consent 1795-4 be reviewed in June 2009. This recommendation was implemented by serving a notice of review in accordance with the conditions of the consent and section 129 of the RMA.

This review process has been on hold with the agreement of the consent holder, pending the collection of further information.

The Council is currently working through a review of the Regional Freshwater Plan for Taranaki and intends to notify a new Plan in early 2015. The recent National Policy Statement for Fresh Water 2014 requires the Plan to include an allocation limit and a minimum flow for every river in order to meet national objectives for water quality and quantity. It now appears that the most effective and efficient way to establish the appropriate residual flows downstream of the operation is through the public process of the Regional Plan rather than by a review of consent conditions. This has been proposed to the consent holder, and further discussions will decide whether this is indeed the appropriate process.

A recommendation to this effect (re that the Council notes the recommendation in the 2007-2008. Report adopted by the Council might now not proceed) is presented in section 4.

4. Recommendations

1. THAT monitoring of Opunake Hydro Limited's hydroelectric power scheme on the Waiaua River continues at the same level as in 2013-2014.
2. THAT Opunake Hydro Limited undertake steps to improve fish passage into the upper Waiaua River catchment.
3. THAT the Council notes the review of consent 1795-4 may lapse.

Glossary of common terms and abbreviations

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

Biomonitoring	Assessing the health of the environment using aquatic organisms.
Bund	A wall around a tank to contain its contents in the case of a leak.
Cumec	A volumetric measure of flow- 1 cubic metre per second (1 m ³ s ⁻¹).
Fish pass	An artificial channel that is intended to facilitate the passage of fish around a barrier or impediment to fish migration. Passage could be for fish migrating upstream and/or downstream.
Fresh	Elevated flow in a stream, such as after heavy rainfall.
g/m ³	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
l/s	Litres per second.
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.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	<i>Resource Management Act 1991</i> and including all subsequent amendments.
UI	Unauthorised Incident.
UIR	Unauthorised Incident Register – contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.

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

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- Taranaki Regional Council, 2010: 'New Zealand Energy Limited Waiaua Hydroelectric Power Scheme Monitoring Programme Biennial Report 2008-2010'. Technical report 2010-48.

Appendix I

Resource consents held by Opunake Hydro Limited

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

Name of
Consent Holder: Opunake Hydro Limited
 7 Tole Street
 Ponsonby
 AUCKLAND 1011

Decision Date: 15 November 2012

Commencement
Date: 15 November 2012

Conditions of Consent

Consent Granted: To discharge water from hydroelectric power generation
 through two marine outfall pipes into the Tasman Sea at or
 about (NZTM) 1673815E-5631907N

Expiry Date: 1 June 2018

Site Location: Beach Road, Opunake

Legal Description: Sec 48 Opunake Suburban (Discharge source)
 Adjacent to Sec 1 Blk VII TN of Opunake (Discharge site)

Catchment: Tasman
 Waiaua

Tributary: Lake Opunake

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

General condition

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

Special conditions

1. The rate of discharge shall not exceed 3900 litres per second.
2. There shall be no discharge of contaminated water as a result of the exercise of this consent.
3. The consent holder shall install and/or maintain signage at the site of discharge warning the public that there may be discharge of water from the outfall structures at any time.

Signed at Stratford on 15 November 2012

For and on behalf of
Taranaki Regional Council

Director-Resource Management



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Please quote our file number
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Water Permit
Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
Taranaki Regional Council

Name of
Consent Holder: Opunake Hydro Limited
7 Tole Street
Ponsonby
AUCKLAND 1011

Consent Granted
Date: 16 October 2006

Conditions of Consent

Consent Granted: To take water from the Waiaua River in association with
the Opunake hydro electric power scheme at or about
(NZTM) 1674582E-5632132N

Expiry Date: 1 June 2018

Review Date(s): June 2009, June 2012

Site Location: South Road [State Highway 45], Opunake

Legal Description: Lot 1 SS6265 Sub Sec 47 Borough of Opunake Blk IX
Opunake SD

Catchment: Waiaua

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

Consent 1795-4

General conditions

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

Special conditions

1. The take authorised by this consent shall be limited to a maximum of 3900 litres per second.
2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 2661. In the case of any contradiction between the documentation submitted in support of application 2661 and the conditions of this consent, the conditions of this consent shall prevail.
3. The consent holder shall maintain a fish pass that allows the passage of native fish, juvenile trout and adult trout to habitat upstream of the weir at SH45.
4. The consent holder shall ensure that a residual flow of not less than 80 L/s as measured in the Waiaua River immediately downstream of the fish pass, and not less than 180 L/s as measured in the Waiaua River immediately downstream of the canal sluice gate discharge, is maintained at all times.
5. In accordance with section 128 of the Resource Management Act 1991, the Taranaki Regional Council shall review during the month of June 2009 and/or June 2012, the appropriateness of a gradual increase in the residual flow specified in condition 4 of this consent.
6. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least seven days prior to the exercise of this consent.
7. The sluice gate/bywash shall only be closed when the level of the Waiaua River in receding flows falls below a level of 100 mm above the intake weir crest.
8. The consent holder shall record generation figures [as a measure of abstraction rates] and fish pass water levels at a minimum of 15-minute intervals, and shall make such records available to the Chief Executive, Taranaki Regional Council, at three monthly intervals.

Consent 1795-4

9. The consent holder shall review the Operational Procedure and forward this to the Chief Executive, Taranaki Regional Council by 30 June of each year. The scheme shall be operated in accordance with this Operational Procedure.
10. The consent holder and staff of the Taranaki Regional Council shall meet as appropriate, and at least once per year, with interested submitters to the consent, to discuss any matter relating to the exercise of this resource consent, particularly the monitoring programme design, implementation and interpretation, in order to facilitate ongoing consultation.
11. This consent shall lapse on the expiry of five years after the date of issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.
12. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2009 and/or June 2012, 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 22 January 2009

For and on behalf of
Taranaki Regional Council



Director-Resource Management



Water Permit
Pursuant to the Resource Management Act 1991
a resource consent is hereby granted by the
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Name of
Consent Holder: Opunake Hydro Limited
7 Tole Street
Ponsonby
AUCKLAND 1011

Change To
Conditions Date: 16 October 2006 [Granted: 21 March 2001]

Conditions of Consent

Consent Granted: To take and use water from Lake Opunake for hydroelectric power generation in association with the Opunake hydroelectric power scheme at or about (NZTM) 1674033E-5631971N

Expiry Date: 1 June 2018

Review Date(s): December 2003, June 2006, June 2009, June 2012

Site Location: Lake Opunake, Layard Street, Opunake

Legal Description: Lot 1 SS6265 Sub Sec 47 Borough of Opunake Blk IX Opunake SD

Catchment: Waiaua

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

Consent 1796-3

General conditions

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

Special conditions

Conditions 1 & 2 [changed]

1. The consent holder shall maintain levels within Lake Opunake in the following manner:
 - a) the lake level shall not be lowered more than 480 mm (equivalent to 500 mm on lake staff gauge) below the lake spillway crest (980 mm on lake staff gauge);
 - b) lowering the lake below this level for maintenance (i.e., weed control, de-silting or other operational reasons) shall be done only with the prior written approval of the Chief Executive, Taranaki Regional Council.
2. Notwithstanding special condition 1 the exercise of this consent shall be undertaken to ensure there is a constant flow through the fish pass.

Conditions 3 & 4 [unchanged]

3. The consent holder shall monitor Lake Opunake levels, at a minimum of 15 minute intervals and shall make records of such measurements available to the Chief Executive, Taranaki Regional Council, at three monthly intervals.
4. The consent holder shall install and maintain a staff gauge at Lake Opunake to the satisfaction of the Chief Executive, Taranaki Regional Council.

Condition 5 [changed]

5. In accordance with section 128 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 2009 and/or June 2012, for the purpose of ensuring that the conditions adequately deal with the environmental effects arising from the exercise of this consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Transferred at Stratford on 22 January 2009

For and on behalf of
Taranaki Regional Council



Director-Resource Management



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

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Name of
Consent Holder: Opunake Hydro Limited
7 Tole Street
Ponsonby
AUCKLAND 1011

Consent Granted
Date: 21 March 2001

Conditions of Consent

Consent Granted: To discharge sand and silt deposits from a diversion canal sand trap via a spillway to the Waiaua River in association with the Opunake hydroelectric power scheme at or about (NZTM) 1674248E-5631944N

Expiry Date: 1 June 2018

Review Date(s): December 2003, June 2006, June 2012

Site Location: Lake Opunake, Layard St, Opunake

Legal Description: Lot 1 SS6265 Sub Sec 47 Borough of Opunake Blk IX
Opunake SD

Catchment: Waiaua

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

General conditions

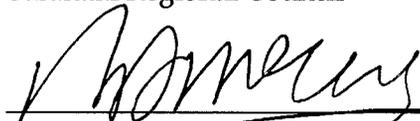
- a) That on receipt of a requirement from the Chief Executive, Taranaki Regional Council (hereinafter the Chief Executive), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) That unless it is otherwise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

Special conditions

- 1) The consent holder shall supply a sediment management protocol within three months of the granting of this consent for the written approval of the Chief Executive, Taranaki Regional Council.
- 2) The consent holder shall maintain a record of any sand trap discharges for supply to the Chief Executive, Taranaki Regional Council, at three monthly intervals.
- 3) The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to avoid or minimise the adverse effect of the discharge.
- 4) The consent holder may apply to the Taranaki Regional Council for a change or cancellation of the conditions of their consent, in accordance with section 127(1)(a) of the Resource Management Act 1991, to take account of operational requirements or the results of the monitoring.
- 5) In accordance with section 128 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 December 2003 and/or June 2006 and/or June 2012, for the purpose of ensuring that the conditions adequately deal with the environmental effects arising from the exercise of this consent, which were either not foreseen at the time the application was considered or which it is not appropriate to deal with at the time.

Transferred at Stratford on 22 January 2009

For and on behalf of
Taranaki Regional Council


Director-Resource Management



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

Name of
Consent Holder: Opunake Hydro Limited
7 Tole Street
Ponsonby
AUCKLAND 1011

Consent Granted
Date: 21 March 2001

Conditions of Consent

Consent Granted: To erect, place and maintain an outfall structure in the coastal marine area on the Opunake Beach foreshore in association with the Opunake hydroelectric power scheme at or about (NZTM) 1673748E-5632044N

Expiry Date: 1 June 2018

Review Date(s): December 2003, June 2006, June 2012

Site Location: Opunake Beach, Beach Road, Opunake

Legal Description: Lot 1 SS6265 Sub SEc 47 Borough of Opunake Blk IX
Opunake SD

Catchment: Tasman Sea

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

General conditions

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

Special conditions

- 1) The structure authorised by this consent shall be maintained generally in accordance with the information submitted in support of the application and to ensure that the conditions of this consent are met.
- 2) The consent holder shall notify the Taranaki Regional Council, at least 48 hours prior to the commencement and upon completion of, the any subsequent maintenance works which would involve disturbance of, deposition to, or discharges to the coastal marine area.
- 3) That during any maintenance works the consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to avoid or minimise the discharge of silt or other contaminants and to avoid or minimise the disturbance of the coastal marine area and any effects to water quality.
- 4) That during any maintenance works the consent holder shall ensure that the area and volume of disturbance shall so far as is practicable, be minimised and any areas which are disturbed, shall so far as is practicable be reinstated.
- 5) The structure authorised by this consent shall be removed and the area reinstated, if and when it is no longer required. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to the structures removal and reinstatement.
- 6) The consent holder may apply to the Taranaki Regional Council for a change or cancellation of the conditions of their consent, in accordance with section 127(1)(a) of the Resource Management Act 1991, to take account of operational requirements or the results of the monitoring.

Consent 4563-2

- 7) In accordance with section 128 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 December 2003 and/or June 2006 and/or June 2012, for the purpose of ensuring that the conditions adequately deal with the environmental effects arising from the exercise of this consent, which were either not foreseen at the time the application was considered or which it is not appropriate to deal with at the time.

Transferred at Stratford on 22 January 2009

For and on behalf of
Taranaki Regional Council



Director - Resource Management



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

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Please quote our file number
on all correspondence

Name of
Consent Holder: Opunake Hydro Limited
7 Tole Street
Ponsonby
AUCKLAND 1011

Consent Granted
Date: 22 March 2006

Conditions of Consent

Consent Granted: To disturb the bed of Lake Opunake in the Waiaua
catchment by removing reeds and flaxes from the edge of
the lake at or about (NZTM) 1674148E-5632044N

Expiry Date: 1 June 2024

Review Date(s): June 2012, June 2018

Site Location: Lake Opunake, Layard Street, Opunake

Legal Description: Sec 46-49 Borough of Opunake Blk IX Opunake SD

Catchment: Waiaua

Tributary: Opunake Lake

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

General conditions

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

Special conditions

- 1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this consent.
- 2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 4057. In the case of any contradiction between the documentation submitted in support of application 4057 and the conditions of this consent, the conditions of this consent shall prevail.
- 3. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least seven days prior to commencing work.
- 4. That works shall only be undertaken during the period 1 May to 31 October.
- 5. That the consent holder shall observe every practicable measure to minimise the discharge or placement of silt and/or organics and/or debris into the lake.
- 6. That the consent holder shall collect and remove all plant trimmings and other floatable material produced during the works.
- 7. That where removed material is placed on or near the banks of the lake, this is done in a manner which avoids decaying vegetation or leaching into the lake or the Waiaua River.
- 8. This consent shall lapse on the expiry of five years after the date of issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.

Consent 4658-2

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 during the month of June 2012 and/or June 2018, 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 22 January 2009

For and on behalf of
Taranaki Regional Council



Director-Resource Management



CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
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Please quote our file number
on all correspondence

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

Name of
Consent Holder: Opunake Hydro Limited
7 Tole Street
Ponsonby
AUCKLAND 1011

Consent Granted
Date: 21 March 2001

Conditions of Consent

Consent Granted: To dam the Waiaua River in association with the Opunake hydroelectric power scheme at or about (NZTM) 1674548E-5632144N

Expiry Date: 1 June 2018

Review Date(s): December 2003, June 2006, June 2012

Site Location: South Road [State Highway 45], Opunake

Legal Description: Lot 1 SS6265 Sub Sec 47 Borough of Opunake Blk IX Opunake SD

Catchment: Waiaua

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

General conditions

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

Special conditions

1. The weir authorised by this consent shall be maintained generally in accordance with the information submitted in support of the application and to ensure that the conditions of this consent are met.
2. It is the responsibility of the consent holder to maintain and operate a safe dam and the Taranaki Regional Council accepts no responsibility in this regard.
3. The consent holder shall maintain a fish pass that allows the passage of native fish, juvenile trout and adult trout.
4. The consent holder shall notify the Taranaki Regional Council, at least 48 hours prior to the commencement and upon completion of, the any subsequent maintenance works which would involve disturbance of, or deposition to, the riverbed or discharges to water.
5. That during any maintenance works the consent holder shall adopt the best practicable option, as defined in the section 2 of the Resource Management Act 1991, to avoid or minimise the discharge of silt or other contaminants into water or onto the riverbed and to avoid or minimise the disturbance of the riverbed and any adverse effects on water quality.
6. That during any maintenance works the consent holder shall ensure that the area and volume of riverbed disturbance shall so far as is practicable, be minimised and any areas which are disturbed, shall so far as is practicable be reinstated.
7. That any disturbance of parts of the riverbed covered by water and/or any works which may result in downstream discolouration shall be undertaken only between 1 November and 30 April, except where this requirement is waived in writing by the Chief Executive, Taranaki Regional Council.

Consent 5581-1

8. The structure[s] authorised by this consent shall be removed and the area reinstated, if and when the structure[s] are no longer required. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to structure[s] removal and reinstatement.
9. The consent holder may apply to the Taranaki Regional Council for a change or cancellation of the conditions of their consent, in accordance with section 127(1)(a) of the Resource Management Act 1991, to take account of operational requirements or the results of the monitoring
10. In accordance with section 128 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 December 2003 and/or June 2006 and/or June 2012, for the purpose of ensuring that the conditions adequately deal with the environmental effects arising from the exercise of this consent, which were either not foreseen at the time the application was considered or which it is not appropriate to deal with at the time.

Transferred at Stratford on 22 January 2009

For and on behalf of
Taranaki Regional Council



Director-Resource Management



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Please quote our file number
on all correspondence

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

Name of
Consent Holder: Opunake Hydro Limited
7 Tole Street
Ponsonby
AUCKLAND 1011

Consent Granted
Date: 21 March 2001

Conditions of Consent

Consent Granted: To disturb the bed of the Waiaua River by removing sediment build-up upstream of a weir for the purpose of maintaining the Opunake hydroelectric scheme intake at or about (NZTM) 1674548E-5632144N

Expiry Date: 1 June 2018

Review Date(s): December 2003, June 2006, June 2012

Site Location: South Road [State Highway 45], Opunake

Legal Description: Lot 1 SS6265 Sub Sec 47 Borough of Opunake Blk IX
Opunake SD

Catchment: Waiaua

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

Consent 5692-1

General conditions

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

Special conditions

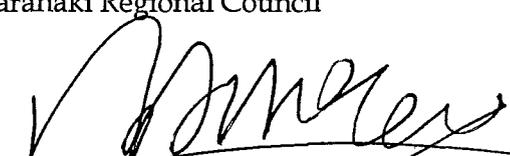
- 1) The consent holder shall notify the Taranaki Regional Council in writing at least 72 hours prior to the commencement and upon completion of any disturbance licensed by this consent.
- 2) The disturbance authorised by this consent shall be undertaken generally in accordance with the documentation submitted in support of the application and to ensure the conditions of this consent are met.
- 3) Any disturbance of parts of the riverbed covered by water and/or any works which may result in downstream discolouration shall be undertaken only between 1 December and 30 April, except where this requirement is waived in writing by the Chief Executive, Taranaki Regional Council.
- 4) The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to avoid or minimise the discharge of silt or other contaminants into water or onto the riverbed and to avoid or minimise the disturbance of the riverbed and any adverse effects on water quality.
- 5) The consent holder shall ensure that the area and volume of riverbed and bank disturbance shall, so far as is practicable, be minimised and any areas which are disturbed shall, so far as is practicable, be reinstated.
- 6) The consent holder shall maintain a record of all disturbance activity including, timing and duration of disturbance activities and volumes of sediment removed, and shall forward this to the Chief Executive, Taranaki Regional Council on an annual basis, by 31 May each year.

Consent 5692-1

- 7) The placement of sediment downstream of the weir for the purposes of maintaining clearance at the intake gates shall only be undertaken upon written approval of the Chief Executive, Taranaki Regional Council, and in accordance with special conditions 3, 4, and 5.
- 8) The consent holder may apply to the Taranaki Regional Council for a change or cancellation of the conditions of their consent, in accordance with section 127(1)(a) of the Resource Management Act 1991, to take account of operational requirements or the results of the monitoring.
- 9) In accordance with section 128 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 December 2003 and/or June 2006 and/or June 2012, for the purpose of ensuring that the conditions adequately deal with the environmental effects arising from the exercise of this consent, which were either not foreseen at the time the application was considered or which it is not appropriate to deal with at the time.

Transferred at Stratford on 22 January 2009

For and on behalf of
Taranaki Regional Council



Director-Resource Management

Appendix II

Fish survey report

Memorandum

To Bart Jansma, Scientific Officer
From Bart Jansma, Scientific Officer
Report No BJ231
Document 1379387
Date 24 July 2014

Fish Survey – Waiaua River

Introduction

Opunake Hydro Ltd operates a hydroelectric power station in Opunake, which diverts water from the Waiaua River, into Opunake Lake, from where it is directed through the station and discharged to the Tasman Sea on Opunake Beach. The scheme holds two resource consents that contain fish passage conditions, with consent 1795-4 licensing the abstraction of water from the Waiaua River, and consent 5581-1 licensing the damming of the Waiaua River. Both consents require that the consent holder shall install and maintain a fish pass that allows the passage of native fish, juvenile trout and adult trout. The weir is shown in Photo 1.

Over time the consent holder (including previous owners) have made modifications to the layout of the scheme, in an effort to provide this fish passage. A fish pass from the Waiaua River to the canal has been operating since 1997 with two channels, catering for swimming fish (i.e., trout, smelt and torrentfish) and climbing fish (many native fish such as the redfin bully and most of the whitebait species). Once the fish have entered the canal, they must then negotiate the intake tunnels where velocities can be high. However, when lake and canal levels are high, this creates a backwatering effect in the canal, and can reduce water velocities during these times. This occurs for short times on a daily basis between times of peak power generation. A fish ladder was also installed in the southern intake tunnel with the intention of providing some lower velocity zones and rest areas for fish that are attempting to pass through the tunnels.



Photo 1 The weir on the Waiaua River associated with the Opunake Hydro intake.

A number of surveys have been undertaken in the Waiaua River in relation to these fish passage requirements. A summary of all results was presented in the last compliance monitoring report (TRC, 2010), and the general conclusion was that although it appeared that all species can negotiate the fish pass into the intake canal, the intake tunnels between the river and the canal still constitute a significant barrier, especially to those poorer swimmers such as inanga and smelt. The survey reported herein was undertaken to further investigate the degree of impact the scheme was having on fish passage, and includes a comparison with a similar stream that flows nearby.

Methods

In this survey, two sites were surveyed in the Waiaua River, and one site was surveyed in the Mangahume Stream. Representative photos of each site are presented in Photo 2. Site 1 was located in the Mangahume Stream, while sites 2 and 3 were located in the Waiaua River, site 2 upstream of the weir, and site 3 downstream of the weir. Details of the sites surveyed are given in Table 1 and the locations of the sites surveyed in relation to the structures are shown in Figure 1. The sites themselves are shown in Photo 2. The Mangahume Stream was chosen as a comparison stream, as from time to time it suffers from sand inundation, similar to that which occurs in the Waiaua River. However, it is a smaller stream, and as a result will contain less habitat, which may impact on the results.

Table 1 Sampling sites surveyed in the Waiaua River and Mangahume Stream in relation to the Opunake Hydro HEP

Site	Location	E	N	Distance Inland (km)	Altitude (MASL)	Electric fishing		Seine netting
						Length surveyed (m)	Approx. area surveyed (m ²)	Approx. area surveyed (m ²)
1	Mangahume Stream	1675805	5631335	2.8	25	8	28	200
2	Waiaua River upstream of weir	1674690	5632262	2.1	20	10	60	295
3	Waiaua River downstream of weir	1674477	5631981	1.7	15	8	80	90

The fish populations were sampled at each site using both the electric fishing method and seine netting method. The electric fishing method used a Kainga EFM300 backpack machine. An area of stream was surveyed, with each site divided into numerous reaches. Starting at the downstream extent of the site, each subreach was fished in a downstream direction, with the stunned fish either collected by the fisher, or collected in a pole net set at the lower end of the sub reach. On this occasion numerous runs were undertaken side by side in some subreaches, to ensure the stream width was surveyed. In most cases only a single pass was undertaken of each area. Once a reach was fished, the fishing team moved upstream to the next reach, until the entire sample area had been surveyed. Those fish captured were identified and counted, where possible. Inevitably some fish eluded capture, although some were identified before reaching cover. Once fish had been identified, they were released.

The length of each fish was estimated, to the nearest 100mm for eels and 10mm for all other species. The length of elvers was not estimated, although any eels longer than 150mm were identified.



Figure 1 Location of the three sampling sites in relation to Opunake Lake and the weir.

Photo 2

Top right – Site 1, Mangahume Stream

Bottom left – Site 2, Waiaua River

Bottom right – Site 3, Waiaua River



Results and Discussion

The Mangahume Stream had a substrate dominated by cobbles, with some coarse gravels and boulders, with a small proportion of fine gravel and sand also present. The two Waiaua River sites had a similar substrate composition, and were also dominated by cobble. All sites contained pool and riffle habitat, with the pool habitat targeted for seine netting, and the riffle habitat targeted for electric fishing. All sites had a clear uncoloured flow, and were relatively unshaded, and consequently algal cover was very similar, with patches of algal mats and filamentous algae observed at all three sites. The only differences noted between the sites was that site 1 in the Mangahume Stream included some undercut bank habitat and patchy growths of aquatic moss, whereas the Waiaua Stream sites contained no undercut banks, and supported no moss. The difference in undercut banks is directly related to the other difference, being bank stability. Site 1 had stable banks, while site 2 had mostly stable banks, and site 3 highly unstable banks.

The full results of the fish survey are shown in Table 2.

Table 2 Results of the electric fishing and seine netting surveys undertaken in relation to the Opanake Hydro HEP.

Survey method	Site:	Site 1		Site 2		Site 3	
	Area fished: Electric fishing Seine netting	28 200		60 295		80 90	
	Species	No.	No. per m ²	No.	No. per m ²	No.	No. per m ²
Electric fishing	Longfin eel (<i>Anguilla dieffenbachii</i>)	-	-	3	0.05	1	0.01
	Juvenile eel (<i>Anguilla</i> sp.)	9	0.32	22	0.37	13	0.16
	Redfin bully (<i>Gobiomorphus huttoni</i>)	2	0.07	2	0.03	18	0.23
	Juvenile bully (<i>Gobiomorphus</i> sp.)	-	-	-	-	45	0.56
	Torrentfish (<i>Cheimarrichthys fosteri</i>)	2	0.07	-	-	3	0.04
	Inanga (<i>Galaxias maculatus</i>)	-	-	-	-	1	0.01
	Common smelt (<i>Retropinna retropinna</i>)	-	-	-	-	-	-
	Brown trout (<i>Salmo trutta</i>)	-	-	1	0.02	-	-
	Shrimp (<i>Paratya curvirostris</i>)	-	-	-	-	Present	
Seine netting	Inanga (<i>Galaxias maculatus</i>)	-	-	-	-	1	0.01
	Common smelt (<i>Retropinna retropinna</i>)	39	0.20	-	-	72	0.8
Total number of species		4	-	3	-	6	-
Total number of fish		52	0.23	28	0.47	154	0.91



Photo 3 Common smelt, recorded at site 1 in the Mangahume Stream

Site 1

Four species were recorded at site 1, three by electric fishing (eel, redfin bully and torrentfish) and one by seine netting (common smelt). Common smelt were easily the most abundant, with 39 individuals recorded, with elvers being the next most common. The common smelt recorded are shown in Photo 3.

Both the abundance and species richness recorded in the Mangahume Stream was lower than expected for a site at this altitude and distance from the coast. Although only a small number of redfin bully and torrentfish were recorded, this is likely to be a reflection of the area of habitat sampled, which was the smallest of this survey, and also the limited amount of habitat available, due to this being a smaller stream.

Site 2

This site, located in the Waiaua River upstream of the weir, contained the lowest number of species (3) and the lowest abundance (28) of the three sites surveyed. Elvers were the most abundant, with 22 individuals recorded. Two redfin bully were also recorded, as was one brown trout, the latter not necessarily a migrant species. It is known that both redfin bully and eels are capable of climbing the weir. No fish were recorded when seine netting, despite that fact that 295m² of stream was surveyed at this site. When compared with the Mangahume Stream, there was a reduction in the number of migrant species recorded, but most significantly, no fish were recorded by seine netting. Seine netting is the most effective survey method for common smelt, and could potentially also record inanga, and bully species. The area surveyed by seine net, 295 m², was the largest area surveyed of the three sites, and it is reasonable to conclude that the density of common smelt in the river above the weir was extremely low, with this species possibly even being absent from the upper river.

Site 3

Located downstream of the weir, this site experiences much lower flows than upstream of the weir, and consequently there is likely to be a change in habitat, suiting slower water species such as bullies. The results support this, with bullies being more abundant at this site than at any other site surveyed. As with site 1, common smelt were the most abundant, with 72 individuals recorded, at a density of 0.8 fish per square metre surveyed. This indicates that smelt are very common in the lower Waiaua River, and if the weir and intake tunnels did not constitute a barrier to fish passage, there should be little difference in smelt density between sites 2 and 3. This is not the case, indicating that the scheme does constitute a barrier. This is supported by the difference in redfin bully abundance, which went from a high of 0.23 fish/m² downstream, to 0.03 fish/m² upstream. Although this species is capable of climbing over the weir, it must still present a formidable barrier to this species.

Summary and conclusions

On 26 February 2014, three sites were surveyed for freshwater fish. Two sites were located in the Waiaua River, upstream and downstream of the Opunake Hydro intake weir, while a third was located in the Mangahume Stream, at a similar altitude and distance inland as the Waiaua River sites. The survey methods employed included electric fishing and seine netting, with the latter method being particularly effective for pelagic species such as common smelt and inanga, species less frequently recorded by electric fishing.

The Mangahume Stream recorded a relatively low species richness and fish abundance for a site so close to coast and at a low altitude. This may reflect the amount of habitat available, as this is a smaller stream, that at times can experience sand inundation. However, it is also likely to be a reflection of the area surveyed, which was relatively small.

The two Waiaua River sites were clearly different to each other, with six migrant species recorded downstream (including one migrant invertebrate), and only two recorded upstream. Redfin bully, which was recorded at both sites, was much more abundant downstream (0.23 fish/m²) than upstream (0.03 fish/m²). Although this species is capable of climbing over the weir, it is apparent that the weir is still a formidable barrier to this species.

The seine netting had similar results, with this method recording 72 common smelt downstream of the weir, at a density of 0.8 fish/m², but recording no fish upstream, despite the area surveyed upstream being approximately 150% of that surveyed downstream.

These results support the conclusions made previously, that the weir and intake tunnels constitute a significant barrier to the passage of some native fish, including common smelt, and inanga. It is apparent that passage into the canal is adequate, however, the intake tunnels present quite an impediment, most likely due to flow velocities. The maximum water velocity in which inanga will swim freely is between 0.30 and 0.34 metres per second (Department of Conservation, 1999). Water velocities suitable for smelt are similar. These velocities have been assessed twice prior to the current monitoring period, with velocities ranging from 1.1 to 2.0 meters per second. They were reassessed on 11 January 2011, and found to range from 0.5 to 1.3 m/sec. Therefore it is concluded that water velocities in the tunnels are frequently (if not always) too high for inanga and smelt to move through. Individuals of other fish species such as torrentfish may also be restricted in their ability to move through the tunnels, although previous surveys confirm that some torrentfish have successfully migrated upstream.

During the 2004-2005 monitoring period, the Company retrofitted one of the intake tunnels with a fish ladder which was hoped to provide rest areas and create a slower flowing boundary layer on the inside edge of the culvert which may improve the passage of fish through this area. Unfortunately it appears that this fish ladder has done little to improve the passage of native fish.

The results of this survey support the conclusion that the weir and intake tunnels constitute a barrier to fish passage, and as such, Opunake Hydro Ltd are non-compliant with resource consents 1795-4 and 5581-1. The consent holder will need to investigate options for remediating fish passage at this location, and it is recommended their investigations include consultation with the Department of Conservation and Fish and Game NZ.

These investigations should as a minimum, consider the following:

- Trap and transfer at the head of the fish pass, possibly in conjunction with a local school(s)
- Installation of an additional fish pass that bypasses the intake tunnels
- Installation of a new fish pass, at the weir, bypassing the canal entirely

It is expected that the consent holder should have a plan ready for implementation by the end of the 2014-15 monitoring period (30 June 2015).

References

McDowall, R.M., 2000: The Reed Field Guide to New Zealand Freshwater Fishes. Reed books, Reed Publishing (New Zealand) Ltd. 224pp.

TRC, 2010: Opunake Hydro Limited Waiaua Hydroelectric Power Scheme Monitoring Programme Biennial Report 2008-2010. Technical Report 2010-48.